Bentley
Advancing Infrastructure

CASE STUDY

MCC Capital Engineering & Research Incorporation Limited Developed the World's First Hydrogen Metallurgy Engineering Facility

Bentley Applications Allowed Design and Construction Teams to Engineer an Unprecedented Plant that Reduced Carbon Emissions by 70%

A FIRST OF ITS KIND FACILITY

MCC Capital Engineering & Research Incorporation Limited (CERI) sought to develop the world's first hydrogen metallurgy engineering plant, located in Zhangjiakou, Hebei, China. The CNY 1.15 billion project utilizes hydrogen as a reducing agent instead of coal, which is traditionally used in smelting.

The plant was designed to address critical environmental challenges by reducing carbon emissions by 800,000 tons annually, a 70% decrease when compared to traditional methods. By pioneering hydrogen metallurgy, the project sets a precedent for sustainable steel production and establishes a new benchmark for green industrial transformation globally.

This innovation dramatically reduces carbon emissions at the source, significantly lowering the environmental footprint of steel production. To complete the project, MCC CERI knew that they needed software that would help them enhance design, construction, and operational efficiency. They also needed real-time data sharing, safety optimization, and seamless collaboration across disciplines.

UNPRECEDENTED PROJECTS BRING UNPRECEDENTED CHALLENGES

To create the first plant of its kind, the design and construction teams had to develop new technologies and ensure efficacy and safety. Plus, because the project site is situated on a relatively small blueprint, MCC CERI needed to develop powerful machinery with minimal spatial capacity.

To certify that the plant was a safe place to work, the team had to develop mechanisms that ensured hydrogen-rich gas could be stored and distributed carefully, which presented unique engineering challenges. Overall, completing the project required 29 design disciplines, which would traditionally make project management and collaboration extremely difficult.

CONNECTING 29 DESIGN DISCIPLINES

MCC CERI chose Bentley applications because of their advanced capabilities in managing complex engineering challenges, as well as their ability to enable seamless collaboration across disciplines. For this project, MCC CERI used Bentley applications for real-time data sharing, precise modeling, and tools to implement enhanced safety standards—all critical to achieving the project's ambitious goals within a tight timeframe.

The team utilized ProjectWise to establish an open, interconnected data environment that enabled real-time updates and streamlined collaboration among the 29 design disciplines. This digital approach minimized information mismatches and accelerated the design process, ensuring progress remained on schedule. For structural challenges, the team used ProStructures, ProConcrete™, and STAAD.Pro® to design the 120-meter-high shaft furnace, which needed to endure extreme temperatures and heavy loads while adhering to safety standards.

"The world's first hydrogen metallurgy engineering demonstration project uses Bentley technology to various stages of design, construction, operation and maintenance," said Zhilong Zhao, chief expert at MCC CERI. "[It is] helping the iron and steel industry to replace coal with hydrogen as a source of energy, apply the technology of low-carbon upgrading and transformation, pave the way for the digitalization of the whole process, and practice

PROJECT SUMMARY

ORGANIZATION
MCC Capital Engineering & Research Incorporation Limited

SOLUTION
Process and Power Generation

LOCATION
Zhangjiakou, Hebei, China

PROJECT OBJECTIVES
- To reduce carbon emissions from a large manufacturing plant.
- To design the first hydrogen metallurgy engineering facility.

PROJECT PLAYBOOK
AutoPIPE®, AutoPLANT®, Bentley LumenRT™, iTwin®, MicroStation®, OpenBuildings®, OpenPlant,® OpenRoads™, ProjectWise®, ProStructures™, STAAD®, SYNCHRO™

FAST FACTS
- MCC CERI used Bentley applications to create the first hydrogen metallurgy engineering facility.
- Bentley's technology comprehensively supported the plant's design and execution, leading to a project that dramatically cut carbon emissions, construction costs, and time.
- Bentley's digital twin also improved safety measures at the plant.

ROI
- MCC CERI's digital twin cut construction time by up to three years, leading to significant cost savings.
- Bentley's technology helped reduce 800,000 tons of carbon emissions per year.
- The team reduced water and energy usage by more than 50%, and diminished emissions of harmful sulfur dioxide, nitrogen oxides, and particulates by 30%, 70%, and 80%, respectively.

> "The world's first hydrogen metallurgy engineering demonstration project uses Bentley technology to various stages of design, construction, operation and maintenance [...] thus laying a solid foundation for the digital transformation and upgrading of the iron and steel industry."
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> *– Zhilong Zhao, Chief Expert, MCC Capital Engineering & Research Incorporation Limited*

and validate the construction of digital twins for iron and steel enterprises, thus laying a solid foundation for the digital transformation and upgrading of the iron and steel industry."

DRAMATICALLY CUTTING COSTS, TIME AND CARBON EMISSIONS

MCC CERI's project achieved significant benefits through the implementation of Bentley applications, resulting in a substantial return on investment. These benefits spanned cost savings, time efficiency, environmental impact, and operational improvements, all of which demonstrated the value of adopting a fully digital workflow.

From an environmental perspective, the project's innovative hydrogen metallurgy process met their 70% reduction goals, which is equivalent to the carbon sequestration capacity of 72 million trees per year. Additionally, the team reduced water and energy usage by more than 50%, and diminished emissions of harmful sulfur dioxide, nitrogen oxides, and particulates by 30%, 70%, and 80%, respectively.

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