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EVALUATION

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**REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE
COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE
COMMITTEE OF THE REGIONS**

**Interim Evaluation of the implementation of the Council Decision (Euratom) 2021/281
amending Decision 2007/198/Euratom establishing the European Joint Undertaking for
ITER and the Development of Fusion Energy and conferring advantages upon it**

{COM(2026) 528 final}

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Glossary

<i>Term or acronym</i>	<i>Meaning or definition</i>
BA	Broader Approach
DA	Domestic Agency
DEMO	Demonstration fusion reactor
EVEDA	Engineering Validation and Engineering Design Activities
F4E	Fusion for Energy
GB	Governing Board of F4E
IFMIF	International Fusion Materials Irradiation Facility
IFERC	International Fusion Energy Research Centre
IO	ITER Organization
ILO	Industrial Liaison Officers
PA	Procurement Arrangement
TB	Tender Batch
VV	Vacuum Vessel

1. INTRODUCTION

The ITER project is a unique case of international scientific collaboration between seven Parties, which are the European Union (represented by Euratom), Russia, United States, China, Korea, Japan, and India. It aims to “demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes, an essential feature of which would be achieving sustained fusion power generation”.

The ITER Agreement was signed in 2006¹ and has set-up the ITER Organisation (IO) as an international organisation, which has the overall responsibility for the construction, operation, exploitation, and de-activation of the ITER facilities, and provide for its decommissioning. The ITER Agreement binds each Party to provide in-kind (components necessary for the construction of the ITER device) and in-cash contributions (financial contribution). Each Party to the Agreement must set-up a Domestic Agency as an entity for coordinated interaction with IO and provision of contribution on behalf of the Party. Euratom’s Domestic Agency is the “European Joint Undertaking for ITER and the Development of Fusion Energy” (Fusion for Energy – F4E).

Euratom through F4E is responsible for contributing ca 45% of the construction cost of ITER, of “which 80% is funded from the EU budget and 20% by France as the ITER host country (the other ITER Members share is around 9% each)”². The contribution finances not only cash funding to IO but also in-kind contributions – delivery of buildings and related site infrastructure and also the delivery of high-tech components such as the Magnets, the Vacuum Vessel, heating systems, first wall components and diagnostics (see Figure 1 and Figure 2).

In parallel to the ITER Agreement, Euratom entered into a separate bilateral agreement with Japan (the “Broader Approach” Agreement (BA)) to further facilitate and coordinate fusion-related activities with Japan. Several F4E Members contribute also on a voluntary basis to the BA activities, which consist of three collaborative projects located in Japan: IFERC (International Fusion Energy Research Centre), JT-60SA, and IFMIF-EVEDA (International Fusion Materials Irradiation Facility, Engineering Validation and Engineering Design Activities).

To discharge Euratom's obligations regarding the ITER project and to carry out other ITER-related activities, the Council of the European Union adopted Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E)³ in March 2007. F4E's members are Euratom, the Member States of the European Union and third countries that have associated their research programmes in fusion to the Euratom research programme⁴.

The Council Decision (Euratom) 2021/281⁵ amending the Council Decision 2007/198 requires the Commission to carry out an interim evaluation of the implementation of the

¹ Euratom (the European Atomic Energy Community) participates as an entity legally distinct from the EU but with the same membership. The other Parties to the ITER Agreement are Russia, United States, China, Korea, Japan, and India

² COM(2017) 319 final: [EU contribution to a reformed ITER project](#)

³ 2007/198/Euratom: Council Decision of 27 March 2007 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it

⁴ Currently there is none, but discussions are ongoing with Switzerland.

⁵ [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. (see in particular, Article 5c)

Decision once sufficient information about its implementation during the period 2021-2027 is available, and at the latest by 2024. The **intervention** assessed is the implementation of this Decision and how F4E achieves its mission. It aims to assess to which extent the Euratom participation to ITER programme through F4E brings results to the EU. The results of the evaluation are used to:

1. inform on the status of the “ITER Programme”.
2. provide elements for the improvement of Euratom’s ITER Programme and the working of F4E in the period 2025-2027.

The evaluation carried out is in line with the applicable evaluation standards⁶, which require an evidenced-based assessment of the relevance and effectiveness, coherence, efficiency and EU added value of the EU intervention. The contractor’s study, which contributes to the preparation of the present Staff Working Document, focuses primarily on **the evaluation of the European participation in the ITER Project through Fusion for Energy during the current MFF and, in particular, for the period 2021-2023**. It has assessed the progress made by the project to date and, especially, compared its current achievements with the 2016 baseline⁷, which defines its scope, schedule and budget. It has assessed the quality and adequacy of the results/outputs in terms of EU policies, priorities, and interests. It has also assessed, *inter alia*, the efficiency of F4E’s governance and the management of its collaboration with the ITER Organization.

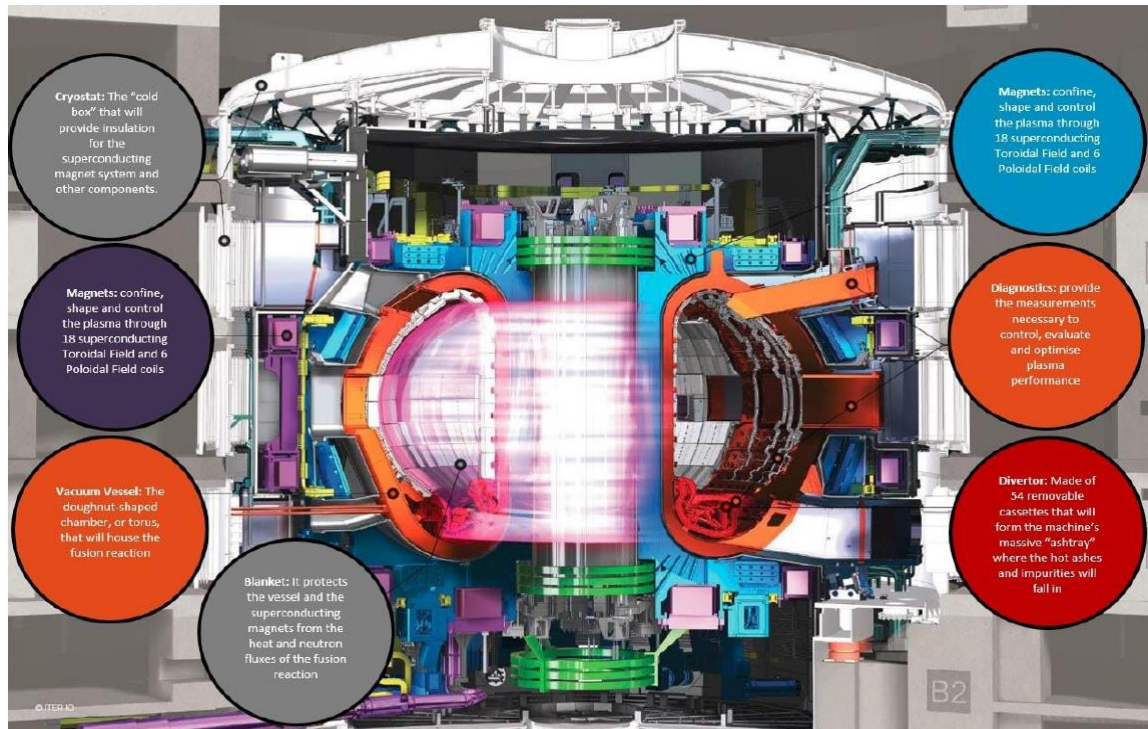
Limitations: The assessment of the impact of the new baseline on the Euratom contribution and its feasibility was beyond the scope of this interim evaluation (review up to 2023). Indeed, after years of steady progress, serious challenges have contributed to slow-down the implementation of the project: The Covid-19 pandemic, quality problems with some key components and difficulties in complying with the regulatory environment have delayed deliveries and assembly activities.

Methodology: The contractor’s study was based on a review of publicly available literature and documentation provided by the European Commission, F4E and the IO and on stakeholder consultations. Annex 1 lists the documents referred to in this evaluation. Annex 5 provides information on the consultation process.

⁶ [Better Regulation Guidelines \(2021\)](#)

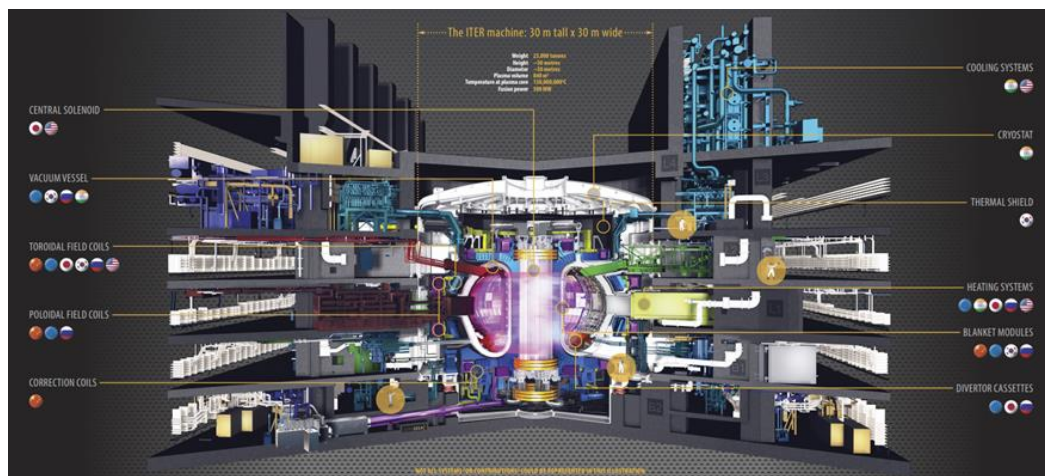
⁷ Source: ITER Organisation <https://www.iter.org/newsline/-/2588>

Figure 1. Cross-section of the ITER tokamak, with labels briefly explaining the functions of the main systems



Source: F4E 2022 Highlight report. Copyright: IO

Figure 2. Diagram of the tokamak showing broadly which Parties are responsible for which components of the machine



Source:

ITER Organisation's website⁸

⁸https://www.iter.org/doc/www/content/com/Lists/list_items/Attachments/661/A1_ITER_FUSION_MACHINEv2.pdf

Figure 3. Diagram of the governance structure of the ITER project (Source: F4E)

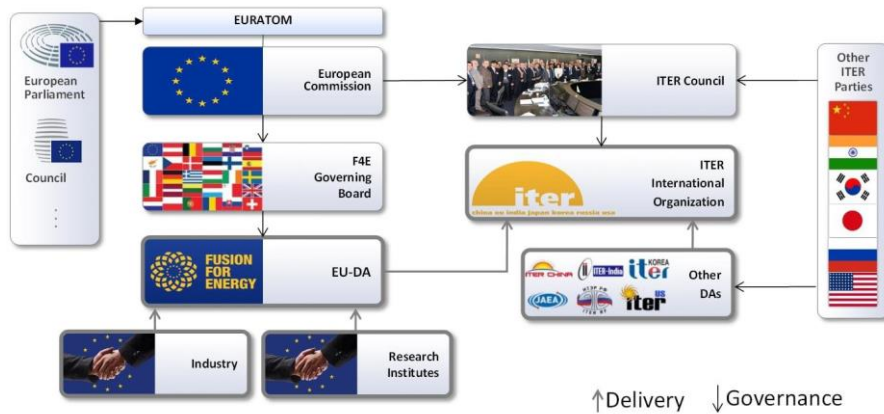


Figure 4.1. Top level ITER project schedule according to the new proposed baseline (Source IO)

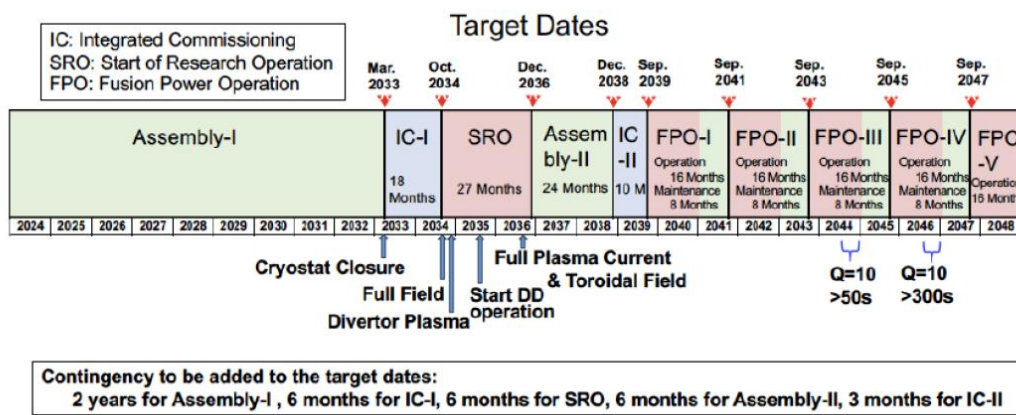
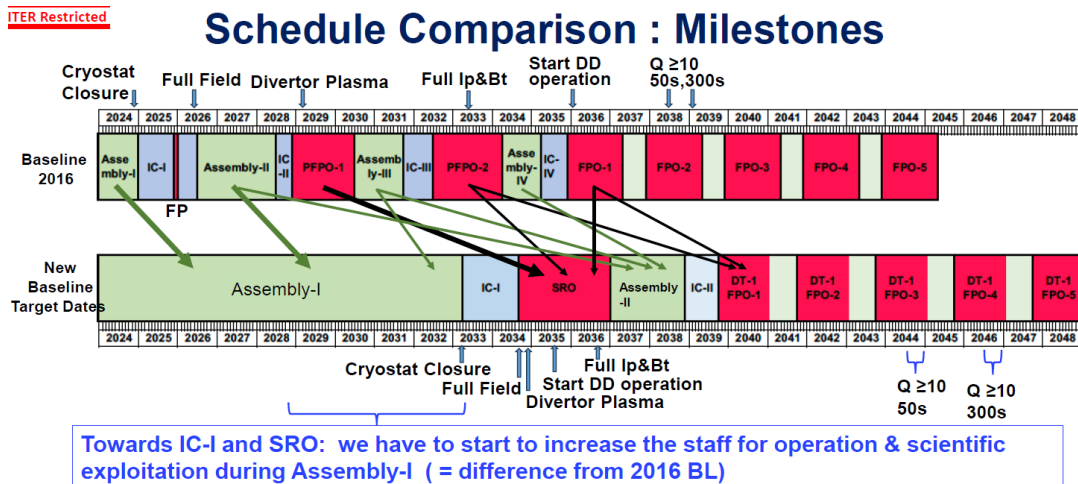


Figure 4.2. Comparison of the 2016 baseline and 2024 baseline (Source: data provided by ITER Organisation)



In order to enhance the joint project implementation by the IO and DAs, DA personnel are expected to join the assembly, commissioning, operation and experimental activities through secondment and other mechanisms to fully leverage the technical and scientific competencies within the Project.

2. WHAT WAS THE EXPECTED OUTCOME OF THE INTERVENTION?

2.1 Description of the intervention and its objectives

Objectives of the ITER project: In accordance with the ITER Agreement and the implementing provisions agreed between the ITER Parties, the objective of ITER project is to construct and operate an experimental fusion reactor to explore and demonstrate the scientific and technological feasibility of sustainable fusion power generation. The successful realisation of ITER would determine whether fusion can become a major sustainable energy source contributing to the EU's strategy for the long-term security in the supply of energy. Fusion offers the prospect of a potentially abundant source of safe, clean and CO₂ free energy. It is likely to play a major role in the decarbonisation of our economies.

The construction of ITER, which began in 2009, is technically extremely challenging because of its scale and the unprecedented nature of the components to be built. For Europe, the project is seen as an opportunity “to take a leading role at the global level in science and technology”⁹. In addition of the scientific dimension, the ITER project has a strong industrial dimension, since one of the expected results is the creation of a strong European fusion industry.

The ITER reactor is currently being built in Saint-Paul-lez-Durance in the south of France. The ultimate goal of ITER is to demonstrate steady-state net power generation from a self-sustaining nuclear fusion reaction in a magnetically confined plasma of deuterium and tritium, which would represent a major scientific and technological breakthrough. The objectives of ITER, as stated on the IO website¹⁰ are to pave the way for the construction of a demonstration power plant (DEMO). This would aim to demonstrate the commercial viability of fusion by delivering fusion power to the grid.

The roles of the ITER Organisation (IO) and F4E are distinct and complementary: the IO, an international organisation based in France, has the overall responsibility for the construction, operation, exploitation, and de-activation of the ITER facilities. While remaining the nuclear operator, the IO should also promote the use of the ITER facilities with laboratories or other institutions participating in the fusion energy research and development programme and promote public understanding and acceptance of fusion energy.

Fusion for Energy (F4E), which was set up as the Euratom Domestic Agency by a Council Decision (Council Decision 2007/198/Euratom11) on 27 March 2007 for a period of 35 years, has its headquarters in Barcelona, Spain. Its tasks are:

1. To provide the contribution of the European Atomic Energy Community (Euratom) to the ITER Organization for the ITER project, under the terms of the International ITER Agreement.
2. To provide the contribution of Euratom to Broader Approach (BA) activities with Japan for the rapid realisation of fusion energy, entailing at present three collaborative projects located in Japan.

⁹ COM(2010) 226 final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL ITER status and possible way forward {SEC(2010) 571}

¹⁰ <https://www.iter.org/proj/inafewlines#1>

¹¹ And further amended by Council Decision 2013/791/Euratom of 13 December 2013 and Council Decision (Euratom) 2015/224 of 10 February 2015.

3. To prepare and coordinate a programme of activities in preparation for the construction of a demonstration fusion reactor (DEMO) and related facilities including the International Fusion Materials Irradiation Facility (IFMIF).

In order to fulfil its obligations related to ITER, F4E provides the Euratom's direct financial contribution ("in-cash") to the IO's costs, as well as its "in-kind" contributions, which take the form of buildings, site infrastructure and components. With regard to these in-kind contributions, F4E organises procurement procedures with a view to concluding contracts, primarily with European manufacturers. F4E then oversees the execution of these contracts, ensuring that work is carried out in accordance with the agreed scope, schedule and cost, as outlined in the project documentation approved by the IO. In addition, F4E issues calls for proposals for research and other pre-fabrication activities, with the aim of concluding grant agreements. These grants primarily support European research centres and laboratories. Figure 3 provides an illustration of ITER's governance structure, with a particular focus on the European perspective.

2.2 Point(s) of comparison.

The progress of the implementation of Council Decision (Euratom) 2021/281 are measured under three units:

1. **The credits**, which are the units used by ITER or BA. For the ITER project, the in-kind contributions to IO are organised through Procurement Arrangements (PAs). Each of them represents specific work to be performed and delivered to IO. When a PA is developed by IO, the milestones agreed to mark the execution of the project correspond to a certain release of credits denominated in ITER unit of account (IUA). A similar system exists for the BA programme, whose unit is the BAUA.
2. **The milestones**, which are predefined by IO (IC Milestones) and F4E (Governing Board milestones) to measure progress of the ITER project, and
3. **The budget**, which gives indication on the resources made available to F4E to achieve its mission. This includes the number of staff.

The milestones are still expressed in the 2016 baseline, which is under review since 2021. The implementation of the baseline has been delayed by a number of factors, including significant disruption to the supply chain during the pandemic and the war in Ukraine, the need to repair components already installed, and the difficulty in complying with the regulatory requirements defined by the Nuclear Safety Authority of the host state. The new baseline is expected to address the issues identified in the current one, which did not include any kind of contingency and which assumed that all risks could have been mitigated. The experts committee, which reviewed the baseline before its endorsement by the ITER Council, acknowledged the lack of a contingency as unusual for such a large project as ITER. The committee underlined that this absence contributed to adding uncertainty to its overall management.

Benchmark: ITER is an international cooperation programme. This pioneering initiative seeks to demonstrate that shared technological solutions may solve scientific challenges. Given the magnitude of the investments to be made in research and the international collaboration, ITER has a limited number of points of comparison. In the framework of this study, ITER has been compared, when relevant, to the CERN, the European Organisation for Nuclear Research, which is probing the fundamental structure of the universe. The two institutions pursue equally ambitious research goals in an international context. The contractor mandated to carry out the study has made, when relevant, a

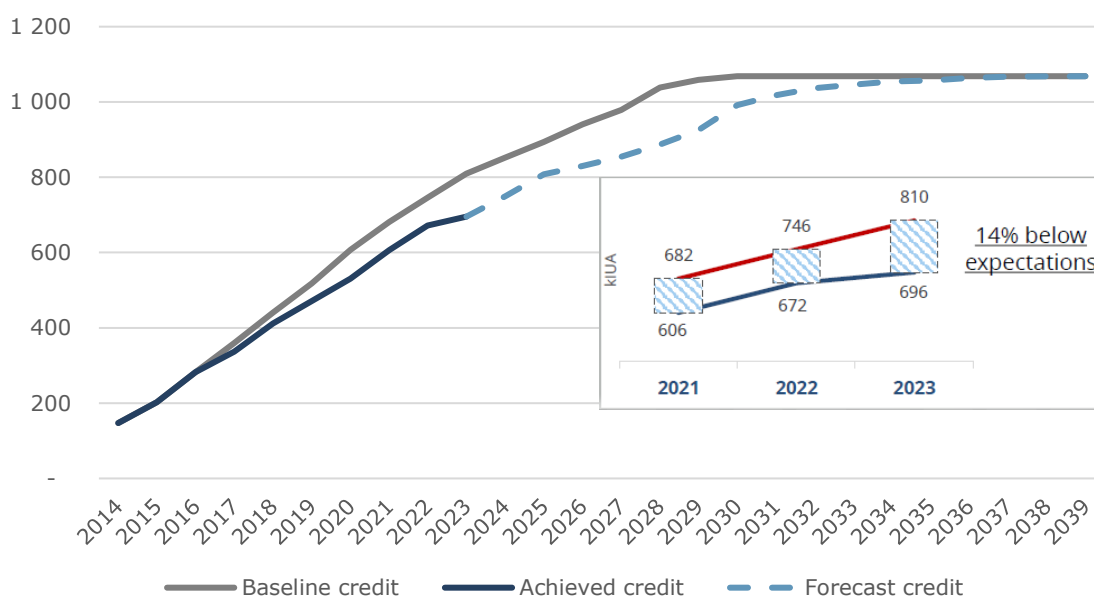
comparison of the practices in term of public procurement, the organisation, and the management of some transversal processes.

3 HOW HAS THE SITUATION EVOLVED OVER THE EVALUATION PERIOD?

3.1 Progress with respect to the 2016 ITER Baseline

The ITER project has encountered delays in its progress, as illustrated by the evolution of its credits in relation to the 2016 baseline. From 2017 to the beginning of 2023, the credits achieved remained consistently below the 2016 baseline, with the gap widening progressively from 2020 onwards.

Figure 5. ITER credits compared to 2016 baseline (ITER credits are in kIUA)



F4E achievements of the milestones and deliveries of the in-kind contribution to ITER:

By the end of 2023, the F4E progress in ITER was below expectations in terms of budgetary expenditure and achievement of key milestones defined by the ITER Council (IC) and Governing Board (GB). F4E had indeed allocated 65% of the ITER credits outlined in the 2016 baseline, which was 14 percentage points lower than expected at that time. The IC and GB milestones are underachieved and delayed by 32 months compared to the 2016 baseline, highlighting a significant deviation from planned contributions, with specific components like the vacuum vessel and the buildings experiencing major delays. A detailed analysis of deviations from the plans in terms of costs is provided in section 3.2.

F4E has delivered a significant part of its expected contributions to ITER. Notable achievements include the delivery of magnets¹², the completion of a significant number of buildings out of 39 to be built (including the Tokamak building that houses the ITER reactor) and the finalisation of the first sector of the Vacuum Vessel (Sector 5) in October 2024. The remaining four sectors are scheduled for delivery to ITER before Mid- 2026.

¹² <https://www.youtube.com/watch?v=7r7Hyg22zCg>

Table 1. F4E schedule performance of European components

Component	Brief description of the schedule performance
Magnets	All Poloidal Fields and Toroidal Fields Coils have been delivered to IO ahead of their need dates (expressed in 2016 baseline), despite of the complexity of the project.
Vacuum Vessel	The European Vacuum Vessel manufacturing has suffered several setbacks during 2022, with severe cleanliness issues and an elevated number of defects detected resulting in the need for huge repair efforts and big impacts on the critical path. In 2023, the European Vacuum Vessel manufacturing has been able to progress, except for Sector 4, for which the contractor is struggling and has accumulated very significant delays beyond the original assumptions. A significant improvement of the situation has been observed in 2024 thanks to an efficient reallocation of the tasks between the contractors, the definition of a test and verifications programme. F4E has been able to deliver the first sector in September 2024 and should deliver the other sectors by Mid-2026.
Site, buildings and power supplies	39 buildings and areas will house the systems necessary for the operation of ITER. Most of the buildings are already delivered or in a phase of finalisation. A couple of new buildings remain to be built to host components (neutral beam and hot cell) not yet under preparation or for activities that are necessary after the commissioning of ITER. As the project is located in Europe, the construction works were mainly undertaken by European Companies. F4E launched 24 contracts for a sum of EUR 3bn. The Buildings Programme has been affected by the numerous changes introduced to the design, delay in receipt of input data and the interpretation of nuclear safety requirements and their transcription into technical requirements leading to increased complexity, and sometimes slow learning curve from contractors. Input data delays and changes have led to an extended construction phase with resultant high levels of coactivity of works on site and concurrent delays.
In-Vessel	The schedule performance of the in-vessel components has been mainly impacted by the potential change of First Wall armour material. As these components are not for First Plasma but due for the second assembly phase, some milestones were postponed because of the delayed activities at the manufacturing site.
Remote handling	The project is behind schedule. Issues arise from commercial as well as from the technical ground, due to concurrent design of other systems sharing the same space, or because of challenging requirements (like fire loads and seismic loads). A big part of the delay has been due to long commercial/technical negotiations with the suppliers and new contract preparation. The sometimes poor supplier performance by providing low quality of deliverables and slow pace in execution of technical activities, together with prototyping difficulties due to test failures that required re-design and re-manufacturing, had an impact on schedule performance.
Cryoplant & fuel cycle	Some components needed for first plasma have suffered delay due to design issues, negotiations with suppliers and changes or late availability of input data.
Heating & current system	The main delays on the delivery of components come from the update of the schedule as a result on manufacturing lessons learned, delays on the PA signature due to internal and external factors, and delays due to buildings and interfaces availability and introduction of risks buffers to increase schedule realism.
Diagnostics	The deliveries are still in line with ITER Project need dates for first plasma components and systems (2016 baseline). For non-first plasma components, the introduction of risk buffers and the schedule review based on the current status and gates passed, has affected significantly the delivery dates for some the non-first plasma components. However, there is an ongoing collaboration defining the dates in conjunction with IO.

Source: From F4E Booklets completed by other source of information¹³

¹³ In particular: Booklet on status of F4E Programmes for GB60 and Booklet on status of F4E Programmes for GB57

Figure 6. State of play of the buildings¹⁴

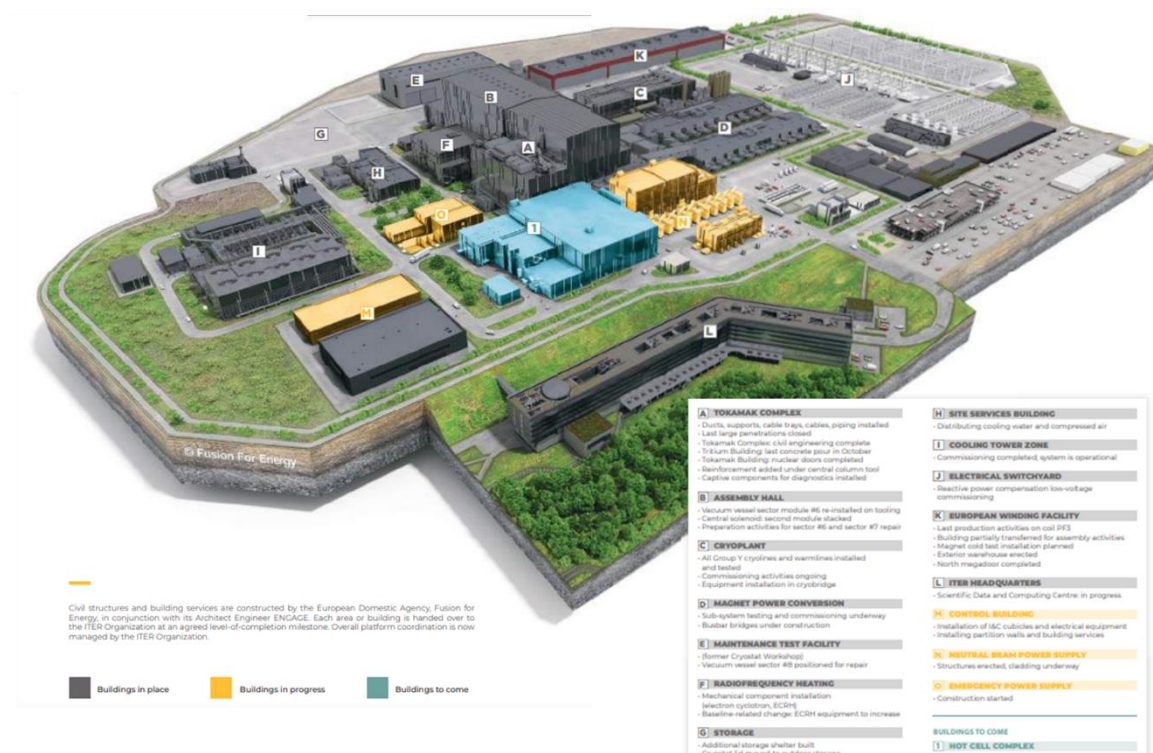


Table 2 below summarises the progress per action of achieved credits in ITER credits called ITER unit of account (IUA). The credits do not correspond to the actual costs in EUR borne by F4E for the procurement of that component but to the values of each Procurement Arrangement (PA) as agreed between IO and its Members.

Table 2. Progress per action in terms of achieved credits in kIUA (period: 2010-2030)

Project Team Unit	Forecasted total credits to be achieved between 2010-2030 (kIUA)	Achieved credits as of April 2024 (kIUA)	Share of achieved credit (%)
MAGNETS	185.9	183.5	99%
VACUUM VESSEL	86.3	70.6	82%
IN VESSEL	70.3	4.2	6%
REMOTE HANDLING	39.9	5.5	14%
CRYOPLANT & FUEL CYCLE	42.0	31.6	75%
HEATING & CURRENT DRIVE	95.7	50.2	52%
DIAGNOSTICS	29.6	6.6	22%
SITE, BUILDINGS AND POWER SUPPLIES	518.8	352.9	68%

Note: * according to 2016 baseline

¹⁴2023 ITER annual activity report: https://www.iter.org/sites/default/files/media/2024-10/2023_iter_annual_report_compressed_1.pdf

Table 3. Progress per action in terms of achieved credits in kIUA (period: 2021-2023)

Project Team Unit	Forecasted total credits to be achieved during 2021-2023 * (kIUA)	Achieved credits as of April 2024 (kIUA)	Share of achieved credit (%)
MAGNETS	46.8	44.8	96%
VACUUM VESSEL	5.5	1.8	32%
IN VESSEL	1.1	1.0	90%
REMOTE HANDLING	11.2	0.8	7%
CRYOPLANT & FUEL CYCLE	12.7	3.5	27%
HEATING & CURRENT DRIVE	20.4	11.9	58%
DIAGNOSTICS	7.5	3.2	43%
SITE, BUILDINGS AND POWER SUPPLIES	97.7	56.0	57%

Note: * according to 2016 baseline.

As outlined in Table 3, all milestones due up between 2021 and the end of 2023 were reviewed. F4E successfully delivered several technically complex components of the ITER tokamak. The table shows that 6 of the 19 IC-GB milestones planned for the 2021-2023 period were achieved within the forecasted timeframe, 3 IC-GB milestones were achieved with some delay, and 10 IC-GB milestones remain to be achieved.

Table 4. Milestones achieved, delayed and not achieved as compared to plans (2021-2023)

	2021	2022	2023
F4E achieved IC-GB milestones		<u>Magnets</u> : Delivery of the 7th Toroidal Field Coil <u>Buildings</u> : Making the Building B71 North Ready for IO Installation	<u>Cryogenics & Fuel Cycle</u> : Delivery of Torus and Cryostat Front-End Cryopump Distribution System and Cryojumpers 5-8 (4 no.) Batch 2 by EU-DA to Site <u>In-Vessel</u> : Completion of the qualification phase prior to start of Blanket First Wall series production <u>Diagnostics</u> : Electronics and Software for Magnetics Delivered to ITER Site <u>Heating and current drive</u> : Manufacturing of the 1st batch of Diamond Disks for EC Upper Launcher 1 finished
F4E achieved IC-GB milestones with some delay	<u>Buildings</u> : Construction of the Cryopant Compressor Building	<u>Buildings</u> : Construction of the Cryoline Bridge available for installation of systems <u>Remote Handling</u> : Signing the task order for Manufacturing for the Cask and Plug Remote Handling System (CPRHS)	
F4E not achieved IC-GB milestones	<u>VV</u> : Delivery of Sector 9 by EU-DA to ITER Site <u>Magnets</u> : Complete FAT for PA work scope for 18 TF Coils	<u>Buildings</u> : Medium Voltage distribution LC1A Ready for Equipment <u>Buildings</u> : Busbar Bridge available for installation of systems	<u>Cryogenics & Fuel Cycle</u> : Delivery of First Torus & Cryostat <u>Buildings</u> : Construction of Cryopant Coldbox Building <u>Commissioning</u> : Delivery of Cryostat Leak Detection System to site <u>Cryogenics & Fuel Cycle</u> : Delivery of Primary (VV)Leak Detection and Localisation by EU-DA to ITER Site for 1st Plasma <u>Remote Handling</u> : Equatorial Port Plug First Assembly Cask Delivered to ITER Site <u>Remote Handling</u> : Upper Port Plug First Assembly Cask Delivered to ITER Site

Source: CSIL-GAC elaboration based on F4E data

3.2 Analysis of the deviations with respect to the 2016 Baseline for ITER

3.2.1 Analysis of the deviations in terms of delays

The delays can be attributed to the following factors: i) An overly optimistic 2016 baseline; ii) The impact of the COVID-19 crisis and its consequences on the supply chain; iii) The quality of some components and conformity issues with the French Nuclear Safety Authority; iv) The late delivery of some contractors.

With regard to the unrealistic baseline, it should be noted that the ITER project is currently experiencing its third revision. Initially, the construction of ITER', which began in 2009, was expected to last ten years. However, following the revelation of multiple weaknesses and shortcomings in 2013, the baseline was deemed unrealistic. One of the key drivers of the delays and extra costs was already the immaturity of the design, which resulted in frequent changes of the first-of-a-kind components. The second revision of the project was presented in 2015 and adopted in 2016¹⁵ after a review by an independent committee¹⁶, which confirmed that the 2025 First Plasma milestone was the earliest technically feasible date. The Committee emphasised that the baseline did not include any contingency, assuming that all risks could be mitigated, which was considered unusual for a project of ITER's size and complexity and introduced a level of uncertainty to its overall management.

In 2020, the COVID crisis added delays to a situation, where ITER was implemented slower than expected. Indeed, the assembly of the reactor itself planned originally to begin in 2018 started finally in 2020¹⁷, when the two major pieces¹⁸, which composed it, were finally delivered. In November 2021, IO internal estimates showed the project, as a whole, was 17 months behind schedule and in June 2022, this number amounted to 35 months of delays. The COVID-19 pandemic and related supply-chain disorganisation explained most of the delay in 2020 and 2021. Restrictions on work attendance and travel in most EU Member States, long shutdowns of factories making ITER components and extension of the shipping duration for some components expected from Korea¹⁹ adversely impacted the deliveries of the components and the assembly work.

Quality and compliance issues: In addition, in 2022, the IO identified quality issues on two key components delivered on the site by the Korean Domestic Agency²⁰. It decided to halt the assembly of the vacuum vessel and to remove the already installed segment to facilitate repairs²¹. In parallel of the repairs (+2 years delay), IO worked on the machine's assembly to tackle the late arrival of some components and supply chain issues (+ 3 years delay) and avoid that these extra delays became additive. Finally, in January 2022 a letter from the French Nuclear Safety Authority (ASN) postponed the long-awaited green light to proceed with the tokamak assembly subject to conditions to comply with.

Management of the performance of contractors: F4E had to manage severe delays caused by its suppliers for the VV and for the buildings. In both cases, F4E decided to transfer a part of

¹⁵ Source: ITER Organisation <https://www.iter.org/newsline/-/2588>

¹⁶ ITER Council Review Group (ICRG), "ITER Council Working Group on the Independent Review of the Updated Long-Term Schedule and Human Resources - Report", 15 April 2016. The report can be found at http://www.firefusionpower.org/ITER_ICRG_Report_2016.pdf

¹⁷ European Parliament (2023). [ITER financing by the EU budget - state-of-play](#). Published in November 2023

¹⁸ A massive magnetic coil to wrap around the tokamak (EU/JAP) and a large section of the vacuum vessel (KO) that makes up the tokamak's walls.

¹⁹ Press release available at: <https://www.euractiv.com/section/energy/news/iter-nuclear-fusion-reactor-hit-by-covid-delay-rising-costs/>

²⁰ F4E (2023). Consolidated Annual Activity Report 2022. First, several thermal shields, designed to keep ITER's liquid helium refrigerant cold and protect the walls of the machine, corroded and cracked because of the way the welds interacted with an acid used to wash the metal. Secondly, certain components of the vacuum vessel, intended to interlock with extreme precision, were found to lack the required manufacturing accuracy

²¹ Press release available at: <https://www.iter.org/newsline/-/3818/>

the original contract from one supplier to one another. In the case of the VV, it had also to finance the construction of an additional assembly frame to avoid any overlap in the assembly of the sectors. Concerning the buildings, a significant restructuring of one major Procurement Arrangement, called TB04, which aimed to deliver “main Mechanical and Electrical Services for Tokamak Complex and Auxiliary Building”²² was decided. Significant parts of the TB04 initial contract were transferred to other tender batches and an important work was done in parallel to clean the huge number of claims received early 2024 following the IO change requests.²³ After the change of contractor, good progress in delivering the auxiliary buildings was already achieved by the end of 2021 and continued during 2022, in line with the target to get all buildings taken over in 2023.

Over the last three years, F4E's milestone achievement was around 60 - 65% showing a lack of reliability of its own forecasts, which translates into cumulative delays year after year. When analysing the root-causes of delays in 2022, the contractor reported that 71% was due to causes internal to F4E (including supplier performance) while 29% to external causes (such as IO or international situation). Delays are also explained by the frequent IO's change requests, which often occur late in the delivery process. These requests impact the due date of the deliverables and costs, and the technological challenges linked to the project's first-of-a-kind nature. They are also linked to the need to manage the claims from suppliers (who request compensation for the extra demands), the need to address quality issues of the deliverables (indeed, a significant number of Non-Conformity Reports had to be cleared) and the need to coordinate between different manufacturing locations to produce a first-of-a-kind component.

3.2.2 Analysis of the deviations in terms of costs

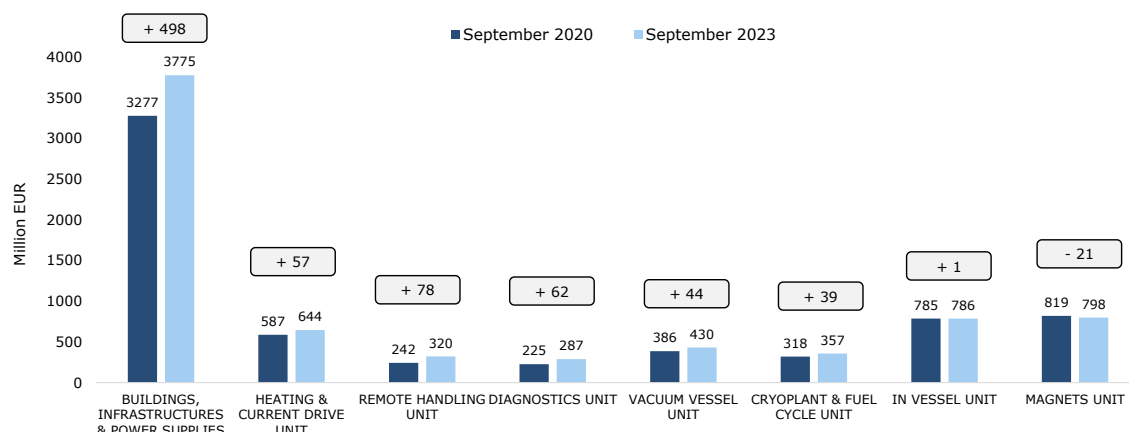
To monitor projects against their budgets, F4E calculates every month the Estimate at Completion (EAC) by using three elements: (a) the actual costs already incurred, (b) the estimate of future costs, (c) the estimate of likely impact of future risks. EAC combines past actual costs and future estimated costs for the construction, operational and decommissioning phases of the project (including the likely impact of future risks) for the completion of F4E's ITER responsibilities until the end of 2035. The EAC for the end of deliveries obligation from F4E is currently around EUR 15 bn²⁴. This has increased by EUR 751 million over the 2020-2023 period.

²² Source June F4E booklet: TB04 = Installation in Tokamak Complex was novated to IO in 2018, whereas design and procurement remained with EU DA. The TB04 initial contract has been partially transferred to TB11, TB12, Engage and TB21 due to TB04 scope restructuring following huge claims received early 2021. End : Jun-2024

²³ F4E (2023) Booklet on status of F4E Programmes for GB60.

²⁴ F4E source (IRS – End of August 2024).

Figure 7. Estimate At Completion (EAC) of ITER in-kind contribution (Sep 2020 vs. Sep 2023)



Source: csil-gac report

The major external factors at the origin of the cost increases were the COVID-19 pandemic and, the inflation in raw material prices. Indeed, the estimated financial impact of COVID-19 was respectively of EUR 57 million and of EUR 45 million (in 2008 current value) in 2020 and in 2021. During 2021-2022, F4E activities also experienced significant inflationary effects. From 2020 to 2021, these effects were induced by supply chain issues following the COVID-19 outbreak, and from February 2022, they became more pronounced due to the Russian invasion of Ukraine. The estimated impact of inflation on the total F4E Estimated At Completion (EAC) amounts to EUR 144 million per the latest analysis available as of the end of 2022. Additional expenditures pertaining to raw material increase should materialise in the years 2023-2026 for existing contracts and new tenders to launch. To mitigate the extra costs caused initially by COVID-19 and later by inflation, F4E established specific task forces and works to facilitate the implementation of mitigation measures to be put in place by the contractors.

Another important source of cost increase pertained to the continuous design changes by the IO and F4E project management put in place. This was particularly true for the Buildings programme (BIPS), which represented 47% of the total ITER in-kind contribution (according to 2016 baseline). The 11th annual assessment report prepared by independent experts identified the lack of maturity of IO's design as a key factor of the EAC increase for BIPS. The prolonged pressure on IO to comply with its own timetable over the period of 2010-2020 has resulted in Procurement Arrangements (PAs) with immature design requirements that were constantly changed or upgraded during the contract execution. This had significant time and cost consequences on F4E, which assumed the responsibility to achieve design maturity for "tender purposes" and consequently had to deal with numerous claims raised by contractors.

From 2021 to 2023, F4E requested reimbursement from IO for a total of 103 Project Change Requests (PCR). Some of these requests were accepted, allowing F4E to receive EUR 109 million from IO. This accounts for around 10% of F4E's expenditure for in-kind contributions to ITER over the same period (2021-2023). However, these figures underestimate the actual costs incurred by F4E (for the design changes requested by IO). In fact, the IO Reserve Fund, created by IO in 2015 to deal with DAs additional cost overruns arising from design changes, compensates (with many exceptions and constraints) only the direct costs of Project Change Requests (PCR) approved by IO. Indirect costs related to design changes, such as prolongation costs, are not eligible for reimbursement. Furthermore, the management of the PCR and claims mobilise F4E resources that could be mobilised on other productive tasks.

Moreover, the assessors of the 11th annual assessment report pointed the inefficient BIPS project management. IO, F4E, the Engineer, two consortiums of engineers²⁵ and architect engineers²⁶ and the contractors are the parties involved in BIPS. Complex circuits were put in place to review the design of the project, without following up the issues of the costs (cost control and estimation). Until October 2023, the BIPS team did not have its own decision-making authority and budget responsibility. In October 2023, BIPS was replaced by Building and Site Management. Since then, the decision-making process has been simplified (shorter circuits, improved communication between F4E and IO) and objectives further aligned. The change is judged positively by both IO and F4E, but it is too early to evaluate objectively its benefits.

Finally, the delays of DAs in delivering their components, including those of F4E, affect the cost overrun of the entire ITER project. Delays contribute to cost increase by mobilising human resources over longer periods and by generating contract suspensions or extensions. They can also impact on logistics (For example, due to long-term onsite storage of delivered components pending assembly).

3.3 A lower capacity to absorb the budget due to the delays of the ITER programme

3.3.1 Commitments

The EU Council conclusions adopted on 7 July 2010²⁷ approved **EUR 6.6 bn** (in 2008 values) for the F4E Joint Undertaking's contribution to the ITER construction phase of the project, with completion initially planned for 2020 under the 2010 baseline.

Following the approval of the 2016 baseline, F4E set the new timetable and recalculated the estimated cost at completion (EAC)²⁸ of the F4E contribution to the project construction phase until the achievement of the First Plasma milestone in 2025. Thus, Europe budgeted an additional **EUR 5.6 bn** for the period 2021-2027.

Over the period 2021-2023, the slower execution of the project has generated significant underspending resulting in an accumulation of unused appropriations in F4E. The Governing Board and the Commission have acted to adapt the budget of F4E according to its needs. Based on the sound financial management principle of the EU resources, EUR 1 bn out of EUR 5.6 bn of the current MFF have been back to the general budget to align the commitment profile over the 2024-2027 on the needs of the project known at this date.

Table 5. Euratom commitments for ITER in the multiannual financial frameworks

	2007-2013	2014-2020	2021-2027
European contributions in commitment appropriations (bnEUR)	3.3	2.9	4.6

Since the start of the ITER programme, Euratom has committed EUR 8.3 bn and paid EUR 6.8 bn. The F4E revenues are further supplemented by the ITER host country

²⁵ Engage SNC is a joint company formed by four European engineering companies for the Architect Engineer contract with F4E. The Architect Engineer assists F4E during the entire construction process, from the detailed design plans to project completion and sign-off, as regards the ITER buildings, the site infrastructures and power supply distribution.

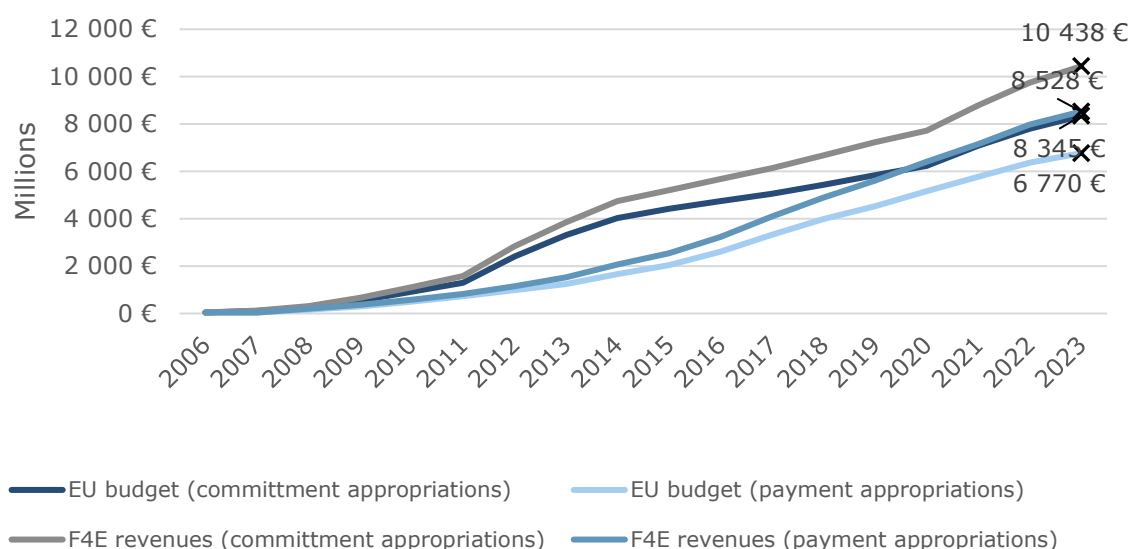
²⁶ Energhia Consortium is formed by three companies. They provide F4E with support services in the day-to-day management of works related to construction of the ITER buildings, site infrastructure and power supply.

²⁷ Council of the European Union. Draft Council conclusions on ITER status and possible way forward. of 7 July 2010 (Ref. 11902/10).

²⁸ Estimate at Completion (EAC) combines past actual costs and future estimated costs (including the likely impact of future risks) for the completion of F4E's ITER responsibilities until the end of 2035.

(France), the IO contributions to the reserve fund²⁹ and other revenues from other Member States willing to associate to ITER³⁰ (Switzerland until 2020).

Figure 8. Cumulative sums of commitment appropriations and payment appropriations 2006-2023 (current value in EUR million)



3.3.2 Use of the commitments

Table 6. Breakdown of F4E expenditure in commitment appropriations over 2021-2023 (EUR million)

	2021	2022	2023	Total over 2021-2023
Operational expenditure	910	583	499	1,991
ITER construction	874	524	436	1,835
ITER in kind	572	300	281	1,152
Cash to IO	264	224	156	644
Cash to Japan	39	0	0	39
Technology for ITER, BA, DEMO	15	20	37	72
Other operational expenditure	20	38	26	84
Administrative expenditure	61	77	73	211
Activities linked to ITER Organisation	5	24	14	43

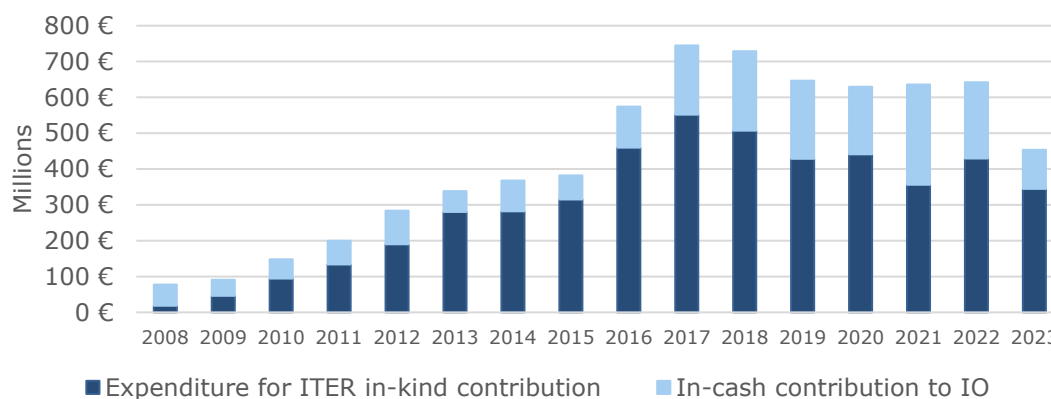
Source: Csil-Gac report

The most important part of the commitments received by F4E serves to finance the in-kind contribution, which amounted to EUR 1.152 bn over 2021-23. Over the same period, F4E has transferred EUR 644 million of commitment to IO for the in-cash contribution, too. IO has received a cumulated amount of EUR 2 bn since 2008, to finance its management, research and development, and the participation in the ITER fund.

²⁹ Since the establishment of F4E, as of 31 December 2023, F4E has received a total of EUR 179 mn in commitment appropriations and EUR 150 mn in payment appropriations (both in current values) from IO.

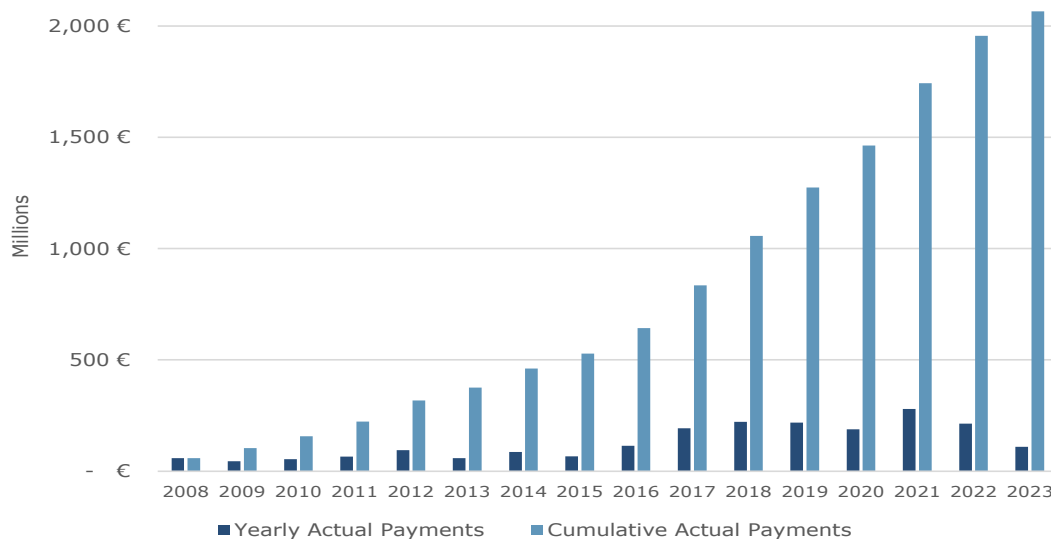
³⁰ Since the establishment of F4E, as of 31 December 2023, F4E has received a total of EUR 76 mn in commitment appropriations and payment appropriations (both in current values) from Membership Contributions.

Figure 9. In-cash contribution and expenditure for in-kind contribution (current value in EUR million)



The IO cash-contribution paid through F4E tended to fluctuate between 2021 and 2023. As can be seen from the figure below, which shows the annual cash contribution paid to IO up to 2023, the contributions increased significantly in 2021, when assembly and installation works started after delivery of in-kind contributions from all the DAs. The in-cash contribution to the IO was reduced in 2022 and 2023 compared to the previous years due to the temporary halt of assembly activities (see section 3.2.1) and the need to allocate resources to the revision of baseline (scope, schedule and cost) that started in 2021.

Figure 10. EU cash contribution to IO (current value in EUR million)



To provide in-kind contributions, F4E uses a combination of contracts and grants with external parties. Since the creation of F4E, as of March 2024, F4E has signed procurement procedures with a total current value of **EUR 7.7 bn** (Figure 9 below). Potential discrepancies between the value of signed contracts and the amount actually paid may arise because contract values may change after signature due to amendments, renegotiations, and other possible adjustments. The money spent has gone to hundreds of different contractors and many more subcontractors inside (and sometimes outside) the EU. This has generated growth and employment in the EU economy (see section 4.2). The two following figures below show respectively the cumulative current value of

procurement and grants and the number and cumulative current value of procurement procedures for the period 2008 – March 2024.

Figure 11. Cumulative current value of procurement and grants (M EUR)

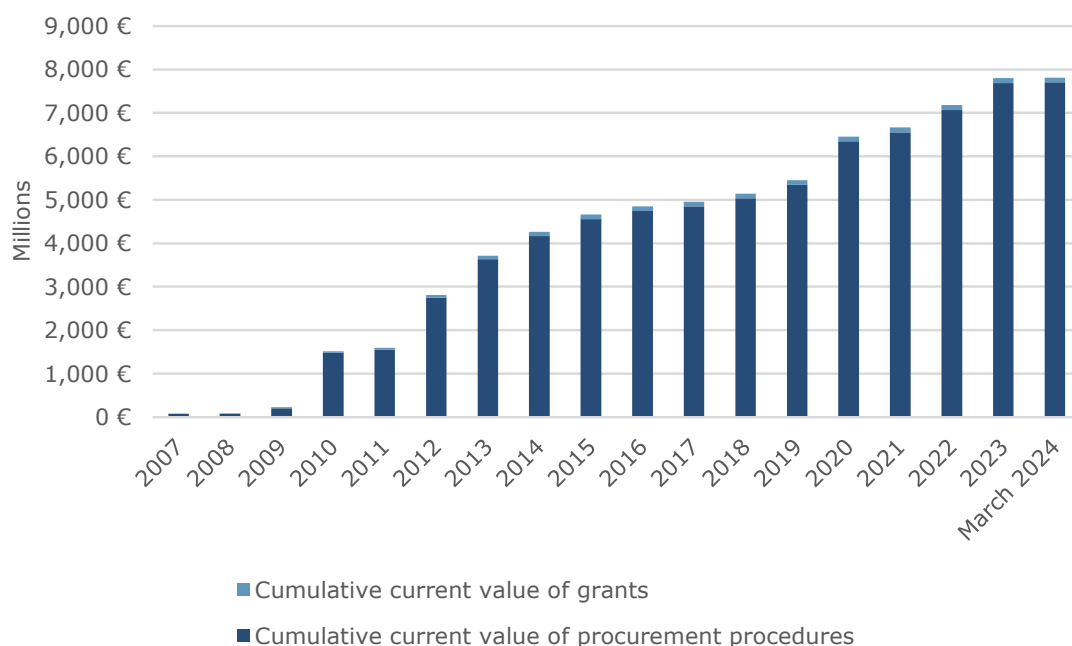
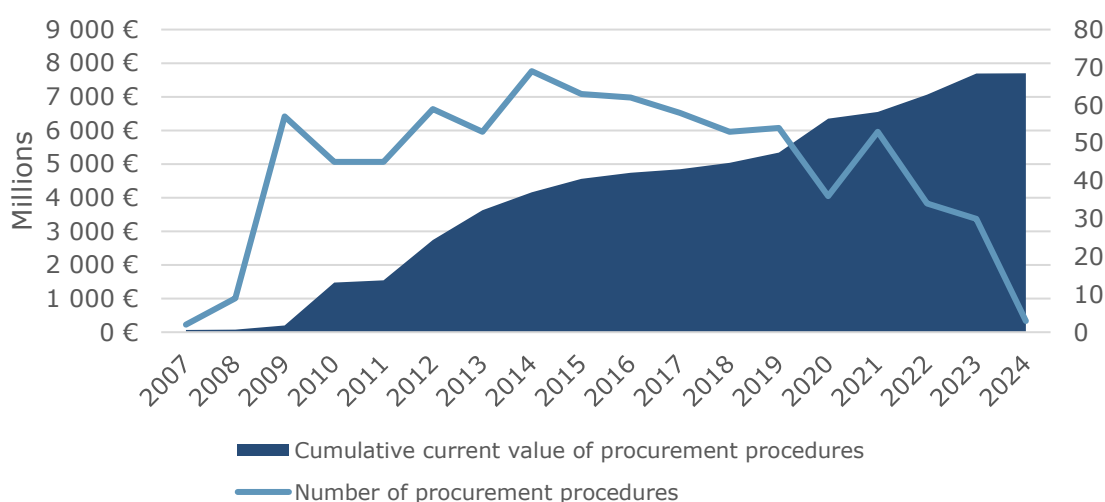


Figure 12. Number and cumulative value of procurement procedures 2008 – March 2024

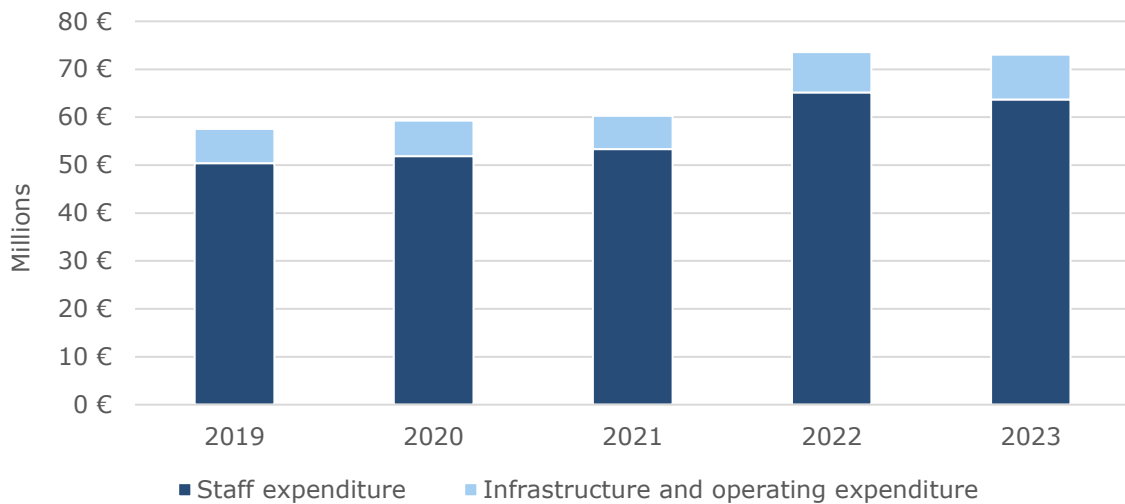


In terms of grants, F4E issues calls for proposals, mainly for research and other pre-production activities. These grants are signed mainly with European research centres and laboratories. Since the creation of F4E, as of March 2024, F4E has signed grants for a total current value of EUR 114 million. On the other hand, F4E organises public procurement procedures to conclude the contracts. F4E then supervises the implementation of these contracts and ensures that the work is carried out in accordance with the agreed scope, schedule and cost. While F4E is responsible for procurement and

contracting, the industry delivers directly to the IO, which performs acceptance³¹. **In addition to the operational expenditures, administrative expenditures** are made up of Staff expenditure (salaries) and infrastructure and operating expenditure. An increase in administrative costs has been observed over the 2021-2023 period, mainly due to an increase in the staff expenditure category in 2022. According to the 2022 F4E final account report, the three main reasons for this increase are:

- The increase in salaries due to the high indexation of salaries in 2022.
- The increased use of interim staff, mainly due to a higher-than-expected impact of sickness and maternity leave in 2022.

Figure 13. Staff and infrastructure and operating expenditure over the years (current value in EUR million)



³¹ European Commission (2018). The European Contribution to Iter: Achievements and Challenges

Figure 14. Staff expenditure 2019-2023 (in EUR million)³²

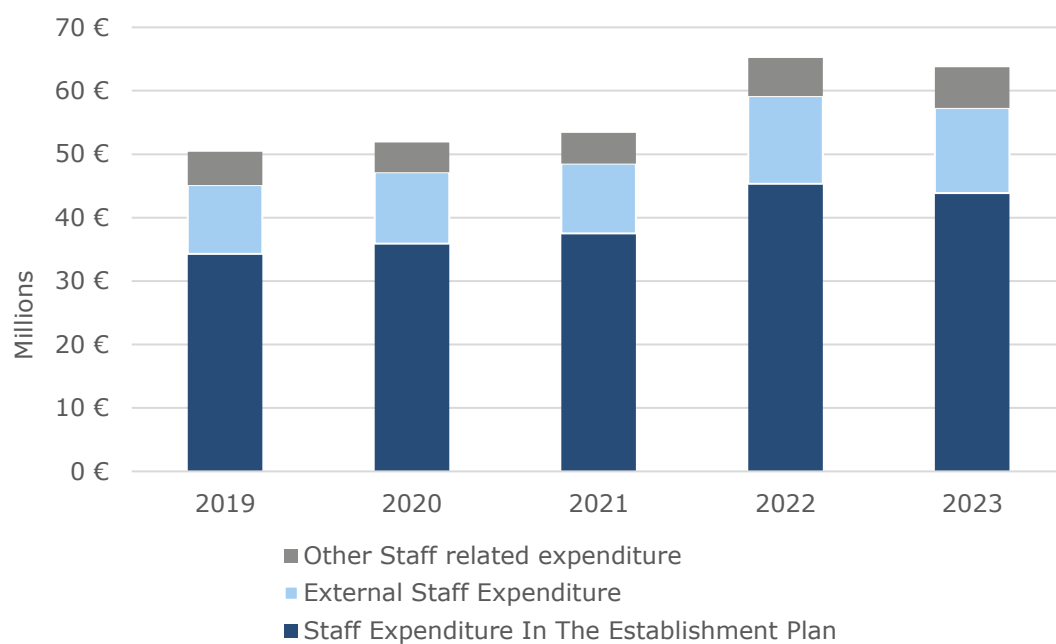
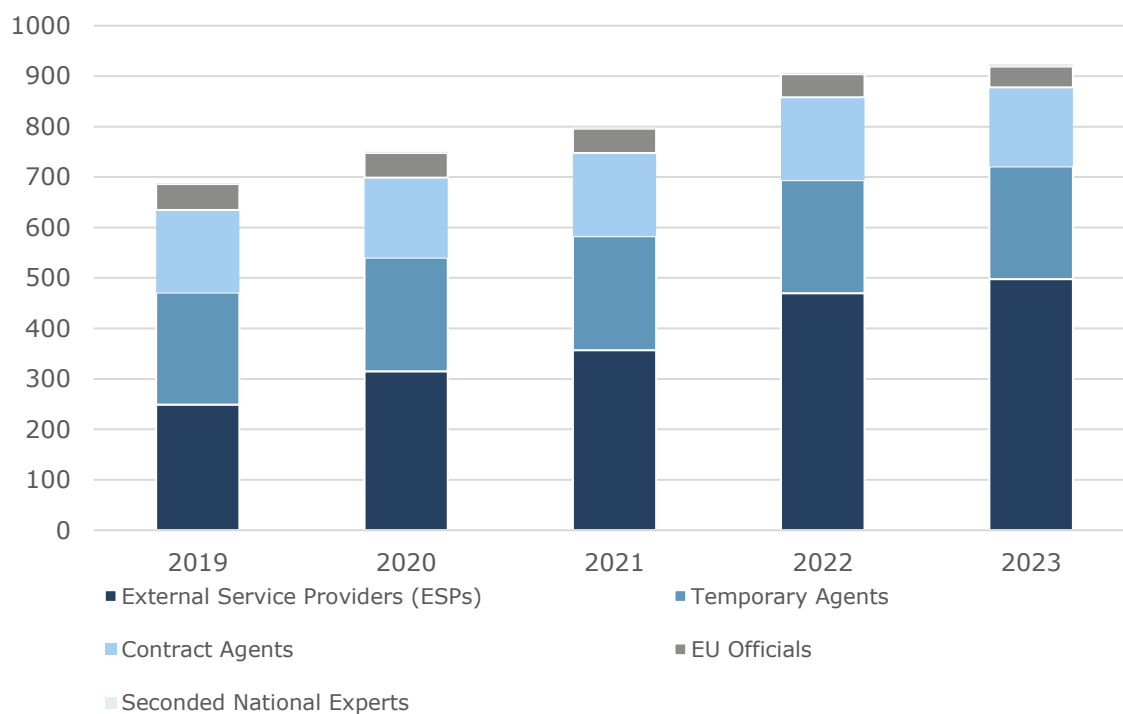


Figure 15. Annual number of statutory staff and ESP, 2019 – 2023



³² Other staff related expenditure includes minor expenses such as Expenditure relating to Staff recruitment, Mission expenses, Socio-medical infrastructure, Training, External Services, Receptions, events and representation, Social welfare, Other Staff related expenditure.

3.4 Measures taken to put the ITER project back on track

At the level of the IO: In November 2021, the ITER Council asked the IO to redefine a New Baseline and to call for a deep change of its management. Since his entry in function in September 2022, the new Director General of the ITER Organization worked on the preparation of a new baseline and undertook a series of reforms to put the project on track. In particular, the IO has been thoroughly reorganised, and a project matrix structure has been put in place. In addition, to streamline the decision-making process, a layer of management was eliminated, and a system of delegation was gradually introduced³³. It has identified ways to repair key components delivered by some Members of the consortium (Sector of the Vacuum Vessel delivered by Korea) and has reset its interaction with the French Nuclear Safety Regulatory Authority (ASN), which became more positive. In order to address past deficiencies, the IO is reinforcing its culture of quality management and has adopted new measures to ensure a more positive dialogue with the ASN. Although some problems remain, a noticeable improvement was reported by the Chair and other authorities at the last Iter Council³⁴. As recently pointed out by experts³⁵, IO needs to progress further on the implementation of the propagation of simplification changes in safety requirements stemming from the newly adopted phased licensing approach. Otherwise, this may have impacts on the overall project performance.

At the level of F4E: For one year, F4E underwent a thorough reorganisation to implement the reforms deemed necessary by the F4E Governing Board after the internal crisis³⁶. The new Director recruited in May 2023 received the mandate³⁷ to i) ensure a closer integration between F4E and the IO; ii) create a modern, diverse, and flexible organisation; iii) speed-up the delivery of the European contribution to the ITER project according to the timing, budget and quality agreed; iv) work collaboratively and in a transparent manner with the Governing Board; v) set-up a sound financial resources management and a better budget planning and reporting; vi) renew engagement with scientific and industrial stakeholders and F4E's long-term perspective.

On 1st July 2024, a new matrix organisation chart entered into force in F4E to streamline its management and reduce the number of its departments and potential overlaps in the management of the programmes. A new culture in the management of the ITER is emerging to ensure that the remaining components are delivered in line with the new baseline proposed by IO. The reorganisation had a major impact on F4E staff. A preliminary analysis of this change shows that 25 Heads of Units or Departments have been impacted by the entities either disappearing or being merged; some 30-selection process would need to be kicked off (3 Departments, 11 Units and 16 Groups); in total approximatively 430 out of 460 staff have seen a change in their department or unit allocation. The recruitment of the managers is expected to be finalised by the end of 2024.³⁸

Integration of IO and F4E: The IO has identified the integration of its activities with the Domestic Agencies as an axis for improving the ITER management culture. Therefore, the IO and F4E have been exploring ways to better integrate their activities

³³ Source: IC-32/10 Director-General's Letter (DG/2023/OUT/0114 (94EGSL) – paragraph “reorganisation”.

³⁴ Draft minutes of the Thirty-Fifth Meeting of the ITER Council (IC-35), November 2024

³⁵ Follow-up of the 2022 Management Report performed in 2024

³⁶ [EU nuclear fusion project under fire for work stress after employee's suicide – POLITICO](#)

³⁷ Mission letter for the Director of Fusion for Energy approved by the Governing Board on 9 February 2023

³⁸ See the contractor study (p 78).

and exploit potential synergies and complementarities between the two organisations. Since September 2023, an important effort has been made to identify the most relevant activities³⁹ and functions⁴⁰ to be integrated, and to identify teams that should be able to share schedules, tools (IT, databases, indicators) and information in the medium term and work on a more efficiently.

The expected outcome of the integration continues to be efficiency gains and potential savings, as the Integrated Project Teams (IPT), composed of representatives from IO and F4E, could identify optimisations in the way components are designed and procured. This will be particularly true for the preparation of the components (diagnostics, heating, in vessel) that are still to be delivered, including during the next MFF. Besides, the integration offers new career prospects for F4E staff and the possibility of retaining qualified personnel, especially after the component on they have worked on has been delivered. An administrative agreement has been signed between IO and F4E, whose staff regulations are different and has clarified the conditions of secondment of the staff.

The integration needs now to be implemented: responsibilities should be assigned and a *modus operandi* between the teams for the different programmes (Vacuum Vessel, Hot cells...) needs to be defined. The proposed IPT structure remains complex due to the challenges of fully integrating functions specific to two different legal entities (such as contract signing and personnel service orders). This dual organisational setup requires the IPT to maintain a split chain of command, separating operational and human resources management functions. The success of the integration between F4E and IO remains uncertain and is expected to vary from programme to programme.

Previous integration efforts have shown that, integration can deliver value under certain conditions. These include a strong management impetus, followed by an adequate delegation to empowered people; close monitoring of progress (including appropriate adjustments where necessary); translation of integration into processes and development of common tools; and an achievable project management plan. A full commitment of the staff is also a prerequisite.

The efforts of both IO and F4E are fully supported by Euratom, which actively participated in the launch of the exercise during 2023 and 2024. Regular reporting on the state of implementation is requested during the F4E governing bodies. While not solving all the problem of the project (immaturity of the design, unrealistic baseline...), the integration should be instrumental in the coming years to prepare the revision of the costs of the new baseline and to establish a calendar of deliverables achievable by both parts.

Revision of the baseline: Contrary to the 2016 one, the new baseline foresees the consolidation of the assembly states of the device before the start of the first phase of test (Start of Research Operation (SRO)) scheduled for 2034, during which a first plasma will take place. The 2016 baseline aimed to achieve a First Plasma in 2025 followed by four stages of assembly and construction, before reaching full plasma in 2033. The revised objective is to have a more complete machine by 2033 with pre-assembly tests having already taken place in order to move from the SRO phase to more meaningful scientific results from the operational phase. The new baseline is intrinsically structured to reduce operational risks and increase scientific output through phased installations and a multi-stage commissioning process. It is based on the assumptions that the IO will manage the safety demonstrations required by the French nuclear safety regulator (ASN). The

³⁹ Candidate projects identified by F4E for the integration Buildings, remote handling, cryoplant and fuel cycle, diagnostics

⁴⁰ In particular, quality assurance, project control and risk management, engineering...

regulatory procedures and requirements can have a significant impact on the critical path of the project. In full transparency and cooperation with the ASN, the IO has submitted a new Master Plan in 2024, which includes the planning for various permits and requests relaxations of some regulatory requirements, if necessary.

The achievement of full magnetic energy is delayed by about 3 years compared to the previous baseline, from 2033 to 2036 (see Figure 4.1). Deuterium-deuterium fusion operation is targeted for 2035, about the same time as in the previous baseline. The Start of Deuterium-Tritium Operating Phase is postponed from 2035 to 2039. Figure 4.2 compares the new baseline with the 2016 baseline.

3.5 F4E achievements for the other programmes (BA, DEMO)

The Broader Approach (BA) activities support the ITER project. The BA consists of three major projects: i) Satellite Tokamak Programme (**JT-60SA**), ii) the International Fusion Materials Irradiation Facility / Engineering Validation and Engineering Design Activities (**IFMIF/EVEDA**), which is a prototype facility for fusion materials testing and iii) the International Fusion Energy Research Centre (**IFERC**), which is a project that carries out different sub-projects, including collaborative activities⁴¹ in testing and development of materials for future Tritium breeding blankets of the tokamak.

The resources allocated to the BA programme is rather limited compared to the resources allocated to ITER construction. Over the period 2021-2023, Euratom through F4E devoted EUR 72 million for the BA and transferred EUR 39 million to Japan for the construction of the JT-60 SA in 2020 (i.e. respectively 3.6% and 1.95% of the operational expenditures mentioned in table 6). The Euratom resources for the implementation of the BA are provided 90% voluntarily by several participating European states (Belgium, France, Germany, Italy, Spain and, in the past, Switzerland).

The JT-60 SA project undertaken under the BA programme aims to accelerate the development of fusion energy by supporting the exploitation of ITER and advancing research towards DEMO. It consists of designing, constructing, and operating a device capable of more performance in plasma physics, including ensuring its confinement, its stability and its duration (performance).

The JT-60SA tokamak⁴², which was inaugurated in December 2023, is the “largest fusion device using magnetic confinement, until ITER becomes operational. It sustains plasmas of up to 200 million °C for up to 100 seconds at a time, offering insight as to how to keep the plasma hot and stable as well as how to handle the power produced. SA stands for “super-advanced” since the experiment will have superconducting coils and study advanced modes of plasma operation.. Europe has contributed to the Toroidal Field (TF) magnets and all coil current leads, the cryoplat, most of the cryostat, and magnet and heating power supplies”⁴³.

The first phase of progress was completed by March 2020, with the assembly of the facility in Naka (Japan). The second phase started with the first operations of the JT-

⁴¹ The collaborative activities cover among other testing and development of materials for future breeder blankets, joint work on pre-conceptual DEMO design, and the preparation of hardware and software for the Remote Experimentation Centre in Rokkasho, Japan. Until May 2017, the Helios supercomputer performed large-scale simulation activities at IFERC, including ITER operation scenarios and contributions to DEMO design.

⁴² <https://www.jt60sa.org/wp/>

⁴³ F4E website: [More Projects - Fusion for Energy \(europa.eu\)](https://www.f4e.europa.eu/en/More-Projects-Fusion-for-Energy)

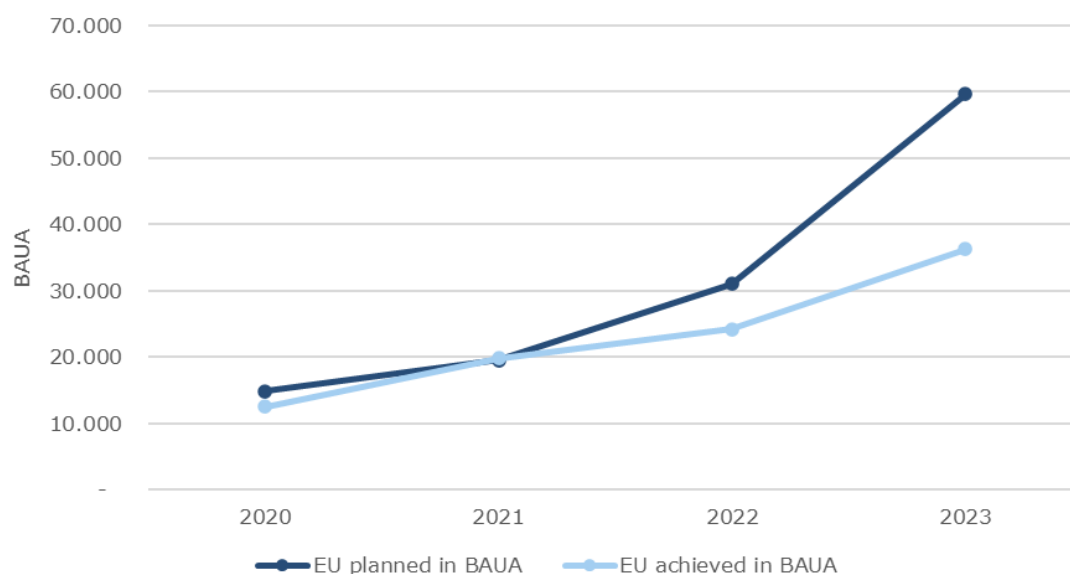
60SA but was interrupted after an incident occurred during the final energisation test of the equilibrium field coil. Most of the activities in the year 2022 and beginning 2023 were devoted to repair and address the reinforcement of magnets insulation. After the repair, a tokamak plasma was achieved for the first time in October 2023 (whereas it was planned originally for 2016) before being inaugurated⁴⁴ by Commissioner Simson and Mr Moriyama, the Japanese Minister of Education, Culture, Sports, Science and Technology (MEXT). Both sides reaffirmed “their long-standing and strong cooperation in the field of fusion energy”. They “reasserted their willingness to support the technical upgrades and operation of JT-60SA to produce ground-breaking research results, useful for ITER and for designing and constructing the fusion reactors of the future”.

Between 2021 and 2023, the expenditure for the BA in commitment and payment appropriations amounted to EUR 60 million and EUR 36 million, respectively⁴⁵.

⁴⁴ The inauguration was covered by tenshs of media in Japan and in Europe (e.g. articles in [Nikkei](#), [Les Echos](#), [Spiegel](#), [The Guardian](#)).

⁴⁵ Single Programming Document 2024-2028.

Figure 16. Achieved and planned EU BAUA for signed PAs in the Satellite Tokamak Programme (JT-60SA project) over the period 2020-2023



The IFMIF/EVEDA project aims at constructing a prototype neutron-producing accelerator for fusion materials testing. The accelerator in Rokkasho has completed an operational phase where a maximum duty cycle of 8.75% was reached. Duty cycle is limited by technical concerns on overheating components, which are being addressed in co-operation with CERN.

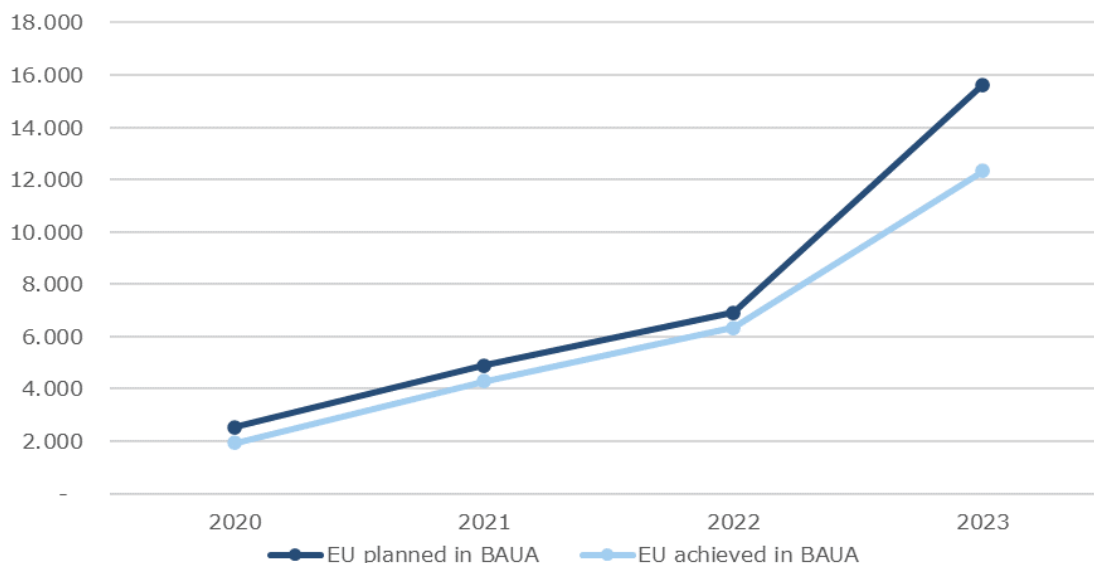
The implementation of the goals⁴⁶ set out in the 2020 agreement⁴⁷ between Japan and Euratom are globally on track. Despite challenges such as travel restrictions due to COVID-19 pandemic, proactive measures were taken to address technical issues and ensure continuation of essential activities⁴⁸. The project is progressing according to plan, but there are concerns on the availability of qualified staff in Rokkasho.

⁴⁶ Complement the engineering design of the IFMIF-like fusion neutron source, complement the Lithium Target Facility engineering validation and continue the commissioning of the LIPAc (phases B+, C and D)

⁴⁷ IFMIF/EVEDA Project: Achievements and Outlooks beyond 2020

⁴⁸ Single Programming Document 2024-2028.

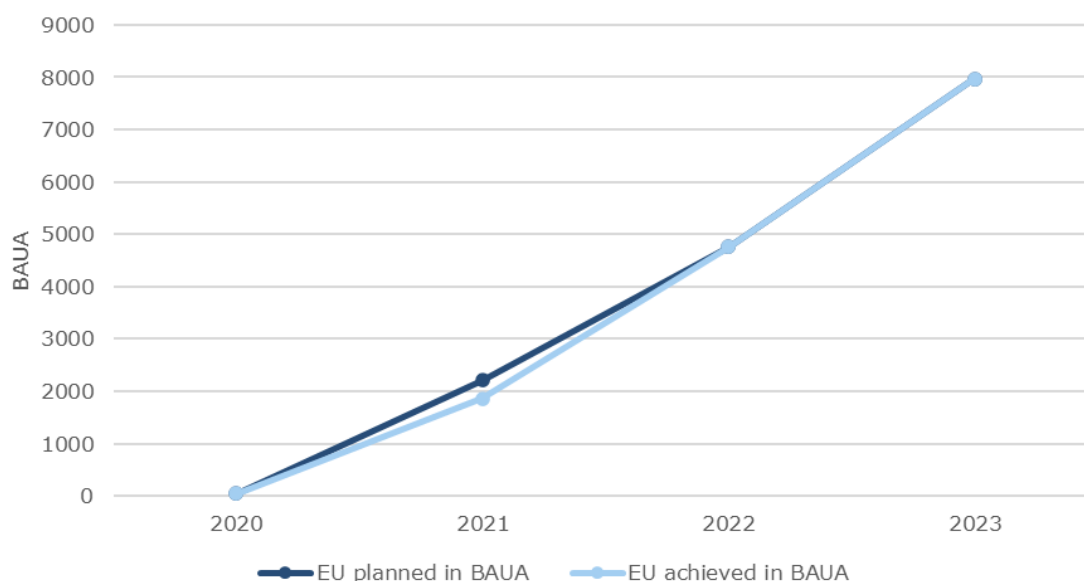
Figure 17. Achieved and planned EU BAUA for signed PAs in the IFMIF/EVEDA Project



The IFERC project comprises the following sub-projects:

- DEMO Design and R&D Coordination Centre in Rokkasho plays an important role in co-ordinating scientific and technological activities necessary for DEMO including design activities and technology R&D on key issues of common interest. The objective includes the assessment of pre-conceptual design options for DEMO, reflecting the outcome of R&D activities. The DEMO R&D Building in Rokkasho has been completed recently as a radioisotope (RI) handling facility, which consists of an RI experimental room, beryllium handling room, microstructure analysis room, and material test room.
- Computational Simulation Centre (CSC) provides a state-of-the-art supercomputer to exploit simulations to analyse experimental data on fusion plasmas, prepare scenarios for ITER operation, predict the performance of ITER, and contribute to the DEMO design. The “Helios” supercomputer was installed at the end of 2011 and at the time was one of the top 10 most powerful computers in the world. The 5th cycle of simulation projects in JFRS-1 is well underway from April 2024 thanks to the extension of Japan Host contributions.
- The Remote Experiment Centre (REC), which continuously implements the collaborations with ITER, IFMIF/EVEDA and with STP projects. This includes the preliminary JT-60SA remote participation system which enables Remote Computer Access to JT-60SA Analysis Server in Naka and the remote backup of JT-60SA data in Rokkasho.

Figure 18. Achieved and planned EU BAUA for signed PAs in in the IFERC Project



DEMO: According to the Council Decision 2007/198/Euratom, F4E has to “prepare and coordinate a programme of activities in preparation for the construction of a demonstration fusion reactor (DEMO)”. F4E has not so far devoted significant resources to prepare a programme of activities for DEMO. F4E's involvement in DEMO was primarily channelled through specific projects and collaborations with EUROfusion, the ‘Co-funded European Partnership on Fusion Research’ with the European Commission, which manages and funds European fusion research activities on behalf of Euratom. It was not deemed relevant for F4E to have a more substantial involvement on the design of the future demonstration reactor, given the delays encountered on ITER implementation and the insufficient level of maturity of key technologies.

EUROfusion has a significant DEMO programme funded through the Euratom Research and Training Programme. Part of this programme is used by F4E to discharge its obligations under the BA agreement as defined in the BA IFERC project.

4 EVALUATION FINDINGS (ANALYTICAL PART)

4.1 To what extent was the intervention successful and why?

The **intervention** assessed in the evaluation is the implementation of the Council Decision (Euratom) 2021/281 amending the Council Decision 2007/198 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it. Therefore, the success of the intervention is measured by the extent to which F4E has been able to achieve its three strategic objectives (ITER, BA, DEMO/IFMIF preparation) as defined in this Decision, in accordance with the applicable baseline. It is also measured by the way in which the intervention has achieved its objectives in terms of research and development of fusion industry, which will be discussed in more detail in the section 4.2 on the added value of the EU intervention. As explained in section 3, the F4E capacity to achieve its three strategic objectives varied from programme to programme:

- ITER: F4E has already been able to deliver a significant part of its expected contributions to ITER, but in most cases the pace of progress has not been in line with the expectations of the 2016 baseline, as in the case of the VV sectors.
- BA: A more positive picture emerged for BA activities, where contributions were delivered globally in line with the agreed schedule and important achievements have been obtained, such as the inauguration of the JT-60 SA, the most powerful tokamak in the world.
- DEMO: F4E has invested limited resources in preparing for the construction of DEMO, mainly because of the delays in the implementation of ITER and the immaturity of key technologies (Tritium breeding, materials qualification).

For ITER, the **reasons for costs slippage and delays** have been analysed in the previous section. Some factors beyond the control of F4E have had a negative impact on its capacity to deliver on time and at the planned cost, in particular, an over-optimistic 2016 baseline, the constant changes in the design and its insufficient maturity level, as well as the impact of the global crisis (COVID 19 and Ukraine war). It remains that **F4E should improve its capacity to prepare its work plan and to deliver** from one year to another. This should avoid under-execution of its budget and work programme and the need to postpone deliverables. During the September 2024 Bureau, F4E reported an improvement of its M-SPI⁴⁹, a schedule performance index that expresses in percentage terms the progress made by F4E in achieving the milestones planned for a given year. This M-SPI stood at 94% compared to 57% in 2021 and 67% in 2022.

The capacity of F4E to meet its objectives should be measured against an **updated baseline**. The adoption of the new baseline resolves scheduling issues and provide a more credible roadmap for the IO and the DAs.

As noted above, while it cannot solve the long-standing problems that have hampered project implementation, **better integration of the IO and F4E** should improve ITER management and replicate the best practices established for the BA programme. For the BA, one of the success factors was related to the fact that F4E and the Japanese Implementing Agency⁵⁰ shared design and budget management. For the JT-60SA, a single ‘Integrated Project Team’ (IPT) coordinates and implements the project as defined

⁴⁹ [Number of milestones with status = completed] / [Number of milestones with reference date ≤ Current month]

⁵⁰ National Institutes for Quantum and Radiological Science and Technology (QST) equivalent to 2 Domestic Agencies

at an early stage. QST, F4E and all other European stakeholders (EU Voluntary Contributors (EUVCs) and EUROfusion) work very closely together. IPT provides with strategies to mitigate delays, to control costs, select low-risk and less time-consuming technical solutions, and focus on activities with the highest added-value.

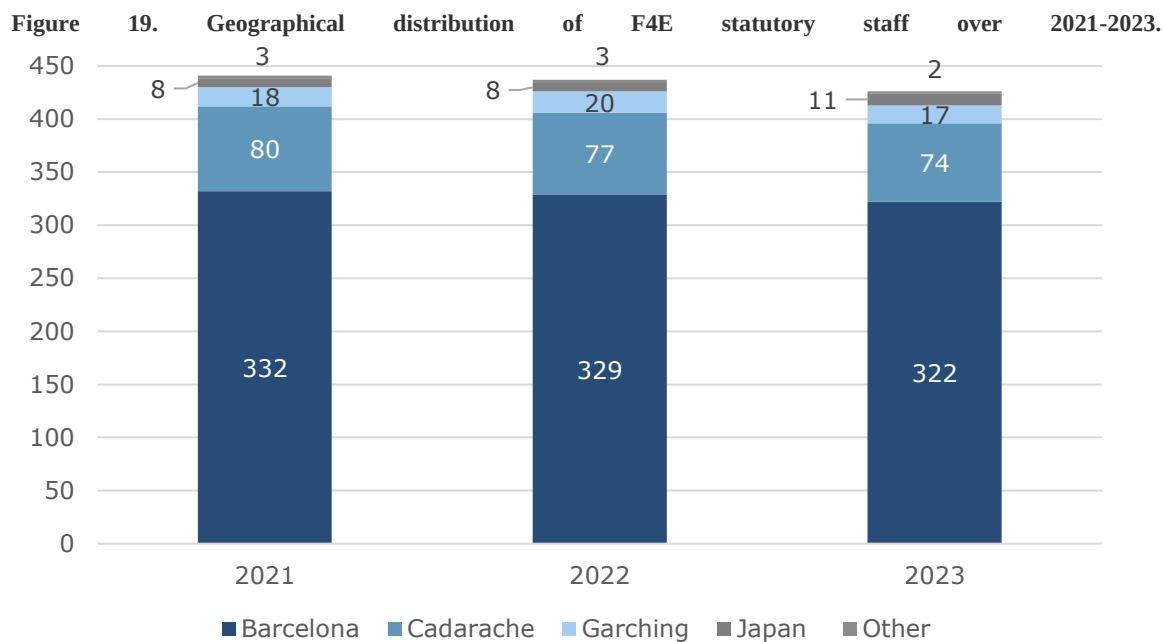
On top of the measures that should be taken to ensure that the ITER project as a whole is managed more efficiently, some potential adjustments have been identified to improve the oversight of the project at the F4E level. In addition to the **reorganisations that have taken place in IO and F4E over the past years** (the success of which still depends on consensus building and adequate implementation after a long period of internal tensions occurred), **F4E should continue its efforts to streamline its staff structure and reporting system.**

Between 2021-2023, the number of resources working for F4E across the four different sites⁵¹ fell slightly from 441 to 426 (-15) but this was offset by the recruitment of external service providers, who - although not all working on a full-time equivalent – amount to 498 by the end of 2023 (+141). The increased reliance on external staff was not a deliberate choice made by F4E, which faces challenges in attracting and retaining qualified staff, particularly following the suicide case in May 2021, which revealed a deteriorated working environment linked to high workloads and pressure to deliver⁵². In 2021, F4E received 10 additional statutory staff out of 34 posts requested under the 2021-27 strategic resource plan. Audits on human resources carried out by the Internal Audit Service and the Court of Auditors revealed several weaknesses, such as the lack of a comprehensive human resource strategy and of an established methodology for assessing its HR needs⁵³. When planning its overall staffing needs (including those for external staff), F4E does not take into account an adequate assessment of the workload or of the skills and competences required to carry out the activities for which it is responsible. F4E, which has recently adopted a human resources strategy, has also taken a number of measures to ensure that decisions on the use of external staff are always adequately justified and address the challenges associated with their assimilation and the retention of competences. The Governing Board regularly monitors the evolution of the number of ESPs and the situation of staff in general (well-being, recruitments, absenteeism...). In 2024 it has regularly asked to reduce the dependence on external staff.

⁵¹ Barcelona, Cadarache, Garching within the Institute for Plasma Physics (Germany), and the BA site in Rokkasho (Japan)

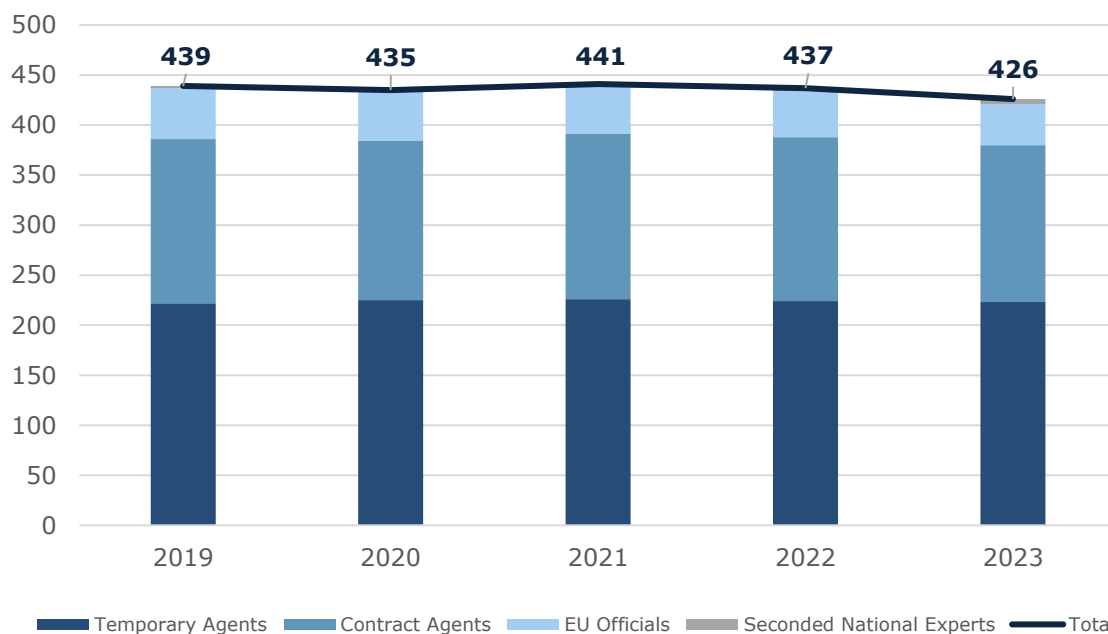
⁵² [EU nuclear fusion project under fire for work stress after employee's suicide – POLITICO](#)

⁵³ European Commission (2024), Final audit on human resources management and ethics in the European Joint Undertaking for ITER and the Development of Fusion for Energy.



As shown in figure 20 below, the workforce is very diverse (EU officials, temporary agents, contract agents, externals, interims, seconded national experts and trainees). According to the experts selected for the 10th F4E Annual Assessment Report, the unbalance in the workforce has an impact on F4E's ability to deliver results on time and on budget, as it encourages competition between categories of staff and group thinking rather than fostering a cooperative atmosphere.

Figure 20. F4E population and its evolution (over 2019-2023) by staff categories



Furthermore, the current resources may be diverted from productive tasks given the high number of reporting to prepare⁵⁴ and audits carried out⁵⁵. This excessive burden,

⁵⁴ Reports prepared for the governing bodies and for the Commission (e.g.: Annual Activity Report, Single Programming Document) but also. Just to illustrate, some past reports quoted in the study mentioned that: "the 2021 "Corporate Governance Audit Report", that focused on the activities of the main governing bodies of F4E between 2007 and 2014/15, found that during the considered 7-8 years,

highlighted in many assessment reports and interviews, is due to requests from different actors involved in F4E governance and to a lack of coordination between proposed audit improvements. The recommendations of the 10th annual assessment report, which has been identified by the European Court of Auditors, include the review of roles and the consolidation of audit responsibilities in order to minimise redundancy and to filter external requests more effectively, to improve operational efficiency and to reduce the administrative burden that currently hampers the performance of F4E. Work is underway at the F4E level to streamline the reporting.

In terms of performance indicators, the mid-term evaluation report noted that different KPIs had been introduced to monitor the progress of the project by F4E and IO (schedule, cost and quality). While these KPIs are adequate and well supported by IT tools for data handling and reporting, the frequent changes in the methodology undermine their long-term effectiveness for external monitoring; in particular, it is not always easy to compare the data provided over the time.

Procurement procedures are at the core of F4E activities. While some efficiency gains are reported (see table below) and contractor are generally satisfied with the procurement process⁵⁶, F4E could explore new ways to improve its management, especially for the highly innovative components.

Table 7. Efficiency gains in procurement process

Indicator (days)	before 2017	end 2020	end 2021	end 2022	end 2023	Efficiency gains (2023/before 2017)
Time to recruit	152	110	109	113	117	23%
Time to procure	287	189	183	184	185	36%
Time to sign a contract	41	11	14	13	27	34%
Time to prepare technical assessment report of the supplier deliverables related to a payment	16	12	8	11	7	56%
Time to pay before 30 days	23	15	13	19	16	30%
Time to perform a contractual deviation	90	36	49	49	46	49%

As highlighted in the previous section, the lack of a stable design at the start of the public procurement procedures makes it difficult for industrial actors, such as those working on the vacuum vessel, to estimate costs and organise their work. As F4E tends to prioritise price over quality and innovation (in order to comply with its Financial Regulation), F4E faces additional challenges when design adaptations are required, which may highlight weaknesses in the selected consortium.

For highly specific components, greater flexibility in public procurement is essential. Many ITER components are not currently available on the market, making their procurement very challenging. If there is only one qualified supplier worldwide, or none at all, public procurement is often not appropriate. F4E could benefit from a more frequent “pre” procurement phase (rather than relying solely on competitive procedures), involving contractors early in the process to discuss the draft terms of reference before the actual procurement starts, especially when the design is not yet mature: consultations with contractors could help identify the main challenges and better align the procurement process with the technical feasibility, potentially reducing overall costs. Currently, 95%

3754 documents were presented and 5583 conclusions for action were taken. In terms of hours, it was estimated that approximately 380 hours per AMC member and 1800 hours per GB member were devoted each year to F4E reports.”

⁵⁵ According to the contractor of the study, “a recent overview of only the ECA, IAS and IAC recommendations for improvement actions in 2015 till 2021 shows a total portfolio of 2084 actions to take (about 300 per year during the last seven years).”

⁵⁶ In the contractors survey, the contractors expressed positive assessments ranging from 91% for the procurement e-submission tool to 57% for managing compensations in cases of deviations from technical specifications.

of F4E bids are open to competition, and F4E does not engage with companies and academics during the pre-procurement phase to discuss draft terms of reference. An even more transformative approach to procurement could be a form of alliance contracting, which has been mentioned by some stakeholders and discussed with F4E. Alliance contracting is highly developed in the United Kingdom. Project teams between contractors and owners of the contract make decisions about what is best for the project within a joint governance framework, and the risks of the project are shared equally to promote a ‘no blame’ culture⁵⁷. With regard to integrated working methods, one participant mentioned that a stakeholder had previously suggested the creation of a joint engineering platform between the F4E engineering team and the IO team to work on a specific topic. Although this idea was considered to offer significant benefits, it could not be implemented due to legal constraints in the procurement processes.

F4E has specific actions to increase the participation of SMEs in the public procurement. Medium-sized companies are typically the beneficiaries of F4E procurement activities. Large companies do not prioritise ITER because of the uncertainties about the scale of future fusion-related activities. However, smaller SMEs have been less involved so far for technical reasons, which F4E has tried to address following the recommendations of the Industrial Policy working group. Measures have been taken or need to be taken to reduce financial barriers to entry for SMEs, to further improve the acceptance of financial guarantees (beyond bank guarantees), to improve price review clauses, while reducing unnecessary complexity and administrative requirements. One of the main challenges for these companies remains the lack of similar contracts from the public or private sector and the risk that the knowledge/know-how gained through ITER will disappear.

4.2 How did the EU intervention make a difference and to whom?

According to all the stakeholders interviewed in the framework of the surveys carried out by the contractor, the EU intervention has been crucial for ITER. Due to its high costs and its complexity, the project requires resources that cannot be provided by a single Member State, especially at a time of constrained public finances. The project requires significant technical expertise as well as highly skilled manufacturers. An intervention at EU level is seen as much more efficient than what could be achieved with the uncoordinated contributions from individual Member States. It avoids duplication of effort and pools resources, skills and competences, knowledge by awarding contracts to the best contractors or grants to the best laboratories. To this end, the EU’s participation in ITER must be pursued, alongside with other initiatives supported by some Member States. Indeed, some Member States (DE and IT⁵⁸) are pursuing work on fusion independently through national funds for fusion research, which sometimes complement, but can also challenge, the programmes managed or coordinated at EU-level by Euratom. These national programmes allow countries to tailor their research priorities and strategies, to address specific challenges or to explore novel fusion concepts. This is the case with Germany’s fusion research programme: In 2023, the German government has decided to invest more than one billion euros in fusion research to create a German

⁵⁷ Shaw, Edward (2021). Alliance contracting in the UK infrastructure industry: An Australian perspective. <https://www.dlapiper.com/en/insights/publications/2021/03/alliance-contracting-in-the-uk-infrastructure-industry>

⁵⁸ The Italian national advanced energy agency, ENEA is leading a consortium composed of Italian research institutions, the energy company ENI, government and regional partners and international stakeholders to conceive the Divertor Tokamak Test (DTT) project. The consortium established in 2019 has raised nearly EUR 500 mn to construct the facility. The facility is based in Frascati (Rome) and aims to conduct scaled experiments to explore and test the physics and technology of divertor concepts for the exhaust of the plasma thermal power which could be used in a fusion power plant, testing different technologies for the building of such device.

collaborative "fusion ecosystem with industry". This financial support is primarily intended to support ongoing activities at national institutes (Max Planck Institute, the Karlsruhe Institute of Technology, and the Research Centre Jülich) until 2028. The German fusion strategy aims to diversify investments to further develop new technological approaches (in particular, to support laser fusion, while ITER is focused on magnetic confinement).

The direct beneficiaries of ITER include all the private companies that have won contracts and developed specific knowledge and skills that they can eventually be exported, as well as the laboratories which have received support and have been able to develop their research programmes. In the longer-term perspective, citizens could also benefit from having an abundant source of clean energy capable of decarbonising the EU economy if ITER demonstrates the feasibility of the fusion and if the technology to produce electricity is developed. This would be a huge competitive advantage for Europe to be able to produce its own electricity.

Since its creation, F4E has awarded a total of EUR 7.7 bn in public contracts and EUR 114 million in grants (see figures 7 and 8). This expenditure has led to significant learning benefits, improving the capabilities of European companies. According to a study on the impact of the ITER activities carried out in 2018, ITER has been able to create a significant number of jobs in the EU over the period 2008-2017, mainly in construction, industry, non-business services and business services. In the same key sectors, a cumulative total of EUR 4.8 bn in additional Gross Value Added (GVA) was generated between 2008 and 2017, compared to a scenario with no spending. A precise figure for the period 2020-2023 is not available but a study has been launched by F4E to assess the economic and social impact of ITER over this period.

Figure 20. Dashboard impact indicators for Gross Value Added (GVA) and employment – gross impacts (compared to no alternative spending) only⁵⁹

Theme/ area	Proposed indicator	Summary impact to date	Estimated impact to 2030
Employment and growth in EU28	Value added (GVA) contribution	Cumulative 2008-2017: €4 786 million 2017 only: €1 104 million Potential additional benefit from spinoffs 2008-2017: €561 million	Cumulative 2018-2030: €15 900 million 2030 only: €795 million Potential additional benefit from spinoffs 2018-2030: €2 248 million
	Employment contribution	Cumulative 2008-2017: 34 000 job years 2017 only: 7 400 job years Potential additional benefit from spinoffs 2008-2017: 4 700 job years	Cumulative 2018-2030: 72 400 job years 2030 only: 2 800 job years Potential additional benefit from spinoffs 2018-2030: 10 900 job years

Other studies, such as the LGI and IHS Market study (2020)⁶⁰, highlight the spill-over effects of ITER: For example, the development of superconducting electromagnets by ASG superconductors for ITER has significantly advanced technologies applicable beyond fusion, including medical diagnostics, semiconductors, electronics, and defence. In the context of the mid-term evaluation, respondents confirmed that the F4E contracts

⁵⁹ [Study on the impact of the ITER activities in the EU - Trinomics](#)

⁶⁰ [Follow up study on the economic benefits of ITER and BA projects to EU industry - Publications Office of the EU \(europa.eu\)](#)

had significantly enhanced their technical and organisational expertise. Working on ITER has also contributed to scientific innovation, the development of new technologies and, to a lesser extent, patenting. In the period 2020-2024, some European enterprises that have developed an expertise through their participation in ITER have been able to conquer new markets such as one of the suppliers of the vacuum vessel, which won a contract with the most advanced fusion start-up in the US, the Commonwealth Fusion Systems⁶¹. 39 concrete applications,⁶² describing some successful capitalisations of the activities carried out either in the nuclear field or in other sectors (hydrogen, tire industry, mobile machinery, etc.) and resulting from the participation of the European companies in ITER have been listed by F4E and EUROfusion. The aim of this list is to promote the portfolio of technologies developed by F4E by making them it widely available and commercially viable. Although it is difficult to estimate the exact economic impact of these examples, it is expected that the scientific and economic benefits will be more important in the future.

Most of the companies that responded to the survey launched by the contractors confirmed the positive impact of their participation in F4E-managed procurement on their know-how and skills. This participation has even helped them to retain staff (Figure 21.1), gain in credibility or establish new international collaborations (Figure 21.2) but has not been as conclusive in terms of profitability and economic benefits (Figure 21.3). This point deserves attention and F4E should adapt the conditions under which it operates. Procurements should continue to attract EU suppliers who need to maintain an appetite for fusion.

⁶¹ [Commonwealth Fusion Systems reaches tech milestone \(axios.com\)](https://www.axios.com/2024/04/11/commonwealth-fusion-systems-reaches-tech-milestone/)

⁶² <https://fusion-technology-transfer.europa.eu/fusion-technology-portfolio/>

Figure 21.1- Question from contractor survey - LEARNING BENEFITS. To what extent do you agree with the following statements? Thanks to the engagement with F4E, my organisation was able to... (respondents=53; organisations=45)

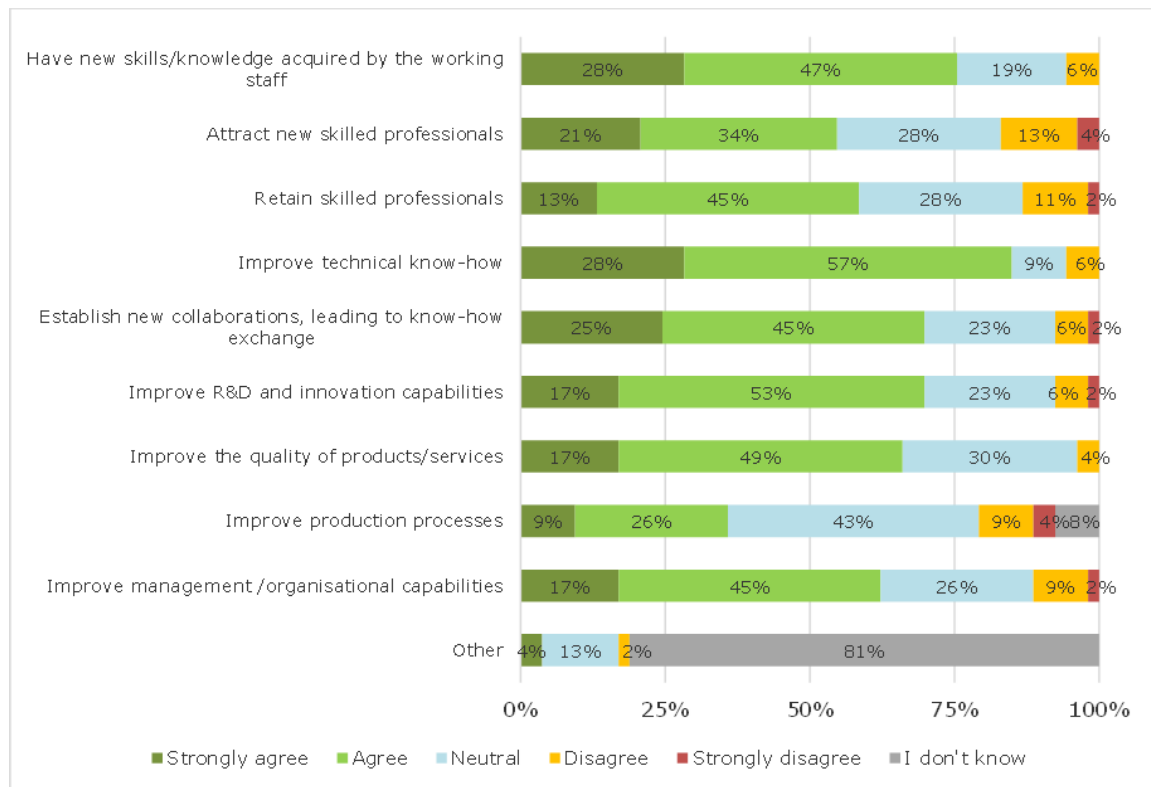


Figure 21.2- Q12. OPPORTUNITIES. To what extent do you agree with the following statements? Thanks to the engagement with F4E, my organisation was able to... (respondents=53; organisations=45)

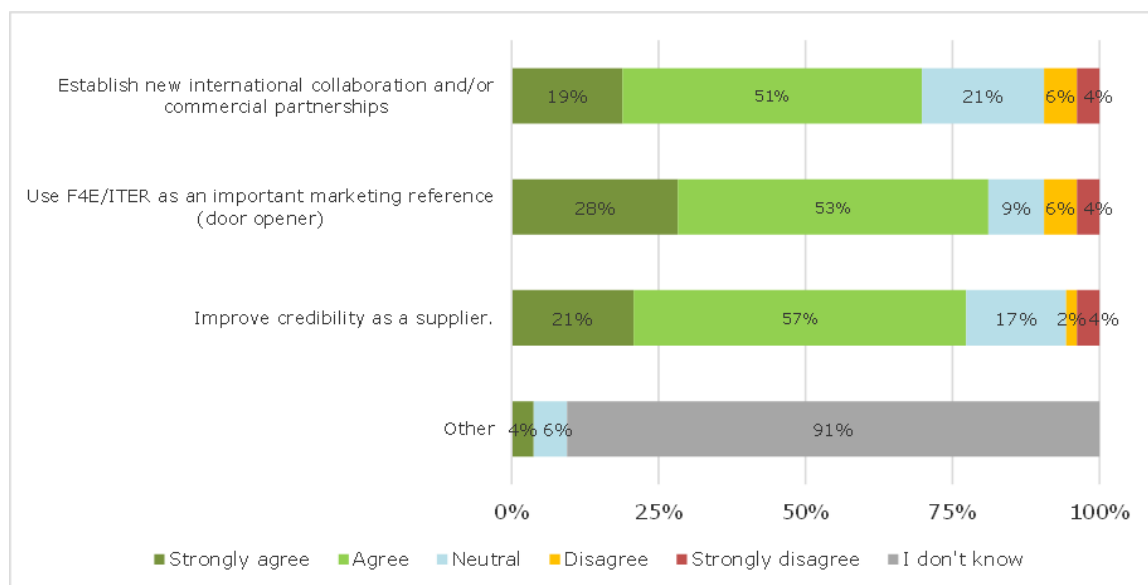
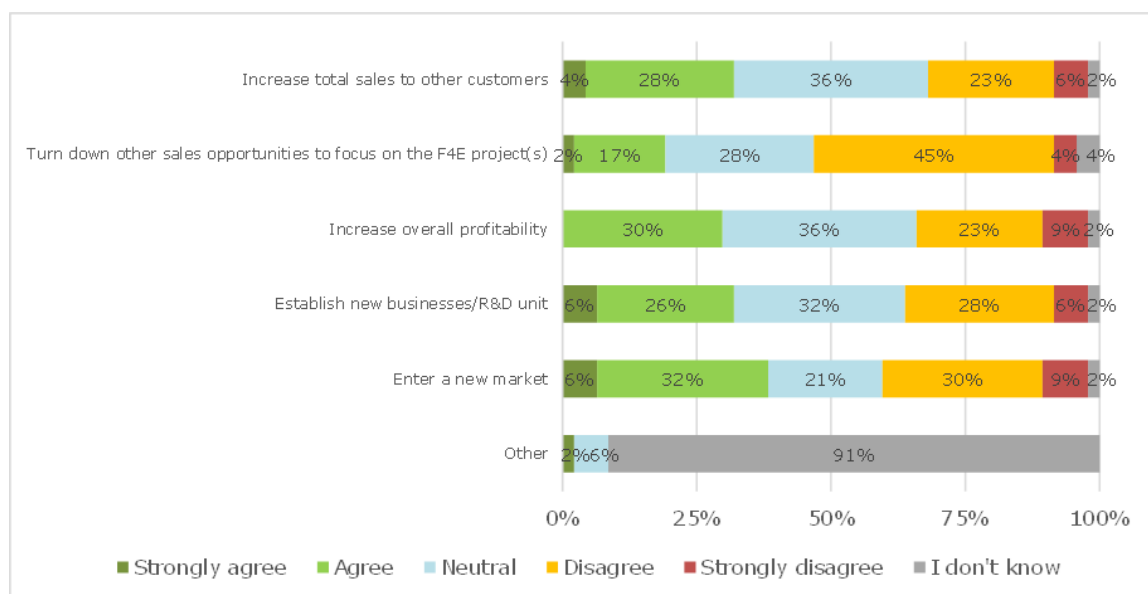


Figure 21.3- Q11. ECONOMIC BENEFITS. To what extent do you agree with the following statements? Thanks to the engagement with F4E, my organisation was able to... (respondents=47; organisations=40)



To ensure that ITER continues to bring benefits to the EU, it is necessary to ensure the development of an effective supply chain and an efficient management of technology development. This will be done not only by improving access to and exploitation of intellectual property, but also through technology transfer and the technology development programme.

The EU supply chain: Thanks to the ITER project, an EU industrial fusion ecosystem has gradually emerged. F4E has been able to develop an extensive knowledge of the actors in the EU fusion supply chain by mapping its contractors, when preparing its procurement procedures. As the new F4E Director has placed the development and consolidation of a European fusion supply chain at the heart of the revised industrial policy, F4E should continue its efforts to map all relevant actors and their respective

capabilities and encourage the development of clusters, as this is the case in other sectors such as the aerospace and the microelectronics

It is noteworthy that the EU ecosystem has only recently started to structure itself: three dedicated European associations were created in June 2024, aiming to play a role similar to that of the Fusion Industry Association (US), which remains the only global association to date, representing members from different countries (including European start-ups) and providing information on the sector (fundings, challenges...). The European associations differ in their objectives and nature: The European Fusion Business Association (EFBA), made up of representatives of the F4E Member States, the Industrial Liaison Officers,⁶³ - who raise awareness of funding schemes and ways to get involved in the ITER project - has called for an open meeting with all interested companies to discuss the role and representation of the European industry in the future European fusion framework. The association is industry-led and works in close collaboration with all stakeholders in the fusion landscape. The European Fusion Association (EFA)⁶⁴ founded by leading companies aims to accelerate the industrialisation of fusion energy by moving from the laboratory to track. Finally, Pro-Fusion⁶⁵ is the central body representing German industry in the field of commercial fusion energy and will address challenges of shaping public opinion, engaging political stakeholders and adapting regulatory frameworks.

To further complete the European supply chain landscape, it would be desirable to identify or to make emerged one or more stakeholder(s), who would act as an integrator of the whole supply chain, capable of coordinating the construction and operation of a future tokamak and/or reactor. According to many stakeholders involved in the contractor's study (e.g. F4E, survey, focus group), it is key to identify an industrial partner in the short term for DEMO, the prototype fusion nuclear power plant project and for the construction of fusion reactors in Europe in the long term.

The development of a supply chain is intrinsically linked to knowledge sharing, which raises the issue of the reciprocity principle with non-EU parties. F4E is currently the gateway to access knowledge generated by EU companies within the ITER project. Without being able to guarantee that the access will be granted, F4E provides a link between the owners of Intellectual Property (IP) and the entities that may request access to it. As with the other DAs, F4E contractors are in most cases IP owners but they grant F4E certain rights over the technology (to use, to authorise the use, etc.). So far, F4E only has access to IP from its own contracts (and not from IO and other DA contracts). The ITER agreement's Intellectual Property framework requires reciprocal-access to IP by all parties, but the DAs decided to assign IP ownership to their contractors. This has led to the under-reporting of IP generated in relation to ITER: the IO intellectual property database, which was intended to centralise background declarations, generated IP declarations, publications, and licences by all DAs, has not functioned as originally defined.

The development of a supply chain also depends on the technology transfer, which is necessary to secure the socio-economic benefits of the project. The Technology Transfer Programme implemented by F4E seeks to lay the foundations for a structured and

⁶³ <https://fusionforenergy.europa.eu/get-involved/>

⁶⁴ Alsymex (France), ASG (Italy), Assystem (France), Bruker EAS (Germany), Demaco (Netherlands), Gauss Fusion (Europe), IDOM (Spain), Simic (Italy), Subra (Denmark), Thales (France), Trumpf (Germany).
<https://www.assystem.com/en/news/establishment-of-a-european-fusion-association/>

⁶⁵ <https://www.bilfinger.com/en/news/press-releases/details/german-fusion-industry-positions-itself-for-fusion-pro-fusion-association-founded/> The founding board members are Heike Freund (Marvel Fusion), Markus Kind (Rolf Kind), Ulli Kraft (FILO), Ulf Thiele (Thiele Techn. & Mgmt.), Hannes Vogel (Proxima Fusion) and Wolfgang Walter (Bilfinger).

sustainable innovation ecosystem by promoting the creation of new businesses based on the commercial exploitation of fusion breakthroughs in new markets. The cross-fertilisation between fusion and non-fusion environments will thus be translated into innovative products and/or manufacturing processes. For the period 2020-2023, the cooperation with EUROfusion is based on the will of both Parties to share information and support each other. However, both the F4E's and EUROfusion's Technology Transfer⁶⁶ Programmes have been managed independently, although with the same objectives. The alignment of technology transfer activities between the two parties should continue until the end of the next MFF and beyond.

While this information shows that F4E has undertaken a strong action to support technology transfer and the creation of new products, services and spin-offs based on the contracts and grants funded, the economic impact of these actions is difficult to assess in the context of this evaluation due to the lack of data on economic indicators (e.g. turnover generated).

International competition is characterised by the race for patents and funding:

Supporting research and its early collaboration with industry is important to continue the competition with other international countries (mainly the US and China). The aim is to keep the promise of demonstrating the feasibility of fusion in the perspective of potentially producing an abundant source of clean energy capable of decarbonising the EU economy. Despite the significant technological advantages associated with ITER in the EU, China and the US are moving ahead faster, building on ITER progress and other initiatives, stimulated by an impressive increase in funding for the start-ups and ambitious national programmes. According to the Fusion Industry Association, the fusion industry (consisting mainly of US companies) has attracted more than \$7.1 billion in investment by mid-2024⁶⁷ (mainly private) and a growing number of private companies declared that they think the first fusion plant will deliver electricity to the grid before 2035. Over the last decades, the EU share of patents has declined and China, with its massive investments, has taken the lead in the race for patents. The fact that the EU has funded ITER components that typically do not generate patents (such as the buildings) explains to some extent why the EU has lost ground to these competitors. It remains to be seen how the next components to be delivered can generate more patents and technologies and whether the EU is still strategically positioned in its investments. It appears that the EU no longer has a clear technological lead in fusion. In addition, China has recently stepped up its efforts and could now “be spending \$1.5 bn each year on fusion, almost double what the US government allocated this year for this research”⁶⁸. China also launched a national consortium in January 2024 to build a nuclear fusion reactor by 2035⁶⁹. This programme raises questions about the expected articulation with ITER and the cooperation with other partners such as the EU.

Figure 22. Nuclear fusion patents' shares⁷⁰

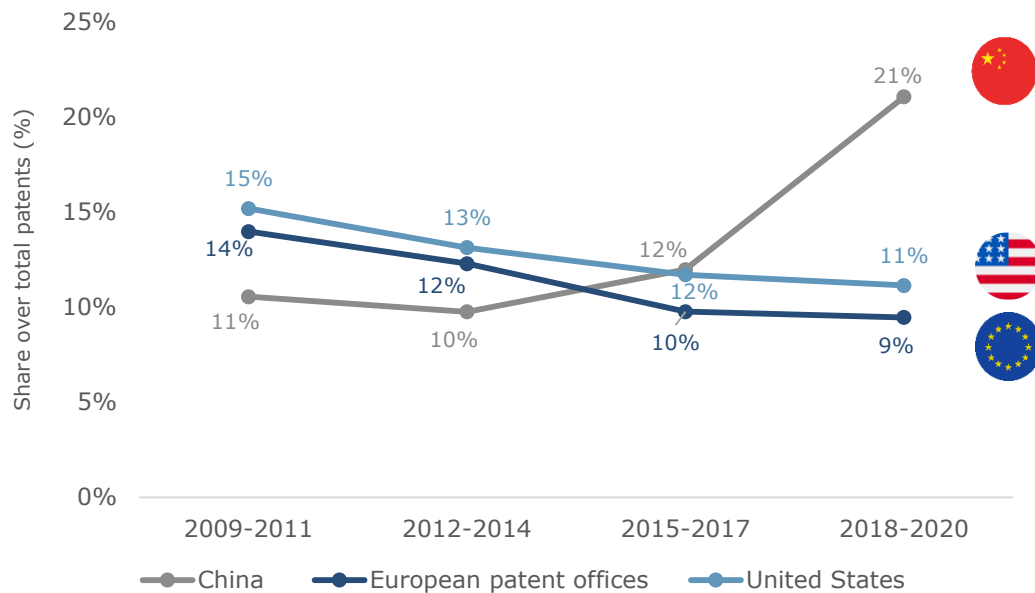
⁶⁶ <http://techtransfer.euro-fusion.eu/>

⁶⁷ <https://www.fusionindustryassociation.org/fia-launches-2024-global-fusion-industry-report/>

⁶⁸ Inside China's race to lead the world in nuclear fusion (nature.com): https://www.nature.com/articles/d41586-024-02759-x?utm_campaign=nature&utm_medium=Social&utm_source=Twitter&mc_cid=fc9d5a2010#Echobox=172485496

⁶⁹ <https://www.ans.org/news/article-5668/china-launches-fusion-consortium-to-build-artificial-sun/>

⁷⁰ Note: "European patent offices" include the patent offices of individual Member States plus the European Patent Organisation, which includes all EU Member and other European countries such as Turkey, and the UK. The Patent Cooperation Treaty accounted for an average of 10% of patents. Japan and Korea also hold important shares (typically 8-12% each)



Source: CSIL-GAC elaboration based on OECD PATSTAT data. Data corresponds to the offices granting the patents.

The contractor's study confirms the need to maintain the skills acquired in the design, development and construction of the ITER project in the EU by ensuring a competitive and sustainable European industrial participation in the future fusion market. To achieve this, it is essential to maintain the commitment and interest of both industrial and academic players in the fusion sector, to sustain their activities and to support the capitalisation of knowledge. Indeed, it seems particularly difficult for companies to cope with periods of inactivity between contracts and to maintain their knowledge of the fusion sector if their resources are not rapidly mobilised. In addition, the way in which procurement contracts are structured affects the attractiveness of the fusion sector, as economic actors may consider exiting the fusion sector in order to reallocate resources to more growth-oriented technology sectors, especially in a context characterised by renewed investment in the fission sector (which is a more mature technology than fusion). The absence of a dedicated fusion education programme was also identified as a major risk to the long-term development of the sector. Dedicated education and training programmes should be established to continue to attract the next generation and sustain the fusion value chain. A well-prepared workforce (including in the industrial sector: welding...) is essential to deal effectively with the various aspects of fusion work.

In conclusion, there appears to be a growing risk that the benefits of ITER will be eroded by its ever-increasing costs and delayed implementation. The ongoing efforts of the IO and F4E to optimise costs through re-baselining, reorganisation and integration appear to be more important than ever. In parallel, efforts should be made to provide European high-tech industries and small and medium-sized enterprises with a valuable opportunity to innovate and develop "spin-off" products for exploitation outside fusion, and to ensure continued EU leadership in the project.

4.3 Is the intervention still coherent with EU policies and relevant?

ITER remains fully aligned and coherent with the long-term objectives of the Commission, in particular the objective to "become the first climate-neutral continent by becoming a modern, resource-efficient economy". Given its multi-dimensional ambition, ITER actively supports the achievement of five Sustainable Development Goals (SDG 7,

SDG8, SDG9, SDG 13, SDG 17)⁷¹: First, ITER is a key project for developing fusion energy, which has the potential to provide a virtually limitless source of clean energy. It contributes to “ensure access to affordable, reliable, sustainable and modern energy for all” **(SDG7)**. Thanks to the number of qualified jobs it creates, it supports “the development of a skilled workforce and promotes sustained, inclusive and sustainable economic growth” **(SDG8)**. Falling under the category of Research and innovation, ITER helps to “Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation” **(SDG 9)**. As ITER contributes to a clean energy transition while boosting jobs and growth in energy and climate, it participates to “Take urgent action to combat climate change and its impacts” **(SDG 13)**. For this MFF, the Commission has considered that 100% of the ITER-related expenditure contributes to the climate effort of the EU budget. ITER contributes indirectly to the implementation of the Net Zero Industry Act, which aims to enhance European manufacturing capacity for net-zero technologies and their key components, addressing barriers to scaling up production in Europe. Finally, ITER is an example of a global partnership involving seven international partners (Euratom, China, India, Japan, South Korea, Russia, and the United States) representing more than half of the world’s population. It contributes to “Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development” **(SDG 17)**.

On the relevance of EU intervention: The Fusion Foresight Study carried out by DG Energy⁷² has mapped the most prominent fusion initiatives in the world⁷³ and drawn up scenarios for future fusion development. In all scenarios, the ITER experiment remains central to further fusion research and initiatives, as it is the only project capable of addressing all technological challenges of fusion in a sustainable way. The new private initiatives expect to demonstrate the possibility of achieving some, but not all, of the conditions. This is the fundamental difference between them and ITER and it explains why the international partners remain committed to sharing the effort to design and build this unique machine. The mid-term evaluation report confirms the interest in and relevance of ITER.

However, ITER seems to be increasingly challenged: leading public fusion initiatives have recently reported significant breakthroughs⁷⁴ in fusion. Some countries (US, KO, China, DE, UK) have developed their own fusion programmes and increased their financial support to public laboratories and/or private companies. Some of the recently created private companies – which have attracted a growing number of private funds - have set ambitious goals to demonstrate rapidly that fusion is a possible commercial energy source. The changed environment necessitates adjustments in policies and practices to guide the efforts of both EU institutions and Member States. There is a consensus, captured in particular in the interviews and events organised by the Commission in 2024, that the approach should move away from considering ITER and other initiatives in a sequential way (i.e. ITER first, then other initiatives) and that the EU should propose an overall strategy for the fusion sector. This point of view is also echoed in the Draghi Report (2024), which states the need to “develop an overarching EU

⁷¹ https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/iter-performance_en#contribution-to-horizontal-priorities

⁷² [Foresight study on the worldwide developments in advancing fusion energy, including the small scale private initiatives - Publications Office of the EU \(europa.eu\)](#)

⁷³ Including the collaboration between the Massachusetts Institute of Technology and the Commonwealth Fusion Systems start-up, and other initiatives in Canada, the United Kingdom and the United States.

⁷⁴ Foresight study on the worldwide developments in advancing fusion energy, including the small scale private initiatives: <https://op.europa.eu/en/publication-detail/-/publication/83bc3ecd-b19c-11ed-8912-01aa75ed71a1/language-en/format-PDF/source-292762830>

innovation strategy for nuclear fusion energy and support the creation of a public-private partnership to promote its rapid, economically viable commercialisation. The partnership should aim to create a stable and predictable ecosystem for industrial innovation, leveraging the ITER project, while ensuring a clear technology development roadmap. The deployment of fusion energy will require public and private investment to act in synergy”. Such strategy is in preparation.

The strategy is prepared on the basis of the conclusions of the ‘Fusion Expert Group’ (FEG), created late 2023, and which was established to support the Commission in ensuring coherence of the Euratom activities for ITER and fusion research. Composed of 25 Members nominated by EU Member States (Cyprus and Luxembourg not represented), and observers coming from F4E and EUROfusion, the FEG is chaired by the Commission.

5 WHAT ARE THE CONCLUSIONS AND LESSONS LEARNED?

The mid-term evaluation, conducted in line with the principles of better regulation, focused on the European contribution to ITER for the period 2020-2023. It has confirmed that the ITER project remains an important part of the EU's energy and innovation policies and can play a decisive role in decarbonising the energy landscape after 2050. Despite delays and the emergence of new initiatives, ITER is central to demonstrating the feasibility of fusion and to meeting the challenges of key enabling technologies (tritium breeding, qualification of materials...) that still need to be developed. The project has already had a positive economic, industrial and social impact and benefits from a positive image among citizens who are aware of it (see Annex 1).

While external factors such as the COVID-19 pandemic and the inflationary context have had a serious impact on the project during the period under review, the main source of difficulties has been structural: An overly ambitious 2016 schedule with no contingency, frequent design changes, underestimation of project risks, unnecessarily complex technical requirements, as well as poor quality control of components that led to a temporary halt in assembly, explain a significant part of the delays and cost overruns. As far as F4E is concerned, some improvements are needed in the management of large industrial contracts and in the cooperation with IOs. The current baseline review should provide an opportunity to put the programme on a sounder footing and ensure that past mistakes are not repeated.

Several measures to improve operational efficiency were identified, such as streamline the reporting to limit administrative burden, and streamline F4E's staff structure. For highly specific components, greater flexibility in procurement is also essential. Many ITER components are not currently available on the market, making their procurement very challenging, especially using standard public procurements.

Although it was not possible to assess the impact of the new baseline on F4E activities (and for the next Multi-annual Financial Framework) in the context of the mid-term review, the measures taken by IO and F4E to get the project back on track, in particular the integration and reorganisation of IO and F4E, should be pursued to ensure that they bear fruit. Without expecting to solve all ITER's problems, integration could help to limit cost overruns by identifying optimisations in the design and scheduling of components. However, the operational integration of staff belonging to different legal entities remains completely unusual for a mega-project such as ITER. Although a secondment agreement has been signed between the IO and F4E to allow the transfer of staff between the

organisations, the fact that the teams are working on two sites with different statutes may contribute to hampering integration in the long term.

It has to be underlined that F4E has a multi-faceted role that other DAs have not: in particular, it has the responsibility to provide a contribution to Broader Approach activities with Japan and to other programmes like DONES which will contribute to the qualification of the materials to be used for ITER. All these involvements multiply the fronts under which F4E operates. One could say that this could lead to a dispersion of resources. It has also allowed F4E to demonstrate its ability to work under different organisational configurations and to contribute to the diversification of its knowledge. For example, for BA, F4E developed solutions in collaboration with the Japanese company in charge of the programme. This collaboration has led to a major technological achievement with the inauguration of the world's most powerful tokamak in December 2023 (with some delays compared to the baseline).

Through its involvement in various projects, F4E has built a unique know-how in Europe in the development of components necessary for a fusion device. It has contributed to and developed a European supply chain. This competence should be better exploited in the pursuit of fusion as a viable future energy source. With IO, F4E should also stimulate its efforts in terms of technology transfer. The issue of technology transfer is essential for the development of the fusion sector in Europe, which has clearly asked the European Commission to develop a strategy that reflects the conclusions of the Draghi report on competitiveness.

For the future, Europe should seek to build components within the ITER project that are much more strategic to the development of fusion than those that have been built so far. This could help Europe to make the most of its contribution to ITER (45% of the cost). In order to stay in the race for patents and research and development, Europe should also invest amounts equivalent to those of its main competitors (China and the USA).

As ITER is facing delays, it is important that Europe diversifies its strategy by offering development opportunities to all actors capable of developing relevant technologies and know-how. In order to further complete the European supply chain landscape, it would be desirable to see the rising of one or more realities acting as an integrator of the whole supply chain, capable of coordinating the construction and operation of a future tokamak and/or reactor, as well as promoting the progress of a prototype fusion power plant. A regulatory framework would enhance the attractiveness of fusion in Europe. The European Commission is therefore working on the preparation of a well-coordinated strategy.

ANNEX I: PROCEDURAL INFORMATION

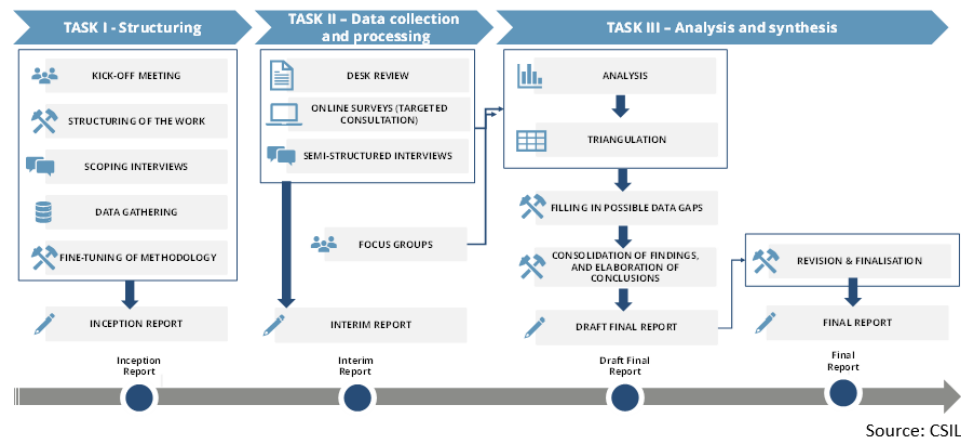
- **Lead DG:** DG Energy (ENER)
- **Exceptions to the Better Regulation guidelines:** None
- **Organisation and timing:**

This evaluation has been steered by DG Energy since December 2023 under the scrutiny of an inter-service steering group (ISSG) consisting of representatives of SG, BUDG, GROW, JRC RTD, and the SJ. In 2024, ISSG meetings took place on 13 March (inception report), 14 June (interim report), and 17 September (Draft final report). The ISG was consulted on the draft report from August to end of September and on the SWD and the report to the European Parliament

- **Evidence used and sources of information:**

The Contractor has based its conclusion on information coming from different sources of documents and tools. These tools are complementary and allowed to collect, process and analyse qualitative and quantitative data for addressing the evaluation questions. The Commission has also launched in parallel a Call for Evidence whose results have been integrated to the contractor's study.

Figure 23. Tasks and activities by task



Data collection: Four main sources of information and data have been used for this report:

- Documentary review (including data provided by F4E)
- Semi-structured interviews with four different groups of stakeholders (EC, F4E staff, IO staff and other external stakeholders)
- Two surveys
- Two online focus groups
- One call for evidence launched in parallel by the Commission.

The evidence from all these sources have been triangulated to generate findings conveyed into this report. During this triangulation phase, the team has also considered insights collected from two events organised respectively by DG RTD and DG ENER and attended by the evaluation team: the High-Level Roundtable on Fusion Innovation held on March 14 and the EU blueprint for fusion energy held on April 23.

Desk research:

Desk research is a central method to collect information for the purposes of evaluation. The desk research involved the systematic assessment and organisation of information pre-existing to the contractor's study.

A wide range of documents of different types were consulted; policy and legal documents, documents internal to F4E and ITER operations, reports, academic literature, and data and documents not available to the public supplied by IO and F4E.

The consultation process (interviews, surveys, focus groups, call for evidence) is described in Annex V.

ANNEX II. METHODOLOGY AND ANALYTICAL MODELS USED

The contractor's study presents the results of the implementation of European participation in ITER and Broader Approach through F4E in line with the requirements of Article 5b of Decision of the Council of the EU establishing F4E. The study has been carried out in accordance with the principles of Better Regulation. The results of the analysis are structured around six evaluation criteria: Relevance, Effectiveness, EU Added Value, Efficiency, Acceptability and Coherence.

Annex 1 details the methodology of the evaluation supporting the study. Annex 3 presents the related evaluation matrix. The methodology defined during the kick-off meeting with the contractor has been respected. The contractor has applied standard practices in terms of triangulation of the information collected from many sources. This has allowed to corroborate the findings.

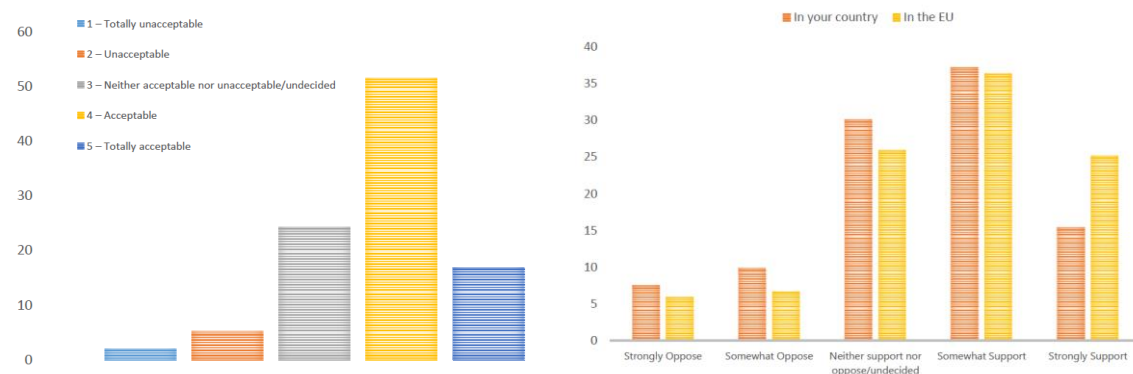
It remains that the assessment to be performed in the framework of this study was challenging, given the unique nature of ITER. ITER is a scientific experiment linked to an international agreement. This adds complexity to the implementation of the expectations initially defined. While it is customary to assess the effects produced by the intervention against a baseline in an evaluation, it appears that in the present case, the 2016 baseline taken to assess the achievements of F4E over the period 2020-2023 appeared as obsolete and overly ambitious. The achievements of ITER project need to be assessed over a very long duration (several decades). Besides, even when one considers only its ITER-related activities, F4E is only one cog in the large, complex machine that is the ITER project. It is therefore difficult to evaluate F4E's performance using ITER's progress as a metric, because the project's progress depends on many organisations of which F4E is only one. F4E's BA-related activities are simpler to analyse as there are only two Parties (Euratom and Japan), but it must be kept in mind that the results seen in the construction and operation of the facilities are not solely under the control of F4E or the EU.

The study could not cover the assessment of the impact of the new baseline for IO and F4E. Indeed, the new baseline was unveiled by IO in June 2024 and the works of the contractors were finalised late July. Additional investigations on the technical feasibility of the baseline and the reliability of the costs are on-going. These works will help Euratom to forge its opinion on the baseline proposed by ITER Organisation and may lead Euratom to ask further amendments of the baseline prior its endorsement at the ITER Council.

Regarding the results of the Call for Evidence, there was an important bias in the respondents (see Annex V). 45 out of the 51 respondents were German citizens and expressed a strong scepticism on the ITER project (security/economic issues, technical and physical challenges) calling for its discontinuation. These opinions are not considered as representative of the public opinion, which has been deeply analysed in a cross-national survey conducted by Oltra et al. in 2019 on a sample of 19970 citizens. As larger, this survey has been used to state in this report that ITER remains acceptable for the public opinion. Indeed, this survey indicates that a majority of the surveyed public was favourable to nuclear fusion technology, with some

heterogeneity between countries. Overall, 36% of respondents considered fusion energy as “important” or “very important”, and 40% as “somewhat important”, with the highest levels of support for fusion energy in Romania, Ukraine, Bulgaria, and Finland (around 80%), and the lowest levels of support in Austria and Belgium (54%). The study also found that support for public investments in the nuclear fusion research programme was also relatively high, with 52% of respondents supporting public investments on fusion in their own country and 61% supporting public investments at the EU level. Support for investments at the national level ranged from 33% in Austria to 68% in Romania. Support for investments in fusion at the EU level ranged from 38% in Austria to 77% in Bulgaria.

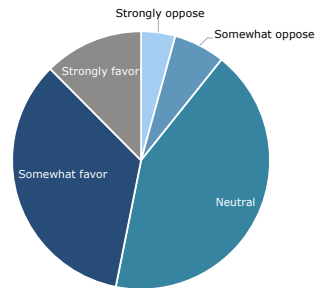
Figure 25. Acceptance of fusion energy (left) and Support for fusion energy research (right) in %, total sample, n=19970)



Source: Oltra, C., Prades, A., Jones, C., Delicado, A., Schmidt, L., Turcanu, C. (2019). Informed Public Attitudes towards Fusion Energy in Europe. EUROFUSION Report, Germany.

Regarding the support to investments in ITER specifically, Oltra et al. (2019) show that the majority of respondents was neutral to positive about the topic. Around 40% of respondents reported a neutral position about investments in ITER, whilst 34% considered themselves somewhat in favour of investments in ITER and 12% totally in favour. Support to investments in ITER ranged from 31% in Belgium to 66% in Bulgaria. Results on the support to ITER are in line with attitudes towards fusion in general.

Figure 26. Support investments in ITER (in %, total sample, n=19970)



Finally, the ITER Agreement mentions that as the Host Party, Euratom may not withdraw from the project. This renders some areas of evaluation, such as the value of continued EU involvement, rather hypothetical. However, the answers to these questions are still valuable as they justify and support other areas of evaluation.

An important verification effort of the quality of the analytical results presented in the evaluation has been undertaken. The study has been extensively reviewed by Euratom, F4E and the representatives of the ISSG. Discussions took place between the contractors and the reviewers in case a statement raised questions. This has led from time to time to corrections on the factual data or wording to be reflect facts more accurately. The work has been done in a very collaborative manner between the different parties involved without impairing the independence of the contractor, who kept its right to accept or not the modifications suggested.

ANNEX III. EVALUATION MATRIX (BY CRITERION)

EFFECTIVENESS			
Sub-questions	Indicators / Descriptors	Judgement criteria	Methodological tools
EQ 1. To what extent have the objectives of the European participation to ITER as stated in Article (2) of F4E's Statutes been achieved so far?			
EQ 1.1 To what extent has F4E delivered its contribution to ITER organisation in accordance with ITER agreement?	- Objectives of European participation to ITER as stated in <i>Article 2 of F4E's Statutes</i> - Activities achieved in relation to what is stated in <i>Article 3 (1) of F4E's Statutes</i> - Independent bodies/stakeholders' assessment of progress made in relation to the objectives and activities stated in the Statutes	- Activities are achieved according to (yearly) targets set in the work programmes - The majority of independent bodies/stakeholders assess progress positively	- Desk research (Statutes, F4E Annual Activity reports, work programmes) - Interviews with stakeholders (representatives of the EC, IO, F4E and EUROfusion) - Targeted consultation with F4E GB and other F4E bodies
EQ 1.2 To what extent has F4E contributed to the implementation of broader approach activities with Japan for the rapid realisation of fusion energy?	- Objectives of European participation to ITER as stated in <i>Article 2 of F4E's Statutes</i> - Activities achieved in relation to what is stated in <i>Article 3 (2) of F4E's Statutes</i> - Independent bodies/stakeholders' assessment of progress made in relation to the objectives and activities stated in the Statutes	- Activities are achieved according to (yearly) targets set in the work programmes - The majority of independent bodies/stakeholders assess progress positively	- Desk research (Statutes, F4E Annual Activity reports, work programmes) - Interviews with stakeholders (representatives of the EC, IO, F4E and EUROfusion) - Targeted consultation with F4E GB and other F4E bodies
EQ 1.2 To what extent has F4E contributed to the programme of activities in preparation for the construction of a demonstration fusion reactor and related facilities?	- Objectives of European participation to ITER as stated in <i>Article 2 of F4E's Statutes</i> - Activities achieved in relation to what is stated in <i>Article 3 (3) of F4E's Statutes</i> - Independent bodies/stakeholders' assessment of progress made in relation to the objectives and activities stated in the Statutes	- Activities are achieved according to (yearly) targets set in the work programmes - The majority of independent bodies/stakeholders assess progress positively	- Desk research (Statutes, F4E Annual Activity reports, work programmes) - Interviews with stakeholders (representatives of the EC, IO, F4E and EUROfusion) - Targeted consultation with F4E GB and other F4E bodies
EQ 2. To what extent the intended milestones of the baseline and other targets foreseen have been met?			
EQ 2.1 To what extent the IC and Governing Board milestones set in the F4E's Single Programming Documents (SPDs) have been achieved?	- Number of achieved milestones as stated in the SPDs, by type ○ ITER Council (IC) milestones ○ Governing Board (GB) milestones - Independent bodies/stakeholders' assessment of progress made in relation to the milestones stated in the SPDs	- Milestones are achieved according to (yearly) targets set in the single programming documents - Key performance indicators are achieved as stated in the F4E dashboard - The majority of independent bodies/stakeholders assess progress positively	- Desk research (SPDs, work programmes, F4E dashboard, F4E Annual Activity reports) - Interviews with stakeholders (representatives of F4E) - Statistical Analysis
EQ 2.2 To what extent additional technical milestones set in the F4E's Single Programming Documents have been achieved?	- Number of achieved milestones as stated in the SPDs by actions - Independent bodies/stakeholders' assessment of progress made in relation to the milestones stated in the SPDs	- Milestones are achieved according to (yearly) targets set in the single programming documents - Key performance indicators are achieved as stated in the F4E dashboard - The majority of independent bodies/stakeholders assess progress positively	- Desk research (SPDs, work programmes, F4E dashboard, F4E Annual Activity reports) - Interviews with stakeholders (representatives of F4E) - Statistical Analysis
EQ 3. What were the main causes of the deviations observed in term of costs, delays, and quality for the delivery of some key components of ITER (e.g.: Buildings, Vacuum Vessels, Magnets or Test Blanket Modules)?			

EQ 3.1 What were the main causes of deviations in terms of costs?	- Planned costs versus actual costs and reasons for deviation - Independent bodies/stakeholders' opinion of causes for deviation	- The actual costs are consistent with the initial estimates or deviations were justified - Issues that caused cost overrun are solved and will not occur anymore because of their nature - Issues that caused cost overrun are not solved but some mitigations actions are ongoing/still possible - Issues that caused cost overrun are not solved/solved but they can occur again in the future	- Desk research (Budget and its amendments, F4E Annual financial accounts, Work Programmes, Annual Activity reports, Project plans, report by the Commission's Internal Audit Service, European Court of Auditors observations) - Interviews with stakeholders (representatives of F4E) - Statistical Analysis (deviation from target)
EQ 3.2 What were the main causes of deviations in terms of time plan?	- Project schedule (planned vs actual) - Independent bodies/stakeholders' opinion of causes for deviation	- The actual schedule is consistent with the initial one or deviations were justified - Issues that caused delays are solved and will not occur anymore because of their nature - Issues that caused delays are not solved but some mitigations actions are ongoing/still possible - Issues that caused delays are not solved/solved but they can occur again in the future	- Desk research (Work Programmes, F4E Annual Activity reports, Project plans, report by the Commission's Internal Audit Service, European Court of Auditors observations) - Interviews with stakeholders (representatives of F4E) - Statistical Analysis (deviation from target)
EQ 3.3 What were the main causes of deviations in terms of quality?	Independent bodies/stakeholders' opinion of causes for deviation	- Deviations in terms of quality were justified - Issues that caused quality for the delivery of some key components are solved and will not occur anymore because of their nature - Issues that caused quality for the delivery of some key components are not solved but some mitigations actions are ongoing/still possible - Issues that caused quality for the delivery of some key components are not solved/solved but they can occur again in the future	- Desk research (Work Programmes, Annual Activity reports, Project plans, report by the Commission's Internal Audit Service, European Court of Auditors observations) - Interviews with stakeholders (representatives of F4E)
EQ 4. How could the planning and scheduling prepared by the IO be improved to ensure a better implementation by the Domestic Agencies (and notably by F4E)?			
EQ 4.1 How could the planning and scheduling prepared by the IO be improved to ensure a better implementation by the Domestic Agencies (and notably by F4E)?	- Main challenges associated to the planning and scheduling prepared by the IO and link to the deviations (EQ 3) - Description of possible measures/strategy to improve planning and scheduling activities as from similar complex projects - Independent bodies/ stakeholders suggestions on how to improve planning and scheduling activities - Evidence of decision-making processes (planning and schedule procedures) adopted by a similar complex organisation	The planning and scheduling activities are adequate to ensure a better implementation by the Domestic Agencies (and notably by F4E)	- Desk research (ITER Organisation Annual reports) - Interviews with stakeholders (representatives of EC DGs, IO and F4E) - Benchmark analysis with a similar complex organisation
EQ 5. Is the performance, monitoring and reporting framework put in place by F4E and the IO relevant and effective for managing European participation in the project?			
EQ 5.1 To what extent is the performance, monitoring and reporting framework relevant and effective for managing European participation in the project?	- Extent to which KPIs are available when needed - Extent to which KPIs are used to steer the European participation to the project - Extent to which the Earned Value Management and	- Integrated Reporting System provides timely results which are easily accessible - Key Performance Indicators reflect effectively how key objectives are being attained	- Desk research (Integrated Reporting System, Integrated Management System, EVM Dashboard, F4E Annual Activity Reports) - Interviews with stakeholders (representatives of EC DGs, IO

	- Estimated Cost at Completion indicators are useful - Independent bodies/stakeholders' assessment of transparency and update of the performance, monitoring and reporting framework	Earned Value Management provides relevant and effective information for managing the EU participation in the project	and F4E)
EQ 5.2 How could this framework be improved to ensure a better achievement of the goals of the ITER project (costs, schedule, quality)?	- Independent bodies/stakeholders' suggestions on how the performance, monitoring and reporting framework could be improved - Measures adopted by a similar complex organisation to guarantee that activities adhere to specified timelines, plans, and standards	- The framework is found relevant and effective for this purpose. - The framework is designed in a similar manner as compared to other complex projects	- Desk research (F4E Annual Activity Reports) - Interviews with stakeholders (representatives of EC DGs, IO and F4E) - Targeted consultation with F4E GB and other F4E bodies - Benchmark analysis with a similar complex organisation
EQ 6. How should the development of the new project baseline contribute to ensuring that F4E is able to achieve its mission?			
EQ 6.1 How should the development of the new project baseline (scope, cost and schedule) contribute to ensuring that F4E is able to achieve its mission?	- Expected effects of a new project baseline - Observed effects of the project baseline adopted in 2016 on the basis of Staged Approach	The new project baseline is found to have a positive effect on the achievement of F4E' mission.	- Desk Research (Commission communications, ICRG report 2016, mid-term progress report 2019, press release) - Interviews with stakeholders (representatives of EC DGs, IO and F4E)
EFFICIENCY AND PROPORTIONALITY			
Sub-questions	Indicators / Descriptors	Judgement criteria	Methodological tools
EQ 7. How efficiently the European contribution to ITER through F4E (in kind and in cash) has been managed so far?			
EQ 7.1 To what extent the European <i>in cash contribution</i> to ITER has been managed efficiently through F4E?	- Planned vs actual in cash contribution vis a vis planned vs actual milestones - Description of procedures (e.g. decision processes, procurements, coordination, etc.) in place to manage EU in cash contribution - Qualitative assessment (perception) of stakeholders regarding the efficient use of EU contribution, in terms of timely delivery and distribution amongst project's priorities - Evidence of how in cash contribution are managed by a similar complex organisation	- The implemented procedures lead to the timely and on budget provision of in-cash contribution - The implemented procedures lead in case of deviation to an efficient allocation based on effective needs	- Desk Research (F4E annual financial statement and budget, annual activity reports) - Interviews with stakeholders (representatives of the EC DGs, other EU institutions, F4E) - Statistical Analysis - Benchmark analysis with a similar complex organisation
EQ 7.2 To what extent the European <i>in-kind contribution</i> to ITER has been efficiently managed through F4E?	- Planned vs actual in-kind contribution vis a vis planned vs actual milestones - Description of procedures (e.g. decision processes, procurements, coordination, etc.) in place to manage EU in-kind contribution - Qualitative assessment (perception) of stakeholders regarding the efficient use of in-kind EU contribution - Evidence of how in kind contribution are managed by a similar complex organisation	- The implemented procedures lead to the timely and on budget provision of in-kind contribution - The implemented procedures lead in case of deviation to an efficient allocation based on effective needs	- Desk Research (F4E annual financial statement and budget, annual activity reports) - Interviews with stakeholders (representatives of the EC DGs, other EU institutions, F4E) - Focus group - Statistical Analysis - Benchmark analysis with a similar complex organisation
EQ 7.3 Which factors have influenced the efficient management of the EU contribution?	Investigate both on internal (e.g. change in the organisation, responsibilities, etc.) and external (e.g. change in legislation, safety regulations, technical requirements, standards and specifications etc) factors	- The organisational changes have positively affected the management of EU contribution - No external factors have negatively affected the management of the EU contribution	- Desk Research (F4E Annual Activity Reports, mid-term progress report 2019, press release) - Interviews with stakeholders (representatives of the EC DGs, other EU institutions, F4E) - Targeted consultation with F4E GB and other F4E bodies

EQ 7.4 How can the financial management of F4E and its decision-making process been improved?	- Qualitative assessment of any inefficiencies/obstacles faced in the financial management and decision making process - Independent bodies/stakeholders' opinion regarding how the financial management can be improved - Evidence of decision-making processes (planning and schedule procedures as well as financial structure) adopted by a similar complex organisation	The implemented procedures are the most effective way to manage resources	- Desk research (F4E Annual Activity Reports, mid-term progress report 2019) - Interviews with stakeholders (representatives of the EC DGs, F4E) - Benchmark analysis with a similar complex organisation
EQ 7.5 Is the mechanism of procurements and grants efficiently implemented considering the ITER objectives?	- Description of the use of grants until today (number, volume and geographical distribution) - Review of procurement and grant processes and procedures - Evidence of procurement procedures adopted by similar complex organisations (e.g. CERN, ESO) - Evidence of collaborations with industries and research organisations fostered by a similar complex organisation	The grants mechanism is sufficiently and appropriately used	- Desk research - Interviews with stakeholders (representatives of the EC DGs, F4E) - Focus group - Statistical Analysis - Targeted consultation with ITER contractors - Benchmark analysis with a similar complex organisation
EQ 8. How efficiently does F4E use the European contribution to ITER to deliver its results?			
EQ 8.1 Can a cost-benefit ratio be assessed or estimated?	- Quantitative assessment of resources (financial and in-kind) deployed to ITER - Quantitative and qualitative assessment of the benefits (e.g. scientific benefits, technological benefits, human resource benefits, outreach benefits). A monetisation of benefits will be attempted for at least a set of benefits	- The benefits are found to exceed the costs - The costs are lower than alternative means of attaining the same benefits - The costs are found to be proportionate to the benefits	- Desk Research (F4E annual financial statement and budget, annual activity reports) - Interviews with stakeholders (representatives of EUROfusion, public authorities, associations, NGOs) - Targeted consultation with F4E GB, other F4E bodies and ITER contractors - Statistical Analysis - Cost-Benefit Analysis
EQ 9. Are the resources (human resources, budget, place of work) entrusted to F4E adequate for achieving its objectives			
EQ 9.1 To what extent are the resources entrusted to F4E adequate to achieve its objectives?	- Resources allocated to F4E in terms of number of people, budget, facilities and their effective allocation (action and related objectives). - Independent bodies/stakeholders' opinion regarding the adequacy of the resources allocated to F4E for the achievement of its objective	The resources allocated to F4E are adequate to achieve its objectives	- Desk Research (F4E annual financial statement and budget, annual activity reports) - Interviews with stakeholders (representatives of the EC DGs, other institutions, F4E) - Targeted consultation with F4E GB and other F4E bodies - Statistical analysis
EQ 9.2 How could the performance in the use of the resources been improved?	- Description of possible measures/strategy to improve the use of resources as from similar complex projects - Independent bodies/ stakeholders suggestions on how the use of resources could be improved - Measures adopted by a similar complex organisation to manage resources (external versus internal) and ensure they are properly used	The use of resources is effectively managed	- Interviews with stakeholders Interviews with stakeholders (representatives of EC DGs, other institutions, F4E) - Targeted consultation with F4E GB and other F4E bodies - Benchmark analysis with a similar complex organisation
EQ 10. To what extent does the integration strategy between the F4E and the IO under development support a better implementation of the ITER programme and the resources made available?			
EQ 10.1 Is the allocation of responsibilities between F4E and the IO adequate in the whole lifecycle of the components delivery (e.g.: design, procurement, manufacturing, installation and assembly)?	- Description of responsibilities entrusted to F4E, IO and domestic agencies - Independent bodies/stakeholders' opinion regarding the adequacy of the allocation of responsibilities between IO	The allocation of responsibilities is adequate to ensure a proper implementation of the ITER programme and an efficient use of resources	- Desk research (ITER agreement, Council Decision 2007/198/Euratom) - Interviews with stakeholders (representatives of IO and F4E) - Targeted consultation with F4E GB and other F4E bodies

and F4E

EQ 10.2 How could the collaboration between F4E and the IO be improved to ensure a more cost-effective implementation of the Programme?	■ Evidence from EQ 11.1 ■ Independent bodies/stakeholders' opinion regarding how this collaboration can be improved to ensure a more cost-effective implementation of the Programme ■ Evidence of measures adopted by a similar complex organisations (e.g. CERN, ESO) to foster internal collaboration and coordination (amongst bodies responsible for different tasks within the organisation)	■ There is room for improving the collaboration between F4E and the IO	■ Interviews with stakeholders (representatives of IO and F4E) ■ Targeted consultation with F4E governing board ■ Benchmark analysis with a similar complex organisation
EQ 10.3 To what extent does the integration strategy being developed between F4E and the IO enable improved collaboration to ensure a more cost-effective implementation of the Program?	■ Evidence from EQ 10.2 ■ Independent bodies/stakeholders' opinion regarding the integration strategy underdevelopment	■ The integration strategy should improve the collaboration between F4E and the IO	■ Desk research (integration strategy) ■ Interviews with stakeholders (representatives of IO and F4E)
Sub-questions	Indicators / Descriptors	Judgement criteria	Methodological tools
EQ 11. To what extent do the original objectives of F4E and the ITER project still correspond to the needs and policies of the EU?			
EQ 11.1 To what extent do the (original) objectives mentioned in F4E's Statutes (still) correspond to the needs and policies of the EU?	■ Objectives of ITER mentioned in F4E's statutes ■ Main current needs and policies (in the area of energy in the EU, as well as other relevant areas) ■ Number of stakeholders agreeing that the objectives are relevant to the needs and policies of the EU	■ The objectives of F4E match the identified current needs and policies of the EU A majority of stakeholders agrees that the objectives are relevant to the needs and policies of the EU	■ Desk research (F4E's statutes) ■ Interviews with stakeholders (representatives of EC DGs and other institutions) ■ Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
EQ 11.2 To what extent are the objectives of ITER relevant to the needs of EU and its policies?	■ Objectives of ITER (other than those mentioned in F4E's statutes) ■ Main current needs and policies (in the area of energy in the EU, as well as other relevant areas) ■ Number of stakeholders agreeing that the objectives are relevant to the needs and policies of the EU	■ The objectives of ITER match the identified current needs and policies of the EU ■ A majority of stakeholders agrees that the objectives are relevant to the needs and policies of the EU	■ Desk research (F4E's statutes, Council Decision 2007/198 and its amendments until Council Decision (Euratom) 2021/281, EU legislation and policies on energy, environment, climate, innovation) ■ Interviews with stakeholders (representatives of EC DGs and other institutions) ■ Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
EQ 12. Does the European participation in the ITER project guarantee an adequate industrial, technological and scientific return to maintain European leadership and competitiveness in nuclear fusion?			
EQ 12.1 To what extent the European participation in the ITER project guarantee an adequate industrial, technological and scientific return to maintain European leadership and competitiveness in nuclear fusion? (linked to EQ19)	■ Evolution of European fusion ecosystem (number of research organisation, companies, clusters) ■ Evolution of the number of publications, patents, major conferences related to nuclear fusion ■ Assessment of the impact of ITER on the technology leadership and ecosystem development (through contracts, grants, in-kind contribution, Education and training) ■ Assessment of whether the European contribution ensure that measures are adopted to guarantee an adequate industrial, technological and scientific return to maintain European leadership and competitiveness in	■ ITER support the technology leadership of European Research organisation and companies ■ Measures are taken to ensure an adequate industrial, technological and scientific return to maintain European leadership and competitiveness in nuclear fusion	■ Desk research (commission communication and other policy documents) ■ Statistical Analysis ■ Interviews with stakeholders (representatives of EC DGs and other institutions) ■ Thematic focus groups ■ Targeted consultation with F4E GB, other F4E bodies, and ITER contractors

EQ 13. To what extent does the Euratom's participation in the ITER project continue to be relevant?

EQ 13.1 To what extent does the Euratom's participation in the ITER project continue to be relevant?	Assessment of whether the European contribution is still deemed to be relevant and for what	The outputs/results of the European contribution to ITER are found to match current technological and scientific advances	- Desk research (commission communication and other policy documents) - Interviews with stakeholders (representatives of EC DGs and other institutions) - Focus group - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
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COHERENCE

Sub-questions	Indicators / Descriptors	Judgement criteria	Methodological tools
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EQ 14. To what extent is the European contribution to and participation in the ITER project coherent with other Commission policies (energy, innovation, climate, environment)?

EQ 14.1 To what extent is the European contribution to and participation in the ITER project coherent with other Commission policies (energy, innovation, climate, environment)?	- Assessing the extent to which overlaps, gaps, contradictions or discrepancies exist with other Commission initiatives - Mapping of Commission's initiatives a) contributing initiatives such as the Roadmap to Fusion Electricity, EUROfusion, Euratom Research and Training Programme, Strategic Energy Technology (SET) Plan, Strategic Transport Research and Innovation Agenda (STRIA), REPowerUE and National energy and climate plans (NECPs) b) initiatives with a potentially contradictable focus such as support of renewable energies and energy efficiency, decentralisation of power sources	Absence of evidence of overlaps, gaps, contradictions or discrepancies with other Commission initiatives	- Policy and legal documents that are the basis for the studied Commission initiatives - Interviews with stakeholders (representatives of EC DGs and other institutions)
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EQ 15. To what extent do the actors involved in fusion and in the ITER project (Commission, F4E, Eurofusion, Member States and the IO) act to avoid duplication of efforts?

EQ 15.1 To what extent do the actors involved in fusion and in the ITER project (Commission, F4E, Eurofusion, Member States and the IO) act to avoid duplication of efforts?	- Mapping of the key actors involved in fusion and in the ITER project and their type of action / responsibilities - Assessing the extent to which ITER project overlaps or duplicate efforts with other actors involved in the fusion area - Qualitative assessment of the measures put in place to ensure communication and synergies amongst the actors involved	Absence of duplication of efforts amongst the actors involved	- Interviews with stakeholders (representatives EC DGs, IO, F4E, EUROfusion) - Targeted stakeholder consultation with F4E GB, other F4E bodies, and ITER contractors
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EQ 16 What is the scope for collaboration between the IO/F4E and the fusion initiatives recently launched (private and public) in the EU Member States?

EQ 16.1 What is the scope for collaboration between the IO/F4E and the fusion initiatives recently launched (private and public) in the EU Member States?	- Mapping of the fusion initiatives recently launched (private and public) in the EU Member States - Number of stakeholders recognising that there is scope for collaboration between IO/F4E and other national initiatives.	A majority of stakeholders recognises that there is scope for collaboration between IO/F4E and other national initiatives.	- Desk Research (e.g Eurofusion website and newsletters, previous studies e.g., European Commission, Directorate-General for Energy, Foresight study on the worldwide developments in advancing fusion energy, including the small scale private initiatives) - Interviews with stakeholders (representatives EC DGs, IO, F4E, EUROfusion, associations) - Focus group - Targeted stakeholder consultation with F4E GB, other F4E bodies, and ITER contractors
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Sub-questions	Indicators / Descriptors	Judgement criteria	Methodological tools
EQ 17. What is the additional value of the EU's intervention (Euratom participation in the ITER project) compared to what could have been achieved by Members States at national level?			
EQ 17.1 What is the additional value of the EU's intervention (Euratom participation in the ITER project) compared to what could have been achieved by Members States at national level?	- Number of stakeholders recognising the EU added value of the Euratom participation in ITER in terms of higher achievements compared to a scenario in which each MS is a single party - Number of stakeholders recognising the EU added value of the Euratom participation in ITER in terms of lower cost and complexity compared to a scenario in which each MS is a single party - Other sources of additional value that has resulted from the EU intervention	- A majority of stakeholders recognise the EU added value of the Euratom participation in ITER in terms of higher achievements - A majority of stakeholders in the IO recognise the EU added value of the Euratom participation in ITER in terms of lower complexity - Other sources of added value are identified	- Desk Research (mid-term progress report 2019) - Mapping of national initiatives (if any) - Interviews with stakeholders (representatives of EC DGs, other institutions, EUROfusion, public authorities, associations, NGOs) - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
EQ 18. What would be the most likely consequences of reducing, deferring, or stopping the existing level of EU participation?			
EQ 18.1 What would be the most likely consequences of reducing, deferring, or stopping the existing level of EU participation?	Stakeholders' opinion on the main consequences of reducing, deferring or stopping EU contribution as from stakeholders' opinion	A majority of stakeholders recognise that there would be negative consequences in reducing, deferring or stopping EU contribution to ITER	- Interviews with stakeholders (representatives of EUROfusion, associations, NGOs) - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
EQ 19 To what extent the ITER Programme (including the way the F4E managed the public procurement procedures) contributed to the maximisation of socio-economic benefits (growth, jobs, innovation, enterprises, SME, skills, industrial policy) to the creation as well as the retention of know-how in Europe?			
EQ 19.1 How did the ITER programme and the way it is managed contribute to the maximisation of socio-economic benefits in Europe?	- Capitalisation on the EQ12 on the technology leadership - Definition of impact pathways - Possibly analyse of the impacts on three scopes: 1 - Impact of ITER fundings (grants, procurement) in terms of CA and jobs, 2- impacts through the exploitation of the technologies, 3- impacts through knowledge and skills capitalisation and dissemination - Stakeholders opinion on the contribution of ITER programme and its management to the maximisation of socio-economic benefits	A majority of stakeholders recognise that ITER programme and the way it is managed contribute to maximise socio-economic benefits	- Interviews with stakeholders (representatives of IO, EUROfusion, public authorities, associations, NGOs) - Thematic focus groups - Statistical Analysis - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
EQ 19.2 How did the ITER programme and the way it is managed contribute to the creation and retention of know-how in Europe?	- Skills and know-how related actions engaged directly through ITER (type, number, beneficiaries) - Articulation between ITER actions and other stakeholders (EUROfusion in particular) to enhance skills and know-how on nuclear fusion - Stakeholders opinion on the contribution of ITER programme and its management to the creation and retention of know-how in Europe	A majority of stakeholders recognise that ITER programme and the way it is managed contribute to the creation and retention of know-how in Europe	- Interviews with stakeholders (representatives of IO, EUROfusion, public authorities, associations, NGOs) - Thematic focus groups - Statistical Analysis - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
ACCEPTABILITY			
Sub-questions	Indicators / Descriptors	Judgement criteria	Methodological tools
EQ 20. To what extent can we observe changes in the perception of Euratom's participation in ITER (positive or negative) by the stakeholders (e.g.: Member States, F4E, IO) and by the general public?			
EQ 20.1 To what extent can we observe changes	Extent to which there is change in the perception of	There is evidence that the perception of	Sentiment Analysis

in the perception of Euratom's participation in ITER (positive or negative) by the targeted stakeholders and by the general public?	- Euratom's participation in ITER among the institutional stakeholders (MS, F4E, IO) - Extent to which we can observe changes in the perception of the general public, including civil society organisations regarding Euratom's participation in ITER	- institutional stakeholders has changed - There is evidence that the perception of civil society organisations has change - There is evidence that the perception of general public has change	- Interviews with stakeholders (IO, F4E, EUROfusion, associations, NGOs) - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors
EQ 20.2 Which actions/measures could be taken to improve the awareness of the general public?	- Description of possible measures/strategy (e.g. open door events, online campaigns, etc.) to improve the awareness of general publics from similar complex projects - Evidence of communication activities/strategy adopted by a similar complex organisation to inform the general public regarding its activities and achievements as well as to foster acceptability by local community	There is evidence that the outreach strategy of the ITER programme can be improved.	- Benchmark analysis with similar complex projects - Desk research (e.g. previous assessment studies, for instance Trinomic 2018) - Interviews with stakeholders (IO, F4E, EUROfusion, associations, NGOs) - Targeted consultation with F4E GB, other F4E bodies, and ITER contractors - Benchmark analysis with a similar complex organisation
EQ 21. What would be the impact (e.g.: on financial resources, on deadlines and on the quality of the components to deliver), in case of a change of scope and nature of F4E's mission?			
EQ 21.1 What would be the impact (e.g.: on financial resources, on deadlines and on the quality of the components to deliver), in case of a change of scope and nature of F4E's mission?	Stakeholders opinion on the impact of the ITER programme – in terms of costs, deadlines quality of components to deliver - in case of a change of scope and nature of F4's mission	- A majority of stakeholders recognise that there will be a positive impact in case of a change of scope and nature of F4E's mission - A majority of stakeholders recognise that the proposed change of scope and nature of F4E's mission will positively affect the perception of Euratom's participation in ITER by the general public	Interviews with stakeholders (IO, F4E, EUROfusion, associations, NGOs)

ANNEX IV. OVERVIEW OF BENEFITS AND COSTS [AND, WHERE RELEVANT, TABLE ON SIMPLIFICATION AND BURDEN REDUCTION]

Table 1. Overview of costs and benefits identified in the evaluation ⁷⁵									
	Citizens/Consumers		Businesses		Administrations		European Commission		
	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	
[Cost or Benefit description]:									
Costs: Direct compliance costs (adjustment costs, administrative costs, regulatory charges) Enforcement costs: (costs associated with activities linked to the implementation of an initiative such as monitoring, inspections and adjudication/litigation) Indirect costs (indirect compliance costs or other indirect costs such as transaction costs) Benefits: Direct benefits (such as improved well being: changes in pollution levels, safety, health, employment; market efficiency) Indirect benefits (such as wider economic benefits, macroeconomic benefits, social impacts, environmental impacts)		Not Applicable	ITER programme is a research programme and does not imply any costs for the citizens and consumers	Not Applicable	ITER is a research programme and does not imply any costs for the businesses.	Not Applicable	ITER is a research programme and does not imply any costs/benefits for the national administrations as Euratom ensures the management of the ITER programme through its contribution to F4E, the European agency.	The Commission has made a huge financial effort to support the implementation of the ITER project. The financial envelope dedicated to the programme for the current MFF amounts to EUR 4.6 bn.	
		Not Applicable	On a long term, the citizens may benefit from a decarbonised source of energy and scientific progress brought by the fusion research.	Not applicable	Industrial companies may apply for the public procurements for the construction of ITER. They develop technologies and know-how that they can resell to other markets.	Not Applicable		ITER has significant contribution to growth as it has created qualified jobs (29700 between 2007 and 2017) and EUR 6164 mn was paid to European companies involved in ITER between 2014 and 2022.	The contribution of ITER to EU policies is multiple (innovation, growth climate change).

⁷⁵ Where there is a prior impact assessment, the table should contain as a minimum the costs/benefits identified in the IA with the information gathered on the actual cost/benefit. As available, the table should include the monetisation (€) of the costs/benefits based on any quantitative translation of the data (time taken, person days, number of records/equipment/staff etc. affected or involved represented in monetary value – see Standard cost model, for example). For all information presented, it should be included in the comments section whether it relates to all Member States or is drawn from a subset. An indication of the robustness of the data should be provided in Annex II on Methodology and analytical models used.

TABLE 2: Simplification and burden reduction (savings already achieved) Report any simplification, burden reduction and cost savings achieved already by the intervention evaluated, including the points of comparison/ where available (e.g. REFIT savings predicted in the IA or other sources).								
	Citizens/Consumers/Workers		Businesses		Administrations		[Other...] _ specify	
	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
Title⁷⁶ [Select among: (i) direct compliance cost savings (for example adjustment cost savings, administrative cost savings, savings from regulatory charges); (ii) enforcement cost savings (for example cost savings associated with activities linked to the implementation of an initiative such as monitoring, inspections and adjudication/litigation); (iii) indirect cost savings (if possible - for example indirect compliance cost savings or other indirect cost savings such as transaction cost savings).								
Type: One-off / recurrent (select)		Not applicable						
PART II: II Potential simplification and burden reduction (savings) Identify further potential simplification and savings that could be achieved with a view to make the initiative more effective and efficient without prejudice to its policy objectives ⁷⁷ .								
	Citizens/Consumers/Workers		Businesses		Administrations		[Other...] _ specify	
	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
Description:...								
Type: One-off / recurrent (select)		Not applicable						

ANNEX V. STAKEHOLDERS CONSULTATION - SYNOPSIS REPORT

Interviews: A total of 32 in-depth interviews involving 41 individuals were conducted with different types of stakeholders, as summarised in the table below. Each interview lasted for about one hour (or one hour and half) and was of a semi-structured nature. The interviews followed list of questions, adapted for the type of stakeholder, yet allowed for exploration of topics outside the list if considered relevant during the interview.

⁷⁶ Each simplification/saving should be included on a separate line.

⁷⁷ This assessment is without prejudice to a possible future Impact Assessment.

Stakeholder group	Number of interviews	Number of interviewees
EC officials	4	7
F4E representatives	10	10
IO representatives	9	12
Other stakeholders (incl. EUROfusion, CEA, EUP, CERN)	9	11

Surveys: A survey was conducted among members of the F4E Governing Board (GB), Technical Advisory Panel and Committees (Administration and Management Committee, Procurement and Contracts Committee, Audit Committee). Another survey was conducted among the enterprises and research organisations that have been involved in Euratom’s in-kind contributions via F4E. The contacts for the two surveys were provided by F4E.

The surveys were launched on Monday, 18th March 2024 and closed on 17th June 2024. The two surveys received a response rate of 46% from members of F4E bodies and 16% from contractors.

The survey for members of F4E bodies achieved a good level of geographic coverage. Responses came from 19 out of 27 countries, resulting in a coverage rate of 70%. The survey for the contractors achieved good geographic representativeness, with responses from organisations in 14 out of 20 countries, resulting in a 70% coverage rate. The geographic distribution aligns with the actual distribution of grants and contracts, with the highest number of responses from French companies (22%), followed by Italy and Spain (18% each), and Germany (13%). Public and private research organisations, universities, and NGOs were also consulted during this survey and constituted 29% of respondents (compared to 18% of the total organisations in the survey sample).

Focus groups: The focus groups were organised to help validate or further elaborate on research findings already partially identified. For this evaluation, two focus groups were organised, each of them involving different stakeholder groups and targeting specific topics, which are briefly presented in the following table. Specifically, 14 people attended the focus group “Building a European leadership in fusion technologies” and 9 attended the focus group “Being involved in ITER: challenges and benefits”.

SECTION	PARTICIPANTS	KEY TOPICS
Being involved in ITER: challenges and benefits	- Industrial and other private companies that have received grants or procurement contracts from F4E - Research organisations that have received grants or procurements.	- Key benefits from receiving ITER grants or procurements; - Difficulties in maximising the socio-economic returns from participating in ITER - Management of grants and procurement

		▪ Comments and suggestions on how to create a European fusion industrial value chain ▪ Interest to maintain the ITER project (what happens if ITER is closed, what if maintained).
Building a European leadership in fusion technologies	▪ ILOs ▪ Members of the F4E governing board ▪ European nuclear fusion projects ▪ Leading research organisation and clusters in the field of nuclear Fusion	▪ Identify key strengths/features for an EU leadership in fusion (including skills and competences). ▪ Benefits from ITER for the European fusion ecosystem and perspectives for the future of European fusion (technologies, skills and competences, etc.) ▪ Contribution of ITER in relation with the other key European initiatives on nuclear fusion and identification of the needs for a further international collaboration. ▪ Explore synergies/complementarities between the actions of the key institutions supporting fusion at a European and MS level)

Call for evidence: The European Commission conducted a public call for evidence to gather feedback on EU's contribution to the ITER project. The consultation was open from 29th July 2024 to 6th September 2024 and attracted 51 responses from a broad range of stakeholders. Responses are available to the public on the Commission's website⁷⁸. These included 42 individual citizens, 4 non-governmental organisations (NGOs), 4 companies, and 1 trade union. Most of the responses were submitted by individuals and organisations based in Germany (45), additional feedback come from Italy (3), France (1), Greece (1), and Slovakia (1).

⁷⁸ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14307-Fusion-for-Energy-joint-undertaking-interim-evaluation_en

Figure 24: Number of respondents by user type and country of residence

