

HOW COST ENGINEERING CONSULTANCY USED CLEOPATRA ENTERPRISE TO EXECUTE TOTAL COST MANAGEMENT FOR THE WORLD'S LARGEST PROJECT



The tokamak is an experimental machine designed to harness the energy of fusion. ITER will be the world's largest tokamak. The image shows the inside of the JET machine at CCFE, UK.

Introduction

On behalf of the ITER Organization, responsible for one of the most exciting projects in the world, Cost Engineering used its software Cleopatra Enterprise to estimate the assembly and installation costs of over 20 of the project's core systems. After familiarizing itself with the project and its specific requirements, an assessment phase followed, in which Cost Engineering identified and described recommendations to increase the quality of the estimates in order to achieve a Class 3, 30% accurate estimate.

The result after 12 months collaboration was a large set of very well structured estimate reports, each containing the estimate methodology, estimate basis, allowances, labor rates, productivity & cost factors, indirect costs, exclusions, contingency and escalation. This extensive way of reporting has led both to an increase in accuracy and to high levels of transparency, which ITER values highly.

Cost Engineering also structured the estimates along the different breakdown structures used throughout ITER, to ensure all can be used directly in the project, without any conversion or alteration.

Finally, quality checks have been performed to verify and validate if the right scope has been estimated. As is common practice for Cost Engineering, accuracy of all cost estimates has been determined based on the level of definition of the input deliverables, according to the estimate classifications of the AACEI (Association for the Advancement of Cost Engineering International).

As a result, there are no example projects that could be used as a reference point, and it all came down to knowledge and experience. For example, labor hours for installation were based on:

- Expert judgments
- Cost Engineering's Standard Knowledgebase (CESK) to determine total labor hours
- Comparison with "similar" components from the CESK

Adding to this is the site construction of the ITER machine and plant being technically challenging, in particular concerning complexity, nuclear safety and regulatory aspects, size, weight, tolerances, scope sharing, cost and schedule.

Benefits for ITER:

- Clearly defined scope of the project
- Integration between planning, estimating and cost management
- Thorough challenge of the technical baseline ensuring alignment with actual costs
- Detailed resource planning for next phase



ITER ("The Way" in Latin) is one of the most ambitious energy projects in the world today.

In southern France, 35 nations are collaborating to build the world's largest tokamak, a magnetic fusion device that has been designed to prove the feasibility of fusion as a large-scale and carbon-free source of energy based on the same principle that powers our sun and stars.

The experimental campaign that will be carried out at ITER is crucial to advancing fusion science and preparing the way for the fusion power plants of tomorrow.

ITER will be the first fusion device to produce net energy, the first to maintain fusion for long periods of time and the first fusion device to test the integrated technologies, materials, and physics regimes necessary for the commercial production of fusion-based electricity.

Facts & Figures

- Machine weight - 23000 ton
- Plasma temperature - 150 million °C (10x the core of the sun)
- Output power - 500MW
- The steel plasma chamber alone is heavier than the Eiffel Tower



CLEOPATRA

Cleopatra Enterprise offers an integrated Project Cost Management solution through the entire project life cycle by including Cost Estimating, Scheduling, Cost Management, and Benchmarking in one system.

The advanced tool owned by Cost Engineering Consultancy, serves the process industry and is used by Owners, Contractors and EPC firms.

Over 20 years, Cleopatra has enabled more than 500 industry-leading companies in 75 countries to control large technical projects and turnarounds, improve their project performance and stay ahead of the competition.

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Furthermore, estimating efforts have to be adjusted due to, for example, congestion at the work site, complexity, safety regulations, working height, etc. To account for all of these, Cost Engineering established so called efficiency factors and applied them to the individual estimates.

To manage such complicated estimates and at the same time make sure it remains transparent, it is necessary to use dedicated cost estimating software. Cost Engineering therefore used its own software Cleopatra Enterprise, which ITER appreciated highly.

The project

The ITER Organization, and specifically its Construction Department, were looking to develop an overall Class 3 cost estimate for the complete project scope within its first phase. The first construction phase will allow ITER to achieve first plasma. This construction phase will stretch from 2017-2025. The construction includes the assembly, installation and testing of the ITER machine, plant and auxiliary systems (e.g. Magnet, Cooling water, Vacuum, fueling and wall conditioning, Ion cyclotron heating, etc.). In order to structure this effort, Cost Engineering has been asked to prepare separate capital cost estimates and reports for the different systems and machine assembly phases.

The total scope of the project is split over 8 construction works and support contracts encompassed no less than six independent worksites covering 35 buildings, increasing its complexity.

“Cleopatra is a great cost estimating tool because a huge amount of well-developed cost databases are provided and strong reporting tools are also more than enough.

The Support & Training team is very skillful and always helpful and quick to respond to questions”

-Moon Joo Kim

Cost Estimation Officer at ITER Organization

Future Steps

ITER has rewarded Cost Engineering a new contract to execute the following major tasks:

- Estimating Construction Phase Two
- Running simulations in order to reduce cost looking at schedule and execution strategies
- Implementing a fully integrated Cost Management process within Cleopatra Enterprise
- Assisting ITER in the tender evaluations

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