



Shandong Metallurgical Engineering Uses 3D Modeling to Design a Low-carbon Emitting Power Plant

Bentley Applications Help Them Gain Economic and Environmental Savings, and Improve Drawing Efficiency by 60%

PROMOTING GREEN DEVELOPMENT IN CHINA

Shandong Province Metallurgical Engineering Co., Ltd is an international engineering smelting company that integrates investment, consulting, design, construction, and operations. After more than 60 years of development, the organization has grown into one of the top 10 design institutes and engineering, procurement, and construction (EPC) contractors in the metallurgical sector of China. Smelting iron and steel often produces by-products such as blast furnace gas, converter gas, and coke. The gases are used in the production process or consumed through chemical product recovery. Remaining gases not used in the smelting process waste energy and could cause great harm to the environment.

To mitigate the risk and limit the amount of pollutants that enter the atmosphere, the Chinese government is promoting smart and green production of smelting plants. Seizing the opportunity, Shandong Province Metallurgical Engineering is developing a new power generation plant in Jinan, Shandong province, a city of over 9 million that is well-known for its natural springs. It is also home to two integrated steel plants with an annual production of over 20 million tons.

High energy consumption and heavy pollution produced by the steel conglomerates contaminate the natural environment, which means a poorer quality of life for residents. To mitigate the environmental impact, Shandong Province Metallurgical Engineering is undertaking the CNY 480 million EPC project. Covering an area of 46,000 square meters, the project involves simultaneously constructing two sets of condensation type steam turbines with ultrahigh temperature and ultrahigh pressure reheat gas boilers, as well as two sets of 65 megawatt ultrahigh temperature and

ultrahigh pressure reheat turbo generator units and supporting facilities. The plant also includes a mature recirculating water cooling system with a circulating water pump house, suction well, and cooling tower.

Among the challenges they were facing included a tight project area, a complicated pipeline layout, and a potential for pipeline and structural clashes. Given these restrictions they could not guarantee a high-quality design or their client's requirement of digital delivery using 2D design. "If we continue to adopt a conventional 2D design method, we won't be able to guarantee the quality of design required by the owner nor the design schedule," said Tao Zhou, senior engineer and project manager with Shandong Province Metallurgical Engineering. "Instead we adopted 3D models to achieve a high-quality and high-efficiency collaborative design using digital applications."

DIGITAL DESIGN INCREASES EFFICIENCY

Shandong Province Metallurgical Engineering commonly uses 2D software to design power generation facilities, which often lead to errors in the plan layout. Because of the complex design required on this project, they decided their conventional 2D power generation design methods would not suffice. Therefore, they opted for 3D modeling applications and a robust collaboration solution to increase efficiency and properly manage the design.

Shandong Province Metallurgical Engineering turned to Bentley's factory digital design applications to quickly adjust the plan and maximize their use of vertical space so that they could work within the tight construction area. They also used LumenRT to visualize the project realistically. Using OpenPlant Modeler, they were able to easily arrange the facilities' massive piping systems and complicated electrical

PROJECT SUMMARY

ORGANIZATION

Shandong Province Metallurgical Engineering Co., Ltd.

SOLUTION

Power Generation

LOCATION

Jinan, China

PROJECT OBJECTIVES

- ◆ To build a low-pollution power generation plant in Jinan, China.
- ◆ To simultaneously construct two sets of condensation type steam turbines with ultrahigh temperature and ultrahigh pressure reheat gas boilers.

PROJECT PLAYBOOK

AutoPIPE[®], Bentley Raceway and Cable Management, LumenRT, MicroStation[®], OpenBuildings[®], OpenPlant[®], OpenRoads[™] Designer, ProjectWise[®], ProSteel[®], ProStructures

FAST FACTS

- ◆ Shandong Province Metallurgical Engineering is building a new power generation plant in a city of over 9 million that is well-known for its natural springs.
 - ◆ The complex design required the team to implement 3D design applications rather than use conventional 2D design methods.
 - ◆ Using OpenPlant Modeler helped Shandong Province Metallurgical Engineering easily arrange the facilities' massive piping systems to avoid clashes and improve accuracy.
- ### ROI
- ◆ The 3D modeling technology helped Shandong Province Metallurgical Engineering save 20% in work days.
 - ◆ Using 3D modeling, the project team improved drawing issuing efficiency by 60%.
 - ◆ Bentley applications helped the team increase material statistic efficiency by 50% and improve communication by 20%.

“Using OpenPlant Modeler, we can rationally arrange the massive piping systems and complicated electrical and instrument control circuits under the steam turbine to effectively avoid clashes and improve design accuracy.”

– Tao Zhou, Senior Engineer and Project Manager, Shandong Province Metallurgical Engineering

and instrument control circuits under the steam turbine to avoid clashes and improve accuracy. In addition, they used Bentley's AutoPIPE for pipeline stress analysis. Lastly, the team used ProjectWise to enable the multidiscipline design team to collaborate seamlessly, which improved design efficiency. Bentley applications helped the team track design progress and identify clashes and other design issues.

VISUALIZATION ENSURES A RELIABLE DESIGN

Bentley's 3D modeling applications allowed the design team to visualize the project in the schematic stage, enabling the specialists in multiple disciplines to intuitively compare and select the plan, ensuring the final design is safe and reliable while reducing project costs for the owner. Other benefits included constructing the main factory's structure in advance, enabling the civil design team to position the steam turbine and auxiliary engine beforehand to improve clash detection and save time and investment. Moreover, using Bentley Raceway and Cable management, electrical and cable disciplines arranged cable trays, ducts, and cable routes in advance in a 3D space, which improved design efficiency by more than 50%. The piping team made use of data from the component library to automatically generate

bills of material for water and gas pipes, which reduced resource hours and ensured accuracy. Using OpenPlant Modeler to grade and accurately position the pipeline height improved design quality by 13%. Applying OpenPlant Isometric Manager to extract the pipeline ISO diagram from the models reduced time and resource hours by 30% compared to using traditional design methods. The innovative 3D modeling technology also helped Shandong Province Metallurgical Engineering save 20% in work days, enhance drawing issuing efficiency by 60%, increase material statistic efficiency by 50%, and improve communication by 20%.



Shandong Province Metallurgical Engineering is building a new power generation plant in a city of over 9 million that is well-known for its natural springs. Image courtesy of Shandong Province Metallurgical Engineering.



The complex design required the design team to implement 3D design applications rather than use conventional 2D design methods. Image courtesy of Shandong Province Metallurgical Engineering.

In addition to economic payoffs, implementing Bentley's factory digital design applications contributed to environmental gains. For example, Shandong Province Metallurgical Engineering designed the plant to use flue gases to produce clean electricity. Further, during the smelting production process, the plant generates very low concentrations of exhaust, dust, and sodium sulfate, a by-product of the desulfurization process that can be used as a raw material for other industrial production. Shandong Province Metallurgical Engineering will continue to use innovative technology on their future projects to help stem the environmental impact of power generation plants and to demonstrate the organization's social responsibility.