



Project Summary

Organization:

Zhongnan Engineering Corporation Limited

Solution:

Water and Wastewater Plants

Location:

Qingzhen, Guizhou, China

Project Objective:

- Complete Design Phase I of the Qingzhen Vocational Education West Urban District sewage treatment plant.
- Implement Bentley's 3D collaborative design technology for the integrated design, construction, and operation of the sewage treatment plant.
- Develop a standardized design and project methodology that shortens delivery time of water projects.

Products used:

AECOSim Building Designer, Bentley Substation, GEOPAK, MicroStation®, Bentley Navigator, OpenPlant, and ProjectWise®

Fast Facts

- Bentley's 3D design applications prepared an intuitive design scheme with 90 percent fewer errors.
- POWERCHINA Zhongnan's standardized design and project methodology included new design standards beneficial to other water projects throughout China.

ROI

- Design time was reduced by one month, saving about CNY 200,000 in design costs.
- Information mobility lessened communication time by 50 percent, saving about CNY 500,000.
- Collaboration among disciplines using Bentley's 3D design environment reduced design errors by 90 percent.

POWERCHINA Zhongnan Standardizes 3D Collaborative Design of Water Projects

Bentley's 3D Technology Reduces Plant Design Costs by 30 Percent

New Method to Meet Demand

China's 12th Five-Year Plan (FYP) (2011-2015) allotted 20 percent more funds for municipal wastewater treatment projects to address the pervasive pollution caused by rapid urbanization and inadequate sewage disposal. The initiative put pressure on leading design institutes to keep pace with demand for water pollution prevention and control projects. Zhongnan Engineering Corporation Limited (POWERCHINA Zhongnan) responded by adopting a new methodology that made the process for designing, constructing, and operating water projects 50 percent more efficient. Bentley 3D design technology provided the capabilities and ProjectWise enabled a 3D collaborative design platform. POWERCHINA Zhongnan used Bentley solutions to standardize its approach to the CNY 75.8 million Qingzhen Vocational Education West Urban District sewage treatment plant, then applied the model on 13 subsequent projects. The new method reduced design time and costs by approximately one-third.

Lagging Technology

A subsidiary of Power Construction Corporation of China and HydroChina Corporation, POWERCHINA Zhongnan is an award-winning EPC contractor for water resource, hydropower, wind power, environmental, and municipal, industrial, and civil projects throughout China and the world. Despite being one of the premier design institutes in China, POWERCHINA Zhongnan suffered from a lag in new technology adoption that caused inefficiencies in several practice areas. The company had improved design efficiency by 75 percent with a Bentley Enterprise License Subscription in the hydropower practice area. However, in water resources project teams were spending 30 percent of design time

coordinating disciplines and 40 percent of construction time communicating with contractors.

The need to update became urgent when China's 12th FYP accelerated construction of water pollution control projects. In 2012, China set aside nearly CNY 2 trillion for wastewater treatment infrastructure, planning to build facilities in some 300 cities by 2015. By the end of the 12th FYP period, China expected to increase treatment rates from 77.5 percent to 85 percent in urban areas, 60 percent to 70 percent in counties, and 20 percent to 30 percent in townships. These advances in wastewater treatment would not only reduce pollution but also protect and improve water quality for the critically short supply of drinking water.

POWERCHINA Zhongnan estimated the average design period for water projects to be 180 days, which was too long to meet the timetable for the slate of 14 immediate projects. To accelerate the process while maintaining quality, the company needed to implement the Bentley solution for water and wastewater treatment plant design. The 20,000-cubic-

meter-per-day (m³/d) Qingzhen Vocational Education West Urban District sewage treatment plant project presented an opportunity to try a more advanced methodology that would introduce the 3D technologies to the practice group and improve overall efficiency.

3D Collaborative Environment

POWERCHINA Zhongnan adopted a portfolio of Bentley products that would create a standardized 3D environment for optimizing and integrating project design, construction, and operations. ProjectWise was implemented as the ideal collaboration platform to enhance communication and coordination among the 10 design



The project team developed optimal solutions using Bentley's 3D design applications, which reduced inaccuracies in the prepared project designs by 90 percent.

“Based on Bentley’s standardized design, the clash detection of the system can help us find out more than 100 clash points quickly, with a design error rate decreased by 90 percent. The design period was reduced to two months from three months, increasing the design efficiency.”

— Yin Xiaowei,
Chief Engineer, Qingzhen
Vocational Education West
Urban District Sewage
Treatment Plant

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disciplines as well as the parties involved in construction and operations. The platform pushed a standardized user workspace and provided a common data environment (CDE) that became the single source of truth for project information.

The project team developed optimal solutions for modularization and standardization using Bentley software including AECOsim Building Designer, GEOPAK, OpenPlant, and Bentley Substation. Each application produced the anticipated benefits. For example, using GEOPAK’s 3D modeling capabilities to develop plans, profiles, and cross-sections took 60 percent less time than previous methods. More importantly, the selected scheme minimized land use, reduced water head loss, saved energy, and facilitated maintenance — saving the client CNY 11.2 million.

The 3D collaborative environment invited an iterative approach that significantly improved design quality. AECOsim Building Designer’s parametric modeling capabilities enabled the team to explore alternative building geometries. The 3D plant design environment in OpenPlant allowed multi-discipline modeling of piping, HVAC, and electrical. And the integrated modeling of the physical and electrical designs in Bentley Substation reduced errors and omissions. Together, the interoperable software accelerated design review and produced an intelligent plant model that could be used throughout the plant lifecycle.

Introducing Design Efficiencies

Information mobility through all phases enhanced project participation and reduced time-consuming face-to-face meetings. Project data was published to iModels, which were accessible from desktop, laptop, and mobile devices, while maintaining all the original attributes. The 3D information models and visualizations simplified communications among the design disciplines as well as with other project participants. Coordination review and clash detection with Bentley Navigator quickly revealed collision points and rapidly resolved issues. This efficient review-and-refine process decreased design time from three months to two months.

Handing over the digitized 3D information models upon project completion provided a multi-view display and 3D roaming video of the plant that became an indispensable management capability during operations and maintenance.

By integrating project design, construction, and operations, POWERCHINA Zhongnan instituted efficiencies across the lifecycle of the sewage treatment plant, to the ultimate benefit of the client and customers served.

The standardized design system implemented for the Qingzhen Vocational Education West Urban District sewage treatment plant achieved the goal of reducing design time by 35 percent and design costs by 30 percent. The collaborative environment also reduced errors by 90 percent, which shortened communications with construction contractors and reduced rework. Overall, the project achieved CNY 300,000 in savings for the client.

Exemplary Plant Model

The Qingzhen Vocational Education West Urban District sewage treatment plant exemplified advances in wastewater treatment technology, deploying an intelligent water management system that unified the process under one control system. The system provided intelligent scheduling, automatic operation management, and business process management. The efficient systems required 60 percent less labor input than prior plants, enabling virtual operations that could save roughly CNY 800,000 per year. The automation also lowered the risk of human error, reduced management risk, and heightened safety.

With a capacity of 20,000 m³/d, Qingzhen Vocational Education West Urban District’s new tertiary treatment plant protects the downstream water that supplies the 4.5 million people of Guiyang City. This successful project now serves as the model for POWERCHINA Zhongnan’s subsequent work on 13 other water projects representing 1.3 million m³/d in capacity, serving nearly 47 million people, and totaling an investment of CNY 6.4 billion.

POWERCHINA Zhongnan used Bentley software to explore new avenues in water project design and compile relevant design standards, specifications, and technical manuals that advance the practice within the industry. As a result, water projects may be developed more quickly, with higher quality designs, and at lower cost — all to advance China’s initiative to control water pollution and protect its drinking water supply.



OpenPlant’s 3D plant design environment enabled multi-discipline modeling of piping, HVAC, and electrical.