



# POWERCHINA Hubei Optimizes City Power Grid with Digital Delivery of Xianning Chibi Substation

Establishing a Digital Twin Reduced the  
Project Footprint and Total Investment

## **CULTURALLY AESTHETIC SUBSTATION TO IMPROVE POWER SUPPLY RELIABILITY**

As a key initiative in Hubei, China, the Xianning Chibi 500-kilovolt substation aims to meet Xianning's power load growth demand, optimizing the power grid to improve power supply reliability. Located approximately 48 kilometers from the historic site of the Battle of Chibi, the substation design fuses industrialization with rich Chinese culture, reflecting the area's historic Three Kingdoms Period. POWERCHINA Hubei Electric Engineering was tasked with delivering the CNY 285.06 million transmission and distribution project, highlighting feasibility, technical reliability, technology advancement, and economic rationality to achieve seamless integration of design standards, cultural heritage, and actual engineering conditions. The substation will also include designs from Three Kingdom culture. Aiming to realize full lifecycle digitization, POWERCHINA Hubei explored 3D collaborative design, 4D visual construction methods, and digital twins for efficient, safe delivery of a culturally aesthetic substation structure that will ensure reliable energy supply.

## **COMPLEX TOPOGRAPHY, COORDINATION, AND COST CONTROL**

The project presented complex topography, requiring a compact arrangement, compounded by a short construction period. Being near farmland and natural habitats demanded that POWERCHINA Hubei emphasize green construction to minimize ecological and agricultural impact. The substation needed to be kept clear of farmland, houses, water canals, and a 10-kilovolt line, restricting both the layout and line corridors. One major challenge was optimizing the layout of the engineering plan based on early feasibility plans to reduce the occupation

of agricultural land. Due to the more compact layout, various disciplines were closer to each other. Coordinating the close, complicated, and concealed underground works, including hydraulic pipe networks and cable trenches, posed significant challenges that conventional workflows could not accommodate on the tight construction schedule.

In addition to addressing topography and coordination issues on a short timeline, POWERCHINA Hubei also needed to meet strict budget constraints, controlling engineering quantities of reinforced concrete, earthworks, and steel to minimize material and construction costs. Traditionally, designers used CAD software for 2D design. However, POWERCHINA Hubei realized that they needed a connected visual, 3D digital platform to coordinate the multiple engineering disciplines, integrate design and construction workflows, and effectively guide construction through 3D design. While AutoCAD provided copy, revision, and other functions absent in early-stage manual drawing, it could not solve the problem of multidiscipline design, as well as information transmission and utilization between different stages of construction. To optimize information exchange and data utilization throughout design and construction, as well as produce digital deliverables for the owner-operator at handover, POWERCHINA Hubei needed integrated digital twin technology.

## **BENTLEY PROVIDES INTEGRATED 3D/4D TECHNOLOGY SOLUTIONS**

POWERCHINA Hubei selected ProjectWise<sup>®</sup>, Bentley Open applications, and the iTwin Platform to establish a collaborative digital design environment, 4D visual construction methodology, and a full 3D substation digital twin. By using Bentley applications, the team was able to provide complete

## **PROJECT SUMMARY ORGANIZATION**

POWERCHINA Hubei Electric Engineering

## **SOLUTION**

Transmission & Distribution

## **LOCATION**

Xianning, Hubei, China

## **PROJECT OBJECTIVES**

- ◆ To meet power load growth demand in Xianning.
- ◆ To achieve full lifecycle digitization throughout substation design, construction, and asset operations.

## **PROJECT PLAYBOOK**

Bentley LumenRT<sup>™</sup>, iTwin<sup>®</sup>, iTwin Capture, OpenBuildings<sup>®</sup>, Raceway and Cable Management<sup>™</sup>, SYNCHRO<sup>™</sup>

## **FAST FACTS**

- ◆ Xianning Chibi substation will meet the city's growing power demands and improve grid reliability.
- ◆ POWERCHINA Hubei sought to implement lifecycle digitization throughout project delivery and operations management.
- ◆ They used Bentley applications to establish collaborative 3D digital design, 4D visual construction methodology, and a digital twin.

## **ROI**

- ◆ Using ProjectWise and Bentley's digital twin technology, POWERCHINA Hubei reduced the project footprint by 42.42%.
- ◆ SYNCHRO 4D helped shorten the overall construction period by 30 days.

“By adopting advanced digital technologies—such as the 4D digital construction and substation digital twin technology—construction quality was improved, winning praises from the owner.”

– Wei Wang, Vice President, Digital Branch Office, POWERCHINA Hubei Electric Engineering

solutions, allowing them to create an excellent design plan through model integration. Working in a connected digital ecosystem throughout each stage of the project across all disciplines and processes—from bidding, survey, and design to construction and asset management—streamlined workflows and communication. Integrating Bentley Open and ProjectWise applications allowed the team to deliver coordinated 3D design models that facilitated accurate quantities extraction to optimize material costs.

Making the models accessible to the construction team through SYNCHRO helped guide construction, facilitating 4D dynamic construction simulation. The workflow made it easier for construction workers to visualize and understand the design intent, as well as keep construction on schedule. Through in-depth application of the SYNCHRO 4D technology, the project achieved construction data sorting, BIM-based schedule preparation, progress visualization, construction progress tracking and management, schedule change and optimization management, and information sharing during the construction phase. The iTwin Platform reflected the real state of the project as it progressed and through its completion, enabling the automatic generation of the final substation digital twin.

## SETTING A BENCHMARK FOR STATE GRID DIGITIZATION

Establishing a fully digital context for the Xianning Chibi substation project, POWERCHINA Hubei optimized design and construction and enabled smart lifecycle management of assets and operations. Working in ProjectWise improved multidiscipline coordination, saving 55 days in design time and avoiding more than 50 design collisions.

Through accurate 3D modeling, the total project footprint was reduced by 0.97 hectares, significantly minimizing farmland occupation and environmental impact. The 3D models facilitated automated digital material extraction, eliminating 63 cubic meters of bore pile works and optimizing



Using ProjectWise and Bentley's digital twin technology, POWERCHINA Hubei reduced the project footprint by 42.42%.

8 tons of structures, saving an additional CNY 190,000 in material costs. Integrating 4D digital construction management also reduced the already tight construction period by 30 days.

By adopting Bentley's advanced digital technologies, POWERCHINA Hubei controlled project costs, reducing the initial approved total investment by approximately CNY 10.54 million. They created a digital twin of the final substation, which was handed over to the owner-operator to monitor and maintain. The digital twin will improve asset management and reliability of the substation, successfully achieving lifecycle substation digitization. Adapting to the needs of the industry, the substation digital twin project plays a demonstrative role in building a digital national grid, and is worthy of being reproduced on other substation projects.