BRIEFING
Requested by the BUDG committee

European Parliament

ITER financing by the EU budget - state-of-play

Introduction[1]

Initiated in 2005 and involving seven global partners (EU -through Euratom-, United States, Russia, Japan, China, South Korea and India), the International Thermonuclear Experimental Reactor (ITER) is a pioneering project to build and operate an experimental facility to demonstrate the scientific viability of fusion[2] as a future sustainable energy source, and help achieve the dream of a world powered not by fossil fuels but by fusion energy, the same process that makes the stars shine.

Since the 1950s fusion machines have grown bigger and more powerful. The ITER machine, when completed, would be the biggest, most powerful fusion device ever devised (a giant, high-tech, doughnut-shaped vessel—known as a tokamak—). Its designers have intended it to be the machine that will finally show that fusion power plants can really be built.

Europe has taken the lead in this project with a 45% stake of the construction costs 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). This cost distribution will change in the operation phase, with Europe providing 34%.

According to a recent article[3], "accumulated schedule slips and budget overruns threaten to make [ITER] the most delayed—and most cost-inflated—science project in history".

1. The overall project "baseline": a moving target with impact

Moving target

According to a 2017 EPRS briefing[4]:

"The 2006 ITER Agreement was signed on the basis of a baseline[5] agreed by the members in 2001, which estimated that building ITER would cost EUR 5.9 billion (in 2008 prices) over a 10-year period, with "first plasma" – the point at which construction is formally completed and the operation phase begins [6] – scheduled for 2016. After the agreement was signed, a design review of ITER completed in June 2008 revised

1 Source: COM(2017)319 and the article referred to in footnote 3.
2 Its purpose is to run high-power fusion experiments using a mixture of the heavy hydrogen isotopes deuterium and tritium; it involves temperatures 10 times higher than that of the sun's core.
3 *World's Largest Fusion Project Is in Big Trouble, New Documents Reveal* (Charles Seife), Scientific American, 15 June 2023. The present note is partly based on this article.
4 https://www.europarl.europa.eu/RegData/etudes/BRIE/2017/608715/EPRS_BRI(2017)608715_EN.pdf
5 "Baseline" refers to the inter-related elements of scope (specifications of the machine to build), schedule (timetable for construction) and projected costs.
6 Under the terms of the ITER Agreement.

Policy Department for Budgetary Affairs
Author: Alix DELASNERIE
Directorate-General for Internal Policies
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the cost estimate upwards to approximately EUR 19 billion and postponed first plasma to 2019, in order to take account of advances in scientific and technical understanding of the technology involved, faster- than-expected price inflation for key raw materials, and unanticipated administrative complexity resulting from the increased number of parties involved (the 2001 baseline assumed that only three parties would participate). Since then, delays and cost overruns that the ITER Organisation attributes to management concerns, and to the highly complex and technical nature of a project with many 'first of a kind' elements, have undermined the 2008 estimate. Therefore, on 27 April 2016, the ITER Council approved an assessment paving the way for another baseline – bringing the estimated cost to approximately EUR 20 billion[7] – and postponing first plasma once more – this time to 2025." In its Communication of 2017 on the "EU contribution to a reformed ITER project"[8], Commission warned that "This schedule does not include contingencies and therefore assumes that all major risks can be mitigated".

ITER timeline as of 2017

2005	Decision to site the project in France
2006	Signature of the ITER Agreement
2007	Formal creation of the ITER Organisation
2007-2009	Land clearing and levelling
2010-2014	Ground support structure and seismic foundations for the tokamak
2012	Nuclear licensing milestone: ITER becomes *une Installation nucléaire de base* (basic nuclear installation) under French law
2014-2021*	Construction of the tokamak building (access for assembly activities in 2019)
2010-2021*	Construction of the ITER plant and auxiliary buildings for first plasma
2008-2021*	Manufacturing of principal first plasma components
2015-2021*	Largest components are transported along the ITER itinerary
2018-2025*	Assembly phase I
2024-2025*	Integrated commissioning phase (commissioning by system starts several years earlier)
Dec 2025*	**First plasma**
2035*	**Deuterium-tritium operation begins**

*Timeline based on an updated overall project schedule presented by the ITER Organisation to the 19th meeting of the ITER Council on 16-17 November 2016.

Source: EPRS briefing on ITER, September 2017

[7] According to the ITER Organisation, 'because multiple members are collaborating to build ITER, each with responsibility for the procurement of in-kind hardware in its own territory with its own currency, a direct conversion of the value estimate for ITER construction into a single currency is not relevant'.

[8] COM(2017)319.

According to an article[9] published in September 2019, around 60 percent of the construction work at ITER had then been completed, and many of the roughly 10 million components needed to assemble ITER were already on site: "Once the facility will be operational, it will need to be carefully tested before it can reach full power. Thus, after the first plasma is produced, which is scheduled for 2025, it will probably take until 2035 to achieve full fusion power. By 2040 the construction of DEMO[10] should start, and the connection to the grid is forecasted for 2060. After that, companies will hopefully take the lead in building fusion power plants, with limited involvement of the research community."

A large proportion of the big components of the machine, however, turned out to be behind schedule by a year or two years or even more, so that ITER's official start of assembly was delayed from 2018 to 2020, then the COVID pandemic slowed manufacturing and shipping of machine components. According to internal documents[11] circulated to the ITER Council in June 2022, the project was 35 months behind schedule.

Some of ITER's components then turned out to be defective and in November 2022 the ITER Organization decided not only to halt assembly of the vacuum vessel, but also to remove the already installed segment for repairs[12].

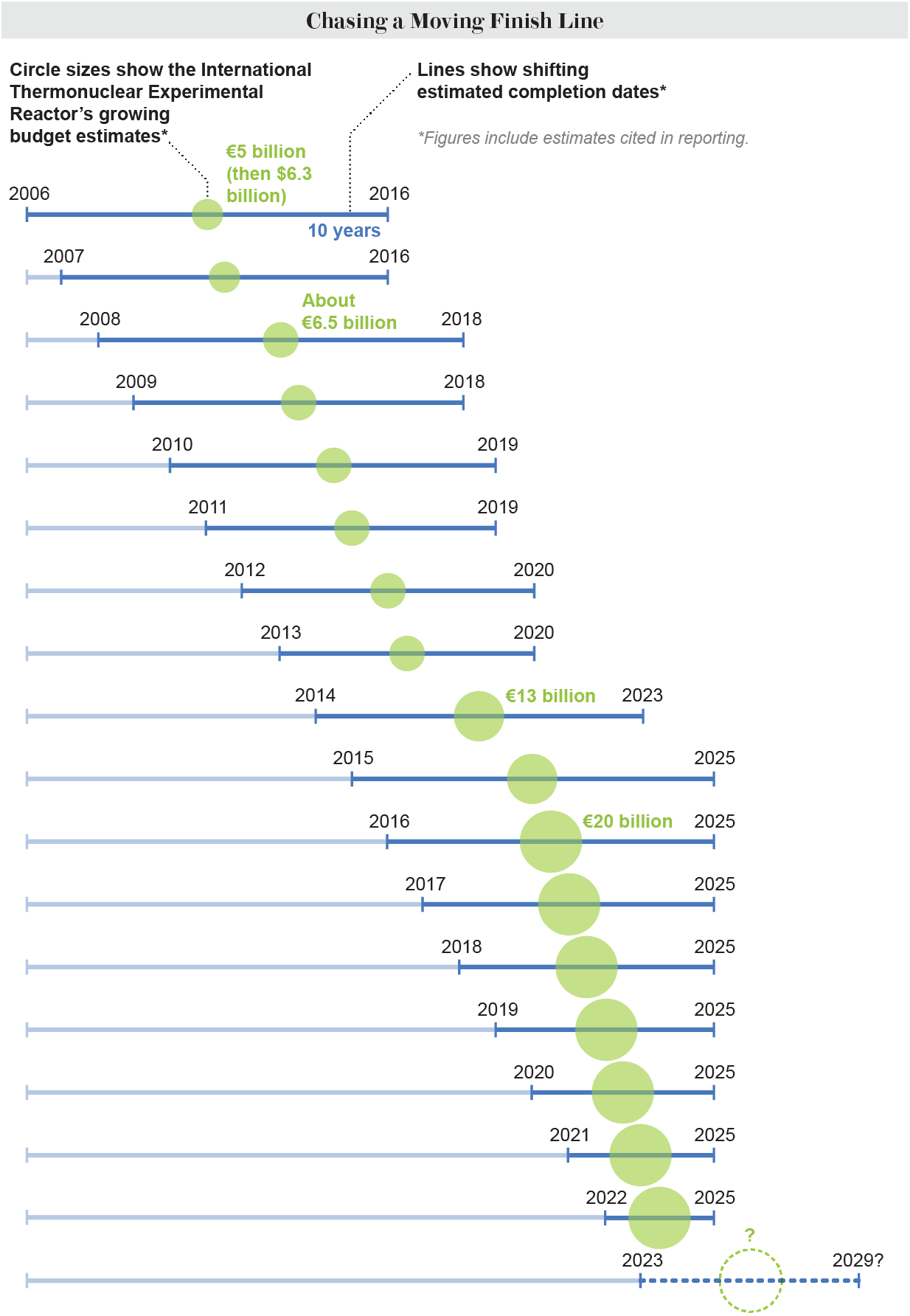
On top of that, in January 2022 the French Nuclear Safety Authority (ASN) put a stop to ITER assembly entirely until ITER can prove that it can keep personnel safe[13]. Mid 2023, ITER's head of communications told a journalist that the situation might be resolved by allowing ITER to run at low power so that the radiation hazard can be mapped and understood more fully before switching over to high-power operations.

Moreover, according to ITER's head of communications, an approximately three-year delay caused by late components and supply chain issues and a roughly two-year delay caused by the defective components won't be additive because many of the problems can be worked out in parallel.

The above-mentioned recent article[14] illustrates (below) the timeline and overall budget for the construction of ITER, arguing: "As early as 2018 the DOE [US Department of Energy]'s undersecretary for science told Congress that the machine was going to cost much more than the then official price tag of $22 billion. ITER officials vigorously disputed this claim, but the as-yet-undisclosed effects of the project's latest setbacks makes it clear, at least, that the final bill will be billions more still."

[9] *The Road to Fusion* (Giulia Pacchioni), Nature magazine, September 2019.
[10] Industrial prototype to convert the fusion energy into electricity and feed it to the electrical grid.
[11] obtained by a journalist after a lawsuit. See: https://www.scientificamerican.com/article/worlds-largest-fusion-project-is-in-big-trouble-new-documents-reveal/
[12] https://www.iter.org/newsline/-/3818.
[13] ASN is unconvinced that, among other issues, the planned amount of radiation shielding around the machine will be adequate.
[14] *World's Largest Fusion Project Is in Big Trouble, New Documents Reveal* (Charles Seife), Scientific American, 15 June 2023.

Figure 1: Construction of ITER: evolution of the timeline and overall budget



Credit: Amanda Montañez; Source: Charles Seife

The latest performance information provided by the Commission indicates that "Work towards achieving first plasma continues to advance, but it has become clear that the milestone of reaching it by 2025 can no longer be achieved."[15]

According to the Commission executability letter for Budget 2024, "a new baseline for the costs of the ITER project, [...] is to be presented to the ITER Council in April 2024".

Impact

In its Communication on the « EU contribution to a reformed ITER project », published on 14 June 2017[16], Commission indicated:

- "ITER's construction involves over 10 million components being built in factories around the world. About 75 % of its investment is spent on the creation of new knowledge and cutting-edge materials and technology. This offers European high-tech industries and SMEs a valuable opportunity to innovate and to develop 'spin off' products for exploitation outside fusion (such as the broader energy sector, aviation and hi-tech instruments like the NMR - nuclear magnetic resonance - scanners)";

-"The Euratom investment in the construction of ITER is bringing important benefits to European industry and research community. Between January 2008 (the start of ITER activities) and December 2016, Fusion for Energy[17] [F4E] has awarded 839 contracts and grants for a value of approximately EUR 3.8 billion spread all over Europe. Some 300 companies including SMEs from about 20 different EU Member States and Switzerland, as well as some 60 research organisations, engaged in cutting-edge R&D, technology, design and manufacture work for ITER components have benefited from this investment on ITER activities. Furthermore, the ITER Organization as well as the Domestic Agencies and industries of other ITER Members have also signed contracts with European industry to support the manufacture of their own components for ITER";

-"As the project evolves new procurements and grants will be awarded in the coming years, not only by Fusion for Energy for the Euratom in-kind contribution[18] but increasingly by the ITER Organization for the assembly and tooling work needed to complete the construction. Overall EUR 1.8 billion is expected to be contracted out by the ITER Organization from now to 2025 particularly in areas like diagnostics, remote handling and heating systems high technology solutions, opening up new opportunities for industries and SMEs in European regions not so far featuring prominently amongst the beneficiaries".

This was acknowledged by the EP in particular in its resolution of 15 January 2019 on the European Joint Undertaking for ITER and the Development of Fusion Energy (2018/2222(INI)), stating that "fusion is already delivering concrete opportunities for industry and is having a positive effect on jobs, economic growth and innovation, with a positive impact beyond the fields of fusion and energy".

The EU budget performance information provided by Commission[19] includes the following:

[15] See: https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/iter-performance_en

[16] COM(2017)319.

[17] Each Member has created a Domestic Agency to fulfil its procurement responsibilities to ITER. These agencies employ their own staff, have their own budget, and contract directly with industry. Fusion for Energy is the EU Domestic Agency.

[18] In kind contribution' refers to the delivery by the ITER Members (through their Domestic Agencies) of all the components necessary to build ITER, including the buildings.

[19] Consulted on 31/10/2023 at: https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/iter-performance_en

Concrete examples of achievements (*)

29 500

annual jobs

were directly or indirectly created by ITER between 2007 and 2019.

529

operational contracts

were signed by the Fusion for Energy Joint Undertaking between 2014 and 2022.

EUR 6 164 million

was paid to European companies

involved in ITER between 2014 and 2022.

(*) Key achievements in the table state which period they relate to. Many come from the implementation of the predecessor programmes under the 2014-2020 multiannual financial framework. This is expected and is due to the multiannual life cycle of EU programmes and the projects they finance, where results often follow only after completion of the programmes.

2. The EU budget contribution

2014-2020 MFF

Commission reports that MFF 2014-2020 EU budget funds for ITER were fully implemented:

Cumulative implementation rate at the end of 2022 (million EUR):

	Implementation	2014-2020 Budget	Implementation rate
Commitments	2 924.6	2 926.4	99.9%
Payments	2 779.9		95.0%

— **More information on the budget implementation**

- The EU budget for the 2014-2020 period was fully implemented in commitments at the end of 2020. The payment plan for the outstanding commitments is aligned with the delivery plan: EUR 232.2 million for 2022 and EUR 150 million for 2023. The other remaining payments will materialise in the following years.

Source: Commission, ITER performance, 2023

2021-2027 MFF

In line with the Commission Communication on the 'EU contribution to a reformed ITER project', the budget of the programme for the 2021-2027 period has almost doubled.

In its above-mentioned resolution of 15 January 2019, the EP regretted "the fact that the Council has not consulted Parliament on [the Commission] proposal and [welcomed] the Commission's stated intention, as part of the State of the Union 2018, to consider 'options for enhanced qualified majority voting and for a

possible reform of the Euratom Treaty", expecting that "such a reform would necessarily lead to co-legislative powers for Parliament".

On 22 February 2021, the Council adopted the Decision on financing the ITER project, setting the indicative EU budget contribution to the project for the period 2021-2027 at "EUR 5.61 billion in current prices."

ITER- EU Budget programming as of 2023 (million EUR):

	2021	2022	2023	2024	2025	2026	2027	Total
Financial programming	864.0	710.1	839.8	556.3	688.8	854.7	665.3	5179.0
NextGenerationEU								
Decommitments made available again	0.0	0.0						
Contributions from other countries and entities	0.6	0.0	p.m.	p.m.	p.m.	p.m.	p.m.	0.6
Total	864.6	710.1	839.8	556.3	688.8	854.7	665.3	5179.7

Source: Commission, ITER performance, 2023

The programming figures in the above table represent, as of 2023, an 8% cut compared to the legal basis (- EUR 435 million)[20] due to "new delays and technical difficulties at the level of the ITER Organization and F4E"[21].

Commission indicated in its replies to EP questions on DAB4/2023 (see below) that EUR 2.8 billion of the total envelope have not yet been committed.

According to WD DB 2024 Part V (Budget implementation and assigned revenue- June 2023)[22], RAL (*Reste-à-liquider*[23]) increased by 9,2% to EUR 1,4 bln in 2022.

The planned payments schedule was as follows according to WD DB 2024 Part XII (June 2023):

Programme	1.0.13	**International Thermonuclear Experimental Reactor (ITER)**

In EUR million

COMMITMENTS									
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**Subsequent years**	**others**
Pre-2023 commitments still outstanding	1.432,6	498,2	533,1	401,4	0,0	0,0	0,0	0,0	0,0
Commitments appropriations made available again and/or carried over from 2022	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Appropriations 2023	832,1	65,3	0,0	150,0	616,8	0,0	0,0	0,0	0,0
Appropriations 2024	548,0	0,0	72,8	0,0	75,2	400,0	0,0	0,0	0,0
Total	**2.812,7**	**563,5**	**605,9**	**551,4**	**692,0**	**400,0**	**0,0**	**0,0**	**0,0**

Commission reports the following implementation rate for overall ITER MFF 2021-2027 EU budget funds:

[20] excluding top-ups pursuant to Article 5 of the MFF from the financial programming.
[21] Source: https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/iter-performance_en#mff-2014-2020--iter
[22] See: https://commission.europa.eu/publications/working-documents-2024_en.
[23] The reste à liquider (RAL or outstanding commitments), is the sum of commitments agreed but that have not yet turned into payments.

Multiannual cumulative implementation rate at the end of 2022 (million EUR):

	Implementation	2021-2027 Budget	Implementation rate
Commitments	1 574.0	5 179.7	30.4%
Payments	436.1		8.4%

Source: Commission, ITER performance, 2023

Transfer requests and a Draft Amending Budget (DAB) to reduce ITER related appropriations were thus submitted to the Budgetary authority in 2022 and 2023.

DEC16/2022, the Global transfer submitted on 5 October 2022, was related to payment appropriations and reduced by EUR 106,7 million the EU budget line 01 04 01 - Construction, operation and exploitation of the ITER facilities - European Joint Undertaking for ITER - and the Development of Fusion Energy.

Commission justified the reduction as follows: "according to the revised estimates established by the Fusion4Energy joint undertaking, the payment needs until the end of 2022 will be lower than initially expected. This is due to a decrease in:

- the contribution to the ITER Organisation in relation to some building construction activities transferred to it that have been delayed (EUR 38,5 million);
- the amount of the Euratom cash contributions to the ITER Organisation for 2023 to be paid in December 2022 (a EUR 22,8 million decrease based on the ITER Organisation's 2023 draft budget); and
- the forecast of ITER delivery contracts, of which some were paid in 2021 (EUR 20 million) and some have been pushed back in time due to delays in the execution of contractors' obligations which affected the progress of activities (EUR 25,4 million)."

DEC07/2023, submitted on 13 April 2023, decreased payment appropriations for 01 03 01 Fusion research and development by EUR 14,8 million. Commission explained that "This budget line is almost fully used for grants to the EUROFUSION consortium. This consortium directs and integrates research across Europe into a comprehensive research and development programme to realise fusion energy, with two main pillars: 1) preparing for ITER experiments, and 2) developing a concept for the future demonstration of a fusion power plant. EUROFUSION is expected to submit costs claims below the level assumed at the time of the preparation of the Draft Budget 2023. This is mostly due to delays in the commissioning of certain research facilities and in the subcontracting with its beneficiaries".

On 11 October 2023, Commission submitted DAB4/2023, proposing to reduce ITER appropriations by EUR 280 million in commitments and EUR 264 million in payments for the year 2023. According to Commission:

"The ITER project experienced increasing difficulties in its implementation in the course of the year, notably due to essential repair needs on some parts. The project is undergoing a full re-baselining exercise whose adoption by the ITER Council is foreseen in November 2024. This situation leads to an important reduction of the needs in 2023".[24]

As of 21 October 2023, the implementation rate of EU budget 2023 appropriations for ITER stood at 65% for commitments and 47% for payments[25].

[24] Further information is available at: https://www.iter.org/doc/www/content/com/Lists/list_items/Attachments/1115/2023_06_IC-32.pdf
[25] Source: Commission weekly report for the third week of October - Ares(2023)7329978.

3. Additional relevant information

In addition to the above-mentioned problems encountered by ITER, the project has been plagued by management and human resources issues, described in a letter addressed by trade unions in the beginning of 2022 to Commissioner Hahn and Commissioner Simson.

The European Parliament discharge resolution of 10 May 2023 concerning ITER[26] underlined that changes in key assumptions for the estimate and risk exposure could lead to significant increases in costs and/or to further delays in the implementation of the ITER project. This resolution also recalled that "in November 2021, the staff of the Joint Undertaking went on strike and that, according to internal and external management assessments and several internal surveys, the main reasons for the deterioration of the working environment at the Joint Undertaking were shortcomings at senior management level, such as non-transparent and dysfunctional decision-making and a lack of social dialogue". The resolution furthermore noted that "the disproportionate use of external staff resources increased challenges and risks" and the "Joint Undertaking has launched several actions to improve the working environment and wellbeing of staff".

Public information regarding performance of the 2021-2027 ITER funding states *inter alia* that:

- "Due to its international nature, whereby Russia is one of the project partners, the ITER project will be impacted by the war in Ukraine. The question of the continuation of Russia's participation is likely to be put on the table due to the expected difficulties for Russia to honour its commitments and the reputational risk for the project";
- "Fusion can be a clean and virtually limitless energy source. The general potential of fusion is nowadays more widely recognised thanks to the strong advancement of fusion science in recent years. ITER is the world's biggest and most intensive fusion project. There are more than a dozen additional fusion research initiatives underway (e.g. a collaboration between the Massachusetts Institute of Technology and the start-up Commonwealth Fusion Systems, and other initiatives in the United States, Canada and the United Kingdom). The fusion foresight study carried out by DG Energy mapped all the initiatives and drew scenarios for future fusion development. In all scenarios the ITER experiment is central for further fusion research and initiatives";
- "The European Commission considers ITER expenditure as 100% relevant to the achievement of the 30% climate spending target of the 2021-2027 multiannual financial framework. The climate contribution from the 2022 commitments was EUR 703.0 million".

[26] 2022/2129(DEC).

Further references

Programme website:

- The Europa site on F4E and ITER (https://ec.europa.eu/energy/topics/technology-and-innovation/fusion-energy-and-iter_en) is a valuable source of information of the ITER project and fusion energy in general.
- The site of the Joint Undertaking F4E (https://fusionforenergy.europa.eu/) presents the activities of the European Union's organisation (Domestic Agency) managing Europe's contribution to ITER.
- The website of the ITER organisation (https://www.iter.org/) provides updated information on the project addressing the needs of the public, the press, scientists and the industry.
- The EUROfusion roadmap (https://www.euro-fusion.org/eurofusion/roadmap/) forms the basis for the programmes of EUROfusion and F4E and provides a structured way forward to commercial electricity from fusion.

Impact assessment:

- The *ex ante* evaluation of ITER was adopted on 7 June 2018: SWD(2018) 325.

Relevant regulation:

- The legal basis is 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.

Evaluations:

- The mid-term progress report in accordance with Article 5b of the Council Decision 2013/791/Euratom has been adopted on 21 March 2019. Seven external studies related to ITER/fusion were conducted between 2018 and 2023. They are available at: https://energy.ec.europa.eu/studies/final-studies_en?f%5B0%5D=topics_topics%3A72).
- The *exante* evaluation of ITER was adopted on 7 June 2018: SWD(2018) 325.

Administrator responsible: Alix DELASNERIE Editorial assistant: Adrienn BORKA
Contact: Poldep-Budg@ep.europa.eu

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