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# Growing LNG Exports Help Drive Improvements To Nitrogen Rejection Units

## By Colter Cookson

While the U.S. may be tempering its greenhouse gas-focused regulations, market forces will likely keep emissions top of mind for many companies. Strong environmental performance can help companies attract investors and employees. It's also required to sell liquefied natural gas to some international markets, including the gas-hungry European Union.

# **Nitrogen Rejection**

As U.S. LNG exports have grown, so has interest in nitrogen rejection units, reports Brennan Heiser, a senior process engineer with BCCK. "Nitrogen is an inert gas that negatively affects the burner, so few gas purchasers want it," he says. "However, it is particularly problematic for LNG companies because it can cause tank rollover, a situation that can lead to dangerous pressure spikes inside the LNG storage tank."

To prevent that, LNG companies seek gas with nitrogen concentrations below 1%, much lower than the 3% or 4% typically allowed by interstate pipelines. "The other trend that is increasing demand for NRUs is gas processing in high nitrogen basins such as the Permian," he says. "As wells in those basins mature, they often produce gas that contains even more nitrogen." In the last two to three years alone, Heiser says BCCK has built seven NRUs. "By improving the design to maximize efficiency, we have been able to reduce these units' methane emissions to some degree," he says. "Those improvements involve optimizing the hydraulics in the plant, adjusting the line sizes to avoid





wasting power, and minimizing pressure drop in various areas to get as much out of the plant as possible."

BCCK has developed a plant design that can achieve even lower methane emissions at the relatively marginal cost of some additional compression. If lower emissions become necessary to avoid fines from the EPA or other regulatory agencies, Heiser predicts this ultra-low-emissions design will gain popularity.

While building and supporting plants, Heiser says he has noticed that many of the plant operators are new to the industry with no processing experience. "To meet the growing power demand across the United States, more gas plants are being built, which means the industry needs more operators," Heiser says. "It's common for a plant to be run by former teachers, mechanics or construction workers who are ready for a new career."

According to Heiser, that trend has reinforced an already compelling case for strong customer support and robust control schemes. "It is easy to develop schemes that work on paper and perform fine when the process is steady, but a good control scheme works when an upset occurs upstream or downstream of the equipment," he stresses. "If a lightning strike or a fire at a compressor station shuts in half the field, the volumes, temperatures and pressures at the plant's inlet can swing wildly. Even so, the plant still needs to keep its output on spec so the pipelines and regulators stay happy."

With the right automation, Heiser says NRUs can show remarkable flexibility. "Shortly after a recent startup, the cryogenic plant that included one of BCCK's NRUs changed from ethane rejection mode to recovery mode while the NRU was online. That altered the inlet composition from almost no ethane to about 10% ethane and a little bit of propane, but we anticipated this scenario when designing the NRU, allowing it to maintain product spec throughout," he illustrates.

#### **Central Control**

In the long run, Heiser envisions operators managing multiple plants from central offices. To maintain process safety and integrity, remote operations will require significant investments in cybersecurity, Heiser acknowledges. However, he muses, the payoff may justify the cost and risks associated with connectivity.

"In college, I had a chance to tour air separation plants. Almost all of them were fully automated, with control rooms in an office building located in a popular city," he says. "That setup makes it much easier to attract operators and to pass knowledge from seasoned hands to novices. Because each person oversees multiple plants, it's also easier to apply best practices across facilities."

This model does have limitations, Heiser allows. "Gas plants are close to the wellhead and see some dirty streams," he clarifies. "There is a lot of manual cleaning that needs to take place, so they will always require someone to visit."

## **Robust Design**

The right design can minimize the chance of issues, Heiser reports. "I'm proud of the changes BCCK is making to its designs," he says. "We are developing plants that are more efficient, more affordable and easier to control, and we continue to learn and improve.

"As part of our optimization efforts, we have focused on every aspect of the NRU, from the cryogenic side to the compression and oil filtration. On the oil filtration skid, we have added check valves in strategic locations, eliminated bypasses and enhanced the automation to prevent oil from getting into the system."

The company has also simplified its compressor automation. "When I started at BCCK in 2022, one project had seven automated controllers on the inlets and outlets of the compressors," Heiser recalls. "Today, we are down to two per compressor, which greatly simplifies operation and improves reliability."

As the need for NRUs has grown, Heiser says BCCK has gotten more involved in assisting customers with decisions they once handled internally. He points to compression as a common source of issues early in a plant's life. "Customers know compression and prefer to buy it themselves based on specifications we provide for the flows and pressures coming into and out of the plant," Heiser says. "In the past, they would also decide how the compression is arranged and design the surrounding systems."

Over time, Heiser says BCCK has seen customers try arrangements that would make sense in other applications but cause issues with NRUs. "To prevent those issues, we now design the systems around the compressor, then inspect them on site to ensure they are installed properly," he says. "That extra guidance has eliminated some early headaches for customers and helped us cut the startup and commissioning time for new units in half."