CASE STUDY

Promech delivers underground coal gasification project with Octave Forte 3DWorx and Aspect Pipe Stress

Key facts:

Company: Promech

Website: promechengineering.com.au

Industry: Oil & Gas

Country: Australia

Octave products used: Forte 3DWorx *(CADWorx Plant Professional),* Aspect Pipe Stress *(CAESAR II)*

Key benefits:

- Ability to handle systems with large temperature differential
- Seamless integration between modeling and pipe stress analysis solutions
- Exceptional user interface

Promech is a multi-disciplinary engineering design and project management company. It specializes in small- to medium-sized projects with particular focus on the alternative industries, including mining and petrochemical. From definition to conception, to commissioning and operations handover, it caters to all stages of projects.

Identifying goals

Promech is an Australian engineering design and project management company that delivers projects for a diverse range of clients across various countries and industries. One of these clients is Carbon Energy, an emerging global energy company with expertise in unconventional syngas extraction through the use of its proprietary keyseam Underground Coal Gasification (UCG) technology.

Promech was engaged to complete the full plant design and project management of Carbon Energy's first commercial UCG project, the Haoqin Coal Field in Xiwuqi in Inner Mongolia, China. The commercial-scale UCG project is set to produce at least 30 petajoules per year and is to be completed in three stages, with the first stage being the design, construction and operation of a process characterization panel.

This project involved all engineering disciplines and included concept development through production of issued-for-construction drawings and equipment specifications. Promech was required to deliver an upgraded, modularized and containerized UCG facility design.

Overcoming challenges

Promech faced two major challenges in the execution of this project:

1. Design conditions ranged from -40 degrees to 340 degrees Celsius. When such a large termperature differential exists, due to thermal expansion of the piping material, there is a natural tendency for the piping to grow and move once heated by the process fluid. Failure to manage a substantial temperature differential in the design phase of a project can lead to considerable issues when the system is operational.
2. In order to reduce site installation time and ensure that the modules were easily transportable to any location in the world, Carbon Energy set the design requirement that all modules had to be designed to fit into 40-foot shipping containers. However, given the anticipated thermal expansion of the system during operation, this containerized modular design approach placed significant restrictions on the amount of space afforded to the Promech design team to account for this thermal expansion.

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Ciaran O'Leary
Promech Director

Prior to the project, Promech carried out a review of the various solutions on the market and based on the experience of various team members – particularly the lead designer on this project – the decision was made to use Forte 3DWorx and Aspect Pipe Stress.

Realizing results

In order to manage the 380-degree temperature differential and to ensure the piping design was in full compliance with ASME B31.3, Aspect Pipe Stress was utilized to conduct a thorough pipe stress analysis of the system.

"The large termperature differential combined with the significant space restrictions, made conducting a thorough pipe stress analysis using Aspect Pipe Stress a fundamental design requirement for the project," said Promech Director, Ciaran O'Leary. "It is the leading pipe stress analysis solution on the market and it's not hard to see why – Aspect Pipe Stress performed excellently."

Promech also had to undertake extensive piping design and analysis to produce modules that met all of Carbon Energy's design requirements. As is standard practice for Promech, the design team took an iterative approach to the design process. The piping designers and mechanical engineers worked together using Forte 3DWorx and Aspect Pipe Stress with the engineering manager and other key project stakeholders to complete 30%, 60% and 90% design review gates to assess, validate and refine the module designs.

"Iterative design requires seamless integration between software packages, so the bi-directional links between Forte 3DWorx and Aspect Pipe Stress were a major selling point for us," said O'Leary. "Rather than building two separate models, we were able to move a single model

between each software package. This saved us an immense amount of time and minimized the potential for errors."

O'Leary also praised Forte 3DWorx's usability, adding that the time invested up front can result in productivity gains towards the end of the project.

"If you are thorough at the start of the project when developing and inputting your piping specifications for the various materials and pressure classifications, you can save yourself a large amount of time at the end – when you need things to be easy," O'Leary said.

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Moving forward

Given the positive experience in delivering this project for Carbon Energy, Promech intends to use the combination of Forte 3DWorx and Aspect Pipe Stress to deliver any detailed design projects going forward.

About Octave

Octave is a leader in enterprise software, turning data into decisive action and intelligence into your edge. Our software solves for and simplifies complexity, from the design and build to operations and protection of people, property and assets – for any scope, at any scale. For decades, we've partnered with customers to sharpen performance, elevate efficiency and amplify results. From factory floors to entire cities, our solutions are tuned to scale up what's possible from day one onward.