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SUNDYNE EXPANDS CO_2 COMPRESSOR CAPABILITIES TO MEET RISING DEMAND FOR CARBON CAPTURE AND LOW-CARBON ENERGY

By Jack Burke, December 2025

New high-pressure design enhances performance, reliability and affordability for emerging CCUS markets.

Sundyne's latest expansion of its LF-2000 centrifugal compressor line marks a significant advance in the company's long history of innovation in high-speed rotating equipment. The latest model, developed to meet the demanding requirements of carbon capture, utilization and storage (CCUS) projects, underscores how engineering refinements and smart packaging can accelerate the energy transition, according to Gregory Junot, Sundyne's Compressor Product Line Manager.

The latest CO_2 compressor is designed for applications across hydrogen production, natural gas processing, industrial manufacturing and power generation. It features larger first-stage casings and customized aerodynamic components that double previous capacity and enable operation in supercritical CO_2 service. With its modular, standardized package, Junot said, Sundyne aims to offer high reliability at lower total cost—critical for operators who must balance emissions goals with economic realities.

A GROWING MARKET FOR CARBON CAPTURE

Industry analysts and policymakers increasingly view carbon capture as an indispensable tool for decarbonizing heavy industry and power generation. "Renewables will not be able to solve the problem by themselves," Junot said. "Cleaner energy needs carbon capture."

Dozens of commercial capture facilities are operating today, and many more are planned or under construction. Each requires specialized compression technology to pressurize CO_2 for transport and permanent storage. For Sundyne, whose LF-series compressors have long served refineries, chemical plants and utilities, adapting proven designs for CO_2 service represents both a technical challenge and a natural evolution.

"Corporate commitments to reduce emissions, policy support and advancements in technology are all driving investment in carbon capture projects, and Sundyne is actively engaged in the research and development that's needed to address these requirements," Junot said. "For decades, thousands of compressors have been deployed either offshore or onshore. Today, many of those same facilities seek to reduce their carbon emissions. Our fit-for-purpose

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CO_2 compressor leverages everything we've learned from prior LF-2000 deployments."

ENGINEERING FOR SUPERCRITICAL PERFORMANCE

The latest model targets operation above the critical pressure of CO_2—about 72 bar—where the gas behaves as a dense fluid and must be handled differently than conventional process gases. Meeting that challenge required innovations in both aerodynamics and mechanical design.

"They need supercritical capacity—higher pressure," Junot explained. "So we developed a specific aero end—the impeller, the diffuser and all the internal parts of the compressor—plus a dedicated test bench to run our compressor at high pressure and validate customer operating conditions."

Supercritical compression amplifies efficiency but introduces new complications. Leakage control, thermal stresses and materials selection become far more demanding. When CO_2 expands rapidly through small clearances, it can form dry ice that interferes with seals and bearings. "When this leakage escapes the compressor, from high pressure to atmospheric pressure, it's like an extinguisher bottle," Junot said. "It makes carbonic ice, very cold. We had to manage this problem at high speed and in a very compact sealing area."

To address that, Sundyne collaborated with a dry-gas-seal manufacturer to refine the geometry of the sealing system, mitigating icing and ensuring stable operation. "It's a simple idea but technically very complex," Junot said. "We worked together to arrange the seals so that even in the worst conditions we maintain reliability."

CHOOSING THE RIGHT METALLURGY

Another crucial factor is material selection. CO_2 captured from industrial exhaust streams typically contains water vapor and trace contaminants that can form corrosive acids. "The CO_2 comes wet when it's coming out of capture units,"

Sundyne has expanded its LF-2000 centrifugal compressor line.

Junot explained. "It's CO_2 plus water plus contaminants, so the metallurgy has to handle this very acid gas mixture."

The gas stream is later dehydrated, allowing less-alloyed steels to be used in downstream stages, but the early compression zones must withstand aggressive conditions. "We use the proper metallurgy for each section," Junot said. "After dehydration, CO_2 is almost pure, so carbon steel is sufficient."

Balancing cost and corrosion resistance is part of Sundyne's broader goal: to deliver oil-and-gas-level reliability for customers who expect lower capital costs in CCUS projects. "We have to propose the highest reliability we have on oil and gas applications for a non-toxic gas where the customer expects a cheaper price," Junot said. "We found solutions to keep the same reliability level with minimal maintenance and reduced package cost."

SIMPLIFYING THE PACKAGE

Roughly one-third of a typical compression package's value lies in the core compressor; the remainder is auxiliaries—coolers, lubrication systems, controls and skids. By standardizing these components and eliminating unnecessary specifications borrowed from API oil-and-gas standards, Sundyne shortened lead times and reduced overall cost.

"All these auxiliaries are cheaper to source, easier to source," Junot said. "There's less testing and less documentation, which also helps shorten delivery schedules."

That streamlined approach aligns with the company's modular "package" philosophy. Each LF-2000 CO_2 compressor system includes process and auxiliary systems built into ready-for-operation modules that can be tailored to site-specific needs. The compact footprint is especially advantageous for retrofits at existing industrial sites, where space is often limited.

LEVERAGING DECADES OF EXPERIENCE

Although marketed for a new application, the CO_2 compressor is not an unproven design. The LF-2000 lineage dates back more than half a century. "We've taken everything we've learned from all of this," Junot said. "This isn't new—it's an expansion of the line. Given the people we're selling to, the word 'new' is not a good word. It's existing technology, applied to a different requirement."

That emphasis on continuity reassures industrial buyers who must meet tight reliability and safety standards. Sundyne's high-speed integrally geared compressors are known for handling demanding services in refineries and chemical plants. Extending that heritage into carbon capture offers customers familiarity and confidence.

FIT-FOR-PURPOSE AND API-COMPLIANT OPTIONS

The expanded LF-2000 family can be configured as a "fit-for-purpose" industrial model with minimal specification overlay or as a fully API-compliant version for oil and gas operations. This flexibility allows Sundyne to serve diverse markets ranging from small-scale LNG refrigeration and ethanol-to-jet production to vapor recovery and feed-gas compression.

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Each version uses the same aerodynamic core but can be adapted to the standards, materials and control systems appropriate to the application. Intercooling between up to six stages and variable inlet guide vane control help optimize efficiency across operating ranges. The high-speed centrifugal design maintains a compact footprint even as flow capacity doubles.

A COLLABORATIVE APPROACH TO INNOVATION

During development, Sundyne's engineers worked closely with customers and component suppliers to validate every design element under realistic conditions. The company invested in a new high-pressure test bench at its Arvada, Colorado, facility to simulate supercritical CO_2 service. Testing at full speed and full load confirmed aerodynamic performance and mechanical integrity before field deployment.

"We developed this in partnership," Junot said. "Our customers are asking for reliable, maintainable, affordable solutions for carbon capture. To meet that, we had to innovate not only in technology but also in how we package and support these systems."

MARKET DRIVERS AND FUTURE APPLICATIONS

While CCUS remains the primary focus, Junot sees a range of adjacent opportunities. Emerging technologies such as solid-oxide fuel cells and other low-carbon power systems may require integrated carbon capture to meet emissions goals. Even data centers—whose explosive growth is straining power grids—could become future customers.

"Think about where the data centers are being built," Junot said. "They're in the Marcellus, the Permian—right where the gas is. Many will generate their own power, and that means they'll produce emissions. They'll need carbon capture. Even the new renewable systems will need carbon capture."

That evolving landscape mirrors broader energy trends. As artificial intelligence drives unprecedented power demand, natural-gas-fired generation is expected to play a central role in supplying stable electricity. Coupling those plants with carbon capture could offer a practical path toward decarbonization without sacrificing reliability.

WHY COMPRESSION MATTERS

In any carbon capture system, compression is the critical link between capture and storage. After CO_2 is separated from process streams, it must be compressed to supercritical pressures for transport via pipeline or for injection into geological formations. The compressor's efficiency and reliability directly affect project economics.

Sundyne sees diverse markets for its expanded LF-2000 family.

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"Compression is the tricky part of this application," Junot said. "We understand that's where projects either succeed or face challenges, and that's where Sundyne brings real expertise."

A GLOBAL FOOTPRINT

Headquartered in Arvada, Colorado, Sundyne maintains operations across Europe, the Middle East, India, Asia and China. Its products are known for precision engineering, safety and efficiency in demanding services such as hydrocarbon processing, hydrogen, renewable fuels and power generation. The company is also part of Honeywell, whose broader portfolio spans industrial automation, energy transition and sustainability solutions.

That global presence positions Sundyne to support CCUS projects wherever they emerge. Europe and Asia are advancing large-scale capture initiatives, while North America is rapidly building pipeline and storage infrastructure to handle millions of tons of CO_2 per year. Each project will require reliable, high-performance compression systems—an area where Sundyne sees clear opportunity.

FROM LABORATORY TO FIELD

Testing and validation are now complete, and early customer interest is strong. Engineers report that several pilot projects are evaluating the compressor for upcoming capture and sequestration systems. "Every site is different," Junot said. "Some need full API compliance; others want a simpler, standardized system. Our modular design lets us accommodate both."

PREPARING FOR THE ENERGY TRANSITION

As governments and industries race to meet net-zero targets, technologies that combine proven reliability with lower emissions will gain favor. Sundyne's expansion of the LF-2000 line illustrates how incremental engineering advances—higher pressure capability, optimized metallurgy, better seals—can make a tangible difference in the pace of decarbonization.

"Cleaner energy needs carbon capture," Junot said. "Even the new technologies need carbon capture too."

For Sundyne, that message resonates beyond a single product. The company's work on CO_2 compression is part of a broader strategy to supply pumps and compressors that enable sustainable fuels, hydrogen, renewable power and low-carbon industrial processes. By bridging legacy energy systems with future requirements, Sundyne is helping industries move toward a lower-carbon world.

CONCLUSION

The latest expansion of the LF-2000 CO_2 compressor embodies both continuity and change: continuity in the decades of engineering expertise behind Sundyne's integrally geared designs, and change in their application to one of the most urgent challenges of the energy transition. With higher capacity, supercritical pressure capability and simplified modular packaging, the machine provides the performance and reliability needed for carbon capture projects worldwide.