



**FUSION
FOR
ENERGY**

**Consolidated Annual Activity Report (CAAR) for 2021
of the European Joint Undertaking for ITER and
the Development of Fusion Energy
(Fusion for Energy – F4E)**

This report fulfils the requirement of Article 48 of F4E's Financial Regulation on the provision of a Consolidated Annual Activity Report.

Fusion for Energy

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and the Development of Fusion Energy
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List of Acronyms

A/E	Architect Engineer
ABAC	(Accrual-based Accounting); Accounting and budgetary tool of the European Commission and F4E
AC	Audit Committee
AHG	Ad-Hoc Group
AMC	Administration and Management Committee
ANB	Authorised Notified Body
B2B	Business-to-business
BA	Broader Approach Agreement
BAUA	Broader Approach Units of Account
BCM	Blanket Cooling Manifold
BIPS	Buildings, Infrastructures and Power Supplies project team
Body PS & MHVPS	Body Power Supply and Main High Voltage Power Supply
BPM	Business Process Management
BSM	Blanket Shield Module
CA	Contract Agent
CAAR	Consolidated Annual Activity Report
CAD	Computer Aided Design
CAS	Credit Allocation Scheme
CB	Cryostat Base
CEL	Conventional Exceptional Loads (convoys)
CER coils	Continuous External Rogowski coils
CMA	Construction Management-as-agent
CMM	Cassette Multifunctional Mover
CN-DA	Chinese ITER Domestic Agency
COSO	Committee of Sponsoring Organizations of the Treadway Commission
CPRHS	Cash and Plug Remote Handling System
CS	Central Solenoid
CSC	Computational Simulation Centre
CVB	Cold Valve Boxes
CVBCS	Cryostat Vessel Body Cylindrical Section
CW	Continuous Wave

CW gyrotron	Continuous Wave gyrotron
CW pumping station	Cooling Water pumping station
DA	Domestic Agency
DACC	Deviations Amendments and Contract Changes tool
DC	Direct Current
DCC	Document Comment Communication
DEMO	Demonstration Fusion Reactors
DG ENER	Directorate-General for Energy
DNB	Diagnostic Neutral Beam
DP	Double Pancake for superconducting magnets
DR	Deviation Request
D-T	Deuterium-Tritium
DTP2	Divertor Remote Handling Test Platform
DWS	Detailed Work Schedules
EAC	Estimate At Completion
EBBTF	European Breeding Blanket Test Facilities
EC	Electron Cyclotron
ECA	European Court of Auditors
ECH	Electron Cyclotron Heating
EcoSys®	Enterprise Project Control System
ECPS	Electron Cyclotron Power Supplies
ECRH	Electron Cyclotron Resonance Heating
EDPS	European Data Protection Supervisor
EF	Equilibrium Field
EU	European Union
EU-DA	European Union ITER Domestic Agency (Fusion for Energy)
EUROFER	A 9% Chromium reduced activation ferritic-martensitic steel
EUROfusion	European Consortium for the Development of Fusion Energy
EVEDA	Engineering Validation and Engineering Design Activities
EVM	Earn Value Management
F4E	Fusion for Energy
FAT	Factory Acceptance Test
FC	Framework Contract
FO	Official staff

FP7 grants	Seventh Framework Programme for Research and Technological Development European Union grants
FR/IR	Financial Regulation/Implementing Rules
FSP	Full-Scale Prototype
FTE	Full Time Equivalent
FW	First Wall
FWC	Framework Contract
GB	Governing Board
GDols	General Declarations of Interest
GHe tank	Gas Helium Tank
H&CD	Heating and Current Drive
HCLL	Helium-Cooled Lithium-Lead (Test Blanket Module)
HEL	Highly Exceptional Loads (convoys)
HFTM	High Flux Test Module
HHF	High Heat Flux
HIP	Hot Isostatic Pressing
HNB	Heating Neutral Beam
HPC	Hold Point Clearance
HR	Human Resources
HRS Water treatments	Heat Rejection System Water treatments
HTS CL	High Temperature Superconducting Current Leads
HV	High Voltage
HVPS	High Voltage Power Supply
I&C	Instrumentation and Control
IAC	Internal Audit Capability
IAEA	International Atomic Energy Agency
IAS	Internal Audit Service
IC	ITER Council
ICRH	Ion Cyclotron Resonance Heating
ICT	Information and Communication Technology
IDM	ITER Document Management (software)
IFERC	International Fusion Energy Research Centre
IFMIF	International Fusion Materials Irradiation Facility
IMS	Integrated Management System

IMSS	Integrated Management System Standards
IN-DA	Indian ITER Domestic Agency
IO	ITER Organization
IP	Intellectual Property
IPR	Intellectual Property Rights
IPTs	Integrated Project Teams
IRP	Internal Review Panel
IRS	Integrated Reporting System
ISC	Improvement Steering Committee
ISEPS	Ion Source and Extraction Power Supplies
ISS	Isotope Separation System
IT	Information Technology
ITER IO	ITER International Organization (Central Team)
IUA	ITER Unit of Account
IVT	Inner Vertical Target
IVVS	In-Vessel Viewing System
JAEA	Japanese Implementing Agency (Broader Approach)
JET	Joint European Torus
JA-DA	Japanese ITER Domestic Agency
KO-DA	Korean ITER Domestic Agency
KPI	Key Performance Indicator
LC	Load Centre
'Lean Six Sigma' methodology	A set of techniques and tools for process improvement
LIFUS	Lithium for Fusion
LIPAc	Linear International Fusion Materials Irradiation Facility Prototype Accelerator
LN2	Liquid Nitrogen
MAD	Material Acceptance Document
MAP	Multi-Annual Plan
MFF	Multi-Annual Financial Framework
MITICA	Megavolt ITER Injector and Concept Advancement
MS	Management Standards
MTA	Milestone Trend Analysis
MV DC	Mega Volt Direct Current

NB	Neutral Beam
NBI	Neutral Beam Injector
NBTF	Neutral Beam Test Facility
NbTi	Niobium Titanium
NCR	Non-Conformity Report
NHF	Normal Heat Flux
NPC	Notification Point Completion
OLAF	European Anti-Fraud Office
OPS	Overall Project Schedule
PA	Procurement Arrangement
PBS	Plant Breakdown Systems
PCC	Procurement and Contracts Committee
PCR	Project Change Request
PCR	Pre-Compression Rings
PF	Poloidal Field (coils)
PGM M/IMP	Programme Management and Implementation
PoE	Port of Entry
PPEN	Pulsed Power Electrical Network
PRIMA	Padova Research on ITER Megavolt Accelerator
PS	Power Supply
PSM	Project Steering Meeting
PTC	Prototype Torus Cryopump
Q1/2/3/4	Quarter
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
QPC	Quench Protection Circuit
R&D	Research and Development
RAMI	Reliability, Availability, Maintenance and Inspectability
RAMIO	Reliability, Availability, Maintenance and Inspectability Officer
RAPID	F4E-developed tool which follows up on the implementation of audit actions
RASCI	Responsible, Accountable, Support, Consulted and Informed
RF	Radio Frequency
RFE	Ready for Equipment

RFQ	Radio Frequency Quadrupole
RH	Remote Handling
RMV	Requirements Management and Validation
RF-DA	Russian ITER Domestic Agency
RWM	Resistive Wall Mode Control
RWMPS	Resistive Wall Modes (Coils) Power Supplies
SAT	Site Acceptance Test
SCMPS	Superconducting Magnets Power Supplies
SF6 gas	Sulphur hexafluoride gas
SMEs	Small and Medium Enterprises
SNE	Seconded National Expert
SOAP	Sign-Off Authorisation Policy
SPI	Schedule Performance Index
SPIDER	Source for Production of Ions of Deuterium Extracted from Radio Frequency plasma
SR2FP	Straight Road to First Plasma
SRF Linac	Superconducting Radio Frequency Linear Accelerator
SSEN	Steady State Electrical Network
TA	Temporary Agent
TAP	Technical Advisory Panel
TB	Tender Batch (building contracts)
TBM	Test Blanket Modules
TF	Toroidal Field (coils)
TSS	Technical Support Services
US-DA	United States ITER Domestic Agency
VC	Voluntary Contributor
VV	Vacuum Vessel
WBS	Work Breakdown Structure
WDS	Water Detritiation System
WP	Work Programme
WRL	Warm Regeneration Lines
WRS	Warm Regeneration System

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Governing Board's Analysis and Assessment

Having regard to Art. 4 of the Statutes annexed to the Council decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and Art. 48 of F4E's Financial Regulation,

the Governing Board,

1. Took note with great sadness of the untimely passing of a member of F4E Staff who took his own life in 2021. The Board decided to open a preliminary assessment seeking to establish if a possible breach of statutory obligations occurred. After a thorough assessment carried out by three independent experts, which concluded that no such links could be established, the GB decided to submit the assessors' report to OLAF for its own consideration. The GB also requested F4E management to take all necessary actions to safeguard the well-being of staff and ensure a fair distribution of workload within the organisation and resolved to closely follow up on the developments in these areas. Furthermore, the December GB, the interest of improving the working environment of the Joint Undertaking, mandated a Member of the GB, for a period of twelve months, to advise on upcoming administrative decisions of the Joint Undertaking, including e.g. publications of and appointments to management positions, changes in F4E organisation structure, transfers of staff between Units or Departments.
2. Decided that the 2021 panel for the Annual Assessment should assess the status of F4E's contribution to the ITER project with a focus on Human Resources (HR) Management and Risk Management
3. Took note of the progress made on the Euratom contribution to the ITER and Broader Approach projects in 2021 and noted:
 - a) The transfer of responsibility of the buildings site coordination from F4E to ITER Organization and the delivery of nuclear cell doors.
 - b) The manufacturing of four superconducting Toroidal Field magnets, three of which have been delivered to ITER Organization.
 - c) The manufacturing of the first three Poloidal Field magnets.
 - d) That the first Vacuum Vessel sectors are under the final assembly phase but regretted to note that manufacturing performance has been lacking throughout 2021, which generated significant delays on the planned schedule.
 - e) The successful test of the First Wall Panels and the start of series production.
 - f) The completion of most of pre-commissioning tests and the successful commissioning of the first sub-systems of the Liquid Nitrogen Plant.
 - g) The successful fabrication and testing of prototypes of the MITICA neutral beam source.
 - h) The delivery of the first batch of 150 Inner Vessel Coils to be used as diagnostic systems to explore the properties of plasma inside ITER.
 - i) The start of the second phase of the Broader Approach fusion project in Japan, after the successful completion of most of the first phase objectives and the steady progress of the integrated commissioning of the machine, despite an incident occurred in March 2021 during a high-voltage test of the Equilibrium Field Coil #1. The GB noted that adequate risk mitigation measures, including extensive testing and repair activities have been carried out in collaboration EU laboratories as part of the EUROfusion consortium providing constant support and expertise.

- j) The upgrade of the LIPAc prototype acceleration for the testing of fusion materials.
4. Welcomed the budget implementation for operational and administrative commitments and payments (respectively 99,6% and 98% for operational expenditure and 100% and 91,6% for administrative expenditure). Nonetheless, regarding operational expenditures, notes that end of 2021, EUR 123.7 million global commitment for contracts to be signed in 2022 are included in the execution rate of 99.6%. Without this figure, the execution rate is 87.4%. In addition to this, several decommitments were made in 2021 on previous years contracts amounting to EUR 111.7 million. This budget is according to F4E's financial regulation available for future project needs but shows further budget under execution.
 5. Noted that according to F4E's assessment of its own internal control system, which has been conducted in line with the Commission framework, all the components of internal control are operating in an integrated manner. On the other hand, the GB noted that the management has identified a critical deficiency in relation to the psychological wellbeing of F4E staff following the death of a staff member, concluding that the Internal Control System is *partially effective*.
 6. Noted the non-quantified, reputational reservation included in the Director's declaration of assurance regarding the issue mentioned in point 5 and is committed to closely follow up on all management actions and mitigation measures put in place to address the situation. The GB noted that a process of analysis and internal improvement is ongoing, and that the status of the related actions are regularly reported to the Bureau.
 7. Paid close attention to the risks posed by delays in the delivery and potential cost overruns of key European ITER components, such as the Vacuum Vessel and Buildings programmes. Upon the request of the Board, F4E has put forward several risk mitigation and performance acceleration measures, whose achievements have been regularly assessed at each meeting of the Bureau and the GB.
 8. Monitored the cost evolution for the implementation of major contracts and assessed the possible cost implications of design changes on future procurements – notably the Hot Cell project – and requested F4E to support the ongoing design reviews and ensure that the financing is in line with the available Euratom budget.
 9. Has been attentive to the issues posed by the reduced projected revenue with respect to the prospected participation of third country members of F4E, namely the UK and Switzerland, and received regular updates on the status of the negotiations for their full association to the Euratom research and training programme, a necessary precondition for their participation in F4E activities.
 10. Noted that uncertainties persist with respect to the revenue side as highlighted in point 9, as well as with regards to the overall ITER schedule and cost baseline, whose revision is currently being discussed at the ITER Council level.

Barcelona, 8 July 2022

Carlos Alejandre
[e-signed in IDM]
Chair of the Governing Board

Executive Summary/The Year in Brief

Imagine if we could create a small Sun on Earth as a virtually inexhaustible and clean energy source – and although this may sound like science fiction, it is the ultimate mission of Fusion for Energy (“F4E”).

We are the main contributor to ITER – an international project to build and operate the largest research machine to create solar fusion. In parallel, we are collaborating with Japan on three smaller fusion projects to improve our technical know-how.

For F4E, 2021 was a very difficult year as a member of our staff, Mario Gagliardi, tragically took his own life. The pain of this unimaginable loss for his family, friends, and colleagues was deeply felt inside our organisation.

We also continued to face challenges due to the ongoing Covid-19 pandemic. I am very proud of how both our staff and our industrial partners coped and kept on delivering as this report demonstrates. Some highlights include:

- After ten years of intensive work, we transferred the responsibility of the **buildings** site coordination from F4E to the ITER Organization. We also delivered all 46 heavy nuclear cell doors to the ITER Organization each weighing around 70 tonnes
- We manufactured four superconducting **Toroidal Field magnets** (making a total of seven), of which three were delivered to ITER Organization. This is the result of several complex technical operations involving more than 30 EU industrial partners
- We manufactured and delivered the first three **Poloidal Field magnets** of up to 17 metres in diameter. The two largest coils were manufactured by F4E in our factory on the ITER site and a third smaller coil in China under contract with F4E
- We entered the final assembly phase for the first EU **Vacuum Vessel** sector that stands 11 metres tall and weighs over 5000 tonnes, albeit behind the planned schedule, due mostly to difficulties with the complex welding procedures
- We successfully tested the **First Wall Panels** at high heat loads and started series production with two industrial partners for the 215 panels that Europe is providing
- After installation of the **Liquid Nitrogen Plant** and Auxiliary systems, F4E completed most of the pre-commissioning tests and successful commissioning of the first sub-system
- We fabricated and successfully tested prototypes of the **MITICA neutral beam source**. We also assembled and aligned the first stage of accelerator that is eventually planned to operate at one megavolt and power of up to 16.5 megawatts
- We delivered the first batch of 150 Inner Vessel Coils that will be used as a **Diagnostic System** to enable scientists to determine the properties of the plasma inside the ITER machine
- We started the **second phase of the Broader Approach** fusion projects with Japan, after having successfully completed most objectives of the first phase
- Together with our Japanese partners, we are commissioned of the **JT-60SA Satellite Tokamak** in Japan and successfully energised the EU-supplied superconducting Toroidal Field magnets

- We upgraded a **prototype accelerator LIPAc** for testing fusion materials. We were able to produce a low intensity proton beam, accelerate it, and transport it in line with the requirements
- We signed new contracts with industrial partners and laboratories for a total of €240m in 2021 bringing the total investment made by F4E into European industries and research organisations since 2007 to almost €5.5bn helping to create jobs and support innovation.
- As the mandates of many Chairs and Members of its advisory Committees came to an end in December 2021, the GB made a number of key appointments with a view to ensuring the appropriate level of skills, experience, and leadership to fulfil the mandates of F4E's governing bodies.
- On the basis of a comparative analysis, the F4E IAC concluded that F4E's governance structure is robust and to a large extent adequate for the mission F4E was tasked with by the Council; division between the responsibilities of the Board and Director ensure high level of oversight and scrutiny; specialised committees systematically assist the Board and also the Director with execution of their responsibilities; the Board and committees are assisted by dedicated secretariats coordinated by the Governance Officer.
- Following the untimely passing of an F4E colleague, who took his own life in May 2021, the Board decided to open a preliminary assessment seeking to determine whether the suicide could be linked to F4E's professional environment, and to establish if a possible breach of statutory obligations occurred. After a thorough assessment carried out by three independent experts, which concluded that no such links could be established, the GB decided not to open a formal administrative enquiry. On the other hand, the GB requested the management to take all necessary actions to safeguard the well-being of staff and ensure a fair distribution of workload within the organisation and resolved to closely follow up on the developments in these areas.
- In terms of the management of the budget, the implementation has been at very good levels, both in terms of commitments and payments for the operational budget (99,6% and 98% respectively) and for the administrative one (100% for commitments and 91,6% for payments).
- The assessment of the F4E's Internal Control System was conducted in line with the EC framework. The component including F4E's working environment was found to have a critical deficiency concluding that the overall internal control system is partially effective. A non-quantified, reputational reservation related to the well-being of F4E Staff is included in the Director's Declaration of Assurance.
- We continue to make internal improvements at F4E and staff well-being had a renewed focus in 2021 following the tragic event mentioned above. Among a range of actions, we conducted a psychosocial risk assessment survey across the whole organisation and initiated a change agenda involving and engaging our staff.

I would like to conclude by thanking our staff and the teams of our industrial partners for their dedication, resilience, and hard work under those challenging circumstances. I hope you will find out more about our achievements during 2021 through this report.


Johannes. P. Schwemmer
Director

Part I: Achievements of the year

1.1 Contributions to the ITER Project

1.1.1 Introduction

ITER is under construction in Cadarache in the south of France. Europe, as the Host Party, and France, as Host State, have special responsibilities for the success of the Project. Europe bears 45.46 % of the construction cost including all the buildings. It will provide 34.00 % of the cost of operation, deactivation and decommissioning of ITER^[1].

Europe budgeted €6.6bn until the end of 2020 according to the July 2010 decision of the Council of which most is earmarked for contracts placed by F4E with European industry, SMEs and research laboratories. F4E signed new contracts with industrial partners and laboratories for a total of €240m in 2021 bringing the total investment made by F4E into European industries and research organisations since 2007 to almost €5.5bn helping to create jobs and support innovation.

The following subsections present a brief report on a selection of the activities undertaken in 2021 on the major systems needed to achieve 'First Plasma' in ITER (marking the start of ITER operations), namely Site and Buildings (subsection 1.1.2.1 Site and Buildings), Vacuum Vessel (1.1.2.2 Vacuum Vessel) and Magnets (1.1.2.3 Magnets).

The subsequent subsections within this chapter deal with the many other complex, first-of-a-kind technological systems for ITER, most of which are still in the design and development phase, which Europe is responsible for. The ITER schedule requires installation of some of these systems, fully or partially, before First Plasma, although delivery, in most cases, is only required for subsequent assembly phases

1.1.2 Major Achievements in EU First Plasma Systems

1.1.2.1 Site and Buildings

Thirty-nine buildings and areas will house the systems necessary for the operation of ITER. The 'Tokamak Complex' will house the main ITER components and will be one of the largest buildings of its type ever constructed: 60 m tall (with an additional 20 m underground), 120 m long and 80 m wide; requiring 16,000 tonnes of iron reinforcement bars, 150,000 m³ of concrete and 7,500 tonnes of steel.

As shown in Figure 1 and Figure 2, the Tokamak Complex civil works have well progressed.

^[1] *Final Report of Negotiations on ITER Implementation, 1 April 2006. Attachment 2_C*

Despite the COVID-19 situation and impacts, the performance of the Buildings team was remarkable with 93% of the planned annual milestones achieved in 2021. A major achievement was reached during Q3 2021, the Site Coordination Responsibility (and associated common expenses) was transferred officially from F4E to IO from 1st of October 2021, after ten years of coordination by F4E. The Handover of the platform was completed.

In October 2021, IO took over all the Heavy Nuclear Doors on Tokamak Building B11: 46 Port cell doors (around 70tons each) and 4 Lift Lobby doors (around 10tons each), marking the successful delivery by F4E of a significant and complex mechanical scope (Figure 3).The construction works continued progressing for the Tritium Building (B14) civil works, and started for the Neutral beam Power Supplies Buildings (B37), Control Building (B71) and Fast Discharge Resistor Building (B75) from January 2021 (figure.4).

Design activities for Emergency Power Supplies Buildings and equipment and for the Plant Bridges progressed well, allowing a start of first preparatory construction activities (the bridges foundation started in June 2021 and excavation for the Emergency Power Supplies buildings in October 2021).

In 2021, due to serious difficulties met on the design, procurement and installation of the Building services, F4E started to implement mitigation actions, negotiating with the contractor while transferring some of its scope to other contractors. Building services design activities were completed on December 2021 for the Diagnostic Building (B74) and continue progressing for the Tokamak building (B11). Progress on the remaining service works activities on the Auxiliary Buildings [Radio frequency building (B15) and Cryoplat Buildings (B51 and B52)] increased successfully after the change of contractor operated by F4E. Painting, doors installation and finishing works continued in the Tokamak Complex with painting advancing in the Tritium building (B14) and with painting finalized in Tokamak building (B11) in September 2021.

The manufacturing design of the cargo lift started with the review of the first batch (long lead items) completed in September 2021. The Support to Owner II (SOII) – continuation of the existing Support to the Owner contract, (but with a different consortium composition), providing support to F4E for all activities including the Hot Cell Complex contract was awarded at the end of 2021, on time to avoid disruption on the management of the activity. Both the cost of the buildings works to date and the scheduled duration have substantially exceeded initial estimates as a result of numerous changes to the design and increased complexity, impacting both the design development and the construction activities, in particular for the Tokamak Complex. These changes were mostly at the request of the ITER Organization.

In late 2015, by benchmarking against other civil engineering projects, independent expert assessments concluded that a much larger budget contingency for the buildings work should have been set aside in 2010. A 'Reserve Fund' created in 2015 at the level of the whole ITER Project now provides a mechanism to compensate F4E (and other Domestic Agencies) for subsequent change requests, however not for those of the past. F4E and the ITER Organization, in consultation with F4E's Governing Board, are working closely together to minimise the ongoing cost increases and schedule delays. F4E has further implemented organisational, project-management-related, scope-related and contractual measures to stabilise this project, giving priority to the First Plasma milestone. These include:

- Postponement or de-scoping (including future optimisation) of non-First Plasma buildings;
- Design-to-cost, resulting in requests by F4E to ITER Organization to accept changes;
- Dedicated variation and claim management team established by F4E;

- Dedicated re-measurement (of activities) team on the worksite;
- Permanent supervision of on-site activities;
- Very conservative approach in the Change Control Board to resist to changes requested by IO;
- Permanent optimisation of construction methods and processes;
- Maximum acceleration of civil works to contain run-rate related cost and secure the First Plasma schedule

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU62.02.72206	HPC - IO approval of Contractor Final & Construction Design (Structure) for Bldg 46 - MRR#1 for B44-45-46-47	Q4 2021	Predecessor of GB24	Achieved
EU62.02.72486	HPC - IO approval of Contractor Final & Construction Design (Structure) for Bldg 47 - MRR#1 for B44-45-46-47	Q4 2021	Predecessor of GB26	Achieved
EU62.050206	IPL > Tokamak Building (11) RFIOC L3M area	Q3 2021	WP21 objective	Achieved
EU62.05.29019	NPC - Notice to Commence construction of Control Bldg 71 Non PIC	Q1 2021	Predecessor of GB34	Achieved
EU62.600650	IPL > Tokamak Building (11) RFIOC Level L4 (Axis T10-T12)	Q3 2021	WP21 objective	Achieved

Table 1: Site and Buildings and Power Supplies – Annual Objectives presented in the F4E Work Programme 2021.



Figure 1: Aerial view of the ITER construction site. Photo: ITER Organization/EJF Riche (May 2021)



Figure 2: Ariel view of the ITER construction site. Photo: Les Nouveaux Médias/SNC ENGAGE (October 2021)



Figure 3: Heavy Nuclear Doors (HND's) before and after installation of cocooning - all transferred to IO in October 2021.



Figure 4: TB12 (Demathieu Bard) B71 North work status in Early 2021 versus December 2021

1.1.2.2 Vacuum Vessel

The ITER plasma, where the fusion reactions will take place, will be under vacuum inside a special double-walled container, the **Vacuum Vessel**. This doughnut-shaped vessel is 19 metres across and 11 metres high. It weighs in excess of 5 000 tonnes, similar to the Eiffel Tower.

F4E is providing five of the nine Vacuum Vessel 'sectors'. Manufacturing is time-consuming and labor-intensive due to the size of the sectors (13.6 metres high, 6.5 metres wide, 7.8 metres deep and weighing 400 - 500 tonnes).

Each sector is composed of 4 Poloidal Segments (PS1-PS4). Each segment is manufactured independently from the others during the Segment Manufacturing phase. Once all 4 segments of one sector are completed, the Sector Assembly phase can start, where the 4 segments are joined together to form the complete Sector

During 2021, AMW (the industrial consortium responsible for the manufacturing of all 5 sectors) completed the manufacturing of 9 out of the total of 20 segments to be produced. The sector assembly phase of Sector 5 started in July and all the welds on the inner side of the sector have been completed and examined.

All preparation works of the sector assembly phase for Sector 4 were also completed in 2021, even though the start of assembly had to be postponed due to last minute Non-Conformities detected on some of the finished segments.

F4E relentlessly supports and pushes the consortium to progress at the fastest rate possible, while at the same time sticking to the stringent geometrical tolerances and in strict compliance with the nuclear safety codes.

Annual Objectives				
Milestone ID	Scope Description	Forecast Achievement Date	Type of Milestone	End of December 2018 Schedule Status
EU15.1A.1139800	PS3 VV9 Fabrication Complete	Q4 2021	Predecessor of GB25	Not achieved due to mechanical breakdown of milling machine(*)
EU15.1A.3039360	S9_PS4_ Poloidal and Toroidal ribs welding and NDE complete	Q4 2021	Predecessor of GB25	Achieved
EU15.1A.3081300	Start of Factory Acceptance Tests - Sector 5	Q4 2021	Predecessor of GB16	Not achieved due to issues with first of a kind manufacturing steps
EU15.1A.3082260	S5 Rotation of complete sector and ready for Lower and Upper Port assembly	Q4 2021	Predecessor of GB16	Not achieved due to issues with first of a kind manufacturing steps

(*) only the final machining part of the scope of this milestone was not achieved

Table 2: Vacuum Vessel – Annual Objectives presented in the F4E Work Programme 2021



Figure 5: Sector 5 being transported to the Radiographic Test facility after completion of inner the shell welding

1.1.2.3 Magnets

30 superconducting magnetic coils hold the hot plasma inside ITER and stop it touching the walls. These are among the largest and most powerful such magnets ever made.

F4E is providing 10 of 18 Toroidal Field (TF) coils installed in the tokamak, 20% of the Nb₃Sn superconductor for the TF coils, five of six Poloidal Field (PF) coils, 11% of the NbTi superconductor for the PF coils and nine fibreglass 'pre-compression rings', which keep the coils in place during operation.

1.1.2.3.1 Toroidal Field Magnets

Each Toroidal Field (TF) coil, weighing 310 tonnes, comprises a superconducting Winding Pack (WP), mounted in a stainless steel case. To form the WP, seven Double Pancakes (DPs) are impregnated with a special resin and then stacked together.

Each DP consists of a D-shaped stainless steel plate with spiral grooves on both sides that support two 700-metre-long length of superconductor, wound into shape, heat-treated and electrically insulated before insertion into the grooves.

By the end of 2020, all 10 WPs have been successfully manufactured and tested, 7 of them have been delivered to the insertion facility, 6 of them have been Cold Tested and 4 of them have been inserted into the coil case, welded and injected with resin.

TF coils fabrication is the result of several complex technical operations involving 3 main industrial contracts and more than 700 people from more than 30 EU companies.

By the end of 2021, all 10 WPs had been completed and delivered to the insertion facility, 9 of them had been Cold Tested.

By the end of 2021, in total seven TF coils were tested and completed: six of them already delivered in Cadarache. Looking at the year performance, during 2021 four TF coils were completed, and three of them were delivered to ITER IO: an excellent result considering the COVID-19 pandemic impact.

1.1.2.3.2 Poloidal Field Magnets

F4E will deliver to ITER IO 5 ITER Poloidal Field (PF) coils.

European industries are fabricating four (PF 2, 3, 4 and 5) giant PF coils (ranging between 17 m and 25 m in diameter) under F4E responsibility and coordination at the PF coils workshop at the ITER site.

The Institute of Plasma Physics (ASIPP), Chinese Academy of Sciences-ASIPP has fabricated another one (PF6) under an international cooperation agreement with F4E.

In 2021 F4E successfully completed and handed over to the ITER Organization (IO) three PF coils: PF6, PF5 and PF2.

Regarding PF4 coil, the largest coil with PF3, all the Double Pancakes (DPs) have been stacked and electrically connected and the Winding Pack (WP) is undergoing preparation activities for impregnation. As for PF3, the last coil to be manufactured by F4E, 5 DPs have been wound, of which 2 have been impregnated.

To accommodate the production of the larger PF3 and PF4 coils, the PF coils building has been extended and the manufacturing stations have been reconfigured.

1.1.2.3.3 Pre-Compression Rings

Before 2021, F4E had already delivered to IO all nine **Pre-compression Rings (PCRs)** that keep the 18 TF Coils in place during ITER operation, in addition to a spare PCR #10 and 8 off “1/5 scale” rings.

Each PCR is made from fiberglass and epoxy resin, weighs > 3 tonnes and has a diameter of 5.5 m. These are be among the largest composite structures ever manufactured as a single piece.



Figure 6: Arrival of the 6th Toroidal Field at the ITER Organization in Cadarache, France



Figure 7: Delivery of the 3rd Poloidal Field coil to the ITER Organization

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU11.1A.22660	Delivery of TFWP14 to Cold Test and Coil Insertion site	Q4 2021	Predecessor of GB54	Achieved
EU11.1A.24800	TF-EU07 Welding Completed	Q3 2021	Predecessor of GB23	Achieved
EU11.3B.01120	IPL > Delivery of PF2 Coil by EU-DA to IO	Q4 2021	WP21 objective	Achieved
EU11.3B.571550	DP2 - PF4.- DP VPI Completed	Q4 2021	WP21 objective	Achieved

Table 3: Magnets – Annual Objectives presented in the F4E Work Programme 2021

1.1.3 Achievements in Other EU Systems

Europe is responsible for many other complex, first-of-a-kind technological systems for ITER, most of which are largely in the design and development phase. Even if not all are required for the First Plasma milestone, the ‘Staged Approach’ of the updated ITER schedule requires installation of some parts of these systems (e.g. ‘captive’ components) before First Plasma that are impossible or very costly to install at a later date.

1.1.3.1 In-Vessel Components

Whilst the ITER magnets will confine most of the hot plasma, radiation and some particles will inevitably escape from this magnetic 'cage'. To protect the Vacuum Vessel and the external systems from this energy flux, the inside surface of the Vacuum Vessel will be covered by 440 special blocks, called Blanket Modules.

Each module is made from a Shield block and a First Wall panel. Europe will provide 215 First Wall panels. The cooling water of all the Blanket Modules is supplied by pipe bundles running inside recesses at the back side of the Shield Blocks: The Blanket Cooling Manifolds, which are also to be delivered by Europe. The blanket system removes heat from the inside of the Vacuum Vessel and transfers it to the Tokamak Water Cooling System.

A device at the bottom of the Vacuum Vessel, the Divertor, removes excess heat and plasma 'ash' keeping the plasma clean enough to continue operation. F4E is responsible for many key components of the Divertor, in particular the Inner Vertical Target and the Cassette Body, which is the supporting structure of the Divertor plasma facing components (Inner and Outer Vertical Target and Dome).

The main achievement in 2021 for the Blanket First Wall was the start and ramp-up of the two first of a kind cost plus fee contracts in Fusion For Energy for the series production of the Blanket First Wall panels. The two contractors, ALSYMEX AND FUSION BUSINESS LEADERSHIP, started the activities for the set up and qualification of the production lines and for the development of the manufacturing design of the pre-series panels. In parallel, the procurement of main raw materials (Beryllium and Copper-Chromium-Zirconium) provided as free issue items to these suppliers started through specific task orders. Specific contracts were also signed to perform financial audits necessary for the monitoring of the above cost plus fee contracts. Also, two First Wall panel full-scale prototypes manufactured during pre-qualification activities were successfully high heat flux tested in the CV Řež test facility at Plsen. A procurement procedure was launched to purchase fixtures needed to connect the first wall panels to the shield blocks.

For the Blanket Cooling Manifolds, following the signature of the Procurement Arrangement between F4E and the ITER Organization (IO) in 2020, a negotiated procedure was launched for the selection of the company(ies) for the series production. Furthermore, the work continued on the development of an alternative support design as an action to potentially reduce costs versus current IO baseline design.

Regarding the Divertor components, in 2021 Stage 2 of the Cassette Body series fabrication contract was awarded to WALTER TOSTO. For Stage 1, all the materials for all standard cassette body series were received and the manufacturing of all standard cassette body series continued for both contractors CNIM-SIMIC AND WALTER TOSTO. Moreover, acceptance tests of the dedicated Hot Helium Leak Test Facility for the Cassette Bodies were successfully performed at WALTER TOSTO premises. 2021 was also an important year for the Inner Vertical Target project. The secondly European full-scale prototype produced by RESEARCH INSTRUMENTS completed its final integration, after a successful High Heat Flux Testing campaign. In regard to the preparation of the call for tender for the Inner Vertical Target Series production, the related technical specification was completed and the call for tender was launched.

Blanket First Wall



Figure 8: Successful high heat flux testing of First Wall panel Full Scale Prototypes in the CV Řez test facility at Plsen

Divertor Inner Vertical Target



Figure 9: RI full-scale prototype completed

Divertor Cassette Body

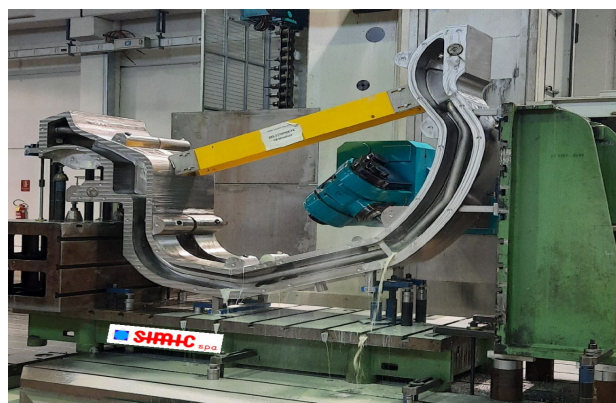


Figure 10: Manufacturing of the CB structure at SIMIC premises



Figure 11: Hot Helium Leak Test facility at Walter Tosto premises

In Vessel – Blanket

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU15.2A.100160	Dispatch Invitation to Submit Updated Tender for FwC BCM	Q4 2021	WP21 objective	Achieved
EU.16.01.208250	Published Call for Expression of Interest for Procurement of Standard Parts	Q4 2021	WP21 objective	Achieved
EU16.01.61400	Task Order Signed for Auditors TO#01 - LOT 1	Q4 2021	WP21 objective	Achieved
EU.16.01.79750	Manufacturing Readiness Review Completed (ADMU) - OPE-443-01	Q3 2021	WP21 objective	Achieved

Table 4: In Vessel-Blanket – Annual Objectives presented in the F4E Work Programme 2021

In Vessel – Divertor

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU17.01.1050800	HP - Reception of the Conformity of XM19 and 316-LN-IG material for Standard CBs (M_CBST_S14B)	Q3 2021	WP21 objective	Achieved
EU17.01.1169400	HP -Reception of the conformity of 316L Tubes (D_TPRHRM_02)	Q3 2021	WP21 objective	Achieved
EU17.2B.12590	Release Technical Specification for IVT Series Production	Q4 2021	Predecessor of GB45	Achieved
EU17.2B.85750	Authorisation of shipment of the Testing Assembly to the HHF Testing Facility - OPE-567-03-01 (II.22)	Q2 2021	WP21 objective	Achieved

Table 5: In Vessel-Divertor – Annual Objectives presented in the F4E Work Programme 2021

design of the tritium accountancy system that is now separate from the one of the water-cooled TBS.

Negotiations with Korea for building a collaboration agreement for the joint procurement of the HCPB-TBS have reached an advance stage with an agreement on a detailed scope and financing sharing, as well as a legal draft of a Partnership Agreement. It is recalled that this collaboration that is expected to enter into force in 2022 is a follow-up from the decision of the ITER Council to reduce the total number of TBMs tested simultaneously in ITER. It may bring some overall cost savings to F4E.

In parallel, for both the water-cooled and helium-cooled TBS, F4E has consolidated elements of safety demonstration and radwaste management and has transmitted a first package of technical documentation to the ITER nuclear operator in preparation of an update of the ITER Preliminary Safety Report scheduled in 2023. This process is continuing in 2022.

An extensive R&D program is now fully operational in EUROfusion to support the TBM Programme (about thirty tasks ongoing). It encompasses activities on materials and technology qualification, with sometimes large facilities like a real size test platform in CV Rez for validation of maintenance operation in the Port Cell.

F4E is also maintaining direct contact with European labs and industry for specialized technological development or simulation. For instance, a workshop on TBS instrumentation has gathered about 80 experts. It was important for F4E at this design stage because instrumentation specifications are being integrated now within the components and system architecture. Another example is in the area of tritium transport. Specific simulation capacities have been developed and implemented in the simulation code TESSIM X. It allows modelling the tritium trapping/de-trapping phenomena in the materials defects generated by neutron irradiation. This is essential for F4E because it allows having a finer assessment of the tritium inventory in the TBM-box and its evolution over the time.

The TBMs comprise steel boxes containing the tritium breeder, neutron multiplier materials and heat extraction plates/tubes. In 2021, F4E has completed with industrial and research partners the development of welding tools and procedure for the most complex part of the TBM box: the manifold area that is distributing the coolant flow to the structures. The demonstration has focused on joining the TBM box main structures with the multi-stage manifold back plates of various thickness (5-25 mm), and on welding elements that are crossing these plates like nozzles, stiffening rods and pipes. For the purpose of the demonstration, mock-ups have been manufactured with EUROFER97 structural material, using a fusion arc welding and hot isostatic pressing. Non-destructive and destructive examinations have been used after post-welding heat treatment for confirming quality of the weld joints and mechanical properties.

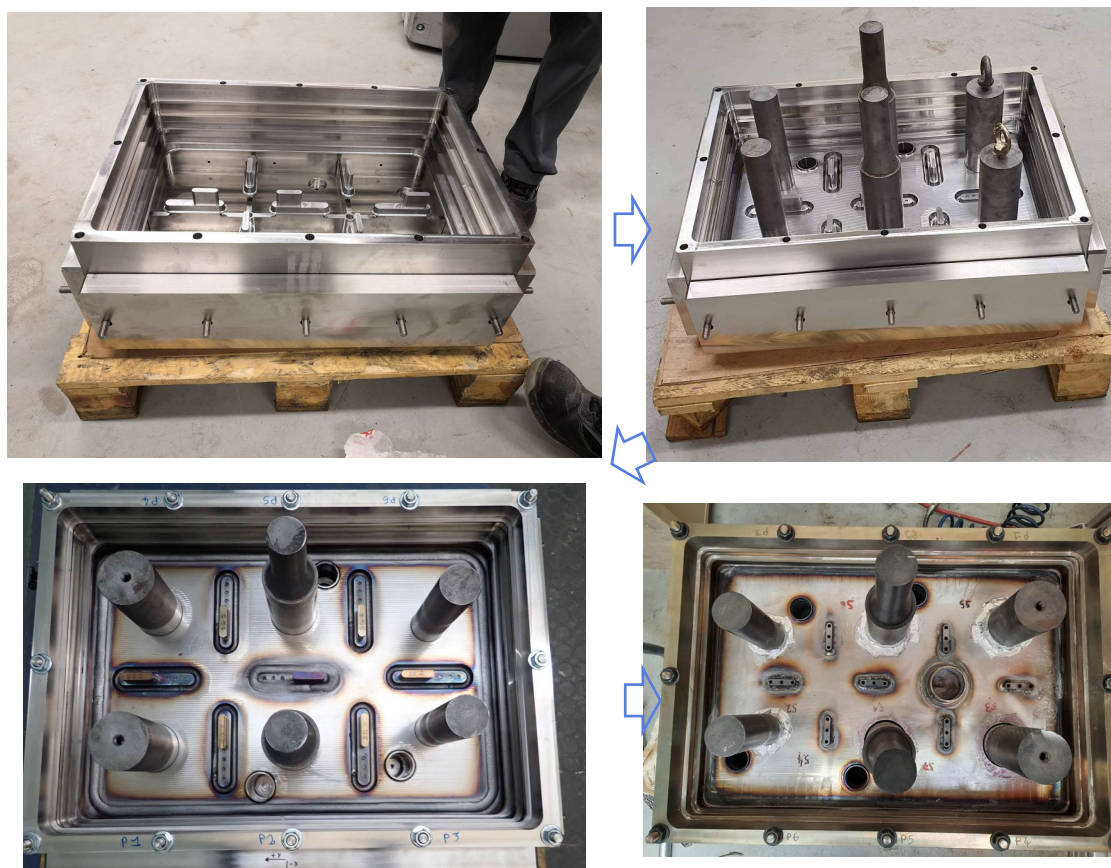


Figure 13: Welding of a mock-up of the back manifold of TBM Box distributing pressurized helium in multi-stages

In continuation, a new framework contract for the proof of the TBM-sets fabrication and assembly processes feasibility has been signed in 2021 with a French consortium CEA-FRAMATOME and a first implementation contract has been signed. It encompasses activities that are essential for the future qualification of the TBM manufacturing processes and TBM licensing: EUROFER97 weldability demonstration, filler material acceptance, effect of multiple post-welding heat treatment operations, double wall tube manufacturing and TBM-box inspectability assessment. The overall scope of this framework contract will close the gap up to the start-up of the TBM fabrication to be installed in ITER. It was developed in consultation with a French Notified Body for nuclear pressure equipment APAVE SUDEUROPE, which is also assisting F4E during its implementation because of the very innovative nature of these developments vis-à-vis the existing French and European regulations.

1.1.3.3 Remote Handling

Remote Handling (RH) will play an essential role in ITER. Once the fusion reactions will have produced significant radiation and activation of the ITER components, robotic tools will be required to inspect and repair components close, or within, the ITER machine. This is challenging since some of the items weigh up to 50 tonnes and need precision positioning. F4E will provide many elements of ITER's RH systems; the Divertor Remote Handling System (DRHS), the Cask and Plug Remote Handling System (CPRHS) for transportation of the components from the Tokamak to the

Hot Cell Building, the Neutral Beam Remote Handling System (NBRHS) and the In-Vessel Viewing System (IVVS). All contracts are in place for the design (and/or in some case prototyping) of these RH systems.

For the DRHS, in 2021 the main effort has been devoted to the final design of the Cassette Toroidal Mover and to the ramp up of the final design of the Cassette Multifunctional Mover, the second major DRHS subsystem, and to responding to specific interface issues with other ITER plant subsystems (in particular the divertor). Like for the other RH systems, each subsystem is the integration of many different devices, components and technologies. The design activities, complemented by prototyping and testing (e.g. water-hydraulic digital valves), will continue during 2022 and beyond. As the DRHS is a complex plant system spanning from in vessel to hot cell, F4E is producing a huge amount of technical documentation in view of the final design review.

In the CPRHS area (a massive plant system spanning all across tokamak and hot cell buildings and with eight different cask variants), during 2021 F4E's main technical achievements have been the completion of the Preliminary Design Review for the cask system needed for first assembly, and the launch of their final design on the one hand; and the ramp up of the preliminary design of the cask variants needed for ITER second assembly (nuclear-grade units) on the other hand.

The NBRHS monorail crane prototyping phase has been successfully performed in 2021, with positive test results, whose final phase will be completed in early 2022. Final design tasks of the crane subsystems have also been performed. Other subsystems needed for assembly phase 2 have been specified in detail and their design and interfaces have been developed further prior to the launch of design tasks with industries.

The IVVS prototyping activities have been performed in 2021 and the preparation of the final design phase completed. F4E has made further progress with common RH technologies in 2021 and has launched the procurement of the rad-hard electronics needed for cameras and multiplexers. Control system related activities have been also performed with in particular the integration of innovative software (GENROBOT) in the DTP2 facility in Finland.

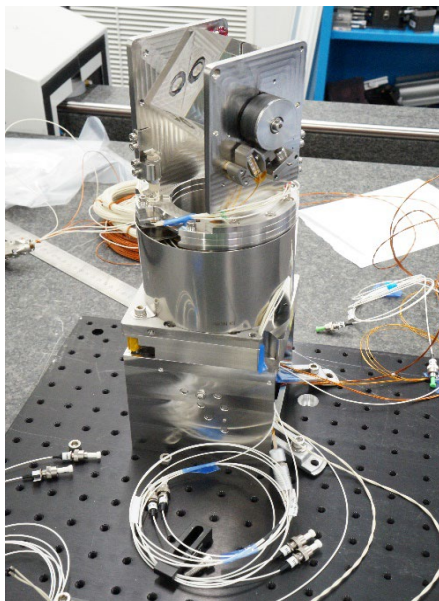


Figure 14: IVVS optical probe prototype (left) under assembly in the laboratory. NBRHS crane prototype (right) under test

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU23.03.14046592	Task Order Signed for (577-02-02) Prelim. Design MA-2 and Final Design MA-1 for CPRHS	Q4 2021	Predecessor of GB40	Achieved
EU23.03.14056380	M7 Preliminary design review meeting held (MA-1 last PDR)	Q2 2021	Predecessor of GB32	Achieved
EU23.05.14053780	Submission Deadline Tender CON 2021 for Final Design of MRC	Q4 2021	Predecessor of GB42	Not achieved due to shortage of manpower for preparation of procurement package.
EU57.01.50260	IVVS Assembly of P&T Prototype completed OMF-383-01-04 (M8)	Q4 2021	Predecessor of GB47	Achieved

Table 6: Remote Handling – Annual Objectives presented in the F4E Work Programme 2021

1.1.3.4 Cryoplant & Fuel Cycle

The ITER Cryoplant, a complex system and one of the largest of its type in the world, will provide the cryogenic fluids necessary to cool ITER's superconducting magnets. F4E is responsible for the Liquid Nitrogen Plant and Auxiliary Systems, about one-half of the Cryoplant, along with part of the network to distribute and regulate the cryogenic fluids; the front-end Cryodistribution lines and Cold Valve Boxes. F4E is also providing all the main Cryopumps, which maintain a high vacuum in the Vacuum Vessel and the Cryostat.

As well as being an expensive resource, tritium is radioactive. Careful management and recycling of tritium on ITER is therefore essential. This is the purpose of the Tritium Plant, a part of which, consisting of a Water Detritiation System and a Hydrogen Isotope Separation System, will be provided by Europe.

The Radiological and Environmental Monitoring Systems (REMS) provide monitoring to ensure protection of the workers against occupational exposures (ionizing radiation and beryllium) and of the public and the environment against the hazards of ionizing radiation and chemical products. The whole scope of REMS is supplied by F4E.

In 2021 the installation of the LN2 Plant and Auxiliary Systems in the cryoplant building was completed together with most of the pre-commissioning tests (leak test, blowing and flushing, electrical and instrumentation checks...). The first sub-system (gaseous helium storage tanks) was successfully commissioned.

F4E manages three contracts in parallel for the development of the front-end cryodistribution system that will manage the cryogens needed for the operation of the cryopumps. All the Johnston couplings were delivered in the first quarter of 2021 and the Warm Regeneration Box delivery to the ITER Organization was made in December 2021. The final assembly of the first of the Cold Valve Boxes started and the Final Design Review for the neutral Beam Cold Front End Cryodistribution System was successfully passed in June 2021. The Torus and Cryostat Cryopumping System will pump the vacuum vessel and cryostat volumes. Most of the individual items were manufactured in 2021, so that work on sub-assemblies could start in time to allow the final assembly of the first cryopump to start mid- 2022.

For the MITICA cryopump, all the cryopanel were coated with charcoal, the first pumping section was qualified and the first 14 pumping sections (out of 68) were produced. Sophisticated leak detection systems are required to detect potential leaks from the vacuum vessel, cryostat and neutral beam equipment. The hold point of the preliminary design review was released and the final

design started. The preliminary design review for the in-pipe inspection tool was also successfully passed in December 2021.

The various REMS components will be delivered in stages. The contract for the First Plasma items was signed. The preliminary design of the Tokamak system was reviewed to prepare for a value engineering phase and the level of definition of the systems for the Hot Cell Complex developed for the conceptual design review held in November 2021.



Figure 15: Giacomo Calchi (F4E) completing dimensional checks on the first pumping section for the MITICA cryopump

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU31.01.11580	IPL > Delivery of Warm Regeneration System by EU-DA to ITER Site	Q4 2021	Predecessor of GB28	The milestone was achieved on 17th of December 2021 but wrongly reported in the reporting system.
EU31.01.305060	M8 - Acceptance #CP4	Q2 2021	Predecessor of GB50	Achieved
EU31.03.25740	M.14 - Preliminary Design Review Approved of Primary & Cryostat Leak Detection System	Q4 2021	Predecessor of GB18	Achieved
EU31.03.26280	Contract Signed for Helium Leak Localisation System	Q2 2021	Predecessor of GB35	Achieved
EU31.03.26800	Quality Plan Approved	Q1 2021	Predecessor of GB18	Achieved

Figure 16: Cryoplant and Fuel Cycle – Annual Objectives presented in the F4E Work Programme 2021

1.1.3.5 Plasma Diagnostic Systems

Ensuring the safe operation of ITER and optimising its performance will require comprehensive information on the behaviour of the fusion plasma. Providing this information will be the responsibility of ITER's many 'Diagnostics' systems; which will number around fifty and will measure parameters of the plasma, together with those of the First Wall Blanket Modules and Divertor. Europe is responsible for twelve Diagnostics and ten ancillary systems. So far, more than 60 European research laboratories and SMEs are involved in the design, development and/or manufacture of these systems.

During 2021, F4E delivered the first batch of 150 Inner Vessel Coils (IVC), for installation on the inner surface of sectors #06, #07 and #08 of the ITER vacuum vessel. The IVC, which form part of the ITER Magnetics Diagnostic suite, include compact 'low temperature co-fired ceramic' sensors and 'high-frequency' coils mounted on electrical platforms that bolt to the vacuum vessel.

The Magnetics Diagnostic suite will produce 1,700 signals in all. During 2021, F4E placed a contract for supply of the many specialist electronics systems required to interface with these signals. Following a successful manufacturing readiness review, manufacture started during 2021. The specialist electronics includes, amongst others, 1,700 state of the art 'integrators' that remain phenomenally stable for the long ITER plasma duration. F4E also completed development of the associated scientific software during 2021, a major project that converts the signals into measurements of the magnetic fields generated in ITER, and processes these to determine the shape and position of the plasma produced inside the ITER vacuum vessel.

A major contract was awarded during 2021 for manufacturing of more than 10,000 mechanical supports and junction boxes, which attach electrical cabling to the ITER Vacuum Vessel and connect the cables to the various diagnostic sensors. The same contract also includes design and manufacture of the divertor remote handling connectors, which will enable the many Diagnostic sensors mounted on the ITER Divertor Cassettes to be connected and disconnected during installation and removal of the Cassettes.

F4E has progressed significantly during 2021 with systems in the design phase; closing two final design reviews and one preliminary design review, and undertaking ten further final design reviews and one preliminary design review. The latter included six final design reviews for the Diagnostic Ports under F4E's responsibility. These Ports, which extend over fifteen metres from the vacuum vessel in three separate zones, provide access to the ITER plasma for the Diagnostics whilst maintaining the ITER vacuum and providing necessary radiation shielding. The final design reviews were the culmination of seven years of design and development, which involved a massive activity to coordinate integration of twenty 'tenant' Diagnostic systems in the Ports from four Domestic Agencies and ITER Organisation.

During 2021, two contracts and one grant were signed for design of three large optical Diagnostic systems: the Core-plasma Thomson Scattering (CPTS) system, the Core-plasma Charge eXchange Recombination Spectrometer (CXRS) and the Equatorial Wide-Angle Viewing System (WAVS). These diagnostics are spread across six of the ITER Ports and use emissions of visible and infra-red light from the ITER Plasma to derive a wide range of parameters; such as the plasma density and temperature, as well as the power arriving to surfaces facing the plasma which is an essential parameter for ITER operations.

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU55.01.0102290	Manufacturing Design for Bespoke Instrumentation Hardware Available	Q4 2021	Predecessor of GB39	Achieved
EU55.01.0103640	Manufacturing Readiness Review meeting for Plant Controller	Q3 2021	Predecessor of GB39	Achieved
EU55.01.203290	Task Order signed for Bespoke Instrumentation Hardware	Q3 2021	Predecessor of GB39	Achieved
EU55.06.681270	HPC - IO Approval of FDR for Feedthroughs	Q4 2021	Predecessor of GB36	In delay due to time required for achievement of technical consensus and completion of documentation review.
EU55.06.682400	Approval of BTP documentation	Q4 2021	Predecessor of GB36	In delay, as a successor to EU55.06.681270

Table 7: Plasma Diagnostic Systems – Annual Objectives presented in the F4E Work Programme 2021

1.1.3.6 Plasma Heating Systems

The extremely high temperature required by the ITER plasma to achieve the conditions for nuclear fusion to occur calls for additional heating systems, as the heat generated by the electric current forming the plasma column is not sufficient on its own. ITER will be therefore equipped with three different systems to provide the overall heating.

Milestone ID	Scope Description	Forecast Achievement Date	Type of Milestone	End 2021 status
EU52.02.18380125	Dispatch Invitation to submit final proposal for European Gyrotrons Procurement	Q1 2021	WP21 objective	Achieved
EU52.04.12635	52HV08 (AAG Set#3) (1 Unit of MHVPS) 3rd set of Electron Cyclotron high voltage power supply completed at Supplier Site	Q1 2021	WP21 objective	Achieved
EU53.06.07280	Start of Manufacture of AGPS-CS of IHNB-1	Q4 2021	Predecessor of GB27	Achieved
EU53.06.07680	Final Design Report of AGPS-CS of IHNB-1 & IHNB-2 Accepted by IO and approved by F4E (MID-6), IP1.2.1	Q1 2021	WP21 objective	Not achieved due to late delivery of Design Report and delays in closure of Design Review.
EU53.01.00060	< IPL PA 5.3.P1A.EU.01 NB Tooling Signed	Q2 2021	PA signature	Achieved
EU53.04.107560	< IPL PA 5.3.P4A.EU.01 HNB Beamline Vessel Approved	Q3 2021	PA signature	Achieved

Table 8: Neutral Beam and EC Power Supplies and Sources - Annual Objectives presented in the F4E Work Programme 2021

1.1.3.6.1 Neutral Beam Heating

The Heating Neutral Beam (HNB) system is one of the additional heating system commonly used in the presently operating fusion devices. Its principle is based on the injection into the plasma of high-energy neutral atoms. Ions are initially produced into an ion source and then accelerated to high energies by means of an electrostatic accelerator. The ion beam emerging from the beam source (ion source + accelerator) is then fully neutralised into two steps, by means of a neutraliser and a residual ion dump, before being injected into the magnetically confined plasma.

Most of the HNB systems are based on the acceleration of positive ions, which is efficient up to energies of about 100keV. In ITER the need of reaching much higher energies, in the range of 1MeV, requires the use of negative ion beams.

Each of the two (or three) HNB of ITER is expected to provide an injected power of 16.5MW. This is achieved by accelerating a 40 Amps negative ion beam up to the energy of 1MeV. These parameters are well beyond the ranges of the presently operating negative ion HNB systems. Therefore to develop and test the HNB injector for ITER a dedicated test facility was established in Padua, Italy.

The Neutral Beam Test Facility (NBTF) hosts two test beds:

- SPIDER (Source for Production of Ions of Deuterium extracted from a Radio Frequency Plasma) where the ion source will be tested up to an acceleration voltage of 100KeV
- MITICA (Megavolt ITER Injector & Concept Advancement) which is the full scale prototype of the ITER HNB Injector

NB and EC power supplies and sources annual objectives work programme 2021

In 2021, in spite of difficulties caused by the Covid-19 pandemic, the activities related to the procurement of both the NBTF and the ITER NB system made substantial progress, in line with the plans.

First, the manufacturing and testing of the main mechanical components of MITICA has progressed very well.

For the Beam Source (BS) all prototypes were fabricated and successfully tested, validating the design adopted, whereas in relation to the manufacturing of the components and sub-assemblies, 75% of the activities have been completed. The assembly of the accelerator, kept on hold for nine months due a major issue, was restarted and the first stage was completely assembled and aligned, and the extremely tight mechanical tolerances required were achieved.

The complete assembly and first testing of the Beam Source handling tool for the installation of the Beam Source into the NB vessel were successfully performed at factory.

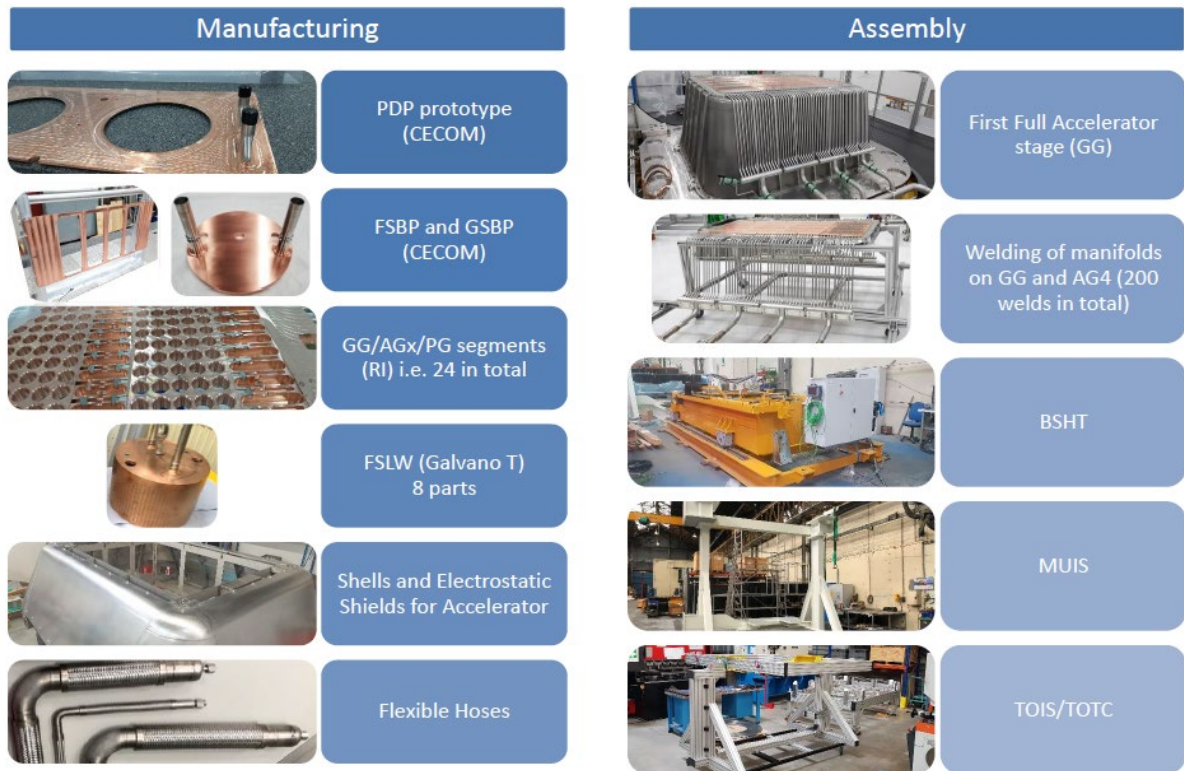


Figure 17: The main 2021 achievements for the MITICA Beam Source supply contract

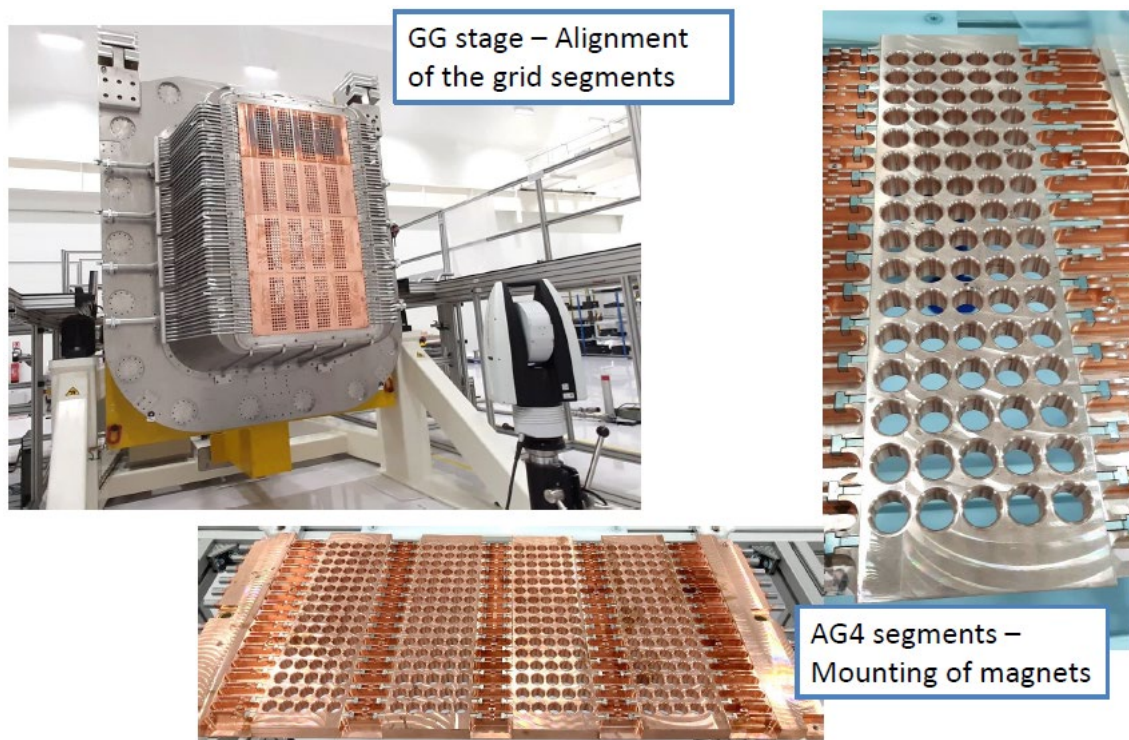


Figure 18: The assembly and alignment of the Grounded Grid (GG) of the MITICA Beam Source accelerator



Figure 19: The Beam Source Handling Tool (BSHT) during the test on the Mock-up simulating the installation of the BS into the vacuum vessel

Very good progress was also achieved on the procurement of the Beam Line Components (BLCs). The e-beam welding of prototypes joints of the Beam Line Components (BLCs) were completed and a new manufacturing strategy for the machining and deep drilling of the Beam Stop Elements (central parts of the Electrostatic Residual Ion Dump (ERID) panels) was assessed and approved.

The first electron beam welds between CuCrZr and Inconel were successfully completed on the swirl tube elements of the Calorimeter, enabling the start of the series production.

In spite of the difficult market conditions on raw material procurement, the last batch of long lead material plates was timely received, allowing the start of the challenging machining operations on the Neutraliser panels.

All the deep drills on the ERID were completed. The tubes of the Calorimeter for one of the panels have already been electron beam welded. Testing campaign for the ceramic insulators prototypes progressed with most of the tests completed.



Figure 20: Four beam stopping elements for the residual ion dump at different stages of the manufacturing cycles



Figure 21: A swirl tube elements of the Calorimeter during the dimensional control

As far as the auxiliary systems of the NBTF are concerned, another important achievement was reached thanks to successful completion of the site acceptance tests of the Gas and Vacuum System.

The integrated tests of the MITICA power supplies were performed with the Japanese domestic agency (QST) components under acceptance and the EU components already transferred to IO upon successful site acceptance tests. At high voltages, close to 1MV, breakdowns occurred. Damages were first identified on one of the rectifying diode and then of the high voltage bushing of the high voltage insulating transformer, both components being supplied by QST. The integrated tests are on hold pending root cause analysis of the issue and a revision of the NBTF integrated schedule. The impact on the overall MITICA experiment is estimated to be approximately one year.



Figure 22: The high voltage deck of the MITICA power supplies during the integrated tests



Figure 23: The high voltage bushing connecting the insulating transformer to the high voltage deck of the MITICA power supplies, during the integrated tests

Meanwhile, activities related to the ITER units of the Heating NB (HNB) system progressed well. The first part of the Procurement Arrangement (PA) on the HNB Assembly & Tooling, for the procurement of the assembly tooling was signed in May. A staged approach for the procurement of the tooling equipment, aligned with the delivery of the different NB components, was discussed and agreed with the IO. In total, more than 40 different tools will be procured to the IO under the PA.

The PA for NB Confinement and shielding, comprising the NB vacuum vessels and the so-called Front-End Components, has been also divided in several batches, to allow timely completion by IO of the technical specification for each of the different and complex mechanical components. The part related to the 2 NB vacuum vessels was signed in July and the call for tender process was launched last autumn. Contract signature is currently planned for end 2022. These are nuclear safety components, due to their confinement function.

F4E also contributed substantially to the Final Design Review (FDR) of the Drift Duct, the NB Passive Magnetic Shielding (PMS) and the Active Compensation and Corrective Coils (ACCC) performed by the IO. The design of the two latter components was substantially changed with respect to the Conceptual Design Review, in particular with an important reduction of coil size.

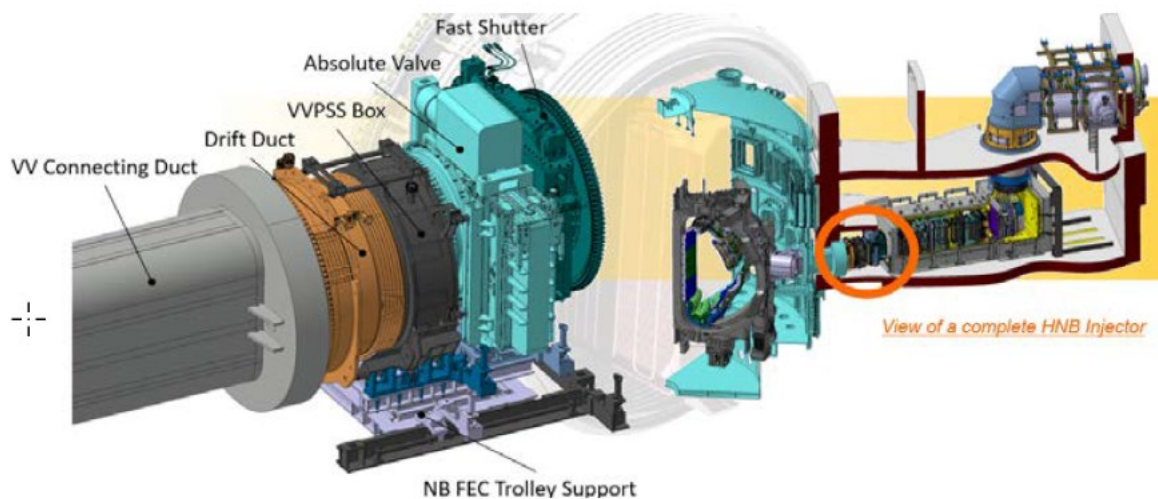


Figure 24: CAD view of the Front-End Components (FEC) of the ITER HNB injector

Finally, regarding the HNB Power Supplies (PS), the Final Design Review for the Residual Ion Dump PS of the ITER units was completed and the Final Design Review meeting was held for the Acceleration Grid Power Supply system. The approval of the Project Change Request (with the IO) and of Deviation Notice (with the F4E supplier) on change of technology to solid-state for the ITER units of the ion Source and Extraction Power Supplies (ISEPS) were both completed. The Final Documentation of MITICA unit of ISEPS was approved.

Electron Cyclotron Power Supplies and Sources

In total six units of the Electron Cyclotron Power Supply (ECPS) system have successfully passed the Factory Acceptance Tests and the remaining two units will be completed soon. Four units have been delivered and stored in ITER warehouse (three of which are needed for the First Plasma), ready for the installation planned to start inside ITER Building 15 in January 2022. All the preparatory activities for the on-site installation have been completed including among others, the Construction Readiness Review and the Common Site Inspection.



Figure 25: The ITER building 15 during the Common Site Inspection



Figure 26: The ITER building 15 during the Common Site Inspection

The Call for Tenders for the Gyrotrons was launched through a worldwide competitive negotiated procedure, covering a joint procurement for F4E and for the Divertor Tokamak Test facility (DTT), which is being set up in Frascati, Italy. The tender scope covers 6 Gyrotrons for F4E and 16 Gyrotrons for DTT. The procurement procedure was organised in two steps, where the tenders are first invited to participate, then in a second step, selected and invited to submit a tender subject to a negotiation phase at the end of which the Tenderers submitted their final offer. The negotiations were completed in October 2021 and the final offers evaluated. As last step of the procedure, the award decision and signature of framework contract will take place in 2022.

1.1.3.7 Radio and Microwave heating systems

Another way to heat up the plasma is to use radio waves to make the ions and electrons in the plasma vibrate, much like the way a microwave oven heats food. ITER is using two systems: **Ion Cyclotron (IC) Heating**, which heats the ions, and **Electron Cyclotron (EC) Heating**, which heats the electrons. Each system comprises power supplies, radio wave generators, transmission lines to transport the radio waves and antennae inside the Vacuum Vessel to launch them into the plasma.

F4E is responsible for providing two equatorial port plugs (each housing one **IC Antenna**) and four upper port plugs (each housing one **EC Upper Launcher**), together with ex-vessel components of both the EC Upper and Equatorial Launchers and control systems for the EC plant and Upper Launchers. One full EC upper launcher is required to achieve First Plasma.

In 2021 the ITER Council agreed that F4E transfer its responsibilities for its contributions towards the **IC Antenna** to the ITER Organisation. This decision was taken since F4E will not follow the design development and a cost effective procurement strategy requires contracts which span over IO and F4E procurement responsibilities.

Following the change of the procurement strategy defined in 2020 and an outstanding team effort between both the F4E and IO organizations, an amendment to the Procurement Agreement for the supply of the **EC Upper Launchers (UL)** and Ex-Vessel Waveguides (EW) was signed in December 2021. This amendment includes in particular the UL and EW systems design to be completed and the manufacturing of these components and associated ancillary systems. In parallel, a negotiated procedure was launched for the selection of an industrial Technical Integrator to perform the above design and manufacturing activities. The negotiations have been completed in 2021 and the signature of the contract is planned first quarter of 2022. Also, a first batch of eight diamond disks required for First Plasma has been manufactured by Diamond Materials. These disks will be delivered to the Technical Integrator for assembly into the diamond window unit.

F4E is also responsible for providing **eight sets of power supplies** for the EC Heating system and **six gyrotrons**, with their superconducting magnets and auxiliaries. Gyrotrons are high power microwave generators.

In total, 6 units of the Electron Cyclotron Power Supply (ECPS) system have successfully passed the Factory Acceptance Tests and the remaining 2 units will be completed soon. 4 units have been delivered and are stored in ITER warehouse (3 of which are needed for the First Plasma), ready for the installation, starting from January 2022. All the preparatory activities for the on-site installation inside the RF building at Cadarache have been completed, including the Construction Readiness Review and the Common Site Inspection.

The Call for Tenders for the Gyrotrons was launched through a worldwide competitive negotiated procedure, covering a joint procurement for F4E and for the Divertor Tokamak Test facility (DTT), which is being set up in Frascati, Italy. The scope of the tender covers 6 Gyrotrons for F4E and 16 Gyrotrons for DTT. The procurement procedure was organised in several steps, where the Tenderers were first invited to participate, then selected and invited to submit a tender, subject to a negotiation phase at the end of which the Tenderers submitted their final offer. The negotiations were completed in 2021 and the final offers evaluated. As last step of the procedure, the award decision for the framework contract will be taken in 2022

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU52.01.2000458	PA Amendment Signature both parties	Q4 2021	Predecessor of GB46	Achieved
EU52.01.203355	TO3 signed for Brazing of Diamond Disks for EC Window prototypes (OFC-729)	Q4 2021	WP21 objective	Not achieved due to technical issues and discussions regarding the modification of the dimensions and tolerances of the copper cuff for the proof of concept Diamond Window Unit prototype, the signature of the contract had to be postponed.
EU52.01.520160	Contract Signed for Manufacturing of Isolation Valve Prototypes and Series Production	Q4 2021	WP21 objective	Not achieved due to difficult negotiation with single tenderer on QA and Nuclear safety documentation requirements, the negotiation process has been prolonged.
EU52.05.500120	Task Order Signed for Support to IO and design for EC Plant Controller	Q4 2021	WP21 objective	Achieved

Table 9: Antennas and Plasma Engineering – Annual Objectives presented in the F4E Work Programme 2021

1.2 Contributions to the Broader Approach Projects

1.2.1 Satellite Tokamak Programme (JT-60SA)

The Satellite Tokamak Project (or JT-60SA), the largest super conducting tokamak to date, is located in QST site of Naka (Japan). While reutilising the site and some of the infrastructures of the former JT-60U (dismantled to make space to the new machine) it is a superconducting device capable of long pulse operation, with the aim of carrying out experiments which should be complementary to those studied in ITER.

From September 2020 the integrated commissioning of the machine had progressed steadily.

From 13 January 2021 all coils systems were progressively energised. EU-supplied toroidal field coil (18 coils, 7-m height each, among the largest superconducting magnets to date) were the first to reach full current (25.7 kA) on 2 March 2021, producing the design toroidal field of 2.25 Tesla on tokamak major radius. The maximum value was reached in steps, monitoring the coils parameter. Eventually full field was kept for more than 1 hour. Taking advantage of the presence of magnetic field a first glow discharge plasma (RF driven) was obtained and nicely documented by optical diagnostics. (see Figure 27)

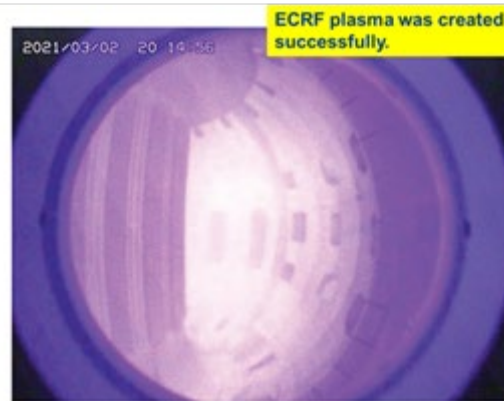


Figure 27: First EC driven plasma in JT-60SA



Figure 28: T-60SA during Magnets Energisation

While integrated commissioning was approaching completion, on 9 March 2021, during the high voltage energization of the Equilibrium Field Coil #1 (a circular magnet of about 12 m diameter and about 30 tons weight, produced by Mitsubishi Electric), a rapid increase in the power supply current was observed, followed by an increase in the cryostat pressure, and the helium cooling circuit pressure. After a few-minutes delay the safety rupture discs, protecting the helium cooling circuit opened and the helium gas was discharged, partially, into the torus hall. The incident did not produce any harm to personnel, limited direct damages to the device, but has serious consequences on the schedule of the project.

After warming up all the superconducting coils, the visual inspection inside the cryostat found that the insulation of both terminals of the EF1 coil had signs of local carbonization (attributed to a double fault to ground resulting in a coil short-circuit). The discharge of the energy stored in the coil sustained the arc, even if the power supplies protection had promptly intervened. This produced a few small holes of helium piping (local melting) which caused the pressurized helium leak.

It was immediately evident that repair and insulation reinforcement had to extend to the damaged EF1 coil terminal joints, but, also, to other EF and CS coils terminal joints with same design.

Extensive and time-consuming experimental tests have progressively revealed that a considerable part of the high voltage insulations (mainly those made manually on-site) did not guarantee its performance in so-called Paschen conditions.

In normal operating conditions the cryostat vacuum (about 10^{-5} Pa) prevents Paschen-type discharges, but EF1 incident has brought renewed attention to the fact that the cryostat vacuum, alone, should not be relied on to prevent discharges. Such discharges can potentially cause permanent damage to the insulation and a non-negligible risk of short circuits at the coil's terminals, with potentially unrecoverable damage to the machine. This analysis has led to the conclusion that an extensive repair action had to be implemented to reduce, as much as possible, this risk.

The rest of year 2021 has been largely devoted to find appropriate technical solutions, considering technical risks involved and constraints of execution, in the limited cryostat space. This requires substantially more time than originally estimated, and it is now expected that machine repair will not be completed before May 2022.

While the incident has been an obstacle in the otherwise smooth commissioning of JT-60SA, on the positive side, it is allowing fixing potentially dangerous defects, to develop repair test and repair techniques with potential use in other machines and notably ITER.

During 2021, F4E (in collaboration with EU laboratories as part of the EUROfusion consortium) provided continuous support and expertise (including remote services from the industrial contractor, which originally procured the cryoplant and the power supplies). After the incident, the support of EU expert was provided by several EU laboratories (IPP-W&X, KIT, and CEA).

While test and repair activities were carried out, at JT-60SA site, several activities in Europe were steadily progressing (also thanks to the cooperation with a number of EUROfusion laboratories).

They include a number of diagnostics (Thomson Scattering, Fast Ion Loss Detector, VUV divertor spectrometer), additional power supplies (Error Field Correction Coils Power Supplies and the second set of ECRF System Power Supplies), in-vessel components (Divertor Cryopumps Actively Cooled Divertor) auxiliary systems (Pellet Launching System, Massive Gas Injection, the ECRH Transmission lines).

1.2.2 IFMIF/EVEDA

The International Fusion Materials Irradiation Facility - IFMIF is an accelerator-based neutron source to produce a large neutron flux to qualify materials for future fusion reactors. The Engineering Validation and Design Activities (EVEDA) for IFMIF are being conducted in Rokkasho (Japan). Because the IFMIF accelerator has to reach unprecedented performances, the engineering design is being validated with the manufacturing, installation and commissioning of the LIPAc accelerator (Linear IFMIF Prototype Accelerator), which is a 1:1-scale prototype accelerator from the injector to the first cryomodule. This initiative brings together QST (Japan) and F4E, coordinating the contributions to IFMIF from INFN (Italy), CIEMAT (Spain), CEA Saclay (France) and SCK CEN (Belgium).

In July 2021, a major step in the development of the LIPAc accelerator was achieved: 5 MeV 10-mA proton and 20-mA deuteron beams were produced, accelerated, and transported in beam line down to the high power beam dump in compliance with the requirements. This was accomplished as planned in the new configuration of the machine, which consists of the complete accelerator except the cryomodule (superconducting radiofrequency linear accelerator) whose assembly is due to start in 2022. It is called the phase B+ and is the third out of four configurations of the machine

to be tested (cf. Figure 27). This has been the result of three years of work, including two years of installation of all the components, in difficult conditions due to the travel restrictions imposed by the COVID-19 outbreak. In order to implement the configuration, a new intermediate transport line has been prepared to stand in place of the cryomodule, connecting the medium- and high-energy parts of the accelerator. Such a configuration was not planned at the beginning of the project. It was devised to optimise beam operation time and commission all the LIPAc subsystems apart from the cryomodule at nominal beam current up to continuous wave at 5 MeV. The validation until the nominal energy of 9 MeV will be done after the completion of the assembly and integration into the beam line of the cryomodule. The first part of the beam operation campaign ended as planned on 30 July 2021. The beam operations restarted as scheduled in November, after the completion of the yearly maintenance of the LIPAc facility. This important step, which was completed on December 17, enabled to validate the different processes, procedures and diagnostics to operate safely the LIPAc accelerator before ramping up in current and power during the second stage campaign due to start the following year. While beam operation was carried out during the day, the conditioning of the Radiofrequency Quadrupole (RFQ), was carried out at night, up to a level of 80% of the nominal accelerating field in continuous waves.

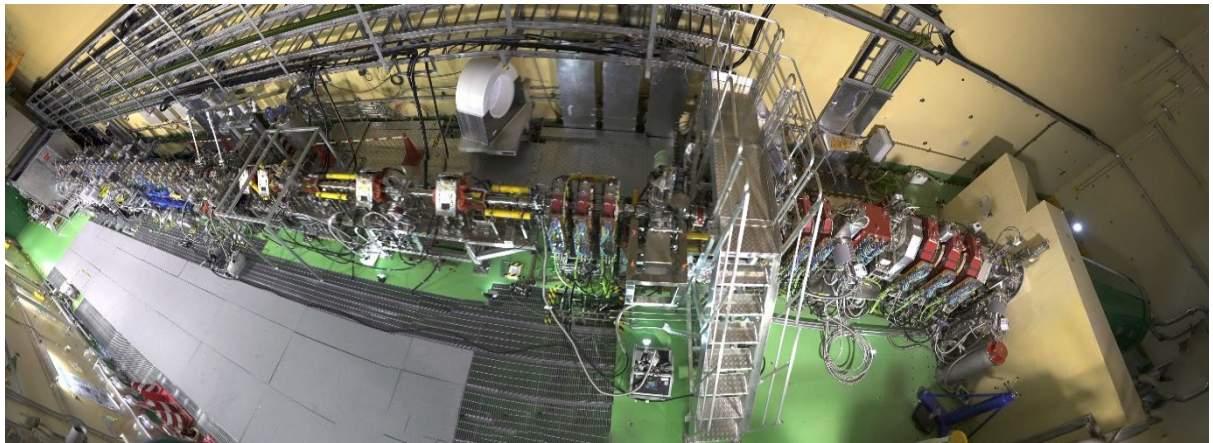


Figure 29: LIPAc top view in the phase B+ configuration in 2021

As the accelerator is growing and more subsystems need to be controlled, a central control room was built in 2020 in collaboration with the IFERC/REC project. It was fully commissioned in 2021 and has successfully been used since then (cf Figure 28).

Due to the impossibility for the EU experts and contractors to travel to Japan for the preparation and execution of the phase B+, the IFMIF team worked closely with the [IFERC](#) team to develop a safe ICT environment so that experts can have a remote access to the LIPAc data and operator interfaces. All these efforts in terms of documentation and ICT tools have significantly improved beam operation management and facilitated the involvement from Europe of the experts.



Figure 30: IFMIF/LIPAc control rooms on Rokkasho site: Left, local control room; right, central control room

In parallel, of the commissioning activities the cryoplant, which will allow to cool the cryomodule down to 4 K, was completed by installing a second Helium buffer tank in October 2021. The last components to be procured to enable the start of the assembly of the cryomodule, namely the superconducting solenoids, were delivered to Rokkasho site in December 2021 after extensive checks and tests in Europe (cf Figure 29).



Figure 31: Left, installation of the 2nd buffer tank for the cryomodule cryoplant. Right, delivery of the superconducting solenoids for the cryomodule

The Fusion Neutron Source engineering design activities and the Lithium Target Facility engineering validation activities, which restarted in 2020 in collaboration with EUROfusion in the framework of the BA phase II, have started to be implemented by both implementing agencies. The corresponding Procurement Arrangements covering the all the activities from 2021 to 2025 were signed in November 2021, and the work until the end of year 2021 was focused on the organization and coordination of such activities both internally in Europe and with QST. This theoretical and experimental work aims to provide an update of the Fusion Neutron Source Engineering Design report delivered in the framework of the BA phase I. The activities will be devoted to the enhancement of the design of the Lithium loop and the update of the Fusion Neutron Source Design focusing on the design activities for safety and accidental scenarios.

1.2.3 IFERC

The International Fusion Energy Research Centre (IFERC) Project is hosted in Rokkasho, Japan, and comprises three sub-projects:

- The Computational Simulation Centre (CSC) provides supercomputer resources for simulation projects in support of ITER, JT60-SA and other high priority areas. The second annual cycle of simulation projects was conducted in 2021 and the third cycle prepared.
- The Demonstration Reactor (DEMO) activities are done in collaboration with EUROfusion. This year, the main achievement has been the progress in research in materials where the experimental results and simulations have led to databases starting to be populated, leading the way for handbooks for future reactor construction.
- ITER Remote Experimentation Centre (REC) has started the first tests with ITER organisation of remote participation tools to give access to ITER data to the Parties. REC also implemented a collaboration with IFMIF/EVEDA on remote participation from Europe that has allowed the European contributors that could not travel due to COVID to participate in the successful commissioning and operation activities of the LIPAc accelerator.

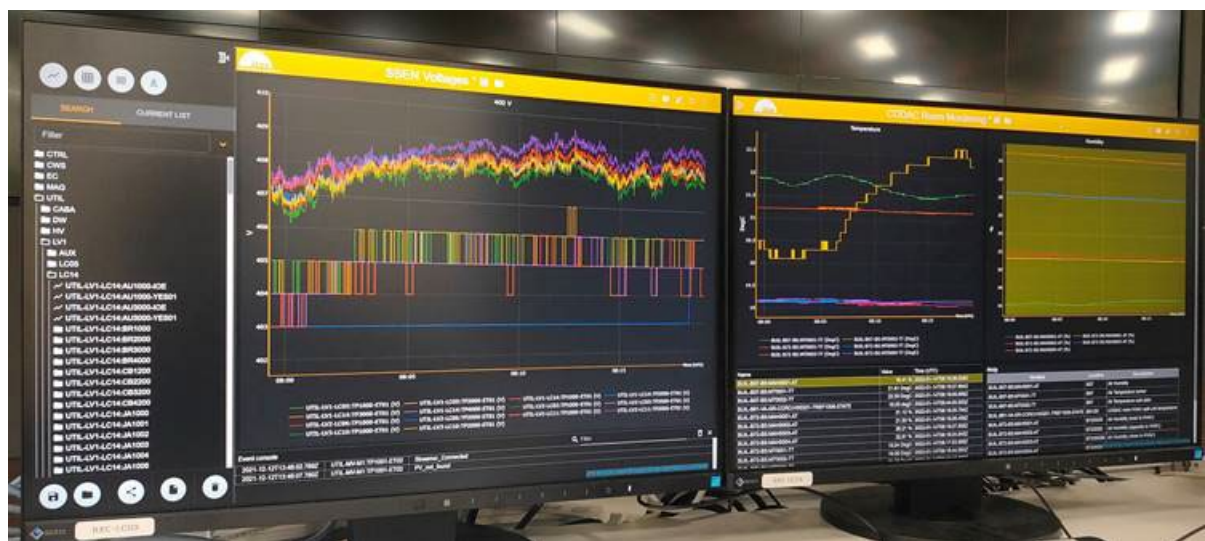


Figure 32: Test of data streaming from ITER to REC

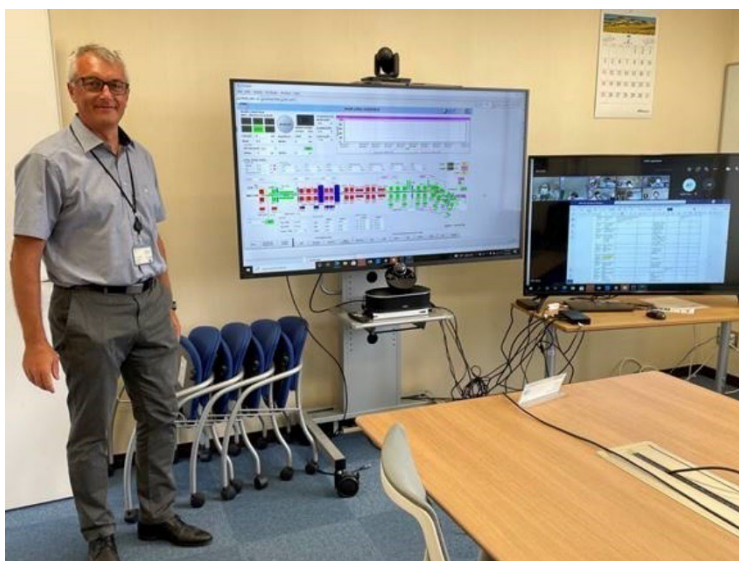


Figure 33: Real time viewing from IFMIF/EVEDA PL office of LIPAc commissioning of first beam. The same access was available to remote participants in Europe

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU.BA.01.19740	Remote participation tests REC-IO and REC-IFMIF completed	Q4 2021	WP21 objective	Achieved
EU.BA.01.22360	Contract signed for Supply of ECRH Power Supplies for two (plus two optional) gyrotrons for JT-60SA	Q1 2021	WP21 objective	Achieved
EU.BA.01.31820	Supply of beam loss detection with high sensitivity	Q3 2021	WP21 objective	Achieved.
EU.BA.01.34220	Deliverable 6th of Optical Fibres for JT-60SA Thomson Scattering	Q4 2021	WP21 objective	Achieved

Table 10: Broader Approach – Annual Objectives presented in the F4E Work Programme 2021

1.3 Technical Support Activities

1.3.1 Technical Support Services

The F4E Engineering Unit provides specific technical expertise in engineering and fusion technologies to the F4E Project Teams delivering systems to the ITER Project and, to a more limited extent, also supports the Broader Approach Projects. Technical support is provided in the following areas:

- CAD and technical data management group:** Providing Computer Aided Design (CAD) support to F4E's Project Teams in setting up the CAD infrastructure for design collaboration with suppliers and ITER organization; reviewing drawings for Procurement

Arrangement signature; warranting the traceability of CAD data exchanges; checking the CAD data at different design maturity levels; performing in-house mechanical design tasks and specifying CAD task to be subcontracted. The group provides support to the Project teams in the management of technical data and documentation to ensure the technical data/documentation is produced, controlled and reviewed according the requirements specified in the IO Procurement Arrangement. During 2021 the group completed 5 pilot PjTs for the implementation of a centralized data management support team (IRIS), this support will be extended to the ITER-D PjTs in 2022. The group provided as well strong CAD support to BIPS, Antennas, Diagnostics, Magnets and In-Vessel by performing in-house design activities, monitoring the work done by suppliers and participating in the design reviews of several components.

- **Analysis (mechanical, structural dynamics, civil engineering, fluid dynamics, electro magnetism, nuclear analyses** In 2021, 20 scientific seminars 2 workshops were organized. All presentations are available in [27ZHTW](#). Some group members contributed directly to the seminars and workshops. On February 4th a lecture on superconducting magnets was delivered ([2N5WX8](#)). An extensive seminar lecture on radiation protection and shielding was prepared and delivered in two sessions, on March 24th and 31st, which attracted approximately 90 attendees ([2RQB3T](#), [2RQBG4](#)). On 20th and 21st of May the workshop on FEM methods for electromagnetics took place ([2RWQ54](#)). More than 100 participants from many institutions (IO, CERN, Eurofusion, CEA, IPP, PSI, RFX, Berkeley lab, International universities, etc.) attended. On 28th of June a Workshop on force mapping methods took place to test different force mapping methods, determine the validity and limitations of methods and software to be used, and demonstrate the ability to solve practical problems. A benchmark exercise has been proposed to some qualified companies. Results of the workshop have been documented in. A modelling of the water activation named Radio Species Transport Model (RSTM) was developed within Fusion for Energy to extend the calculation of N16 and N17 concentration to large geometries under any complex activation rate field scenario. The methodology proposed is an embedded formulation of species activation and decay processes into the fluid dynamic equations. The RSTM was validated on a simple 2D axisymmetric experimental water expansion tank model (WET) [2] and benchmarked against experimental FW finger mock-up, detailed in the publications [3][4][5]. This study shows that former approaches [2][3] lead to much higher-than-reality activation in long residence-time areas like the FW beam. Outlet N16 and N17 concentrations are thus potentially overestimated by the order of 20-40%, depending on the homogeneity of the activation rate field. For the FWs, the larger the velocity the larger the distortive effects of stagnation and recirculation due to a dispersion of residence times.

[1] Testoni P. et al., *Fusion Engineering and Design* Volume 177, April 2022.

[2] Pampin R., Cau F. et al., *Nuclear Fusion* 61 (2021) 036003

[3] Nobs C.R, Naibs J., Packer L.W. et al., *Fusion Eng. Des.* 159, 111743 (2020).

[4] Berry T. A., Nobs C.R., Dubas A. et al., *Fusion Eng. Des.* 173, 112894 (2021)

[5] Angelone M., Pillon M., Loreti S. et al., *Fusion Eng. Des.* 160, 111998 (2020)

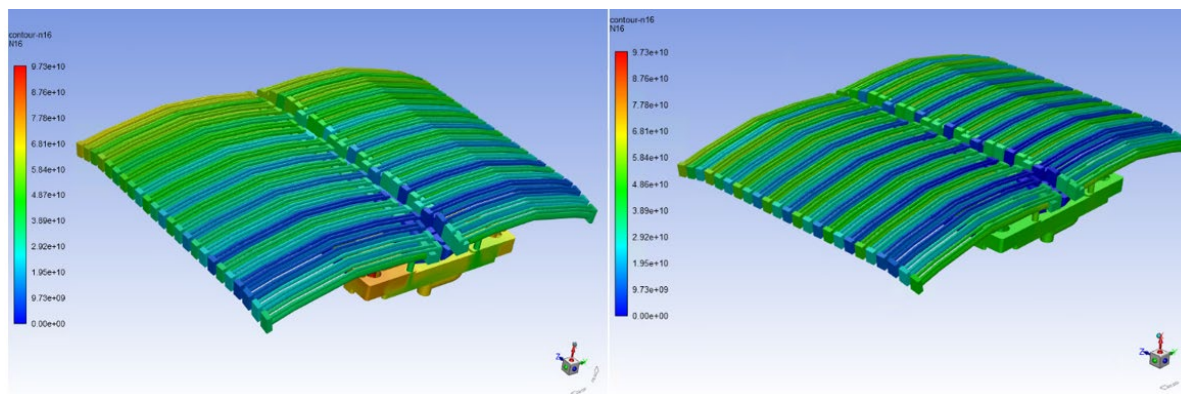


Figure 34: N16 concentration field solution (in at/cc) for an “averaged” activation rate field (left) and for a closer-to-reality “region-wise” activation rate field (right), for the FW06.

- Design Codes and Standards:** Tracking developments in, and the application of, standard codes (e.g. ASME, RCC-MR, RCC-MRx) to the design of the key ITER mechanical components (e.g.: Vacuum Vessel, Buildings and Magnets); assuring the ACO role (Analyses & Codes) in the review of all technical specifications prepared by F4E; managing F4E code & standards repository and consultations from teams; assuring access to AFCEN Nuclear Codes and relevant Codes & Standards via subscriptions for F4E users.
- Reliability, Availability, Maintenance and Inspection (RAMI):** Coordinating internally with F4E Project Teams and with ITER Organization/Operations all actions concerning RAMI processes and due analyses; assuring the RAMIO role (Reliability, Availability, Maintenance and Inspection Officer) for the review of RAMI deliverables by suppliers; support F4E suppliers in the rightful application of ITER RAMI Analysis Programme (PA AD).
- Assembly, Integration and Validation (AIV):** Coordinating internally within F4E and with the ITER Organization Construction Domain the applicable framework for assembly works at ITER Site, relevant for F4E Suppliers with assembly scope of work. Support the continuous improvement of AIV activities on site by proposing organizational, technical, management, etc. enhancements. Negotiate with IO AIV applicable documents and assess impacts of them on F4E suppliers (e.g., the General Management Specification for Executing Entities on Site).
- Instrumentation and Control:** Leveraging the synergy of 4 framework contracts provides integrated solutions to projects; from support and consultancy to fully managed product developments. Provides necessary development and managerial/technical support resources to the development and integration of plant system instrumentation, from the conception to the final acceptance: control system modelling and design, electronics modelling and design, requirements analysis and formalization, system design and documentation, preparation of design reviews, FAT (Factory Acceptance Test) and SAT (Site Acceptance Test) manning.

Issues during the delivery of certain systems prompted for an increased synergy between F4E and IO I&C teams. The two teams jointly focus at avoiding future issues, resulted in the co-development of a PLC software framework. After a first application to the vacuum project, it will become the standard for all F4E industrial I&C projects. Also the collaboration sponsored IO adoption of F4E software framework for high performance/real-time software.

- Metrology:** Defining metrological strategies both for manufacturing related activities and final acceptance of components during FAT (Factory Acceptance Test) and SAT

(Site Acceptance Test) processes; providing technical support to programmes on activities related to metrology. Expertise and services are provided for: verification of supplier metrological procedures, participation to the assessment of Non-Conformities related to metrology, witnessing of geometrical survey campaigns, carrying out of independent geometrical surveys, supporting programmes in the definition, checking and propagation of geometrical requirements, supporting programmes/suppliers in fit-up/assembly activities of components using reverse engineering and virtual fitting techniques, designing of novel metrological hardware/software solutions.

During 2021 Virtual Fitting and In-process control techniques have been extensively used for defining fit-up and machining strategies for preparing the final welds of the Vacuum Vessel sector. Ad-hoc measurement tools have been developed from scratch for assessing specific geometrical requirements (e.g. VV datum measurements, Inner Vertical Target tiles, Cassette Body datum). Follow-up of different manufacturing contracts has been accomplished by putting in place efficient procedures and detailed metrology strategies which has allowed to review around a 1000 of documents related to metrology and to ease the acceptance of different components during FATs (MITICA cryopump pumping section, PFCs, TFCs). Effort has been put in order to support different programmes (e.g. NB, Diagnostic, In-Vessel programmes,..) aiming at improving the quality of contractual drawings which are been used for defining the main geometrical requirements to be meet during manufacturing.

Complex dimensional inspections have been carried out by the team supporting specific requests by programmes, for guiding difficult assembly processes and for reconstructing the as-built geometry and or positions of manufactured/assembled parts (e.g. ITER embedded plates in Cadarache).

A number of supervision activities on metrology related topics has also been accomplished working together with the F4E quality team in order to monitor the implementation of metrology related quality requirements in different supplier chains.



Figure 35: Dimensional Inspection Survey for the MITICA Pumping Section Qualification (left) and In-Vessel FWs full scale prototypes (right)



Figure 36: VV Virtual Fitting studies (left) and In process control set up during the follow up of VV manufacturing (right)

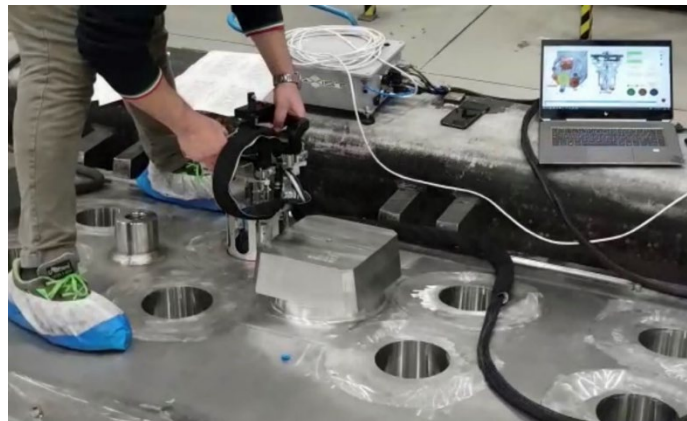


Figure 37: Ad-hoc measurement tool for VV datum reconstruction



Figure 38: Dimensional Inspection Survey for the TFC FAT

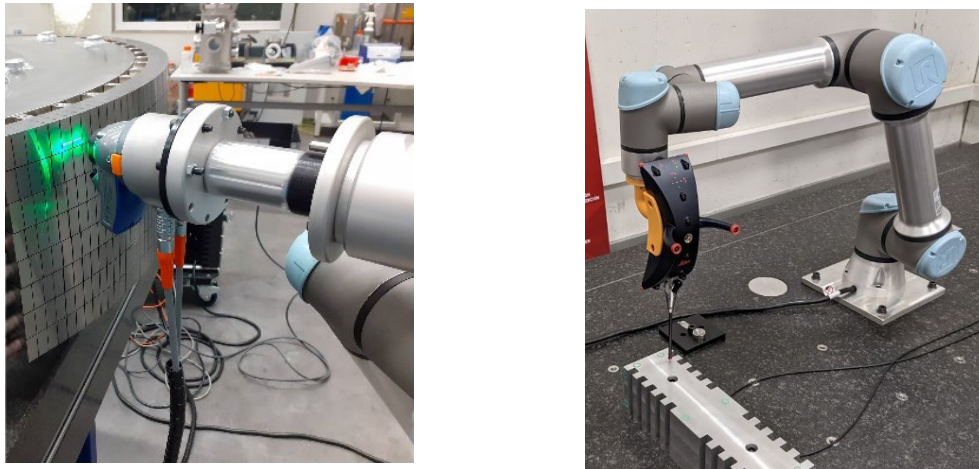


Figure 39: Ad-hoc measurement tool for IVT tiles (left) and CB datums (right)

- **Materials and Manufacturing Technologies and Processes:** Providing human resources or service contribution to ITER Programmes' activities in the scope of materials and fabrication related technologies. The services range from R&D, technical specifications and prototyping, to commissioning and manufacturing follow-up, on-site support and trainings. The key to achieve success of the group is linked to utilizing the best transversal knowhow at F4E with support from framework contracts. The versatile services embrace a variety of joining technologies such as welding, electron beam welding, hot isostatic pressing, and assessment of materials properties exposed to ITER operational conditions (neutrons, cyclic heat flux, mechanical loads and coolant) and health & safety

Materials testing, qualification of joints, mock-ups and manufacturing processes are supported via Framework contract F4E-OFC-1082 by ISQ, Portugal.

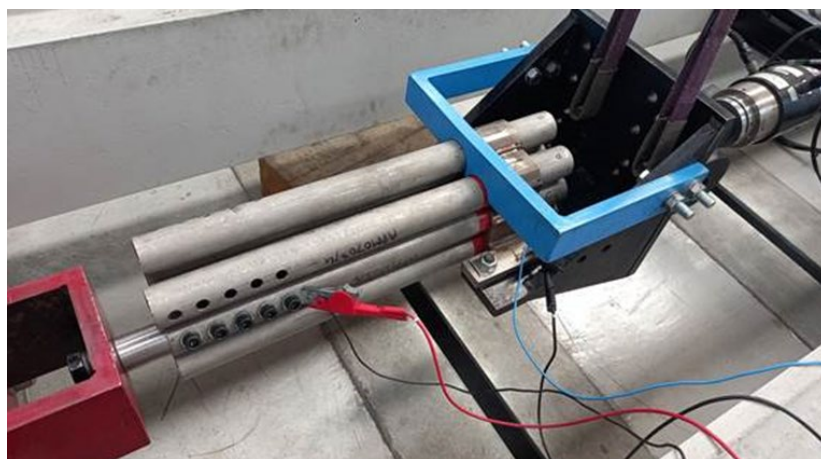


Figure 40: Thermo-mechanical testing to qualify new support concepts for ITER Cooling Manifold System. Extensive combined thermal conductance (TCC) and cyclic mechanical tests being carried out in a dedicated test facility at ISQ laboratories in Portugal.”

- System Design and Mechanical Engineering.** To provide effective technical support in system design and mechanical engineering topics, most group Members are “embedded” in the Project Teams and their contribution will be part of the Programs reporting. In general, SDME members have undertaken a large number of tasks, ranging from Magnets, First Wall, NBI, ECRH antenna and RH systems designs. Notable efforts during 2021 comprised a redesign of the critical ECRH antenna in-vessel waveguides assembly to meet the stringent operational optical requirements (Figure 39). A full assessment of the ex-vessel waveguides and its cooling systems have also been performed.

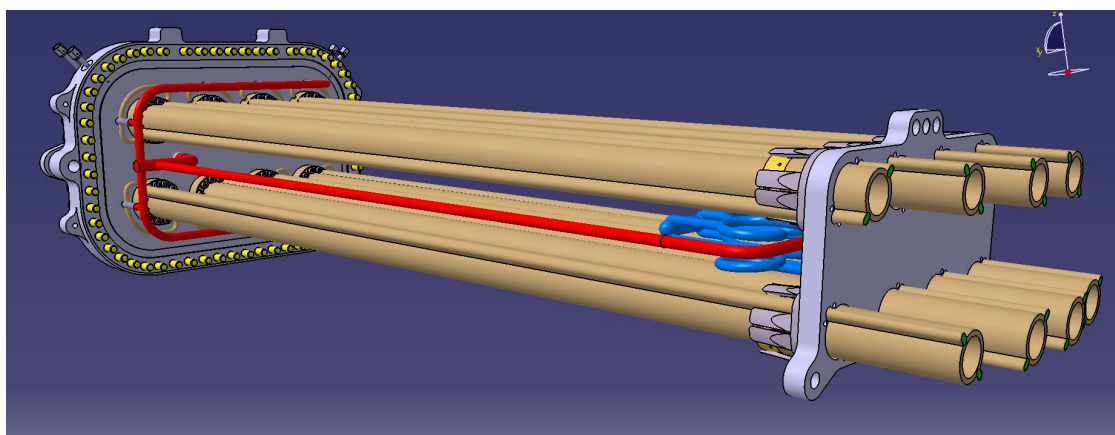


Figure 41: ITER ECRH antenna in-vessel waveguides assembly, comprising (left-to-right) closure plate sub-plate, waveguides and front support plate

Moreover, as part of its transversal support function, the SDME group also contributed directly to the 3D modelling of the new water-cooled graphite divertor for the JT-60 machine (Figure 40)

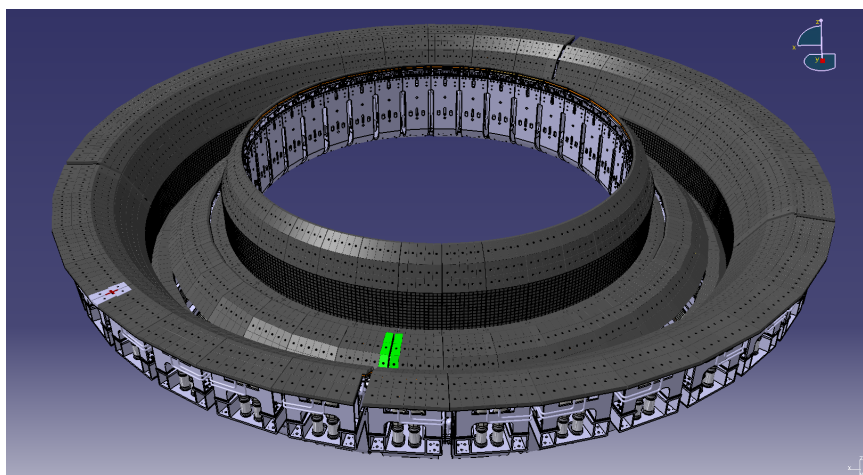


Figure 42: JT60 water-cooled graphite divertor.

- New Engineering FWC:** The renewal of an Engineering Support Contract, providing services in a wide range of engineering fields to nearly all F4E Programmes & Projects was prepared in 2021 and is expected to be signed early 2022. The contract will have a duration of four years and a total ceiling of 36 M€".

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU.ES.01.8140	Published Call for Tender for Engineering Support Contract	Q3 2021	WP21 objective	Achieved
EU.ES.02.5860	Contract Signed for Mechanical analysis of ITER Components LOT 1	Q4 2021	WP21 objective	Not achieved due to change in procurement strategy to give priority to Lot 2 which had reached its financial ceiling.
EU.ES.03.60700	Contract Signed for Provision of System, Instrumentation and Control Engineering Support-Conventional I&C	Q3 2021	WP21 objective	Achieved
EU.NS.01.23220	FwC F4E-OMF-1110 signed for Eng. Supp. Serv. in the Area of Nuclear Safety 2021-2025	Q4 2021	WP21 objective	Achieved
EU.PM.3027530	Task Order Signed for TO 14 for Convention 4 for Real Convoys for Gendarmerie Services	Q2 2021	WP21 objective	Achieved
EU.PM.3035350	Option release for extension of TO #23 under FwC F4E-OMF-0937-01 signed for QA Support to BIPS Project Team (cont.TO 03)	Q3 2021	WP21 objective	Achieved
EU.PM.3051990	FWC F4E-OMF-1127 signed for System Engineering Support Services (2021-2024)	Q4 2021	WP21 objective	Achieved
EU.PM.3072460	Task Order 22 under FwC F4E-OMF-0895 LOT 1-01 signed for PPM Support VV (cont. TO 08)	Q2 2021	WP21 objective	Achieved
EU.PM.3076400	FWC F4E-OMF-1147 signed for Project Management Systems Support Services (2021-2025) - LOT 1	Q3 2021	WP21 objective	Achieved
EU.PM.3081580	Option 5 for extension of Task Order #02 under FwC F4E-OMF-895 LOT 3 in Support on Planning & Scheduling BIPS	Q2 2021	WP21 objective	Achieved
EU.PM.3081920	Task Order #05 under FwC F4E-OMF-0895 LOT 2 signed for Risk Management Senior Support (cont. TO 03)	Q2 2021	WP21 objective	Achieved
EU.PM.4021975	Task Order Signed for TO 15 for Convention 4 for Real Convoys for Gendarmerie Services	Q4 2021	WP21 objective	Achieved
EU.PM.51380	Task Order under OMF-0783-01 signed for Support to Technical Integration (cont. TO 05 OMF-783-01-02)	Q2 2021	WP21 objective	Achieved

Table 11: Technical Support Activities – Annual Objectives presented in the F4E Work Programme 2021

1.3.2 Transportation

This activity reflects the management, on F4E's side, of technical aspects of the joint procurement with the ITER Organization for the transportation of ITER components to the site in Cadarache. The scope includes the transportation of large ITER components from all ITER Domestic Agencies, from the point of entry (the port of Marseille at Fos or Marseille's Marignane Airport) to the ITER site as well as F4E technical support on transportation and logistics activities.

The main cost driver is transportation of Highly Exceptional Loads that follow the dedicated ITER itinerary. During 2021, this activity mainly covered transportation of non-EU loads and EU-loads between Fos and Cadarache (EU-leg): The Second VV sector (from the Korean Domestic Agency) arrived successfully at the ITER site in August 2021, the heaviest HEL, according to these dimensions and weight ITER Itinerary was designed and tested. Also from Korea, 6 Vacuum Vessel Thermo Shields were delivered in Spring 2021. Several TF coils from both Japan (2 components) and Europe (4 components) were transported to the site. From the US, 2 Central Solenoid magnet modules arrived and from China 2 magnet Feeders with a width in the order of 10 meters.

In order to transport the Highly Exceptional Loads in a safe manner, support from the French Gendarmerie is provided. Two Task Orders ordering for these services were timely signed in Q2 and Q4 2021.

In 2021, the focus was put on the reduction of the number of Highly Exceptional Loads and the related number of convoys, this jointly with the ITER Organization, all ITER Domestic Agencies and the transport company that F4E has chartered. For example, Highly Exceptional Load convoys carried three components instead of one (see above KO DA VVTS), thus resulting in risk reductions and savings in terms of guarding, traffic sign removal, highway closures and crossing, railway crossing, police escort, deviation routing and surveyors. Several transports were done consecutively, reducing mobilisation and de-mobilisation cost for barge and trailers. During 2021, loads were delivered successfully and on time; risks were mitigated; and opportunities used productively, thus resulting in significant cost-savings.



Figure 43: Unloading of the Barge

KO-DA VV sector arrived in Fos-sur-Mer (Grand Port maritime de Marseille) in August 2021 and was after crossing the Lake of Berre by barge, transported during 4 nights to the ITER Site in September.

Part II (a): Management

2.1 Major Developments

For F4E, 2021 was a very difficult year as a member of our staff tragically took his own life. The pain of this unimaginable loss for his family, friends, and colleagues was deeply felt inside our organisation.

We also continued to face challenges due to the ongoing Covid-19 pandemic. F4E staff and our industrial partners have coped well and kept on delivering as this report demonstrates. Some highlights include:

- As the mandates of many Chairs and Members of its advisory Committees came to an end in December 2021, the GB made a number of key appointments with a view to ensuring the appropriate level of skills, experience, and leadership to fulfil the mandates of F4E's governing bodies.
- On the basis of a comparative analysis, the F4E IAC concluded that F4E's governance structure is robust and to a large extent adequate for the mission F4E was tasked with by the Council; division between the responsibilities of the Board and Director ensure high level of oversight and scrutiny; specialised committees systematically assist the Board and also the Director with execution of their responsibilities; the Board and committees are assisted by dedicated secretariats coordinated by the Governance Officer.
- Following the untimely passing of an F4E colleague, who took his own life in May 2021, the Board decided to open a preliminary assessment seeking to determine whether the suicide could be linked to F4E's professional environment, and to establish if a possible breach of statutory obligations occurred. After a thorough assessment carried out by three independent experts, which concluded that no such links could be established, the GB decided not to open a formal administrative enquiry. On the other hand, the GB requested the management to take all necessary actions to safeguard the well-being of staff and ensure a fair distribution of workload within the organisation and resolved to closely follow up on the developments in these areas.
- In terms of the management of the budget, the implementation has been at very good levels, both in terms of commitments and payments for the operational budget (99,6% and 98% respectively) and for the administrative one (100% for commitments and 91,6% for payments).
- The assessment of the F4E's Internal Control System was conducted in line with the EC framework. The component including F4E's working environment was found to have a critical deficiency concluding that the overall internal control system is partially effective. A non-quantified, reputational reservation related to the well-being of F4E Staff is included in the Director's Declaration of Assurance.
- We continue to make internal improvements at F4E and staff well-being had a renewed focus in 2021 following the tragic event mentioned above. Among a range of actions, we conducted a psychosocial risk assessment survey across the whole organisation and initiated a change agenda involving and engaging our staff.
- We signed new contracts with industrial partners and laboratories for a total of €240m in 2021 bringing the total investment made by F4E into European industries and research organisations since 2007 to almost €5.5bn helping to create jobs and support innovation.
- We continue to make internal improvements at F4E and staff wellbeing had a renewed focus in 2021 following the tragic event mentioned above. Among a range of actions, we

conducted a psychosocial risk assessment survey across the whole organisation and initiated a change agenda exercise involving and engaging our members of staff.

The implementation of multiannual and annual objectives set in SPD 2021-2025 is shown below.

Three multiannual objectives:

1/GB-IC milestones: There were three IC-GB milestones planned for 2021 and none was achieved.

GB/IC REFERENCE	AREA	MILESTONE	AGREED QUARTER	STATUS
GB19	Site, buildings and Power Supplies project team	Cryoplant Compressor Building (51) RFE (RFE #8B)	Q3 2021	Not achieved
GB25	Vacuum Vessel Unit	Delivery of Sector 9 by EU-DA to ITER Site	Q2 2021	Not achieved
GB54/IC67	Magnets Unit	TF coils: Complete FAT for PA work scope for 18 TF Coils	Q4 2021	Not achieved

Table 12: GB-IC milestones

2/Schedule Performance Index:

AREA	OBJECTIVE	PERFORMANCE
Schedule Performance Index	Schedule Performance Index above 0.95	0.94

Table 13: Schedule Performance Index

The multiannual Schedule Performance Index (SPI) encompasses short term and long term milestones. The non-achievement of this objective is partially due to delayed activities in VV and TB04 (resulting in TB04 re-structuring). As a consequence of the start of the re-baseline exercise, some other activities were delayed due to the changing IO need dates. The lack of F4E staff also impacted negatively the performance of this KPI.

3/Overall Costs:

AREA	OBJECTIVE	PERFORMANCE
Overall Costs	Cost estimation for ITER + Broader Approach for period up to 2027 should be less than the total budget available for this period.	Failed Budget/Cost=0.99

Table 14: Overall Costs

Due to the 7.5 % cut in the Multiannual Financial Framework (MFF) the cost estimation is higher than the Budget and the KPI therefore displays a value below the target of 1.

Six annual objectives:

AREA	OBJECTIVE	PERFORMANCE
Work Programme objectives	Implement 95% of Work Programme objectives [including GB milestones and predecessors] by end of the year	82%
Credit Allocation Scheme (CAS)	Reach 95% of achieved CAS by end of the year	90%
Quality	Reduce percentage of long aging NCRs compared to total number of open NCRs KPI≤0.22.	0.20
Annual budget	Implement 96% of Commitment Appropriations by end of the year	99.7%
Annual payment	Implement 96% of Payment Appropriations by end of the year	97.4%
Human Resources	Vacancy rate to be less than 4% by end of the year	2.44%

Table 15: Annual Objectives

This KPI covers short term objectives that are listed in the annual Work Programme. The non-achievement of the 95% target is due to a mix of reasons related to Supplier performance, F4E performance and IO performance.

CAS: The main reason for not achieving the 95% target in terms of CAS achievement is linked to the delays of Vacuum Vessel and mainly TB04 (addressed through TB04 re-structuring) together with the effects of the start of the re-baseline exercise.

2.2 Safety

2.2.1 Health and Safety

With the objective of safeguarding occupational health in line with the first corporate objective 'safety first', the beginning of the year was dedicated to the testing and implementation of the procedures and instructions of the Health and Safety (H&S) Management System, which translated into records and reports containing the results of H&S activities with the related communication.

As the COVID pandemic continued throughout 2021, the H&S team carried on a constant monitoring of the sanitary situation, designing preventive measures against the spread of the virus and working arrangements at F4E in order to ensure healthy and safe working conditions. This was done in close collaboration with the relevant stakeholders (F4E Medical Advisor, the Senior management, the H&S Committee, staff on three different worksites). Regular communication to Senior management and staff was ensured.

Considerable efforts were undertaken for issuing content applicable to all F4E sites, taking into account the particularities of each site. Whenever it was not possible to edit a unified document for all F4E sites, specific documents were issued for each site.

The [Covid Phased Working Arrangements \(2RH2KN\)](#) were issued, a document expressing in a synthetic mode the different phases (red, orange, yellow, blue and green) for all the F4E permanent sites. This document indicates, for every given phase, the preventive measures to be taken in every F4E site. It also establishes the triggers to change from one phase to another for each given F4E site.

In accordance with the legislation applicable on each site, the Health and Corporate Services Unit liaised with the national and local authorities to make sure staff members were included in the various waves of vaccination.

2.2.2 Nuclear Safety

Nuclear safety is a priority for F4E and is one of its top Corporate Objectives. ITER Organisation, as the nuclear operator of ITER, retains the primary responsibility for safety. However, F4E, as a major contributor and the principal external "intervener" to the ITER Project, has the responsibility to design and build safe systems, buildings and equipment and, overall, to give to nuclear safety the attention it deserves by maintaining a high level of a nuclear safety culture across the whole organization and its supply chain.

In this perspective, the Nuclear Safety Unit launched a series of actions to enhance the nuclear safety awareness across F4E. The first Nuclear Safety Week was organized in October, with a cumulative attendance of more than 1000 hours of workshops, trainings, talks by international safety experts, presentations and a special All Hands Meeting dedicated to this event.

A quarterly nuclear safety bulletin was launched in September aiming at bringing to F4E staff the latest news and developments about nuclear safety. Training of F4E staff, managers and external service providers was also reinforced. Finally, the Nuclear Safety Unit has signed a new framework contract that ensures a significant increase in nuclear safety support services.

Between September and November 2021, BEL-V, an internationally recognized nuclear safety organization, conducted a thorough assessment of nuclear safety culture across the whole F4E organization and concluded that F4E had reached the Stage II according to the IAEA scale, the key criterion being the general increase in safety awareness and the staff commitment to integrate safety into activities. In 2018, a similar assessment was conducted by ENSTII and had concluded at that time, that F4E was "at the first development stage of nuclear safety culture" (Stage I).

F4E's Nuclear Safety Unit main mission consists of supervising, implementing and ensuring the propagation of nuclear safety requirements into the supply chain and checking the final compliance of built and manufactured systems, structures and components to these requirements. It provides the relevant expertise and assistance to F4E's programs, and executes various controls during design and manufacturing phases. This year, the team performed eight nuclear safety inspections, in complement to the Quality audits (performed by another F4E team). These inspections demonstrate that nuclear safety management and culture are considered by F4E's suppliers but more efforts are necessary to fully comply with F4E safety standards.

The French Nuclear Safety Authority (ASN) also controls F4E activities: it conducted four inspections on the ITER site. None of them showed any major issue related to the F4E work.

In 2021, a special focus was put on the completion of the training and qualification scheme for F4E staff performing protection important activities (PIA). In April 2021, 100% of PIA performers were trained and qualified.

2.3 Governing Board

As the body responsible for the supervision of F4E in the implementation of its activities, the Governing Board (GB) meets at least twice a year and is composed of all Member States of the EU and Euratom.

The GB met on 4 occasions during 2021, while the Bureau – its preparatory body which gathers Euratom, France, the Committees' Chairs and up to three GB members elected every two years by the Board – convened 7 times with the aim of reviewing key documents and propose recommendations on GB decisions.

The summaries of the meetings of the Governing Board are made public and accessible via F4E's website: <https://fusionforenergy.europa.eu/governance-committees/governing-board/>

Risk and control issues discussed

The GB discussed several risk and control issues, in particular with regards to the emerging challenges posed by the COVID-19 pandemic and its impact on the cost and performance of the European contribution to ITER, the health danger faced by all staff and collaborators involved in the project, as well as the psychosocial impact of remote-work and social distancing. In this respect, the GB has requested and obtained an independent assessment of the impact of the pandemic on the staff psychological welfare and has called upon the management to take all necessary actions to safeguard the wellbeing of staff and ensure a fair distribution of workload within the organization.

In its statutory supervisory capacity, the GB paid close attention to the risks posed by delays in the delivery and potential cost overruns of key European ITER components, such as the Vacuum Vessel and Buildings programmes. Upon the request of the Board, F4E has put forward several risk mitigation and performance acceleration measures, whose achievements have been regularly assessed at each meeting of the Bureau and the GB.

For what concerns some of the highest-value procurements and contracts, the Board monitored the cost evolution for the implementation of major contracts and assessed the possible cost implications of design changes on future procurements – notably with regards to the Hot Cell project – and requested F4E to support the ongoing design reviews and ensure that the financing is in line with the available Euratom budget.

The GB has been attentive to the issues posed by the reduced projected revenue with respect to the prospected participation of third country members of F4E, namely the UK and Switzerland, and received regular updates on the status of the negotiations for their full association with the Euratom research and training programme, a necessary precondition for their participation in F4E activities.

The main decisions taken by the Board in 2021 are outlined as follows:

Governance

As the mandates of many Chairs and Members of its advisory Committees came to an end in December 2021, the GB made a number of key appointments with a view to ensuring the appropriate level of skills, experience, and leadership to fulfil the mandates of F4E's governing bodies.

To this end the GB appointed, upon the proposal of Euratom, Carlos Alejaldre as its new Chair for a term of two years, replacing the incumbent Chair Beatrix Vierkorn-Rudolph, who received the praise of the whole Board for her strong and committed leadership during her two-year tenure.

The GB appointed for a second, two-years mandate Maria Faury as Chair of the Administration and Management Committee (AMC) and Radomir Panek as Chair of the Technical Advisory Panel (TAP), both to serve also in the capacity of Governing Board Vice Chairs. It then renewed the mandate of the Audit Committee (AC) Chair, Ciaran Spillane, for a second term and appointed Guadeloupe de Cordoba as AMC Vice-Chair.

The GB also appointed the following Committee members:

- Paola Batistoni (Italy) and Peter Schroth (Germany) as members of the Bureau
- Mario Perez as a new Member and Vice-Chair of the Procurement and Contracts Committee (PCC)
- Laetitia Unger (Austria) as member of the AMC
- Elena Gaio for a second term as member of the TAP

Agnieszka Kazmierczak as a new member of the AC and renewed the mandate of Jeannette Ridder-Numan for a second term.

In 2021 the GB Secretariat performed a self-assessment that focused on key aspects of the F4E corporate governance, such as strategic focus, leadership, board engagement and diversity. A survey addressed to the members of the GB provided both quantitative and qualitative feedback on the F4E's governance and highlighted its strengths and areas for improvement. The overall results showed an overall positive result (68% of favourable response): the efficiency of the Secretariat and the competences and assurances provided by the Committees to the Board have been identified among the strongest assets of F4E's governance (>85% overall positive response), while the overall engagement of members, especially during virtual meetings, as well as the strategic focus emerged as areas for improvement (<60% positive response). As agreed by the Board, the Secretariat will follow-up on these results and perform this self-assessment exercise on a regular basis.

The Internal Audit Capability (IAC) performed a planned audit of F4E's corporate governance with the objective of assessing the suitability, effectiveness, and efficiency of F4E's corporate governance and the compliance with the applicable regulatory framework. On the basis of a comparative analysis, IAC concluded that F4E's governance structure is robust and to a large extent adequate for the mission F4E was tasked with by the Council; division between the responsibilities of the Board and Director ensure high level of oversight and scrutiny; specialised committees systematically assist the Board and also the Director with execution of their responsibilities; the

Board and committees are assisted by dedicated secretariats coordinated by the Governance Officer. In December 2021, the Board received the audit report and approved an action plan with a set of improvement measures, such as regular compliance self-assessments and the review of the GB and Committees' rules of procedure, whose implementation will be presented and assessed by the Board.

Preliminary Administrative Assessment

Following the untimely passing of an F4E colleague, who took his own life in May 2021, the Board decided to open a preliminary assessment seeking to determine whether the suicide could be linked to F4E's professional environment, and to establish if a possible breach of statutory obligations occurred. After a thorough assessment carried out by three independent experts, which concluded that no such links could be established, the GB decided not to open a formal administrative enquiry. On the other hand, the GB requested the management to take all necessary actions to safeguard the well-being of staff and ensure a fair distribution of workload within the organisation and resolved to closely follow up on the developments in these areas.

Human Resources

In July 2021, the GB endorsed F4Es' Strategic Resource Planning, a document providing a long-term outlook of F4E's staffing needs and recommended to use it as a basis for the negotiations with the relevant Commission services on the reinforcement of the F4E statutory staff contingent.

Annual Assessments

The GB approved the action plan following the 2020 (9th) Annual Assessment of F4E and approved the Terms of Reference for the 2021 (10th) Annual Assessment, a yearly exercise mandated by the EU Council. For the 2021 Assessment, the Governing Board decided that it should place a particular focus on the management of human resources, leadership, and corporate culture, as well as on risk management. The Governing Board appointed four independent experts to the panel of assessors, which is due to present its findings to the Board and to the EU Council and Parliament in Q3 2022.

Project Planning and Budget

The GB endorsed in July 2021 the key planning assumptions for the 2023 Single Programming Document (SPD) covering the budget, the establishment plan and laying down the main annual and multiannual objectives for the period 2023-2027 and endorsed the target objectives for the 2022 SPD. In December 2021, the Governing Board finally adopted SPD 2022 and endorsed the draft 2023 SPD. The Governing Board also adopted in November 2021 two amendments to the 2021 Work Programme and Budget and approved the original Budget for 2022.

Annual Accounts and Audit matters

The GB adopted in July 2021 the updated Management and Internal Control Standards and approved the 2020 Annual Accounts and the 2022 Audit Plan of the Internal Audit Capability (IAC).

International Agreements

In December 2021, the Governing Board approved the ITER Host Agreements between F4E and the ITER Organisation, for a duration of 10 years from their entry into force and approved the related Data Protection Agreement regulating the transfer of personal data between the two entities.

Upon a delegation from the Governing Board, the AMC approved the following technical, non-strategic agreements:

- Agreement with IO on the transfer of scope of Diagnostics Electrical Services (55.NE.C0 and 55.NE.V0).
- Agreement with IO on the transfer of scope of high voltage cables (PBS41.PP 66kV and PBS41.PP 22kV).
- Complementary Arrangement between F4E and IO on the payment for the Transfer of Scope of PBS 51.AN IC antenna (PCR-001271).

2.4 Budgetary and Financial Management

This section gives information on the establishment of 2021 Budget, its evolution and its implementation. More details are available in the 2021 Annual Accounts and in the 2021 Budgetary and Financial Management Report.

2.4.1 Establishment of the 2021 Budget

F4E's Governing Board adopted F4E Original budget for 2021² for EUR 1 048.77 million in commitment appropriations and EUR 742.81 million in payment appropriations. This budget was amended at F4E Governing Board meeting of November 2021³.

The final available appropriations, including the carry-over from the previous year amount to EUR 1 069.88 million in commitment appropriations and EUR 764.83 million in payment appropriations.

2.4.2 Budget 2021 in Revenue (Payments): Contributions

The distribution of the 2021 revenue ensures a fair balance between contributors to the F4E budget, in line with their proportional participation during the overall period of ITER construction⁴.

² Decision of the F4E GB F4E_D_2HUMRW adopted on 10 December 2020

³ Decisions of the F4E GB F4E_D_2JYS7S and F4E_D_2LG7J9 adopted on 05 November 2021

⁴ Detailed figures are presented in Annex II b. Evolution of the Statement of Expenditure in Payments

The final available appropriations, including the carry-over from the previous year amount to EUR 764.83 million.

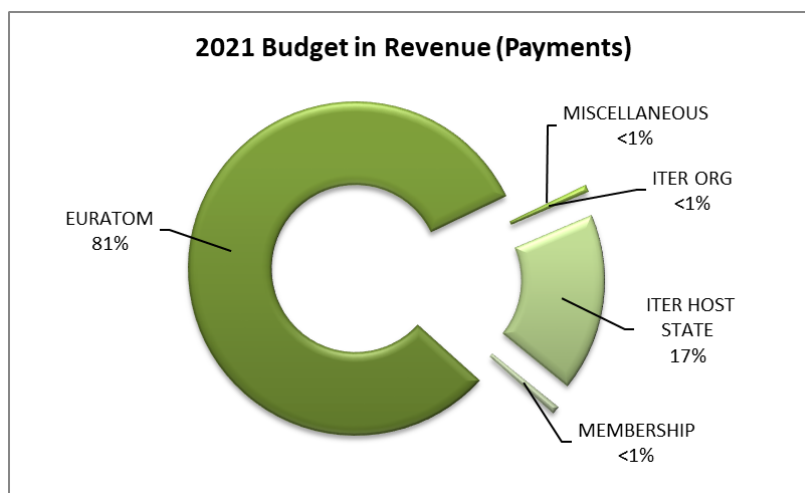


Figure 44: 2021 revenue (Payment)

2.4.3 Budget 2021: Implementation

Commitments	99.7% of implementation of the final available budget
	Final Budget: 1 069.88 Execution: 1 066.23 EUR million
	101.7% compared to the original budget
	Original Budget: 1 048.77 Execution: 1 066.23 EUR million
	88.4% in individual commitments
	Execution: 1 066.23 Ind. Commit.: 942.50 EUR million
Payments	97.4% of implementation of the final available budget
	Final Budget: 764.83 Execution: 745.25 EUR million
	100.3% compared to the original budget
	Original Budget: 742.81 Execution: 745.25 EUR million

Figure 45: Implementation in Commitments and Payments

2.4.3.1 Implementation of the 2021 Administrative Expenditure

The continuous monitoring of F4E administrative expenditure allows reaching a fair balance between actual needs and available budget. The final execution of administrative expenditure was lower than the total amount reserved in the original budget, thanks to the effort of containment of this budget and due to the Covid-19 situation. In accordance with Article 26 of F4E Financial

Regulation, the Director approved a series of transfers resulting in a reduction of EUR 1.11 million in the administrative expenditure to the benefit of the operational expenditure⁵.

The execution of the final administrative budget was respectively 100.0 % in commitment and 91.6 % in payment appropriations.

2.4.3.2 Implementation of the 2021 Operational Commitments

The Statement of Expenditure⁶ for operational commitments was amended in November 2021 by F4E Governing Board in order to align the operational budget in commitment appropriations with the evolution of the Statement of Revenue and with the successive amendments to the 2021 Work Programme. The final execution of the budget was 99.6 %, of which 87.7% in individual commitments. Three on-going procurement procedures have been globally committed, amounting in total to EUR 123.74 million.

2.4.3.3 Implementation of the 2021 Operational Payments

Title 3 – Operational expenditure⁷ was amended by F4E Governing Board in November 2021 too, in order to align the operational payments with the changes in the Statement of Revenue. In accordance with Article 26 of F4E Financial Regulation, the F4E Director adopted a series of transfers within the Title 3 to cover the operational needs on each chapter at the year-end and to ensure the best possible implementation.

Title 4 – Earmarked expenditure, the appropriations from the ITER Host State contribution (France), have been allocated entirely to the domain of ITER construction in full, were not modified along 2021. The appropriations received from ITER Organization covered tasks implemented by F4E on ITER Organization request. The other earmarked expenditures were financed from the call for funds to Japan.

The final implementation rate for all operational payments was 98.0% by the end of 2021. The non-execution is mainly due to the lack of treasury at the year-end, with VAT amounts paid and not yet reimbursed by national tax authorities. The amounts not spent on Title 3 were cancelled and those on Title 4 automatically carried over to the budget 2022.

2.4.4 Impact of the 2021 Budget in Commitment

2.4.4.1 Main Commitments

The main operational commitments for the 2021 budget are:

⁵ Detailed figures presented in Annex II c. Statistics on Financial Management - Transfers

⁶ Detailed figures presented in Annex II a. Evolution of Expenditure in Commitments for the 2021 Budget

⁷ Detailed figures presented in Annex II a. Evolution of the Expenditure in Payments for the 2021 Budget

- EUR 137.35 million for the balance of the instalments on four multi-annual contracts signed in 2020 but not fully committed on 2020 Budget in accordance to F4E Financial regulation⁸.
- EUR 255.12 million for the in-cash contribution to the ITER Organisation;
- EUR 75.78 million for the release of the Option 4 of the Tritium Building (B14), scope of the TB04 contract;
- EUR 42.99 million for the Fabrication of the ITER Divertor Cassette Bodies Stage 2;
- EUR 41.21 million to fund additional scope for the TB12 contract transferred from the TB04 contract for the Non-Nuclear Building;
- EUR 38.64 million for the in-cash contribution to Japan;
- EUR 24.13 million for the transfer of scope of the IC Antennas;
- EUR 22.71 million to fund additional scope, quantities and complexity increase for the Architect Engineer Service contract (Building);
- EUR 18.47 million for the Support to the Owner II contract;
- EUR 17.09 million for the Final Design and Manufacturing of IDES and Manufacturing of In-Vessel Supports;
- EUR 14.15 million for the TO#7 of the TB11 contract;
- EUR 123.74 million for the three on-going procurement procedures that have been globally committed at the end of 2021 are:
 - The Task Order 1 of the Design Finalization, Manufacturing & Assembly of the Electron Cyclotron Upper Launcher Port Plug;
 - The settlement of the TB04 past claims and the definition of the future sub-contract;
 - The Vacuum Vessel Action plan.

The balance to the executed budget for Title 3 and 4 (EUR 1 003 980 163) was about 700 commitments for smaller contracts, amounting in total to EUR 192.60 million.

2.4.4.2 Actions Carried Forward to 2021

The F4E obligations amount to EUR 1 531.25 million at the closure of the 2021 budget. It corresponds to the total amount left over on open budgetary commitments, as detailed below:

⁸ Article 74 (2) of the F4E financial regulation in conjunction with Article 1(5) of Annex III to the F4E Statutes provides for the possibility to make use of annual instalments for actions extending over more than one financial year. An annual instalment consists in breaking down a budgetary commitment into annual instalments. Annual instalments can be implemented according to forecast of annual payment due, forecast of progress in the implementation of the contract, or annual budget availability.

(EUR)

2021 budget Heading	Open Commitments				
	from previous years (1)	from 2021 budget (2)	Total (3)=(1)+(2)	To be de-committed (4)	Net Total (5)=(3)-(4)
TITLE 1 - STAFF EXPENDITURE	0.00	1 355 058.47	1 355 058.47	0.00	1 355 058.47
TITLE 2 - INFRASTRUCTURE AND OPERATING EXPENDITURE	0.00	3 461 583.05	3 461 583.05	0.00	3 461 583.05
Total TITLE 1 & 2	0.00	4 816 641.52	4 816 641.52	0.00	4 816 641.52
B31 - ITER CONSTRUCTION INCLUDING SITE PREPARATION	680 815 358.84	541 033 199.98	1 221 848 558.82	57 084 161.69	1 164 764 397.13
B32 - TECHNOLOGY FOR ITER AND DEMO	173 964.07	5 139 601.25	5 313 565.32	0.00	5 313 565.32
B33 - TECHNOLOGY FOR BROADER APPROACH	5 167 252.61	6 073 176.62	11 240 429.23	0.00	11 240 429.23
B35 - EXTERNAL SUPPORT ACTIVITIES	8 669 880.85	13 083 000.88	21 752 881.73	0.00	21 752 881.73
B36 - OTHER OPERATIONAL EXPENDITURE	0.00	3 483 706.12	3 483 706.12	0.00	3 483 706.12
Total TITLE 3	694 826 456.37	568 812 684.85	1 263 639 141.22	57 084 161.69	1 206 554 979.53
B41 - ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	161 086 558.94	141 789 191.05	302 875 749.99	0.00	302 875 749.99
B42 - ACTIVITIES LINKED TO ITER ORGANIZATION	11 145 716.00	14 516 891.19	25 662 607.19	9 393 964.01	16 268 643.18
B43 - OTHER EARMARKED EXPENDITURE	0.00	736 527.90	736 527.90	0.00	736 527.90
Total TITLE 4	172 232 274.94	157 042 610.14	329 274 885.08	9 393 964.01	319 880 921.07
Total TITLE 3 & 4	867 058 731.31	725 855 294.99	1 592 914 026.30	66 478 125.70	1 526 435 900.60
Total	867 058 731.31	730 671 936.51	1 597 730 667.82	66 478 125.70	1 531 252 542.12

Table 16: Open budgetary commitments at the closure of F4E's 2021 Budget

The total amount of open commitments has increased by EUR 198.37 million in 2021 compared to the end of 2020⁹.

Notes:

- Title 1 and 2: Administrative expenditure carried forward from 2020 and not paid were cancelled;
 - Title 1: There was no leftover on the 2021 commitments related to direct staff cost, normally cancelled at the end of the current year. The balance as shown in the table above corresponds to other expenses linked to staff: missions, interim staff, schooling, training, etc. for which the commitments are carried over for one year;
 - Title 2: The commitments that are carried over should be consumed at the latest by 31 December of the following year;
- Title 3 and 4: The open operational commitments are carried over to the following year with no limitation in time, to be paid according to the advancement of the contracts.
- Three on-going procurement procedures have been globally committed on the budget 2021, amounting in total to EUR 123.74 million.

⁹ F4E_D_2RG9QG 2020 Final Annual Accounts adopted on 09/07/2021

2.4.4.3 Action Extending for More than One Financial Year

The entire operational budget of F4E consists of differentiated appropriations. About 570 open commitments positions from the 2021 budget, amounting to EUR 770.00 million, cover actions extending for more than one financial year (final date of implementation after 31 December 2022).

2.4.5 Interest Charged by Suppliers through Late Payments

During 2021, F4E processed around 2 600 payment transactions (excluding salaries). Payments of invoices falling under Title 3 and Title 4 (operational expenditure) increased by 14 % in 2021 compared to 2020.

F4E paid EUR 10 545 of late interests in 2021.

2.4.6 Procurement Procedures in 2021

In line with the focus that F4E has on the achievement of ITER First Plasma, procurement procedures continued in 2021 to further progress, with focus on the prototyping and production of the systems and components part of the EU in-kind obligation.

During 2021, 35 operational procurement procedures were launched, 52 operational procurement procedures were awarded (including multiple lots) and 78 operational contracts were signed (direct and framework), for a total value of around 208 million euro.

Of the 52 operational procedures awarded, 22 were awarded following a Negotiated Procedure for a total value of 9 million euro, 21 following an Open Procedure representing 223 million euro, and 9 following a Competitive Procedure with Negotiation amounting 126 million euro. No Restricted Procedures nor Competitive Dialogues have been concluded by F4E during 2021.

For what concerns administrative expenditure, 18 administrative procurement procedures were launched, and 13 contracts were signed (direct and framework), for a total value of 29 million euro.

In 2021, only 1 grant was launched, and 1 was signed with a value of 2.3 million euro.

2.4.6.1 Type of Operational Procurement Procedures

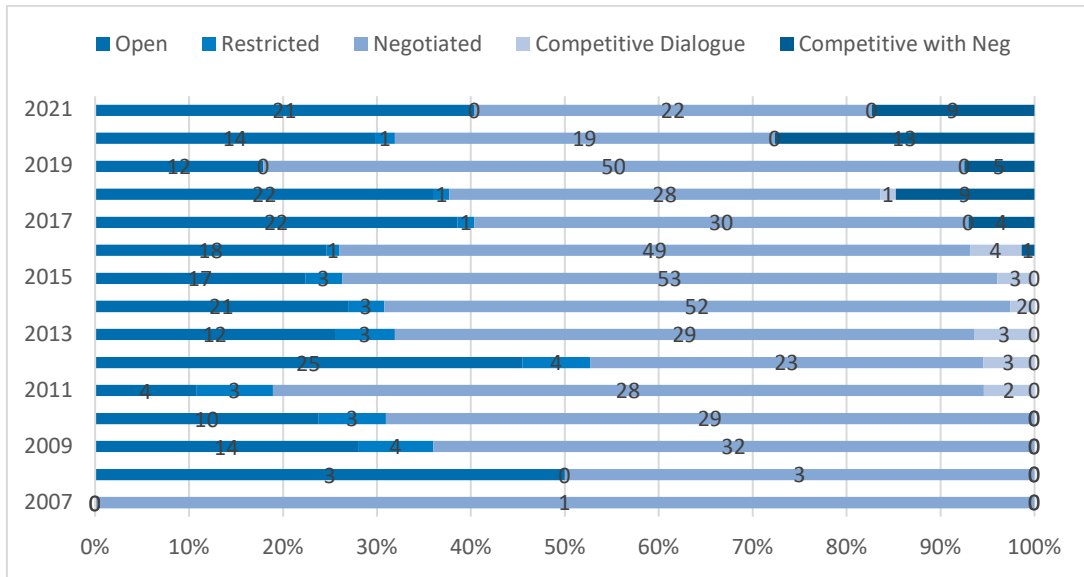


Figure 46: Number of operational procedures (LOT level) awarded by type of procurement procedure

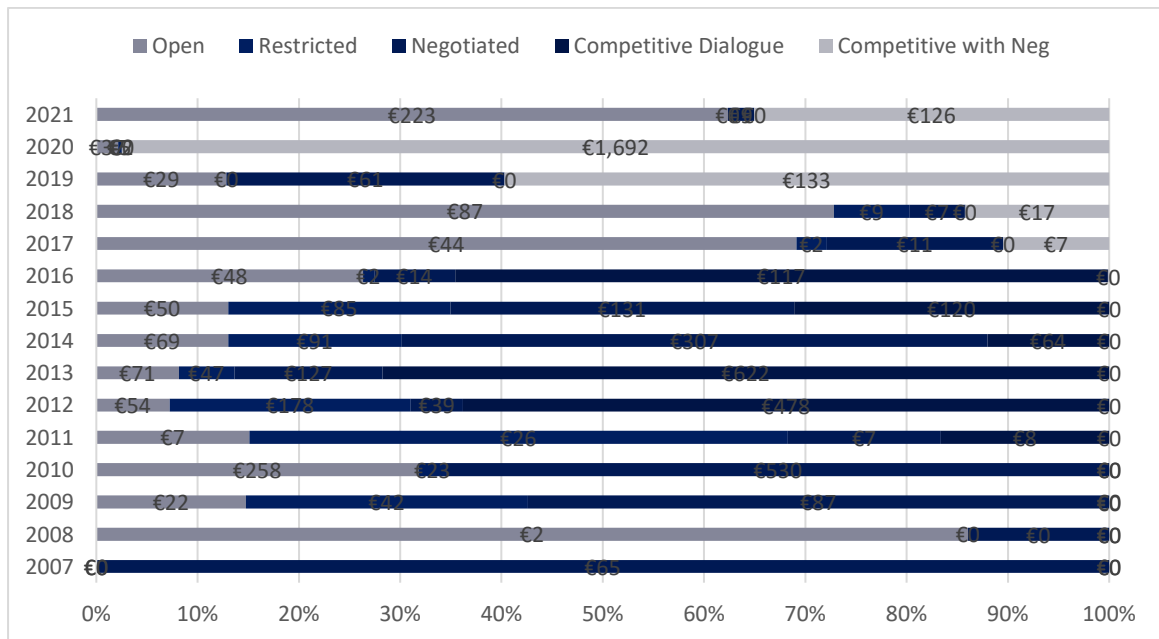


Figure 47: Value of operational procedures (LOT level) awarded by type of procurement procedure (€ million)

2.4.7 Budget Evolution for 2008-2021

The graphs below show the evolution of available F4E budgets in commitment and payment appropriations and their final execution since F4E financial autonomy in 2008.

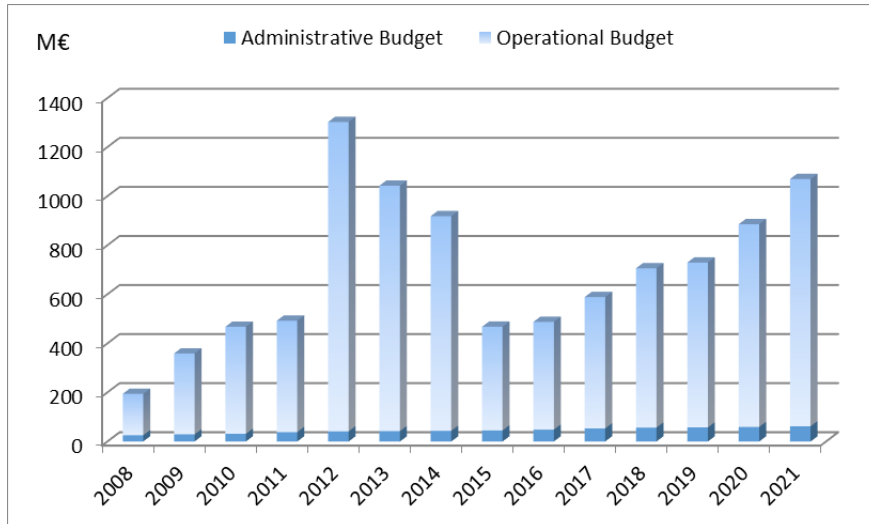


Figure 48: Budget evolution in commitment appropriations for 2008 – 2021

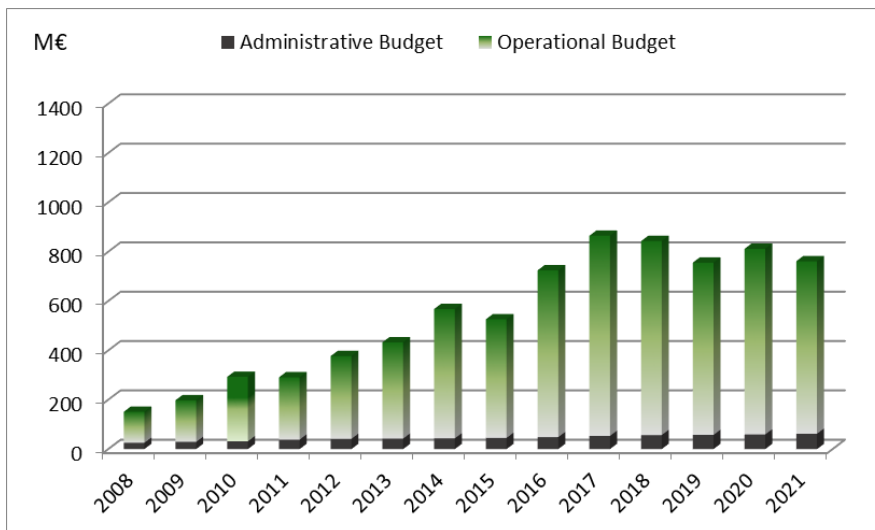


Figure 49: Budget evolution in payment appropriations for 2008 - 2021

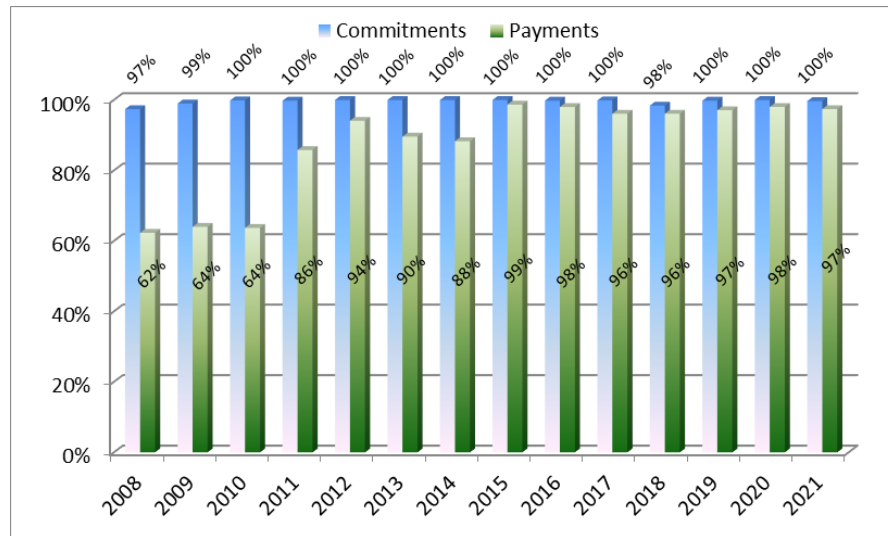


Figure 50: Evolution of Budget Execution for 2008 – 2021

2.4.8 Budget Implementation Tasks Entrusted to Other Services and Entities

There are no F4E activities delegated to other European Institutions or Bodies.

2.4.9 Cost of Controls

F4E performs a yearly calculation of the cost of controls in compliance with article 48 of the F4E FR and to provide as an input to the Directorate-General Energy of the European Commission for publication in its Annual Activity Report under the cost of controls of entrusted entities.

This exercise consists of estimating all the staff (FTEs) assigned and involved in control activities within the organisation. Once the number of FTEs is calculated, it is converted into a monetary value additionally to the budget used for other cost control activities (audit contracts, quality inspectors, etc.). F4E follows the guidelines provided by Directorate-General Budget and Directorate-General Energy, containing some general principles to perform this exercise, detailing in particular the functions that have to be considered as 100% control (financial, legal, quality, procurement activities, IT, etc.).

For the year 2021, the result of this calculation is that out of the 439 staff members at F4E, 84% (369 FTEs) spent their time in control activities. The cost of these FTEs is calculated by using a pro rata of the number of staff by category (Administrator, Assistant, Contractual Agent FG-IV and the rest of contractual agents), and using the yearly costs per category as indicated by the Commission. The result of this calculation is that the 369 FTEs dedicated to control activities at F4E have an estimated cost of 40 921 468 EUR.

In addition to this, F4E made an estimation of the cost of External Service Providers (ESPs) supporting F4E in internal and operational control activities. These include amongst others the following activities¹⁰: quality and nuclear inspectors, adjudicators for buildings contracts, Support to the Owner for building contracts, engineering and other operational support to F4E staff, etc.). The cost of these services for 2021 is estimated at 30,892,328 EUR, of which 30,305,283 EUR on operational budget and 587,045 EUR on administrative budget.

Finally, F4E also calculated the payments made on audit and certification contracts, which resulted in a total of 103,825 EUR.

The benefits of controls cannot be quantified due to the nature of activities that F4E performs, providing in-kind contributions to the ITER project. However, F4E's controls bring about significant qualitative benefits, which are confirmed by the external assurance sources, in particular by the yearly granting of discharge on the F4E budget by the European Parliament and the unqualified opinion of the European Court of Auditors on the F4E Annual Accounts.

2.5 Delegation and sub-delegation

Delegations and sub-delegations in 2021 followed the organisational structure, with a clear segregation between administrative and operational project management, empowering staff members within their areas of responsibility. During 2021, there were 116 authorising officers in F4E (12 Authorising Officers by Delegation, 29 Authorising Officers by Sub-Delegation and 75 Authorising Officers by Sub-Delegation level 2).

Each staff member who received a (sub)-delegation for the implementation of the 2021 budget provided his/her individual 'Declaration of Assurance' for the budgetary area for which they were responsible. None of these contained a reservation nor raised any issue of significance that may have an impact on the F4E Director's Declaration of Assurance.

Notwithstanding this, one observation has been included in the F4E Director's Declaration of Assurance to draw the attention of the reader to the most significant operational risks F4E is addressing at corporate level. It relates to those risks that may lead to cost increases and schedule delays, which are inherent to the magnitude and complexity of the ITER in-kind delivery project, in particular in the areas of the buildings and vacuum vessel.

In addition, the F4E Director's Declaration of Assurance contains a non-quantified reputational reservation on staff wellbeing and psychosocial risks following the tragic event of the suicide of one F4E staff member in May 2021. Actions are being implemented to improve the working environment and wellbeing of the F4E staff and mutual trust across the organisation.

¹⁰ The costs of the Architect Engineer and Occupational Health and Safety contracts in the buildings areas are not included in the calculation, as these are legal requirements according to the applicable legislation which are included in the Procurement Arrangements and therefore part of the EU in-kind contribution to the ITER project.

The declarations of assurance of the different authorising officers, together with the reports from the different assurance functions form the basis for the “Declaration of Assurance” of the F4E Director (see Part V).

2.6 Human Resources (HR) Management

2.6.1 Major HR Developments

Staff evolution, selections, and recruitment

As of 31 December 2021, the occupied staff posts at F4E included 47 Officials, 226 Temporary Agents and 166 Contract Agents. In addition, F4E relied on the support of 11 interim staff (in FTE) and two Seconded National Experts. The staff evolution at the end of the year can be seen in the following table:

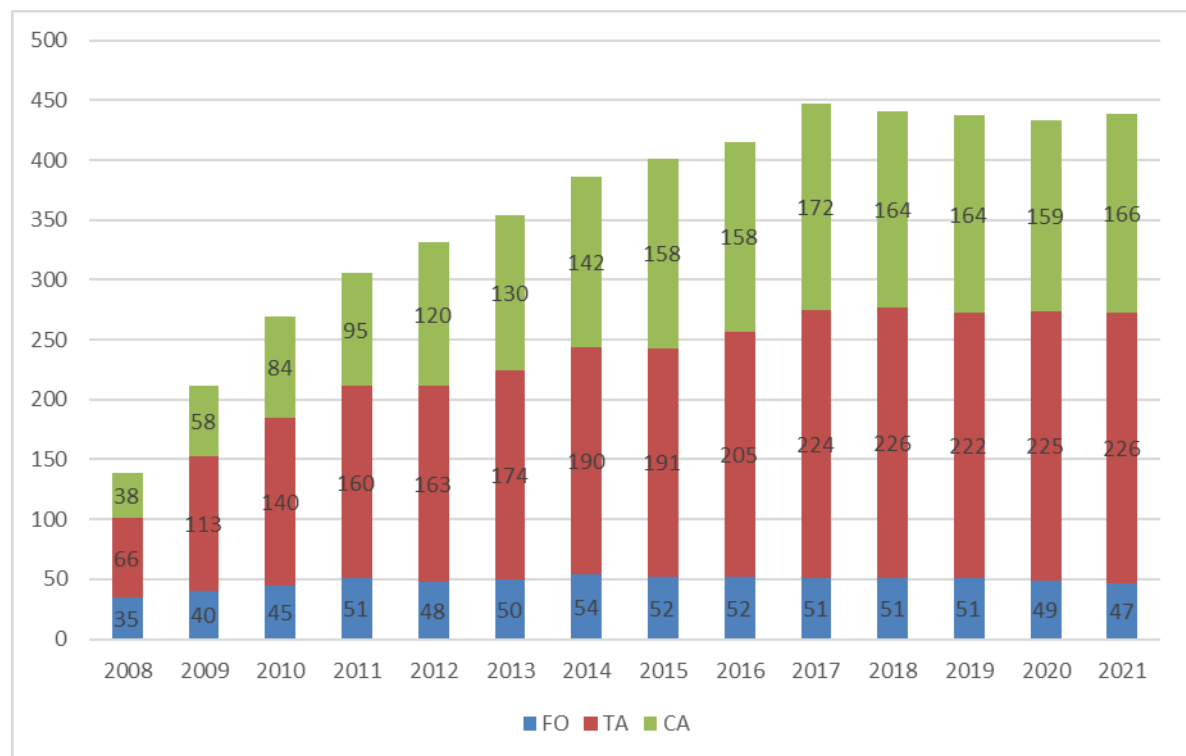


Figure 51: Staff evolution from 2008 to 2021 where FO stands for Officials, TA for Temporary Agents and CA for Contract Agents.

During 2021, 14 vacancy notices were published externally for six Temporary Agents and eight Contract Agents. Overall, 14 selection procedures were completed: of which three were published in 2020 and the remaining 11 published in 2021.

A total of 24 newcomers (six Temporary Agents and 18 Contract Agents) took up duties in 2021. In addition, six staff members (three Temporary Agents and three Contract Agents) changed their contracts. The following table shows those figures distributed by type of contract, category and department:

Department	FO	TA	CA
Administration	-	2 AD	3 FGIV, 1 FGIII, 2 FGII
Broader Approach Programme & Delivery	-	-	1 FGIII
Commercial	-	1 AD	1 FGIV
Director	-	-	1 FGIII, 1 FGII
ITER Programme	-	1 AD	-
ITER Delivery	-	1 AD	5 FGIV, 1 FGIII, 1 FGII
Project Management	-	4 AD	4 FGIV

Table 17: Recruitments distributed by type of contract, category and department

Changes to the Establishment Plan during 2021:

Conversion of two FO AD posts into two TA AD posts in line with the F4E Policy on FO positions within F4E.

Traineeship Programme

Due to the pandemic, the F4E trainees that were recruited during 2020 and 2021 worked remotely in the same way as any F4E staff member. F4E decided to exceptionally extend their traineeships for an additional 9-month period. During 2021, F4E had a total of 16 trainees – 15 of them assigned to F4E Headquarters in Barcelona and one to F4E Cadarache.

People Matters Newsletter

The former HR Notices newsletter was revamped in terms of its look and feel. The collaboration to produce it was heightened amongst all Administration Units whilst Human Resources retained ownership of the final product. Through the newly created Internal Communication Board (ICB), the upcoming newsletters topics are presented, and F4E's Communication Team coordinate the input from the representatives of the other services. The informal feedback received has been very positive and a total of four editions were issued in 2021.

Training/Career Development

F4E's Learning & Development (L&D) continued to offer learning solutions suitable for the Covid-19 circumstances, that is to say a larger variety of online and digital resources giving increased flexibility and the freedom to learn when desired and needed. A total of 94% of F4E staff members enrolled to at least one learning activity during 2021. The rate of satisfaction from F4E staff concerning internal L&D activities was high – 88% of F4E staff rated them either excellent or good.

With the objective of offering F4E staff innovative learning initiatives, Learning & Development piloted a number of initiatives, for example active bystander training and sustainable team management. These trainings received excellent feedback from F4E staff and therefore implementation will continue in the coming year. In addition, L&D sponsored development of in-house mindfulness competence, thus encouraging a rollout of mindfulness training to take place throughout F4E.

Following up on the dedicated leadership development programme, Fuel4Empowerment, of 2020 which encompassed a 360° feedback exercise of F4E's managers, targeted training, as well as group, peer and individual coaching sessions were completed during 2021. F4E managers rated their experience very positively, and L&D work will now turn to consolidating long-term benefits and further developing the leadership programme.

Health and Wellbeing

Following the survey on the impact of Covid-19 from 2020 and based on its results, F4E's Human Resources continued in 2021 to focus very actively on psychosocial preventive actions in the area of emotional wellbeing and stress management.

From March to December 2021, HR organised a pilot programme of individual coaching to help staff deal with difficulties due to the pandemic. The programme, in which a total of 32 staff members participated, consisted of five coaching sessions per person guided by a certified coach.

In March 2021, F4E's Human Resources implemented a Help Line service giving employees the opportunity to receive advice from a psychologist in order to help face mental or emotional distress. This service was implemented through a specific contract F4E had with the F4E Medical Services and is now part of the current offer F4E provides its employees.

The intranet section "Supportive Actions" continued to develop with the implemented new actions. This section presented detailed information related to supportive actions, for example wellbeing webinars that started in 2020 and continued during 2021, presentations, as well as videos.

The "Healthy Minds" intranet page promoting mindfulness and stress prevention at work, continued to develop throughout 2021. A new intranet page on psychological support covering all professional support available at F4E – existing and new services – was created to give F4E staff a full overview. In addition, a dedicated intranet page was created with a direct link on the F4ENet homepage to raise visibility and facilitate the user navigation through the many pages dedicated to these topics (psychological support, supportive actions, helpline, Confidential Counsellors etc.).

A series of wellbeing webinars were made available exclusively for F4E staff. The selection of the topics were done based on the results of the Medical Services on the impact of the Covid-19, in consultation with the HR wellbeing representative and in coordination with F4E's Health and Corporate Services and Staff Committee in order to avoid any overlaps with other wellbeing initiatives both in terms of topics and timing. Communication actions included calendar invitations, intranet articles and social media Yammer posts. All in all, seven webinars of 30 minutes each were organised at lunchtime throughout the year resulting in a participation of between 15 and 30 staff members. The webinars dealt with the following topics:

- How to Stay Active at Home
- Do You Spend Hours Sitting Down? Learn Specific Exercises to Counteract

- Keys to Exercising for Effective Weight Loss
- Healthy Coping with the Grieving Process
- Positive Psychology and Coping Strategies
- Emotional Intelligence in Everyday Life
- Stress and Time Management

Job Description Exercise

During 2021, the Job Description Exercise was launched to update and create, where necessary, all job descriptions at F4E. This action not only complies with the Internal Control Standards and other regulations on the maintenance of job descriptions and auditors' requirements, but also leads to the optimisation of processes such as recruitment, appraisals, identification of training needs, mobility and career guidance and development.

The Director, Heads of Department, Heads of Unit and Group Leaders have been actively involved in the definition of each profile, providing updates on the job overall purpose, main responsibilities and competencies.

Flexitime Data

The number of authorised days of leave under the flexitime scheme is provided in Annex V d. Flexitime Scheme in 2021. The table shows the number of days recuperated per type of contract, category and grade as well as the overtime. On average, 13% of the overtime declared by staff members was recuperated.

Diversity

In its commitment to having a diverse and inclusive workforce, F4E continued the implementation on the Strategy on Diversity, Equal Opportunities and Non-Discrimination to undertake promoting equality and diversity in the workplace. This has been coupled with information campaigns celebrating Women's Day, Women in Science Day, Disability Day, Pride Day, Men's Day as important dates to confirm the attachment to a diversity and inclusive policy.

F4E also participates in the EU Inter-Agency Group on Diversity & Inclusion, and in that framework, launched its first survey on the topic. Related talks have also been programmed in F4E.

Gender balance: In order to tackle its gender imbalance (63% male, 37% female), F4E has adopted the corporate goal that 35% of Senior Management and 45% of Middle Management positions should be filled by women by the end of 2025.

Gender	Function Group	Official		Temporary Agents		Contract Agents		Grand Total	
		Staff	%	Staff	%	Staff	%	Staff	%
Female	Administrator	11	23%	46	20%			57	13%
	Assistant	8	17%	10	4%			18	4%
	FGII, FGIII, FGIV					88	56%	88	20%
	Total female	19	40%	56	25%	88	56%	163	37%
Male	Administrator	23	49%	149	66%			172	39%
	Assistant	5	11%	21	9%			26	6%
	FGII, FGIII, FGIV					78	49%	78	18%
	Total male	28	60%	170	75%	70	49%	276	63%
Grand Total		47	100%	226	100%	158	105%	439	100%

Table 18: Gender balance on 31 December 2021

	2015		2019		2020		2021	
	Number	%	Number	%	Number	%	Number	%
Female Senior Managers	0	0	0	0	1	14%	1	14%
Male Senior Managers	3	100%	7	100%	6	86%	6	86%
Total	3		7		7		7	
Female Middle Managers	2	8%	4	16%	4	16%	5	20%
Male Middle Managers	22	92%	21	84%	21	84%	20	80%
Total	24		25		25		25	

Table 19: Gender balance on Senior and Middle Management on 31 December 2021

Geographical balance: F4E endeavours to have a balanced geographical balance. Nevertheless, this is highly dependent on the nationality of applicants to the vacancies or calls for expression of interest. In this respect, the strong representation of Spanish nationals (34.4%) reflects the location of the F4E Headquarters in Spain. They are followed by Italian nationals (18.5%) and French nationals (19.6%).

Nationality	AD + AC FG IV		AST/SC- AST + CA FGI/CA FGII/CA FGIII		TOTAL	
	Number	% of Total Staff members in AD and FG IV categories	Number	% of Total Staff members in AST SC/AST and FG I, II and III categories	Number	% of total staff
Belgian	7	2.1%	10	9.1%	17	3.9%
British	8	2.4%	4	3.6%	12	2.7%
Bulgarian	3	0.9%	1	0.9%	4	0.9%
Croatian	1	0.3%		0.0%	1	0.2%
Czech	2	0.6%	2	1.8%	4	0.9%
Dutch	5	1.5%		0.0%	5	1.1%
Estonian	1	0.3%		0.0%	1	0.2%
Finnish	3	0.9%	1	0.9%	4	0.9%
French	68	20.7%	18	16.4%	86	19.6%
German	9	2.7%	6	5.5%	15	3.4%
Greek	6	1.8%	3	2.7%	9	2.1%
Hungarian	6	1.8%		0.0%	6	1.4%
Irish	5	1.5%	2	1.8%	7	1.6%
Italian	61	18.5%	20	18.2%	81	18.5%
Lithuanian		0.0%	3	2.7%	3	0.7%
Maltese	1	0.3%		0.0%	1	0.2%
Polish	5	1.5%		0.0%	5	1.1%
Portuguese	10	3.0%	1	0.9%	11	2.5%
Romanian	10	3.0%	1	0.9%	11	2.5%
Slovak	1	0.3%		0.0%	1	0.2%
Spanish	113	34.3%	38	34.5%	151	34.4%
Swedish	4	1.2%		0.0%	4	0.9%
TOTAL	329	100%	110	100%	439	100.0%

Table 20: Geographical balance on 31 December 2021

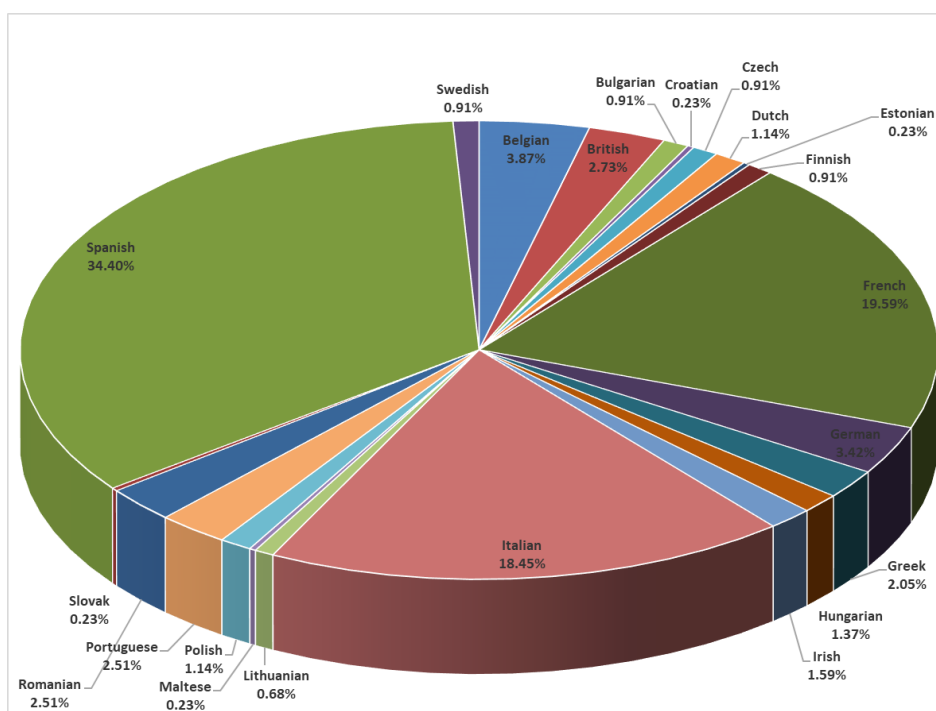


Table 21: Geographical distribution - All F4E staff

2.7 Strategy for efficiency gains

Upon the direction of its senior management team, F4E manages its corporate improvement projects through an **Improvement Steering Committee (ISC)** that provides a dedicated forum to set priorities on corporate improvement actions and align management views. This committee monitors results and proposes corrective actions if needed.

F4E uses the DMAIC (Define, Measure, Analyse, Improve, and Control) approach that forms part of the Lean Six Sigma methodology (a set of techniques and tools for process improvement). This ensures that processes are more efficient and effective to achieve efficiency gains. F4E measures results over a certain period with key performance indicators to confirm the positive trends, and corrective actions taken if needed to streamline F4E's core activities. F4E achieved the following efficiency gains from a series of improvement projects:

Project Name	Achievements	Conclusion (objective vs achievement)
Time to recruit	Reduction of the average lead time to recruit, 28 % of efficiency gain: <ul style="list-style-type: none"> • Before = 152 days • 2021 = 109 days 	Improvement achieved on time to finalise a selection procedure from the launch of the publication to the reserve list of candidates. Electronic tool being developed to manage the steps toward digitalisation.
Time to procure	Reduction of the average lead time to procure for open procedure, 36% of efficiency gain: <ul style="list-style-type: none"> • Before = 287 days • 2021 = 183 days 	Improvement achieved on the time from approved Contract Procurement Strategy to contract signature. F4E performs procurement (up to award) through an electronic tool facilitating the reception and management of tenders.
Time to sign and pay	Reduction of the average time to sign a contract (from award to legal commitment), 60% of efficiency gain: <ul style="list-style-type: none"> • Before = 35 days • 2021 = 14 days Reduction of average time to prepare the Technical Assessment Report, of the supplier deliverables related to a payment, 50% of efficiency gain: <ul style="list-style-type: none"> • Before = 16 days • 2021 = 8 days Reduction of the average time to pay for the 30 days payment type by 43%. <ul style="list-style-type: none"> • Before = 23 days • 2021 = 13 days 	Financial Transactions – improvement achieved and good performance of the improved process for the time to sign and to pay. Further financial modules were piloted to the existing contract management electronic tool (DACC) to perform budgetary commitments, contract signature (legal commitments), supplier deliverable acceptance and payments. This means that F4E has digitised all the core processes of the contractual cycle as the process reached a high maturity and efficiency level. F4E envisages further developments and improvements to the documentation exchange with suppliers.
DACC (Deviation, Amendment and Contract Changes) tool	Reduction of the average time to perform a contractual change or deviation, 46 % of efficiency gain: <ul style="list-style-type: none"> • Before: 90 days • End of 2021: 49 days 	F4E added an additional scope of contract signature in April 2020 to provide F4E with business continuity during the Covid-19 pandemic. All Deviations and Contract changes being performed through DACC as well as all operational contracts signed in DACC.

Table 22: Overview of Improvement Projects

In 2017, a **Business Process Management frame** was introduced and fully rolled out since 2019 with full process mapping and the compilation of a complete portfolio of working procedures. This strengthens the process approach and aligns improvement priorities with IT tool developments, key to optimising efficiency.

2.8 Assessment of audit and ex-post evaluation results during the reporting year

2.8.1 Internal Audit Service (IAS)

The Internal Audit Service (IAS) of the European Commission concluded one audit report during 2021, on Delegations and efficiency of decision making in F4E and cooperation mechanisms with DG ENER; and two follow-ups on Project Management of ITER deliverables and on Implementation of the Internal Control Standards Framework audit.

Delegations and decision making in F4E and cooperation mechanisms with DG ENER

This audit was included in the IAS 2021 audit plan following the non-quantified, reputational reservation in F4E's 2020 consolidated annual activity report (CAAR), as well as a qualification in the 2020 annual activity report (AAR) of the Directorate-General for Energy (DG ENER), the partner DG of F4E.

The objective of this audit was to assess the adequacy of the design and the effective implementation of F4E's internal control processes for financial circuits and financial delegations and deputising arrangements for its key operational processes. Furthermore, the audit assessed DG ENER's and F4E's cooperation and supervision mechanisms.

The audit report was finalised in January 2022, and concluded that although F4E has generally executed transactions in accordance with the principle of segregation of duties (at transaction level), and despite the challenging environment resulting from the Covid-19 pandemic, significant weaknesses exist as regards their design as well as their effective and efficient implementation. The IAS issued three very important recommendations in the areas of roles and responsibilities, automated controls and management of conflicts of interest.

Project Management of ITER deliverables

The IAS performed a follow-up on the "Project management of ITER deliverables", which was finalised in January 2022. The audit aimed to assess if the management and control systems put in place by F4E are adequately designed, effective and efficient to ensure that project management activities related to deliverables to ITER support the timely delivery of the planned project deliverables, at the required level of quality and within the planned budget.

As a result of the follow-up, the IAS considered two recommendations as closed, and left open (downgraded from Very Important to Important) another two, related to: a) Human Resources needs analysis and allocation; and b) risk reporting roles.

Implementation of Internal Control Standards Framework

The objective of the audit was to assess if the Authorising Officer has performed an adequate overall assessment of the presence and functioning of all internal control principles and components

as laid down in the Communication on the revision of the internal control framework¹¹. The focus of the review was on the assessment process, not on the internal control system itself. The aim was to have an overview of a complete cycle and hence the review covered the assessment process performed by F4E in 2020 up to the issuing of the 2019 Consolidated Annual Activity Report. This engagement is part of the horizontal audits performed in all EU Bodies (Agencies, JUs), and was not included in the IAS Strategic Audit plan 2019-2021.

The IAS performed the follow-up in January 2022 and concluded that all the recommendations were effectively implemented.

Annual Report of the IAS

Article 78(7) of the F4E Financial Regulation¹² provides that, beyond reporting on its findings and recommendations in audit reports, "the internal auditor shall also report to the Governing Board, or where the Constituent instrument allows it, a body delegated by the Governing Board and to the Director in any of the following cases:

- *Critical risks and recommendations have not been addressed;*
- *There are significant delays in the implementation of the recommendations made in previous years.*

The IAS reported on one recommendation from the audit on Project Management of ITER Deliverables, related to Human Resources needs analysis and allocation. This recommendation has been re-opened (downgraded from Very Important to Important) as per IAS' follow-up made in early 2022. The delay from the original target date is 15 months.

The status of implementation of the IAS audit actions is set out in section 2.9a Follow up of recommendations and action plans for audits and evaluations of this report.

2.8.2 Internal Audit Capability (IAC)

In 2021, F4E's Internal Audit Capability (IAC) performed five main assurance engagements:

- the Audit of Corporate Governance,
- the Validation of User Access Rights in ABAC and in DACC,
- the Follow-Up of the Audit of Nuclear Safety Management,
- the Follow Up of the Audit of Technical Support Services,
- the Follow-Up of the Audit on Implementation of the Broader Approach Agreement

¹¹ Internal Control Framework for the European Commission in April 2017 (see C(2017)2373 final)

¹² https://industryportal.f4e.europa.eu/IP_PAGES/keyreference.aspx

The new engagements resulted in 18 new recommendations. 16 were accepted or accepted with comments by the management, two were rejected.

IAC followed up 26 recommendations from the past audits and considered 18 of them as implemented, seven partially implemented and one not implemented. 19 recommendations were reported as closed, three were referred to the audit committee for closure, three were kept open and one was obsolete.

IAC also completed the first Phase of the IT digitalisation and Cyber-Security Management Audit, covering the Electronic Exchange System (“DACC”) and its compliance with Article 148 of Financial Regulation (EU, Euratom) 2018/1046.

Considering the departure of the Head of IAC as of 01/01/2022, the assessment of compliance with the IAC Charter, the professional standards of internal auditing standards, the declaration of independence as well as IAC’s opinion on the overall system of internal control will not be done for the year 2021. IAC does not provide any assurance on these aspects for the year 2021.

2.8.3 European Court of Auditors (ECA)

In November 2021, the European Court of Auditors (ECA) adopted the final Annual report on the EU Joint Undertakings for the financial year 2020, where Chapter 3.10 is devoted to F4E accounts. The ECA 2020 report is structured in three Chapters, where Chapter 1 describes the Joint Undertakings, and the nature of the audit performed by the Court, Chapter 2 presents the overall result of the audit, and finally, Chapter 3 contains, for each of the eight JUs, a statement of assurance with the opinions and observations on, firstly, the reliability of their accounts and, secondly, the legality and regularity of the underlying transactions.

The ECA provides a reasonable assurance for the implementation of the budget of F4E, concluding that:

- the accounts of the JU for the year ended 31 December 2020 present fairly, in all material respects, the financial position of the JU at 31 December 2020, the results of its operations, its cash flows, and the changes in net assets for the year then ended, in accordance with its Financial Regulation and with accounting rules adopted by the Commission’s accounting officer. These are based on internationally accepted accounting standards for the public sector.
- revenue and payments underlying the accounts for the year ended 31 December 2020 are legal and regular in all material respects.

“Emphasis of matter”

Since 2013 the Annual Report from the ECA includes, in the Statement of Assurance section, a sub-section ‘Emphasis of Matter’ raising awareness on the problems faced by F4E in relation to the cost and schedule of the overall project. The ECA refers to the estimation of the total cost for completing F4E’s delivery obligations for the ITER project assessed at €17.97 billion; and that changes in key assumptions for the estimate and risk exposure could lead to significant costs increases and/or to further delays in the implementation of the ITER project.

Observations of current and previous years

The 2020 ECA report contains 15 observations which do not affect the overall statement of assurance. F4E will enhance its overall control environment in the areas reported by the ECA as 11 out of those 15 observations require some actions.

The ECA 2020 report also confirms that F4E has fully and effectively implemented two observations from previous year (2019) and considered that other two are still in-progress.

The following table provides an overview of the status of these observations at the end of 2021:

Area	In Progress	Implemented	No Action	Total
Calculation of Memberships' contribution		1		1
DACC certification		1		1
Electronic Signatures of Legal commitments in DACC		5		5
EU e-Procurement tool -		1		1
Recruitment procedures		1		1
Responsible officers for contracts – review model contract		1		1
Validation of accounting system	1			1
TOTAL from 2020	1	10		11
Follow up of previous year comments				
Insourced resources	1			1
Re-evaluation of the effectiveness of the new EVM system		1		1
Human Resource management – Corporate Culture		1		1
Cost Based management (mission charged on operational budget)		1		1
Evaluation process, equivalence for specific certification			1	1
Total from Follow up	1	3	1	5
GRAND TOTAL	2	13	1	16

Table 23: Observations and actions taken by F4E

The status of the actions in progress is the following:

- Validation of the accounting system: the external validation is being carried out by an external audit firm and the final report is expected by July 2022.
- Insourced resources: the budgetary caps on statutory staff as foreseen in the F4E's establishment plan indeed fall well below the needs of the ITER project. The need for external resources is accompanied by various risks that F4E manages in line with its: (i) resource strategy, (ii) comprehensive risk analysis and (iii) mitigation action roadmap approved by its Governing Board. The various actions foreseen under this risk management program launched in April 2020 tackle the issues mentioned by the ECA

and provide safeguards considered adequate also by the governance instance responsible for administrative and management oversight.

2.9 a Follow up of recommendations and action plans for audits and evaluations

The status of the implementation of the internal audit action plans as of 31 December 2021 is as follows:

Audit Name	Audit Source	Recs	Actions	In Progress	Implemented	Cancelled	Obsolete	Implemented %
Action plans issued before 2021								
Technical Support Services Audit	IAC	8	16	0	16	0	0	100,00%
Broader Approach Agreement Audit	IAC	8	9	0	9	0	0	100,00%
Nuclear Safety Management	IAC	10	24	2	22	0	0	91,67%
Project Management of ITER deliverables	IAS	20	26	3	23	0	0	88,46%
ECOSYS - Systems and Controls ensuring reliability of financial planning data	IAC	28	28	3	25	0	0	89,29%
Internal Control Framework Implementation	IAS	6	12	0	12	0	0	100,00%
total before 2021		80	115	8	107	0	0	93,04%
Action plans issued from 2021								
Vacuum Vessel contract	IAC	14	17	6	11	0	0	64,71%
Corporate Governance Audit	IAC	7	14	14	0	0	0	0,00%
Total from 2021		21	31	20	11	0	0	35,48%
TOTAL PORTFOLIO		101	146	28	118	0	0	80,82%
				19%	81%	0%	0%	

-* Implemented % is equal to the number of actions implemented per total number of actions that can be executed (Cancelled and Obsolete actions are not taken into account)

Table 24: Overview of implementation of action plans per Audit

F4E's portfolio includes six action plans issued before 2021, for which the implementation rate has reached 93% (with 107 actions already implemented), and two action plans from 2021, already implemented at 35%, including the action plan from Corporate Governance (IAC) issued in December 2021, with 14 actions.

During the year, the IAC conducted the second follow up of the Technical Support Services contracts, and concluded that the remaining 4 recommendations (with 7 related actions) were all effectively implemented, closing the audit.

In November 2021, after the IAC's follow up, the Audit Committee concluded that the audit on Broader Approach was fully implemented, as F4E management had already taken all possible actions, and since then the report is closed.

The IAS performed the follow up of their audit on Internal Control Framework Implementation in January 2022, and concluded that all the recommendations were effectively implemented, and that the report could be considered as closed.

Five action plans are in the process of being implemented. The detailed status is as follows:

- **IAC audit on Nuclear Safety:** The IAC finalised the audit report in October 2019. The scope of the audit covered the management and compliance aspects of F4E's nuclear safety management. The report concluded on 10 recommendations (2 Critical, related to ownership and assurance on ITER Generic Safety Requirements and the implementation of management standards, and 8 recommendations rated Very Important). In May 2020, the IAC performed a first follow-up and reduced the criticality of the 2 Critical recommendations to Very Important. In May 2021, IAC conducted a second follow up, and concluded that 7 recommendations were fully implemented, two recommendations needed further efforts in order to mitigate the remaining risks, and one recommendation was considered by the IAC as obsolete. Of the two actions in-progress at the end of 2021, one action has been implemented early in March 2022 and the other one has a target date end June 2022.
- **IAS audit on Project Management of ITER deliverables:** The final report, issued in May 2020, resulted in 20 recommendations (14 Very Important and 6 Important), and one "Issue for Consideration". F4E accepted 19 recommendations and rejected one recommendation (rated as Important). F4E agreed with IAS an action plan containing 26 actions. The IAS performed the follow up in January 2022, and concluded that out of 26 actions, 22 actions have been fully implemented (84%) and other 4 actions were re-opened and downgraded from Very Important to Important. At present, there are three actions in progress, with target date June 2022.
- **IAC audit on Systems and Controls ensuring reliability of financial planning data – ECOSYS:** The report was issued in June 2020, including 28 recommendations (9 Very important, 13 Important and 6 Desirable). F4E rejected one recommendation (rated as Important). F4E submitted an action plan with 28 actions in agreement with IAC, where 25 actions have already been implemented, and another three have target dates along the first half 2022.
- **IAC Vacuum Vessel contract:** The scope of the audit covered, in particular, the assessment of the adequacy of the Vacuum Vessel contract; compliance of the contractor (AMW consortium) and F4E with the key contractual provisions including delivery times; and test of controls of key contract management processes put in place by F4E. The report was issued in February 2021, with 14 recommendations (2 Very Important, 9 Important and 3 Desirable), all of them accepted by F4E. The action plan, agreed with the IAC, included 17 actions, 11 of them already implemented.
- **IAC Corporate Governance audit –** The final report was issued in November 2021, and concluded with 7 recommendations, all rated as Important. The main audit objectives were to assess: a) suitability of F4E's corporate governance arrangements and their current maturity level; b) the compliance with the legal, regulatory and procedural framework applicable to corporate governance; c) the design and effectiveness of controls applied in the governance process(es) and the accountability tools; and finally, d) to assess the efficiency of corporate governance processes. The action plan includes a total of 14 actions, all of them in progress.

Evolution of F4E's portfolio of actions in progress

Looking at the evolution of the portfolio it can be concluded that F4E has timely implemented most of the action plans. As regards audit reports issued before 2021, the rate of implementation has reached 93%, with only 8 actions in-progress, and 35% of actions are implemented for the action plans issued in 2021.

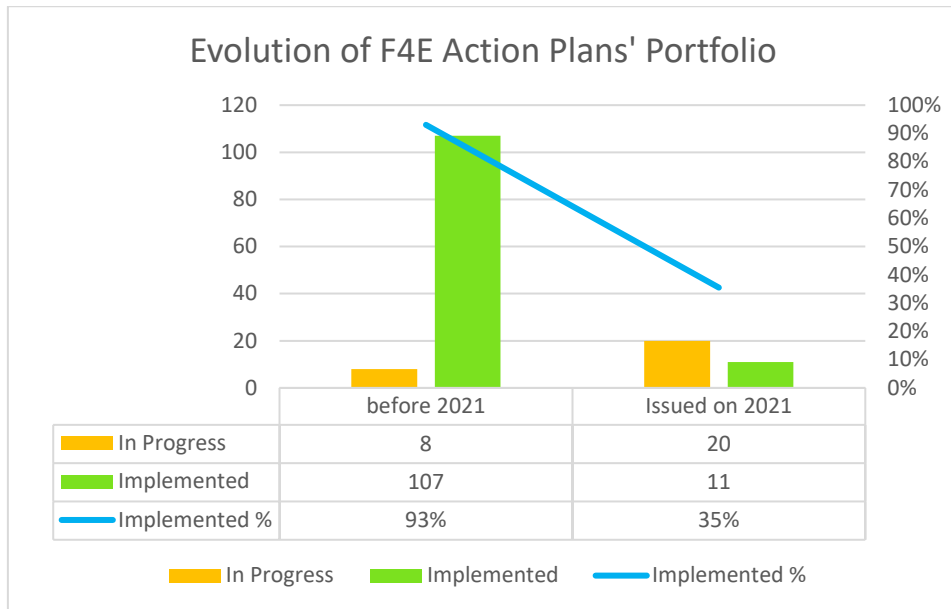


Table 25: Evolution of F4E's portfolio and status of implementation by year of audit

Overview per Criticality of Actions

	In Progress	Implemented	Cancelled	Obsolete	Totals	Implemented %*
Critical	0	0	0	0	0	00,00%
Very Important	5	58	0	0	63	94%
Important	21	51	0	0	72	71%
Desirable	2	9	0	0	11	82%
Totals	28	118	0	0	146	81%

*Implemented % is equal to the number of actions implemented per total number of actions that can be executed (Cancelled and Obsolete actions are not taken into account)

Table 26: Overview per Criticality of Actions

2.9 b Follow up of recommendations issued following investigations by OLAF

The Anti-Fraud and Ethics Officer is the single and confidential contact point for OLAF. There have been no specific OLAF recommendations to follow up during the reporting period.

2.10 Follow up of observations from the discharge authority

For the financial year 2019, the European Parliament (EP) granted, in its plenary session of April 2021, the Discharge in respect of the implementation of the budget to F4E and the closure of its accounts. They issued 31 observations with regards to some aspects of the project, in relation to the “Emphasis of Matter” of the European Court of Auditors raising concerns on the cost and schedule risk of F4E and the ITER project, and in relation to procedural aspects of F4E internal control.

In July 2021, F4E submitted a report to the EP on the measures taken in the light of the observations accompanying the EP’s discharge decision for 2019, in accordance with Article 107 of the F4E Financial Regulation. Out of 31 observations of the European Parliament, 18 were reported as “No Action” required from F4E, 7 were reported as “Implemented” and the remaining 6 as “Ongoing”.

Currently there are 4 observations still ongoing, and its status is the following:

- **ITER Organisation’s members’ financial contributions no yet received:** While the observation reports issues outside of F4E remit, F4E, after consultation with the European Commission, addresses the observation as follows. Some ITER Members have been having problems in providing their in-cash contribution to the project but continue committed to deliver their in-kind contribution in the form of the components to build the ITER device. Diplomatic channels have been activated to resolve these issues, resulting in the reception of some in-cash payments. However, the Covid-19 pandemic has exacerbated the difficulties for some of the faulting countries. In addition to this, already in 2018, the ITER Council created a mechanism to partially replace the in-cash contributions of the Members into in-kind contributions and the ITER Organization is also facilitating the payments to it by allowing dividing these contributions into several instalments within a year, in accordance with the schedule and plans of the corresponding Member. The Joint undertaking is closely following and will report further on this matter.
- **Risk of further cost increases and delays in the implementation of the ITER project - Contingency:** While the observation reports issues outside of F4E remit, F4E, after consultation with the European Commission, addresses the observation as follows. Last November 2020, the ITER Organisation informed that it would assess the impact of the on-going COVID-19 pandemic in the schedule and cost of the project (the baseline) during 2021. This exercise is on-going and will be concluded only once the pandemic is over and all the ITER Members and the ITER Organisation have the accurate information to evaluate this impact, expected to be presented in the summer 2022.

- **Insourced resources:** F4E defined an elaborate risk assessment related to its use and reliance on external resources. Implementation of the various risk mitigating elements and action plans is structured and supervised by its Improvement Steering Committee and will continue to reinforce F4E's capacity to adequately deliver on its mandate while, at the same time effectively manage the potential security and reputational risks associated to external workforce reliance. In parallel, management has elaborated a strategic resource planning (i.e. long term resource needs analysis) spanning the period of the current MFF and articulating a strategy for plugging the gap between the demand and supply of resources.
- **Gender equality and geographical representation:** in April 2020 F4E approved its *Diversity, Equal Opportunities and Non-Discrimination* policy, where the objectives are: a) to promote the values of equality and non-discrimination; and b) to promote diversity. Then, in September 2021, F4E issued the action plan *Strategy on Diversity, Equal Opportunities and Non-Discrimination*, which contains actions addressed to geographical and gender balance. This includes actions of a continuous nature (related to vacancies, raising awareness, etc.) and others with a concrete target date in 2021 and 2022.

2.11 Environment Management

Following the commitment of the Spanish authorities to refurbish F4E premises, renovation works have started on one floor with emphasis on energy savings and adequate thermal installations.

In October 2021, F4E endorsed the Presidency of the Greening Subnetwork and prepared its first work programme in order to increase collaboration among Agencies and Joint Undertakings on environmental issues.

The current premises hosting F4E are LEEDS certificated. Fusion for Energy shares the same building with several companies and therefore, has limited room for manoeuvre to reduce its impact on the environment, but actively collaborates with the Building Management to act whenever possible.

2.12 Assessment by Management

2021 was a very difficult year for F4E as a member of our staff tragically took his own life. F4E also continued to face the challenges due to the ongoing Covid-19 pandemic, having its staff and industrial partners coping with these difficult times and delivering on the project.

The results measured by corporate action implementation, audit action implementation, budget implementation and efficiency gains, show that F4E rose to the challenges with overall positive results, achieving continuity and improvement in many areas. However, the tragic event took its toll, and required a focus on the wellbeing of staff. This led to the inclusion of a reputational reservation on the F4E Director's Declaration of Assurance. Actions are being implemented to improve the working environment and wellbeing of the F4E staff and mutual trust across the organisation.

As explained above, F4E is doing its utmost to respect the ITER project baseline. An important milestone was achieved in 2021, by transferring the responsibility of the buildings site coordination from F4E to the ITER Organisation. A number of key components were also delivered, including three Toroidal Field coils, and the first three Poloidal Field coils, and we entered the final assembly phase for the first EU Vacuum Vessel sector..

Two critical projects – the buildings services (TB04) and the vacuum vessel are under close F4E supervision to ensure the necessary effort by the contractors to deliver the first products out (First of a Kind). By the end of 2021, the overall impact of Covid-19 on F4E's projects is in the range of x months and around EUR x million (constant 2008 values). F4E is working closely with ITER to mitigate the impact of delays and optimise the assembly sequence of the project.

F4E has also started to apply lessons learnt and pre-emptively work on risk mitigation for the ITER second and third plasma projects, which are still in a very early phase. The largest and most challenging are the hot cell facility as well as the remote handling and neutral beam heating systems. F4E is informing its Governing Board and subsidiary committees on a regular basis about the risks associated with the above projects.

Part II. (b) External Evaluations

The April 2018 Council Conclusions on the reformed ITER project state that “the independent annual assessments of the progress of ITER have to be continued and intensified with a focus on the performance and project management, including cost containment, schedule project control as well as risk management”.

To meet the Council request for an enhanced annual assessment, the Governing Board instructed F4E to contract four independent experts of recognized standing to assess F4E according to the terms of reference for the 10th Annual Assessment, which the Governing Board approved at its October 2021 meeting. At its November 2021 meeting, the Governing Board appointed four experts with the task of providing a report and a set of recommendations to be presented to the Governing Board at its meeting of July 2022 and then distributed to the EU Council and Parliament.

In December 2021, the GB approved the action plan following the 2020 (9th) Annual Assessment, whose implementation will be systematically monitored by the Bureau and Governing Board in the course of 2022.

Part III Assessment of the effectiveness of the internal control systems

3.1 Effectiveness of internal control systems

At the end of 2018, the Governing Board adopted a revised framework 'F4E Management and Internal Control Standards' (MICS) adapting it to the 2017 EC Internal Control Framework covering the five components: control environment, risk assessment (including risks of fraud), control activities, information and communication and monitoring activities.

Monitoring criteria, comprising baselines, indicators and targets for measuring the effectiveness of the implementation of the MICS were also introduced with the aim of facilitating the identification of any deficiencies in the internal control system as part of the overall procedure for conducting the Internal Control System Annual Assessment (from now on, the assessment).

In 2021, F4E further aligned its MICS, indicators and procedures with the EC Internal Control Framework.

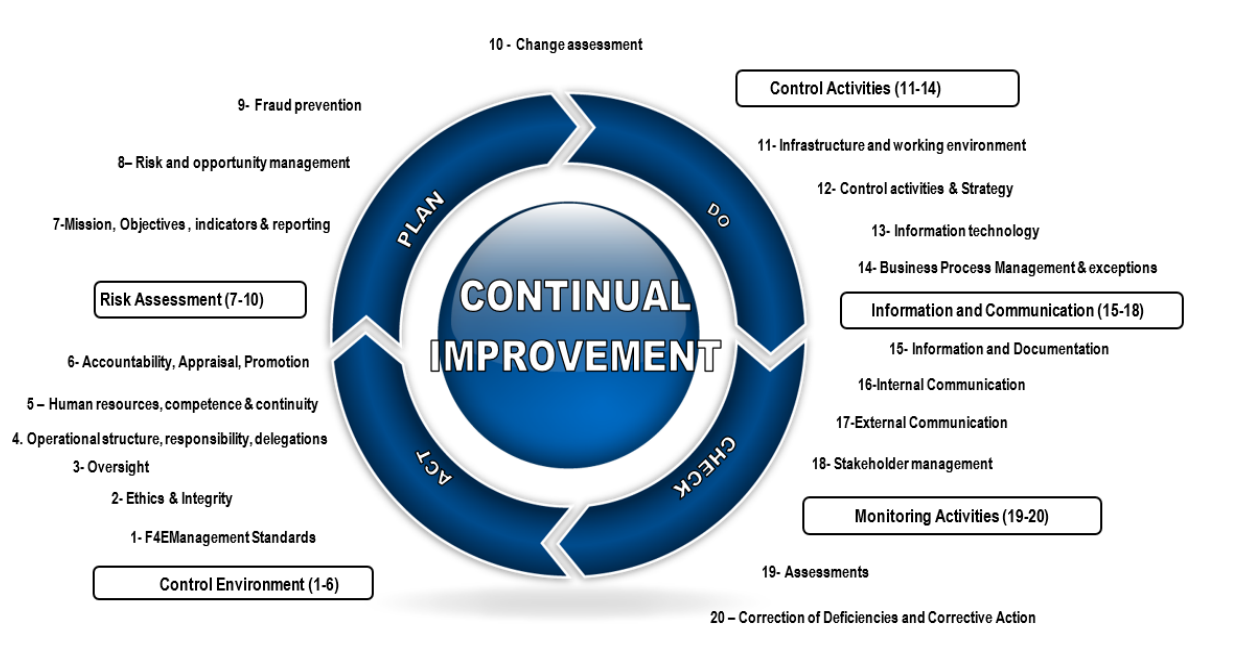


Figure 52: F4E Management and Internal Control Standards (MICS)

F4E followed a step-by-step approach on the identification of strengths and weakness of the Internal control system based on any deficiencies identified in the functioning of the MICS and formulated corresponding corrective action, leading to the conclusions for the establishment of the Director's Declaration of Assurance and reporting in the CAAR.

3.1.1 Actions undertaken during the year to respond to the priority areas identified in the 2020 CAAR

In last year's Consolidated Annual Activity Report, F4E concluded that :

All the components are operating together in an integrated manner.

Due to the fact that one component was found to have a critical deficiency - issue occurred with the formalisation of legal commitments for operational expenditure in F4E's contract management tool that was adapted for new contracts while remote working during the Covid-19 pandemic - impacting the Internal Control System and included by the Director as a reservation in his Declaration of Assurance, F4E Management concluded that the overall internal control system was **partially effective**.

This conclusion was in line with IAC's overall opinion that the F4E internal control system is Outlined and Operated.

In response to the reservation in the 2020 Director's Declaration of Assurance, F4E took the following actions in 2021:

- F4E registered a non-compliance related to the contract management tool (DACC)
- A corrective action plan with 8 actions was adopted and it has been implemented
- Certification that the DACC tool meets the requirements of the General Financial Regulation article 148 'Electronic exchange systems'

In addition, an IAS audit on the decision making processes and the related delegation of powers, resulted in 3 Very Important recommendations. The IAS accepted the F4E action plan to address the risks identified. Furthermore, the IAC also included DACC in their annual review of the ABAC system access rights, which was also recommended to enhance the security of the tool.

The following actions were pursued throughout 2021 with the aim of addressing the deficiencies identified in the 2020 CAAR, as well as the ongoing implementation of actions of auditors and assessors.

MICS	CATEGORY	DEFICIENCIES	STATUS
4 Operational Structure, Responsibility, Delegations and Reporting Lines	Effective with moderate deficiencies	Issues identified by the External Assessors in the area of trust between management teams	Ongoing: The actions taken will be evaluated in the 2022 Annual Assessment and followed up in the 2021 Corrective Action plan
		Issue in the area of project governance - matrix structure and by the IAC in the area of financial reporting.	Closed: Audit actions implemented
		Issue related to reporting lines and accountability chains in the area of financial management	Closed: Audit actions implemented
5 Human Resources, Competence and Continuity	Effective with moderate deficiencies	Risk of assimilation of external resources	Ongoing: Project underway to address external resources management
		Staff perception on the need to enhance availability and accessibility of training and on the need to better allocate resources on the basis of competencies needed to achieve F4E objectives and priorities.	Closed: Roll out planned training initiatives under HR new programme and Staff Engagement Action plan
		Issues identified by the IAS in the area of quality of information provided by suppliers and by the ECA in the way F4E shortlists candidates	Closed: Audit actions implemented

6 Accountability, Appraisal and Promotion	Effective with moderate deficiencies	Timely Completion of appraisal exercise	Closed: Progress made in the timeliness of the exercise
		Issue related to definition of professional duties	Ongoing: Update the job descriptions being finalised
7. Mission, Objectives, Indicators and Reporting	Effective with moderate deficiency	Weaknesses in the financial reporting (project planning, budget execution and payments traceability) identified by the IAC and the IAS	Closed: Audit actions implemented
8. Risk and Opportunity Management	Effective with moderate deficiency	Risk of further cost increases and delays in project implementation compared to the current approved baseline as identified by the ECA	Ongoing – continuous nature and follow-up in the 2021 Corrective Action plan
		Minor weaknesses in the risk data input and traceability	Ongoing – follow-up in the 2021 Corrective Action plan
12 Control activities and Strategy	Not fully effective with critical deficiency	Formalisation of legal commitments for operational expenditure in F4E's contract management tool that was adapted for new contracts while remote working during the Covid-19 pandemic.	Closed, see above the actions implemented in response to the reservation 2020.
	Moderate deficiency	Issues in the follow-up of project progress, cost estimation and control and nuclear safety culture, identified by the IAC and the External Assessors	Closed: Audit actions closed
13 Information Technology	Effective with moderate deficiency	Minor weaknesses in the areas of fraud prevention, HR, Finance and procurement	Ongoing
14 Business Process Management and Exceptions	Effective with moderate deficiency	Minor weaknesses in the processes and procedures in the areas of financial reporting and project management identified by the IAC and the IAS	Closed: Audit actions implemented
15 Information and Documentation	Effective with moderate deficiencies	Issues identified by IAC on documentation of financial reporting and nuclear safety areas	Ongoing
		Document Management Support Officer visibility	Closed: Corrective action implemented
16 Internal Communication	Effective with moderate deficiency	Issues raised by the IAC in relation to sharing best practices between project teams, by the anti-fraud action plan in the area of awareness raising and by the External Assessors in the area of trust	Closed: Audit actions implemented
18 Stakeholder Management	Effective with moderate deficiency	Reporting Actual contributions of the BA projects and their costs	Closed: Audit actions implemented
19 Assessments	Effective with moderate deficiency	External assessors recommendation to raise Nuclear Safety Culture awareness	Closed: External assessors actions implemented

3.1.2 Methodology for the Internal Control System annual assessment for 2021

The following steps, in line with the EC Internal Control Framework and methodology, were taken to conduct the assessment:

- I. Assessment of the Internal Control Monitoring Criteria and Staff MICS questionnaire results;
- II. Analysis of sources available in RAPID (F4E's database to follow-up actions): ECA Annual Report, Annual Assessments of External Assessors and ad hoc group reports, Reports from IAC, IAS audits, Actions proposed for each exception and non-compliance and Anti-Fraud Strategy Action Plan;
- III. Other sources: Corporate Risk and Opportunity register, Declarations of Assurance of the Responsible Authorising Officers (RAOs), Annual report of Internal Auditors, weaknesses reported by Staff;
- IV. Determination of the Severity of Deficiencies per MICS and proposal of corrective actions;
- V. Workshops with the Internal Control Coordinator and the Risk and Opportunity Manager with assurance providers and the staff responsible for the areas covered by the 20 MICS;
- VI. Preliminary assessment made by the Internal Control Coordinator;
- VII. Conclusion of assessment per Standard, Component and Overall System;
- VIII. Workshop for Senior Management and Director endorsement; and,
- IX. Preparation of the Director's Declaration of Assurance and CAAR.

The workshops with the assurance providers and contact points of the MICS activity areas, as well as the Risk and Opportunity Manager further reinforced the clarification of any issues (in particular on the status of actions in RAPID) and gave the opportunity to discuss the mitigating actions being implemented to address the deficiencies identified during the preliminary assessment conducted by the Internal Control Coordinator and when possible, to review the initial severity rating of the MICS.

During the Senior Management and the Director workshop, additional information was provided, where relevant, to complement the preliminary assessment and a final corrective action plan endorsed.

- 8 MICS have been identified as effective and functioning well
- 9 MICS have been identified as effective with moderate deficiencies
- 2 MICS have been identified as effective with major deficiencies
- 1 MICS has been identified as not fully effective with one critical corrective action (information on critical corrective action can be found in section 3.1.3)

The corrective actions proposed as a result of the assessment will be regularly monitored by the Assurance Network, in charge of the ongoing monitoring of the F4E internal control system.

3.1.3 Classification of the MICS resulting from the assessment and corrective actions

The following classification has been applied to determine the severity level of the deficiency.

Category	Definition
Effective, functioning well – Minor corrective actions	The MICS is present and functioning well, in some cases minor corrective actions are needed.
Effective with moderate deficiencies – Moderate corrective actions	The MICS is present and functioning but some moderate corrective actions are needed.
Partially Effective – Major corrective actions	The MICS is partially present and functioning, major corrective actions are needed.
Not Fully Effective – Critical corrective actions	The MICS is not fully present and functioning.

On the level of the MICS

Below is a summary of the assessment by MICS, detailing the deficiencies identified, the corrective actions and target dates.

MICS	CATEGORY	DEFICIENCIES	CORRECTIVE ACTIONS	TARGET DATE
1 Management and Internal Control Standards	Effective, functioning well			
2 Ethics and Integrity	Effective with moderate deficiencies	Ongoing actions under the IAC audit on Corporate Governance	Actions being implemented, no new action needed	
3 Oversight responsibility	Effective with moderate deficiencies	Ongoing actions under the IAC audit on Corporate Governance	Actions being implemented, no new action needed	
4 Operational Structure, Responsibility, Delegations and Reporting Lines	Partially effective with 1 major deficiency	Issues identified by the External Assessors in the area of trust between management teams	No new action needed The effectiveness of actions taken in response to the 2019 Annual Assessment related to the mutual trust issue will be evaluated in the 2022 Annual Assessment and at this time still remain open as a potential major issue.	
		Financial Delegations tool still to be enhanced (access rights, deputising role, etc.)	Actions being implemented, no new action needed	
5 Human Resources, Competence and Continuity	Partially effective with 1 major deficiency	Risk of assimilation of external resources	Actions being implemented, no new action needed	
		Workload (major)	Actions being implemented, no new action needed	
6 Accountability, Appraisal and Promotion	Effective with moderate deficiency	Update of job descriptions	Action being implemented, no new action needed	

7. Mission, Objectives, Indicators and Reporting	Effective with moderate deficiency	Update the Cost Containment Policy (also included in the corporate objectives)	Action being implemented, no new action needed	
8. Risk and Opportunity Management	Effective with moderate deficiency	Risk of further cost increases and delays in project implementation compared to the current approved baseline as identified by the ECA	Actions of continuous nature being implemented, no new action needed Implementation of mitigating actions in the ongoing ITER in-kind delivery projects, in particular the buildings and the vacuum vessel	
		Escalation of the risks to support a decentralised risk management practice	Action being implemented, no new action needed	
9 Fraud Prevention	Effective, functioning well			
10 Change Assessment	Effective, functioning well			
11 Infrastructure and Work Environment	Not fully effective with critical deficiency	Issue on wellbeing of staff as set out in the annex to the reservation (critical)	New actions (1) Complete the implementation of action plan in response to the psychosocial risk assessment (2) Communicate on the measures already implemented to Staff	(1) Dec 2021 (2) Sep 2021
12 Control activities and Strategy	Effective with moderate deficiency	Ongoing actions in response to IAC audit to improve cost estimates in buildings and improve follow up of VV delivery	Actions being implemented, no new action needed	
		Delays and non-compliance (record of exception) in administrative procurement	New action Assess the efficiency and effectiveness of administrative procurement and implementation of administrative budget in the Admin department	Dec 2022
13 Information Technology	Effective with moderate deficiency	Weakness in the areas of fraud prevention and HR tracking	Actions being implemented, no new action needed	
14 Business Process Management and Exceptions	Effective with moderate deficiency	Weakness in the process to ensure resources take into account evolutions of needs, in response to IAS audit	Actions being implemented, no new action needed	
15 Information and Documentation	Effective with moderate deficiencies	Issue identified by IAC on historical documentation in nuclear safety	Action being implemented, no new action needed	
16 Internal Communication	Effective, functioning well			
17 External Communication	Effective, functioning well			
18 Stakeholder Management	Effective, functioning well			
19 Assessments	Effective, functioning well			
20 Correction of Deficiencies and Corrective action	Effective, functioning well			

For most of the deficiencies identified, corrective actions had been already launched in order to respond to the auditors' and external assessors' recommendations. The new actions have been listed.

On the level of the Components

COMPONENT	CLASSIFICATION
1. CONTROL ENVIRONMENT (MICS 1 to 6)	Major deficiency
2. RISK ASSESSMENT (MICS 7 to 10)	Moderate deficiency
3. CONTROL ACTIVITIES (MICS 11 to 14)	Critical deficiency
4. INFORMATION & COMMUNICATION (MICS 15 to 18)	Moderate deficiency
5. MONITORING ACTIVITIES (MICS 19 and 20)	No deficiency

On the level of the System

All the components are operating together in an integrated manner. Due to the fact that one component has been found to have a critical deficiency – Control activities -Issue on wellbeing of staff, as set out in section 4.3 'Reservation', F4E Management concludes that the overall internal control system is **partially effective**.

3.1.4 Prevention, Detection, Correction of Fraud

The Anti-Fraud (OLAF) and Ethics Officer promoted and coordinated the implementation of the F4E Anti-Fraud Strategy and the accompanying Anti-Fraud Action Plan covering the period 2020 through 2023.

Several anti-fraud awareness raising events were organised for F4E staff and management. The Anti-Fraud and Ethics Officer monitored, guided and regularly followed up on the execution of the actions foreseen in the Anti-Fraud Action Plan for the year under review by means of targeted communications, individual meetings with action owners as well as transversal compliance oriented meetings and meetings of the Audit Committee.

The implementation of the actions in the Anti-fraud Action Plan is systematically monitored through a dedicated database (RAPID) which details the scope of each action, the action owner and the target date for its implementation. In 2021, good progress has been achieved as regards the implementation of anti-fraud actions.

In 2021, information and support on fraud prevention matters was provided on an ongoing basis, notably to staff involved in procurement, contracts management and finance. The F4E internal network of fraud correspondents was kept informed individually and in the context of the regular Assurance Network meetings.

3.1.5 Ethics and Prevention & Management of Conflicts of Interest (Col)

Rules, procedures, processes and best practices in these areas have been communicated to staff in 2021, including via the F4E Manual on the F4E intranet with specific chapters on Ethics & Integrity and Fraud Prevention, a page on Whistleblowing as well as a section on the Prevention and Management of Conflicts of Interest.

With a view to preventing and managing conflicts of interest, the Anti-Fraud and Ethics Officer met on several occasions with F4E staff and managers on the purpose, correct use and assessment of declarations of interest. Specific instructions on the prevention of conflicts of interest in the context of selection committees had been issued previously.

As a follow-up, the Anti-Fraud and Ethics Officer guided staff in the preparation and assessment of declarations of interest in individual cases. In the F4E Conflict of Interest Register declarations of interest are registered and their assessment documented. It is planned to digitalise the F4E Conflict of Interest Register in 2022 to facilitate the use, follow-up and traceability of conflict of interest declarations and their assessment.

Furthermore, the Anti-Fraud and Ethics Officer advised on the prevention of conflicts of interest as regards F4E committee chairs and members. As meetings have mostly been held remotely also 2021, before the start of meetings of the F4E Governing Board and other F4E committees, the delegates had been requested to declare potential conflicts of interest by email in advance of the meeting.

Based on input from a dedicated working group and internal stakeholders, the Anti-Fraud and Ethics Officer developed the F4E Charter of Engagement which serves as a reference point for relations amongst staff. The Charter identifies a catalogue of concrete do's and don'ts building on the values of integrity, trust, respect, teamwork, high achievement, contribution, flexibility and innovation. The Charter foresees recourse to the Ethics Officer and/or the F4E Ethics Committee. In cooperation with the Communications Unit, dedicated communication and information sessions have been organised to raise awareness. The Ethics Officer was intervened on a number of occasions in this capacity.

3.2 Conclusions of assessment of internal control systems

F4E demonstrated its Business Continuity capability in the face of the COVID-19 pandemic challenges. Its resources had to adapt to this continued unforeseen change, on top of business as usual activities, and finding timely solutions to maintain the effective functioning of the Internal Control System.

All the components are operating together in an integrated manner. Due to the fact that one component has been found to have a critical deficiency – Control activities -Issue on wellbeing of staff, as set out in section 4.3 'Reservation', F4E Management concludes that the overall internal control system is **partially effective**.

3.3 Statement of the Senior Manager in charge of risk management

I, NEIL COLLINGS the undersigned, make the following declaration.

In my capacity as Senior Manager in charge of risk management,

I declare that in accordance with F4E's Internal Control System, I have reported my advice and recommendations on the corporate and project risks and opportunities to the Director and to the F4E governance bodies.

Neil Collings

Head of Project Management Department

17 May 2022

3.4 Statement of the Senior Manager in charge of internal control

I, the undersigned, Alessia Vecchio, Head of Administration Department of the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E),

In my capacity as Senior Manager in charge of internal control,

I declare that in accordance with F4E's Internal Control System, I have reported my advice and recommendations on the overall state of internal control in F4E to the Director.

I hereby certify that the information provided in the present Consolidated Annual Activity Report and in its annexes is, to the best of my knowledge, accurate, reliable and complete.

Alessia Vecchio

Head of Administration

17 May 2022

Part IV. Management assurance

4.1 Review of the elements supporting assurance

The Internal Control System comprising F4E’s Integrated Management System is based on the 3 layers of defence of the IIA (Institute of Internal Auditors) and combines the two control environments within which F4E operates - the ITER-wide quality system which is intended to ensure the performance of ITER and the compliance with the nuclear safety requirements, and the European Commission Internal Control Framework which is inspired in the internationally recognised COSO framework.

- 1st LAYER (or 1st LINE OF DEFENCE) ESTABLISH AND INFORM: Internal controls as defined by F4E Management for application by all F4E Staff and providing adequate training and raising awareness.
- 2nd LAYER (or 2nd LINE OF DEFENCE) MANAGEMENT ASSURANCE: The Management (in its role of 1st line of defence) puts in place the 2nd layer of defence by establishing risk management and assurance functions to help build and/or monitor the first line-of-defence controls.
- 3rd LAYER (or 3rd LINE OF DEFENCE) INDEPENDENT ASSURANCE Internal auditors (IAS/IAC) who provide the Governance bodies and Senior Management with comprehensive assurance based on the highest level of independence and objectivity within the organisation. IAS/IAC activities (including ex post audit on contracts) are described in the IAS/IAC annual audit plan. OLAF carries out independent investigations.

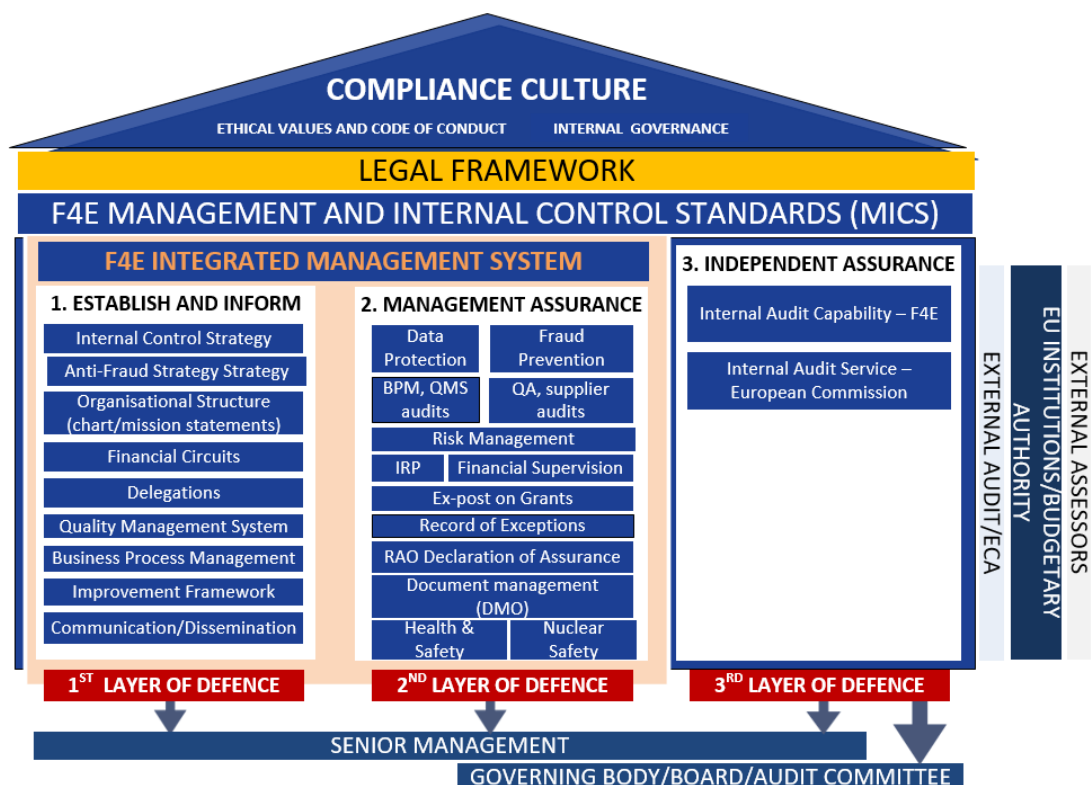


Figure 53: F4E Internal Control System

The F4E Internal Control Strategy defines internal control roles and responsibilities and outlines how the Internal Control System provides reasonable assurance of achieving the following objectives (based on Article 30 of the F4E FR). The main elements supporting the assurance of the F4E Director are the following:

4.1.1 Annual assessment of the Internal Control System

The annual assessment of the internal control system is designed to identify deficiencies in the internal control system in line with a formalised procedure and reporting requirements in line with the EC Internal Control Framework.

As a result of the 2021 Annual Assessment of the internal control system, and due to the fact that one component has been found to have a critical deficiency – Control activities -Issue on wellbeing of staff, as set out in section 4.3 'Reservation', F4E Management concludes that the overall internal control system is partially effective.

4.1.2 Observations of the European Court of Auditors

Check section 2.8.3 European Court of Auditors (ECA)

4.1.3 Annual assessment of F4E

Check section 2.3 Governing Board

4.1.4 Internal Audit Service (IAS) and Internal Audit Capability (IAC)

Check section 2.8.1 Internal Audit Service (IAS) and 2.8.2 Internal Audit Capability (IAC).

4.1.5 Declarations of the Authorising Officers by Delegation and Sub-Delegation

Check section 2.5 Delegation and sub-delegation.

4.1.6 Health and Safety and Nuclear Safety

F4E has set up a Joint H&S Committee with representatives of both F4E management and staff members. The function of the Joint H&S Committee is to promote, maintain and review H&S measures according to the documents of the F4E H&S Management System and to facilitate the exchange of views between F4E staff and management by creating a stable forum for orderly dialogue. The H&S Committee is appointed under the H&S management rules as set out in F4E's Consultation and Participation of Staff procedure.

Every staff member can address his/her queries or concerns to the Health & Safety Coordinator, or to the members of the H&S Committee. Health and Safety objectives are monitored in the frame of the overall Health and Safety policies and procedures.

F4E has intensified its activities in relation to Nuclear Safety. The Nuclear Safety Unit was reinforced under the Project Management Department, which supports the projects on nuclear safety topics and developing, promoting a nuclear safety culture, as well as supporting the compliance requirements.

In 2020, a special focus was put on the implementation of a new training and qualification program for F4E's staff performing protection important activities (PIA), in application of the new F4E policy related to Nuclear Safety Competence and Qualification.

In 2021, F4E has implemented several actions to enhance Nuclear Safety awareness within the F4E Organisation: Nuclear Safety trainings, Nuclear Safety Culture events (talks, Nuclear Safety Week, Nuclear Safety Bulletin), reinforcement of the Nuclear Safety Unit with a new support services contract.

The Nuclear Safety Unit performed 8 Nuclear safety inspections.

The nuclear safety training and qualification scheme was completed and allowed to qualify 100% of PIA performers in 2021.

Finally, F4E stepped up from stage I to stage II of Nuclear Safety Culture according to IAEA standards.

Check sections 2.2.1 Health and Safety and 2.2.2 Nuclear Safety.

4.1.7 Anti-Fraud, OLAF contact point and Ethics Officer

The functions of Anti-Fraud, Ethics and Data Protection Officer of F4E were established in 2015. These functions have a direct reporting line to the Director. They constitute one of the components of the second line of defence of the F4E Internal Control System.

Check section 3.1.4 Prevention, Detection, Correction of Fraud.

4.1.8 Data Protection

In 2021, the Data Protection Officer (DPO):

- Negotiated a Data Protection Agreement with the ITER International Organization which was approved by the F4E Governing Board and signed by both parties in December 2021;
- Monitored the implementation of the Data Protection Regulation and organised awareness raising sessions for data protection coordinators to promote the protection of personal data at F4E;
- Maintained close contacts with the DPOs of other EUIs and in particular with the European Data Protection Supervisor (EDPS).
- Actively participated in several interagency DPO/EDPS Network and Iberia DPO meetings.

4.1.9 Quality Management System Assurance

In 2020, F4E continued the implementation and development of the Quality Management System through four main activity areas: (1) Business Process Management, (2) Quality Assurance in Support of the Operational Projects, (3) Quality Management System and Supplier Audits and (4) Continual Improvement of the Quality Management System.

4.1.9.1 Business Process Management

The F4E quality system is a stakeholder-oriented system, taking into account equally: the requirement definitions, the stakeholder feedback, and F4E compliance with the stakeholder requirements (European Commission and ITER Project).

Following this approach F4E has continued to strengthen its 'process strategy by assessing the maturity of the various elements of its 'process map' showing the links between all activities to carry out across the organisation. The main activities developed in 2021 were:

- Support on the implementation the F4E Management and Quality Programme implementation, and propagation of the applicable ITER Project requirements into the F4E working procedures;
- Further improvement and development of the contract management framework, with the further development of the electronic tool for all the contract lifecycle;
- Coordination of the Business Process Management (BPM) framework implementation across the organization, reinforcing the common frame for all working procedure documentation and F4E manual;
- Implementation of the Documentation Management Policy at corporate level through the coordination of the Documentation Management Officer function.

The statistics of the working procedures development during 2021 were:

Working procedures	Standard	Policy	Process	Procedure
Releases by type in the 2021 (new developments or updates)	3	20	21	10
Total portfolio on 31 Dec 2021	17	109	97	107

As part of the Integrated Management System, an F4E Manual (hosted on F4E's intranet accessible to all staff) aims to closely mirror the evolution of the organisation and encourage a harmonised approach in the development and application of working procedures to achieve organisational objectives on all levels (corporate, departmental and individual staff objectives).

4.1.9.2 Quality Assurance in support of Operational Projects

One of the major Quality Assurance (QA) activities is the support to the operational projects to ensure the correct implementation of the quality programme. This activity can be divided into:

- Full support to the technical departments on quality issues of Procurement Arrangements and ITER task agreement, verification of the Call for tender documentation, and

implementation contracts and grants quality documentation for compliance with the F4E Management and Quality Programme (MQP);

- Perform monitoring and assessments of the Quality Management System implementation within the supply chain.
- Training on QA to suppliers providing 'protection important class' items and/or services.

Another major support QA activity is the coordination, registry and reporting of Nonconformities and contract Deviations (punctual deviation from a requirement) and Changes (modify requirement) to the specified requirements. F4E has defined processes for handling all aspects of the Changes, Deviations and the detected Nonconformities.

- In 2021 the main types of nonconformities (includes from Supplier Audits) are represented below:

Nonconformities (F4E classification)	Cases	(~) %
Major (impact on customer critical requirements)	329	39
Minor (impact on customer non-critical requirements)	387	46
Relevant (impact on F4E contract, but not on customer requirements)	134	16
Technical Exception (no impact on F4E contract requirements)	0	0
Pending classification	0	0
Total	850	100

Table 27: Statistics on nonconformities by type

- Corrective actions are triggered by the occurrence of Nonconformity to eliminate the cause and prevent repetition.
- In 2021 the main types of changes and deviations are represented in the tables below:

Changes and Deviations (by type)	Cases	(~) %
F4E DR (Deviation Request by F4E, internally or to customer)	35	5
Supplier DR (Deviation Request by the supplier to F4E)	338	52
ITER IO DR (Deviation Request by ITER IO towards F4E)	25	4
Change Notice/Order (Change by F4E towards supplier)	256	39
Total	654	100

Table 28: Statistics on deviations by type

4.1.9.3 Quality Management System and Supplier Audits

A Quality Management System Audit aims to provide F4E and its stakeholders reasonable assurance that the system is adequately implemented according to the standards. F4E is developing and implementing an annual audit programme to assess that the Quality Management system requirements are properly fulfilled by F4E Programme Teams and its supply chain. The objective of Supplier Audits is to ensure that F4E Suppliers comply with the approved Quality Plan and it is effectively implemented.

A Quality Management system and Supplier Audit process frames the methodology to be followed for each key step of those audits (planning, preparation, implementation, follow-up of actions and

recording). The audit result is presented in an audit report, which includes the identification of any strong areas describing the strengths of the Supplier Quality Plan, improvement areas and nonconformities. When improvements or nonconformities are identified, the report is followed by an action plan from the auditee to address the findings. Once the action plan is approved it is followed to ensure correct implementation and closure of the audit.

At the end of 2020 the 'Annual Supplier Audit Programme' for 2021 were developed and approved for implementation. Due to the exceptional circumstances of 2020, many of the audits had to be cancelled, so all the 2020 internal Quality Management System audits were postponed to 2021 and 2022 due to the resources required to support the digitalisation of the processes.

In 2021, out of the 22 Supplier + 4 Internal on Quality Management System planned Audits: 19 Supplier audits were performed (16 with an acceptable result, 1 partially meet the criteria and 2 with a non-acceptable result).

These audits resulted in 158 findings, classified as follows: 41 strong areas, 97 improvement areas and 20 nonconformities.

As foreseen in the related process, all the Supplier nonconformities found triggered a Nonconformity Report issued by the auditee with the action to address the weaknesses.

4.1.9.4 Continual Improvement of the Quality Management System

In line with the Management and Internal Control Standards 19 'Assessment' and 20 'Correction of Deficiencies and Corrective Action', F4E continually improves the effectiveness of the Integrated Management System and where necessary takes corrective and preventive measures to address weaknesses identified and feedback received. This continual improvement is also implemented in support of the several improvements made in 2021.

4.1.10 Corporate Risk Management

The Integrated Management System (IMS) and its Management and Internal Control Standards (MICS) provide the basis for the Risk Management framework at F4E. Standard 8 specifies that F4E has a system to manage risks and opportunities at corporate and project level. In particular, F4E performs regular risk analysis at project and corporate level, proposes mitigating actions and monitors and reports on its implementation.

Overview of Risk and Opportunity Management (ROM) activities in 2021

The process to identify, assess and monitor the risks and opportunities is based on the "market standard" process and ISO 31000 for risk management.

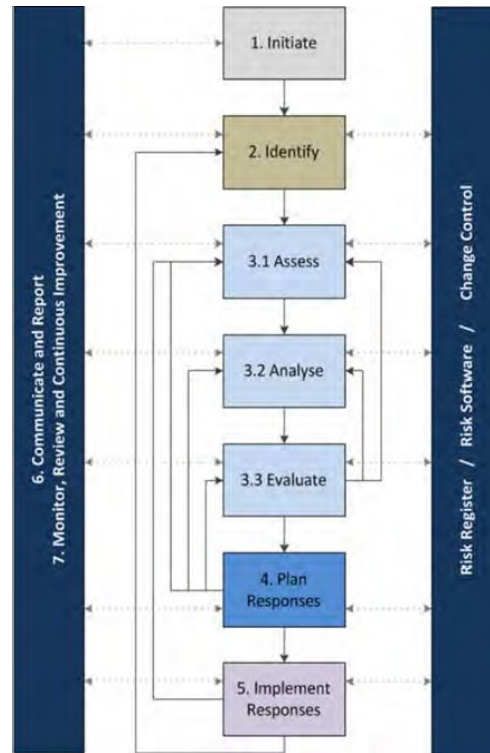


Figure 54: Risk & Opportunity Management Procedure

During 2021 the risk register has been migrated from Primavera P6 to Active Risk Management (ARM) in order to have a tool that can better support F4E needs on qualitative assessment, audit trail of the changes and better follow up of the data. ARM is one of the leading risk management tools, easy to customise and which uses a cloud-based database.

With the support of the tool ARM, risks and opportunities are included in the Risks register and evaluated with an assessment in the following categories: Probability, Cost impact and Schedule impact. In addition to those assessments, since 2021 also technical impact and reputational impact have been added to the assessment, making the impact analysis more complete. The go live of the new tool took place in July 2021, and more than 40 hours of training were provided to 60 users in 3 weeks.

During 2021, in addition to the standard activity of internal update of the corporate risk management, a working group was set-up by the chair of the Administrative and Management Committee (AMC) in order to enhance the interaction of the F4E stakeholders in the identification and assessment of the risks. There were 2 sessions of this working group in May and October and there will be a follow up in October 2022.

This information is then analysed on the three levels of the current framework: Corporate, Project and Supplier level depending on the needs.

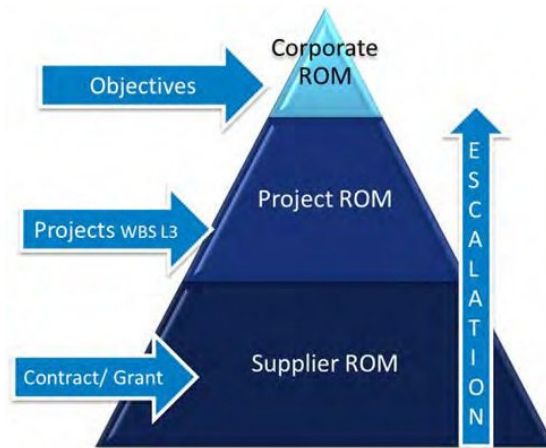


Figure 55: Risk & Opportunity Management Framework

4.1.11 Corporate Supervision Functions

Internal Review Panel

The Internal Review Panel (IRP) is an internal function of F4E, for reviewing the correctness of the procedural aspects followed for contracts and framework contracts. Its scope is to review procurement procedures with a value equal to or above € 1m and grants or framework partnership agreements with a maximum F4E contribution equal to or above € 400k.

In the past, the IRP proved to be a useful tool to ensure the procedural correctness of the procurement and grant files it examined. The uniform control of the files it analysed allowed the IRP to identify and address recurrent issues by issuing recommendations which have been translated into the relevant processes and procedures.

As a consequence, the F4E processes and procedures attained a high degree of maturity. This, together with the effective internal control mechanisms and the now obligatory involvement of legal officers in the evaluation of files which would previously have to be presented to the IRP have reduced the need to recur to the IRP. In 2021, the IRP has not been called upon.

Surveillance of financial transactions

Financial supervision, performed by the Finance Unit of F4E, examines the final transaction from a compliance and efficiency perspective and responds to the need for further control mechanisms after the decentralisation of the financial circuits. In 2021, due to the COVID19 pandemic, the resource has been used to support the teams responsible for financial verification.

In 2021, F4E launched the regular financial campaign aimed to assess the efficiency of the financial circuits (time to commit and pay) and to monitor if the defined Key Performance Indicators (KPI) were met. A comparison was made in terms of 'Time to Contract' and 'Time to Pay' and the results were communicated to the Improvement Steering Committee.

Based on the analysis done with regard to the KPI reports, the lead time measured has confirmed a similar trend in comparison with the previous period. Regarding 'Time to Pay', the lead time measured on average is in line with what is expected through the contractual requirements. More details are available in section 2.7 Strategy for efficiency gains.

Ex-post audits on Grants

F4E grants account for a minimum portion of the F4E operational budget: in 2021, F4E's commitments on grants represented only 0,47% of the total of EUR 674m of operational commitment appropriations for the year.

No new audit was performed, and one audit is still on hold pending the outcome of an external independent audit in the frame of the Horizon 2020 programme.

4.1.12 Register of exceptions and non-compliances

The obligation to record exceptions and non-compliances, in accordance with the principle of sound financial management, stems directly from the requirement to implement the budget in compliance with effective and efficient internal controls (Art. 30.3 of F4E's Financial Regulation).

The internal control system should ensure, inter alia, that prior approval is given to control overrides or deviations from the F4E Financial Regulation. To this extent, a policy and a process have been put in place since 2011 (last update early 2021) to ensure that exceptions and non-compliances are documented, justified, centrally logged and duly approved before action is taken.

During 2021, 5 exceptions and 11 non-compliances have been registered. Regarding the exceptions, a detail is provided below:

Reason for Exceptions	Number of cases
Extension of duration of Interim Services Framework Contract	1
Direct award for negotiation support	1
Telework at a distance >80km from the place of employment	1
Spanish Host State Agreement for additional space	1
Urgent purchase of repair materials	1

Table 29: Detail of exceptions

For the non-compliances, the table below shows the root causes that originated them. For each of them, actions were proposed to remedy the situation.

Root causes of non-compliances	Number of cases
Budgetary commitment after legal commitment	6
Issues with financial delegations	3
Payment made without technical approval formalised	1
Service provided once the contract was finalized – (medical visit)	1

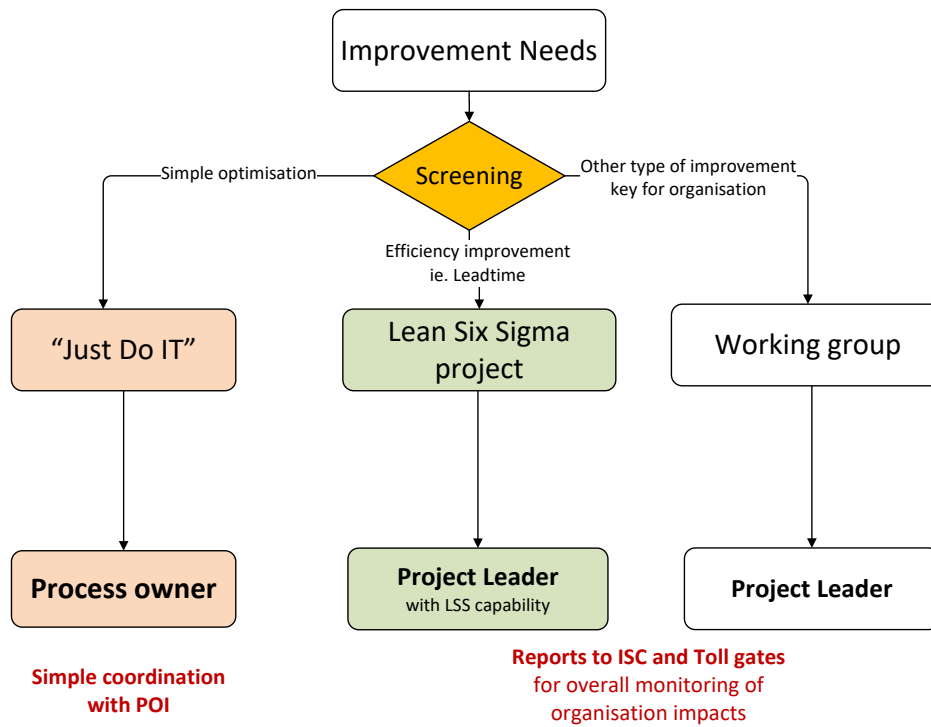
Table 30: Detail of root causes of non-compliances

This register has proven to be an important control mechanism for F4E, not only to document exceptions and non-compliances from financial regulatory frameworks, but also to help identify root causes and remedy them when possible.

4.1.13 Improvement Framework

F4E is fully committed to continuous improvement and manages its corporate improvement projects triggered by a Senior Management decision which is then implemented through its various committees and networks. In 2016, F4E set up an Improvement Steering Committee (ISC) to provide a dedicated forum to set priorities on corporate improvement actions and align management views. This committee monitors results and proposes corrective actions if needed.

The ISC together with the Senior Management Meeting (SMM) and the Project Steering Meeting (PSM) form the internal governance strategy and decision-making bodies of F4E. The SMM is the main decision-making body of F4E, and the PSM scope covers activities linked to fulfilling the technical programmes of the ITER Project.



F4E uses the **DMAIC** (Define, Measure, Analyse, Improve, and Control) **approach** which forms part of the Lean Six Sigma methodology (a set of techniques and tools for process improvement) to ensure that processes are more efficient and effective to achieve efficiency gains. Results are measured over a certain period with key performance indicators to confirm the positive trends, and corrective actions are taken if needed to further reinforce and streamline F4E’s core activities.

4.2 Reservation

Title of the reservation, including its scope	Non-quantified, reputational reservation because of deficiencies of the Internal Control systems in relation to the wellbeing of F4E staff.
Reason for the reservation	<p>On 1st May 2021, a former staff member of F4E committed suicide. According to various documents, notably in one of his letters, his suicide was due to work conflicts and pressure from his hierarchy, including behaviour that could be qualified as psychological harassment (Article 12a(3) Staff Regulations).</p> <p>In June 2021 F4E’s Governing Board initiated a preliminary assessment into the circumstances of the suicide. The assessment was carried out by three external experts independently of F4E’s Director and his staff.</p>

	<p>In July 2021 F4E carried out a psychosocial risk assessment that confirmed a very high risk in the areas of 'Workload' and 'Participation/Supervision' and a high risk in the area of 'Roles and Responsibilities'.</p> <p>In the meantime, F4E took a number of measures to raise awareness of mental health in F4E and support for staff at risk. F4E also implemented changes to the organisational of the affected team and improvements to the medical surveillance framework.</p> <p>Governing Board representatives communicated the conclusions of the assessment to all F4E Staff in a dedicated meeting on the 8th November 2021. The experts concluded that there was no breach of the rules by F4E staff.</p> <p>The F4E staff assembly on 9 November 2021 expressed deep disappointment for the way the preliminary assessment was conducted, as part of the inquiry for the tragic loss. In particular, the failure to provide any clear conclusions on the link between the F4E work environment and this tragic event. As a consequence, the Trade Unions called for a strike on the 24th November 2021 that was seconded by most of F4E Staff.</p>
Materiality criterion/criteria	<p>The reputation of the Joint Undertaking might be significantly damaged, and the damage might persist over time, if the necessary actions to restore psychosocial wellbeing are not undertaken.</p>
Quantification of the impact (= actual "exposure")	<p>The deficiency did not affect any budgetary transaction, and therefore had no financial impact.</p>
Impact on the assurance	<p>Reputational impact, as the system of internal control is 'partially effective'.</p> <p>The Management and Internal Control Standard 11 'Infrastructure and work environment' was found to have a critical deficiency due to this issue. This standard states that: <i>"F4E determines, provides and maintains a functional, safe and secure infrastructure and suitable work environment for the operation of its activities."</i></p> <p>In addition, the Management and Internal Control Standard 4 'Operational Structure, Responsibility, Delegations and Reporting lines' was found to have a major deficiency related to mutual trust in the organisation. The effectiveness of actions taken in response to the 2019 Annual Assessment related to this issue will be evaluated in the 2022 Annual Assessment.</p> <p>Finally, the Management and Internal Control Standard 5 'Human Resources, Competence and Continuity' was found to have a major deficiency related to workload following the outcome of the psychosocial risk assessment. This remains a major corporate issue as it is not fully addressed at Governance level.</p>
Corrective action	<p>In his address to the European Parliament Committee on Budgetary Control on 29th November 2021, in the context of the Discharge procedure, the F4E Director expressed his support for an additional investigation if this would bring rest to the organisation.</p> <p>On 20th February 2022 considering further allegations of potential misconduct, the Director wrote to OLAF asking them to investigate if there were any breaches of the statutory obligations by any F4E staff member that might have contributed to the suicide and issue any recommendations appropriate for improvements to F4E's organisation.</p>

	<p>On the 28th February 2022 the European Parliament Committee on Budgetary Control organised a dedicated hearing on the F4E working conditions, the suicide, and other matters under the responsibility of the ITER Organization.</p> <p>F4E has initiated a wide dialogue in F4E and developed a “change agenda” for which three working groups are developing actions to improve the working environment and wellbeing of the F4E staff and improve trust across the organization In parallel, the F4E Director and Senior Management have regular meetings with a Joint Working Group composed of the Staff Committee and Unions.</p> <ol style="list-style-type: none"> 1) Complete the implementation of action plan in response to the psychosocial risk assessment. Target date 31/12/2022. 2) Communicate on the measures already implemented to Staff. Target date 30/09/2022. 3) Continue the discussion for extra resources with Governance instances. Target date 31/12/2022.
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Table 31: 2021 Reservation

Part V. Declaration of assurance

I, the undersigned, Johannes P. Schwemmer,

Director of the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E),

In my capacity as authorising officer,

- Declare that the information contained in this report gives a true and fair view.
- State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.
-

This reasonable assurance is based on my own judgment and on the information at my disposal, such as the results of the annual assessment of the Internal Control System. It also takes into account the reports from:

- the Internal Audit Service: and,
- the Internal Audit Capability;
- the observations of the European Court of Auditors (ECA); and,
- the recommendations from the Governing Board annual assessment.

Without qualifying this reasonable assurance, I would like to highlight the fact raised by the ECA in the “Emphasis of Matter” section of their 2020 Annual Report *“any changes in key assumptions concerning the estimate and the risk exposure could lead to significant cost increases and/or further delays in the implementation of the ITER project”*.

I confirm that F4E is addressing this risk together with the F4E Governing Board and the ITER Organisation through the implementation of mitigating actions in the ongoing ITER in-kind delivery projects, in particular the buildings and the vacuum vessel. It should be noted that the ITER Organisation will assess and, if necessary, update the schedule to First Plasma once the final impact of the COVID-19 pandemic is known.

I would like to point out that F4E has also started to apply lessons learnt from delivering ITER components for the “first plasma” phase and pre-emptively works on risk mitigation for projects due for the ITER second and third plasma phases, which are still in a very early phase. The largest and most challenging are the hot cell building as well as the remote handling and neutral beam heating systems. F4E is informing its Governing Board and subsidiary committees on a regular basis about the risks associated with the above projects.

Furthermore, I draw attention to a non-quantified reputational reservation on staff wellbeing and psychosocial risks following the tragic event of the suicide of one F4E staff member in May 2021. Actions are being implemented to improve the working environment and wellbeing of the F4E staff and mutual trust across the organization.

I confirm that I am not aware of anything not reported here which could harm the interests of the Joint Undertaking.

Johannes P. Schwemmer

Director

17 May 2022

Annexes

Annex I Core Business Statistics

Key Performance Indicators for 2021

ITER Project Progress

- 75.8% for the scope of work achieved for First Plasma in December 2025
- 60.6% for all the work required for the construction of ITER

Broader Approach Project Progress

- 57% of the EU contributions to the Satellite Tokamak (JT-60SA) delivered
- 74% of the EU contributions to the IFMIF/EVEDA project delivered
- 87% of the EU contributions to the IFERC project delivered

F4E Project Performance

- F4E's current and planned budget compared to Estimate at Completion is 101%
- 94% Schedule Performance achieved on the basket of internal milestones
- 82% implementation of Work Programme objectives
- For the main ITER Council and Governing Board milestones, F4E has:
 - 23 achieved
 - 13 which are expected to be delivered on time
 - 21 at risk of being delayed

F4E Procurement

- 92 contracts signed in 2021 for a value of €240m
- Total cumulative value of contracts €5.5bn

F4E Annual Budget Performance

- Annual Commitments 99.7 %, 101.7 % compared to original budget.
- Annual Payments 97.4 %, 100.3 % compared to original budget.

F4E Quality

F4E has 113 F4E Non-Conformity Reports (NCRs) open for > 12 months compared to 412 NCRs still open giving a ratio of 20% (achieving the 2021 target of ≤22%)

F4E Human Resources

- Assignment of human resources to different areas:
 - 56% for ITER and PM
 - 6% Broader Approach and DEMO

- 38% Commercial and Administration
- 2,4% Vacancy Rate below target of 4%
- 2,4% Turnover Rate
- 2,4% Absenteeism Rate

F4E Organisational Improvement

- Implemented 93% of Corporate Actions
- Implemented 80.82% of Internal Audit Actions

Background

F4E has identified specific Key Performance Indicators (KPI) in order to measure how effectively the organisation achieves the target set in different project (i.e. schedule, cost, risk, etc.) and programmatic areas (i.e. annual budget consumption, quality, etc.). F4E updates these KPIs on a monthly basis and reviews them at the level of its Senior Management and takes action to address events or risk that could threaten their achievement.

For the EU contributions to ITER, the basis for the adopted KPIs is the F4E current baseline, in schedule, cost and budget. F4E ensures that the baseline is maintained through change control processes together with the ITER Organization. Dashboards are available with the possibility of drilling down for more details, both at a global F4E level and individually per Programme. KPI information is included in many F4E documents and reports to its governing bodies.

Key Performance Indicators

In relation to F4E's obligation to provide in kind contributions to the **ITER Project**:

The ITER Council approves, monitors and updates a set of high-level monitoring milestones

- the so-called **ITER Council (IC) milestones**, which track the overall progress of the project in all the seven ITER Domestic Agencies (including F4E) and the ITER Organization. These milestones are suitable for tracking progress as they cover a larger group of components at different stages of their development. Most of them are key to achieve the ITER First Plasma, but some of them also relate to post-First Plasma systems;
- To complement the ITER Council milestones, an expanded set of high-level milestones are approved, monitored and updated by F4E's Governing Board – the **Governing Board (GB) milestones** which are solely applicable to F4E. Their status is reported to F4E's Governing Board and other governance bodies on a monthly basis and subject to change control by the Governing Board. The complete list of F4E's Governing Board and ITER Council milestones for 2021 is provided in F4E's Single Programming Document (SPD);
- In addition, F4E uses a basket of **additional technical milestones** to monitor more precisely its own performance. F4E has selected such milestones by making sure that they cover important activities inside the organisation and therefore can provide a meaningful measure of F4E performance. These include Procurement Arrangement signatures, commitments >€ 2m, Calls for tender, contract signatures >€ 2m and project execution milestones. These are described in Table 24

- Relying on the 331 milestones for 2021 (shown in Table 24 below), one can infer a **Schedule Performance Index (SPI)** that measure the performance of F4E according to the number of milestones achieved during the year compared with the amount initially forecasted (baseline of the year). The Schedule Performance Index is calculated on the basis of a moving annual average which is reviewed on a monthly basis by F4E's Senior Management and reported regularly to its Governing Board;
- **Earned Value Management (EVM)** is a project management technique for measuring project performance and progress in an objective manner. F4E has implemented an Earned Value Management system which provides monthly Schedule Performance Index (SPI) and Cost Performance Index (CPI), and the trend of these metrics. This EVM system is based on ITER Credits and Actual Payment data. The EVM Dashboard is shared with F4E's external stakeholders at the end of each month.

ITER Council and Governing Board Milestones

Milestones against which the ITER Council and Governing Board will measure the project.

PA Signature	Signatures of PAs. ITA signatures and PA amendment signatures are not included.
Call for Tender	Publication of a Call for Tender.
Commitments above €2m	Any commitment above 2 million Euros.
Project Execution Milestones	Milestone in the on-going execution of a project. These milestones are selected by the project teams at the end of the previous year.
Work Programme Objectives	Objectives set in the Work Programme
F4E Gates Design Review	F4E Gates Design Reviews
Delivery	Delivery Milestones

Table 32: Technical objectives and KPIs used for monitoring purposes

- To monitor projects against their budgets, the **Estimate at Completion (EAC)** is calculated by F4E on a monthly basis using three elements (a) actual costs already incurred, (b) estimate of future costs, (c) estimate of likely impact of future risks. F4E follows an industry standard process for its EAC. The monthly update process is complemented by biannual deep-dive reviews to assess in more detail the quality of the estimates and the associated assumptions at programme and project level. F4E systematically presents the EAC at each biannual Governing Board meeting.

Contributions to Broader Approach (BA) projects are formalised under Procurement Arrangements between F4E and the Japanese Implementing Agency (QST), which in turn are backed by Agreements of Collaboration between F4E and institutions chosen by the Voluntary Contributors. The accounting of contributions is tracked by an Earned Value Management approach using credits. In addition, the Broader Approach projects are monitored by the achievement on time of the milestones defined in the Project Plan approved by the Broader Approach Steering Committee. The complete list of F4E's Broader Approach milestones for 2021 are provided in F4E's SPD. Each of these milestones is assigned a credit value that is used to allow an Earned Value calculation of the overall level of achievement against the Planned Value.

Multiannual and annual Indicators

F4E has defined a set of multiannual objectives that are shown in Table 24: Multiannual objectives and KPIs used by F4E and a set of annual objectives that are shown in Table 25: Annual objectives and KPIs used by F4E.

Other indicators but for which targets are not currently set but are monitored internally and, in some cases, reported on a biennial basis to F4E's Governing Board, include the staff attrition rate, gender balance, time to place contracts and grants and time to recruit.

AREA	Objective
GB/IC milestones	Achieve the GB and IC milestones within "agreed quarters"
Schedule Performance Index	SPI above a defined value
Overall Costs	Cost estimation for ITER + Broader Approach for period up to 2027 should be less than the total budget available for this period.

Table 33: Multiannual objectives and KPIs used by F4E

AREA	Objective
Work Programme objectives	Implement a defined percentage of Work Programme objectives [including GB milestones and predecessors] by end of the year
Credit Allocation Scheme [CAS]	Reach a defined percentage of achieved CAS by end of the year
Quality	Reduce percentage of long aging NCRs compared to total number of open NCRs.
Annual budget	Implement a defined percentage of Commitment Appropriations by end of the year
Annual payment	Implement a defined percentage of Payment Appropriations by end of the year
Human Resources	Vacancy rate to be less than a defined value by end of the year

Table 34: Annual objectives and KPIs used by F4E

To ensure the widespread awareness of F4E's performance against the above annual and multiannual objectives, F4E has created a 'dashboard' showing the most important KPIs which is not only used for monthly reporting to the Project Steering Meeting and stakeholders but also shown on screens located on every floor of F4E's offices at the Barcelona headquarter offices.

The F4E dashboard consists of four parts:

1. **General part on the overall progress.** It provides a summary of the progress through the current status, against the baseline, for the achieved ITER credits for EU in-kind procurements, milestones completion, ratio of assigned budget vs cost, commitments and payments implementation;
2. **A multiannual part:** it shows the evolution over the past months of indexes such as the achieved ITER credit, the estimate at completion (EAC), the schedule performance index (SPI) and the forecast of completion of the key milestones selected by the F4E and ITER Organization supervising boards;
3. **An annual part:** it shows, for the current year, both achieved and forecast evolution of achieved ITER credit, commitments, payments and annual objectives of the organisation;
4. **Earned Value Management (EVM):** this system provides monthly Schedule Performance Index (SPI) and Cost Performance Index (CPI), and the trend of these metrics. This EVM system is based on ITER Credits and Actual Payment data.

Annex II Achievement of 2021 Work Programme Objectives

Action 1. Magnets

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU11.1A.22660	Delivery of TFWP14 to Cold Test and Coil Insertion site	Q4 2021	Predecessor of GB54	Achieved
EU11.1A.24800	TF-EU07 Welding Completed	Q3 2021	Predecessor of GB23	Achieved
EU11.3B.01120	IPL > Delivery of PF2 Coil by EU-DA to IO	Q4 2021	WP21 objective	Achieved
EU11.3B.571550	DP2 - PF4.- DP VPI Completed	Q4 2021	WP21 objective	Achieved

Action 2. Vacuum Vessel

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU15.1A.1139800	PS3 VV9 Fabrication Complete	Q4 2021	Predecessor of GB25	Not achieved due to mechanical breakdown of milling machine
EU15.1A.3039360	S9_PS4_ Poloidal and Toroidal ribs welding and NDE complete	Q4 2021	Predecessor of GB25	Achieved
EU15.1A.3081300	Start of Factory Acceptance Tests - Sector 5	Q4 2021	Predecessor of GB16	Not achieved due issues with first of a kind manufacturing steps
EU15.1A.3082260	S5 Rotation of complete sector and ready for Lower and Upper Port assembly	Q4 2021	Predecessor of GB16	Not achieved due issues with first of a kind manufacturing steps

Action 3. In Vessel – Blanket

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU15.2A.100160	Dispatch Invitation to Submit Updated Tender for FwC BCM	Q4 2021	WP21 objective	Achieved
EU.16.01.208250	Published Call for Expression of Interest for Procurement of Standard Parts	Q4 2021	WP21 objective	Achieved
EU16.01.61400	Task Order Signed for Auditors TO#01 - LOT 1	Q4 2021	WP21 objective	Achieved
EU.16.01.79750	Manufacturing Readiness Review Completed (ADMU) - OPE-443-01	Q3 2021	WP21 objective	Achieved

Action 4. In Vessel – Divertor

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU17.01.1050800	HP - Reception of the Conformity of XM19 and 316-LN-IG material for Standard CBs (M_CBST_S14B)	Q3 2021	WP21 objective	Achieved
EU17.01.1169400	HP -Reception of the conformity of 316L Tubes (D_TPRHRM_02)	Q3 2021	WP21 objective	Achieved
EU17.2B.12590	Release Technical Specification for IVT Series Production	Q4 2021	Predecessor of GB45	Achieved
EU17.2B.85750	Authorisation of shipment of the Testing Assembly to the HHF Testing Facility - OPE-567-03-01 (II.22)	Q2 2021	WP21 objective	Achieved

Action 5. Remote Handling

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU23.03.14046592	Task Order Signed for (577-02-02) Prelim. Design MA-2 and Final Design MA-1 for CPRHS	Q4 2021	Predecessor of GB40	Achieved
EU23.03.14056380	M7 Preliminary design review meeting held (MA-1 last PDR)	Q2 2021	Predecessor of GB32	Achieved
EU23.05.14053780	Submission Deadline Tender CON 2021 for Final Design of MRC	Q4 2021	Predecessor of GB42	Not achieved due to shortage of manpower for preparation of procurement package.
EU57.01.50260	IVVS Assembly of P&T Prototype completed OMF-383-01-04 (M8)	Q4 2021	Predecessor of GB47	Achieved

Action 6. Cryoplant and Fuel Cycle

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU31.01.11580	IPL > Delivery of Warm Regeneration System by EU-DA to ITER Site	Q4 2021	Predecessor of GB28	The milestone was achieved on 17th of December 2021 but wrongly reported in the reporting system.
EU31.01.305060	M8 - Acceptance #CP4	Q2 2021	Predecessor of GB50	Achieved
EU31.03.25740	M.14 - Preliminary Design Review Approved of Primary & Cryostat Leak Detection System	Q4 2021	Predecessor of GB18	Achieved
EU31.03.26280	Contract Signed for Helium Leak Localisation System	Q2 2021	Predecessor of GB35	Achieved
EU31.03.26800	Quality Plan Approved	Q1 2021	Predecessor of GB18	Achieved

Action 7. Antennas and Plasma Engineering

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU52.01.2000458	PA Amendment Signature both parties	Q4 2021	Predecessor of GB46	Achieved
EU52.01.203355	TO3 signed for Brazing of Diamond Disks for EC Window prototypes (OFC-729)	Q4 2021	WP21 objective	Not achieved due to technical issues and discussions regarding the modification of the dimensions and tolerances of the copper cuff for the proof of concept Diamond Window Unit prototype, the signature of the contract had to be postponed.
EU52.01.520160	Contract Signed for Manufacturing of Isolation Valve Prototypes and Series Production	Q4 2021	WP21 objective	Not achieved due to difficult negotiation with single tenderer on QA and Nuclear safety documentation requirements, the negotiation process has been prolonged.
EU52.05.500120	Task Order Signed for Support to IO and design for EC Plant Controller	Q4 2021	WP21 objective	Achieved

Action 8. Neutral Beam and EC Power Supplies and Sources

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU52.02.18380125	Dispatch Invitation to submit final proposal for European Gyrotrons Procurement	Q4 2021	WP21 objective	Achieved
EU52.04.12635	52HV08 (AAG Set#3) (1 Unit of MHVPS) 3rd set of Gyrotrons high voltage power supply completed at Supplier Site(M3.3.2)	Q2 2021	WP21 objective	Achieved
EU53.06.07280	Start of Manufacture of AGPS-CS of IHNB-1	Q4 2021	Predecessor of GB27	Milestone achieved at the end of 2021 but only after the cut-off of the reporting system.
EU53.06.07680	Final Design Report of AGPS-CS of IHNB-1 & IHNB-2 Accepted by IO and approved by F4E (MID-6), IP1.2.1	Q4 2021	WP21 objective	Not achieved due to late delivery of Design Report and delays in closure of Design Review.

Action 9. Diagnostics

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU55.01.0102290	Manufacturing Design for Bespoke Instrumentation Hardware Available	Q4 2021	Predecessor of GB39	Achieved
EU55.01.0103640	Manufacturing Readiness Review meeting for Plant Controller	Q3 2021	Predecessor of GB39	Achieved
EU55.01.203290	Task Order signed for Bespoke Instrumentation Hardware	Q3 2021	Predecessor of GB39	Achieved
EU55.06.681270	HPC - IO Approval of FDR for Feedthroughs	Q4 2021	Predecessor of GB36	In delay due to time required for achievement of technical consensus and completion of documentation review
EU55.06.682400	Approval of BTP documentation	Q4 2021	Predecessor of GB36	In delay, as a successor to EU55.06.681270

Action 10. Test Blanket Modules

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU56.01.10180	TO 01 Signed for Preliminary Design of WCLL AS	Q3 2021	WP21 objective	Achieved
EU56.01.1227200	Task Order F4E-OFC-0950-01-02 Signed for Preliminary Design of HCPB TBM set	Q3 2021	WP21 objective	Achieved
EU56.01.1232060	TO 02 Signed for Safety Analyses for HCPB TBS PD	Q4 2021	WP21 objective	Achieved
EU56.01.80210	Task Order OMF-1070-01 Signed for Proof of the TBM-Sets fabrication and assembly processes feasibility	Q4 2021	WP21 objective	Achieved

Action 11. Site and Buildings and Power Supplies

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU62.02.72206	HPC - IO approval of Contractor Final & Construction Design (Structure) for Bldg 46 - MRR#1 for B44-45-46-47	Q4 2021	Predecessor of GB24	Achieved
EU62.02.72486	HPC - IO approval of Contractor Final & Construction Design (Structure) for Bldg 47 - MRR#1 for B44-45-46-47	Q4 2021	Predecessor of GB26	Achieved
EU62.050206	IPL > Tokamak Building (11) RFIOC L3M area	Q3 2021	WP21 objective	Achieved
EU62.05.29019	NPC - Notice to Commence construction of Control Bldg 71 Non PIC	Q1 2021	Predecessor of GB34	Achieved
EU62.600650	IPL > Tokamak Building (11) RFIOC Level L4 (Axis T10-T12)	Q3 2021	WP21 objective	Achieved

Action 12. Cash Contributions

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EUCC.01.1530	Commitment for PA 5.3.P6.JA.02 - 2022	Q4 2021	WP21 objective	Achieved
EUCC.01.220	Cash Contributions to ITER Organization 2022	Q4 2021	WP21 objective	Achieved
EUCC.01.2400	Reinforcement of commitments for escalation revision in 2021 (90%)	Q4 2021	WP21 objective	Achieved

Action 13. Technical Support Activities

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU.ES.01.8140	Published Call for Tender for Engineering Support Contract	Q3 2021	WP21 objective	Achieved
EU.ES.02.5860	Contract Signed for Mechanical analysis of ITER Components LOT 1	Q4 2021	WP21 objective	Not achieved due to change in procurement strategy to give priority to Lot 2 which had reached its financial ceiling.
EU.ES.03.60700	Contract Signed for Provision of System, Instrumentation and Control Engineering Support- Conventional I&C	Q3 2021	WP21 objective	Achieved
EU.NS.01.23220	FwC F4E-OMF-1110 signed for Eng. Supp. Serv. in the Area of Nuclear Safety 2021-2025	Q4 2021	WP21 objective	Achieved
EU.PM.3027530	Task Order Signed for TO 14 for Convention 4 for Real Convoys for Gendarmerie Services	Q2 2021	WP21 objective	Achieved
EU.PM.3035350	Option release for extension of TO #23 under FwC F4E-OMF-0937-01 signed for QA Support to BIPS Project Team (cont.TO 03)	Q3 2021	WP21 objective	Achieved
EU.PM.3051990	FWC F4E-OMF-1127 signed for System Engineering Support Services (2021-2024)	Q4 2021	WP21 objective	Achieved
EU.PM.3072460	Task Order 22 under FwC F4E-OMF-0895 LOT 1-01 signed for PPM Support VV (cont. TO 08)	Q2 2021	WP21 objective	Achieved
EU.PM.3076400	FWC F4E-OMF-1147 signed for Project Management Systems Support Services (2021-2025) - LOT 1	Q3 2021	WP21 objective	Achieved
EU.PM.3081580	Option 5 for extension of Task Order #02 under FwC F4E-OMF-895 LOT 3 in Support on Planning & Scheduling BIPS	Q2 2021	WP21 objective	Achieved
EU.PM.3081920	Task Order #05 under FwC F4E-OMF-0895 LOT 2 signed for Risk Management Senior Support (cont. TO 03)	Q2 2021	WP21 objective	Achieved
EU.PM.4021975	Task Order Signed for TO 15 for Convention 4 for Real Convoys for Gendarmerie Services	Q4 2021	WP21 objective	Achieved
EU.PM.51380	Task Order under OMF-0783-01 signed for Support to Technical Integration (cont. TO 05 OMF-783-01-02)	Q2 2021	WP21 objective	Achieved

Action 14. Broader Approach

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2021 Status
EU.BA.01.19740	Remote participation tests REC-IO and REC-IFMIF completed	Q4 2021	WP21 objective	Achieved
EU.BA.01.22360	Contract signed for Supply of ECRH Power Supplies for two (plus two optional) gyrotrons for JT-60SA	Q1 2021	WP21 objective	Achieved
EU.BA.01.31820	Supply of beam loss detection with high sensitivity	Q3 2021	WP21 objective	Achieved.
EU.BA.01.34220	Deliverable 6th of Optical Fibres for JT-60SA Thomson Scattering	Q4 2021	WP21 objective	Achieved

Annex III. Statistics on Financial Management

Annex III. a. Evolution of Expenditure in Commitments for the 2021 Budget

Heading of the 2021 Budget Commitment Expenditure	Evolution of the statement of expenditure								Implementation	
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
A1 STAFF EXPENDITURE										
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	37 198 000.00			306 468.71	37 504 468.71			37 504 468.71	37 504 468.71	100.0%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	12 168 000.00			-1 249 640.87	10 918 359.13			10 918 359.13	10 918 359.13	100.0%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	685 000.00			-115 969.32	569 030.68			569 030.68	569 030.68	100.0%
A13 MISSION EXPENSES	800 000.00			-550 000.00	250 000.00	771.46		250 771.46	250 771.46	100.0%
A14 SOCIO-MEDICAL INFRASTRUCTURE	350 000.00			172 000.00	522 000.00			522 000.00	522 000.00	100.0%
A15 TRAINING	689 000.00			99 761.00	788 761.00	569.53		789 330.53	789 330.53	100.0%
A16 EXTERNAL SERVICES	p.m.			630 000.00	630 000.00			630 000.00	630 000.00	100.0%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-9 875.00	125.00			125.00	125.00	100.0%
A18 SOCIAL WEALFARE	47 000.00			-16 400.00	30 600.00			30 600.00	30 600.00	100.0%
A19 OTHER STAFF RELATED EXPENDITURE	2 828 000.00			-4 873.35	2 823 126.65	5 633.50		2 828 760.15	2 828 760.15	100.0%
TITLE A1 - Total	54 775 000.00	0.00	0.00	-738 528.83	54 036 471.17	6 974.49	0.00	54 043 445.66	54 043 445.66	100.0%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE										
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 460 000.00			-209 500.00	1 250 500.00	14 046.61		1 264 546.61	1 264 546.61	100.0%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 960 000.00			134 603.90	4 094 603.90	3 565.00		4 098 168.90	4 098 168.90	100.0%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	369 000.00			-160 152.87	208 847.13			208 847.13	208 847.13	100.0%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 438 000.00			196 413.98	1 634 413.98	1 607.40		1 636 021.38	1 636 021.38	100.0%
A25 POSTAGE / TELECOMMUNICATIONS	531 000.00			-137 200.00	393 800.00			393 800.00	393 800.00	100.0%
A26 MEETING EXPENSES	469 000.00			-121 406.48	347 593.52			347 593.52	347 593.52	100.0%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES	p.m.				0.00		33 161.55	33 161.55	33 161.55	100.0%
A28 INFORMATION AND PUBLISHING	40 000.00			-25 500.00	14 500.00			14 500.00	14 500.00	100.0%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	266 000.00			-53 414.20	212 585.80			212 585.80	212 585.80	100.0%
TITLE A2 - Total	8 533 000.00	0.00	0.00	-376 155.67	8 156 844.33	19 219.01	33 161.55	8 209 224.89	8 209 224.89	100.0%
TITLE A1 & A2 - Total Administrative Expenditure	63 308 000.00	0.00	0.00	-1 114 684.50	62 193 315.50	26 193.50	33 161.55	62 252 670.55	62 252 670.55	100.0%

Heading of the 2021 Budget Commitment Expenditure	Evolution of the statement of expenditure								Implementation	
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
B3 OPERATIONAL EXPENDITURE										
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	742 301 679.51	-1 711 896.92	18 054 947.84	5 202 389.23	763 847 119.66	209 726.45		764 056 846.11	764 056 846.11	100.0%
B32 TECHNOLOGY FOR ITER AND DEMO	10 275 000.00	-5 881 206.70	1 906 063.96	-905 233.33	5 394 623.93			5 394 623.93	5 394 623.93	100.0%
B33 TECHNOLOGY FOR BROADER APPROACH	30 424 241.52	2 658 758.12	-19 538 908.20	-3 482 804.88	10 061 286.56			10 061 286.56	10 061 286.56	100.0%
B35 EXTERNAL SUPPORT ACTIVITIES	p.m.	6 173 870.74	-1 915 939.65	12 693 361.59	16 951 292.68			16 951 292.68	16 951 292.68	100.0%
B36 OTHER OPERATIONAL EXPENDITURE	17 758 275.97	-1 238 345.96	1 377 848.05	-12 393 028.11	5 504 749.95	608.27		5 505 358.22	5 505 358.22	100.0%
Title B3 - Total	800 759 197.00	1 179.28	-115 988.00	1 114 684.50	801 759 072.78	210 334.72	0.00	801 969 407.50	801 969 407.50	100.0%
B4 EARMARKED EXPENDITURE										
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	184 700 000.00				184 700 000.00		626 031.77	185 326 031.77	185 326 031.77	100.0%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	15 107 842.85	3 825 307.46	18 933 150.31	15 285 208.66	80.7%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00	1 399 515.87		1 399 515.87	1 399 515.87	100.0%
Title B4 - Total	184 700 000.00	0.00	0.00	0.00	184 700 000.00	16 507 358.72	4 451 339.23	205 658 697.95	202 010 756.30	98.2%
Titles B3 & B4 - Subtotal	985 459 197.00	1 179.28	-115 988.00	1 114 684.50	986 459 072.78	16 717 693.44	4 451 339.23	1 007 628 105.45	1 003 980 163.80	99.6%
Total BUDGET in Commitment appropriations	1 048 767 197.00	1 179.28	-115 988.00	0.00	1 048 652 388.28	16 743 886.94	4 484 500.78	1 069 880 776.00	1 066 232 834.35	99.7%

Note: Presentation of the carry over in Commitment for B4x in appropriation for the year only.

Annex III. b. Evolution of Expenditure in Payments for the 2021 Budget

Evolution of the Statement of Expenditure in Payment Appropriations (EUR)

Heading of the 2021 Budget Payment Expenditure	Evolution of the statement of expenditure								Implementation			
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2021 commitments (9)	On B2020 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
A1 STAFF EXPENDITURE												
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	37 198 000.00			306 468.71	37 504 468.71			37 504 468.71	37 504 468.71		37 504 468.71	100.0%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	12 168 000.00			-1 249 640.87	10 918 359.13		161 358.84	11 079 717.97	10 869 553.19	137 527.06	11 007 080.25	99.3%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	685 000.00			-115 969.32	569 030.68		31 514.94	600 545.62	470 958.08	15 830.49	486 788.57	81.1%
A13 MISSION EXPENSES	800 000.00			-550 000.00	250 000.00	771.46	85 642.41	336 413.87	117 192.88	29 204.77	146 397.65	43.5%
A14 SOCIO-MEDICAL INFRASTRUCTURE	350 000.00			172 000.00	522 000.00		154 116.51	676 116.51	404 288.33	61 940.69	466 229.02	69.0%
A15 TRAINING	689 000.00			99 761.00	788 761.00	569.53	402 687.49	1 192 018.02	300 815.61	326 748.94	627 564.55	52.6%
A16 EXTERNAL SERVICES	p.m.			630 000.00	630 000.00			630 000.00	557 062.06		557 062.06	88.4%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-9 875.00	125.00		60.00	185.00			0.00	0.0%
A18 SOCIAL WELFARE	47 000.00			-16 400.00	30 600.00		33 079.75	63 679.75	1 500.00	32 080.75	33 580.75	52.7%
A19 OTHER STAFF RELATED EXPENDITURE	2 828 000.00			-4 873.35	2 823 126.65	5 633.50	105 766.74	2 934 526.89	2 462 548.33	47 069.53	2 509 617.86	85.5%
TITLE A1 - Total	54 775 000.00	0.00	0.00	-738 528.83	54 036 471.17	6 974.49	974 226.68	55 017 672.34	52 688 387.19	650 402.23	53 338 789.42	96.9%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE												
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 460 000.00			-209 500.00	1 250 500.00	14 046.61	403 940.71	1 668 487.32	913 345.85	328 969.60	1 242 315.45	74.5%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 960 000.00			134 603.90	4 094 603.90	3 565.00	1 402 671.09	5 500 839.99	2 216 675.98	1 351 210.22	3 567 886.20	64.9%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	369 000.00			-160 152.87	208 847.13		154 312.15	363 159.28	77 684.06	138 989.93	216 673.99	59.7%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 438 000.00			196 413.98	1 634 413.98	1 607.40	211 045.25	1 847 066.63	1 044 100.06	158 466.51	1 202 566.57	65.1%
A25 POSTAGE / TELECOMMUNICATIONS	531 000.00			-137 200.00	393 800.00		170 107.08	563 907.08	233 644.46	68 951.51	302 595.97	53.7%
A26 MEETING EXPENSES	469 000.00			-121 406.48	347 593.52		56 369.53	403 963.05	141 701.83	47 160.29	188 862.12	46.8%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES	p.m.				0.00		33 161.55	33 161.55	2 688.00		2 688.00	8.1%
A28 INFORMATION AND PUBLISHING	40 000.00			-25 500.00	14 500.00		1 292.70	15 792.70	6 852.29	357.08	7 209.37	45.7%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	266 000.00			-53 414.20	212 585.80		161 472.22	374 058.02	110 949.31	82 003.36	192 952.67	51.6%
TITLE A2 - Total	8 533 000.00	0.00	0.00	-376 155.67	8 156 844.33	19 219.01	2 594 372.28	10 770 435.62	4 747 641.84	2 176 108.50	6 923 750.34	64.3%
TITLE A1 & A2 - Total Administrative Expenditure	63 308 000.00	0.00	0.00	-1 114 684.50	62 193 315.50	26 193.50	3 568 598.96	65 788 107.96	57 436 029.03	2 826 510.73	60 262 539.76	91.6%

Heading of the 2021 Budget Payment Expenditure	Evolution of the statement of expenditure							Implementation				
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2021 commitments (9)	On B2020 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
B3 OPERATIONAL EXPENDITURE												
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	519 803 868.00	1 179.28	-126 900.00	7 389 111.73	527 067 259.01	209 726.45		527 276 985.46			521 657 388.66	98.9%
B32 TECHNOLOGY FOR ITER AND DEMO	4 100 000.00			-613 838.93	3 486 161.07			3 486 161.07			3 486 161.07	100.0%
B33 TECHNOLOGY FOR BROADER APPROACH	11 500 000.00			-4 091 817.40	7 408 182.60			7 408 182.60			7 408 182.60	100.0%
B35 EXTERNAL SUPPORT ACTIVITIES	p.m.		10 912.00	10 553 624.03	10 564 536.03			10 564 536.03			10 564 536.03	100.0%
B36 OTHER OPERATIONAL EXPENDITURE	15 000 000.00			-12 122 394.93	2 877 605.07	608.27		2 878 213.34			2 877 605.07	100.0%
Title B3 - Total	550 403 868.00	1 179.28	-115 988.00	1 114 684.50	551 403 743.78	210 334.72	0.00	551 614 078.50			545 993 873.43	99.0%
B4 EARMARKED EXPENDITURE												
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	129 100 000.00				129 100 000.00			129 100 000.00			127 715 100.01	98.9%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	5 319 008.98	11 610 146.80	16 929 155.78			10 613 351.30	62.7%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00	1 399 515.87		1 399 515.87			662 987.97	47.4%
Title B4 - Total	129 100 000.00	0.00	0.00		129 100 000.00	6 718 524.85	11 610 146.80	147 428 671.65			138 991 439.28	94.3%
Titles B3 & B4 - Subtotal	679 503 868.00	1 179.28	-115 988.00	1 114 684.50	680 503 743.78	6 928 859.57	11 610 146.80	699 042 750.15			684 985 312.71	98.0%
Total BUDGET in Payment appropriations	742 811 868.00	1 179.28	-115 988.00	0.00	742 697 059.28	6 955 053.07	15 178 745.76	764 830 858.11			745 247 852.47	97.4%

Annex III. c. Transfers Adopted by the F4E Director

BUDGET 2021 Transfers (EUR)	Transfer no 1		Transfer no 2		Transfer no 3		Transfer no 4	Transfer no 5		Transfer no 6		Total Transfers	
	Commitment	Payment	Commitment	Payment	Commitment	Payment	Commitment	Commitment	Payment	Commitment	Payment	Commitment	Payment
A-1 STAFF EXPENDITURE													
A-10 SALARIES ALLOWANCES STAFF IN ESTABLISHMENT PLAN					320 000.00	320 000.00		-13 531.29	-13 531.29			306 468.71	306 468.71
A-11 STAFF EXPENDITURE IN THE ESTABLISHMENT PLAN	-770 000.00	-770 000.00			-350 000.00	-350 000.00		-129 640.87	-129 640.87			-1 249 640.87	-1 249 640.87
A-12 EXTERNAL STAFF EXPENDITURE (CONTRACT AGENTS, INTERIM STAFF AND NATIONAL EXPERTS)								6 997.61	6 997.61	-122 966.93	-122 966.93	-115 969.32	-115 969.32
A-13 MISSIONS AND DUTY TRAVEL			-150 000.00	-150 000.00	-400 000.00	-400 000.00						-550 000.00	-550 000.00
A-14 MISCELLANEOUS EXPENDITURE ON STAFF RECRUITMENT AND TRANSFER			150 000.00	150 000.00	35 000.00	35 000.00		-5 000.00	-5 000.00	-8 000.00	-8 000.00	172 000.00	172 000.00
A-15 REPRESENTATION					30 000.00	30 000.00		-30 014.92	-30 014.92	99 775.92	99 775.92	99 761.00	99 761.00
A-16 EXTERNAL SERVICES	770 000.00	770 000.00	-200 000.00	-200 000.00	100 000.00	100 000.00		-40 000.00	-40 000.00			630 000.00	630 000.00
A-17 RECEPTIONS/EVENTS AND REPRESENTATION								-9 875.00	-9 875.00			-9 875.00	-9 875.00
A-18 SOCIAL WELFARE										-16 400.00	-16 400.00	-16 400.00	-16 400.00
A-19 OTHER STAFF RELATED EXPENDITURE					140 000.00	140 000.00				-144 873.35	-144 873.35	-4 873.35	-4 873.35
Title 1 Total	0.00	0.00	-200 000.00	-200 000.00	-125 000.00	-125 000.00	0.00	-221 064.47	-221 064.47	-192 464.36	-192 464.36	-738 528.83	-738 528.83
A-2 BUILDINGS, EQUIPMENT AND MISCELLANEOUS OPERATING EXPENDITURE													
A-21 BUILDINGS AND ASSOCIATED COSTS								-37 500.00	-37 500.00	-172 000.00	-172 000.00	-209 500.00	-209 500.00
A-22 INFORMATION/COMMUNICATION TECHNOLOGY/DATA PROCESS								134 603.90	134 603.90			134 603.90	134 603.90
A-23 MOVABLE PROPERTY AND ASSOCIATED COSTS								-46 876.43	-46 876.43	-113 276.44	-113 276.44	-160 152.87	-160 152.87
A-24 CURRENT ADMINISTRATIVE EXPENDITURE			200 000.00	200 000.00	125 000.00	125 000.00				-128 586.02	-128 586.02	196 413.98	196 413.98
A-25 POSTAGE / TELECOMMUNICATIONS								-120 000.00	-120 000.00	-17 200.00	-17 200.00	-137 200.00	-137 200.00
A-26 MEETING EXPENSES								-112 410.00	-112 410.00	-8 996.48	-8 996.48	-121 406.48	-121 406.48
A-28 INFORMATION AND PUBLISHING								-25 500.00	-25 500.00			-25 500.00	-25 500.00
A-29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE								-53 414.20	-53 414.20			-53 414.20	-53 414.20
Title 2 Total	0.00	0.00	200 000.00	200 000.00	125 000.00	125 000.00	0.00	-261 096.73	-261 096.73	-440 058.94	-440 058.94	-376 155.67	-376 155.67
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-482 161.20	-482 161.20	-632 523.30	-632 523.30	-1 114 684.50	-1 114 684.50
B-3 OPERATIONAL EXPENDITURE													
B3-1 ITER CONSTRUCTION INCLUDING THE ITER SITE PREPARATION	-2 000 000.00	-6 000 000.00					0.00	482 161.20	482 161.20	6 720 228.03	12 906 950.53	5 202 389.23	7 389 111.73
B3-2 TECHNOLOGY FOR ITER										-905 233.33	-613 838.93	-905 233.33	-613 838.93
B3-3 TECHNOLOGY FOR BROADER APPROACH										-3 482 804.88	-4 091 817.40	-3 482 804.88	-4 091 817.40
B3-5 ITER CONSTRUCTION - APPROPRIATION ACCRUING FROM THE ITER HOST STATE CONTRIBUTION	14 000 000.00	15 000 000.00					0.00			-1 306 638.41	-4 446 375.97	12 693 361.59	10 553 624.03
B3-6 APPROPRIATION ACCRUING FROM THIRD PARTIES TO SPECIFIC ITEM OF EXPENDITURE	-12 000 000.00	-9 000 000.00								-393 028.11	-3 122 394.93	-12 393 028.11	-12 122 394.93
Title 3 Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	482 161.20	482 161.20	632 523.30	632 523.30	1 114 684.50	1 114 684.50
TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Annex III. d. Implementation of the F4E Work Programme 2021

2021 Work Programme		Grant		Procurement		Cash Contribution		TOTAL	
		Amount (€)	Variation (%)	Amount (€)	Variation (%)	Amount (€)	Variation (%)	Amount (€)	Variation (%)
B3-1 & B4-1 ITER Construction	Original WP	6 751 166	-	610 780 407	-	309 470 106	-	927 001 680	-
	Last amended WP	3 192 279	-53%	618 627 182	1%	320 269 251	3%	942 088 712	2%
	Execution	3 198 428	0%	618 710 359	0%	327 474 091	2%	949 382 878	1%
B3-2 Technology for ITER	Original WP	0	-	10 125 000	-	150 000	-	10 275 000	-
	Last amended WP	0	-	6 299 857	-38%	0	-100%	6 299 857	-39%
	Execution	0	-	5 290 457	-16%	104 167	-	5 394 624	-14%
B3-3 Broader Approach	Original WP	0	-	23 792 242	-	6 632 000	-	30 424 242	-
	Last amended WP	0	-	11 564 407	-51%	1 979 684	-70%	13 544 091	-55%
	Execution	0	-	8 083 892	-30%	1 977 395	0%	10 061 287	-26%
B3-5 External Support Activities	Original WP	0	-	0	-	0	-	0	-
	Last amended WP	0	-	18 257 931	-	0	-	18 257 931	-
	Execution	0	-	16 951 293	-7%	0	-	16 951 293	-7%
B3-6 Other Expenditure	Original WP	0	-	17 758 276	-	0	-	17 758 276	-
	Last amended WP	0	-	5 897 778	-67%	0	-	5 897 778	-67%
	Execution	0	-	5 505 358	-7%	0	-	5 505 358	-7%
B4-2 Activities linked to ITER Organization Reserve Fund	Original WP	0	-	25 000 000	-	0	-	25 000 000	-
	Last amended WP	0	-	18 257 931	-27%	0	-	18 257 931	-27%
	Execution	0	-	15 285 209	-16%	0	-	15 285 209	-16%
B4-3 Other earmarked expenditure	Original WP	0	-	0	-	0	-	0	-
	Last amended WP	0	-	1 399 516	-	0	-	1 399 516	-
	Execution	0	-	1 399 516	0%	0	-	1 399 516	0%
TOTAL	Original WP	6 751 166	-	687 455 925	-	316 252 106	-	1 010 459 197	-
	Last amended WP	3 192 279	-53%	680 304 602	-1%	322 248 935	2%	1 005 745 816	0%
	Execution	3 198 428	0%	671 226 083	-1%	329 555 653	2%	1 003 980 164	0%

Variations: Last amended WP compared to Original WP and Execution to Last amended WP

Annex III. e. Statistics on Financial Management Budget – Procurement Data

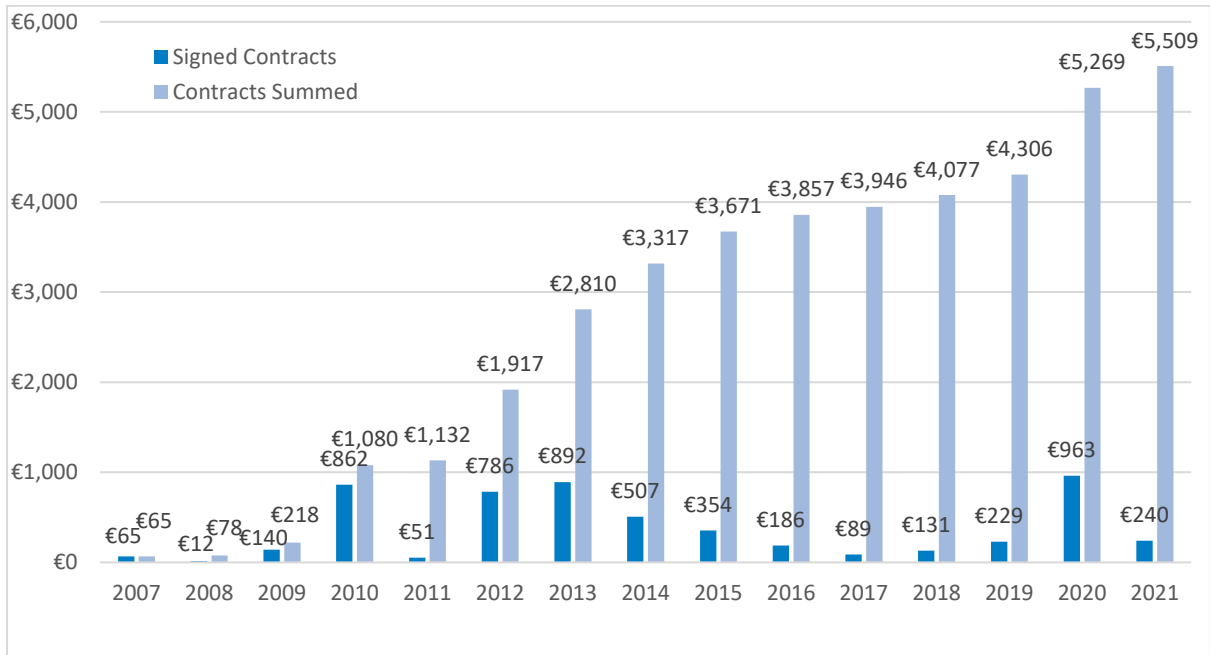


Figure 56: Annual and cumulative value of operational and administrative contracts and grants signed by F4E (€ million, in-year values)

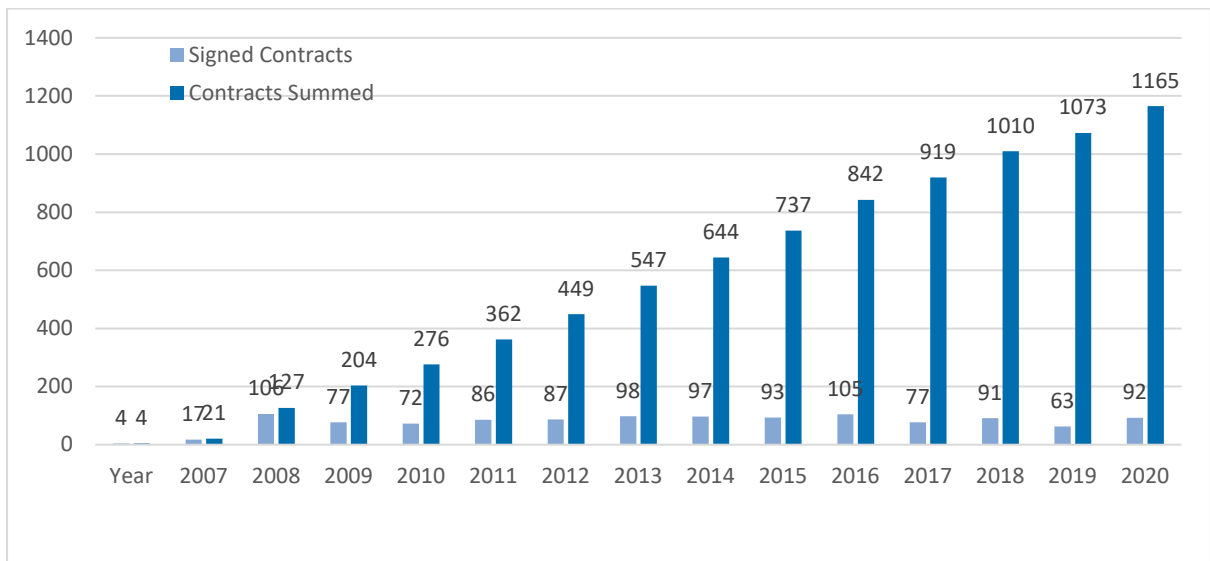


Figure 57: Annual and cumulative number of operational and administrative contracts and grants signed by F4E (in-year values)

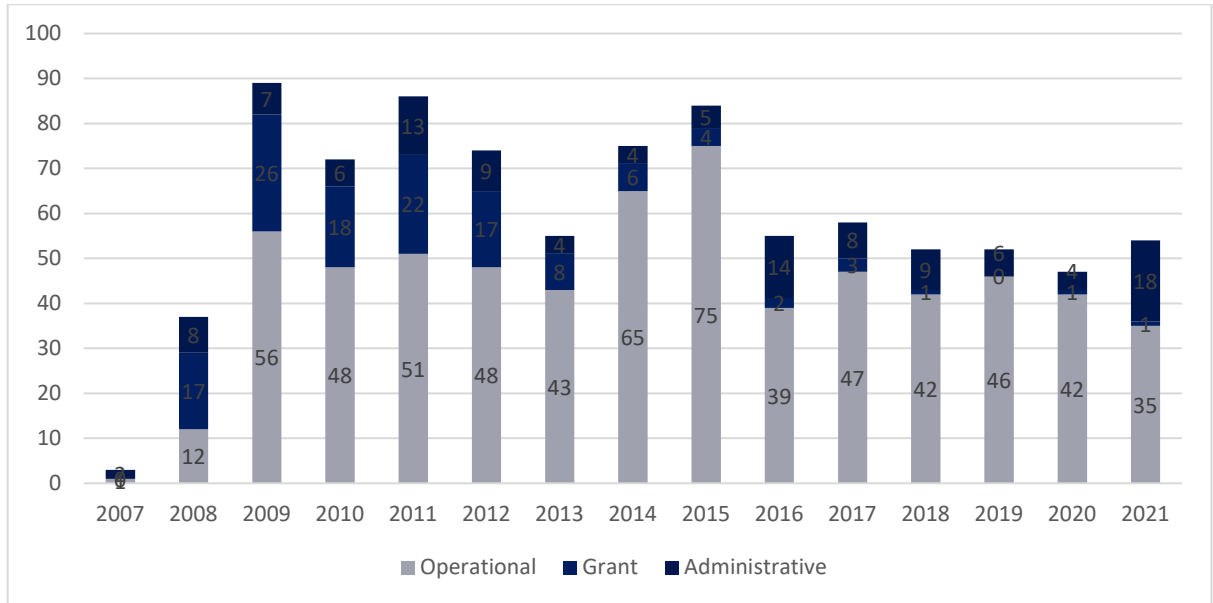


Figure 58: Procurement and grant procedures launched

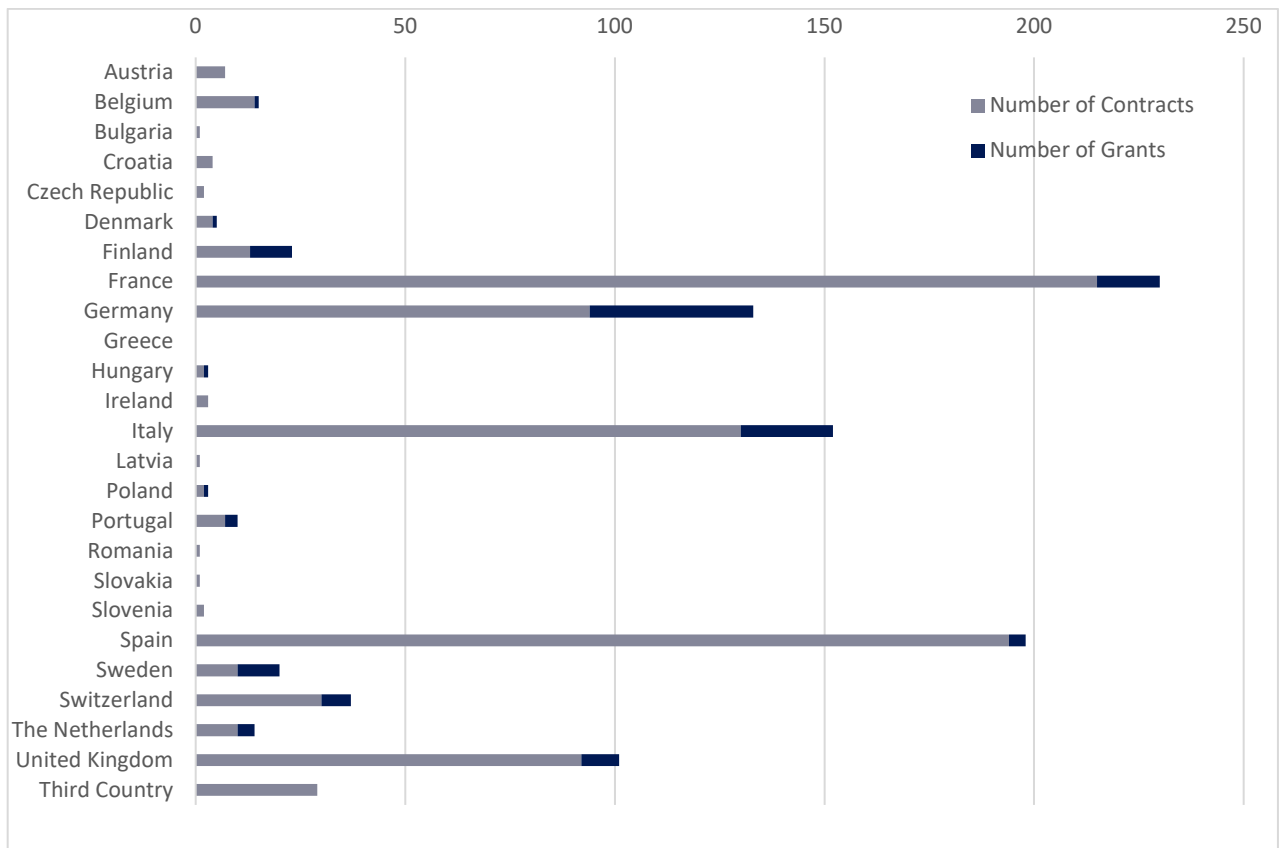
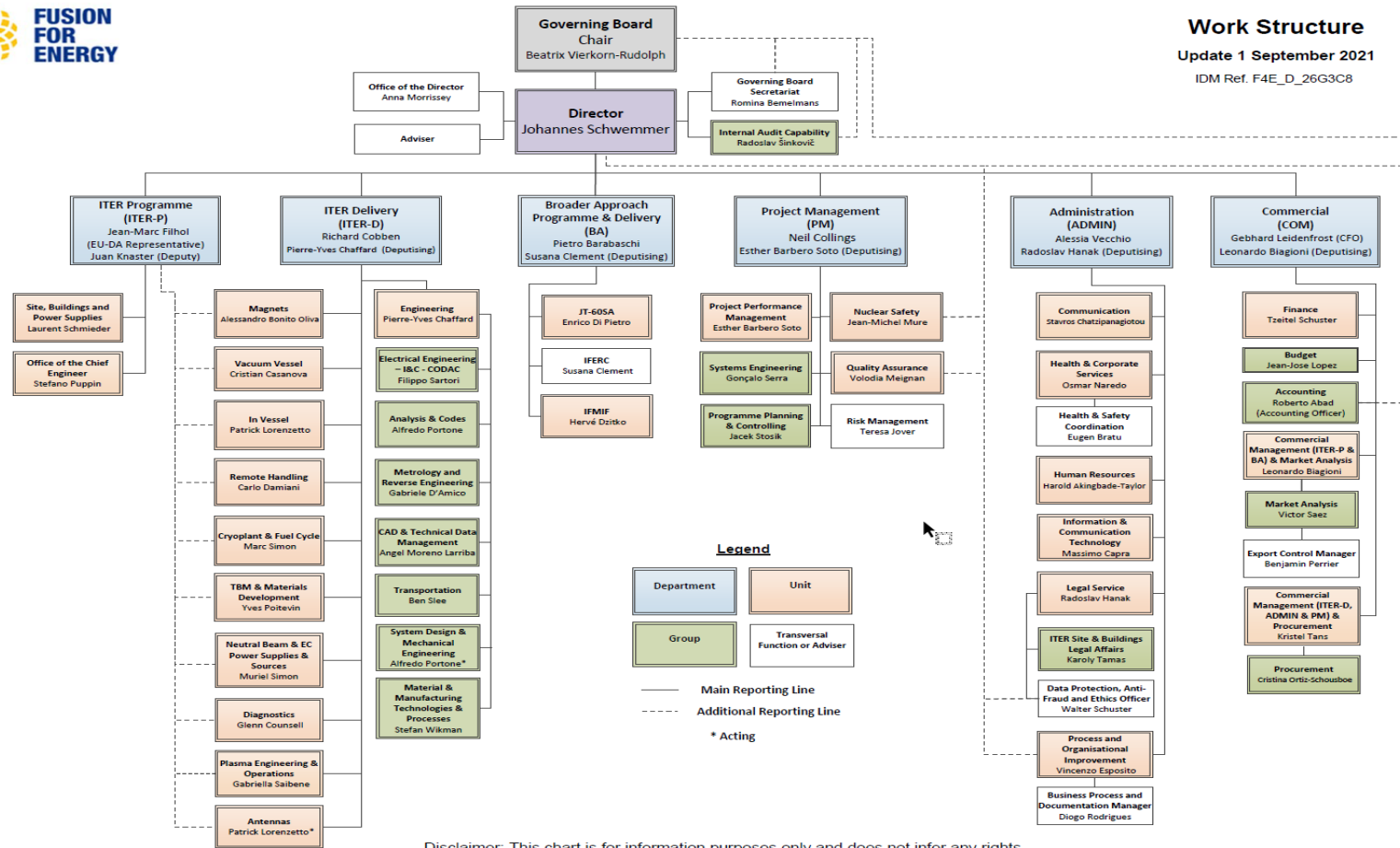


Figure 59: Geographical distribution of awarded contracts and grants (Number in the period 2007-2021). Please note that the contribution of UK and CH during

Annex IV Organisational chart



Annex V. Establishment Plan and Additional Information on Human Resources Management

Annex V a. Establishment Plan

	<u>Authorised</u> Posts (EP 2021)		Filled as of 31/12/2021	
	FO	TA	FO	TA
AD 16				
AD 15		1		1
AD 14	5	3	2	
AD 13	13	10	7	4
AD 12	14	21	10	19
AD 11	2	29	4	15
AD 10		33		32
AD 9		42	9	58
AD 8	1	33	1	23
AD 7	2	21		23
AD 6	1	12	1	20
AD 5				
AD Total	38	205	34	195
AST 11	6		1	
AST 10			1	
AST 9	4	1	2	
AST 8	1	2	2	
AST 7		5	1	2
AST 6		9		10
AST 5		8	4	7
AST 4		1	1	6
AST 3			1	6
AST 2				
AST 1				
AST Total	11	26	13	31
Total	49	231	47	226
Grand total	280		273	

Annex V b. Table: Job Screening/Benchmarking Against Previous Year Results

Job type	Sub-category	Year 2021 (%)	Year 2020 (%)
Administrative Support and Coordination	Administrative support	13.02 %	12.58 %
	Coordination	1.77 %	1.55 %
	Total	14.79 %	14.13 %
Operational	Top level operational coordination	6.62 %	7.51 %
	Programme management and implementation	63.80 %	63.13 %
	Evaluation and impact assessment	1.10 %	1.10 %
	General operational activities	3.09 %	3.31 %
	Total	74.61 %	75.06 %
Neutral	Finance, Control	10.60 %	10.82 %
	Linguistics	0.00 %	0.00 %
	Total	10.60 %	10.82 %

Annex V c. Indicative Table - Information on Recruitment Grade/Function Group For Each Type Of Post

Key functions (examples – terminology should be adjusted to each agency's job titles)	Type of contract (official, TA or CA)	Function group, grade of recruitment*	Indication whether the function is dedicated to administrative support or operations [subject to definitions used in screening methodology]
<i>Adviser / Senior Expert</i>	FO/TA	AD13-14	Administrative/Operations
<i>Head of Department (level 2, taking the Director as level 1)</i>	FO/TA	From AD12 to 14	Administrative/Operations
<i>Head of Unit/Project Team Manager (level 3)</i>	FO/TA	From AD9 to AD14	Administrative/Operations
<i>Group Leader (level 4)</i>	FO/TA	From AD5 to AD12	Operations/Neutral
<i>Officer</i>	FO/TA	From AD5 to AD12	Administrative/Operations/Neutral
<i>Assistant</i>	FO/TA	From AST1 to AST9	Administrative/Operations/Neutral
<i>Senior Assistant</i>	FO/TA	AST10-11	Administrative/Operations/Neutral
<i>Head of Administration</i>	TA	AD12 (external)	Administrative
<i>Head of Human Resources</i>	TA	AD11 (external)	Administrative
<i>Head of Finance</i>	FO	AD10	Neutral
<i>Head of ICT</i>	TA	AD 9 to 14 (internal)	Administrative
<i>Secretary/Clerk</i>	CA	II	Administrative/Operations/Neutral
<i>Data Protection Officer</i>	FO	AD11	Administrative
<i>Accounting Officer</i>	FO	AD7	Neutral
<i>Internal Auditor</i>	FO	AD7	Administrative
<i>Assistant to the Director</i>	TA	AST3 (external)	Operations

Annex V d. Flexitime Scheme in 2021

Category	Grade	Overtime (days)	Recuperation (days)
AST	3	36.17	7.00
	4	22.02	8.17
	5	27.68	6.83
	6	66.50	16.67
	7	36.45	4.00
	8	24.50	6.17
	9	2.13	1.67
	10	0.00	0.00
AD	11	5.95	1.17
	6	103.14	27.00
	7	130.04	43.83
	8	58.95	21.00
	9	344.87	76.67
	10	261.94	36.83
	11	116.95	10.33
	12	158.65	16.67
II	13	54.98	1.17
	14	23.61	0.00
	4	2.64	0.67
	5	3.43	0.67
III	6	14.94	9.17
	7	11.70	1.17
	8	-	-
	9	20.06	10.33
	10	40.69	15.33
IV	11	35.71	16.50
	12	13.71	3.00
	13	2.89	0.00
	14	62.95	16.00
	15	174.29	51.00
	16	74.08	30.17
	17	24.62	13.83
	18	3.70	1.17
Average in F4E		61.25	14.19

Annex VI. Human and Financial Resources by WP Actions

The projects of F4E are divided in Actions, defining the structure the Annual Work Programme (WP). F4E Staff is assigned to each Action.

F4E applies a **'flexibility' clause** in the Annual Work Programme in order to limit the changes in the implementation of the actions compared to the substance of the Work Programme adopted by the Governing Board.

The budget 2021 has been implemented in full respect of this flexibility clause, with the following breakdown of human resources per WP action:

Action #	Action	Staff 2021	Original Budget/WP21	Final Budget/WP21	Execution	Variation [2] %
1	Magnets	29.7	10 179 277	5 750 000	6 610 455	15%
2,3,4,10 [1]	Main Vessel	91.1	167 984 720	151 092 194	146 750 577	-3%
5	Remote Handling	38.0	30 840 485	24 703 115	21 838 745	-12%
6	Cryoplant and Fuel Cycle	25.8	11 110 183	9 501 477	9 172 494	-3%
7	Antenna and Plasma Engineering	27.8	38 773 146	78 726 455	77 944 984	-1%
8	Neutral Beam and EC Power Supplies	42.2	4 733 417	7 772 014	6 588 634	-15%
9	Diagnostics	40.0	45 565 240	41 484 562	42 114 795	2%
11	Site and Buildings and Power Supplies	71.4	341 994 310	356 203 917	359 608 300	1%
12	Cash Contributions	2.4	301 143 374	295 532 180	302 737 020	2%
13	Supporting Activities	45.6	27 233 306	21 115 369	20 223 382	-4%
14	Broader Approach	39.0	30 901 742	13 864 535	10 390 777	-25%
Total		453	1 010 459 197	1 005 745 816	1 003 980 164	-

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

[2] Variation: Execution compared to last amended WP

The major changes (> +/-10%) in the Operational expenditure (variation of the final implementation in % of the last amended WP) are:

- **Magnets:** the increase is due to the price revision of the PF coils Manufacturing and Cold Test contract, and to the extension of the contract for the Supply of TF and PF Conductors;
- **Remote Handling:** the decrease is due to the postponement of the contract for the Development of Radiation Hardened Application specific Circuits (ASICs), and of a task order for final design phase 1 for IVVS;
- **Neutral Beam and EC Power Supplies:** the commitment of the HVD1 & Bushing of IHNB-1 & IHNB-2 to cover the delays introduced by the new integrated schedule revised by IO is postponed to 2022, mainly due to delay of B37 availability;
- **Broader Approach:** One of the activities for the Supply of the JT-60SA Actively Cooled Divertor kept in the 2021 planning was postponed to 2022.

The evolution of the 2021 Financial resources of the Work Programme is reflected in its amendments approved by the Governing Board in November 2021¹³, the major changes (higher than EUR 10 million) were the following:

In Vessel Blanket

- Reduction in the forecast for the Blanket First Wall (BFW) Series due to a higher amount implemented in 2020 for the first instalment.
- Increase of the Task Order #2 of Beryllium Series after re-assessment of Supplier's Beryllium free issue demands for the Blanket First Wall Series contract.

In Vessel Divertor

- Stage II of the Cassette Body Series was awarded with a lower value than the estimate, thanks to the fostered competition between tenderers and the procurement strategy defined.

Antennas and Plasma Engineering

- Increase in the values for the Integrator Framework Contract's Task Orders based on the initial offers received from the supplier during the ongoing negotiations.
- New action to cover the approved PCR-001271 for the Ion Cyclotron procurement scope transfer to IO. The estimated cost has been agreed at a ceiling price of EUR 50.3 million (2021), which is composed of cash contribution of EUR 24 million planned for 2021 and credit return.

Site and Buildings and Power Supplies

The increase is the resulting figure of the main following decreases and increases of sub-actions:²

- TB13 and TB18: reduction in the forecast due to higher amounts implemented in 2020 for the first instalment.
- TB09 Commitment for Hot Cell Complex (HCC) is postponed to the following year as the strategy is not yet finalized.
- New forecast for the Support to the Owner (SO) II firm part moved from TB09.
- SO II - (HCC) Option 1 for engineering support services is postponed to 2022 as the HCC strategy is still to be defined.
- TB21 commitment postponed to 2022.
- TB20 the contract for B14 Doors Manufacturing / Installation is postponed to 2022 due to call for tender negotiation phase that last more than expected.
- AE increase in the forecast for (i) the B14 Building services Construction Design (first plasma) which has been transferred from TB04 and (ii) transfer of scope for the design and qualification of B11/B74 and procurement.

¹³ Amendment 1 to WP 2021 (F4E_D_2RT2WJ) and Amendment 2 to WP 2021 (F4E_D2TVVWQ)

- TB12 increase in the forecast for the Non Nuclear Building (NNB) which has been transferred from TB04
- TB04 decrease in the forecast as part of the general items of Option 4 were already committed at the end of 2020.
- TB04 additional commitments to cover (i) additional Design effort and changes in quantities and Non-Nuclear Building (NNB) and (ii) potential past claim and future sub contract.

Broader Approach

- The definition of some technical aspects of the most critical High Heat Flux (HHF) contract is delayed, and it has an impact on the finalisation of the technical specification of the Normal Heat Flux (NHF) and the Divertor Cassette contract contracts.

Annex VII Environmental Management

Following the commitment of the Spanish authorities to refurbish F4E premises, renovation works have started on one floor with emphasis on energy savings and adequate thermal installations.

In October 2021, F4E endorsed the Presidency of the Greening Subnetwork and prepared its first work programme in order to increase collaboration among Agencies and Joint Undertakings on environmental issues.

The current premises hosting F4E are LEEDS certificated. Fusion for Energy shares the same building with several companies and therefore, has limited room for manoeuvre to reduce its impact on the environment, but actively collaborates with the Building Management to act whenever possible.

Annex VIII Contribution, grant and service level agreements. Financial Framework Partnership Agreements¹⁴

Ongoing grants signed before 31/12/2021

Grant Agreements Reference	Date of Signature	Total Amount		Duration	Counterpart (Leader Company)	Short Description
		Committed Value	of which Committed in 2021			
F4E-FPA-327 (PMS-DG)-07	2/20/2020	€2,015,297.00		50	AGENZIA NAZIONALE PER LE NUOVE TECN	FPA-327-07_Development of the Final Design and Prototyping
F4E-FPA-364-06	10/22/2018	€1,390,426.00		50	MAX-PLANCK-GESELLSCHAFT ZUR FORDERU	Development of the Design and Critical Prototyping
F4E-FPA-375-02	7/12/2013	€984,080.00		87	ISTITUTO SUPERIOR TECNICO*	FPA-375: SG02_CA01812_COORDINATION SUPPORT OFFICE
F4E-FPA-384 (DG)-05	7/30/2018	€2,286,133.00	€787,479.00	56	MAX-PLANCK-GESELLSCHAFT ZUR FORDERU	F4E-FPA-384-SG05 Development of the Design and Prototyping
F4E-FPA-393 (DG)- 05	5/23/2018	€1,615,711.00	€249,859.00	49	Danmarks Tekniske Universitet(Leader)	Development Of The Design And Critical Prototyping
F4E-FPA-407-04 (DG)	9/22/2017	€4,574,345.69		51	COMMISSARIAT A L ENERGIE ATOMIQUE E	DEVELOPMENT OF THE DESIGN AND PROTOTYPING: EQUATORIAL
F4E-GRT-553	7/9/2014	€2,562,993.00		89	ECOLE POLYTECHNIQUE FEDERALE DE LAU	DESIGN, DEVELOPMENT AND VALIDATION OF THE EUROPEAN GYROTRON
F4E-GRT-0901-01	3/9/2018	€1,611,591.00	€106,149.00	64	TEKNOLOGIAN TUTKIMUSKESKJUS VTT OY* ^T	Development and integration of 3D Machine Vision, HLCS modules and GENROBOT at DTP2
F4E-GRT-0974-01	12/20/2018	€304,986.00	€55,000.00	50	TUOTEKEHITYS OY TAMLINK*	PROTOTYPING AND TESTING OF HYDRAULIC DIGITAL VALVES FOR THE DIVERTOR
F4E-GRT-1146-01	7/25/2021	€1,999,941.00	€1,999,941.00	48	COMMISSARIAT A L ENERGIE ATOMIQUE E	Completion of the design of Equatorial Wide Angle Viewing System (EP-WAVS) in EP12 and

¹⁴ F4E does not provide to other entities Contribution and service level agreements nor Financial Framework Partnership Agreements

Annex IX – Annual Accounts

Final Annual Accounts 2021 added following the Governing Board meeting.



**FUSION
FOR
ENERGY**

FINAL ANNUAL ACCOUNTS

Financial statements & Budget implementation

Fourteenth financial year – 2021

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

Josep Pla nº 2 · Torres Diagonal Litoral · Edificio B3· 08019 Barcelona · Tel. +34 93 320 18 00 · Fax +34 93 320 18 51

www.fusionforenergy.europa.eu

These annual accounts have been drawn up by the Accounting Officer of Fusion for Energy (F4E).

The final accounts, together with the opinion of the F4E Governing Board, are sent to the Commission's Accounting Officer, the European Court of Auditors, the European Parliament and the Council.

The final accounts are published on F4E's website:

<https://fusionforenergy.europa.eu/key-reference-documents/>



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Certification letter from F4E Accounting Officer

I acknowledge my responsibility for the preparation and presentation of the annual accounts of Fusion for Energy (F4E) in accordance with Article 102 of the Framework Financial Regulation ('FFR')¹ and I hereby certify that the annual accounts of F4E for the year 2021 have been prepared in accordance with Title IX of the FFR and the accounting rules adopted by the Commission's Accounting Officer, as are to be applied by all the institutions and union bodies.

I have obtained from the Authorising Officer, who certified its reliability, all the information necessary for the production of the accounts that show the F4E's assets and liabilities and the budgetary implementation. Based on this information, and on such checks as I deemed necessary to sign off the accounts, I have a reasonable assurance that the accounts present fairly, in all material aspects, the financial position, the results of the operations and the cash-flow of F4E.

Mr Roberto Abad Villanueva
Accounting Officer

Done in Barcelona, 1st June 2022

¹ COMMISSION DELEGATED REGULATION (EU) 2019/715 of 18 December 2018 on the framework financial regulation for the bodies set up under the TFEU and Euratom Treaty and referred to in Article 70 of Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council.

1. Introduction

F4E is a Joint Undertaking created under the Euratom Treaty by a decision of the Council of the European Union (EU)².

F4E was established for a period of 35 years from 19th April 2007 and its seat is located in Barcelona, Spain.

The main tasks of F4E are as follows:

- In relation to the obligations stemming from the ITER International Agreement: to provide the contribution of the European Atomic Energy Community (Euratom) to the ITER International Organisation (IO).
- In relation to the obligations stemming from the Broader Approach Agreement with Japan (BA): to provide components, equipment, materials and other resources for BA activities and to prepare and coordinate Euratom's participation in the implementation of BA activities.
- In relation to DEMO: to prepare and coordinate a programme of research, development and design activities other than ITER and BA activities, in preparation for the construction of a demonstration fusion reactor and related facilities, including the IFMIF (International Fusion Materials Irradiation Facility).

Regarding the ITER project, in November 2016 the Council of IO approved a new ITER project baseline for the scope, schedule and the cost of the project. The overall project schedule is based on a progressive four-stage approach with the so-called 'First Plasma' in December 2025 and culminating in the 'Deuterium-Tritium' phase in December 2035. Following the approval of the new ITER project baseline, F4E set the new timetable and recalculated the related cost at completion of the F4E's contribution to the project construction phase.

In addition to the construction of the machine, F4E will have to contribute to the ITER operational phase and to the subsequent ITER deactivation and decommissioning phases. The F4E contribution to the deactivation and the decommissioning phases are defined as EUR 95 540 000 (in 2001 values) and EUR 180 200 000 (in 2001 values).

For the Multiannual Financial Framework (MFF) period 2021-2027, the European Council has agreed a budget for the Euratom contribution to ITER amounting to a total value of EUR 5 614 million (in current values) of which EUR 5 560 million (in current value) of direct contribution to the project. The ITER Host State and Membership contributions will be added to this figure, subject to the final decision by the relevant Budgetary Authorities.

² Council decision 2021/281/Euratom of 22 February 2021 Amending Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it.

a) F4E revenue is made up of the:

- **Euratom contribution**

The contribution from Euratom constitutes the main source of revenue for F4E.

The annual contribution is determined in the European Union General Budget in commitment and in payment appropriations, as well as the F4E establishment plan. The revenue received from Euratom is earmarked for operational expenditure and for administrative expenditure (running costs).

- **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 until 2020 have been agreed in a formal exchange of letters between France and the European Commission in 2011³. This agreement ended on 31st December 2020 and the establishment of a new legal framework is of paramount importance to support the political commitment taken by France in 2006 to contribute to the ITER project. F4E and Euratom are discussing a new methodology (post 2020) with France that should be finalized in the coming months. In the meantime, France has committed to continue to honour its commitments throughout the implementation of the ITER project.

- **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 and are universal (not assigned) revenue.

- **Reserve Fund and other tasks requested and financed by IO**

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 and from other requested tasks is earmarked for financing the corresponding requests for change from IO introduced after 5th March 2015.

³ Contribution financière française à la construction d'ITER - Letter from The Haut Representant Français pour ITER to the EU Commission on 08/09/11 and reply on 17/11/11.

b) United Kingdom and Switzerland Participation in ITER Programme

On 1 February 2020 the UK ceased to be a Member State of the EU. Following the conclusion of the Agreement on the withdrawal of the UK from the EU and the Euratom (the 'Withdrawal Agreement') between the two parties, the UK committed to pay all its obligations under the 2014-2020 MFF and previous financial perspectives following from its membership of the Union. The UK has paid into the 2020 EU Budget during the year, and received payments, as if it was a Member State.

The UK and EU concluded negotiations on future UK relationship with the EU on 24 December 2020, however the agreement was not ratified during 2021 and therefore had no effect on the herein reported F4E financial year.

According to the 2020 agreement, after its ratification the UK will become an associate member state of Euratom and shall retain participation in all parts of the Euratom programme, under equivalent conditions as full Member States.

Article 8 of the EU-UK Joint Declaration states that the UK will continue to participate as a member of F4E. The UK financial contribution is subject to negotiation. Once Britain's membership shall take effect, UK economic operators will be able to sign new contracts and grants with F4E and British citizens will be again eligible for F4E employment. Existing contracts, with companies and individuals, are not impacted, while grants with UK beneficiaries have been terminated or suspended until ratification.

On 31st December 2020 the research cooperation agreement between Switzerland and the EU expired. This cooperation agreement covered, among other fields, the Swiss participation to Euratom research programmes (including fusion and ITER), therefore on the same date Switzerland ceased being an F4E Member.

No new agreement was negotiated between Euratom and Switzerland during 2021, therefore Switzerland remained a non-member for the whole duration of the 2021 financial year and therefore paid no contribution to the F4E budget.

Existing contracts, with companies and individuals, are not impacted, while grants with Swiss beneficiaries have been terminated or suspended.

c) Main achievements during 2021

During 2021 F4E has further progressed in the work and continued the delivery of some of the major components to ITER in order to start the assembly activities according to plan for the achievement of First Plasma at the end of 2025. Notably in 2021 F4E delivered three Toroidal Field coils in 2021 which makes a total of 6 Toroidal Coils delivered out of 10 assigned to F4E, and three Poloidal Field coil magnets.

It should be noted that IO is currently re-planning the First Plasma baseline, the outcome of which is expected to be decided by the ITER Council in 2022 and F4E will subsequently adjust its planning accordingly.

Both design and manufacturing activities have progressed in Europe in laboratories and industry.

In 2021 F4E achieved an overall Schedule Performance Index (SPI):

$$SPI = \frac{\text{Number of milestones achieved to end of previous month}}{\text{Number of milestones in baseline to end of previous month}} = 0.94$$

2021 was the first year of the new 2021-2027 Multiannual Financial Framework.

The achievements during the year are detailed in the 2021 Consolidated Annual Activity report (with the annual accounts in annex).

d) Impact of Covid19

During 2021, the COVID19 pandemic has continued to have significant impacts on the EU economy and F4E supply chain.

Many of the F4E suppliers have been affected by the COVID19 pandemic, with varying restrictions on work attendance and travel, and ongoing and future efficiency impacts due to the enhanced sanitation measures required in most EU member states. The consequences have been assessed as a delay in some deliveries of up to 4 months, and a “cost at completion” impact of EUR 45 million (2008 euros) on the overall project. While the estimated financial impact of COVID19 showed a decreasing trend in 2021, further repercussions are possible in 2022 depending on how the pandemic develops.

Additionally, during the second half of 2021 and as a consequence of economic incentives initiated by many countries worldwide to stimulate a prompt recovery, raw material markets showed exceptionally high increases in prices. This indirect effect of the COVID19 pandemic is already clearly having impact on many F4E contracts and its effect on the cost at completion is presently under estimation.

In any event, the COVID19 impact is serious but not substantial, and the result on the 2021 financial statements is not material.

e) 2021 Accounts

The 2021 financial statements of F4E and its reports on budget implementation for 2021 have been prepared in conformity with:

- The Council Decision establishing F4E,
- The Financial Regulation (FR) applicable to the general budget of the European Union⁴,
- The F4E FR⁵,
- The « Inventory directive » (EC n° 643/2005),
- The European Commission's consolidation manual for the 2021 closure.

The accounts have also been drawn up in accordance with the accounting rules adopted by the Accounting Officer of the European Commission (EC). As an EU body, F4E is fully consolidated in the EU accounts. Articles 80.1 and 82.1 of the general FR state that the Accounting Officer of the EC adopts the accounting rules and the harmonised chart of accounts to be applied by all institutions and EU bodies. They are accrual based accounting policies derived from International Public Sector Accounting Standard (IPSAS) or by default, International Financial Reporting Standards (IFRS).

F4E has implemented the ABAC system (Accrual Based Accounting) owned by the EC and used by many EU bodies. The accounting and budgetary information is integrated in one system which has SAP as a back-end for the accounting part. The workflow system in ABAC allows the Authorising Officer to ensure that the “four eyes” principle has been observed for each transaction.

The representation letter related to the accounts 2021 has been transmitted to the President of the European Court of Auditors (ECA) in a separate note. It includes no reservation from the F4E Accounting Officer.

In line with Article 70.6 of the FR applicable to the general budget of the EU, Baker Tilly has been appointed as independent external auditor in order to verify that the 2021 annual accounts properly present the income, expenditure and financial position of F4E.

ECA shall prepare a specific Annual Report in line with the requirement of Article 287 (1) TFEU. When preparing this report, ECA shall consider the audit work performed by the independent external auditor and the action taken in response to the auditor's findings.

The European Parliament is the discharge authority within the EU. This means that, following the audit and finalisation of the annual accounts, it falls under the responsibility of the Council to recommend and then to the European Parliament to give a discharge to F4E.

⁴ Financial Regulation (EC, Euratom) n° 966/2012 of the European Parliament and of the Council of 25 October 2012, last amended on 18/07/2018 (EU, Euratom) n° 2018/1046.

⁵ F4E Financial Regulation adopted by F4E Governing Board on 9-10/12/2019 – F4E(19)-GB45-45.

Section I. 2021 Financial Statements

2. Balance Sheet

As at 31 December 2021

EUR thousands

	Note	2021	2020
CURRENT ASSETS			
Cash and cash equivalents	6.2.1.	5 010	5 535
Receivables	6.2.2.	284 904	234 657
Pre-financing	6.2.3.	37 774	42 980
		327 688	283 173
NON-CURRENT ASSETS			
Pre-financing	6.2.3.	70 356	75 497
Property, plant and equipment	6.2.4.	669	1 084
Intangible assets	6.2.4.	84	141
		71 110	76 722
TOTAL ASSETS		398 798	359 895
CURRENT LIABILITIES			
Accounts payable	6.2.5.	66 739	84 432
Accrued charges and deferred income	6.2.6.	62 830	45 686
Current provisions	6.2.7.	62 872	1 400
		192 441	131 518
NON-CURRENT LIABILITIES			
Non-Current provisions	6.2.7.	183 060	143 609
		183 060	143 609
TOTAL LIABILITIES		375 501	275 126
NET ASSETS		23 297	84 769
NET ASSETS/EQUITY			
Accumulated surplus/deficit		84 769	-16 063
Economic result of the year - Profit (+)/Loss (-)		-61 472	100 832
NET ASSETS	6.2.8.	23 297	84 769

Fig. 1 Balance Sheet

3. Statement of Financial Performance

As at 31 December 2021

EUR thousands

	Note	2021	2020
NON-EXCHANGE REVENUES			
Revenue from Euratom		601 227	632 450
Revenue from other contributors (Member States)		135 083	156 100
Other non exchange revenue		173	195
		736 483	788 745
EXCHANGE REVENUES			
Reserve Fund		6 444	9 278
Other revenues		1 423	5
		7 867	9 283
TOTAL REVENUE	6.3.1.	744 350	798 028
OPERATIONAL EXPENSES			
	6.3.2.		
Expenses with third parties		639 154	631 988
		639 154	631 988
OTHER EXPENSES			
	6.3.3.		
Staff costs		51 608	50 338
Provisions - additions and adjustments		102 323	1 786
Property, plant and equipment related expenses		2 136	2 301
Other expenses		10 601	10 785
		166 668	65 209
TOTAL EXPENSES		805 822	697 196
SURPLUS (+) / DEFICIT (-) OF THE YEAR		-61 472	100 832

Fig. 2 Statement of Financial Performance

4. Cash Flow Statement (indirect method)

As at 31 December 2021

EUR thousands

	2021	2020
Surplus/(deficit) from ordinary activities	-61 472	100 832
Operating activities		
Amortization (intangible fixed assets) +	107	143
Depreciation (tangible fixed assets) +	418	-948
Increase/(decrease) in Provisions for risks and liabilities	100 923	-68 214
Increase/(decrease) in Value reduction for doubtful debts	0	0
(Increase)/decrease in Stock	0	0
(Increase)/decrease in Long term Pre-financing	5 141	-9 021
(Increase)/decrease in Short term Pre-financing	5 207	-9 611
(Increase)/decrease in Long term Receivables	0	0
(Increase)/decrease in Short term Receivables	-50 247	-14 921
Increase/(decrease) in Other Long term liabilities	0	0
Increase/(decrease) in Accounts payable	-549	-4 946
	-472	-6 686
Investing activities		
Increase of tangible and intangible fixed assets (-)	-126	-422
Proceeds from tangible and intangible fixed assets (+)	74	1 471
	-53	1 050
Net increase/(decrease) in cash and cash equivalents	-525	-5 636
Cash and cash equivalents at the beginning of the period	5 535	11 171
Cash and cash equivalents at the end of the period	5 010	5 535

Fig. 3 Cash Flow Statement

5. Statement of Changes in Net Assets

As at 31 December 2021

EUR thousands

Net assets	Accumulated Surplus (+) / Deficit (-)	Economic result of the year	Net assets (Total)
Balance as of 31 December 2020	-16 063	100 832	84 769
Balance as of 1 January 2021	-16 063	100 832	84 769
Fair value movements	0	0	0
Allocation of the Economic Result of Previous Year	100 832	-100 832	0
Economic result of the year	0	-61 472	-61 472
Balance as of 31 December 2021	84 769	-61 472	23 297

Fig. 4 Statement of Changes in Net Assets

6. Notes to the Financial Statements

6.1. Accounting Principles

The Financial statements provide information about the financial position, performance and cash flow of an entity that is useful to a wide range of users. For a public sector entity such as F4E, the objectives are more specifically to provide information useful for decision-making, and to demonstrate the accountability of the entity for the resources entrusted to it.

The accounts of the Joint Undertaking comprise the general accounts and budget accounts. These are kept in euro on the basis of the calendar year. The budget accounts give a detailed picture of the implementation of the budget. They are based on the modified cash accounting principle. The general accounts allow for the preparation of the financial statements which consist in a statement of financial performance, showing all income and expenditure for the financial year, and a balance sheet designed to establish the financial position of F4E at 31 December.

Article 98 of F4E FR sets out the accounting principles to be applied in drawing up the financial statements.

Use of estimates

In accordance with IPSAS and generally accepted accounting principles, the financial statements include amounts based on estimates and assumptions by management based on the most reliable information available.

Significant estimates include, but are not limited to, amounts for provisions, accounts receivables, accrued income and charges, contingent assets and liabilities, and the degree of impairment of intangible assets and property, plant and equipment. Actual results could differ from those estimates. Changes in estimates are reflected in the period in which they become known.

IPSAS 11 – Construction contracts

Most of the components that make up ITER will be delivered by the ITER parties (including F4E) “in-kind” (providing directly the components rather than contributing only cash).

The EU contribution to IO through F4E is established on the ITER Agreement and Common Understanding on Procurement Allocation and its amendments, and it comprises mainly buildings, magnets, vessels and other engineering components.

On the basis of the Procurement Arrangements (PA), F4E launches procurements and conclude contracts with the industry. The industry delivers usually directly to IO, which also performs the acceptance. IO then informs F4E about the acceptance, i.e. IO recognises the credits to F4E. In order to consider that the PA obligations have been fulfilled by each party, the PA value has to be fully earned, independently of the actual cost incurred for executing the scope of work of each PA.

For each PA key milestone an ITER credit is associated and this is released to the specific Party whenever the milestone has been achieved and the related documentation verified by IO. Therefore the progress in the execution of the work and in discharging the EU from its obligation toward the ITER Agreement is recognized by means of credit earned by F4E depending on the achievement of project milestones laid down in each PA.

As there is no specific EC accounting rule covering those operations, F4E refers to IPSAS rule n° 11 “Construction contracts”.

The ITER Agreement and Common Understanding on Procurement Allocation and its amendments together with the F4E Statutes can be considered as a binding arrangement and therefore as a construction contract according to IPSAS 11.

From an IPSAS 11 perspective, F4E can be considered as contractor and the agreement with Euratom as a construction contract.

Based on the accounting guidance applicable to the type of transactions managed by F4E, the cost of the items, acquired or constructed, incurred with the purpose of the final manufacture of the research components that F4E agreed to deliver **should be expensed when incurred**.

The recognition as an expense is the approach that better capture the nature of the transaction given that :

- in most of the cases the suppliers hold the economic ownership (i.e., is not presently controlled by F4E);
- F4E does not foresee using the assets for other purpose, or
- F4E agrees/foresees to provide the legal ownership to the subcontractors for no consideration after delivery.

It is to be noted that the use of IPSAS rule n° 11 (Construction contracts) is extended to the accounting of all operational contributions within the ITER and BA agreements.

6.2. Notes to the Balance Sheet

6.2.1. Cash and Cash Equivalents

Description	31.12.2021	31.12.2020
Bank accounts:		
Central treasury (EC)	4 964 662.70	5 489 620.53
Current accounts	0.00	625.00
Imprest accounts/Cash in hand	45 537.20	45 000.00
Short-term deposits	0.00	0.00
TOTAL	5 010 199.90	5 535 245.53

Fig. 5 Central treasury and Cash Equivalents

In view to increase the efficiency, F4E has externalised its treasury to the EC in May 2019. The cash position at the end of 2021 is composed of one account with the EC and three imprest accounts (petty cash).

No bank interests have been generated in 2021.

6.2.2. Current Receivables

All receivables are carried out at the original amount less write-down for impairment when there is objective evidence that F4E will not be able to collect all amounts due according to the original payment terms.

Current receivables: EUR 14 593 093.11 referring mainly to the recoverable VAT from France.

Sundry receivables: EUR 32 777.84 composed mainly of advances to staff (salaries and missions) and amounts due by other EU bodies.

Deferrals and accruals: EUR 259 058 391.79 corresponding to the deferred charges related to the 2022 cash contribution to IO (EUR 256.6 million) and deferred charges for insurance premiums paid in advance (EUR 2.5 million).

Accrued income: EUR 11 219 668.24 corresponding to the accrued revenue from the ITER Reserve fund.

6.2.3. Pre-Financing

Pre-financing is a payment intended to provide the beneficiary with a cash advance, i.e. a float. It may be split into a number of payments over a period defined in the specific pre-financing agreement. The float or advance is repaid or used for the purpose for which it was provided during the period defined in the agreement. If the beneficiary does not incur eligible expenditures, he has the obligation to return the pre-financing to F4E.

The amount of the pre-financing is reduced (wholly or partially) by the acceptance of eligible costs and amounts returned.

At year-end, outstanding pre-financing amounts are valued at the original amount(s) paid less: amounts returned, eligible amounts cleared, estimated eligible amounts not yet cleared at year-end, and value reductions.

Pre-financing without interest for F4E	31.12.2021	31.12.2020
Pre-financing given to third parties (non-current)	70 356 400.38	75 497 219.36
Pre-financing given to third parties (current)	93 569 016.33	87 550 377.00
Accrued charges on Pre-financing given to third parties	-55 795 460.93	-44 569 986.35
TOTAL	108 129 955.78	118 477 610.01

Fig. 6 Pre-Financing

It is estimated that EUR 70.4 million of the pre-financing open at 31/12/2021 will be cleared with eligible amounts after 2022.

These pre-financings are related mainly to the following operational procurement contracts:

Contract Reference	Contractor	Amount
OPE-1003-01_TB13_Emergency electrical power distribution	ANSALDO NUCLEARE	30 392 876.58
OPE-301_TB04_Buildings	AXIMA	24 228 574.29
OPE-0688_TB12_Buildings	DEMATHEU BARD CONSTRUCTION	19 165 355.60
OMF-444-03-02_Fabrication ITER divertor cassette bodies	WALTER TOSTO	7 598 979.03
OPE-046 Supply of 2 Ion source and extraction power supplies	ENERGY TECHNOLOGY	2 015 167.68
OMF-0847-01-01_Preliminary design of the core plasma Thomson scattering	IDOM INGENIERIA	1 767 969.30
OMF-0795-01-01 Supply of the beam components	AVS ADDED VALUE IND. ENG.	1 727 222.67
OPE-285_TB02_Tokamak cargo lift and crane	NKM NOELL SPECIAL CRANES	1 693 621.20
OPE-0982-01_Supply primary vacuum and cryostat leak detection systems	IDOM INGENIERIA	1 088 910.97

Fig. 7 Main Operational Pre-Financings

6.2.4. Fixed Assets

An asset shall be recognised only if it is probable that the expected future economic benefits or service potential that are attributable to that asset will flow to F4E and the cost or fair value of the asset can be measured reliably. Service potential would refer to assets that are used to achieve an objective but which do not directly generate net cash inflows. In the context of F4E this comprises all assets that are used by F4E to fulfil its objectives.

F4E books as fixed assets only items with a purchase price above EUR 5 000.00. Items with a lower value, such as monitors, digital cameras, etc., are treated as expenses of the year but are however registered in the physical inventory. All assets are stated at cost less accumulated depreciation and impairment losses.

F4E has introduced the module ABAC Assets in 2008. ABAC Assets has been developed to meet the requirements of the EC “Inventory Directive” (EC n° 643/2005) and its content is replicated in SAP Assets Accounting module.

All fixed assets are depreciated monthly, with zero residual value, over a variable useful lifetime:

Asset type	Annual depreciation rate
Intangible fixed assets	25%
Tangible fixed assets	
Buildings	4%
Plant and equipment	12.5%, 25%
Furniture and vehicles	
Office furniture	10%
Transport, electrical office, printing and mailing equipment	25%
Kitchen, Printshop and postroom equipment	12.5%
Computer hardware	25%
Other fixtures and fittings	
Audiovisual and Telecommunications equipment	25%
Computer, scientific and general books, documentation	25%, 33%
Health, safety, protective, security and medical equipment,	12.5%
Other	10%
Tangible fixed assets under construction	0%

Fig. 8 Depreciation Rate

Intangible fixed assets:

An intangible asset is an identifiable non-monetary asset without physical substance.

Regarding the internally developed intangible assets (e.g. software), the requirements of the accounting rule n°6 from 1/1/2010 onwards are:

- costs directly linked to an internally developed intangible asset, providing they meet the necessary criteria, must be capitalised as asset under construction. Once the project goes live, the resulting asset will be amortised over its useful life,
- the amount of research expenses incurred on IT projects and development costs not capitalised (e.g. for small projects below threshold, see note 6.3.3. below) must be disclosed in the financial statements.

As of 31/12/2021, all projects identified were below the threshold of EUR 500 000.00 used by F4E for the capitalisation of internally generated intangible assets.

Tangible fixed assets:

A tangible asset is an identifiable non-monetary asset with physical substance.

The following table Fig.9 provides the variation of the fixed assets in 2021 :

ASSETS		Intangible fixed assets			Tangible fixed assets							Fixed assets
2021		Intangible fixed assets internally generated	Computer Software	Total Intangible fixed assets	Buildings	Plant and Equipment	Computer hardware	Furniture and vehicles	Other Fixtures and Fittings	Tangible Fixed Assets under Construction	Total Tangible fixed assets	Total fixed assets
Gross carrying amounts 01.01.2021	+	0.00	2 877 072.77	2 877 072.77	0.00	765 624.39	4 357 506.68	780 204.20	791 046.22	0.00	6 694 381.49	9 571 454.26
Additions	+		49 724.95	49 724.95			17 251.54	13 048.60	46 298.40		76 598.54	126 323.49
Disposals	-			0.00			-29 791.39	-43 125.32	-594.00		-73 510.71	-73 510.71
Transfer between headings	+/-			0.00							0.00	0.00
Other changes :	+/-			0.00							0.00	0.00
Gross carrying amounts 31.12.2021		0.00	2 926 797.72	2 926 797.72	0.00	765 624.39	4 344 966.83	750 127.48	836 750.62	0.00	6 697 469.32	9 624 267.04
Accumulated amortization and impairment 01.01.2021	-	0.00	-2 735 873.77	-2 735 873.77	0.00	-445 484.39	-3 801 733.68	-713 857.20	-649 511.22	0.00	-5 610 586.49	-8 346 460.26
Depreciation	-		-106 576.95	-106 576.95		-139 461.00	-263 818.54	-33 814.60	-52 885.40		-489 979.54	-596 556.49
Write-back of depreciation	+			0.00							0.00	0.00
Disposals	+			0.00			29 791.39	41 900.32	594.00		72 285.71	72 285.71
Impairment	-			0.00							0.00	0.00
Write-back of impairment	+			0.00							0.00	0.00
Transfer between headings	+/-			0.00							0.00	0.00
Other changes :	+/-			0.00							0.00	0.00
Accumulated amortization and impairment 31.12.2021		0.00	-2 842 450.72	-2 842 450.72	0.00	-584 945.39	-4 035 760.83	-705 771.48	-701 802.62	0.00	-6 028 280.32	-8 870 731.04
Net carrying amounts 31.12.2021		0.00	84 347.00	84 347.00	0.00	180 679.00	309 206.00	44 356.00	134 948.00	0.00	669 189.00	753 536.00
Accounts				210000	221000	230000	241000	240000	242000	244000	200000	

Fig. 9 Intangible and Tangible Fixed Assets

6.2.5. Accounts Payable

Current and sundry payables are **EUR 60 364 519.03** and are composed of the balance of the 2022 cash contribution to IO (EUR 60.3 million) and suppliers' invoices received but not paid at year end and reimbursements to staff.

Pre-financing received from Euratom totalled **EUR 6 374 572.42** refers to the balance of the budget outturn account 2021, to be reimbursed to the EC in 2022 (Cf. point 7.7. Budget outturn account).

6.2.6. Accrued Charges and Deferred Income

In accordance with EU Accounting Rule n° 3, accruals are made to recognize the amounts to be paid for goods or services that have been received or supplied but have not been paid, invoiced or formally agreed with the supplier, including amounts due to employees. The accruals are based on project analysis performed by the Authorizing Officer and cross-checked with the amounts actually invoiced at the time of finalization of the accounts.

The amount of **EUR 62 829 810.95** which represents mainly invoices to be received in 2022 for services rendered in 2021, includes:

- EUR 56 241 991.52 for services rendered in 2021 on operational activities and not invoiced at 31/12/2021,
- EUR 4 835 562.43 for services rendered in 2021 on administrative expenditures and not invoiced at 31/12/2021,
- EUR 1 752 257.00 for F4E staff's untaken leave as at the end of December 2021. In conformity with EC Accounting Rule n° 12, an entity shall recognize the cost of holidays carried over to the following years during the year the services were rendered by the staff members.

6.2.7. Provisions

Provisions are recognised when F4E has a legal or constructive obligation towards third parties as a result of past events, for which it is more likely than not that an outflow of resources will be required to settle the obligation, and when the amount can be reliably estimated. Provisions are not recognised for future operating losses. The amount of the provision is the best estimate of the expenditures expected to be required to settle the present obligation at the reporting date. The EU Accounting rule n°10 (Provision, contingent assets and liabilities) is applicable.

Description	Amounts at 31.12.2020	Amounts used (Payment in 2021)	Transfer to current (Payment in 2022)	Addition and value adjustments	Amounts at 31.12.2021
Decommissioning fund (2001)	134 934 902.09	0.00	0.00	38 929 750.78	173 864 652.87
Other provisions	10 073 286.57	-1 399 515.87	0.00	63 393 206.01	72 066 976.71
Total	145 008 188.66	-1 399 515.87	0.00	102 322 956.78	245 931 629.57

Fig. 10 Non-current and current Provision

Non-current provision for the decommissioning fund :

When the construction of an asset requires removal after the end of its useful life and restoration of the site, then a present obligation arises at the time of its construction.

F4E shall contribute jointly through the Budget of the IO to the accumulation of the Decommissioning Fund from the date of First Plasma through the Operation Phase. This will be done by making regular payments through the IO budget.

Based on the Overall Project Cost approved by the ITER Council⁶, the Decommissioning cost is estimated to EUR 530.0 million in 2001 value (not including the Deactivation cost). The EU share of the estimated costs for Decommissioning is EUR 180.2 million (34 % of EUR 530.0 million).

Based on :

- the percentage of completion as of 31.12.2021 (58.3 % according to the F4E Monthly Dashboard), this results in an applicable cost base of EUR 105.11 million in 2001 value (58.3 % of EUR 180.2 million),
- the assumption that the cost contributions will be done in equal annual instalments of EUR 15.0 million in 2001 value (180.2 divided by 12 years) during the Operation Phase 2026 to 2037,
- the assumption that the contributions relating to the applicable cost of EUR 105.11 million will be paid into the fund in the years 2026 to 2031 (7 times EUR 15.0 million),
- EU HICP annual inflation rate from 2001 to 2021,
- an annual inflation rate of 1.8 % provided by Eurostat to reflect future prices,
- the contributions in future prices are not discounted due to negative interest rates,

the resulting provision is recognised at the reporting period for an amount of **EUR 173 864 652.87** (in 2021 value).

Other provision - Additional financial contribution to Japan :

Regarding the arrangements signed between F4E, the JAEA and IO, the transfer of procurement responsibilities from Europe to Japan is implemented through annual cash contributions.

In addition to the original agreements, in January 2014, Euratom and the Japanese Ministry of Science and Technology reached an agreement for settling the transfer of procurement responsibilities, following the request by Japan for an additional financial contribution of EUR 75.0 million (2014 value).

In line with the specific agreement signed in 2020, the provision has been consumed by EUR 70.0 million in 2020. An amount of EUR 1.4 million has been paid in 2021 and the balance will be executed in 2025.

Therefore, in compliance with the accounting rules, the provision has been adjusted based on :

- EU HICP annual inflation rate from 2014 to 2021,
- an annual inflation rate of 1.8 % provided by Eurostat to reflect future prices,
- the contributions in future prices are not discounted due to negative interest rates.

⁶ Updated Overall Project Cost (OPC) – ITER_D_26B8X9 v1.1 presented to IC-25

Other provision – Amendment to TB04 Contract

The TB04 contract covers for the most part the design and supply of the equipment for electrical and HVAC services in the ITER Tokamak Building. Installation of this equipment is under IO's responsibility.

F4E is currently negotiating a commercial agreement with the Omega consortium recording the full and final settlement of some claims and other open disputes. The amount booked as provision is based on an assessment done by F4E with the assistance of external experts.

Other provision - Employer's contribution to the EU pension scheme

In accordance with Article 83a (2) of the Staff regulation, as from January 2016, JUs which are only partly financed from the EU budget should pay the part of the employer's contributions to the EU pension scheme, corresponding to the ratio of their non-EU subsidised revenues to their total revenues. F4E has never been formally requested the payments and therefore has not yet paid such contributions. The method for calculation of the contribution is under discussion with the Commission services.

The total provision for the sum of the three cases (additional contribution to Japan, TB04 contract and the contribution to the EU pension scheme), related to financial year 2021 and previous years, amounts to EUR 72.1 million at the time of issuing the Final accounts.

6.2.8. Net Assets

F4E net assets are decreased by the negative financial performance of the year (EUR 61.5 million) totalling **EUR 23 297 090.68** as of 31 December 2021.

The resources of F4E consist of contributions from Euratom and from the ITER Host State, annual membership, voluntary contributions from the Members other than Euratom and additional resources.

It is to be noted that according to F4E FR, if the balance of the outturn account is positive, it shall be repaid to the EC up to the amount of the Euratom contribution paid during the financial year (see point 7.7. Budget outturn account).

6.3. Notes to the Statement of Financial Performance

6.3.1. Revenue

F4E's revenues consist mainly of contributions granted by Euratom as a participation in the financing of F4E, the ITER Host State, annual membership contributions from other members than Euratom, the ITER Reserve Fund, recoveries of expenses as well as revenue from liquidated damages.

A distinction is made in the Statement of financial performance between :

- revenue from **non-exchange transactions** (mainly from contributors) : the related receivables and revenue are recognized when the recovery orders are issued by F4E (in line with the payment needs and within the Budget approved by F4E's GB). At the end of each financial year, the surplus assessed for budget purposes on a modified cash basis is returned to Euratom (see point 7.7. Budget outturn account). The EU Accounting rule 17 – Revenue from non-exchange transactions is applicable.
- revenue from **exchange transactions** (mainly from the ITER Reserve Fund) : the revenue recognition criteria applied are those described in the EU Accounting rule n° 4.

It is to be noted that since 2021, the revenue from ITER Reserve Fund is recognised subject to the:

- authorisation for financing from the Reserve Fund, implemented through the decisions of the Executive Project Board;
- approval of the related contractual amendment, given by the IO-DG;
- implementation of the related actions by F4E's suppliers (allowing to match the cost with the revenue from ITER).

The operating revenues, **EUR 744 350 258.95** (EUR 798 028 009.01 in 2020), include mainly the 2021:

- Euratom contribution: EUR 601 227 295.71
- ITER Host State contribution: EUR 129 100 000.00
- Membership contributions: EUR 5 983 100.00
- Revenue from ITER: EUR 6 443 841.75

6.3.2. Operational Expenses – EUR 639 153 906.14 (EUR 631 987 784.64 in 2020)

The types of expenses that F4E reports include exchange expenses (where F4E receives goods or services in return) and non-exchange expenses (where F4E transfers value to another entity without receiving anything in exchange).

In line with IPSAS rule n° 11, the construction contracts for which no inflow of service potential will arise to F4E are accounted as expense (operational items that are being built by F4E's contractors and directly handed over to IO after acceptance by the latter – including tooling and work in progress).

The operational expenses include mainly the following items:

Contract Reference	Contractor	2021 Expenses
2021 Cash contribution for ITER IO	ITER IO	218 905 945.45
OPE-301_TB04_Buildings	AXIMA/IO	42 810 606.11
OPE-0688_TB12_Buildings	DEMATHEU BARD CONST.	31 112 056.16
OPE-058_Civil engineering	ENGAGE	25 347 297.06
OPE-068_Supply VV Sectors	ANSALDO NUCLEARE	18 660 004.58
OPE-0414 Cold test of 10 winding packs	SIMIC	18 607 343.77
OPE-636_TB16_Site infrastructure works	SPIE BATIGNOLLES	17 001 778.00
OPE-0996-01_TB18_Completion of the civil works for B14 Tritium building	VINCI CONSTRUCTION	16 443 199.43
OFC-755_Finishing and retrofit works for buildings	DALKIA FRANCE	15 029 579.33
OPE-286_TB03_Building	ENGAGE/VINCI CONST	14 123 496.38
Cash contribution to QST for PA 3.2.P4JA.01	NATIONAL INSTITUTES FOR QUANTUM	12 488 226.10
OPE-0969_Magnet supply contract	ASG SUPERCONDUCTORS	9 494 919.77
OPE-570_PF Coils manufacturing and cold test	CNIM	9 010 409.34
OPE-1003-01_TB13 Emergency electrical power distribution	ANSALDO NUCLEARE	6 855 316.98
OMF-605-01-02_Supply of beam source for MITICA	ALSYOM	6 604 529.49
OPE-090_Civil engineering & construction consultancy	ALTRAN TECHNOLOGIES	6 457 592.33
OMF-444-03-01/02_ITER Divertor cassette bodies	WALTER TOSTO	6 009 353.57
OPE-906 Painting and coating works for Buildings	GDES	5 560 800.62
OPE-0966 Manufacture of the torus and cryostat cryopumping system	RESEARCH INSTRUMENTS	5 255 017.67
OPE-428_TB06_EPD_Buildings	FERROVIAL AGROMAN	4 956 477.07
OPE-053_Toroidal Field coils winding packs	IBERDROLA	4 651 376.51
OPE-0376_Installation Test LN2 plant and auxiliary systems	AIR LIQUIDE ENGINEERING	4 431 720.09
OFC-433-04_Design of diagnostics ports and in-vessel feedouts	IDOM	4 274 284.41
OPE-454_HV Power suppl. electron cyclotron heating/current drive system	AMPEGON POWER	3 609 981.37
OPE-0982-01 Supply primary vacuum and cryostat leak detection systems	IDOM	2 621 081.14
OPE-0568_PF Coil site, Infrastructure and facilities management	DALKIA FRANCE	2 145 409.64
OPE-278-01 Supply of acceleration grids power supply conversion system	NIDEC ASI	1 897 539.38
OPE-0654_Supply impreg syst. & add. toolings	ELYTT ENERGY	1 844 367.29

Fig. 11 Main Operational Expenses

6.3.3. Other Expenses – EUR 166 668 076.24 (EUR 65 208 712.17 in 2020)

- Staff expenses: EUR 51 607 812.85** (EUR 50 337 727.59 in 2020)
 This includes the total gross salaries (including allowances, social contributions, taxes and pension contributions), employer's contribution for social security, allowances for seconded national experts and other staff related costs. The above social contributions and taxes are transferred to and managed by the EU Paymaster Office (PMO).
- Provision for liabilities: EUR 102 322 956.79** refers to the yearly addition and value adjustment of the provisions described here above under point 6.2.7.
- Property, plant and equipment related expenses: EUR 2 136 296.40** refers to the yearly depreciation of fixed assets and the cost for building rent, maintenance and security.

- Other administrative expenses: the amount of **EUR 10 601 010.20** includes mainly the following items:

	2021	2020	Variation
IT costs – operational/support	2 729 134.44	3 820 523.69	-1 091 389.25
IT costs - development	707 262.83	888 895.66	-181 632.83
Office supplies & maintenance	2 058 818.47	1 617 108.14	441 710.33
Legal expenses	1 171 287.86	11 709.94	1 159 577.92
Training	721 709.02	519 674.60	202 034.42
Interim staff	544 344.27	638 537.66	-94 193.39
Communications & publications	522 918.03	630 018.68	-107 100.65
Service level agreement with EU Paymaster Office	338 072.59	385 394.17	-47 321.58
Experts and related expenditure	293 200.03	242 749.82	50 450.21
Missions	252 233.77	1 081 263.21	-829 029.44
Recruitment	50 983.95	32 673.20	18 310.75
Car and transport expenses	23 862.86	24 680.72	-817.86
Interest expense on late payment	10 544.90	4 755.77	5 789.13
TOTAL	9 424 373.02	9 897 985.26	-473 612.24

Fig. 12 Other Administrative Expenses

6.4. Off Balance Sheet Items and Notes

6.4.1. Contingent Assets

A contingent asset is a possible asset that arises from past events and the existence of which will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of F4E. A contingent asset is disclosed when an inflow of economic benefits or service potential is probable.

Contingent assets are assessed at each balance sheet date to ensure that developments are appropriately reflected in the financial statements. If it has become virtually certain that an inflow of economic benefits or service potential will arise and the asset's value can be measured reliably, the asset and the related revenue are recognised in the financial statements of the period in which the change occurs.

Guarantees

Guarantees are possible assets (or obligations) that arise from past events and whose existence will be confirmed by the occurrence or non-occurrence of the object of the guarantee. Guarantees can thus qualify as contingent assets (or liabilities). A guarantee is settled when the object of the guarantee no longer exists. It is crystallised when the conditions are fulfilled for calling a payment from the guarantor.

Description	31.12.2021	31.12.2020
Guarantees for pre-financing (nominal-on going)	167 900 528.39	163 565 947.70
Performance guarantees	173 301 490.76	204 287 575.36
Total - Guarantees received	341 202 019.15	367 853 523.06

Fig. 13 Guarantees

Guarantees received in respect of pre-financing:

These are guarantees that F4E in certain cases requests from beneficiaries when paying out advance payments (pre-financing). There are two values to disclose for this type of guarantee, the “nominal” and the “on-going” values. For the “nominal” value, the generating event is linked to the existence of the guarantee. For the “on-going” value, the guarantee’s generating event is the pre-financing payment and/or subsequent clearings.

Performance guarantees are sometimes requested to ensure that beneficiaries of F4E funding meet the obligations of their contracts with F4E.

ITER Reserve Fund

The terms of reference of the ITER Reserve Fund were approved in 2015 in order to compensate the Domestic Agencies for cost increases incurred due to changes which are requested by the IO and have cost impacts.

At the request of F4E, the Executive Project Board approved on 19th January 2022 to increase the ceiling of PCR-662 (from 3.70 MEUR to 10.11 MEUR) and of PCR-698 (from 36.00 MEUR to 57.31 MEUR).

EUR 24.72 million of this increase amounting in total to EUR 27.72 million refers to variations already implemented by F4E’s suppliers and shall be recognised as revenue once the corresponding variations are formally approved.

6.4.2. Contingent Liabilities and Significant Legal Commitment

A contingent liability is:

- A possible obligation that arises from past events and of which the existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of F4E; or
- A present obligation that arises from past events but is not recognised because:
 - It is not probable that an outflow of resources embodying economic benefits or service potential will be required to settle the obligation; or
 - The amount of the obligation cannot be measured with sufficient reliability

The information provided under this note refers to the F4E open obligations under the ITER and BA activities. Those future obligations are considered as net deficits from future operating activities and reported as significant legal commitment.

ITER is being constructed at Cadarache in the South of France. Europe supports 45.46% of the construction cost and 34% of the cost of operation, deactivation and decommissioning of the facility as well as preparing the site.

Most of the components that make up the ITER facility are to be manufactured by each of the ITER Parties and contributed in-kind to ITER through Domestic Agencies. F4E will provide components to ITER on behalf of the EU.

In addition to the in-kind procurements F4E has also an obligation to finance the transportation of the non-EU components from the entry site in France (i.e. either Fos-sur-Mer or the Marignane airport) to Cadarache. Additionally, as far as the Test Blanket System is concerned, in 2014 F4E has signed two TBM Arrangements for the delivery of two systems to the ITER site.

The contractual commitments for which budgetary commitments have not yet been placed refers to the outstanding activities which have not yet been awarded as procurement contracts to European industry.

F4E maintains an estimate of the cost of completing its obligations to ITER. This comprises the costs already committed, and the estimate of the future commitments. This is managed in EcoSys and an extract is presented to each of the biannual GB meetings.

The table below shows an update of these figures with a cut-off date of December 2021, and expressed in EUR 2008 (used as basis to ensure a comprehensive financial monitoring).

Cost Estimate at 31/12/21 (MEUR-2008 value)	Actual Commitment (1)	Estimate to Complete (2)	Estimate at Completion (3)=(1)+(2)
Construction Phase	7 211.92	4 496.69	11 708.61
Operation Phase until 2035	0.00	1 638.20	1 638.20
Post-2035	0.00	221.04	221.04
TOTAL	7 211.92	6 355.94	13 567.86

Fig. 14 Cost Estimate in Commitment (in 2008 value)

The F4E Estimate at Completion (EaC) comprises two major elements – (a) the costs incurred directly by F4E and (b) the cash contributions representing the EU share of the IO costs. EaC covers the costs of the full Construction Phase and the costs of the Operations Phase and the Decommissioning Phase that will be incurred in the same timeframe. The only costs expected after 2035 are the final parts of the cash contributions towards the Operations Phase and Decommissioning Phases and the full costs of the Deactivation Phase.

The following key assumptions have been made in the compilation of the EaC :

- The number of requirement changes will be minimized according to the new policy of IO and if there are any changes, they will be funded via the Reserve Fund.

The positive effect of this policy has been noted by F4E with the number of changes reducing. However, it is recognised that despite strong management pressure at IO and F4E it is impossible to reduce the rate to zero.

- The nuclear safety requirements: F4E is working with IO to ensure that the designs being developed respect the various nuclear safety requirements. Nevertheless, the French nuclear safety authority [ASN] has the ultimate authority and interacts only with IO, and any future changes required could have a high cost impact.
- There are no increases to the required cash contributions to IO.
- For the Hot Cell Complex, F4E is unable to prepare a credible cost estimate until the design requirements from IO reach a level of maturity. The final requirements and scope of the Hot Cell Complex, as well as the sharing of the related increased cost, will be decided at the ITER Council level where EU interests are represented by EURATOM.
- The current ITER baseline leading to First Plasma in December 2025, and the start of the Deuterium-Tritium phase in December 2035 is maintained. This assumption will be updated when the ITER revised baseline integrating the updated schedule to First Plasma and beyond, and the updated Overall Project Cost, will have been proposed by IO and approved by the ITER Council at the end of 2022.

Regarding the structure, the EaC is calculated as the sum of the EaC Base and the Risk Exposure over all activities. The EaC Base is the most likely commitment estimate for a given activity, plus the cost of planned risk mitigation activities. The Risk Exposure is the estimated impact value of the risk(s), multiplied by the probability of the risk(s) associated to a given activity.

Indicatively, the estimate to complete in commitments amounts to EUR 8 526.58 million in 2021 value.

Cost Estimate at 31/12/21 (MEUR-2021 value)	Actual Commitment (1)	Estimate to Complete (2)	Estimate at Completion (3)=(1)+(2)
Construction Phase	9 791.86	6 121.45	15 913.31
Operation Phase until 2035	0.00	2 119.19	2 119.19
Post-2035	0.00	285.94	285.94
TOTAL	9 791.86	8 526.58	18 318.44

Fig. 15 Cost Estimate in Commitment (in 2021 value)

In payments, the estimate to complete amounts to EUR 10 027.52 million in 2021 value.

Cost Estimate at 31/12/21 (MEUR-2021 value)	Actual Payment (1)	Estimate to be Paid (2)	Estimate at Completion (3)=(1)+(2)
Construction Phase	8 290.92	7 622.39	15 913.31
Operation Phase until 2035	0.00	2 119.19	2 119.19
Post-2035	0.00	285.94	285.94
TOTAL	8 290.92	10 027.52	18 318.44

Fig. 16 Cost Estimate in Payment (in 2021 value)

More details on the actual advancement of the works achieved at the end of the year are available in the F4E Annual report 2021.

6.4.3. Other Significant Disclosures

Under the Host agreement with Spain, the office building used by F4E is free of charge. For the year 2021, this service in-kind amounts to EUR 3 251 128.61.

6.5. Financial Instruments

Financial instruments comprise cash, current receivables and recoverables, current payables, amounts due to and from consolidated entities. Financial instruments give rise to liquidity, credit, interest rate and foreign currency risks. Information about which and how they are managed is set out below. Pre-financings and deferrals are not included.

The carrying amounts of financial instruments are as follows:

Financial assets	2021	2020
Receivables with Member States	14 584 938.64	10 776 787.04
All receivables with third parties including accruals (excluding deferrals)	11 260 600.55	10 103 200.89
Cash and deposits	5 010 199.90	5 535 245.53
TOTAL	30 855 739.09	26 415 233.46
Financial liabilities	2021	2020
Current payables	60 364 519.03	83 248 909.98
Other payables	0.00	39 166.24
Accounts payable with EU entities	6 374 572.42	1 143 821.85
TOTAL	66 739 091.45	84 431 898.07

Fig. 17 Financial Instruments

6.5.1. Liquidity Risk

Liquidity risk is the risk that arises from selling an asset; for example, the risk that a given security or asset cannot be traded quickly enough in the market to prevent a loss or meet an obligation. Liquidity risk arises from the ongoing financial obligations, including the settlement of payables.

Details of contractual maturities for assets and liabilities form an important source of information for the management of liquidity risk.

Bank accounts opened in the name of F4E may not be overdrawn. Treasury and payment operations are highly automated and rely on modern information systems. Specific procedures are applied to guarantee system security and to ensure segregation of duties in line with the FR, the internal control standards, and audit principles. EU budget principles ensure that overall cash resources for a given year are always sufficient for the execution of all payments.

F4E's liabilities have remaining contractual maturities as summarised below:

31 December 2021	< 1 year	1 - 5 years	> 5 years	Total
Payables with third parties	60 364 519.03	0.00	0.00	60 364 519.03
Payables with consolidated entities	6 374 572.42	0.00	0.00	6 374 572.42
Total liabilities	66 739 091.45	0.00	0.00	66 739 091.45

Fig. 18 Liquidity Risk – Payables

6.5.2. Credit Risk

Credit risk is the risk of loss due to a debtor's/borrower's non-payment of a loan or other line of credit (either the principal or interest or both) or other failure to meet a contractual obligation. The default events include a delay in repayments, restructuring of borrower repayments and bankruptcy.

Treasury resources are kept with the EC since May 2019. F4E recovers contributions from Euratom and the ITER Host State in average 3 times per year to ensure appropriate cash management, taking into account payment time limits for the recovery of contributions and the total of payments executed in 2021. Requests to the EC and ITER Host State are accompanied by cash forecasts.

Following the externalisation of the treasury to the EC the counterparty risk to which F4E is exposed is minimized.

The table below shows the maximum exposure to credit risk by F4E.

Credit quality/rating	Amount of receivables with Member States
Prime and high grade	14 584 938.64
Upper medium grade	0.00
Lower medium grade	0.00
Non-investment grade	0.00

Fig. 19 Credit Risk – Receivables

6.5.3. Market Risk

Market Risk can be split into interest rate risk and currency risk.

Interest rate risk arises from cash. F4E treasury has been externalised to the EC and consequently it is not exposed to interest rate risk. F4E's treasury does not borrow any money.

The vast majority of transactions are executed in EUR. It is recognised that exchange rates fluctuate and F4E accepts the risk and does not consider it to be material.

6.6. Related Party Disclosure

The related parties of F4E are the key management personnel. Transactions between F4E and the key management personnel take place as part of the normal operations and as this is the case, no specific disclosure requirements are necessary for these transactions in accordance with the EU Accounting rules.

Highest grade description	Grade	Number of persons of this grade
Director	AD15	1

Fig. 20 Related Party Disclosure

The transactions of F4E with key management personnel during financial year 2021 consist only of the payment of their remuneration, allowances and other entitlements in accordance with the EU Staff Regulations.

6.7. Events After the Reporting Date

In accordance with EU accounting rule 19, Events after Reporting Date, the war in Ukraine, that began in February 2022 is a non-adjusting event, thus not requiring any adjustments to the figures reported in these financial statements at 31 December 2021. For subsequent reporting periods, the war may affect the recognition and measurement of some assets and liabilities on the balance sheet and also of some revenue and expenses recognised in the statement of financial performance. Based on the facts and circumstances at the time of preparation of these financial statements, in particular the evolving situation, the financial effect of the war in Ukraine cannot be reliably estimated.

Section II. Budget Implementation 2021

7. Budget Implementation

7.1. Main Facts on the Implementation of the 2021 Budget of F4E

Commitments	99.7% of implementation of the final available budget	Final Budget: 1 069.88	Execution: 1 066.23	EUR million
	101.7% compared to the original budget	Original Budget: 1 048.77	Execution: 1 066.23	EUR million
	88.4% in individual commitments	Execution: 1 066.23	Ind. Commit.: 942.50	EUR million
Payments	97.4% of implementation of the final available budget	Final Budget: 764.83	Execution: 745.25	EUR million
	100.3% compared to the original budget	Original Budget: 742.81	Execution: 745.25	EUR million

Fig. 21 Budget Implementation 2021

Additional comments on the final execution of the 2021 budget:

- In commitment appropriations, F4E made use of global commitments, amounting to EUR 123.74 million, linked to three procurement procedures not yet concluded at the end of the year;
- In payment appropriations, EUR 7.00 million remained non executed, equivalent to one percent. The amount of VAT paid on contracts and not yet reimbursed by Members Tax Authorities to F4E was EUR 14.58 million at the 31/12/2021. Together with the fund reservation for the payment of January salaries, it created a deficit in treasury preventing 100% execution of the budget.

7.2. Evolution of the Budget

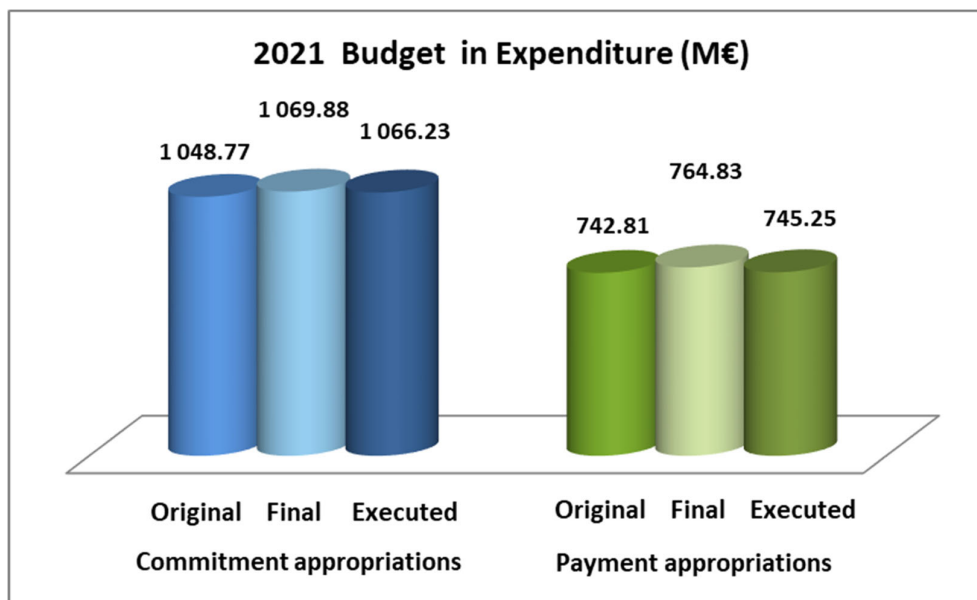


Fig. 22 Budget 2021 in Expenditure

F4E 2021 budget was originally adopted by F4E's Governing Board⁷ (GB) for the amount of EUR 1 048.77 million in commitment appropriations and EUR 742.81 million in payment appropriations.

It was modified in two amendments in the GB meeting of November 2021⁸.

The final available appropriations, including the carry-over from the previous year were EUR 1 069.88 million in commitment appropriations and EUR 764.83 million in payment appropriations.

7.3. Provisional Twelfths Regime

The 2021 Budget was normally adopted by F4E GB on 10th December 2020.

On 1st January 2021, the F4E budget entered into provisional twelfths regime because the amendment to its legal basis, allowing F4E financing for the period (2021-2027), has not been finalised, despite the global political agreement on the new MFF.

The statements of expenditure of the final 2020 budget and of the original 2021 budget served as references for the establishment of the provisional twelfths according to article 18 of the F4E FR. Anticipating the possibility of entering into the provisional twelfths regime, the Director requested in advance the GB the authorisation to open additional twelfths each months, necessary to ensure the payment of the monthly salaries.

⁷ Decision of the F4E GB F4E_D_2HUMRW adopted on 10 December 2020

⁸ Decisions of the F4E GB F4E_D_2JYS7S and F4E_D_2LG7J9 adopted on 05 November 2021

The provisional twelfth regime continued until the 24th February 2021, after the legal basis was published in the OJ⁹. It had no impact on the final implementation of the budget and its execution at end January is as follow:

Heading of the 2021 Budget in Expenditure		Commitments		Payments	
		Amount Available	Execution on 31/01/21	Amount Available	Execution on 31/01/21
A1	STAFF EXPENDITURE				
A10	SALARIES AND ALLOWANCES/ ESTABLISHMENT PLAN	8 974 430.00	8 000 000.00	5 982 953	3 036 523.26
A11	SALARIES AND ALLOWANCES/ EXTERNAL PERSONNEL	2 822 497.00	2 822 000.00	1 881 665	844 290.78
A12	EXPENDITURE RELATING TO STAFF RECRUITMENT	173 227.00	173 030.00	114 166.00	34 038.13
A13	MISSION EXPENSES	56 454.00	56 000.00	37 636.00	0.00
A14	SOCIO-MEDICAL INFRASTRUCTURE	473 291.00	192 800.00	315 527.00	0.00
A15	TRAINING	159 809.00	94 297.00	106 539.00	0.00
A16	EXTERNAL SERVICES	Interims were provisionally charged under budget chapter B36			
A17	RECEPTIONS, EVENTS AND REPRESENTATION	125.00	125.00	83.00	0.00
A18	SOCIAL WEALFARE	23 664.00	5 000.00	15 776.00	0.00
A19	OTHER STAFF RELATED EXPENDITURE	259 316.00	106 000.00	172 877.00	31 148.10
Title 1 - Total		12 942 813.00	11 449 252.00	8 627 222.00	3 946 000.27
A2	INFRASTRUCTURE AND OPERATING EXPENDITURE				
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	356 268.00	335 000.00	237 512.00	42 964.41
A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	902 404.00	470 866.40	601 602.00	0.00
A23	MOVABLE PROPERTY AND ASSOCIATED COSTS	58 550.00	42 000.00	39 033.00	4 025.00
A24	CURRENT ADMINISTRATIVE EXPENDITURE	298 978.00	298 108.80	199 318.00	760.23
A25	POSTAGE / TELECOMMUNICATIONS	112 050.00	112 000.00	74 700.00	0.00
A26	MEETING EXPENSES	36 737.00	36 000.00	24 491.00	0.00
A27	RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES				
A28	INFORMATION AND PUBLISHING	6 355.00	6 000.00	4 236.00	0.00
A29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	63 554.00	36 500.00	42 369.00	0.00
Title 2 - Total		1 834 896.00	1 336 475.20	1 223 261.00	47 749.64
Titles 1 & 2 : Administrative expenditure - Total		14 777 709.00	12 785 727.20	9 850 483.00	3 993 749.91
B3	OPERATIONAL EXPENDITURE				
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	172 713 379.00	7 719 585.24	86 633 978.00	38 820.18
B32	TECHNOLOGY FOR ITER AND DEMO	200 033.00	0.00	270 583.00	0.00
B33	TECHNOLOGY FOR BROADER APPROACH	4 867 463.00	1 744 836.00	1 916 666.00	0.00
B34	TECHNOLOGY FOR DONES				
B35	EXTERNAL SUPPORT ACTIVITIES	Externals were provisionally charged under budget chapter B36			
B36	OTHER OPERATIONAL EXPENDITURE	4 484 764.00	2 889 253.80	1 923 510.00	711 053.39
Title 3: Operational expenditure - Total		182 265 639.00	12 353 675.04	90 744 737.00	749 873.57
B4	EARMARKED EXPENDITURE				
B41	ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	20 122 712.00	0.00	21 516 666.00	0.00
B42	ACTIVITIES LINKED TO ITER ORGANIZATION	P.M.		P.M.	
B43	OTHER EARMARKED EXPENDITURE	P.M.		P.M.	
Title 4: Earmarked Expenditure - Total		20 122 712.00	0.00	21 516 666.00	0.00
Titles 3 & 4 : Operational expenditure - Total		202 388 351.00	12 353 675.04	112 261 403.00	749 873.57
TOTAL BUDGET		217 166 060.00	25 139 402.24	122 111 886.00	4 743 623.48

Fig. 23 Execution of January Provisional Twelfth

⁹ COUNCIL DECISION (Euratom) 2021/281 of 22 February 2021 amending Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it, published on 23th February 2021, OJ L 62/41

7.4. Statement of Revenue

7.4.1. Commitment Appropriations

Heading of the 2021 Budget Commitment Revenue	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Final Budget (4)=(1)+(2)+(3)	Additional revenue (5)	Final Available Revenue (6)=(4)+(5)	Carry Over From previous year (7)	Final Available Budget (8)=(6)+(7)
110 PARTICIPATION FROM THE EUROPEAN UNION TO OPERATIONAL EXPENDITURE	794 259 197.00		390 000.00	794 649 197.00		794 649 197.00		794 649 197.00
111 RECOVERY FROM PREVIOUS YEARS OPERATIONAL EXPENDITURE	p.m.			0.00		0.00		0.00
120 PARTICIPATION FROM THE EUROPEAN UNION TO ADMINISTRATIVE EXPENDITURE	62 483 826.00			62 483 826.00		62 483 826.00		62 483 826.00
121 RECOVERY FROM PREVIOUS YEARS ADMINISTRATIVE EXPENDITURE	824 174.00	0.13		824 174.13		824 174.13		824 174.13
210 ANNUAL MEMBERSHIP CONTRIBUTIONS	6 500 000.00		-516 900.00	5 983 100.00		5 983 100.00		5 983 100.00
310 ASSIGNED REVENUE ACCRUING FROM THE CONTRIBUTION OF ITER HOST STATE	184 700 000.00			184 700 000.00		184 700 000.00	626 031.77	185 326 031.77
410 MISCELLANEOUS REVENUE <i>Of which revenue of the year</i> <i>Of which revenue from previous year</i>		1 179.15 <i>1 179.15</i>	10 912.00 <i>10 912.00</i>	12 091.15 <i>12 091.15</i>	236 528.22 <i>230 205.75</i> <i>6 322.47</i>	248 619.37 <i>242 296.90</i> <i>6 322.47</i>	33 161.55 <i>33 161.55</i>	281 780.92 <i>242 296.90</i> <i>39 484.02</i>
510 OTHER REVENUE	p.m.			0.00	1 399 515.87	1 399 515.87		1 399 515.87
520 REVENUE FROM ITER ORGANISATION <i>Of which revenue of the year</i> <i>Of which revenue from previous year</i>	p.m. <i>p.m.</i> <i>p.m.</i>			0.00 <i>0.00</i> <i>0.00</i>	15 107 842.85 <i>15 107 842.85</i>	15 107 842.85 <i>15 107 842.85</i> <i>0.00</i>	3 825 307.46 <i>3 825 307.46</i>	18 933 150.31 <i>15 107 842.85</i> <i>3 825 307.46</i>
Total Revenue	1 048 767 197.00	1 179.28	-115 988.00	1 048 652 388.28	16 743 886.94	1 065 396 275.22	4 484 500.78	1 069 880 776.00

Fig. 24 Evolution of Statement of Revenue in Commitment Appropriations

The evolution of statement of revenue in commitment appropriations is made of:

- The revenue added or subtracted in the amendments to the budget represents the evolution of the main contributions (Euratom, France and Members). Each change in revenue is individually detailed and submitted to the GB for adoption.
- The miscellaneous revenue mainly corresponds to reimbursement of undue payments. Defined as internal assigned revenue in F4E FR, these are not net additional revenue but re-collected revenue.
- The other revenue are assigned to the implementation of specific tasks, mainly tasks requested by the IO. Defined as external assigned revenue in the F4E FR, these are net additional revenue for which the GB authorises the principle of collection, as shown with the p.m., 'Pro Memoria', in the original budget.

F4E reports to the GB on the status of miscellaneous and other revenue with each amendment to the annual budget, together with the carry-over from the previous year.

The main changes to the statement of revenue in commitment appropriations according to the table in Fig. 24 are the following:

- **Chapter 110: + EUR 390 000.00** of additional Euratom contribution to F4E operational expenditure, to cover needs of the ITER project;
- **Chapter 121: + EUR 0.13** to align the outturn from previous year according to the F4E Annual Accounts from 2019;
- **Chapter 210: - EUR 516 900.00** corresponding to the deduction of the Swiss contribution due the absence of renewal of the association agreement with EURATOM in the field of controlled nuclear fusion, since December 2020;
- **Chapter 410: + EUR 12 091.15** made of EUR 1 179.15 linked to sale & purchase agreement for Remote Handling target and EUR 10 912.00 linked to liquidated damages;
- **Chapter 410: + EUR 236 528.22** from various recoveries of undue payments, from contract pre-financings and regularisations on administrative expenditure (internal assigned revenue);
- **Chapter 510: + EUR 1 399 515.87** of Contribution from Japan Domestic Agency for the Integration of the Upper Port #10;
- **Chapter 520: + EUR 15 107 842.85** of revenue earmarked to the implementation of project changes requested and financed by the IO. The detailed list of requested tasks is provided in Annex 8.1.

The automatic carry-over of commitment appropriations from the 2020 budget are the following:

- **Chapter 310: + EUR 626 031.77** from the de-commitments done on contracts, due to change of scope or from left over at the closure of the contracts. According to the F4E FR the de-committed amounts on this chapter are immediately available again (external assigned revenue);
- **Chapter 410: + EUR 33 161.55** of carry-over from 2020 from the partial participation of the building owner to F4E refurbishment in Barcelona premises;
- **Chapter 520: + EUR 3 825 307.46** from the carry-over of revenue received from IO but not yet implemented at the end of 2020, and from de-commitments done during 2021.

7.4.2. Payment Appropriations

Heading of the 2021 Budget Payment Revenue	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Final Budget (4)=(1)+(2)+(3)	Additional revenue (5)	Final Available Revenue (6)=(4)+(5)	Carry Over From previous year (7)	Final Available Budget (8)=(6)+(7)
110 PARTICIPATION FROM THE EUROPEAN UNION TO OPERATIONAL EXPENDITURE	543 903 868.00		390 000.00	544 293 868.00		544 293 868.00		544 293 868.00
111 RECOVERY FROM PREVIOUS YEARS OPERATIONAL EXPENDITURE	p.m.			0.00		0.00		0.00
120 PARTICIPATION FROM THE EUROPEAN UNION TO ADMINISTRATIVE EXPENDITURE	62 483 826.00			62 483 826.00		62 483 826.00	3 535 437.41	66 019 263.41
121 RECOVERY FROM PREVIOUS YEARS ADMINISTRATIVE EXPENDITURE	824 174.00	0.13		824 174.13		824 174.13		824 174.13
210 ANNUAL MEMBERSHIP CONTRIBUTIONS	6 500 000.00		-516 900.00	5 983 100.00		5 983 100.00		5 983 100.00
310 ASSIGNED REVENUE ACCRUING FROM THE CONTRIBUTION OF ITER HOST STATE	129 100 000.00			129 100 000.00		129 100 000.00		129 100 000.00
410 MISCELLANEOUS REVENUE		1 179.15	10 912.00	12 091.15	236 528.22	248 619.37	33 161.55	281 780.92
<i>Of which revenue of the year</i>		<i>1 179.15</i>	<i>10 912.00</i>	<i>12 091.15</i>	<i>230 205.75</i>	<i>242 296.90</i>		<i>242 296.90</i>
<i>Of which revenue from previous year</i>					<i>6 322.47</i>	<i>6 322.47</i>	<i>33 161.55</i>	<i>39 484.02</i>
510 OTHER REVENUE	p.m.			0.00	1 399 515.87	1 399 515.87		1 399 515.87
520 REVENUE FROM ITER ORGANISATION	p.m.			0.00	5 319 008.98	5 319 008.98	11 610 146.80	16 929 155.78
<i>Of which revenue of the year</i>	<i>p.m.</i>			<i>0.00</i>	<i>5 125 000.00</i>	<i>5 125 000.00</i>		<i>5 125 000.00</i>
<i>Of which revenue from previous year</i>	<i>p.m.</i>			<i>0.00</i>	<i>194 008.98</i>	<i>194 008.98</i>	<i>11 610 146.80</i>	<i>11 804 155.78</i>
Total Revenue	742 811 868.00	1 179.28	-115 988.00	742 697 059.28	6 955 053.07	749 652 112.35	15 178 745.76	764 830 858.11

Fig. 25 Evolution of Statement of Revenue in Payment Appropriations

The breakdown of revenue by contributors in 2021 in payment appropriations is:

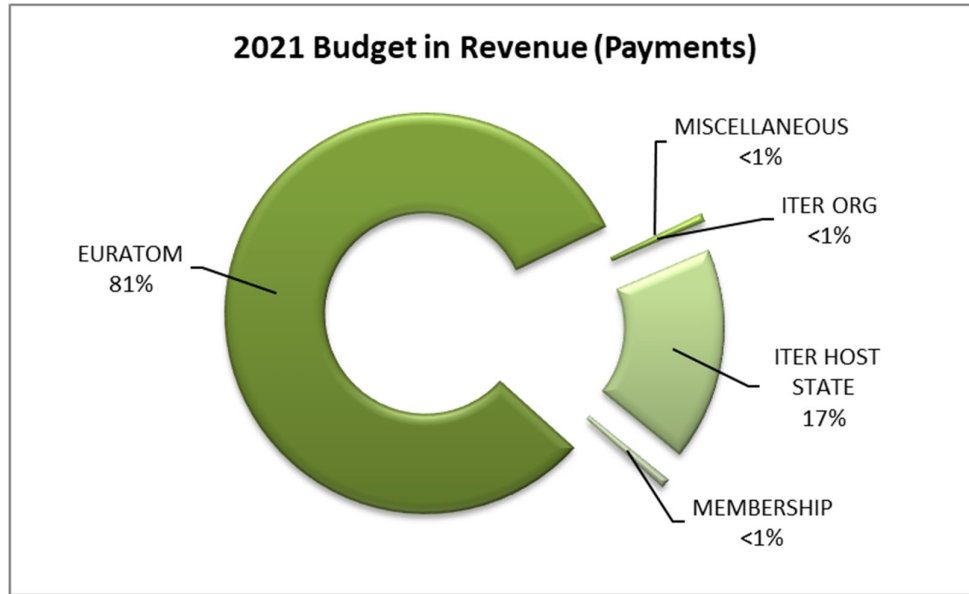


Fig. 26 Revenue Breakdown in Payment Appropriations

The changes to the statement of revenue in payment appropriations are identical to those in commitment appropriations, except for the revenue received from IO and the appropriations carried over from the 2020 budget:

- **Chapter 520: + EUR 5 319 008.98** of revenue earmarked to the implementation of project changes requested and financed by the IO, called according to the needs of treasury for the overall set of requested changes.

The automatic carry-over of payment appropriations from the 2020 budget are:

- **Chapter 120: + EUR 3 535 437.41** from the automatic carry-over of 2020 administrative expenditure committed and not yet paid at the end of 2020 (non-differentiated appropriations);
- **Chapter 410: + EUR 33 161.55** identical to commitments, and corresponding to a contribution of the building owner, paid in 2020;
- **Chapter 520: + EUR 11 610 146.80** of carry-over from 2020 of revenue received from the IO but not yet implemented at the end of this previous year.

7.5. Statement of Expenditure

7.5.1. Expenditure in Commitment Appropriations

The statement of expenditure adopted with the original 2021 budget is aligned to the Single Programming Document 2021-2025¹⁰, in particular the *Work Programme 2021* that serves as financing decision for the operational budget 2021.

The statement of expenditure has been further adjusted in the course of its implementation in accordance with the successive changes in the statement of revenue and with the amendments to the Work Programme (WP). These adjustments were implemented through the amending budgets and the transfers approved by the F4E Director within the limits foreseen in article 26 of the F4E FR.

The GB is duly informed about the transfers at each GB meeting, and in the Budgetary and Financial Management Report after the closure.

The appropriations accruing from assigned revenue and not used at the end of 2020 were automatically carried over to the budget 2021.

No further carry-over was requested to the GB.

The final breakdown of the statement of expenditure in commitment appropriations is as follows:

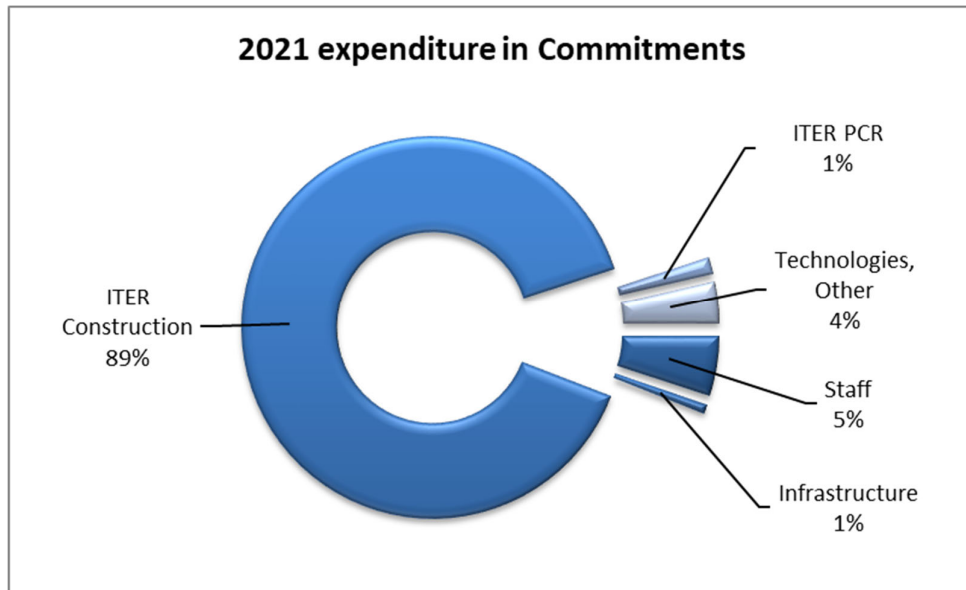


Fig. 27 Final breakdown of the Expenditure in Commitments

¹⁰ F4E_D_2MXBS2 adopted by F4E GB on 10 December 2020

Heading of the 2021 Budget Commitment Expenditure	Evolution of the statement of expenditure							Implementation		
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
A1 STAFF EXPENDITURE										
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	37 198 000.00			306 468.71	37 504 468.71			37 504 468.71	37 504 468.71	100.0%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	12 168 000.00			-1 249 640.87	10 918 359.13			10 918 359.13	10 918 359.13	100.0%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	685 000.00			-115 969.32	569 030.68			569 030.68	569 030.68	100.0%
A13 MISSION EXPENSES	800 000.00			-550 000.00	250 000.00	771.46		250 771.46	250 771.46	100.0%
A14 SOCIO-MEDICAL INFRASTRUCTURE	350 000.00			172 000.00	522 000.00			522 000.00	522 000.00	100.0%
A15 TRAINING	689 000.00			99 761.00	788 761.00	569.53		789 330.53	789 330.53	100.0%
A16 EXTERNAL SERVICES	p.m.			630 000.00	630 000.00			630 000.00	630 000.00	100.0%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-9 875.00	125.00			125.00	125.00	100.0%
A18 SOCIAL WELFARE	47 000.00			-16 400.00	30 600.00			30 600.00	30 600.00	100.0%
A19 OTHER STAFF RELATED EXPENDITURE	2 828 000.00			-4 873.35	2 823 126.65	5 633.50		2 828 760.15	2 828 760.15	100.0%
TITLE A1 - Total	54 775 000.00	0.00	0.00	-738 528.83	54 036 471.17	6 974.49	0.00	54 043 445.66	54 043 445.66	100.0%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE										
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 460 000.00			-209 500.00	1 250 500.00	14 046.61		1 264 546.61	1 264 546.61	100.0%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 960 000.00			134 603.90	4 094 603.90	3 565.00		4 098 168.90	4 098 168.90	100.0%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	369 000.00			-160 152.87	208 847.13			208 847.13	208 847.13	100.0%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 438 000.00			196 413.98	1 634 413.98	1 607.40		1 636 021.38	1 636 021.38	100.0%
A25 POSTAGE / TELECOMMUNICATIONS	531 000.00			-137 200.00	393 800.00			393 800.00	393 800.00	100.0%
A26 MEETING EXPENSES	469 000.00			-121 406.48	347 593.52			347 593.52	347 593.52	100.0%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES	p.m.				0.00		33 161.55	33 161.55	33 161.55	100.0%
A28 INFORMATION AND PUBLISHING	40 000.00			-25 500.00	14 500.00			14 500.00	14 500.00	100.0%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	266 000.00			-53 414.20	212 585.80			212 585.80	212 585.80	1.00
TITLE A2 - Total	8 533 000.00	0.00	0.00	-376 155.67	8 156 844.33	19 219.01	33 161.55	8 209 224.89	8 209 224.89	100.0%
TITLE A1 & A2 - Total Administrative Expenditure	63 308 000.00	0.00	0.00	-1 114 684.50	62 193 315.50	26 193.50	33 161.55	62 252 670.55	62 252 670.55	100.0%

Heading of the 2021 Budget Commitment Expenditure	Evolution of the statement of expenditure							Implementation		
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
B3 OPERATIONAL EXPENDITURE										
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	742 301 679.51	-1 711 896.92	18 054 947.84	5 202 389.23	763 847 119.66	209 726.45		764 056 846.11	764 056 846.11	100.0%
B32 TECHNOLOGY FOR ITER AND DEMO	10 275 000.00	-5 881 206.70	1 906 063.96	-905 233.33	5 394 623.93			5 394 623.93	5 394 623.93	100.0%
B33 TECHNOLOGY FOR BROADER APPROACH	30 424 241.52	2 658 758.12	-19 538 908.20	-3 482 804.88	10 061 286.56			10 061 286.56	10 061 286.56	100.0%
B35 EXTERNAL SUPPORT ACTIVITIES	p.m.	6 173 870.74	-1 915 939.65	12 693 361.59	16 951 292.68			16 951 292.68	16 951 292.68	100.0%
B36 OTHER OPERATIONAL EXPENDITURE	17 758 275.97	-1 238 345.96	1 377 848.05	-12 393 028.11	5 504 749.95	608.27		5 505 358.22	5 505 358.22	100.0%
Title B3 - Total	800 759 197.00	1 179.28	-115 988.00	1 114 684.50	801 759 072.78	210 334.72	0.00	801 969 407.50	801 969 407.50	100.0%
B4 EARMARKED EXPENDITURE										
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	184 700 000.00				184 700 000.00		626 031.77	185 326 031.77	185 326 031.77	100.0%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	15 107 842.85	3 825 307.46	18 933 150.31	15 285 208.66	80.7%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00	1 399 515.87		1 399 515.87	1 399 515.87	100.0%
Title B4 - Total	184 700 000.00	0.00	0.00	0.00	184 700 000.00	16 507 358.72	4 451 339.23	205 658 697.95	202 010 756.30	98.2%
Titles B3 & B4 - Subtotal	985 459 197.00	1 179.28	-115 988.00	1 114 684.50	986 459 072.78	16 717 693.44	4 451 339.23	1 007 628 105.45	1 003 980 163.80	99.6%
Total BUDGET in Commitment appropriations	1 048 767 197.00	1 179.28	-115 988.00	0.00	1 048 652 388.28	16 743 886.94	4 484 500.78	1 069 880 776.00	1 066 232 834.35	99.7%

Note: Presentation of the carry over in Commitment for B4x in appropriation for the year only.

Fig. 28 Evolution of the Expenditure in Commitments in 2021

Note: the figures for the budget Title 4 refer to the available appropriations for the 2021 budget only, whereas the details of the 2021 implementation by funds source provided in Fig. 43, Annex 8.4 from ABAC refers to the appropriations of the year plus the amounts left over on the commitments carried over from the previous years. This is due to the specific management of assigned revenue in the accounting system.

7.5.1.1. Administrative Expenditure

The administrative expenditure are made of non-differentiated appropriations (commitment and payment appropriations are in unison), therefore any transfers or budget amendments are identical in commitment and payment appropriations.

The F4E Director approved a series of transfers resulting in a reduction of the administrative budget amounting in total to EUR 1 114 684.50. Those transfers allow to adjust the detailed allocation to the evolution of the needs.

The obligation made to F4E to submit an original budget strictly equal to the detailed allocation of the administrative expenditure provisionally established for the preparation of the Draft Single Programming Document, more than 24 months in advance, shall be considered when analysing the multiple adjustments.

The major changes (> +/-10%) in the administrative expenditure (variation of the final implementation in % of the initial budget) by chapter are:

Title 1 – Staff expenditure (-1%)

- **Chapter A11 Salaries and allowances for external personnel (-) 10%**
The Budget decrease is due to a higher vacancy rate than foreseen during the first semester 2021. i.e. most of foreseen recruitments were postponed as from September onwards;
- **Chapter A12 Expenditure relating to staff recruitment (-) 17%**
The expenses linked to taking up duties and departures (daily allowances, installation/reinstallation, removals and travel expenses) have significantly decreased due to the lower number of requests from staff compared to the forecast. There was also a decrease of the expenditure related to selections (Assessment centre, publications, interviews and medical visits. etc.) mainly due to Covid-19 situation;
- **Chapter A13 Mission expense (-) 69%**
The Budget decrease in missions is obviously due to the crisis of the Covid-19 and the various form of confinements;
- **Chapter A14 Socio medical infrastructure (+) 49%**
The original budget requested and approved for the medical expenditure was not sufficient, in particular to cover the different actions to support staff in the area of psychological support;
- **Chapter A15 Training (+) 15%**
The Budget increase is due to the necessity to launch a series of workshops in the area of “the human capital and working culture”, which were not foreseen in the original budget;
- **Chapter A16 External services (+) - %**
There was no appropriations assigned to this new budget chapter in the original budget. The cost of interim staff has later been moved under this budget chapter;
- **Chapter A17 Receptions/events and representation (-) 99%**
F4E is traditionally making a very limited use of this budget;

- **Chapter A18 Social Welfare (-) 35%**
The Budget decrease is due to the cancellation of any foreseen events, in relation with the crisis of the Covid-19 and the various form of confinements.

Title 2 – Infrastructure and operating expenditure (- 4%)

- **Chapter A21 Rental of buildings and associated cost (-) 13%**
The budget decrease is linked to the Covid-19 crisis and the lower occupancy of the building, resulting in lower maintenance fees (electricity, water, air conditioning...);
- **Chapter A23 Movable property and associated cost (-) 43%**
Some purchases for the refurbishment of the ground floor including equipment for the main meeting room, and also the replacement of one of the service cars were postponed due to delays in works and to transitional requirements from the Covid-19 situation;
- **Chapter A24 Current administrative expenditure (+) 14%**
The budget increase is in particular due to the increase of the costs for consultation in the area of workforce planning and to expenses related to general services;
- **Chapter A25 Postage and Telecommunications (-) 26%**
The exceptional cost booked in view of contracting telephony services for the post-covid-19 workplace, were evidently not executed. The expenditure foreseen for the video conference system Elisa Videra (which has been used extensively in 2020) has been reduced following its replacement with MS Teams during 2021;
- **Chapter 26 Meeting expenses (-) 26%**
The Budget decrease is obviously due to the crisis of the Covid-19 and the various form of confinements, in particular all governance meeting were held by videoconference;
- **Chapter 27 Running cost in connection with operational activities (+) - %**
The allocation is from the carry-over of revenue from the contribution of the building owner to F4E refurbishment;
- **Chapter A28 Information and publishing (-) 64%**
The restrictions applied because of Covid-19 have minimized the number of events with physical presence almost to none. The production of publications is frequently linked to these events, where our publications are offered to participants. The increase of the teleworking has also affected the production of publications, replaced sometimes by electronic publications/electronic information;
- **Chapter A29 Other infrastructure and operating expenditure (-) 20%**
The decrease is linked to the restrictions applied because of Covid-19, which have minimized the number of events with physical presence almost to none, with the correspondent decrease in the amount spent in F4E participation or organisation of such events. At the same time, other activities like filming have also been affected by the restrictions.

7.5.1.2. Operational Expenditure in commitment

The statement of operational expenditure was modified with the amending budgets to reflect the changes in the statement of revenue and to align the operational budget in commitment appropriations with the successive amendments to the 2021 WP.

The major changes (> +/-10%) in the Operational expenditure (variation of the final implementation in % of the original budget) are:

Title 3 – Operational expenditure (+0%)

The budget for operational expenditure was stable compared to the original budget. The only small adjustment are due to the carry-over from the previous year and the transfer from administrative expenditure. This small budget increase was entirely allocated to the domain of ITER construction, the main F4E project.

- **Chapter B32 Technology for ITER and Demo** **(-) 47%**
 The decrease is related to changes in the planning and changes of procurement strategy for the Test Blanket Modules and the Plasma Engineering activities, leading to the postponement of specific contracts to 2022;
- **Chapter B33 Technology for Broader Approach** **(-) 67%**
 The definition of some technical aspects of the most critical High Heat Flux (HHF) contract faced some delays that affected the finalisation of the technical specification of the Normal Heat Flux (NHF) and the Divertor Cassette contracts. Those contracts are postponed to 2022;
- **Chapter B35 External Support Activities** **(+) - %**
 Following the recommendation from the European Court of Auditor to create a new chapter to cover the expenditure linked to “External Service providers”, previously hosted in a “Chapter 34 Other expenditure”, the F4E Budgetary nomenclature has been revised in 2021. There was no appropriations assigned to this new budget chapter in the Original Budget. The cost of External staff providers have been moved under this budget chapter, in particular from Chapter 36 below;
- **Chapter B36 Other Operational Expenditure** **(-) 69 %**
 This Chapter, issued from the “Chapter 34 Other expenditure” in previous F4E Budgets, was created on the recommendation from the European Court of Auditors mentioned above. This variation is therefore the result of the breakdown of the previous budget chapter 34 into chapter 35 for External support activities and the present chapter for Other operational expenditure, of administrative nature.

Title 4 – Earmarked expenditure

The budget from the ITER Host State contribution (France), entirely allocated to the domain of ITER construction, was not modified along 2021. The Budget chapters for other earmarked expenditure and from IO were fed from the call for funds to Japan for the UP#10 arrangement and from variations (tasks) requested and financed by IO.

7.5.1.3. Implementation of the Budget in Commitments

Commitments 2021: 1069.9 M€

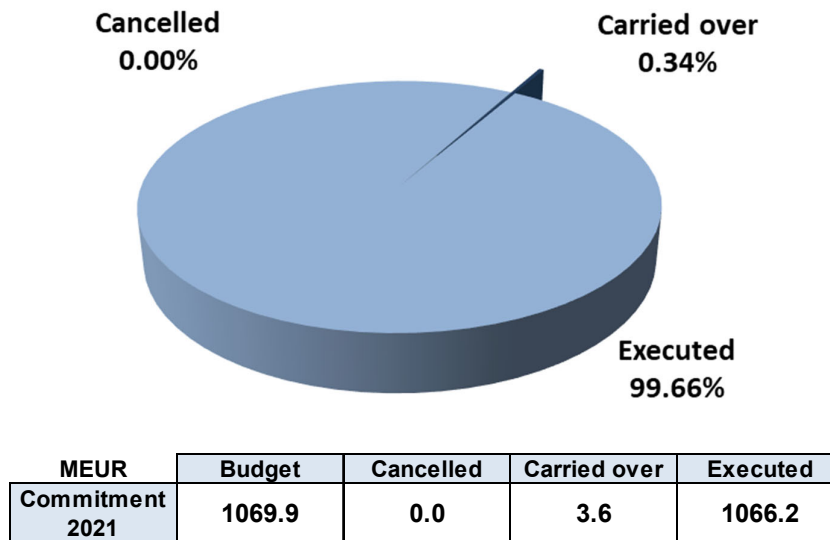


Fig. 29 Implementation of the Budget in Commitments

7.5.1.4. Open Commitments at 31 December 2021

The F4E obligations amount to EUR 1 531.25 million at the closure of the 2021 budget, representing an increase of about EUR 200.00 million compared to the end of 2020.

Remarks:

- The budgetary commitments made through instalments on the budget 2020 have been completed with the budget 2021 for a total amount of EUR 137.35 million.
- Three on-going procurement procedures have been globally committed for a total amount of EUR 123.74 million, for implementation in individual commitments in 2022. They are included in the total of the F4E obligations/open commitments at the end of 2021.

(EUR)

2021 budget Heading	Open Commitments				
	from previous years (1)	from 2021 budget (2)	Total (3)=(1)+(2)	To be de-committed (4)	Net Total (5)=(3)-(4)
TITLE 1 - STAFF EXPENDITURE	0.00	1 355 058.47	1 355 058.47	0.00	1 355 058.47
TITLE 2 - INFRASTRUCTURE AND OPERATING EXPENDITURE	0.00	3 461 583.05	3 461 583.05	0.00	3 461 583.05
Total TITLE 1 & 2	0.00	4 816 641.52	4 816 641.52	0.00	4 816 641.52
B31 - ITER CONSTRUCTION INCLUDING SITE PREPARATION	680 815 358.84	541 033 199.98	1 221 848 558.82	57 084 161.69	1 164 764 397.13
B32 - TECHNOLOGY FOR ITER AND DEMO	173 964.07	5 139 601.25	5 313 565.32	0.00	5 313 565.32
B33 - TECHNOLOGY FOR BROADER APPROACH	5 167 252.61	6 073 176.62	11 240 429.23	0.00	11 240 429.23
B35 - EXTERNAL SUPPORT ACTIVITIES	8 669 880.85	13 083 000.88	21 752 881.73	0.00	21 752 881.73
B36 - OTHER OPERATIONAL EXPENDITURE	0.00	3 483 706.12	3 483 706.12	0.00	3 483 706.12
Total TITLE 3	694 826 456.37	568 812 684.85	1 263 639 141.22	57 084 161.69	1 206 554 979.53
B41 - ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	161 086 558.94	141 789 191.05	302 875 749.99	0.00	302 875 749.99
B42 - ACTIVITIES LINKED TO ITER ORGANIZATION	11 145 716.00	14 516 891.19	25 662 607.19	9 393 964.01	16 268 643.18
B43 - OTHER EARMARKED EXPENDITURE	0.00	736 527.90	736 527.90	0.00	736 527.90
Total TITLE 4	172 232 274.94	157 042 610.14	329 274 885.08	9 393 964.01	319 880 921.07
Total TITLE 3 & 4	867 058 731.31	725 855 294.99	1 592 914 026.30	66 478 125.70	1 526 435 900.60
Total	867 058 731.31	730 671 936.51	1 597 730 667.82	66 478 125.70	1 531 252 542.12

Fig. 30 Open Commitments Carried Forward from 2021 to 2022

7.5.1.5. Status of Unused Commitment Appropriations

According to the annuality principle of the F4E FR, the unused commitment appropriations at the end of each year and the de-commitments made on the budget of the previous years are cancelled, except for assigned revenue. The F4E FR also foresees the possibility to make the cancelled appropriations available again in future F4E budgets. The situation for unused appropriations at 31/12/2021 is as follows:

Operational Commitment Appropriations (EUR)		Budgets (Title 3)	Assigned revenue (Title 4)	Total
Under execution (since 2008)	+	660 956.56	16 993 811.15	17 654 767.71
De-commitments (since 2008)	+	876 597 478.10	203 189 999.33	1 079 787 477.43
Carry-over (since 2008)	-	551 436.18	16 993 811.15	17 545 247.33
Made available again (since 2008)	-	765 632 662.39	199 025 547.90	964 658 210.29
Amount available for future budgets	=	111 074 336.09	4 164 451.43	115 238 787.52

Fig. 31 Status of Unused Commitment Appropriations

F4E successfully executed the amount available for re-use since 2008 by the end of 2020, except for the last de-commitments done during the last quarter of 2020, achieving the objective of the full implementation of the allocated budget for the period 2007-2020.

New important de-commitments were done during 2021, in particular in relation with the TB04 contract.

7.5.2. Expenditure in Payment Appropriations

The statement of expenditure was modified in the course of its implementation in accordance with the successive changes in the statement of revenue. Additional adjustments between budgetary chapters were implemented through transfers authorised by the F4E Director, to honour all contractual obligations toward suppliers and to reach the highest possible rate of budget implementation at the year-end.

Evolution of the Statement of Expenditure in Payment Appropriations (EUR)

Heading of the 2021 Budget Payment Expenditure	Evolution of the statement of expenditure								Implementation			
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2021 commitments (9)	On B2020 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
A1 STAFF EXPENDITURE												
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	37 198 000.00			306 468.71	37 504 468.71			37 504 468.71	37 504 468.71		37 504 468.71	100.0%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	12 168 000.00			-1 249 640.87	10 918 359.13		161 358.84	11 079 717.97	10 869 553.19	137 527.06	11 007 080.25	99.3%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	685 000.00			-115 969.32	569 030.68		31 514.94	600 545.62	470 958.08	15 830.49	486 788.57	81.1%
A13 MISSION EXPENSES	800 000.00			-550 000.00	250 000.00	771.46	85 642.41	336 413.87	117 192.88	29 204.77	146 397.65	43.5%
A14 SOCIO-MEDICAL INFRASTRUCTURE	350 000.00			172 000.00	522 000.00		154 116.51	676 116.51	404 288.33	61 940.69	466 229.02	69.0%
A15 TRAINING	689 000.00			99 761.00	788 761.00	569.53	402 687.49	1 192 018.02	300 815.61	326 748.94	627 564.55	52.6%
A16 EXTERNAL SERVICES	p.m.			630 000.00	630 000.00			630 000.00	557 062.06		557 062.06	88.4%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-9 875.00	125.00		60.00	185.00			0.00	0.0%
A18 SOCIAL WELFARE	47 000.00			-16 400.00	30 600.00		33 079.75	63 679.75	1 500.00	32 080.75	33 580.75	52.7%
A19 OTHER STAFF RELATED EXPENDITURE	2 828 000.00			-4 873.35	2 823 126.65	5 633.50	105 766.74	2 934 526.89	2 462 548.33	47 069.53	2 509 617.86	85.5%
TITLE A1 - Total	54 775 000.00	0.00	0.00	-738 528.83	54 036 471.17	6 974.49	974 226.68	55 017 672.34	52 688 387.19	650 402.23	53 338 789.42	96.9%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE												
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 460 000.00			-209 500.00	1 250 500.00	14 046.61	403 940.71	1 668 487.32	913 345.85	328 969.60	1 242 315.45	74.5%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 960 000.00			134 603.90	4 094 603.90	3 565.00	1 402 671.09	5 500 839.99	2 216 675.98	1 351 210.22	3 567 886.20	64.9%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	369 000.00			-160 152.87	208 847.13		154 312.15	363 159.28	77 684.06	138 989.93	216 673.99	59.7%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 438 000.00			196 413.98	1 634 413.98	1 607.40	211 045.25	1 847 066.63	1 044 100.06	158 466.51	1 202 566.57	65.1%
A25 POSTAGE / TELECOMMUNICATIONS	531 000.00			-137 200.00	393 800.00		170 107.08	563 907.08	233 644.46	68 951.51	302 595.97	53.7%
A26 MEETING EXPENSES	469 000.00			-121 406.48	347 593.52		56 369.53	403 963.05	141 701.83	47 160.29	188 862.12	46.8%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES	p.m.				0.00		33 161.55	33 161.55	2 688.00		2 688.00	8.1%
A28 INFORMATION AND PUBLISHING	40 000.00			-25 500.00	14 500.00		1 292.70	15 792.70	6 852.29	357.08	7 209.37	45.7%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	266 000.00			-53 414.20	212 585.80		161 472.22	374 058.02	110 949.31	82 003.36	192 952.67	51.6%
TITLE A2 - Total	8 533 000.00	0.00	0.00	-376 155.67	8 156 844.33	19 219.01	2 594 372.28	10 770 435.62	4 747 641.84	2 176 108.50	6 923 750.34	64.3%
TITLE A1 & A2 - Total Administrative Expenditure	63 308 000.00	0.00	0.00	-1 114 684.50	62 193 315.50	26 193.50	3 568 598.96	65 788 107.96	57 436 029.03	2 826 510.73	60 262 539.76	91.6%

Heading of the 2021 Budget Payment Expenditure	Evolution of the statement of expenditure								Implementation			
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2021 commitments (9)	On B2020 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
B3 OPERATIONAL EXPENDITURE												
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	519 803 868.00	1 179.28	-126 900.00	7 389 111.73	527 067 259.01	209 726.45		527 276 985.46			521 657 388.66	98.9%
B32 TECHNOLOGY FOR ITER AND DEMO	4 100 000.00			-613 838.93	3 486 161.07			3 486 161.07			3 486 161.07	100.0%
B33 TECHNOLOGY FOR BROADER APPROACH	11 500 000.00			-4 091 817.40	7 408 182.60			7 408 182.60			7 408 182.60	100.0%
B35 EXTERNAL SUPPORT ACTIVITIES	p.m.		10 912.00	10 553 624.03	10 564 536.03			10 564 536.03			10 564 536.03	100.0%
B36 OTHER OPERATIONAL EXPENDITURE	15 000 000.00			-12 122 394.93	2 877 605.07	608.27		2 878 213.34			2 877 605.07	100.0%
Title B3 - Total	550 403 868.00	1 179.28	-115 988.00	1 114 684.50	551 403 743.78	210 334.72	0.00	551 614 078.50			545 993 873.43	99.0%
B4 EARMARKED EXPENDITURE												
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	129 100 000.00				129 100 000.00			129 100 000.00			127 715 100.01	98.9%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	5 319 008.98	11 610 146.80	16 929 155.78			10 613 351.30	62.7%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00	1 399 515.87		1 399 515.87			662 987.97	47.4%
Title B4 - Total	129 100 000.00	0.00	0.00		129 100 000.00	6 718 524.85	11 610 146.80	147 428 671.65			138 991 439.28	94.3%
Titles B3 & B4 - Subtotal	679 503 868.00	1 179.28	-115 988.00	1 114 684.50	680 503 743.78	6 928 859.57	11 610 146.80	699 042 750.15			684 985 312.71	98.0%
Total BUDGET in Payment appropriations	742 811 868.00	1 179.28	-115 988.00	0.00	742 697 059.28	6 955 053.07	15 178 745.76	764 830 858.11			745 247 852.47	97.4%

Fig. 32 Evolution of the Operational Expenditure in Payment Appropriations

7.5.2.1. Administrative Expenditure

As mentioned previously, the administrative expenditure are of non-differentiated nature with the following consequences:

- The main changes made during the year compared to the original budget are identical in commitment and in payment. The changes for the 2021 budget are described in section 7.5.1.1;
- The statement of expenditure in payment appropriations includes the carry-over of appropriations corresponding to administrative contracts committed but not yet paid at the end of the previous year. This carry-over amounted to EUR 3 568 598.96;
- The current budget committed but not paid at the end of the year is automatically carried over and entered in the statement of expenditure of the following year.

7.5.2.2. Operational Expenditure in payments

Title 3 – Operational expenditure

The budget for operational expenditure remained stable compared to the original budget. The small amounts from additional revenue and carry over from the previous year and the transfer from administrative expenditure slightly increased the operational budget.

- **Chapter B32 Technology for ITER and Demo:** (-) 15%
The decrease of budget is the consequence of the reduction in commitment, having less advance payments to execute on the new contracts.
- **Chapter B33 Technology for Broader Approach:** (-) 36%
The reduction is also due to the corresponding decrease in commitment with less advanced payments.

Title 4 – Earmarked expenditure

The budget from the ITER Host State contribution (France), allocated to the domain of ITER construction in full, was not modified along 2021. The Budget chapters for other earmarked expenditure and from IO arose from the cashing of the respective call for funds.

7.5.2.3. Implementation of the budget in payment

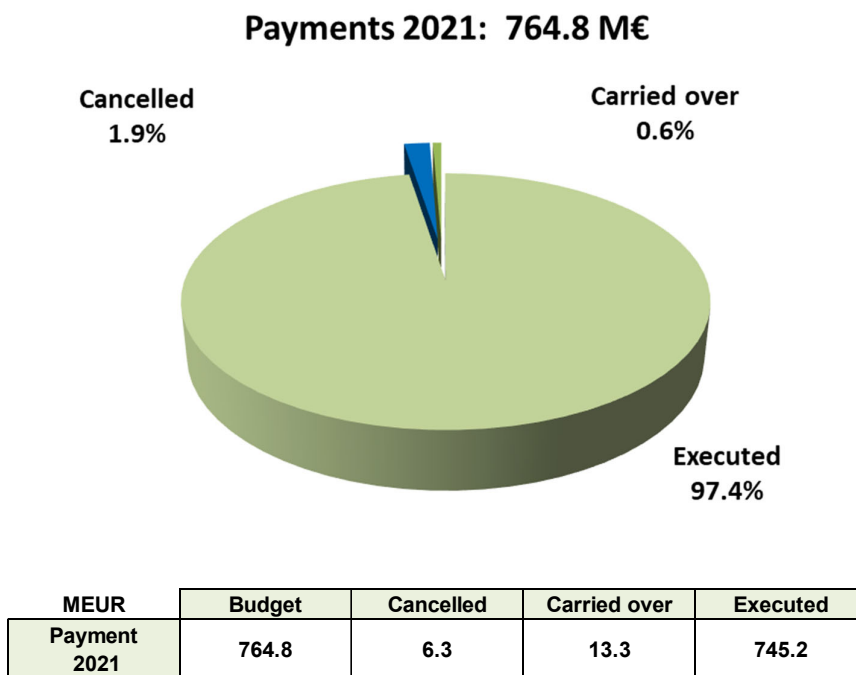


Fig. 33 Final Implementation in PA

97.4% of the available budget has been implemented.

The amount of VAT paid on contracts and not reimbursed by Members Tax Authorities to F4E was EUR 14.29 million at 31/12/2021.

Together with the funds reservation for the payment of salaries in January 2022, it resulted in an insufficient treasury balance preventing 100 % execution of the budget (EUR):

VAT France, not called	11 926 945.86
VAT France, requested	2 643 829.12
VAT Germany, not called	1 933.00
VAT Germany, requested	12 230.66
Reserve for salaries Jan 22	5 000 000.00
Total	19 584 938.64

Balanced with the following non-execution (EUR):

Administrative expenditure 2021 not yet paid	4 768 436.44	Automatically carried over
Administrative expenditure 2020 not paid	708 926.68	Cancelled
B41 ITER construction HIS contribution	1 384 899.99	Automatically carried over
B42 Activities linked to ITER organization	6 315 804.48	Automatically carried over
B43 Other earmarked expenditure	736 527.90	Automatically carried over
Other miscellaneous revenue, not used	48 813.35	Automatically carried over
B31 ITER construction	5 619 596.80	Cancelled
Total	19 583 005.64	

7.5.2.4. Cancelled Payment Appropriations

2021 budget Heading	(EUR)		
	Unused Appropriations (1)	Carry over to 2022 (2)	Cancelled appropriation (3)=(1)-(2)
TITLE 1 - STAFF EXPENDITURE	1 678 882.92	1 355 058.47	323 824.45
TITLE 2 - OPERATING EXPENDITURE	3 846 685.28	3 461 583.05	385 102.23
Total TITLE 1 & 2 Payment	5 525 568.20	4 816 641.52	708 926.68
TITLE 3 - OPERATIONAL EXPENDITURE	5 620 205.07	608.27	5 619 596.80
TITLE 4 - EARMARKED EXPENDITURE	8 437 232.37	8 437 232.37	0.00
Total TITLE 3 & 4 Payment	14 057 437.44	8 437 840.64	5 619 596.80
Total BUDGET in Payment	19 583 005.64	13 254 482.16	6 328 523.48

Fig. 34 Cancelled Payment Appropriations

The payment appropriations not used by the 31/12/2021 are cancelled except the amount automatically carried over for non-differentiated appropriations (Title 1 and Title 2) and assigned revenue (Title 4), according to the F4E FR.

7.5.3. Additional Information on the Final Implementation 2020**7.5.3.1. Final Implementation of the Administrative Expenditure 2020**

The definitive execution of the administrative budget 2020 is determined at the end of 2021, when the amounts carried over from the previous year corresponding to administrative actions committed but not yet paid are executed or cancelled. The execution of the payment appropriations carried over is shown with the implementation of the statement of expenditure above, column (10) of Fig.32.

The final execution of the 2020 administrative budget is therefore as follows:

(EUR)	Title 1	Title 2	Total
Final 2020 Administrative Budget	51 558 335.60	6 956 150.67	58 514 486.27

Fig. 35 Final Implementation of the Administrative Expenditure 2020**7.5.3.2. Global Commitments from 2020**

No global commitments remained open at the end of 2020 for execution in 2021.

7.6. Tasks financed by the ITER Organization

In 2021, the GB authorised F4E to collect revenue for any tasks requested and financed by IO, under a transparency provision consisting in the publication of the detail of the variation requested and approved for financing.

7.6.1. Variations approved in the 2021 Budget

The budget 2021 was increased by EUR 15 107 842.87 in commitment appropriations, corresponding to:

PCRs	Project request changes from Reserve Fund	11 384 597.51
I-NCs	Resolution of Non-Conformities	194 008.98
DIs	Direct Implementation	1 196 123.46
HC	HIT CARDS	2 333 112.92
TOTAL		15 107 842.87

Fig. 36 Variations approved in the 2021 budget

The total amount of variations corresponds to the sum of the various deviations or amendments to F4E contracts approved by IO DG or his delegate for the implementation of the requested changes.

7.6.2. Changes approved during 2021 for F4E

New changes to the project were requested by IO and their financing approved.

Some changes are merged with the variations for immediate execution.

The changes from the Reserve Fund are first approved on the principle and for either a fixed price or for actual cost. The variations implementing those changes are later submitted to IO for approval, once the cost is agreed with F4E suppliers.

The changes approved during 2021 amounted in total to EUR 13 574 436.10, made of:

PCRs	Project request changes from Reserve Fund	11 299 036.45
I-NCs	Resolution of Non-Conformities	137 519.07
DIs	Direct Implementation	1 683 279.89
HC	HIT CARDS	454 600.69
TOTAL		13 574 436.10

Fig. 37 Changes approved in 2021 for implementation by F4E

:

7.7. Budget Outturn Account 2021

The outturn for the financial year is calculated according to the total revenue actually cashed minus the total payment incurred during the year, minus the appropriations carried over to the following year.

Budget Outturn Account		2021	2020
REVENUE			
Euratom contribution	+	607 601 868.13	633 593 734.17
ITER Host state contributions	+	129 100 000.00	150 000 000.00
Membership contributions	+	5 983 100.00	6 311 400.00
ITER Organization	+	5 319 008.98	4 663 474.73
Other revenue	+	1 648 135.24	727 524.17
Other non budgeted revenue	+	28 162.61	0.00
TOTAL REVENUE (a)		749 680 274.96	795 296 133.07
EXPENDITURE			
<i>Title I: Staff</i>			
Payments	-	52 688 387.19	50 907 933.37
Appropriations carried over to the following year	-	1 355 058.47	974 226.68
<i>Title II: Infrastructure Expenditure</i>			
Payments	-	4 747 641.84	4 780 042.17
Appropriations carried over to the following year	-	3 461 583.05	2 594 372.28
<i>Title III: Operational Expenditure</i>			
Payments	-	545 993 873.43	741 050 777.29
Appropriations carried over to the following year	-	608.27	11 610 146.80
<i>Title IV Earmarked revenue</i>			
Payments	-	138 991 439.28	
Appropriations carried over to the following year	-	8 437 232.37	
<i>Total Payments (b)</i>		<i>742 421 341.74</i>	<i>796 738 752.83</i>
<i>Appropriations carried over to the following year (c)</i>		<i>13 254 482.16</i>	<i>15 178 745.76</i>
TOTAL EXPENDITURE (d)=(b)+(c)		755 675 823.90	811 917 498.59
OUTTURN FOR THE FINANCIAL YEAR (a-d)			
		-5 995 548.94	-16 621 365.52
Cancellation of unused payment appropriations carried over from previous year	+	708 926.68	933 726.90
Adjustment for carry-over from the previous year of appropriations available at 31.12 arising from assigned revenue	+	11 643 308.35	16 832 766.00
Exchange differences for the year (gain +/-)	+/-	17 886.33	-1 305.53
BALANCE OF THE OUTTURN ACCOUNT FOR THE FINANCIAL YEAR		6 374 572.42	1 143 821.85
Of which Administrative expenditure		726 813.01	1 008 571.34
Of which Operational expenditure		5 647 759.41	135 250.51
Administrative outturn:			
Exchange differences for the year		17 886.33	
Cancelled appropriation on title 1 and 2 from 2021		0.00	
Cancelled appropriation on title 1 and 2 from 2020		708 926.68	
Operational outturn:			
Cancelled payment appropriation on title 3 from 2021		5 619 596.80	
Non budgeted revenue from liquidated damages and Court decisions		28 162.61	

Fig. 38 Budget Outturn 2021

For the 2021 financial year, the balance of the budget outturn amounts to EUR 6 374 572.42.

8. Annexes

8.1. IO Tasks, variations approved for implementation in the 2021 budget

Hierarchy Path ID	ID	Name	Change Type	Year Of Change	OBS	Variation Total
F4E.PCR-642	Amendment 12	PBS 26 Interfaces with TB07 Buildings (64, 67, 68A, 68B, 69 and surrounding area)	PCR	2016	IP.SB	163 667.85
F4E.PCR-689	DNO#193	Creation of CCWS-2E loop by modification of CCWS-2C loop and to provide F4E a binding offer for mainly Supervision/SPC/B	PCR	2017	IP.SB	24 302.20
	OS#020	B37 Annex - Increase in room size	PCR	2017	IP.SB	72 260.96
F4E.PCR-716	DNO#171	Isolation valves for early operation of CWS	PCR	2017	IP.SB	13 244.56
F4E.PCR-717	#	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	303 481.58
	Cost Incurred (eme	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	3 546 281.02
	DN#188	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	384 496.59
	DN#194	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	22 197.05
	DNO#16	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	208 051.06
	OS#248	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	46 276.89
	OS#529	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	97 307.83
	Pending	"Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 i	PCR	2021	IP.SB	516 907.98
F4E.PCR-720	DNO#114	Definition of TB16 Interfaces at west end of CCWS-1 gallery (plates)	PCR	2016	IP.SB	92 601.90
	OS#187	Definition of TB16 Interfaces at west end of CCWS-1 gallery (plates)	PCR	2016	IP.SB	9 638.54
F4E.PCR-757	DNO#101	Nuclear Shielding improvement in Tokamak Building for critical/SIC electronic protection	PCR	2017	IP.SB	28 017.14
	DNO#106	Nuclear Shielding improvement in Tokamak Building for critical/SIC electronic protection	PCR	2017	IP.SB	52 903.76
	DNO#124 (DI-28)	Nuclear Shielding improvement in Tokamak Building for critical/SIC electronic protection	PCR	2017	IP.SB	17 970.01
F4E.PCR-805	DNO#151	RFE 1B stage1 modifications to reflect the updates in the sequence of activities	PCR	2018	IP.SB	14 567.55
	DNO#167	RFE 1B stage1 modifications to reflect the updates in the sequence of activities	PCR	2018	IP.SB	38 827.91
	OS#64	RFE 1B stage1 modifications to reflect the updates in the sequence of activities	PCR	2018	IP.SB	42 235.44
F4E.PCR-823	OS#596 (DI-9)	OS#596 (DI-9)	PCR	2019	IP.SB	219 170.64
	DN#200	DN#200	PCR	2019	IP.SB	125 832.05
F4E.PCR-824	OS#174	Reconciliation of additional costs for PBS26 new scope and quality issues on BIPS site works	PCR	2018	IP.SB	1 844 784.48
F4E.PCR-827	PCR-827	Installation of an additional oil retention tank on the north side of Building 32	PCR	2018	IP.SB	125 541.25
F4E.PCR-1010	DNO#160	DNO#160	PCR	2019	IP.SB	118 456.18
	OS#055	OS#055	PCR	2019	IP.SB	317 000.00
	OS#008	Temporary openings/ recesses in Tokamak Complex buildings	PCR	2019	IP.SB	141 997.05
F4E.PCR-1048	DNO#155	DNO#155	PCR	2019	IP.SB	65 588.64
	DNO#170	DNO#170	PCR	2019	IP.SB	143 881.12
F4E.PCR-1099	DNO#95 (DI-13)	DNO#95 (DI-13)	PCR	2020	IP.SB	210 005.00
F4E.PCR-1100	DNO#123DI-13)	DNO#123DI-13)	PCR	2020	IP.SB	286 074.00
F4E.PCR-1086	DNO#164	DNO#164	PCR	2020	IP.SB	106 174.27
F4E.PCR-1106	DN#019	DN#019	PCR	2020	IP.SB	1 045 073.70
	DN#181	DN#181	PCR	2020	IP.SB	123 686.39
F4E.PCR-1178	DACC#110654	Changes from IO on the technical requirements for the HINS vacuum valves	PCR	2020	IE.CF	108 626.92
F4E.PCR-1202	DNO#133774	Preliminary and final design of diagnostic ports and in-vessel feedouts	PCR	2021	IE.DG	465 000.00
F4E.PCR-1207	OS#104	OS 104 - DACC Process#134182 - Interfaces with PBS26 Chilled Water in the Tokamak Complex and Demoting of B74 LACs	PCR	2021	IP.SB	161 373.45
	DN#111	DN#111 - Interfaces requirements between PBS 26.CH and PBS 62; and between various PBSs and PBS 65	PCR	2021	IP.SB	81 094.55
	DN#111	DN#111	PCR	2021	IP.SB	81 094.55
TOTAL PCRs						11 384 597.51
F4E.INC-0019	DACC#113234	Repair Work for TFCC06 and TFCC04 AUs (I-NC 19)	I-NC	2020	IE.MG	21 500.00
F4E.INC-0020	DACC#135522	Sector 3 PS3 RH CP 244 - IWS Clash Repair (IO NCR 24VNCQ)	I-NC	2020	IE.IV	132 508.98
F4E.I-NC-0021	DACC#114426	Repair Work for TFCC04 (I-NC 21 also NCR-069)	I-NC	2020	IE.MG	40 000.00
TOTAL I-NCs						194 008.98

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Hierarchy Path ID	ID	Name	Change Type	Year Of Change	OBS	Variation Total
F4E.DI-69	DNO#186	2019/038 Notification VISA, Supervision and Coordination for Backfilling of 80 Openings for PBS 62 in the TKC Service Pe	DI	2020	IP.SB	48 986.63
F4E.DI-75	OS#82	TB04 - OS#82 - Modification of PBS65 Compressed Air Network interfaces with PBS34 in Buildings 51-52 and Area 53	DI	2020	IP.SB	94 592.54
F4E.DI-78	DN#009	TB12 DNO #009 - Network connections to Emergency Response Building (ERB)	DI	2020	IP.SB	14 700.00
F4E.DI-80	OS#012	TB12 OS #012 - Modifications to B37 and Area 30 – Hooks, Embedded Plates and Transformers Oil Volume	DI	2020	IP.SB	60 000.00
F4E.DI-83	OS#207	TB16 - OS#207 - Instruction to Repairs Works Damaged by Others in Area 39/ Zone 11	DI	2021	IP.SB	28 414.13
F4E.DI-84	DN#220	F4E-2009-OPE-058-DNO220 Notification 2021/009 TKC Technical Support by the Architect Engineer	DI	2021	IP.SB	81 171.00
F4E.DI-87	OS#102	TB04-OS#102- Building 11 – Omission and Cancellation of Common Mode Failure (CMF) requirements for fire in Contractor's	DI	2021	IP.SB	128 328.00
F4E.DI-87	OS#103	TB04-OS#103- Building 11 Level B1- procurement of equipment and components, excluding PIC active components	DI	2021	IP.SB	641 640.00
F4E.DI-90	OS#210	TB16 - OS#210 - Update of Execution Design for new HSF routing	DI	2021	IP.SB	73 751.16
F4E.DI-91	OS#651	F4E-2009-OPE-058-OS651 Feasibility study to be performed by ENGAGE related to the inclusion of a modular building	DI	2021	IP.SB	14 185.00
F4E.DI-93	DNO#221	2021/008 Notification - Instruction to modify Inputs for PA 6.2.P2.EU.02 for implementation via PA 6.2.P2.EU.05	DI	2021	IP.SB	10 355.00
TOTAL DIRECT IMPLEMENTATION						1 196 123.46
TB04-HC-110005	TB04-HC-110005	Reaction forces for 13 common supports with PBS 26	HC	2019	IP.SB	2 489.76
TB04-HC-111012	TB04-HC-111012	11-B1 post K1 remaining action	HC	2020	IP.SB	35 505.68
TB04-HC-111017	TB04-HC-111017	B11-B1- PORT CELLS: interfaces PBS65 with PBS18	HC	2019	IP.SB	3 354.62
TB04-HC-111019	TB04-HC-111019	B11-B1-Constructive actions in Non-fire rated networks due to CMF report	HC	2019	IP.SB	106 460.62
TB04-HC-112012	TB04-HC-112012	B11- vertical shafts constructive actions in non-fire rated networks due to CMF	HC	2020	IP.SB	5 758.92
TB04-HC-112013	TB04-HC-112013	B11- Ring Manifold CMF requirements (E1631)	HC	2020	IP.SB	11 426.50
TB04-HC-112011	TB04-HC-112011	B11-Port Cells CMF requirements (E1631)	HC	2020	IP.SB	5 758.92
TB04-HC-111021	TB04-HC-111021	B11-DTR 4 Constructive actions in Non-fire rated networks due to CMF (E1628)	HC	2020	IP.SB	32 984.00
TB04-HC-111010	TB04-HC-111010	B11 level B1- CMF (non fire rated networks)	HC	2019	IP.SB	150 023.96
TB04-HC-110024	TB04-HC-110024	B11-B2-Constructive actions in Non fire rated networks due to CMF report	HC	2019	IP.SB	135 123.08
TB04-HC-113004	TB04-HC-113004	Constructive actions in non fire rated network due to CMF report	HC	2020	IP.SB	50 145.25
TB04-HC-113007	TB04-HC-113007	B11-alternative solution to flexible solution in non fire rated networks E1650 v1	HC	2020	IP.SB	16 456.48
TB04-HC-119001	TB04-HC-119001	B11-all levels implementation flexible solution in non fire rated networks	HC	2020	IP.SB	103 162.23
TB04-HC-112002	TB04-HC-112002	B11-L1-south gallery clashes TB04 with PBS 23,51,52 & accesibility with PBS32	HC	2019	IP.SB	71 580.59
TB04-HC-112004	TB04-HC-112004	B11- L1 relocation LAC 6211AC-ACG-3018	HC	2019	IP.SB	3 910.20
TB04-HC-112005	TB04-HC-112005	B11- L1 interface with PBS26 is missing for LAC 6211AC-ACG-3018	HC	2019	IP.SB	7 928.93
TB04-HC-112006	TB04-HC-112006	B11-L1 PBS 65 interfaces position modification requested by PBS 55	HC	2019	IP.SB	3 064.32
TB04-HC-113001	TB04-HC-113001	B11- L2 interface with PBS26 is missing for LAC 6211AC-ACG-4004	HC	2019	IP.SB	6 573.67
TB04-HC-111014	TB04-HC-111014	B11- DTR relocation LAC 6211AC-ACG-2002	HC	2019	IP.SB	18 194.40
TB04-HC-111018	TB04-HC-111018	B11-B1- PORT CELLS: interfaces PBS65 with PBS31 (CA)	HC	2019	IP.SB	14 708.73
TB04-HC-000004	TB04-HC-000004	AVEVA migration	HC	2019	IP.SB	178 000.00
TB04-HC-000005	TB04-HC-000005	AVEVA migration 2nd phase migration	HC	2019	IP.SB	160 479.30
TB04-HC-110012	TB04-HC-110012	Thermal expansion of PBS31 Cryostat Roughing line 11-B2M	HC	2019	IP.SB	1 339.50
TB04-HC-110014	TB04-HC-110014	B11- Splitted shafts for all levels	HC	2019	IP.SB	36 000.00
TB04-HC-110017	TB04-HC-110017	"Level B2/B2M- CMF Fire stability justification for nonPI/non SIC networks not fire rated"	HC	2019	IP.SB	143 750.00
TB04-HC-110019	TB04-HC-110019	11-B2 PBS26 thermal expansion	HC	2019	IP.SB	14 076.00
TB04-HC-110020	TB04-HC-110020	B11 level B2 Stress Calculation reports realignment with CMM	HC	2019	IP.SB	134 288.35
TB04-HC-110021	TB04-HC-110021	11-B2 realign calculation notes SIC CAS train A (increase thickness thermal protection due to CMF)	HC	2019	IP.SB	49 000.00
TB04-HC-11003	TB04-HC-11003	Shared OP with IO	HC	2019	IP.SB	3 726.00
TB04-HC-111002	TB04-HC-111002	Space availability in north gallerie B11-B1 (reducing HVAC duct)	HC	2019	IP.SB	4 140.00
TB04-HC-111003	TB04-HC-111003	Update of TB04 design following PC manifold workgroup	HC	2019	IP.SB	13 395.20
TB04-HC-111004	TB04-HC-111004	PBS 65 interfaces position modification requested by PBS 32	HC	2019	IP.SB	1 472.00
TB04-HC-111005	TB04-HC-111005	PBS 65 interfaces position modification requested by PBS 55	HC	2019	IP.SB	1 472.00
TB04-HC-111006	TB04-HC-111006	B11-B1 - PBS31 CA SIC connection points on PC pillars	HC	2019	IP.SB	4 416.00
TB04-HC-111008	TB04-HC-111008	WG63 - Alternative Design for HVAC System in DTR in B1	HC	2019	IP.SB	54 000.00
TB04-HC-111009	TB04-HC-111009	B11-B1 boundaries evolution btw PBS26 CCWS and TB04 LAC's (9214 & 2007)	HC	2019	IP.SB	828.00
TB04-HC-111011	TB04-HC-111011	B11 level B1 fire casing in Port cells ring manifold	HC	2019	IP.SB	86 400.00
TB04-HC-740004	TB04-HC-740004	Openings shared with IO PBS	HC	2019	IP.SB	1 863.00
TB04-HC-740009	TB04-HC-740009	Possibility to move LAC 6274AC-ACR-1040 :	HC	2019	IP.SB	66 517.28
TB04-HC-740012	TB04-HC-740012	B74 level B1 Evolution 3D CMM EP Draft B1 – K1	HC	2019	IP.SB	61 707.85
TB04-HC-744001	TB04-HC-744001	B74-L3 Modification LAC 6274AC-ACR-5020 (escape route)	HC	2019	IP.SB	4 600.00
TB04-HC-000003	TB04-HC-000003	TB04 participation in CAS planning	HC	2021	IP.SB	94 320.00
TB04-HC-110022	TB04-HC-110022	11-B2 realign calculation notes NDG B2M (rearragment due to clash resolution with thermal expansion+ CMF)	HC	2020	IP.SB	179 954.40
TB04-HC-111022	TB04-HC-111022	HELB DTR SIC CA A&B	HC	2020	IP.SB	7 495.42
TB04-HC-112007	TB04-HC-112007	B11-L1-Constructive actions in Non-fire rated networks due to CMF report	HC	2020	IP.SB	40 000.00
TB04-HC-112017	TB04-HC-112017	Mist connection interface L1 gallery	HC	2020	IP.SB	14 891.00
TB04-HC-112020	TB04-HC-112020	Post step K changes proposal on TB04 model modification to improve accesibility for cable pulling	HC	2020	IP.SB	7 137.50
TB04-HC-114002	TB04-HC-114002	B11 L3- Corner shaft- 2nd part of HC112002	HC	2020	IP.SB	16 227.00
TB04-HC-000011	TB04-HC-000011	Engineering for OGP2 AVEVA migration (complete engineering 1D scope for HC000005)	HC	2021	IP.SB	42 906.60
TB04-HC-111026	TB04-HC-111026	Port cells Removal Fire box Mist System	HC	2021	IP.SB	36 737.84
TB04-HC-112001	TB04-HC-112001	LAC 6211AC-ACP-3018 in Port Cell 18	HC	2021	IP.SB	9 321.50
TB04-HC-112022	TB04-HC-112022	VS07 Modifying penetration impacting TB04	HC	2021	IP.SB	3 071.90
TB04-HC-113008	TB04-HC-113008	PC pillars exact location for interface points	HC	2021	IP.SB	28 443.18
TB04-HC-113009	TB04-HC-113009	B11-L2 Clashes after Step K	HC	2021	IP.SB	8 657.48
TB04-HC-114003	TB04-HC-114003	B11-L3/L4/L5- Alternative routing HVAC duct-3rd part of HC112002	HC	2021	IP.SB	37 867.76
TOTAL HIT CARDS						2 333 112.92
TOTAL						15 107 842.87

Fig. 39 IO Tasks, variations approved for implementation in the 2021 budget

8.2. Multi-Annual Payment Schedule for the Operational Budget

Year	Commitments	Paid until end of 2013	MFF 2014-2020								Paid 2021	Outstanding amount
			Paid 2014	Paid 2015	Paid 2016	Paid 2017	Paid 2018	Paid 2019	Paid 2020			
<= 2007	115 445 438.21	113 121 009.41	2 062 547.93	261 880.87	-	-	-	-	-	-	-	-
2008	162 357 720.16	154 330 986.04	8 026 734.12	-	-	-	-	-	-	-	-	-
2009	295 658 870.68	234 711 366.38	26 549 875.43	13 259 338.45	8 008 925.36	9 541 166.89	1 995 858.00	595 166.88	294 128.11	494 543.46	208 501.72	
2010	389 677 891.70	274 537 523.43	34 717 587.59	39 227 964.72	9 607 653.62	15 107 792.58	7 052 706.24	7 271 509.84	330 273.04	520 457.78	1 304 422.86	
2011	370 662 303.45	224 611 776.68	29 962 742.34	26 739 952.54	35 305 192.97	42 950 825.08	1 186 051.53	1 003 257.15	1 425 464.43	227 422.68	7 249 618.05	
2012	1 066 110 011.76	227 971 230.12	128 364 796.05	164 239 683.64	189 718 067.75	152 829 836.45	59 686 026.83	30 102 558.63	35 684 826.57	14 418 968.18	63 094 017.54	
2013	754 633 022.58	67 053 699.98	181 415 330.39	96 759 662.07	124 738 904.24	85 677 718.98	80 349 613.29	14 030 308.08	28 835 072.31	18 485 338.22	57 287 375.02	
2014	573 399 164.84	-	52 626 681.58	93 676 757.92	116 670 110.66	78 631 340.28	68 952 541.72	42 675 882.86	22 013 774.00	19 482 123.37	78 669 952.45	
2015	366 701 610.71	-	-	46 616 552.99	123 149 761.09	50 541 171.89	57 643 284.14	39 324 580.84	6 428 325.64	3 947 737.56	39 050 196.56	
2016	411 227 727.89	-	-	-	58 687 305.83	229 014 259.88	59 591 457.06	55 272 443.55	3 525 294.43	1 423 809.18	3 713 157.96	
2017	481 672 933.29	-	-	-	-	119 010 491.88	168 993 842.63	65 041 867.40	79 991 985.33	19 067 695.60	29 567 050.45	
2018	625 681 152.84	-	-	-	-	-	254 664 005.74	158 238 420.21	63 029 881.57	35 594 872.67	114 153 972.65	
2019	660 573 038.06	-	-	-	-	-	-	267 773 299.20	170 961 600.39	72 880 000.06	148 958 138.41	
2020	815 565 792.76	-	-	-	-	-	-	-	328 530 151.47	220 317 475.14	266 718 166.15	
2021	1 003 980 163.80	-	-	-	-	-	-	-	-	278 124 868.81	725 855 294.99	
Total	8 093 346 842.73	1 296 337 592.04	463 726 295.43	480 781 793.20	665 885 921.52	783 304 603.91	760 115 387.18	681 329 294.64	741 050 777.29	684 985 312.71	1 535 829 864.81	

Fig. 40 Multiannual payment schedule (Operational)

- Notes :
- The actions accounted to F4E projects and implemented by the Commission and the CEA before F4E financial autonomy in 2008 are included.
 - For information, 1 244 commitment positions are open in ABAC on the 31/12/21, representing 15% more compared to the end of 2020.
 - Indicatively, the cumulative operational expenses at 31/12/21, are estimated to EUR 6 306.79 million in current value.

Estimate cumulative expense at 31/12/21 (MEUR - current value)	
Cumulative Payments	6 557 516 977.92
Open Pre-financing	-163 925 416.71
Accruals	111 980 623.25
Deferrals	-198 778 514.97
Cumulative Expenses	6 306 793 669.49

Fig. 41 Cumulative operational expenses

8.3. Reconciliation Between Budgetary and Accrual Based Accounts

	sign +/-	Amount (EUR)
Economic result (+ for surplus and - for deficit)	+/-	-61 471 723.43
<i>Adjustment for accrual items (items not in the budgetary result but included in the economic result)</i>		
Adjustments for Accrual Cut-off (reversal 31.12.N-1)	+/-	133 421 903.51
Adjustments for Accrual Cut-off (cut- off 31.12.N)	+/-	-151 652 788.15
Unpaid invoices at year end but booked in charges (class 6)	+	60 295 799.03
Depreciation of intangible and tangible assets	+	597 781.49
Provisions (impact of the year)	+/-	100 923 440.92
Recovery Orders issued in 2021 in class 7 and not yet cashed	-	-5 000.00
Prefinancing given in previous year and cleared in the year	+	40 985 912.11
Prefinancing received in previous year and cleared in the year	-	0.00
Payments made from carry over of payment appropriations	+	2 826 510.73
Other : 2021 corrections/credit notes on transactions booked in charges in previous years	+/-	-65 984.19
<i>Adjustment for budgetary items (item included in the budgetary result but not in the economic result)</i>		
Asset acquisitions (less unpaid amounts)	-	-126 323.49
New pre-financing paid in the year 2021 and remaining open as at 31.12.2021	-	-41 863 732.46
New pre-financing received in the year 2021 and remaining open as at 31.12.2021	+	6 374 572.42
Budgetary recovery orders issued before 2021 and cashed in the year	+	200 331.45
Budgetary recovery orders issued in 2021 on balance sheet accounts (not 7 or 6 accounts) and cashed	+	12 877.53
Payment appropriations carried over to 2022	-	-13 254 482.16
Cancellation of unused carried over payment appropriations from previous year	+	708 926.68
Adjustment for carry-over from the previous year of appropriations available at 31.12 arising from assigned revenue	+	11 643 308.35
Other : Invoices paid in 2021 but booked in charges in previous years	+/-	-83 176 808.76
Total		6 374 521.58
Budgetary result (+ for surplus)	+/-	6 374 572.42
Including amount of exchange rate differences		17 886.33
Delta not explained		-50.84

Fig. 42 Reconciliation between budgetary and accrual based accounts

8.4. 2021 Budget Implementation – Details by Fund Source

Fund Source: C1 - Credits of the year (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A10	SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	C1	37 504 468.71	37 504 468.71	100.00%	37 504 468.71	37 504 468.71	100.00%
A11	SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	C1	10 918 359.13	10 918 359.13	100.00%	10 918 359.13	10 869 553.19	99.55%
A12	EXPENDITURE RELATING TO STAFF RECRUITMENT	C1	569 030.68	569 030.68	100.00%	569 030.68	470 958.08	82.76%
A13	MISSION EXPENSES	C1	250 000.00	250 000.00	100.00%	250 000.00	116 421.42	46.57%
A14	SOCIO-MEDICAL INFRASTRUCTURE	C1	522 000.00	522 000.00	100.00%	522 000.00	404 288.33	77.45%
A15	TRAINING	C1	788 761.00	788 761.00	100.00%	788 761.00	300 815.61	38.14%
A16	EXTERNAL SERVICES	C1	630 000.00	630 000.00	100.00%	630 000.00	557 062.06	88.42%
A17	RECEPTIONS, EVENTS AND REPRESENTATION	C1	125.00	125.00	100.00%	125.00		
A18	SOCIAL WEALFARE	C1	30 600.00	30 600.00	100.00%	30 600.00	1 500.00	4.90%
A19	OTHER STAFF RELATED EXPENDITURE	C1	2 823 126.65	2 823 126.65	100.00%	2 823 126.65	2 457 142.33	87.04%
Total Title 1			54 036 471.17	54 036 471.17	100.00%	54 036 471.17	52 682 209.73	97.49%

Fund Source: C1 - Credits of the year (EUR)

(cont'd)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	C1	1 250 500.00	1 250 500.00	100.00%	1 250 500.00	911 061.34	72.86%
A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	C1	4 094 603.90	4 094 603.90	100.00%	4 094 603.90	2 216 675.98	54.14%
A23	MOVABLE PROPERTY AND ASSOCIATED COSTS	C1	208 847.13	208 847.13	100.00%	208 847.13	77 684.06	37.20%
A24	CURRENT ADMINISTRATIVE EXPENDITURE	C1	1 634 413.98	1 634 413.98	100.00%	1 634 413.98	1 044 100.06	63.88%
A25	POSTAGE / TELECOMMUNICATIONS	C1	393 800.00	393 800.00	100.00%	393 800.00	233 644.46	59.33%
A26	MEETING EXPENSES	C1	347 593.52	347 593.52	100.00%	347 593.52	141 701.83	40.77%
A28	INFORMATION AND PUBLISHING	C1	14 500.00	14 500.00	100.00%	14 500.00	6 852.29	47.26%
A29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	C1	212 585.80	212 585.80	100.00%	212 585.80	110 949.31	52.19%
Total Title 2			8 156 844.33	8 156 844.33	100.00%	8 156 844.33	4 742 669.33	58.14%

Fund Source: C1 - Credits of the year (EUR)

(cont'd)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	C1	763 847 119.66	763 847 119.66	100.00%	527 067 259.01	521 447 662.21	98.93%
B32	TECHNOLOGY FOR ITER AND DEMO	C1	5 394 623.93	5 394 623.93	100.00%	3 486 161.07	3 486 161.07	100.00%
B33	TECHNOLOGY FOR BROADER APPROACH	C1	10 061 286.56	10 061 286.56	100.00%	7 408 182.60	7 408 182.60	100.00%
B35	EXTERNAL SUPPORT ACTIVITIES	C1	16 951 292.68	16 951 292.68	100.00%	10 564 536.03	10 564 536.03	100.00%
B36	OTHER OPERATIONAL EXPENDITURE	C1	5 504 749.95	5 504 749.95	100.00%	2 877 605.07	2 877 605.07	100.00%
Total Title 3			801 759 072.78	801 759 072.78	100.00%	551 403 743.78	545 784 146.98	98.98%
Total C1			863 952 388.28	863 952 388.28	100.00%	613 597 059.28	603 209 026.04	98.31%

Fund Source: C4 - Internal assigned revenues (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A13	MISSION EXPENSES	C4	771.46	771.46	100.00%	771.46	771.46	100.00%
A15	TRAINING	C4	569.53	569.53	100.00%	569.53		
A19	OTHER STAFF RELATED EXPENDITURE	C4	5 633.50	5 633.50	100.00%	5 633.50	5 406.00	95.96%
Total Title 1			6 974.49	6 974.49	100.00%	6 974.49	6 177.46	88.57%
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	C4	14 046.61	14 046.61	100.00%	14 046.61	2 284.51	16.26%
A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	C4	3 565.00	3 565.00	100.00%	3 565.00		
A24	CURRENT ADMINISTRATIVE EXPENDITURE	C4	1 607.40	1 607.40	100.00%	1 607.40		
Total Title 2			19 219.01	19 219.01	100.00%	19 219.01	2 284.51	11.89%
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	C4	209 726.45	209 726.45	100.00%	209 726.45	209 726.45	100.00%
B36	OTHER OPERATIONAL EXPENDITURE	C4	608.27	608.27	100.00%	608.27		
Total Title 3			210 334.72	210 334.72	100.00%	210 334.72	209 726.45	99.71%
Total C4			236 528.22	236 528.22	100.00%	236 528.22	218 188.42	92.25%

Fund Source: C5 - Carried-over internal assigned revenues (EUR)

No appropriations under the Fund Source C5

Total C5			0.00	0.00	-	0.00	0.00	-
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Fund Source: C8 - Carried over credits from previous years (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A11	SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	C8	161 358.84	137 527.06	85.23%	161 358.84	137 527.06	85.23%
A12	EXPENDITURE RELATING TO STAFF RECRUITMENT	C8	31 514.94	15 830.49	50.23%	31 514.94	15 830.49	50.23%
A13	MISSION EXPENSES	C8	85 642.41	29 204.77	34.10%	85 642.41	29 204.77	34.10%
A14	SOCIO-MEDICAL INFRASTRUCTURE	C8	154 116.51	61 940.69	40.19%	154 116.51	61 940.69	40.19%
A15	TRAINING	C8	402 687.49	326 748.94	81.14%	402 687.49	326 748.94	81.14%
A17	RECEPTIONS, EVENTS AND REPRESENTATION	C8	60.00	0.00	0.00%	60.00		
A18	SOCIAL WEALFARE	C8	33 079.75	32 080.75	96.98%	33 079.75	32 080.75	96.98%
A19	OTHER STAFF RELATED EXPENDITURE	C8	105 766.74	47 069.53	44.50%	105 766.74	47 069.53	44.50%
Total Title 1			974 226.68	650 402.23	66.76%	974 226.68	650 402.23	66.76%

Fund Source: C8 - Carried over credits from previous years (EUR)

(cont'd)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	C8	403 940.71	328 969.60	81.44%	403 940.71	328 969.60	81.44%
A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	C8	1 402 671.09	1 351 210.22	96.33%	1 402 671.09	1 351 210.22	96.33%
A23	MOVABLE PROPERTY AND ASSOCIATED COSTS	C8	154 312.15	138 989.93	90.07%	154 312.15	138 989.93	90.07%
A24	CURRENT ADMINISTRATIVE EXPENDITURE	C8	211 045.25	158 466.51	75.09%	211 045.25	158 466.51	75.09%
A25	POSTAGE / TELECOMMUNICATIONS	C8	170 107.08	68 951.51	40.53%	170 107.08	68 951.51	40.53%
A26	MEETING EXPENSES	C8	56 369.53	47 160.29	83.66%	56 369.53	47 160.29	83.66%
A28	INFORMATION AND PUBLISHING	C8	1 292.70	357.08	27.62%	1 292.70	357.08	27.62%
A29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	C8	161 472.22	82 003.36	50.78%	161 472.22	82 003.36	50.78%
Total Title 2			2 561 210.73	2 176 108.50	84.96%	2 561 210.73	2 176 108.50	84.96%
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	C8	1 027 942 939.56	979 449 101.37	95.28%	Payment appropriations under C1 Fund source		
B32	TECHNOLOGY FOR ITER AND DEMO	C8	4 137 055.51	3 405 102.46	82.31%			
B33	TECHNOLOGY FOR BROADER APPROACH	C8	8 742 106.67	8 587 325.27	98.23%			
B35	EXTERNAL SUPPORT ACTIVITIES	C8	16 596 386.93	15 366 125.08	92.59%			
B36	OTHER OPERATIONAL EXPENDITURE	C8	1 521 737.18	855 952.97	56.25%			
Total Title 3			1 058 940 225.85	1 007 663 607.15	95.16%			
Total C8			1 062 475 663.26	1 010 490 117.88	95.11%	3 535 437.41	2 826 510.73	79.95%

Fund Source: C9 - Carried over credits from previous years (EUR)

A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	C9	366.56	0.00	0.00%			
Total Title 2			366.56	0.00	0.00%			
Total C9			366.56	0.00	0.00%	0.00	0.00	-

Fund Source: R0 - Assigned revenues (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A27	RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES	R0	33 161.55	33 161.55	100.00%	33 161.55	2 688.00	8.11%
Total Title 2			33 161.55	33 161.55	100.00%	33 161.55	2 688.00	8.11%
B41	ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	R0	430 590 850.00	430 590 850.00	100.00%	129 100 000.00	127 715 100.01	98.93%
B42	ACTIVITIES LINKED TO ITER ORGANIZATION	R0	39 923 900.14	36 275 958.49	90.86%	16 929 155.78	10 613 351.30	62.69%
B43	OTHER EARMARKED EXPENDITURE	R0	1 399 515.87	1 399 515.87	100.00%	1 399 515.87	662 987.97	47.37%
Total Title 4			471 914 266.01	468 266 324.36	99.23%	147 428 671.65	138 991 439.28	94.28%
Total R0			471 947 427.56	468 299 485.91	99.23%	147 461 833.20	138 994 127.28	94.26%

Fig. 43 Budget Implementation – Details by Fund Source

8.5. 2021 Establishment Plan

Function group and grade	Budget 2021			
	Authorised under the EU Budget		Actually filled as of 31/12/2021	
	Permanent posts	Temporary posts	Permanent posts	Temporary posts
AD 16				
AD 15		1		1
AD 14	5	3	2	
AD 13	13	10	7	4
AD 12	14	21	10	19
AD 11	2	29	4	15
AD 10		33		32
AD 9		42	9	58
AD 8	1	33	1	23
AD 7	2	21		23
AD 6	1	12	1	20
AD 5				
AD TOTAL	38	205	34	195
AST 11	6		1	
AST 10			1	
AST 9	4	1	2	
AST 8	1	2	2	
AST 7		5	1	2
AST 6		9		10
AST 5		8	4	7
AST 4		1	1	6
AST 3			1	6
AST 2				
AST 1				
AST TOTAL	11	26	13	31
AST/SC TOTAL				
TOTAL	49	231	47	226
GRAND TOTAL	280		273	

Fig. 44 Budget 2021 Establishment Plan

9. Glossary and Abbreviations

ABAC	Accrual Based Accounting (accounting system used by F4E and managed by the EC).
Accounts payable	Organisation's current payables due within one year. Accounts payable are current liabilities.
Accounts receivable	Organisation's current receivables due within one year. Accounts receivable are current assets
Accrual accounting	Accounting methodology that recognises income when it is earned and expenses when they occur, rather than when they are actually received or paid, as opposed to cash accounting.
Actual = Actual amounts	Budget outturn = Budget execution = Budget implementation
Assets	Assets are items owned by an individual or an organisation, which have commercial or exchange value. Assets may consist of specific property or claims against others.
BA	Broader Approach
Cash accounting	Accounting methodology based on cash flows, i.e. transactions are recognised when cash is received or paid, as opposed to accrual accounting.
Current asset	The group of assets considered to be liquid in that they can be turned into cash within one year.
Current liability	Liabilities to be paid/settled within one year of the balance sheet date. (e.g. vendor's payables, etc.).
DI	Direct implementation for tasks requested by IO
EaC	Estimate at Completion
EC	European Commission
EPB	Executive Project Board
EU	European Union
External assigned revenues	Dedicated revenue received to finance specific items of expenditure
FR	Financial regulation
Financial statements	Written reports which quantitatively describe the financial health of an organisation. They comprise the Statement of Financial Performance, the Balance Sheet, the Cash Flow Statement, the Statement of Changes in Net Assets (capital) and the explanatory notes.
GB	Governing Board
Imprest account	Bank accounts and/or cash at hand used for the payment of low value expenses.
Internal assigned revenues	Funds received for specific assigned operations and activities from amounts recovered.
IO	ITER Organisation
Liability	A financial obligation, debt, claim, payable or potential loss.
NCR	Non conformity Report is a document issued by the supplier, F4E or the Customer detailing a condition that does not comply with a specified requirement.
PA	Procurement Arrangement: the PA between F4E and IO define the F4E deliverables to IO as well as the credit allocation scheme for each deliverable under the ITER unit of account.
PCR	Project Change Request
RAL	Commitments resulting in payment appropriations remaining to be paid.
TB	Tender Batches
WP	Annual Work Programme