How digital innovation is transforming the design, construction and delivery of the world’s largest waste-to-energy plant

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MR YUE
Vice President of Shanghai Environmental Group
How digital technology enabled the complex Phase II to be built faster, saving over RMB 5 million yuan, and is supporting continuous handover of engineering information, as the plant nears commissioning.

Shanghai Laogang Waste Incineration Power Plant Phase II is a comprehensive power generation project by the Shanghai Environmental Group. Phase I has a waste-handling capacity of 3,000 tons per day and produces 60 MW of electricity. Phase II, which is scheduled for completion in 2019, will have a treatment capacity of 6,000 tons per day, making it the world’s largest waste-to-energy facility. The combined waste incineration capacity of Phases I and II will be around 3 million tons per annum, with annual power generation in the order of 900 million kWh. The plant is viewed as a model for future waste-to-energy plants that can ensure efficient waste treatment alongside maximum electricity generation.

Shanghai Environmental Group owns and operates the plant. For the Phase II construction, they selected the engineering, procurement and construction (EPC) company China Wuzhou Engineering Corporation Ltd to work alongside them.

Problems with the 2D, document centric approach
Numerous design companies contributed to Phase I of the project, using diverse platforms based on conventional 2D methodology. The drawings and engineering data were created and stored as 2D documents.

This approach caused several problems, for example:

- Information was in some cases inaccurate or out of date, and could not be shared easily or consistently between the designers of different elements of the plant.
- This led to interference and collision issues so that e.g. structures and cabling needed to be dismantled and reworked, causing delays and creating extra costs.
- There was no mechanism for transferring consistent and correct data between the EPC and the operator. This became a major obstacle to completing the plant efficiently and inhibited the effective start-up because there were significant data queries that delayed the subsequent operation and maintenance phases.

Using AVEVA NET simulation, the construction team leader can see the task, and the 3D model of the current construction area, so that multiple construction teams can quickly understand the tasks they need to complete. (Red indicates constructed, yellow indicates to-be-constructed).

Source: Shanghai Environmental Laogang Phase II Project Department.
Adopting a digital approach

Mr. Yue, Vice President of Shanghai Environmental Group, decided that the only way to solve these problems was to switch to the latest AVEVA software. He recommended that China Wuzhou Engineering should adopt AVEVA’s 3D plant design tools and the AVEVA NET information management system, as the digital integration and delivery platform for the Laogang Phase II project.

Most importantly, AVEVA provided us with an engineering information sharing platform, which is vital for the success of any multi-party collaboration venture and enables us to achieve fast efficient digital handover and information sharing.

Mr. Yue explains, ‘AVEVA’s solutions enabled our engineering and design teams to complete their tasks more quickly and efficiently than ever before. They also eliminated many of the construction and inter-disciplinary collision problems at the design stage, reducing waste and rework during the construction phase. Most importantly, AVEVA provided us with an engineering information sharing platform, which is vital for the success of any multi-party collaboration venture and enables us to achieve fast efficient digital handover and information sharing.’

Implementing the solution

AVEVA’s specialist team worked closely with Wuzhou Engineering and the Laogang Project Department to introduce AVEVA’s 3D plant design tools and AVEVA NET effectively throughout the project. Wuzhou Engineering is also using both these systems extensively for formal engineering design and to optimise design and build. AVEVA NET is also enabling the continuous handover of the project through regular updates of all the engineering information (data & documents) between the EPC and the plant operator.

On-going 3D simulation of the various phases of the plant construction is delivered through AVEVA NET. This integrated overview of progress on the plant construction is helping Laogang’s management team to check that the project is on track against plan and to spot any errors immediately. Having access to accurate, timely data helps them to make better, quicker decisions during the construction phase, improving overall efficiency. By creating a single source of truth for all aspects of the design and build process, the team is also ensuring that they have the project information already in place for final handover.
The key improvements achieved by using the integrated system include:

- Compared with traditional waste generation projects, AVEVA’s 3D plant design tools have prevented more than 200 collisions, saved more than RMB 5 million yuan and cut construction time.

- 900 piping isometrics were produced quickly and easily, saving 1000 days, equivalent to 2 million RMB. The high levels of automation also shortened Laogang’s design and construction delivery cycle.

- During the construction phase, multiple teams work around the clock to build the plant. AVEVA NET construction simulation supported the Construction manager in scheduling the construction tasks effectively, helping him to arrange the teams so they can coordinate appropriately on site. This also eliminates potential conflict between the activities of the construction workers, helping to ensure that work progresses on schedule.

- The plant site is more than 40 kilometers from the centre of the city of Laogang, and traffic is very heavy making it difficult to transport the materials needed to construct it. The complexity of the project also demanded integration of numerous parties into a working team, including a major design institute, the plant owner, the construction side contractors, the site supervisor and the equipment supplier. The different elements of the supply chain are located in different cities, some in Shanghai, some in Beijing, some outside China. All used AVEVA NET to share data and to promote collaboration. The system enabled quick, clear communication between these diverse parties. This helped the operator to understand the status more clearly, and to build up a reservoir of documents that form the backbone of the digital plant – this data reservoir will be the foundation of the digital plant handover when it is commissioned. This means that, now that construction is complete and the team is preparing for commissioning, they already have the data that will form the foundation of its Digital Twin.

Laogang Power Plant Phase II is the first project to employ digital design and digital delivery in the waste-to-energy power generation industry in China.

First waste to energy project in China with digital design & delivery

Mr. Yue, a senior specialist in waste-to-energy power generation, is very pleased with the pioneering way that the team has made use of the AVEVA software tools.

He says, ‘Laogang Power Plant Phase II is the first project to employ digital design and digital delivery in the waste-to-energy power generation industry in China. It has improved both construction efficiency and accuracy, saves cost and time and should be used more extensively in the design and build of complex plant.’