TURN IT UP (AND DOWN)

Michael Calvert, Emerson Process Management, Australia, introduces Emerson's new solution to control wells at the Santos GLNG project.

The Santos Gladstone LNG (GLNG) project is charting new territory by developing coal bed methane (CBM) fields to be used for LNG production. The joint venture (JV) between Santos, Petronas, Total and Kogas, will extract gas from its gas fields in Queensland's Bowen and Surat Basins to supply its LNG facility on Curtis Island, near Gladstone, Australia, via a 420 km pipeline. At the LNG facility, the gas will be liquefied by cooling it to -161°C, using a large scale refrigeration process. From there, the liquid will be stored in refrigerated tanks and then loaded onto LNG tankers that will transport the product to market. Queensland's LNG projects, including Santos GLNG, mark the first time that a CBM field will be the single supplier to an LNG plant.

The impact of single supply

Typically, LNG facilities are supplied by six or more offshore oil platforms. As a result, they have more flexibility in their supply management. To better understand the impact of being the single supplier, Santos conducted several analyses, beginning in 2012.

In one analysis, it identified the need to turn down field production quickly to avoid reaching maximum pressure in the pipeline, minimise flaring at compression hubs and protect the LNG plant. Specifically, if the LNG plant was shut in, and no action was taken with the wells, within 30 – 45 min. the pipeline would be at its maximum allowable operating pressure (MAOP) and the gas would go to flare.

Figure 1. Using the Well Manager, technicians can manage the turn-up, turn-down or rapid shut-in of wells across a hub, by priority group, from a remote location.

Traditional means of pressure control would not be a feasible answer. In a conventional gas field, the wells are on pressure control. If the LNG plant shuts in, the pressure rises and the wells shut in. When the pressure drops, the wells come back online. In a CBM application, if the coal bed wells shut in, 20 – 30% of the wells will not come back online due to ingress of water at the coal bed, resulting in a shortage of supply to the LNG plant. This presented a significant challenge for the Santos GLNG application. In order to meet commitments to the LNG facility, the wells have to be at 95% availability at all times.

A risk assessment also indicated the need for rapid shut-in capability. For example, if someone accidently drilled a hole through one of the high density polyethylene plastic gathering pipelines, Santos GNLG would need to be able to shut in hundreds of wells very quickly. Typically it would take up to 16 hours to turn all of the wells down manually, one-by-one, and Santos GLNG could not afford that kind of time.

New application, new approach for design

With hundreds of wells located at vast distances across its gas fields, Santos GLNG brought the challenge to Emerson Process Management, as the main automation contractor, to find a way to quickly, effectively and remotely control each well. Emerson suggested using a custom designed application of the Syncade operations management software, which provides resource management, operations optimisation, integrated information, and quality and regulatory compliance support. However, using this software for a CBM application was unprecedented.

The first step was to define the requirements with a cross-functional team made up of engineers from the engineering, construction and procurement (EPC) firm, Santos engineers and operations personnel, and Emerson experts.

After the company defined the 'what', its next step was to determine the 'how'. It worked with Santos GLNG to design the solution to imitate the operator with largely manual initiation for changes. The capability for rapid shut-in was also added. In case of a field-based incident or issue, all wells on the line or in the hub could be shut-in, or set to 'minimum gas' or 'minimum water.'

Another critical step in the design process was the identification of parameters to include in the well management system. With CBM wells, water as well as gas is produced. If

the flow of the well is adjusted, the amount of water that is produced can also fluctuate. At a given well, that could mean the control valve should only be closed 60%. More than that and the well will 'water up', resulting in a disruption to gas production and additional effort to de-water the well.

In addition to information on water, the database also needed to include the well number, flow line, compressor station, minimum/maximum speed of the down-hole pump, minimum/maximum pressure, minimum/maximum flow, 'pumped' or 'free flowing' well, information on water, and wells on maintenance that should be excluded.

Santos GLNG's wells in the field are organised geographically into three gas processing hubs. Emerson worked with Santos GLNG to focus on a design that would allow production across a hub to be adjusted. Santos GLNG wanted to be able to make simultaneous flow set-point adjustments by priority group, potentially adjusting hundreds of wells at a time, while building in capability for local control to override the software if needed.

Changing the way wells are managed

Santos GLNG's Well Manager will be used in combination with the distributed control systems at each of the three hubs. Six operators control the entire gas field from Brisbane, which is hundreds of kilometers away from the field. As such, Santos GLNG's technicians can remotely manage the turn-up, turn-down or rapid shut-in of up to 2000 wells at a time.

Additional automation was also added for hazardous operations for compressor stations. If there is an emergency shutdown, the Well Manager automatically puts all wells to minimum.

This well management approach represents a significant change for the industry. Prior to Santos GLNG's development of the Well Manager and its Brisbane operations centre, wells were typically monitored on a daily or weekly basis. Operators in the field would drive to remote, often rugged locations, to tune and check the wells, and would spend approximately 60% of their day in a vehicle. With the new remote technology, a single operator is now able to simultaneously control 100 wells.

Testing the new technology

Comprehensive factory acceptance test was achieved in May 2014, which included data for 2000 wells, as well as multiple well pads, DeltaV distributed control systems, and ROC units. During the test, within 90 sec. after a turn-down, turn-up or shut-down event was initiated, the software had calculated all new set-points and broadcasted them to the distributed control system for implementation. It would previously have taken a single operator 16 hours to manually turn down 500 wells, but the operator is now able to perform the same operation in two minutes, up to 600 km from the wells.

Implementation

After more than three years from concept to implementation, the Santos GLNG team has said it is excited to see the Well Manager at work, with gas now flowing from the gas fields into the LNG plant, ahead of the anticipated first LNG production at the end of 3Q15. **LNG**