

ON-TIME AND ON-BUDGET

Build or Refurbish Energy Capital Projects Profitably



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Executive Summary

Energy is the lifeblood of modern civilization and the cornerstone of economic prosperity. With a stable, affordable energy supply, industrialized nations thrive and emerging nations embrace new opportunities.

Today the world is at an “energy crossroads.” Energy consumption is growing rapidly. Fossil fuel sources are dwindling. Nuclear power is experiencing a renaissance while nuclear fusion remains a scientific challenge. Renewable choices such as water, wind, solar, or biomass cannot fill the gap entirely.

Energy companies face the dilemma of both meeting consumption demands and making a profit. They must plan future capacity by either building new power plants or refurbishing old ones. In parallel, they must comply with government tariffs and quota mechanisms to include renewable sources as part of the overall energy mix, or else pay penalties.

Delivering a stable and affordable energy supply is a complex endeavor that requires overcoming numerous technology and financial challenges.

Owner/operators (O/Os) and engineering, procurement, and construction (EPC) companies need to deliver projects ‘on time and on budget’ as well as establish effective collaboration between suppliers, partners and other stakeholders. The most significant “build new or refurbish old” challenge they encounter today is managing and synchronizing project information that is undergoing constant change and revision.

By enabling project execution excellence, Dassault Systèmes ENOVIA Capital Project Management (CPM) helps energy companies optimize capital expenditures, accelerate time to first fuel, and increase return on investment (ROI).

CPM manages all aspects of a project in one single system, facilitating enterprise-wide collaboration and improving productivity during all phases of a project —from design, planning and construction, through operations and decommissioning.

Project managers can focus on high value activities while real-time dynamic dashboards provide the scorecards, eliminating tedious tasks and processes. Project teams can seamlessly create, collaborate, share, and manage information globally using best-in-class templates with predefined phases, gates, and milestones.

Dassault Systèmes is the #1 enterprise product lifecycle management (PLM) software provider worldwide, with 2009 revenues of \$2B and more than 115,000 customers in 80 countries. Providing mission-critical solutions to some of the largest energy companies, the DS portfolio for energy includes CATIA® for equipment design and the virtual plant — SolidWorks® for 3D mechanical design — DELMIA® for virtual planning and construction— SIMULIA® for virtual testing — ENOVIA® for global collaboration and capital project management, and 3DVIA® for virtual training.

Introduction

For the economically mature industrialized nations, an uninterrupted energy supply is taken for granted. For growing powerhouses such as China, India and others, energy fuels economic growth, world stature, and a higher standard of living. In short, energy is the source of social progress and economic power.

Like an old steam engine's boiler, the pressure is building for companies to find new and affordable energy sources that offer consumers a balance of traditional (oil, gas, coal), renewable (wind, solar, water, geothermal, and biomass) and nuclear options.

The depletion of traditional sources, rising costs and complexities of exploration and production are only part of the story. Consumers are fueling political, social, and ecological pressures for clean energy. Complicating the situation further is the prospect of deregulation in some parts of the world.

Deregulation enabled the telecommunications and airline industries to offer consumers innovative changes, more choices, and in many cases, lower costs. Energy consumers are skeptical that they will experience similar results.

Energy companies operating in deregulated markets must source at competitive prices and deliver a supply that is available, affordable and clean. To satisfy consumer demands, market needs, and remain profitable, energy companies must 'spend money to make money.'

Confronted with reinventing itself to meet global demand, evolving standards and government regulations, the energy industry is faced with a number of options that represent major technological and financial challenges:

- Extending the operational life of fossil fuel and nuclear plants past their originally planned decommissioning date
- Increasing productivity by minimizing plant shut-down time for scheduled maintenance or refurbishment
- Investing in next generation nuclear power plant construction
- Adding renewable energy sources to the power mix
- Exploring for new and viable oil and gas fields in ever more distant and deeper offshore waters

Effectively responding to any of these challenges involves undertaking megaprojects that often bear a price tag that exceeds the capitalization of even the healthiest energy company.

On Time, On Budget

Capital projects today are bigger, more global and riskier. A new fossil fuel plant can cost hundreds of millions of dollars and an average of five to ten years to complete before handover and commissioning. Construction costs for nuclear power plants soar high into billions of dollars, and construction takes longer to complete because of the greater complexity and security requirements. Capital spending for offshore oil drilling platforms goes even higher.

The productive life of these power plants and oil rigs currently runs between 40 and 60 years. Owner/operators (O/Os) are fully aware of the implications that such a long operational life has on the need for regular, on-going maintenance and refurbishment—through to final decommissioning. The lengthy life of a power plant or oil rig and the strict regulations associated with construction, operations and maintenance, require a streamlined and integrated approach to information management.

Throughout a new construction or refurbishment project, participants, from diverse disciplines and functions, generate billions of dynamic, living documents containing multiple iterations and revisions of mission-critical project and equipment information. Retaining accurate information for updating and inspection throughout the lifecycle of a power plant, oil rig, or other major energy project is a daunting task.

Often the issue is not whether the information exists, but whether it is still consistent with the sources and easily accessible to all stakeholders. In the case of older plants or rigs that were built in pre-computer times, most facilities still rely on paper drawings and documents.

One of the tasks today when undertaking life extension or refurbishment projects is to make these key records accessible in a digital environment.



Managing a capital project ‘on time and on budget’ requires access to accurate, real-time up-to-date information, regardless of time or geographic location. Achieving that goal of making ‘the right information available to the right people at the right time’ is one of the major challenges facing O/Os and engineering, procurement, and construction (EPC) companies.

With shareholders interests to consider, O/Os must optimize and standardize project execution processes, accelerate the handover process, and facilitate the on-going plant operations and maintenance procedures.

The larger the project, the more complex the business processes. EPCs need to integrate information from many sources such as the materials and equipment supply chain, construction contractors and sub-contractors. Accurate information ensures better decision-making and reporting throughout the project life cycle.

When EPCs and O/Os miss their targets, the results are obvious: late deliveries, budget overruns, and disgruntled shareholders. According to a Booz Allen Hamilton survey of energy leaders, capital projects in oil and gas frequently exceed both schedule and budget by

more than 10 percent (Figure 1), especially in the case of megaprojects. In such multi-billion-dollar projects, a schedule overrun of even one single percent has serious financial impact. The pitfalls the survey highlighted included performance management, risk management, and project planning.¹

Performance Management

A critical component of successful performance management is ensuring effective collaboration between all stakeholders. Today there is a growing trend for major O/Os to take a more active role in project management or alternatively to impose severe penalties on EPCs for overruns. While O/Os concentrate on the results, EPCs have to focus on the execution. A reliable system that enables both the OOs and the EPCs to work collaboratively from the same up-to-date information is key to success.

Risk Management

Any gambler will tell you, the bigger the pot, the bigger the risk. Energy megaprojects are no different. At the core of capital project risk mitigation is how O/Os and EPCs plan for future contingencies and ensure that the right information is not only available when needed, but rapidly accessible for prompt issue resolution (Figure 2).

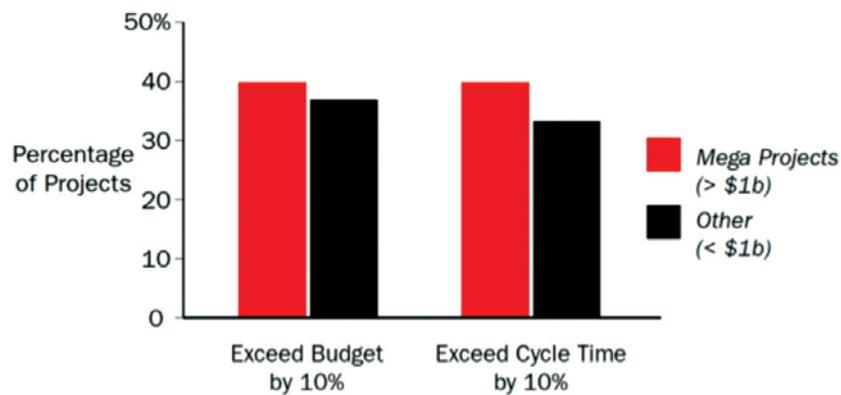


Figure 1: Percentage of Projects Exceeding Budget and Cycle Time by Greater Than 10%. Source: Booz Allen Hamilton

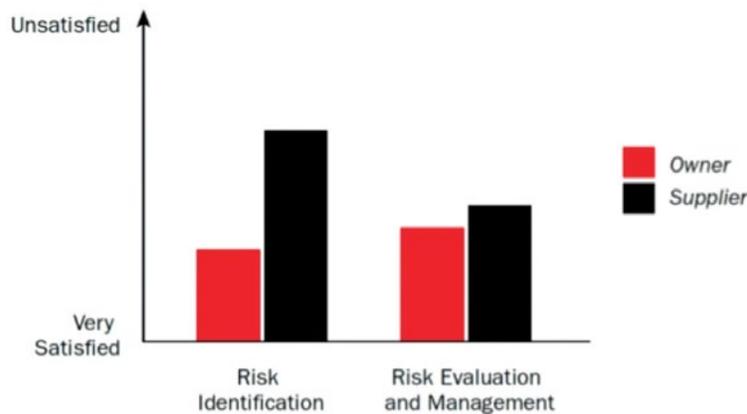


Figure 2:
Assessment of Risk Management Practices

Plant owner operators are demanding more aggressive delivery schedules, associated with tighter budgets. The EPC’s challenge is to meet the performance standards set and mitigate the risks. As project complexity increases and the number of stakeholders grow, the need to implement best business practices becomes greater, coupled with a reliable information system to enable fast and easy access to up-to-date auditable information.

Project Planning

EPCs are responsible for defining the resource scheduling, work package details, and providing the supporting documents and drawings to contractors and suppliers for bids. Unavailable resources or inaccurate bid proposals fuel delays, rework, and schedule overruns.

Particularly problematic are large, manufacture-to-order complex pieces of equipment that require extended manufacturing lead times. To meet construction deadlines, EPCs must make buy decisions for these items early on in the project planning cycle—at a time when design data is incomplete and information sources are the poorest.

The ability to keep all stakeholders, suppliers, and contractors abreast of any design changes reduces the risk of incompatible deliverables that are often the source of project schedule overruns.

Interoperability and Efficient Information Management

Probably the most significant challenge today for capital projects is managing and synchronizing project information in an environment of constant change.

Experts, located in far-flung regions of the world, create and maintain information in disparate systems that are not integrated. They often work in isolation and fail to communicate effectively —resulting in poor information management.

According to the US National Institute of Standards and Technology (NIST), capital projects incur problems because of:

- Lack of collaboration software that integrates with other systems
- Fragmented lifecycle management processes that are not integrated across the project lifecycle
- Incompatible software packages
- Computer-Aided-Design (CAD) interoperability issues
- Lack of data standards
- Fragmented business processes and legacy systems
- Automated and paper-based systems (depending on location)
- Limited use of technology for managing business processes and information ²

Enabling O/Os and EPCs to work from the same data, originating from one single source, is key to overcoming these challenges.

Excellence in Capital Project Management

Today energy projects lifecycles extend beyond the initial construction or retrofit stages to include handover, operations, repair and maintenance, refurbishment, and final decommissioning. In its survey, Booz Allen Hamilton identified three major themes that both owners and EPCs view as imperative to the future well-being of the industry:

- Adopting a more global project management framework to increase performance
- Standardizing design and targeting technological innovations
- Revamping the relationship between owners and suppliers ³

To enhance the O/Os ability to centralize and share information, Booz Allen Hamilton recommended a single knowledge management repository. Centralization drives significant increases in project performance (see Figure 3), reducing the risk of budget overruns and schedule delays. Tighter collaboration between O/Os and EPCs had the greatest potential for improvement in planning, resource efficiencies and sharing risk/incentives equitably.

ENOVIA Capital Project Management

By enabling execution excellence, Dassault Systèmes ENOVIA Capital Project Management (CPM) helps energy companies reduce capital expenditures, accelerate time to first fuel, and increase return on investment (ROI).

ENOVIA CPM manages all aspects of the execution of a capital project:

- Requirements Management
- Schedule Management
- Bid Management
- Deliverable Management
- Work Package Management
- Milestone Management
- Risk Management
- Issues and Change Management

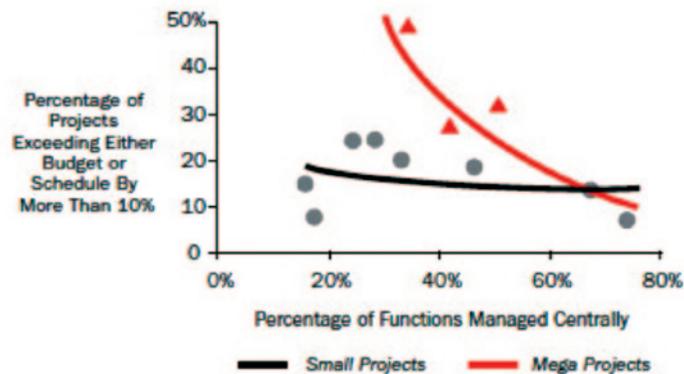


Figure 3: Centralization Drives Significant Increases in Project Performance. Source: Booz Allan Hamilton

ENOVIA CPM provides templates that enable project managers to automate resource planning and institutionalize best practices for different types of projects. Productivity improves for globally distributed users because of the collaborative, flexible, project management features. Users can access dynamically updated information through direct links to tasks, documents, deliverables, and other data sources.

These automatic updates allow project managers to focus on high value activities rather than tracking down project status. Best-in-class templates with predefined phases, gates, and milestones drive phased-based decision-making. Project teams can create, share and manage project information globally, ensuring consistent progress and informed collaborative decisions.

An effective CPM approach enables a project to scale across its entire lifecycle – from inception through to decommissioning. This allows for the integration of supplementary sub-processes as necessary:

- Requirements Traceability
- Planning, Scheduling, and Monitoring
- Engineering Deliverable Validation
- Equipment and Work Package Procurement
- Issue to Engineering-Change Traceability
- Checklist and 'Punch List' Resolution

Real-time automated project dashboards and scorecards provide stakeholders visibility into up-to-date project progress, eliminating risks of schedule or budget overruns. These features overcome the root causes of project delays and cost overruns identified in the Booz Allen report.

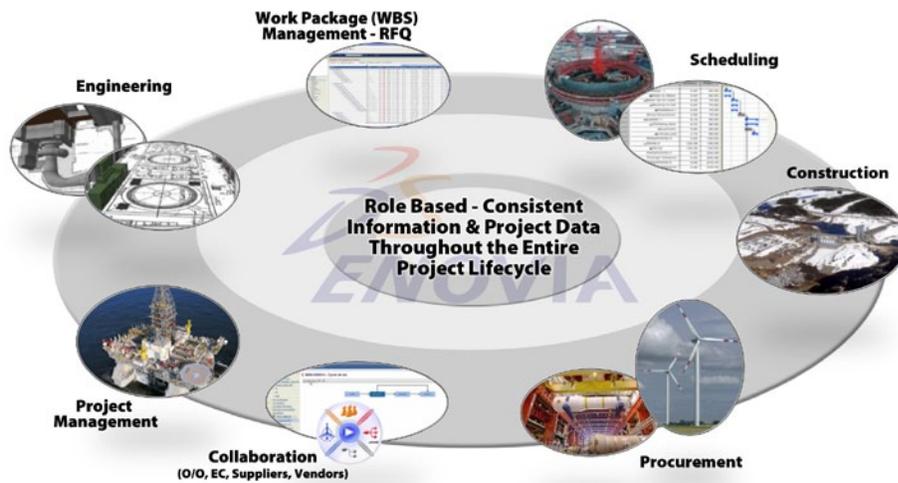


Figure 4: With ENOVIA it is possible to manage the execution of all aspects of a project or program: deliverables, schedules, resources, work requests/orders/permits, risks and issues in one single system.

Nuclear Power: A Global Fuel for the 21st Century

Much has changed in the nuclear power industry since the events of Three Mile Island (US – 1979) and Chernobyl (Ukraine – 1986). Fueled by energy demands, climate change, supply concern, and a respectable safety record, nuclear power has a brighter image in the 21st century. The renaissance in nuclear energy is global as industrialized and emerging nations see an opportunity for affordable and safe energy.

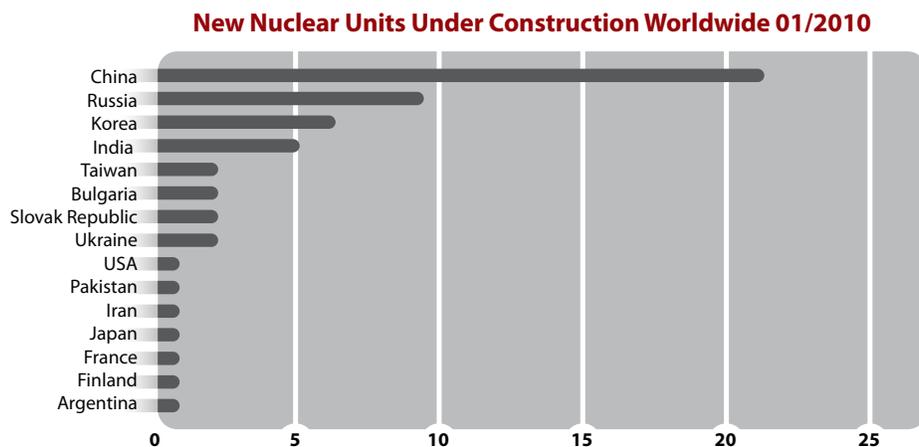
Refurbishing nuclear power plants is acceptable today. The United States, Japan, the United Kingdom, Spain, and Russia are granting license renewals to extend existing nuclear power plant life for an additional 20 years.⁴

On the scientific front, Dassault Systèmes technology is enabling several key internationally-recognized research organizations conduct fundamental particle research or investigate alternative sources of reliable and clean energy for the future, such as nuclear fusion. To read how customers such as Lawrence Livermore National Laboratories, ITER, Entergy Nuclear are using Dassault Systems solutions to solve their energy-related challenges in the 21st century, visit www.3ds.com/company/customer-stories/.

International cooperation has been instrumental in changing the perception of nuclear energy globally.

To optimize costs, share risks, expertise and experience, the tendency in the market is for O/Os to create joint ventures or consortiums with like-minded partners. In the US for example, Unistar is a joint venture between Constellation Energy, a premiere US nuclear fleet operator, and France’s EDF Group, the global leader in nuclear power generation. Their goal is to enhance US energy security by constructing a standardized fleet of at least four advanced nuclear power plants at selected sites throughout the US.

The World Nuclear Association (WNA) predicts that by the end of the 21st century, world energy demand – even in a ‘business as usual’ environment – will require a game-changing reliable resource beyond renewable sources or any technology known today.



Conclusion

Managing Capital Projects Profitably

The surging global demand for energy is putting pressure on the sector to find, build, and produce a clean and sustainable supply—economically and fast. But, energy-related capital projects are bigger, more global and riskier than in any other industry.

Successful capital projects rely on clearly defined business processes and thorough planning upstream to provide the basis for sound execution downstream. EPCs and O/Os must have the ability, throughout the project life cycle, to dynamically assemble a loose amalgamation of data, materials, equipment, skills and know-how from functionally and geographically dispersed players, and funnel that information into a tightly-knit, unified project repository. In turn, decision-makers have the information they need at their fingertips to deliver complex capital projects on time and on budget.

To find out more about Dassault Systèmes ENOVIA Capital Project Management, visit our website:
<http://www.3ds.com/solutions/energy>.

ENOVIA Capital Project Management:

- Provides the interoperability that enables instantaneous visibility across all aspects of the execution of a project, for all participants, from one single data source.
- Captures work efforts and interactions in real time and consolidates project knowledge and experience, making it available for reuse.
- Facilitates handover from EPC to O/O by ensuring the integrity and availability of up-to-date information including regulatory compliance, asset tracking for maintenance and operations, auditing for government, health, safety and environmental reporting.
- Reduces the project cycle times for O/O, optimizing capital expenditure and accelerating time to first revenues.
- Jump-starts new projects by enabling the redeployment of knowledge assets created and captured throughout the life cycle of previous ones. (this capability is especially useful in an industry where the workforce is ageing, knowledge resources are declining, and turnover of project personnel is frequent).
- Offers scalable and open technology capable of supporting an extended enterprise collaborative infrastructure that enables technical, engineering and construction data management; knowledge transfer for operations and maintenance; a common user interface for work-in-process; CAD data management; customizable team workspaces; document revision, version controls and release processes for change management.

END NOTES

1. Source: *Booz Allen Hamilton Capital Project Execution in the Oil and Gas Industry; Increased Challenges, Increased Opportunities*
2. Source: *NIST, Cost Analysis of Inadequate Interoperability in the US Capital Facilities Industry*
3. Source: *Booz Allen Hamilton Capital Project Execution in the Oil and Gas Industry; Increased Challenges, Increased Opportunities*
4. Source: *World Nuclear Association*, <http://www.world-nuclear.org/>
5. Source: *World Nuclear Association, Plans for New Reactors Worldwide*, <http://www.world-nuclear.org/info/inf17.html>



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