

Project Summary

Organization:

Guangdong Electric Power Design Institute

Solution:

Power Generation

Location:

Dalian, Liaoning, China

Project Objective:

- Perform Phase 1 engineering for simultaneous construction of four 1,000 MW electric CPR-1000 units
- Coordinate engineering design among Chinese project team and three global partners
- Migrate from 2D to Bentley's 3D design technology and collaboration platform

Products used:

ProjectWise Integration Server
Bentley Architecture
Bentley Navigator
Structural Modeler
MicroStation
PlantSpace P&ID
PlantSpace SupportModeler

Fast Facts

- Use of 3D design marked a milestone in GEDI NPS practices
- Adopting 3D design improved design reviews, interference checking, and communications
- Approximately 110 users accessed engineering documents through the ProjectWise Integration Server
- GEDI customized P&ID and 3D design system specifications for conformance with Chinese codes

ROI

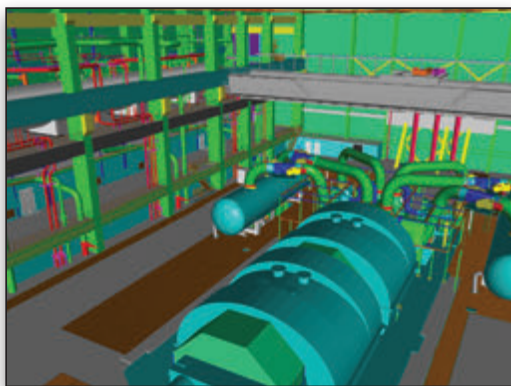
- Bentley's 3D design technology improved productivity by 10 percent, saving 4,000 working days
- The 3D approach to interference checking reduced the probability of clashes by 90 percent
- The optimized design improved plant efficiency by approximately 20 percent

Guangdong Electric Power Design Institute Standardizes on Bentley on \$730 Million Project

Uses Bentley Software for Global Collaboration on Nuclear Power Station Design, Saving 10 Percent in Productivity While Increasing Plant Efficiency

Simultaneous Construction of Four 1,000 MW Units

Located in the seaport city of Dalian in the south of Liaoning province, the Liaoning Hongyan River Nuclear Power Plant is the first nuclear power station in northeast China. This project is also the first where the simultaneous construction of four 1,000 megawatt (MW) units has been approved. To overcome the challenges associated with Phase 1 design of this \$730 million megaproject, the Guangdong Electric Power Design Institute (GEDI) migrated from a purely 2D design environment to Bentley's 3D design software and ProjectWise, Bentley's system of collaboration servers and services for AECO information. Bentley software enabled GEDI to improve productivity by 10 percent and reduce the probability of clashes by 90 percent.



3D models produced by designer productivity and significantly reduced the probability of clashes during construction.

The Hongyanhe River Nuclear Power Plant was approved under China's 11th Five-Year Plan. It has a planned installed capacity of six 1,000 MW units. Phase 1 design, which includes the first four units, began in 2004, and construction began in 2007. The long lead time was due to the complexity of engineering nuclear power stations. Nuclear power plants are significantly more complex than fossil fuel power stations, with complicated interfaces and demanding safety requirements that require many more deliverables.

As part of the Guangdong Power Grid Corp., which is a wholly owned subsidiary of China Southern Power Grid Co. Ltd., GEDI was responsible for engineering the conventional island as well as many other facilities and structures for the plant. The planning, design, and construction staging for the first four units required cooperation and collaboration among the Chinese team and three international partners located around the globe.

Using 3D Engineering Design and Collaboration Software to Increase Efficiency

GEDI's goal was to apply 3D design during the entire engineering lifecycle and achieve efficiency in the process of coordinating the global team. Based on past experience, GEDI recognized that traditional 2D design processes would not enable the companies to work together effectively. Bentley's 3D design technology and engineering information management systems enabled GEDI to coordinate the multidiscipline team and facilitate collaboration on the complex design interfaces.

During the engineering process, GEDI used Bentley applications including MicroStation, Bentley Architecture, Structural Modeler, PlantSpace P&ID, PlantSpace SupportModeler, and Bentley Navigator for all design activities, and ProjectWise for engineering information management and project collaboration.

3D Modeling Facilitates Design Review and Reduces Clashes

Adopting 3D design technology for the building, plant, and structural design facilitated internal and external design reviews, interference checking, and design communication between GEDI and its Chinese and international partners. GEDI estimates using 3D models during the review process reduced meeting time by 20 percent.

Using the 3D model for clash checking allowed multidiscipline teams in different locations to review designs and detect interferences at the same time. The team could also perform visual and simulated access checks to ensure sufficient space for operations and maintenance. The 3D model-based process

“The addition of Bentley’s 3D engineering software improved the design efficiency by 10 percent and reduced the probability of clash by 90 percent. In addition, using the 3D model for design review meetings reduced meeting time by 20 percent”

— Zhaoying Zheng, Guangdong Electric Power Design Institute

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reduced the probability of clashes by 90 percent, compared to the number of expected clashes with GEDI’s previous 2D design process.

Accurate Modeling Enables Automatic Creation of 2D Deliverables

To help meet the challenges of such a demanding project, GEDI customized numerous aspects of the 3D design system. GEDI changed the way components were selected, extended component attributes as per nuclear power station codes, established piping design and hanger/support databases, and input data for tens of thousands of valves. GEDI also created a set of tools to enable automatic node point labeling, interactive data labeling, automatic piping model grooving, and intelligent P&ID system filing. Drawing block, bills of material, and note graphics were customized to conform to Chinese practices.

GEDI input Chinese electric power drawing standards to the plant project database, and was then able to use PlantSpace P&ID to easily generate piping and instrumentation diagrams from those standards. These diagrams were in turn used to generate 3D models.

By building accurate piping and pipe hanger and support models, the designers were able to automatically extract plot plans and material lists, and automatically generate piping isometric and pipe hanger and support drawings. As a result of these and other efficiency gains, the main building arrangement was optimized to provide smooth and spacious passages, and more convenience for operation and maintenance.

ProjectWise Manages Access to Information; Enforces Standards

ProjectWise provided GEDI with the structured environment it needed to manage design files and enforce 3D design standards while enabling appropriate user access. GEDI developed rules for using 3D design files and created relevant coding and naming rules. A 19-digit coding system was

applied to each drawing, incorporating GEDI’s own coding system as well as the owner’s separate system. The double coding was used for document control and filing, with some drawings being updated up to seven times.

Over 110 users accessed engineering documents through the ProjectWise Integration Server. GEDI granted or restricted access based on role-based privileges, and document updates were synchronized. This setup eliminated the use of email to exchange information among team members in different locations. External users accessed ProjectWise remotely. Version control prevented the use of duplicate or outdated documents, and data integration and timely updates simplified data delivery to collaborators.

ProjectWise allowed team members to access the right information in real time, thus achieving a paperless work process. It encouraged collaborative design, improved document management efficiency, and simplified search and retrieval of documents.

Design Productivity Yields Savings

Construction of the Hongyan River Nuclear Power Plant began in 2007 and was scheduled for completion in 2012. The Phase 1 project plan had called for 40,000 working days. Using Bentley’s 3D design technology, GEDI improved productivity by 10 percent, saving 4,000 working days.

In addition, the optimized design increased electric power generation capacity by over 31 MW compared to the Ling’ao II nuclear power station. This, in combination with the plant’s next-generation technology, will make the plant about 20 percent more efficient than a comparable nuclear power station. As a result, Hongyanhe NPS will have the lowest per kilowatt cost in China.

Ultimately, the 3D design deliverables that GEDI provided to the plant owner-operator will help to achieve the goal of creating a digital plant. The digital plant will inform operation and maintenance planning, as well as enhance operational safety, thus adding value throughout the entire plant lifecycle.