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ITER costs are pinned down, with caveats

External review of international fusion project comes as Department of Energy prepares to make recommendations to Congress on whether US should remain involved.

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An independent review of the latest cost and schedule for ITER, the international project to develop fusion energy, has confirmed that an additional €4.6 billion (\$5.3 billion) will be needed to complete the first stage of the experiment.

The external review, approved by the project's governing body at a 27 April meeting in Paris, sets December 2025 as the earliest possible date for experiments to begin; experiments with the potential to achieve ignition will require an additional seven years. The previous baseline, drafted in 2010, had set initial completion for 2020. But the review committee cautions in its report that cost and completion estimates do not include contingencies and "cannot yet be considered to be reliable given that some risks will inevitably materialize."

The report's approval comes days before the 2 May deadline for the US Department of Energy to report to Congress on whether the US should remain in ITER.



Workers continue construction of the ITER fusion energy facility, which has been beset by delays and cost overruns. Image credit: © ITER Organization

The €4.6 billion estimate is best case and assumes there is no limitation on what the participating countries can contribute. It covers only the operations of the ITER Organization in Cadarache, France. The cost of the components provided by the seven participants—more than 80% of the project's total price tag—was not included. Because those in-kind contributions are the responsibility of the member states and include variables such as labor and material costs, currency fluctuations, and other factors, ITER officials say it is not possible to provide a precise overall cost estimate for the project. The 2010 baseline also did not provide a top-line estimate, but extrapolating from the EU's contribution, the cost then was projected to be roughly €13 billion (see *Physics Today*, January 2016, page 30).

The review committee is working to develop a realistic overall estimate that reflects the known budgetary constraints of ITER members. But the committee's report, a copy of which was obtained by *Physics Today*, said the only way to reach the 2025 startup date is by deferring work on additional components required for ITER's second stage: experiments with deuterium–tritium plasmas. The report says that deuterium–tritium operation—required if the reactor is to achieve ignition and sustained fusion—will be delayed until 2032, five years beyond the previous target date. Initial experiments will work with a “first plasma” that does not contain tritium.

US involvement in ITER is in flux as DOE prepares its recommendation to Congress. Last month, the Senate Appropriations Committee approved a spending bill that would cut off funding for the project. But the companion House bill would continue ITER appropriations. The US and five other countries—China, India, Japan, Russia, and South Korea—each have a 9% share in the project; the hosting European Union pays 45% of the costs. Cost increases would be split accordingly.

A draft document prepared for Congress by the ITER Organization says that based on the EU's estimate of €6.6 billion for its contributions, and the ITER Organization's estimate of €6.9 billion for its operations, the overall ITER cost to reach first plasma is €18–22 billion. The draft adds, however, that extrapolating the US's cost estimate for its contribution would yield a total cost of \$49.5 billion (€44 billion). The document calls that figure “highly inaccurate” in part because of the much higher procurement and contract costs in the US. It notes also that the US estimate of \$6.5 billion for its share includes a 50% contingency.

The review was commissioned by the ITER Council, the project's governing body, last November to validate the new baseline that was prepared by the ITER Organization and its director general Bernard Bigot. Former Deutsches Elektronen-Synchrotron chairman Albrecht Wagner chaired the 14-member review committee. The ITER final design is 89% complete, and 24% of the components have been built, the report states.

The review team lauded Bigot's leadership and highlighted a “substantial improvement in project performance, a high degree of motivation, and considerable progress during the past 12 months.” It found no major issues with the new baseline.

The committee, however, said that despite Bigot's efforts at improving teamwork between the ITER Organization and the domestic agencies that are responsible for supplying components, trust between them “is still not deep.” It recommended that management “seriously consider making changes within the Human Resources Department and to human resources policies and procedures to ensure that the organization is more flexible and supportive.”

Editor's note: This post was updated on 29 April, 4:30pm with new cost estimates for the US and the entire ITER project.

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