Briefing

How the EU budget is spent

September 2017

European Parliament

ITER

In a nutshell

The International Thermonuclear Experimental Reactor (ITER) project is a major global collaborative scientific experiment aimed at demonstrating the feasibility of nuclear fusion as an unlimited and relatively clean source of energy. The EU Member States participate by virtue of their membership of Euratom. Work on the site in France (Cadarache) began in 2007, but since then the expected final cost and year of completion have twice been revised upwards. It is now hoped that 'first plasma', the point at which the ITER device is deemed operational, will be achieved by 2025.

EU's Multiannual Financial Framework (MFF) heading and policy area

Heading 1a (Competitiveness for growth and jobs)

Energy; research and innovation

2014-20 financial envelope (in current prices and as % of total MFF)

Commitments: €2 985.62 million (0.27 %)

2016 budget (in current prices and as % of total EU budget)

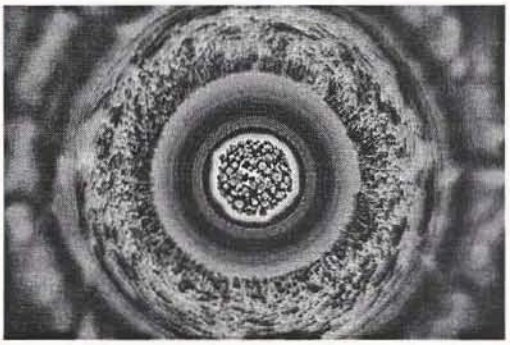
Commitments: €330.12 million (0.21 %)
Payments: €474.60 million (0.33 %)

2017 budget (in current prices and as % of total EU budget)

Commitments: €322.71 million (0.20 %)
Payments: €426.34 million (0.32 %)

Methods of implementation

Indirect management (Fusion for Energy agency, a joint undertaking of Euratom, Euratom's Member States, and Switzerland)



In this briefing:

- EU role in the policy area: legal basis
- ITER's objectives
- Funded actions
- Assessment of ITER
- Other EU programmes and action in the same field

EPRS | European Parliamentary Research Service

Author: Matthew Parry

Members' Research Service

PE 608.715

EN

EU role in the policy area: legal basis

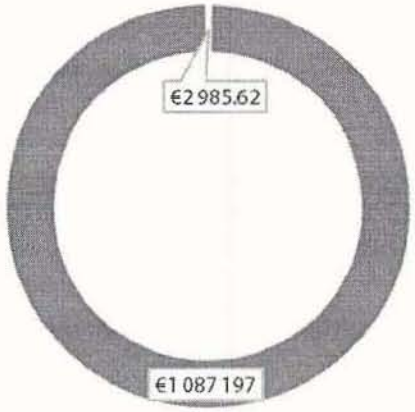
The ITER project is based on the ITER Agreement, which was signed on 21 November 2006 by the seven ITER members: China, India, Japan, Korea, Russia, the United States and the European Union. The EU Member States participate in the ITER project to build an international thermonuclear experimental reactor by virtue of their membership of the European Atomic Energy Community (Euratom). Euratom, while legally distinct from the European Union, is represented by the European Commission and was established in 1957 alongside the EU's forerunner, the European Economic Community, to advance research into the safety and viability of nuclear power.[1] Euratom Member States' participation in ITER takes the form of a Barcelona-based agency called Fusion for Energy (F4E), a joint undertaking based on Chapter 5 on joint undertakings of the Euratom Treaty, in particular Articles 47 and 48. F4E is Euratom's 'domestic agency', and is the analogue of the domestic agencies of the other six international ITER partners.

The Euratom Member States have a unique role and special responsibility in the project, since the EU hosts the project in France. Consequently, under the ITER Agreement, Euratom cannot withdraw from the agreement. Switzerland has participated in Euratom programmes as an associated state since 2014, the only non-EU member state with this status.[2] In addition, the Joint Comprehensive Plan of Action agreed between Iran, the EU and the five permanent members of the United Nations Security Council provides scope for a scientific cooperation agreement between Iran and the ITER Organisation, though this project has been put on hold for the moment.[3]

ITER's objectives

ITER is a joint international attempt to demonstrate the feasibility of fusion as a sustainable and economically viable energy source by constructing an experimental tokamak[4] nuclear fusion device in Cadarache (Saint-Paul-lès-Durance), in southern France. It is one of the world's largest international research projects, bringing together as financial contributors the Euratom Member States, Switzerland as an associate state to Euratom, China, India, Japan, Korea, Russia and the United States. Once ITER has reached completion – on the current schedule by late 2025 – work will begin on moving from first plasma (FP) to full performance operation using deuterium-tritium fuel (referred to as the deuterium-tritium or DT phase), currently scheduled for 2035. This in turn will pave the way for construction of DEMO, a prototype fusion reactor. To date, the world record for fusion power generation is held by the UK-based European tokamak Joint European Torus (JET), currently the world's largest operational magnetic confinement plasma physics

EU budget contribution to ITER as a share of the 2014-2020 MFF
(€ million in current prices)



Source: European Commission

experiment. While JET has produced a quantity of 16 MW of fusion power from a total input power of 24 MW (i.e. 0.67 MW of output per MW of input, or Q=0.67), ITER is designed to produce 500 MW of output thermal power compared to 50 MW of input thermal power required to heat the plasma, which means an amplification factor of Q=10. It is hoped that once ITER has demonstrated the feasibility of fusion energy, and DEMO has demonstrated its potential for industrial and commercial exploitation, it will be possible to generate fusion-sourced electricity by 2050.

The origin of the project is a 1985 political initiative by the United States and the then-USSR to cooperate on a major scientific experiment beyond the capacity of any one country, but of potentially global benefit; however, it was only in 2006 that the ITER agreement was signed between Euratom and the other six international parties, taking effect in 2007 and establishing the ITER Organisation. Since then, the timeline and cost estimates ('baselines') have twice been revised upwards: in 2010 and 2016 (see Funded Actions below).

ITER timeline (current baseline)

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: ITER Organisation.

Euratom and the other ITER members are contributing to the ITER project both in cash payments and in kind in the form of procurement of the components used to build ITER. From the European Commission's perspective, a secondary objective of ITER is to support European industry and research and development, including small and medium-sized enterprises, which F4E will depend on to manufacture the cutting-edge components that Euratom has agreed to contribute in kind.

The United Kingdom, Euratom and ITER after Brexit

It is not yet known whether the United Kingdom will continue to participate in the ITER project once it has left the European Union, and if so whether it will do so through Euratom or as an independent member of the ITER Organisation. The Article 50 letter sent by the UK government triggering the withdrawal process also announced the United Kingdom's intention to withdraw from Euratom; however, a subsequent UK government negotiating position paper on nuclear materials and safeguards expressed a desire for a 'close and effective relationship' with Euratom, including collaboration on nuclear research and development. One possibility may be some form of 'associate state' participation in Euratom research comparable to Switzerland's, though there is some debate about the concomitant legal obligations this might entail. Alternatively, the United Kingdom may wish to participate independently as an eighth ITER member, subject to the unanimous approval of the current seven members, including Euratom.

Funded actions

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 €5.9 billion (2008 prices) over a 10-year period, with first plasma – the point at which construction is formally completed and the operation phase begins – scheduled for 2016. After the agreement was signed, a design review of ITER completed in June 2008 revised the cost estimate upwards to approximately €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 €20 billion[6] – and postponing first plasma once more – this time to 2025.

ITER members contribute to the project both in cash and in kind, with the latter provided through amounts budgeted for procurement of components needed for the project's construction, assembly and operations. In addition, each ITER member is responsible for administering its participation via a 'domestic agency' (F4E is Euratom's domestic agency) and is responsible for the agency's budget. Euratom leads the project with a 45 % stake in construction costs, with 80 % of this amount covered by the EU budget and the remaining 20 % covered by France, reflecting its special status as host state for the ITER construction site. The other six international ITER partners contribute approximately 9 % each. On 14 June 2017, the European Commission published a communication updating the figures for Euratom's contribution – coming primarily from the EU budget, with minor supplementary contributions from France and from the F4E members[7] for the agency's administration – through to 2025.

Scheduled Euratom contributions to ITER, 2007-2020+ by source, € billion (2016 baseline)

	Up to the end of the current MFF period		To first plasma	From first plasma to DT		
	2007-2013	2014-2020	2021-2025	2026-2027	2028-2035	Total after 2020
EU budget	**3.36**	**2.96**	**4.56**	**1.51**	**2.58**	**8.6**
France	0.52	0.84	0.95	0.3	0.5	1.7
F4E members	0.02	0.03	0.03	0.01	0.06	0.1
Totals	**3.9**	**3.8**	**5.5**	**1.8**	**3.1**	**10.4**

Source: European Commission staff working document 'The ITER Project Status', 14 June 2017.

Scheduled Euratom contributions to ITER (IO), 2007-2020+ by cost, € billion (2016 baseline)

	Up to the end of the current MFF period		To FP	From FP to DT		
	2007-2013	2014-2020	2021-2025	2026-2027	2028-2035	Total after 2020
F4E total cash to IO	3.5	1.1	1.5	0.7	1.6	3.8
construction		*1.1*	*1.4*	*0.4*	*0.4*	*2.2*
operations		*0.0*	*0.1*	*0.3*	*1.2*	*1.6*
F4E in kind contribution		2.5	3.1	0.8	0.7	4.6
F4E admin.		0.4	0.3	0.1	0.6	1.0
F4E other activities		0.1	0.5	0.2	0.1	0.8
EC project admin.		0.07	0.05	0.02	0.08	0.15
Totals	**3.5***	**4.2***	**5.5**	**1.8**	**3.1**	**10.4**

Source: European Commission Communication 'EU Contribution to a Reformed ITER Project', 14 June 2017.

*Project delays meant it was not possible to use F4E commitment appropriations for the period 2007-2013 in full, so appropriations initially committed for 2007-2013 were cancelled and re-appropriated to the following financial period.

As of December 2016, Fusion for Energy had awarded 839 contracts and grants worth some €3.8 billion across Europe since January 2008, when construction of ITER began. This investment has benefited around 300 companies and 60 research organisations in 20 EU Member States and Switzerland. So far, of the 39 buildings planned on the 42-hectare ITER site, the tokamak complex and a number of other elements are currently being built, while an assembly hall, cleaning facility and site services building have already been completed.

Assessment of ITER

ITER has attracted criticism in the wake of successive upward revisions by the ITER Organisation of the projected cost of the project, as well as delays in the expected dates of operational milestones. The ITER Organisation has attributed this to a series of complicating factors: the sheer complexity and technical nature of a large-scale and

ground-breaking scientific experiment involving many first-of-a-kind technological components; faster-than-expected price inflation of some of the raw materials needed to build ITER; more stringent safety requirements following the Fukushima incident; management failures, including slow decision-making in the ITER Organisation; and lack of coordination between domestic agencies and the ITER Organisation.

A 2013 management assessment of the ITER Organisation found there was a 'lack of strong project management culture inside the [organisation]' and deemed the ITER Council-approved baseline in use at the time unrealistic. The assessment recommended that project management and communication be improved, and the director-general replaced. In response, the ITER Council nominated the current director-general, Bernard Bigot, who took over on 5 March 2015, and presented an action plan to the ITER Council promising a 'fundamental restructuring' of the ITER Organisation and its relationship with the seven ITER Members' domestic agencies. In addition, a reserve fund has been set up to cover additional costs entailed by design changes approved by the ITER Organisation.

European Court of Auditors (ECA) audits of the F4E annual accounts, including the most recent report on the 2015 financial year published in November 2016, have consistently resulted in an 'unqualified' statement of assurance since 2007, confirming their legality and regularity. Nevertheless, the ECA underlined in an October 2015 report that steps had to be taken to curtail continuous cost increases, and in April 2016 the European Parliament postponed a decision on discharge of F4E for the financial year 2014, before ultimately granting it in October 2016 following revision of the baseline. Changes at the top of the ITER Organisation have been reflected in Euratom's domestic agency F4E, where a new director, Johannes Schwemmer, took over in January 2016, promising to improve industrial and project management.

A May 2016 report published by the US Department of Energy recognised that improvements had been made to the project's management, but added that it was too soon to tell whether they would lead to the project's long-term success. Nevertheless, it also recognised that ITER remained the best candidate for demonstrating the feasibility of fusion energy, and recommended that the USA continue to participate in ITER until at least fiscal year 2018, when the project should be reassessed.

Other EU programmes and action in the same field

Euratom Research and Training Programme

The Euratom Research and Training Programme (RTP) supports research in three areas: nuclear safety and security; nuclear fission; and nuclear fusion, of which the ITER project is an example. The RTP does not follow the same programming schedule as the 2014-2020 MFF, instead running for five years (2014-2018), with an expected complementary programme for 2019-2020. Its budget for the period 2014-2018 is €1.6 billion.

EUROfusion and the Joint European Torus

ITER is anticipated and supported by Europe's other fusion experiment, the Joint European Torus (JET). Established in 1978, JET is a fusion research facility operated by the EUROfusion consortium, in which 30 research organisations and universities from 26 EU Member States plus Switzerland and Ukraine collaborate on research that will ultimately make possible fusion electricity. EUROfusion is funded by a €440 million grant from the RTP, with another €410 million provided by the Member States (total 2014-2018 budget: €850 million).

The first European-level budgetary provision for research dates back to the 1951 Treaty constituting the European Coal and Steel Community, and for energy-related research in particular to the 1957 Treaty establishing Euratom, on which EU participation in ITER is based (see legal basis above).[8] Since then, research and innovation have become an increasingly important part of the EU's agenda, and were given particular prominence in the Europe 2020 strategy adopted in 2010. EU programmes funding research activities in the current 2014-2020 MFF can be broadly divided into (i) the Horizon 2020 framework programme – the EU's largest research funding programme; (ii) the European Structural and Investment Funds, part of which are spent on research and innovation; and (iii) sectoral research and innovation programmes, including for nuclear and other energy research.

Endnotes

[1] For more on Euratom, see M. Szczepański, Understanding the European Atomic Energy Community (Euratom), European Parliamentary Research Service, European Parliament, September 2017.

[2] Article 1.3 c of the Fusion for Energy statutes allows third countries with a cooperation agreement with Euratom to become members of the joint undertaking.

[3] In July 2016, the Atomic Energy Organisation of Iran reported that it had carried out preliminary work on the country's participation in the ITER project. See 'Iran to join ITER', Trend News Agency, 23 July 2016.

[4] A tokamak, from the Russian 'токамáк', is a doughnut-shaped magnetic confinement device used to contain plasma.

[5] 'Baseline' refers to the set of estimates of the technical requirements, schedule and cost of building ITER.

[6] 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'.

[7] The F4E members include the Euratom Member States and Switzerland, which has 'associated country status' in the ITER project.

[8] See V. Reillon, Overview of EU funds for research and innovation, European Parliamentary Research Service, European Parliament, September 2015.

Disclaimer and Copyright

eprs@ep.europa.eu
http://www.eprs.ep.parl.union.eu (intranet)
http://www.europarl.europa.eu/thinktank (internet)
http://epthinktank.eu (blog)