Bentley
Advancing Infrastructure

CASE STUDY

SIDRI Delivers Kubuqi Photovoltaic Desertification Control Project (Section I), Contributing to Saving 1.23 Million Tons of Standard Coal Annually

Bentley Applications Improved Design and Construction Efficiencies, Shortening the Project Schedule by Six Weeks

CLEAN ENERGY AND NEW DESERT VITALITY

Located in the Kubuqi Desert in Ordos City, Inner Mongolia, the Kubuqi photovoltaic (PV) desertification control project spans 6,666 hectares and is China's largest environmental desert control PV project. With an installed capacity of 2 million kilowatts and equipped with an 800 megawatt-hours energy storage system, the project will provide clean energy for China's power grid while simultaneously improving the Kubuqi Desert environment. Sandstorms consistently plague the desert; however, the abundant sunlight and less competition for land—compared to densely populated or agriculturally active regions—make it a prime location to capitalize on solar resources and utilize PV panels to produce electricity, restore the environmental ecosystem, and bring new vitality to the desert.

Shanghai Investigation, Design & Research Institute Co., Ltd. (SIDRI) is one of the general contractors and the design company for the project that is expected to generate 4.1 billion kilowatt-hours (kWh) of annual electricity to the grid, saving 1.23 million tons of standard coal and avoiding the emission of 3.19 million tons of carbon dioxide per year. SIDRI worked on section I of the project, which included about 60% of the entire project. It promotes ecological restoration, utilizing the PV panels to resist harsh winds, prevent sand drift, and collect dew to provide water for vegetative growth suitable for the desert climate. "It provides clean energy to the local area, achieving a win-win situation for photovoltaic power generation and desert control, as well as supporting the adjustment of Inner Mongolia's industrial and energy structure," said Zeyang Lyu, engineer at SIDRI.

LARGE PROJECT SCALE, DESERT CONDITIONS, SHORT SCHEDULE

As one of SIDRI's most ambitious solar power undertakings, the large-scale project presented significant challenges when managing the desert terrain and voluminous project data on a tight deadline. "This project has a huge scale, with a large number of photovoltaic components and electrical equipment, and the project site is divided into four blocks, occupying a large area," said Lyu. Throughout the design process, they also had to consider the lack of roads, water, electricity, and heavy equipment required to enter the desert during construction. The Kubuqi Desert is composed of shifting dunes, and without stabilizing the desert, the photovoltaic panels would be quickly buried by sand. Multidiscipline design coordination and collaboration was crucial to meeting the tight construction deadline. Typically, SIDRI used several different CAD, solar design, and structural analysis applications, making data exchange difficult and time-consuming.

Faced with high design requirements, multi-sourced data, and a short construction period, SIDRI viewed these potential obstacles as an opportunity to establish coordinated digital processes that would not only optimize design and construction for this PV project, but also serve as a blueprint for their future solar endeavors. "Conventional solutions require the use of multiple software from different vendors, which cannot achieve a smooth design process and data exchange, resulting in low efficiency and poor quality," said Lyu. SIDRI sought to create a project management and design platform to facilitate seamless data exchange and streamline planning, design, analysis, and construction. To develop and implement their digital innovation, they needed integrated modeling and analysis applications.

PROJECT SUMMARY

ORGANIZATION

Shanghai Investigation, Design & Research Institute Co., Ltd. (SIDRI)

SOLUTION

Facilities, Campuses, and Cities

LOCATION

Ordos, Inner Mongolia Autonomous Region, China

PROJECT OBJECTIVES

- To develop photovoltaic resources and achieve desertification control in the Kubuqi Desert.
- To provide clean energy supporting Inner Mongolia's and China's sustainability initiatives.

PROJECT PLAYBOOK

OpenBuildings®, OpenRoads™, STAAD®

FAST FACTS

- The 2 million-kilowatt Kubuqi photovoltaic desertification control project is the largest of its kind in China.
- SIDRI needed to address challenging desert conditions on a short project schedule.
- Based on Bentley's applications, they developed CTGSolar, a digital design and project management platform, providing a blueprint for delivering their future solar power projects.

ROI

- SIDRI increased design efficiency by 70% and reduced on-site changes during construction by 40%.
- The comprehensive technology solution shortened the project schedule by six weeks.
- The PV panels will provide more than 61 billion kilowatt-hours of clean electricity over 25 years.

"Bentley software has various functions such as terrain processing, geometric modeling, and structural analysis, which can be combined and used together with convenient and reliable data exchange between different software."

– Zeyang Lyu, Engineer, Shanghai Investigation, Design & Research Institute Co., Ltd.

DEVELOPING A DIGITAL PROJECT MANAGEMENT AND DESIGN PLATFORM

Already familiar with Bentley applications, SIDRI selected OpenBuildings Designer, OpenRoads Designer, and STAAD for terrain processing, 3D modeling, and structural analysis. With Bentley's road design software, the team created a digital terrain model using the contours and altimetric points and planned the necessary site leveling. Integrating OpenBuildings Designer, SIDRI generated accurate PV panel and bracket models, referencing the terrain file to check for structure interferences and shadowing analysis, and incorporating their 3D structural analysis to ensure the bracket design could withstand the environmental loads. "Bentley software, such as OpenRoads Designer, OpenBuildings Designer, and STAAD, effectively enable the modeling and analysis of the Kubuqi 2,000-megawatt photovoltaic desertification control project, handling terrain analysis, site leveling, and site layout at the kilometer scale in the overall design, and processing structures and components at the millimeter scale in the local design," said Lyu.

Based on key features of Bentley's applications, SIDRI developed their CTGSolar platform, integrating and expanding the digital modeling and simulation capabilities to develop a benchmark project management and design solution that will improve efficiencies for future solar power station projects. "CTGSolar realizes the mainstream forward design (correct BIM-based) process, pre-installs a series of databases and model libraries, and can be used for the integration of multiple software," said Lyu. The digital solar design platform facilitates rapid 3D modeling and equipment coding, as well as can generate bill of quantity, feasibility reports, and calculation books.

SUCCESSFUL DIGITIZATION SUPPORTS FUTURE PV DESERTIFICATION CONTROL

By developing their CTGSolar digital project management and design platform, SIDRI achieved design automation and accurate quantity takeoffs and material costs. The Bentley-based technology solution increased design efficiency by 70% and accuracy by 80%, as well as reduced on-site changes during construction by 40%, shortening the project schedule by six weeks. By establishing a comprehensive digital approach to data and project management, design, and construction, SIDRI made full use of the barren desert land resources for their solar power station, avoiding excessive land expropriation and rental costs, and reducing millions of dollars in land expenses.

The Kubuqi PV desertification control project is expected to provide power to more than 1 million households, greatly reducing annual emissions of various atmospheric pollutants, while promoting ecological restoration and economic benefits by developing desert agriculture, planting cash crops. Through their innovative application of Bentley software, SIDRI successfully digitized delivery of the large-scale solar power station. Their CTGSolar platform will become the backbone for all SIDRI's solar power station projects, demonstrating that clean energy projects can become more time-efficient, better managed, and less expensive. With ecological desert control PV systems gaining more and more popularity in China, SIDRI's digitalization of the Kubuqi PV desertification control project supports and helps streamline the path towards green development of the region. It contributes to realizing China's dual carbon goals of peaking carbon dioxide before 2030, as well as reaching carbon neutrality before 2060.

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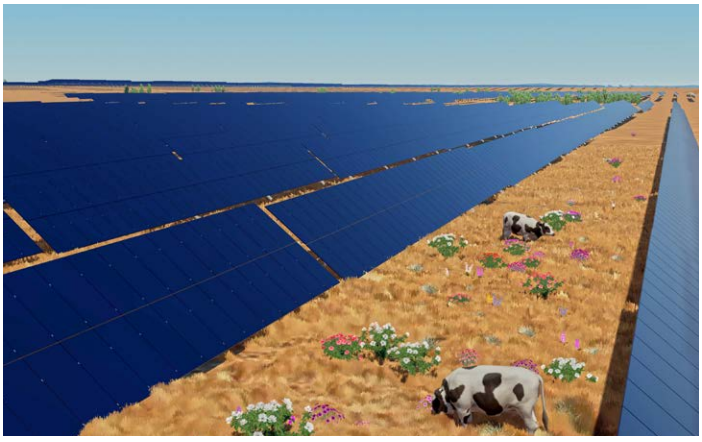

The comprehensive technology solution shortened the project schedule by six weeks.

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