Case Study

West Kimberley Power Project, Maitland, Australia Operated by Energy Developments Pty Limited (EDL)

Overview

- Through the production and delivery of LNG to remote areas in Western Australia, EDL provides customers with a viable long-term energy source for power generation, particularly in locations with limited energy infrastructure.
- The power generation company's ongoing challenge was to keep its LNG plant online 24/7, avoid running into the risk of depleting its reserve tanks with any LNG shortfall - with only a few planned shutdown maintenance days per year.
- To have 100 percent electricity availability one of the most critical pieces of equipment would be the compressors where Ingersoll Rand's IGC technology was well suited to handle the range of cooling loads the plant requires.

About EDL

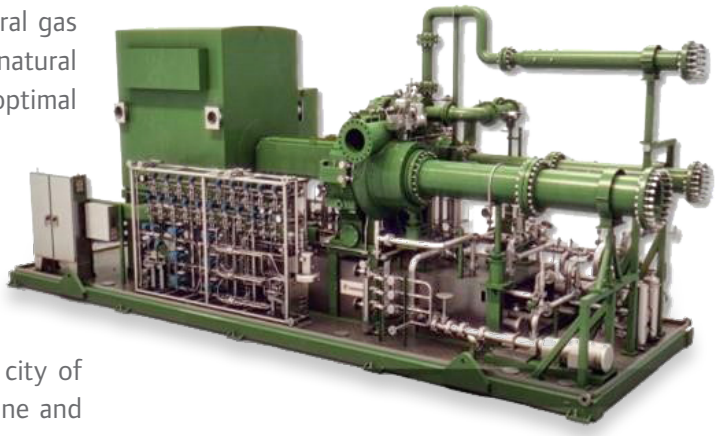
Energy Developments Pty Limited (EDL) is a power generation company committed to developing innovative, tailored solutions that deliver reliable, cost-effective and environmentally sustainable energy, utilizing a range of fuel sources, including renewables, landfill gas, remote energy and hybrids, liquefied natural gas (LNG) and compressed natural gas (CNG), waste coal, and mine gas. Rather than using conventional power stations with a large centralized energy source that must transmit electricity long distances, EDL specializes in distributed energy through small power plants located close to end users. The company owns and operates a portfolio of 100 power stations, with 1078MW of energy generating capacity, in Australia, North America and Europe, and employs more than 565 individuals.

Challenge

In the summer, when temperatures swell into the mid 40s Celsius, a dependable electricity supply is crucial for the comfort and safety of residents in the Kimberly region of Western Australia. However, providing electrical power to the region is challenging because its remote towns are not easily accessible by a centralized power plant or gas pipeline. For four particular towns in the West Kimberly region, diesel fuel was not only the main source of energy, but also a source of air and noise pollution, as it was used to fuel reciprocating engine-generators, which electrify the area. Realizing the benefits that could be achieved, EDL made plans to switch from diesel fuel to natural gas–an abundant, affordable, cleaner burning fuel. When compared with diesel, LNG is not only less expensive, but generates fewer greenhouse gas and particulate emissions. Additionally, natural gas fueled engines run much quieter than diesel, an important benefit for residents of the nearby communities.

Along with the switch to natural gas came the challenge of transporting large quantities of fuel to the remote areas.

Solution



The innovative solution deployed by EDL to deliver natural gas to its remote power stations consisted of a small-scale natural gas liquefaction plant and high capacity road-trains. For optimal energy efficiency of the LNG plant, a single mixed-refrigerant cycle was implemented to chill the incoming natural gas to -162 °C, the temperature required to change from gas to liquid phase. Changed to its liquid state, the natural gas is reduced to 1/600 of its original volume, making it more economical to transport over long distances. Locating the LNG plant in Maitland, near the city of Karratha, allowed for direct access to a natural gas pipeline and manageable travel times to the five towns to be served.

Maintaining Efficient 24/7 Plant Operations

EDL knew that with a shortfall in LNG production, the company would run the risk of depleting its reserve tanks, leaving its Western Australia customers without electricity. The power generation company's ongoing challenge would be to keep its LNG plant online 24/7 with only a few planned shutdown maintenance days per year.

EDL's engineering consultant considered many factors to ensure 100 percent electricity availability, knowing that when it came to refrigeration for LNG liquefaction, one of the most critical pieces of equipment would be the compressors. To meet EDL's expectations, a reliable flow of compressed mixed refrigerant gas would be needed to drive the refrigeration process that is used to liquefy natural gas. Two model 3R2-MSG3G integrally geared compressors (IGC) from Ingersoll Rand were given that duty.

Ingersoll Rand's IGC technology is well suited to handle the range of cooling loads the plant requires. As refrigeration load is reduced, the pressure and mass flow entering the compressor decrease, but the actual volumetric flow and pressure ratio remains relatively consistent. These properties present an optimal match to the characteristics of an IGC, leading to efficient operation for all conditions. In addition, with the inherent oil-free design of the compressors, no downstream oil removal is required.

Servicing Remote Customers with Unique Road Train System

EDL employed an innovative haulage system for delivering LNG to the power stations servicing the remote communities. Liquefying the natural gas reduces its volume, enabling EDL to use four triple-tanker road trains with cryogenic storage tanks, each carrying 60 tonnes of LNG for delivery to four power stations. The longest haul for the road trains is a two-day trip to Halls Creek; the shortest a 12-hour journey to Broome.

The LNG is stored at the power stations as fuel for gas engine-generators to provide electricity to the towns. The cryogenic storage tanks feature stainless steel inner surfaces and carbon steel outer surfaces and use vacuum insulation to keep the gas in a liquid state. LNG storage capacity at each power station varies– Broome, its largest power station, houses six tanks of 325kl; Derby station has three 200kl tanks; and Halls Creek and Fitzroy Crossing stations each have two 200kl capacity tanks on site.

Online since 2007, Ingersoll Rand integrally geared compressors provide reliable refrigeration at this LNG plant

Results

Through the production and delivery of LNG to remote areas in Western Australia, EDL provides customers with a viable long-term energy source for power generation, particularly in locations with limited energy infrastructure. The 160-tonne per day micro-LNG plant in Maitland generates fuel for its power stations in Broome, Derby, Fitzroy Crossing and Halls Creek.

EDL has experienced consistent production thanks to the reliability of Ingersoll Rand integrally geared compressors, which have been online since 2007. With extremely low-leakage tandem dry-face seals, the compressors have also helped to minimize hydrocarbon refrigerant replenishment costs. The total seal loss from the compressors is less than one one-thousandth of one percent of the delivered flow.

According to the spokesperson from EDL, "Uptime of the Maitland LNG facility is of paramount importance, particularly in summer, our peak demand season. We don't have a large inventory of fuel storage, so any plant downtime must be avoided. The mixed refrigerant compressors are a main-line unit that cannot be taken offline quickly for repair. So, it is valuable that the Ingersoll Rand compressors are reliable."