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Valve options plentiful in pandemic
Hydrogen gains momentum
Reeves/Hope gas engines and compressors

**EXECUTIVE
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The new normal

There are several moments in a lifetime that alter the collective norm. World history has an abundance of watershed moments weaved through its timeline.

Conflicts (the French Revolution, the Revolutionary War, World War I and II), inventions (the light bulb, the combustion engine, the telephone) and crisis (the Spanish Flu, the Great Depression, Sept. 11, 2001) all have shaped the world we know today.

Who knew 2020 would give us another watershed moment in the form of COVID-19? We know how this story began and how it has progressed thus far, but the big question mark is how will it alter the collective norm.

As the pandemic continues deep into the year, we already have a glimpse of what this might look like in 2021 and beyond.

Remote work will likely become the new standard among companies with employees that spend most of their office time in front of a monitor. If it can be accomplished at home with the same (or better) productivity, perhaps sprawling office spaces aren't the best investment.

Consider Wisconsin Public Service, an electric and natural gas utility that closed its office indefinitely during the pandemic. All of its employees now work from home.

Business travel will likely be used more conservatively. Instead of sending five employees across the world to meet with a client, perhaps only two make the trek. Or perhaps that meeting occurs over a Zoom call. Given the the pace of our improving connectivity across the world and the gas compression industry, not as many face-to-face meetings are necessary.

Webinars will likely rule the Internet, even after the pandemic. Industry events will still be the preferred way to gather and share information, but the effectiveness and convenience of webinars can't be denied. They can also share a wealth of information directly with the recipient without the expenses that accumulate with work trips.

Hand sanitizer will likely be everywhere. Before COVID-19, you might have seen a sanitizing station or two near a restroom. After the pandemic, it'll be as widespread as Starbucks in a major city. We suspect it'll be the most common trinket at industry shows in the coming years.

We'll likely have a better sense of personal hygiene too. Not that we didn't collectively before. Then again, those soap dispensers and hand sanitizing stations always seemed a little too full after the last day of [insert your favorite event here].

CT2**DJ Slater**

Senior Editor dj.slater@khl.com



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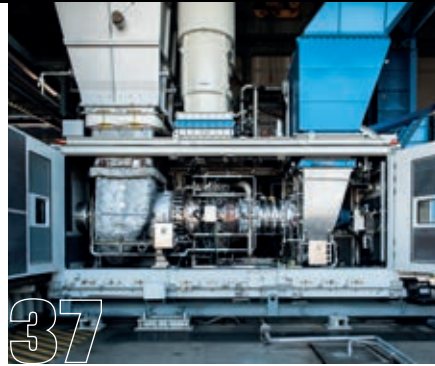
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20 Cooper's John Sargent discusses the company's past year and what lies ahead.

OUTSIDE



Crusoe's flare mitigation systems using INNIO engines

Crusoe Energy Systems, a Denver, Colorado-based energy company, has selected INNIO Waukesha natural gas engine generator sets for its digital flare mitigation systems. The systems use Waukesha's VHP9504GSI Series Five genset packages to convert flared natural gas into electrical power used by mobile, modular data centers on the well site.

Crusoe has deployed more than 30 DFM modules throughout North Dakota, Montana, Wyoming and Colorado, with Waukesha engine

generators powering a large portion of that fleet. INNIO Waukesha is on pace to deploy about 40 MW of generation capacity in cooperation with Crusoe by early 2021, primarily in the Bakken oilfields in North Dakota and Montana. Each unit features INNIO Waukesha's myPlant asset performance management system for remote monitoring.

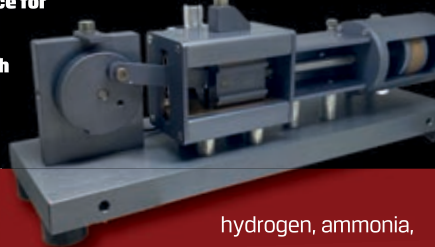
Cully Cavness, the president and co-founder of Crusoe, said "many of the flaring situations we encounter require solutions at a scale of hundreds of thousands to millions of cubic feet of gas per day. Our

technical and engineering teams worked closely with INNIO Waukesha to identify, specify and configure a large-capacity rich burn engine capable of managing the rigors, variability and scale of flaring in the modern energy industry. Today INNIO Waukesha is an integral part in our mission to eliminate natural gas flaring and reduce emissions through large-scale DFM projects."

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STI Vibration has released the CMCP601R reciprocating compressor demonstration kit, designed to display vibration monitoring techniques used on reciprocating machinery. The kit includes sensors and can also be equipped with accelerometers on the motor/gear, crosshead and cylinder end along with proximity probes in the distance piece for rod drop and rod runout.

A mounting bracket and machined flywheel notch are designed for a proximity probe key phasor or other types of a once-per-turn reference signal.



COMPRESSED NEWS

■ **THE ELECTRIC POWER RESEARCH INSTITUTE (EPRI) and GAS TECHNOLOGY INSTITUTE (GTI)** have created a five-year initiative focused on developing low-carbon energy technologies.

The Low-Carbon Resource Initiative (LCRI) spans the electric and gas sectors with a goal of global decarbonization. It has 18 anchor sponsors and US\$10 million in funding from the EPRI collaborative, with an expectation to reach more than US\$100 million through public and private collaboration.

The LCRI is targeting advancements in low-carbon electric generation technologies and low-carbon energy carriers, such as

hydrogen, ammonia, synthetic fuels and biofuels.

This worldwide collaborative will identify and accelerate the development of low-carbon technologies, demonstrate and assess the performance of technologies and processes and inform stakeholders and the public about potential pathways to a low-carbon future.

■ **MHI COMPRESSOR INTERNATIONAL CORP.**

(MCO-I) received a contract to supply compression for Gulf Coast Ammonia's (GCA's) ammonia production facility in Texas City, Texas. The facility will produce 3600 T/d of ammonia.

Air Products will build and operate the facility, as well as purchase the equipment. The order includes two compressor trains – a syngas compressor train and an ammonia refrigerant compressor train. The two trains consist of four compressors and supporting auxiliary systems.

MHI Compressor Corp. (MCO) will build and test the compressors at its factory in Hiroshima, Japan and at MCO-I's Houston, Texas facility. MCO-I will package the trains.

■ **MAN ENERGY SOLUTIONS and ROLLS-**

ROYCE's business unit Power Systems are set to collaborate on an asset and fleet management system that provides

Air-Sonic to open European catalyst wash facility

Air-Sonic, a Miratech company, will open its first catalyst washing facility in Europe on Oct. 1. The catalyst chemical washing facility is at Air-Sonic's Sinntal, Germany location and will provide services to the company's European and Middle Eastern customers.

Along with the catalyst washing system, Air-Sonic will also offer catalyst testing services at the start of 2021, Miratech said.

Miratech currently has six catalyst washing and testing facilities in the United States with a large-scale system processing 40 to 1000 catalyst elements from combustion turbines and small-scale systems processing one to 40 reciprocating engine catalysts.



One of Miratech's washing units.

a collection of data in one place. The two companies signed a memorandum of understanding (MoU) to work together on the new system.

The system, known as *mýa*, serves a digital platform that pools OEM, asset owner and operator data across the power, energy and marine industries. *mýa* members would be able to access that data from a single interface, providing them with a complete view of their systems.

MAN Energy Solutions and other founding members plan to create an independent, non-profit organization to govern *mýa* and promote industry collaboration to widely accept the benefits of digital technology.

Atlas Copco, Vericor partner on compressor packages

Atlas Copco Gas and Process has formed a strategic alliance with Vericor Power Systems. The partnership enables the two companies to manufacture integrally geared centrifugal compressors and companders powered by Vericor gas turbines.

This package features a 5000 hp (3728 kW) ASE50B gas turbine, designed for compression applications in remote and demanding environments.

The turbine has fuel flexibility and cold-start capability. The integrally geared GT series compressor features oil-free and pulsation-free gas processing. Companders are a compressor and radial turboexpander mounted on the same gearbox.

"Our customers now have the option to install these compressors in applications that would have been considered too difficult in years past," said Tushar Patel, global head of marketing, Atlas Copco Gas and Process.

Vericor, based in Alpharetta, Georgia, specializes in gas turbine technology used in the industrial, oil and gas and military sectors.



An Atlas Copco refrigeration compressor.

SoftInWay nets NASA grant

SoftInWay has received an SBIR award from NASA, which the company will use to develop an autonomous program aimed at optimizing compressor performance. Using its AxSTREAM software platform as the foundation, SoftInWay will use artificial intelligence (AI) and machine learning technology to improve compressor operations.

More specifically, SoftInWay will use AI capabilities created in AxSTREAM ION. This new AI-based workflow will be trained using AxSTREAM, but can also be trained using proprietary software and third-party codes, such as those at NASA. These programs will be able to automate performance data generation for compressors in this test case.

When subsequently combined with data gathered from test rigs, the autonomous AI program will be able to generate accurate turbomachinery performance data, with minimal error percentages, significantly shortening the time required to design a complex machine such as a multistage compressor, the company said.

■ **MOL GROUP**, an international oil and gas company, has discovered gas and condensate reserves in Pakistan. The find is MOL Group's 13th in Pakistan and the 10th in the TAL Block, an oil and gas field located in the Kohat District in Pakistan.

On May 23, the Mamikhel South-1 exploratory well reached a total depth of 16,204 ft. (4939 m). During testing, gas and condensate flowed from the Lockhardt & Hangu formation at a flow rate of 16.1 MMcf/d (456,467 m³/d). MOL Group will continue to further test the well.

MOL Group has operated in Pakistan's upstream sector for 21 years. The company has made 13 discoveries there since 2000.

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SIAD MI sending four compressors for Russian plant

A polyethylene plant in Russia has ordered four compressors from SIAD Macchine Impianti (SIAD MI). The plant serves as a naphtha cracker that breaks down heavy hydrocarbons into simpler molecules (ethylene, propylene and butene) for use in producing plastics.

SIAD MI's contribution consists of two hydrogen HPS2-1 make-up compressors. The plant will pair those compressors with an HSFS3-3 nitrogen compressor and a WS1-2 instrument air compressor.

Sparrows Group moves to new Angola facility

Engineering and maintenance specialist Sparrows Group, which services the oil and gas, renewables and industrial sectors, has relocated to a new purpose-built facility in Luanda, Angola to support its growing operations in Africa.

The move provides the company with a new workshop, storage yard, training facilities and office to deliver its services in-country. This includes a broad range of turnkey engineering, equipment maintenance and training services.

Located in the Vila Flor area, the 21,528 sq.ft. (2000 m²) complex allows Sparrows to deliver its full suite of training courses. It also includes workshops, which are outfitted to handle the maintenance and testing of hydraulic and electrical components

(pumps, motors, gearboxes, cylinders, winches and fabricated assemblies).

"Africa is a strategic growth area for Sparrows and we have seen a surge in demand for local training, equipment maintenance and rental services in recent years," Stewart Mitchell, Sparrows' chief executive officer said.

CT2



Sparrows employees working at the purpose-built facility in Luanda, Angola.

PCB Piezotronics, a wholly owned subsidiary of MTS Systems Corp., has released its latest precision triaxial ICP accelerometer, known as Model 630A91. The accelerometer, which features a top exit M12 connector, is designed for space-constrained installations that require an ICP accelerometer with a vertical run of cable but lack room for a 90° turn from a straight connector.

The accelerometer is contained in a case-isolated stainless steel housing and can take three simultaneous vibration measurements. The company also has a variation of the accelerometer for hazardous areas.



PEOPLE NEWS

■ **The Interstate Natural Gas**

Association of America (INGAA) has appointed **AMY ANDRYSZAK** as the association's new president and chief executive officer, effective Sept. 21.

Before this position, Andryszak served as the principal at Ogilvy Government Relations, managing a portfolio across several policy areas, such as energy, travel and tourism. Before that, she spent seven years at the Loews Corp. as director of government affairs and then as assistant vice president of government affairs.

Andryszak led public affairs and advocacy efforts for Loews and its five principal portfolio companies including INGAA



member company Boardwalk Pipelines.

For the last nine years, she has been an active member of INGAA's Government Affairs Committee.

■ **Continental Controls Corp.**, the California-

based manufacturer of fuel control and ultralow emissions controllers for gas turbines and gas engines, has hired **KEITH FLITNER** as manager of Gas Turbine Products.

Flitner has years of experience dealing with gas turbine OEMs, packagers and end users, including 15 years at Parker Hannifin's aerospace and energy segments and two years at Victory Turbine.



■ **SEC Energy Products &**

Services, a packager of natural gas compression and production equipment, has appointed **KURT LOUSTALOT** as its president.

Loustalot, who joined the company in March, formerly served as the general manager, midstream, for SNC-Lavalin. Most of Loustalot's career centers on managing projects, which he's done for Valerus Field Solutions, Exterran and Hanover Compression.

SEC Energy Products & Services, founded in 2003, provides compression packages, production equipment and measurement skids.



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New pipeline capacity enters service

Between January and early July, 5 Bcfd (0.14 X 10⁹ m³/d) of new pipeline capacity entered service in the United States, according to the U.S. Energy Information Administration's (EIA) Natural Gas Pipeline Project Tracker.

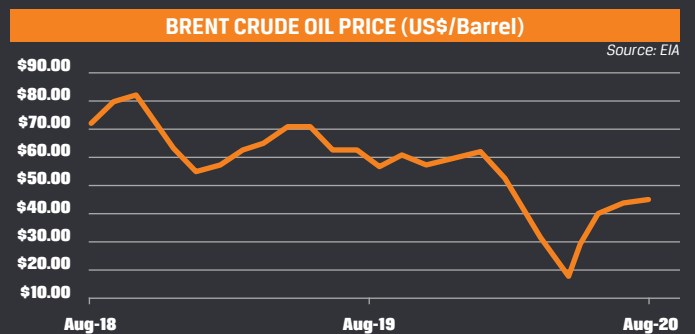
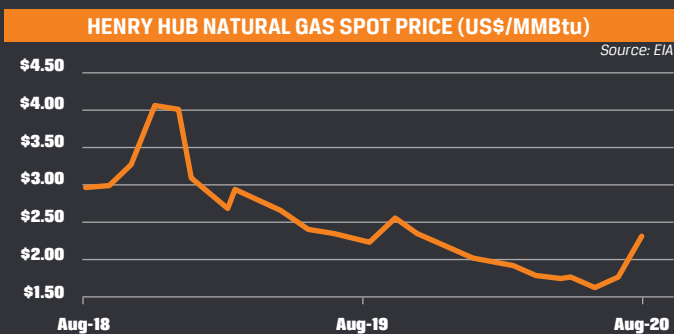
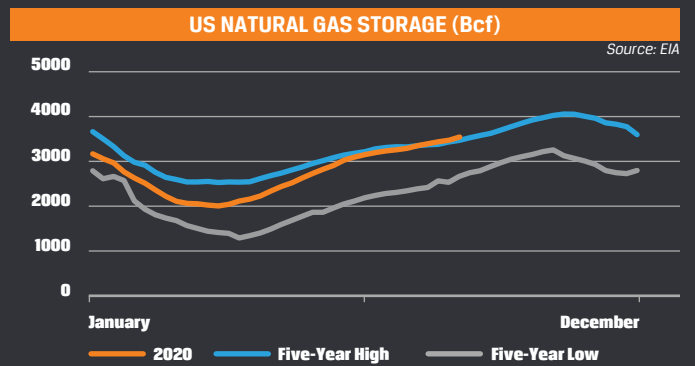
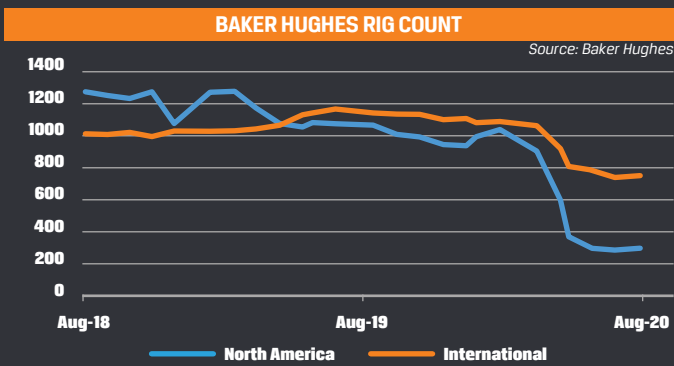
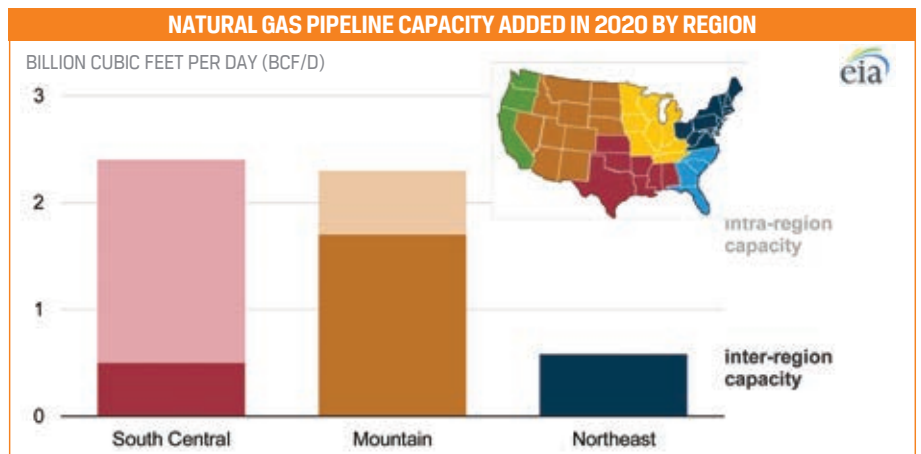
Projects that primarily serve to connect additional natural gas supplies to existing infrastructure include the Cheyenne Connector Pipeline and Cheyenne Hub Enhancement Project (1.6 Bcfd [45.3 X 10⁶ m³/d]); the Cheniere MIDSHP Pipeline (1.1 Bcfd [31.1 X 10⁶ m³/d]); and three projects that connect to the Waha hub (more than 1 Bcfd [28.3 X 10⁶ m³/d]), the EIA said.

In addition to these projects, which account for most of the new pipeline capacity in the first half of 2020, the second phases of the Sabal Trail Pipeline (0.17 Bcfd [4.8 X 10⁶ m³/d]) and the Hillabee Expansion (0.2 Bcfd [5.6 X 10⁶ m³/d]) entered service in April, increasing deliverability to Southeast demand markets. The 0.3 Bcfd (8.5 X 10⁶ m³/d) Empire North Expansion Project, which

increases deliverability to western New York consumers on the Empire Pipeline, entered partial service in late June, the EIA said.

Although 5 Bcfd (0.14 X 10⁹ m³/d) of new pipeline capacity has entered service in the United States this year, an estimated 8.7 Bcfd (0.24 X 10⁹ m³/d) of pipeline projects have been canceled in 2020. These cancellations include the 1.5 Bcfd (42.5 X 10⁶ m³/d) Atlantic

Coast Pipeline and the 0.65 Bcfd (18.4 X 10⁶ m³/d) Constitution Pipeline, which would transport northeastern natural gas production into New England. At the regional level, the South Central region had the most potential added capacity canceled, at 3.5 Bcfd (99.1 X 10⁶ m³/d), with the cancellations of the Permian to Katy Pipeline and the Creole Trail Expansion Project 2. **CT2**



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Lawsuits sidetrack railroad transport of LNG

Opponents look to stop 'bomb trains'. By **Patrick Crow**

Legal appeals have attacked a Pipeline and Hazardous Materials Safety Administration (PHMSA) rule to allow liquefied natural gas (LNG) shipments in specialized railroad tank cars.

If the rule eventually takes effect, it could prompt the production of stranded U.S. gas resources that are too small or too remote to warrant the construction of pipelines. That, in turn, would expand the need for compression services and equipment.

Rail-hauled LNG ventures would be relatively small-scale and likely would supply peak-shaving at powerplants, truck refueling stations, LNG-powered locomotives and such.

"This rule will help underserved markets with limited access to energy infrastructure benefit from natural gas, economically and environmentally," said Charlie Riedl, executive director of the Center for Liquefied Natural Gas.

He said PHMSA's regulation would put LNG on par with other industrial chemicals that are presently shipped by rail car. At present, the Federal Railroad Administration only authorizes LNG to be conveyed in portable tanks.

The PHMSA rule requires liquefied gas to be carried in DOT-113C120W9 tank cars with enhanced outer walls. Other flammable cryogenic hydrocarbons have been

shipped in such DOT-113 cars for some time.

The rule would require a thicker carbon-steel outer tank, remote monitoring of the pressure and location of LNG rolling stock, improved braking for trains and other safety measures.

PHMSA said initially manifest trains might have a few LNG cars, but eventually trains might be composed mostly or entirely of LNG tankers.

Legal pushback

Opponents of the regulation have claimed PHMSA didn't fully assess the environmental impacts of the rulemaking and didn't specify adequate safeguards.

Six environmental groups, including Earthjustice and the Sierra Club, filed suit in the District of Columbia Circuit Court of Appeals before the rule was to take effect Aug. 24.

Fourteen states filed a separate lawsuit. They were California, Delaware, Illinois, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont and Washington.

"Californians who live, work or go to school near train routes are not interested in being specimens in a crash-test laboratory for the Trump Administration," said California Attorney General Xavier Becerra.

"Ships carrying LNG have been characterized as floating bombs," said Maryland Attorney General Brian Frosh. "Rolling tank cars filled with LNG through our neighborhoods are vastly more dangerous."

Those statements revealed the attorneys general to be more adept at rhetoric than science.



"Californians ... are not interested in being specimens in a crash-test laboratory."

GENERAL XAVIER BECERRA, California Attorney

The web page of the California Energy Commission spells out the facts. It explains, "As a liquid, LNG is not explosive. LNG vapor will only explode if in an enclosed space. When cold LNG comes in contact with warmer air, it becomes a visible vapor cloud. As it continues to get warmer, the vapor cloud becomes lighter than air and rises. When LNG vapor mixes with air, it is only flammable if within 5% to 15% of natural gas in the air. Less than this is not enough to burn. More than this, there is too much gas in the air and not enough oxygen for it to burn."

The National Transportation Safety Board (NTSB) raised some practical concerns when it reviewed the PHMSA proposal earlier this year.

NTSB noted that U.S. railroads have relatively few DOT-113C cars. It said 405 units commonly are used for cryogenic ethylene service but only 67 of them meet the PHMSA specifications.

Because so little LNG has been shipped by rail, PHMSA based its rule on safety data from the truck transport of liquefied petroleum gas and LNG. NTSB said that approach "does not provide a statistically significant or valid safety assessment" and questioned just how PHMSA concluded the DOT-113C car was acceptable.

THE AUTHOR

PATRICK CROW is an Austin, Texas, writer and a former COMPRESSORTECH² editor. He has reported for oil and gas publications since 1967 and has written extensively about energy issues before Congress, federal agencies and the courts.



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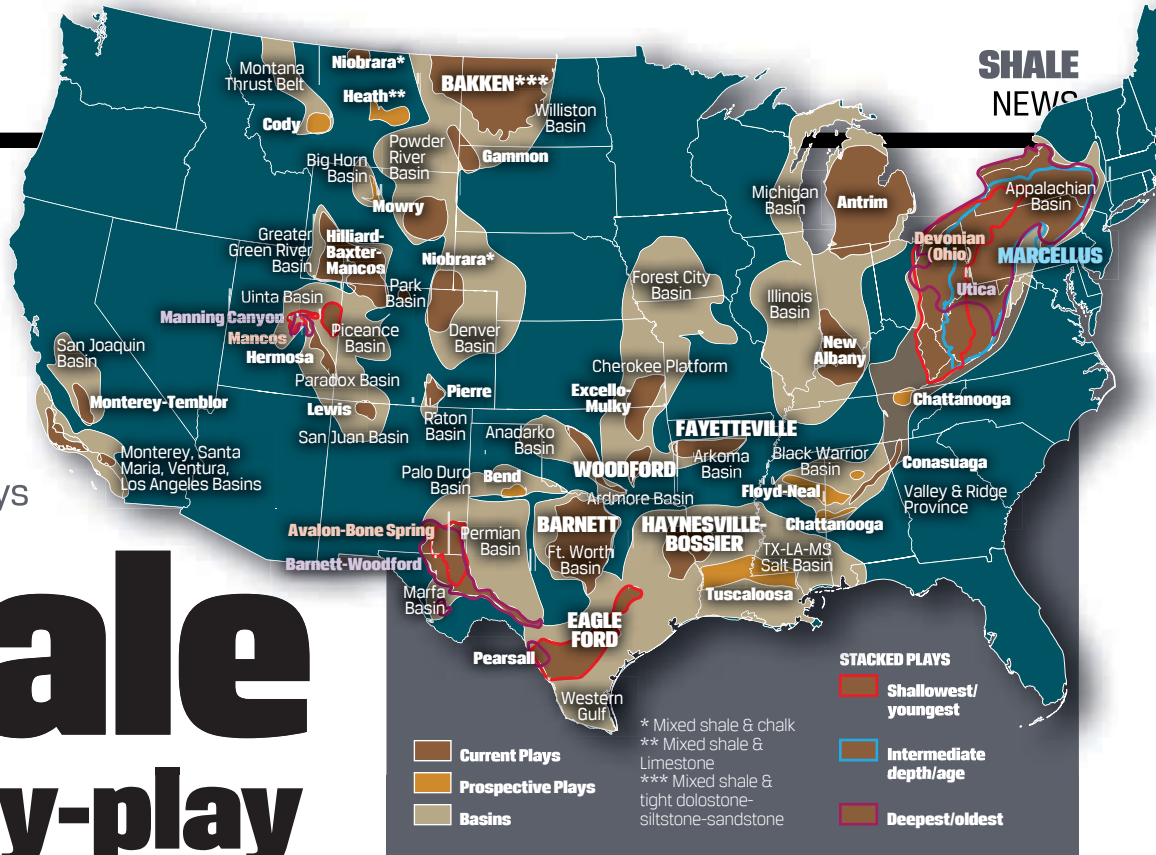
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James Willis highlights the latest news from the major North American shale plays

Shale play-by-play



APPALACHIA (MARCELLUS/UTICA)

Liberty cancels Granite Bridge

In May 2018, Liberty Utilities, a New Hampshire utility serving nearly 100,000 customers, announced a new pipeline project called Granite Bridge, which is 27 miles (43.5 km) of new natural gas pipeline buried along Route 101 from Stratham to Manchester. Liberty will not build the US\$440 million project, however, opting instead to contract for capacity along the existing Concord Lateral pipeline.

FERC begins EA for PennEast competitor

In March 2019, Williams announced a plan to beef up the Transco pipeline in Pennsylvania and New Jersey to deliver extra Marcellus gas to Pennsylvania, New Jersey and Maryland. The plan, known as the Regional Energy Access expansion project, is a potential competitor to UGI's PennEast Pipeline project. Both projects

would flow gas from Luzerne County (near Wilke-Barre), Pennsylvania, to Mercer County (near Trenton), New Jersey. FERC launched an environmental evaluation of the Williams project, which will construct 36 miles (58 km) of pipeline loop and build one new

compressor station in New Jersey, as well as modify existing compressor stations and facilities in Pennsylvania and New Jersey. The project will flow 760 MMcf/d (21.5 X 10⁶ m³/d) of natural gas to multiple delivery points along Transco's existing system. According

PERMIAN (DELAWARE)

Black River gas processing plant expands

San Mateo Midstream, a joint venture of Matador Resources and Five Point Capital Partners, will soon complete and place a 200 MMcf/d (5.6 X 10⁶ m³/d) expansion of the Black River cryogenic natural gas processing plant in service. Once finished, Matador's oil and natural gas trunk lines will stretch for 43 miles (69 km) across the Delaware Basin.

Whistler scores investment

Whistler Pipeline, a greenfield 500 mile, 2 Bcf/d (805 km, 56.6 X 10⁶ m³/d) natural gas pipeline connecting the Permian Basin to the Agua Dulce hub near Corpus Christi, Texas, received US\$325 million from Global Infrastructure Partners. WhiteWater is developing the project and expects it to be in service during the third quarter of 2021.

Tiger gas plant nears startup

EnLink Midstream's Tiger Natural Gas Processing Plant in the Delaware Basin is nearing completion and expected to become operational by the end of the third quarter of 2020. Once operational, the 200 MMcf/d (5.6 X 10⁶ m³/d) plant will bring EnLink's total processing capacity in the Permian to over 1 Bcf/d (28.3 X 10⁶ m³/d).

DCP Midstream fined for air pollution

New Mexico state regulators fined DCP Midstream US\$5.3 million, alleging violations of state and federal air pollution laws at the company's natural gas compressor stations.

THE AUTHOR

JAMES WILLIS is the editor of the Marcellus Drilling News, a daily newsletter covering the Marcellus and Utica plays.

For more information, go to: www.marcellusdrilling.com



HAYNESVILLE

Range sells Haynesville assets

Range Resources cut a deal to sell its Haynesville Shale assets to Castleton Resources, a privately owned company, for US\$245 million, with an extra US\$90 million contingent on the price of gas. Castleton is majority-owned by Tokyo Gas. In 2016, Range purchased Memorial Resource Development Corp. (MRD) in a stock swap/debt assumption deal worth US\$4.4 billion. MRD held 220,000 acres (89,031 ha) of leases and wells in the Terryville Field in the northern Louisiana Haynesville. Following the deal, Castleton will own 315,000 acres (127,476 ha) total in the Haynesville. Range Resources will become a pure-play driller focused on the Marcellus/Utica.

Tokyo Gas buys majority stake in Castleton

In July, Tokyo Gas announced it would boost its ownership interest in Castleton Resources from 46% to a majority stake of 70%. The deal, for an undisclosed amount, was completed in August. A few days later, Castleton announced it would buy Range Resources' Haynesville assets, more than doubling Castleton's leased acreage. Castleton will change its name to TG Natural Resources in early 2021. Tokyo Gas, the new owner, also owns 130,000 acres (52,609 ha) in the Barnett Shale of North Texas and 34,000 acres (13,759 ha) in the Eagle Ford Shale of South Texas.

LEAP online ahead of schedule

DTE Midstream, the non-utility subsidiary of DTE Energy, began service on its Louisiana Energy Access Project (LEAP) gathering system on Aug. 1, ahead of schedule. The 150 mile, 36 in. (241 km, 914 mm) gathering pipeline connects Louisiana's Haynesville Basin to the Gulf Coast region. The LEAP gathering system was part of DTE's fourth-quarter 2019 acquisition of Momentum Midstream's Louisiana assets. LEAP is fully contracted under long-term, demand-charge agreements. Current capacity is 1 Bcfd (28.3 X 10⁶ m³/d) with future expansion capability.

to Williams, the project will provide customers with enhanced access to Marcellus and Utica Shale gas supplies.

Ohio cracker loses backer

Thailand-based PTT Global Chemical announced South Korea's Daelim Chemical USA, its principal partner and financial backer for a planned US\$10 billion ethane cracker facility in Belmont County, has decided to pull out of the project. PTT said it remains committed and will look for a new partner.

ANR upgrades

TC Energy is spending US\$400 million on the Elwood Power/ANR Horsepower Replacement Project. The project will replace, upgrade and modernize facilities along the ANR Pipeline system. ANR runs from the Midwest to the Southwest and Gulf Coast. In early 2014, ANR became bi-directional, with the stated purpose of flowing Marcellus/Utica gas as far away as the Gulf Coast. The project will flow more natural gas to the Elwood Power electric generating station in Elwood, Illinois.

PA AG turns drilling accidents into crimes

After impaneling a grand jury for more than two years, Pennsylvania Attorney General Josh Shapiro charged three Pennsylvania drilling companies with environmental crimes. Shapiro charged Range Resources with seven misdemeanors related to its handling of contamination at a pair of well sites a decade ago. Range pleaded guilty and paid

ROCKIES (POWDER RIVER BASIN, DENVER-JULESBURG BASIN, NIOBRARA)

Tumbleweed processes helium-laced gas

Tumbleweed Midstream executed three new long-term gathering and processing agreements, quadrupling helium production at its facility in eastern Colorado. Two of the new agreements more than doubled the plant's inlet volume to 12 MMcfd (339,802 m³/d). The third contract will increase production by another 3 to 5 MMcfd (84,950 to 141,584 m³/d). The increased throughput from these three agreements will increase the plant's daily helium output to more than

a US\$150,000 fine. Shapiro charged Cabot Oil & Gas with 15 counts of breaking the law, including several felonies, for the company's long-resolved methane migration issues in Dimock, Pennsylvania, events that occurred more than a dozen years ago. Cabot is fighting the charges. Finally, Shapiro charged National Fuel Gas Co. with several counts of violating environmental regulations in 2015.

FERC OKs Leidy South, FM100

FERC approved two related projects aimed at boosting pipeline flows in Pennsylvania. The first was Williams' Transco Leidy South Project, which will connect an extra 582 MMcfd (16.4 X 10⁶ m³/d) of Pennsylvania Marcellus gas with markets along the Atlantic

EAGLE FORD (AUSTIN CHALK, TUSCALOOSA MARINE SHALE) Sanchez has a new name

In August 2019, Sanchez Energy filed for bankruptcy. Nearly a year later, the company emerged with US\$2.3 billion in debt eliminated and a new name - Mesquite Energy. Mesquite will remain focused on the development of its Eagle Ford properties.

White River buys Sanchez assets

Ecoark Holdings subsidiary White River SPV went shopping at the bankruptcy sale of Sanchez Energy. In two different transactions, White River picked up over 9000 acres (3642 ha) and 268 wells from Sanchez. In the first transaction, White River purchased 262 total wells in Mississippi and Louisiana, 9000 acres (3642 ha) of active mineral leases and drilling and production materials and equipment. The deal includes 57 active producing wells, 19 active disposal wells, 136 shut-in with future utility wells and 50 shut-in wells.

200 MMcfd ($5.6 \times 10^6 \text{ m}^3/\text{d}$), or 65 Mmcfy ($1.8 \times 10^6 \text{ m}^3/\text{d}$). Several new and existing producers in the region have initiated exploration and development plans for helium-rich natural gas. Tumbleweed expects the plant to be at maximum capacity within the next year or two.

Cheyenne Connector goes live

Tallgrass Energy's Cheyenne Connector pipeline and Rockies Express Pipeline (REX) Cheyenne Hub Enhancement Project began service on June 26. Tallgrass and DCP Midstream each own 50%. The Cheyenne Connector is fully subscribed at 600 MMcfd ($16.9 \times 10^6 \text{ m}^3/\text{d}$), with additional expansion capacity available.

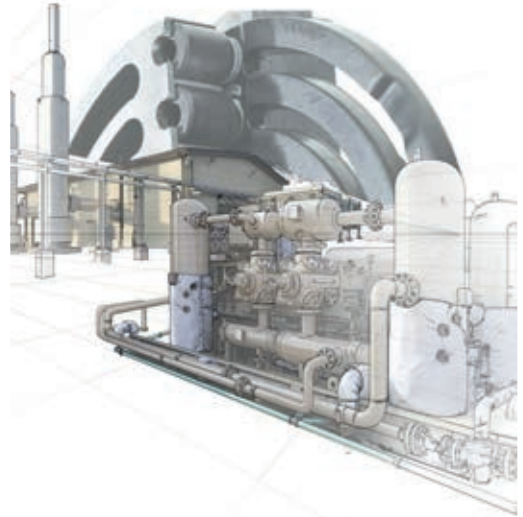
Seaboard by the 2021-2022 winter heating season. Leidy South will replace 6.3 miles (10.1 km) of existing pipe, build 5.9 miles (9.5 km) of new pipeline loop segments along the existing Transco corridor, add horsepower at two existing compressor facilities, and build two new greenfield compressor stations. The second project is National Fuel Gas Co.'s FM100 Project in northwestern Pennsylvania, which will bolster and extend an existing pipeline network to flow an extra 330 MMcfd ($9.3 \times 10^6 \text{ m}^3/\text{d}$) of Marcellus gas to the Transco system. FM100 will build 31 miles (49.8 km) of new pipeline, abandon 45 miles (72.4 km) of old pipeline and construct a new compressor station.

Federal judge rules in favor of compressor station

National Fuel Gas Co.'s (NFG) US\$500 million Northern Access Pipeline project will build 97 miles (156 km) of new pipeline along a power line corridor from northwestern Pennsylvania to Erie County, New York. The aim is to flow Pennsylvania Marcellus fracked shale gas into New York. The project also calls for 3 miles (4.8 km) of new pipeline and a compressor station in Niagara County, New York. The Town of Pendleton, the potential location for the compressor station, refuses to issue a permit. A federal judge overruled the town and said NFG can move forward with construction.

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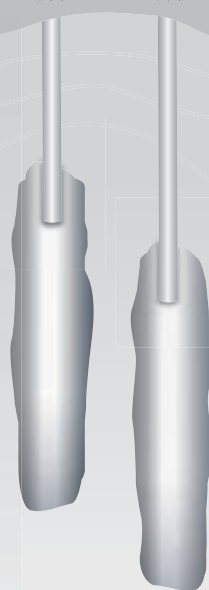
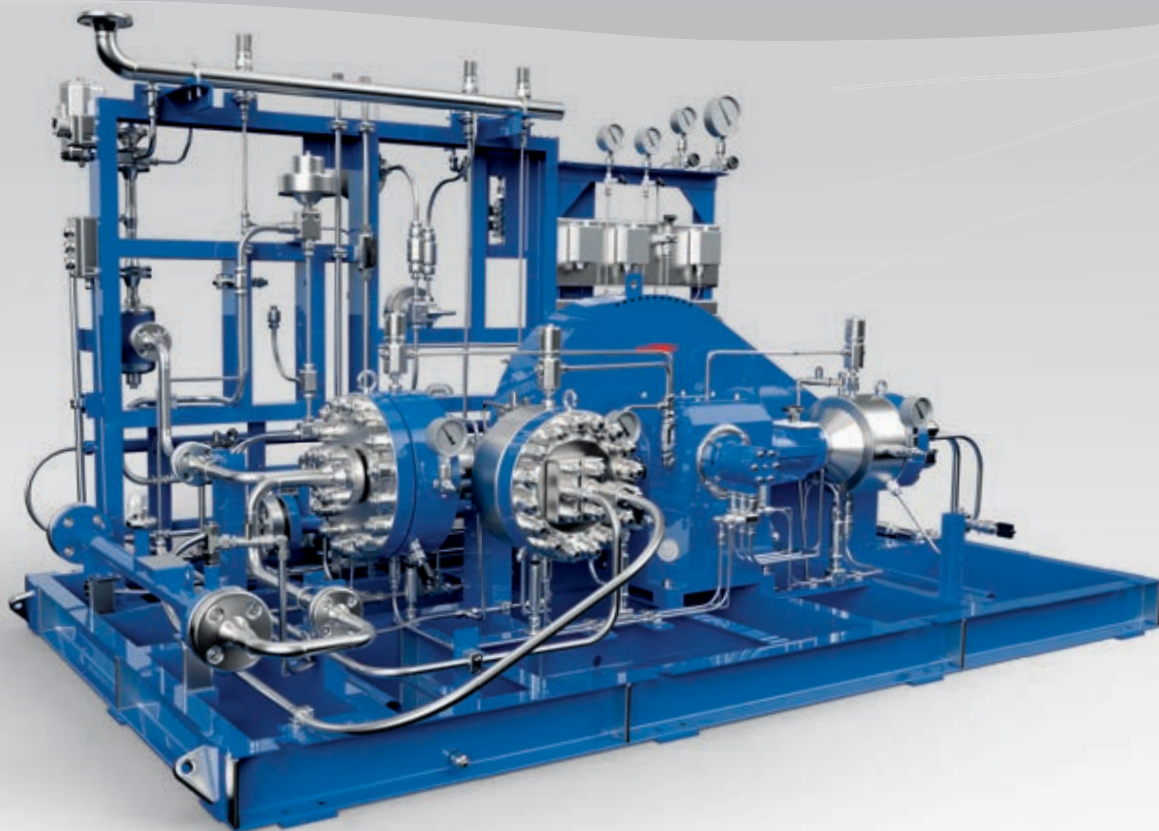
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John Sargent is a 25-year veteran of the engine-compressor world.

Sargent: Cooper keeps eye on future purchases, service offerings

OEM's first year marked with establishing new culture, acquisitions. By **DJ Slater**

John Sargent is the chief executive officer (CEO) of Cooper Machinery Services, headquartered in Houston, Texas. The original Cooper was founded 30 years before the commencement of the American Civil War by two Ohio brothers, and has been a mainstay in the engine and compressor business ever since. In 2019, Cooper emerged from the former reciprocating compression division of Baker Hughes, a GE Company (BHGE), which Arcline Investment Co. acquired. BHGE purchased the reciprocating compression business five years prior from Cameron International.

Sargent, a 25-year veteran of the engine-compressor world, has former ties to Epic, Cameron, Exterran and El Paso. He became

Cooper's CEO in September 2019 (see **COMPRESSORTECH²**, November 2019, p. 27). **COMPRESSORTECH²** spoke with him about the company's evolution since its inception, its current situation in these trying times and the company's future plans.

COOPER'S REBIRTH TOOK PLACE A LITTLE OVER A YEAR AGO. HOW HAS THIS FIRST YEAR BEEN FOR YOU AND THE COMPANY?

Sargent: Where do I begin? The organization has been through so much change and been forced, like the entire industry, to navigate through the extremely rough waters of COVID-19 and the corresponding energy demand downturn. The reality is that Cooper is a completely new and different

"The reality is that Cooper is a completely new and different company than it was a year ago."

JOHN SARGENT, CEO, Cooper Machinery Services

company than it was a year ago. We've changed out our entire senior management team to a diverse group that includes several compression industry veterans. We've replaced four of our five U.S. regional directors and inserted compression-industry veterans into those slots. We have acquired six separate companies and have entered several new product lines. We have switched our primary business emphasis from the selling of new compressors to the servicing of existing horsepower. We've modernized our systems internally with a new CRM and online technical support system. And we have done all of this while working from home since March and suffering, like most, through an industry downturn. But through



Since Cooper's rebirth, it has acquired six companies in the gas compression industry.

it all, we have been able to implement real and substantive change to our culture, our priorities and to the way we treat our employees and customers. I've very excited about where Cooper is as an organization and I believe the customer is seeing the difference from where we were in the recent past.

TELL ME ABOUT THE CULTURE SHIFT AT COOPER IN THE LAST YEAR. THE ORGANIZATION WAS OWNED BY A LARGE CORPORATION AND IS NOW PRIVATE. WHAT CHALLENGES AND OPPORTUNITIES HAS THAT PROVIDED?

Cooper has been around since 1833. During that time, the organization has evolved and reinvented itself many times over. The nexus for this reinvention is the fact that we cannot be the same Cooper we have been in the past. We have to put the customer

first and not our own short-term interests. We must shelve the urge to have a sense of entitlement about the business just because we are the OEM. We can't behave with short-term thinking when it comes to pricing and inventory and quarter-to-quarter profit figures as we have to look long term to determine what's best for Cooper and what's best for our industry overall. And we must get, as I like to say, "back on the wrench" by deploying a world-class service team. Our customers deserve an OEM they can rely on, and only when we become that will customers work with us to keep their Cooper and non-Cooper high-speed and slow-speed engines and compressors in place and running for the long term.

I love this company and industry and have for my entire career. It is a tremendous honor to be in this position. But the reality is

that I must implement a tremendous amount of change in our company and transform our systems, business model and culture if we are going to be successful. Some of that change will be painful; it often is in organizations. But our employees need to know that we cannot stay the same, and our customers need to know that we are committed to change. In life and in business, you either get better or you get worse. You do not stay the same.

ARE ALL THE TRANSITIONAL PARAMETERS FINISHED FROM COOPER'S ACQUISITIONS OR IS THERE STILL A LITTLE MORE WORK TO BE DONE IN THIS AREA?

All the companies Cooper purchased had the after-sale support DNA that we were seeking, and all of them helped us increase our connectivity to the customer and increase our overall after-sale capabilities. The Cooper organization needed to upgrade its culture and almost all our key product and service lines – from parts support to upgrades to turbochargers to our service and parts capabilities for non-Cooper engines and compressors. To that end, we have made a strong effort to learn from the cultures of some of our acquired companies and avoided the urge to impose our way to thinking on them. We have purposely retained key leaders and managers from most of our acquired companies. This has allowed us to maintain continuity and improve our overall business culture and continuity with our customer base.

IT IS IMPOSSIBLE NOT TO TALK ABOUT THE CORONAVIRUS AND ITS IMPACT ON THE WORLD. HOW HAS THE CORONAVIRUS IMPACTED COOPER?

I would love to talk about anything but coronavirus if I can be perfectly honest. Like most service companies in the engine-compressor space, we have seen a downturn resulting from COVID-19. But our business and markets are resilient, so our day-to-day parts business and general service work has not been overly impacted as companies need to keep their equipment running. Where we see the most impact is with our overhaul and upgrade business and our large project work. Those projects are labor intensive and require

EXECUTIVE OUTLOOK COOPER MACHINERY SERVICES

a lot of face-to-face interaction to execute, so both Cooper and the customer have been proceeding with caution here. But our view is that we must be prepared for the fourth quarter or the first quarter of 2021 when customers will need engine-compressor overhauls done quickly, so we're spending a lot of time as a team making sure our parts inventory is healthy and our service locations are ready for when the next wave hits.

Of course, our top priority during this time has been the safety of our employees and customers. We have not seen a coronavirus outbreak of any size anywhere within Cooper.

IS THE COVID-19 PANDEMIC THE MOST CHALLENGING THING THE NATURAL GAS MARKET HAS FACED OR WAS THERE A MORE CHALLENGING TIME?

I think the number one issue that hinders businesses and economic progress is uncertainty. When organizations are operating in an environment of uncertainty, they sit on cash and are unwilling to invest and spend on large projects. With the coronavirus, we have seen the greatest period of uncertainty that the industry has experienced in my career. Add to that the double whammy of low energy prices and I think the industry is in a situation where



John Sargent sees this year and 2021 as an opportunity to continue making moves that will further transform the company.

lots of organizations will have to evolve to remain healthy. I expect a lot of evolution and consolidation in 2021.

But for Cooper, we have looked at this time as an opportunity. We have great support from our ownership and have made aggressive moves to transform our business this year. We are no longer a large public company. We're private and we've used the flexibility that our ownership situation allows and spent this time to quickly strengthen our management and leadership team, build up our parts inventory, update our systems, modify our sales channels so we can get closer to the customer, and launch our strategy to become the OEM this great industry has been in need of for some time. We do not take long here at Cooper to make

a decision and implement our plans.

WHAT CAN NATURAL GAS PROFESSIONALS LEARN FROM A DOWNTURN? WHAT LESSONS DOES A PANDEMIC PROVIDE FOR THIS INDUSTRY?

Cooper acted quickly to protect our employees and develop a business plan when the coronavirus became an issue. I would cite the decisiveness of our management team in the time of crisis as the number one lesson. And while we paid close attention to COVID-19, we were not obsessed with it to the point that we ignored our long-term goals for the business. We have continued to acquire good businesses, launch our strategic initiatives and acquire strong leaders for our executive team and regional locations.

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DOES COOPER HAVE MORE ACQUISITIONS OR OTHER BIG INITIATIVES COMING SOON?

Cooper has an aggressive plan designed to transform our business and become the industry's premier provider of after-sale support. While we have made a lot of progress toward that end, but there is still much to do. Cooper does intend to consider additional acquisitions so long as they bring us closer to the customer and fit with our long-term strategy.

As for the future and what Cooper is planning, I can share the following:

- **Cooper is entering the CAT 3600 and Waukesha VHP after-sale support businesses**

Our acquisitions of EnDyn, Archrock Turbocharger were all designed to strengthen our overall after-sale support offering but also to give us direct access to the CAT 3600 and Waukesha VHP lines.

For the CAT 3600, we will soon offer full overhaul kits, remanufactured heads, turbochargers for the CAT 3600 GP engines (3606/3608/3612/3616). Our ability to supply full overhaul kits for the 25,000-hour to the 100,000-hour turnarounds will soon be in place. We have a new power head cell in Houston and will deliver our customers a fully assembled and tested power head that includes new premium springs, valves and valve seats.

Our acquisition of EnDyn gave us entry into the Waukesha VHP after-sale support business as that organization has been dabbling in this business for some time. Since the acquisition, we have taken real steps to increase our capabilities to produce parts, overhauled engines, and swing engines. Our Alice and Odessa, Texas locations are the centers-of-excellence for our Waukesha line, and we now have the people and expertise to compete in this market. We have expanded our parts, service and shop capabilities at both locations. We have reconditioned and exchange "zero hour" overhauled engines to better serve our customers' requirements.

- **Cooper is now fully engaged with the purchase and lease back of customer horsepower**

One of the major avenues we are pursuing with several key customers is lease backs.



Cooper's future includes offering after-sale support for Caterpillar, Waukesha engines.

Under this model, Cooper would purchase an end user's fleet outright, take on all responsibility for maintenance and unplanned equipment failure, control operations in certain circumstances, and charge a fixed monthly lease rate.

We think this is a win-win for Cooper and its customers. Our end users get cash up front to deploy wherever they need it and Cooper ensures that we keep our equipment running for years to come. We are also embarking on a substantial engine monitoring and automation program we will utilize as part of this program to keep maintenance costs low and engine availability high. At the end of the day, we want to relieve the pressure on our end users so that they can

focus on transporting gas for their customers and we can focus on keeping their units running.

- **Cooper is taking technology seriously again with emissions reduction, engine upgrades, automation, and new product development**

For many decades, Cooper was a leader in emissions technology and engine upgrades. When I landed in this role, I discovered quickly that we were going to need some outside assistance if we were going to get back to our roots when it comes to equipment upgrades and, especially, emission reduction and automation. That is why I made it a priority to acquire the Hoerbig Engines Services (HES) division. With that move, we can now offer more upgrade technologies including the HyperFuel System, HyperBalance, HyperLogic, ePCC and ePFI. The HES team has retrofitted over 350 engines over the last few years and that team gets Cooper back in the lead when it comes to emissions reduction solutions that our customers need.

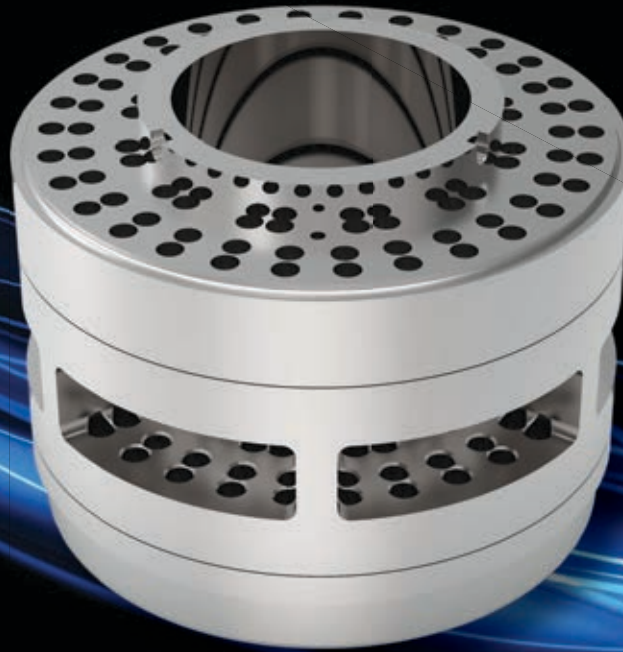
Cooper currently offers and continues to develop technologies to reduce greenhouse gas emissions for the legacy fleet. As the leader in .5g/bhp-hr technologies for all makes of integral engines, Cooper's customer-centric model supports owners by maximizing reliability, extending the lifetime of the existing fleet and minimizing the capital requirements for continued operation.



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Euro gas report

Anna Kachkova
provides information
on the latest gas
compression news
from Europe

EUROPE

Russia's Gazprom loses European market share

Russia's Gazprom said its share of the European gas market fell during the second quarter of 2020. COVID-19 played its part in this, as well as the large volumes of gas in storage across Europe and rising LNG imports on the continent.

A corporate filing published in August showed that Gazprom had a 39.2% share of the European market – excluding the Baltic countries during the quarter, down from 43.2% in the same quarter of 2019. Pipeline supplies from Russia to Europe showed a larger decline of 6.7% year on year.

The ongoing expansion of LNG receiving capacity across Europe suggests that pipeline gas from Russia will continue to face intensifying competition. The Warsaw Institute, a Polish think tank, suggested in late August that Bulgaria's move to purchase a stake in a Greek LNG import project was "somewhat uneasy for Gazprom".

Despite these challenges – and amid ongoing uncertainty over the fate of the Nord Stream 2 pipeline – Gazprom continues to develop projects targeting Europe. On Aug. 19, the Russian

ROMANIA

Transgaz completes Bibesti

Romania's Transgaz has completed construction on Bibesti – the third and largest compressor station that forms part of the first phase of the Bulgaria-Romania-Hungary-Austria (BRUA) gas pipeline project.

The station, which is bidirectional, was inaugurated on Aug. 23. The other two compressor stations that form part of this phase of BRUA – Jupa and Podisor – were completed and commissioned in September and October 2019, respectively.

The first phase of the BRUA project includes the construction of the Podisor-Recas gas pipeline, which enables gas flows from Romania to Hungary and Bulgaria. Transgaz hopes to complete the Romanian section of the pipeline by the end of 2020.

Each compressor station comprises one active compressor and one idle unit to be used as a backup. There are plans to add a second active compressor at each station at a later stage of the pipeline project's development.

Solar Turbines supplied the compressor packages for the three stations, including its C40 centrifugal compressor and Solar Centaur 50 gas turbine for the Podisor and Jupa stations.



Transgaz's Bibesti compressor station.

company said it had completed the last phase of its salt cavern storage facility at Jemgum in northern Germany. The facility consists of 10 caverns with a combined working gas capacity of around 31.8 Bcf (0.9 x 10⁹ m³).

Gazprom noted that the Jemgum facility's location meant it was connected to the gas transportation system of the Netherlands, as well as to the Gascade-operated pipeline grid in Germany.

Russian natural gas is transported to the facility via the Nord Stream and NEL pipelines.

GERMANY, POLAND

Poland to offer Germany gas for Nord Stream 2 cancellation

A Polish government spokesman, Piotr Muller, said in televised comments on Sept. 10 that his country was prepared to offer Germany access to gas supplies that would be imported via the Baltic Pipe system if Berlin halts construction on the Nord Stream 2 pipeline.

This follows the suspected poisoning of Kremlin critic Alexei Navalny, an event that has intensified calls to take action against Russia, such as preventing the Nord Stream

THE AUTHOR

ANNA KACHKOVA is an independent oil and gas writer based in Edinburgh, Scotland. She has over 10 years' experience of covering the energy industry, including five years in Houston, Texas, as NewsBase's North America editor.

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2 pipeline from Russia to Germany from reaching completion.

Poland has long seen the project as a threat to stability in the region, which will allow Russia to maintain its dominance over gas supply to Europe. Polish Prime Minister Mateusz Morawiecki has now called on Germany to halt the construction of the remaining 5% of the pipeline that still needs to be completed.

Poland is involved in various projects to end its dependence on Russian gas, including the Baltic Pipe, which is due to enter service in October 2022, carrying gas from Norway via a compressor station on the Danish island of Zealand.

"We have to consider various options when it comes to energy security," Muller said on Polish television. "From the beginning, Poland has emphasized that European solidarity in this area must be maintained. That's why, if Germany declares energy needs, Poland is open to it using the infrastructure that we are building for our own energy security."

NORWAY

Aibel wins FEED contract for Hammerfest LNG modification

Aibel said on Sept. 2 that it received the front-end engineering and design (FEED) contract for the modification of the Hammerfest LNG plant by fellow Norwegian company Equinor. The upgrades form part of the Snøhvit Future project to boost recovery from the Snøhvit field as pressure falls while minimizing the development's carbon footprint.

Aibel's FEED work will consist of two sub-projects. The first involves the construction of an onshore compression station at the Hammerfest LNG facility. The second sub-project will involve evaluating the potential electrification of Hammerfest LNG to minimize the Snøhvit carbon footprint.

The FEED contract is estimated to be worth NOK 140 million (US\$15.4 million). It includes an option for each of the sub-projects for an execution phase that would involve engineering, procurement,

MOLDOVA, ROMANIA

EBRD buys into Moldovan gas transmission firm

The European Bank for Reconstruction and Development (EBRD) is acquiring a 25% stake in Vestmoldtransgaz, the operator of the newly built Ungheni-Chisinau gas pipeline between Romania and Moldova. The bank is investing €20 million (US\$23.6 million) in the gas transmission company, which is the Moldovan subsidiary of Romania's Transgaz.

This comes as Vestmoldtransgaz prepares to place the Ungheni-Chisinau pipeline into service, allowing Moldova to diversify its supply sources.

The 75 mile (120 km) pipeline will link the Moldovan capital, Chisinau, to the Iasi-Ungheni interconnector between the eastern Romanian city of Iasi and the Moldovan town of Ungheni on the Romanian border.

"The project also helps integrate Moldova into future major gas infrastructure projects, such as the Trans Adriatic Pipeline and gas sources from central European hubs, and links it with Black Sea gas deposits," said Alain Pilloux, EBRD's vice president.



EBRD gained a 25% stake in Vestmoldtransgaz, which operates the Ungheni-Chisinau gas pipeline.

construction and installation (EPCI) of the compression and electrification components.

The company will begin its work immediately, with the delivery of the FEED scheduled for April 2021.

ALBANIA, GREECE

TAP moves closer to start up

The Trans Adriatic Pipeline (TAP), which will carry natural gas from Azerbaijan to Europe, is moving closer to start up. The pipeline was 97% complete at the end of July and is expected to be in service later this year.

Azerbaijan's Trend News Agency reported on Aug. 26 that the introduction of gas and all required testing was finished at the Kipoi compressor station in Greece. Construction and the introduction of gas have also been completed at the Fier compressor station in Albania, where testing will conclude around mid-September.

Siemens supplied six 15 MW STC-SV (08-4-A) turbo compressor units for the compressor stations. Siemens SGT-400N gas turbines will drive the compressors.

The TAP will have an initial capacity of 353 Bcfy (9.9 x 10⁹ m³/y). This could double in the future, which would require the installation of two additional compressor

stations at Serres, Greece and Bilsht, Albania.

The pipeline will cross northern Greece, Albania and the Adriatic Sea before coming ashore in southern Italy, where it will connect to the country's gas network.

RUSSIA

Nikkiso subsidiary opens new office in Russia for LNG support

Nikkiso Cryogenic Industries' Clean Energy & Industrial Gases Group, a subsidiary of Nikkiso Co., has established its new office in Moscow, Russia.

The subsidiary's new facility will support LNG and petrochemical customers in the Russian market and other CIS countries.

The subsidiary already has its first order. It will supply all the cryogenic pumps for a major liquefaction terminal under construction in Russia.

Nikkiso's Higashimurayama, Tokyo plant will design and engineer most of the pumps for the order, while Nikkiso's Miyazaki City, Japan factory will assemble and test them. ACD Cryo in Germany will provide the remainder of the pumps.

The project is scheduled to begin in late 2022 and will run for several years. The subsidiary has a long relationship with the client.

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Pictured is a Compass three-stage, sweet natural gas compressor and inlet separator. With its Exterran deal, Compass will be able to reach areas of the United States and internationally that it couldn't before.

Move supports Compass' United States expansion plan. By DJ Slater

Compass to acquire Exterran U.S. compression assets

Compass Energy Systems' footprint is about to get much bigger following its move to acquire U.S. natural gas compression assets from Exterran Corp. Through an asset purchase agreement, Compass will acquire Exterran's U.S. compressor package fabrication business.

The acquisition, which closes in the fourth quarter of this year, includes Exterran's Brittmoore Road facility in Houston, Texas, as well as a team of Exterran compression employees, equipment and components.

"In our industry, Exterran has a strong legacy," said John Forgeron, Compass president. "We're building a similar legacy in Canada."

Compass, headquartered in Calgary, Alberta, Canada, is a private company that specializes in designing and fabricating natural gas compression and process package systems for a global customer base. The company has a sales office in Dallas, Texas and parts and service locations in Alberta (Clairmont, Spruce Grove), British Columbia (Fort St. John) and the United States (Greeley, Colorado; Casper, Wyoming; and Dickinson, North Dakota).

Compass has a 19-year history filled with packaging agreements with major OEM suppliers. This acquisition lifts many of the territory restrictions and most importantly,

gives Compass access to Ariel worldwide. Compass can now reach areas of the United States and internationally that were not accessible to them before and can compete with southern compression suppliers that specialize in warm-weather packages.

"The warm-weather expertise is something we never had," Forgeron said. "We've always wanted to be better situated in the U.S. and this acquisition gives us access to the Port of Houston which will help grow our U.S. and international business."

The next steps before the official closing of the deal involve working through an integration plan with the senior management teams from both companies.

From theory to reality

Part of that senior management team is Bill Moore, the company's chief operating officer. Forgeron credits Moore with the genesis of the deal and retells the story in this fashion: Moore approached him last year after noticing that Exterran expressed interest in leaving the U.S. compression business. While it seemed unlikely, Forgeron knew they had to take a shot. It ticked every box Compass was looking for to help accomplish their strategic business goals.

As the momentum built, the marketplace took a sharp turn downward, with COVID-19



Compass is known for its compressor packages, such as this 3750 hp (2796 kW) package.

also joining the fray, leaving Forgeron wondering if this move remained possible given the new reality.

"It is risky to do an acquisition in current market conditions," he said. "But this acquisition will give us access to the largest compressor market in the world. It will significantly increase our U.S. footprint and our ability to provide top-quality compression and process equipment to clients across the United States and around the world."

Andrew Way, Exterran's president and CEO, echoed Forgeron's sentiments on the deal, stating through a press release that Exterran is pleased with the sale of its U.S. compressor fabrication business and that it'll serve as a positive move for his company, as well as his employees and customers. **CT2**

All eyes on valves

Manufacturers, service providers provide abundance of options to aid operators. By **DJ Slater**

The natural gas market received a rough hand in 2020 – a double whammy of a down market paired with a pandemic. In a volatile market, uncertainty reigns, causing companies to hold tight to cash and sometimes forgo routine maintenance.

Valve manufacturers and service providers have a direct line to the pulse of the marketplace. Given the importance of the compressor valve to the operation of the machine itself, these companies offer a variety of options to operators. The goal is striking a balance between providing essential maintenance, while also being cost effective.

Valve services

The common compressor operator offering is valve services, such as repairs or reconditioning. The method consists of fixing



an operator's current valves to like-new condition, saving them from the costs of purchasing new valves outright.

Companies like Hoerbiger, Cook Compression, Compressor Products International (CPI) and Compressor Elements Service Inc. provide valve repair and reconditioning services.

All of CPI's service centers, as well as its manufacturing plants, handle valve reconditioning, which consists of cleaning, inspection, an engineering review as needed, remachining of the seats and guards, installation of new sealing components and springs, final assembly and leak testing.

"Valve life and reconditioning intervals vary widely throughout the industry," said David Schroeder, CPI's vice president of technology. "We want a customer to have a minimum one-year life for the most difficult applications to four years plus for cleaner, slower-speed applications."

Compressor Elements, a Texas-based aftermarket service company, provides new replacement valves for up to a 40% savings over brand new OEM variants. Additionally, Compressor Elements can also rebuild compressor valves using OEM repair kits (while also maintaining the OEM warranty) and can even improve on valve designs, especially on legacy valves, said Steve

Cook Compression's service programs range from performance guarantees to valve repairs.



Valves from Samco's exchange program.

Swarb, Compressor Elements' president.

"These improvements on designs improve the operational life of the valves and extend their use, which saves the customer money in the long run," he said.

Hoerbiger has a standard valve service, which acts as repair work with warranty support, and its enhanced service known as Vistra. Through Vistra, Hoerbiger serializes all of a customer's valves and uses a mobile app and desktop dashboards to track and monitor them in the field.

"Vistra helps keep track of everything," said John Metcalf, Hoerbiger's senior vice president – head of product management and business development. "Customers can see what valves they have, how many they have in repair and identify the bad ones."





Cook Compression has a full lineup of proprietary valve designs.

Valve exchanges

Valve exchange programs are another way for operators to avoid spending money on new valves. Under these programs, operators send a used valve to a service company and get a replacement valve in its place. The used valve gets reconditioned and becomes available for another customer.

Samco Enterprises, a compressor manufacturer and service provider, started its exchange program 17 years ago. At that time, Samco was limited to obtaining valves from a customer's site, repairing them at its shop and then returning them several days later. The flaw in this approach came from the company's field inventories, which didn't have enough in stock to support entire sets of valves. Then the wheels began to turn in the mind of Joe Frisby, Samco's vice president.

"Our exchange program is simple," he said. "We bring you a properly engineered set of valves and packing to your location and we bring back the cores and bill appropriately. The customer owns his valves, so there's no real inventory management."

While traditional valve services have their place, Frisby appreciates the benefits of the exchange program because of its speed and effectiveness.

"When we perform an exchange for the first time with a customer and they see tangible results, they are very happy to do business with us," he said. "Our entire team

feels great knowing we helped someone out of a problem and made a difference."

Hoerbiger's exchange program, only available for its CP valves, provides customers with a factory repaired valve before they remove the worn one from their unit, Metcalf said. The worn valve goes to Hoerbiger for refurbishing before being added to its inventory.

"We often refer to the CP exchange as a 'valve for life' concept," he said. "You will always get an exchanged valve even if the returned valve has reached the end of its service life."

Valve rentals

Zahroof Valves has a new concept available to compressor operators – valve rentals. Operators can turn to the Houston, Texas-based valve manufacturer to rent valves for reciprocating compressors. Those operators can then either keep renting the valves indefinitely or purchase them at any point during the lease, said Zahroof "Zee" Mohamed, Zahroof Valves' president.

"A barrier we see in many cases is that a company does not have the money to spend on a complete, new set of valves," he said. "Our rental program allows the customer to immediately take advantage of our valves at a low monthly cost."

The design and composition of Zahroof's valves make the rental option possible. All of the wear on Zahroof's valves are captured in the module and not on the metal valve housing, Mohamed said. Because of this, once the modules are replaced, the valve is back to its original factory specifications. With conventional valves, wear occurs on the metal housing, which requires reconditioning work as well as

replacing the internals, he said.

"The valve housing (on our valves), under normal conditions, should last the life of the compressor," Mohamed said, adding that the company offers a 10-year warranty on its valves. "If operating conditions change over time, we can optimize the valves to the new conditions by providing a new set of modules that are optimized to the new conditions while keeping the same valve housing."

Marketplace

The pandemic has caused operators in different parts of the world to react differently. In Europe, where cases have lessened since March, companies like Cook Compression are seeing a surge in reconditioning and valve upgrade requests.

"Europe appears to be awakening fast," said Paul Modern, chief engineer – valves for Cook Compression. "Globally, we are seeing trends toward high-speed compressor units and small, high-pressure hydrogen compressors."

In the United States, however, the pace for valve repairs is slower, said Skip Foreman, manager of product sales – Americas, Cook Compression.

"The U.S. appears to be behind the curve on recovery," he said.

Frisby's business slowed during the early days of the pandemic, yet his exchange program remains robust, he said, adding that Samco has averaged about 20 exchange jobs per week.

"We definitely see more urgent requests as maintenance has taken a back seat to saving money," Frisby said. "But as the saying goes, you need to make time for your machine's maintenance or your machine will make time for you."

CT2



Samco's exchange program consists of bringing valves to a location and taking the cores to repair and put on the shelf for next time.

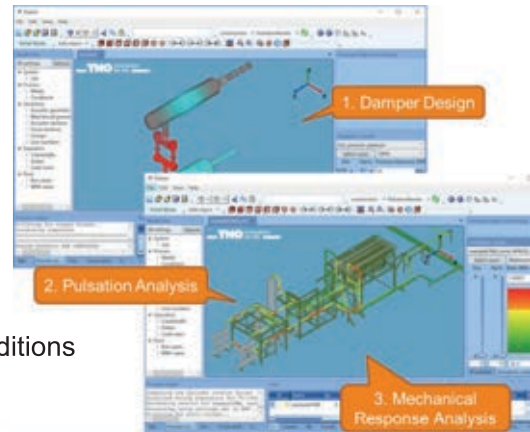
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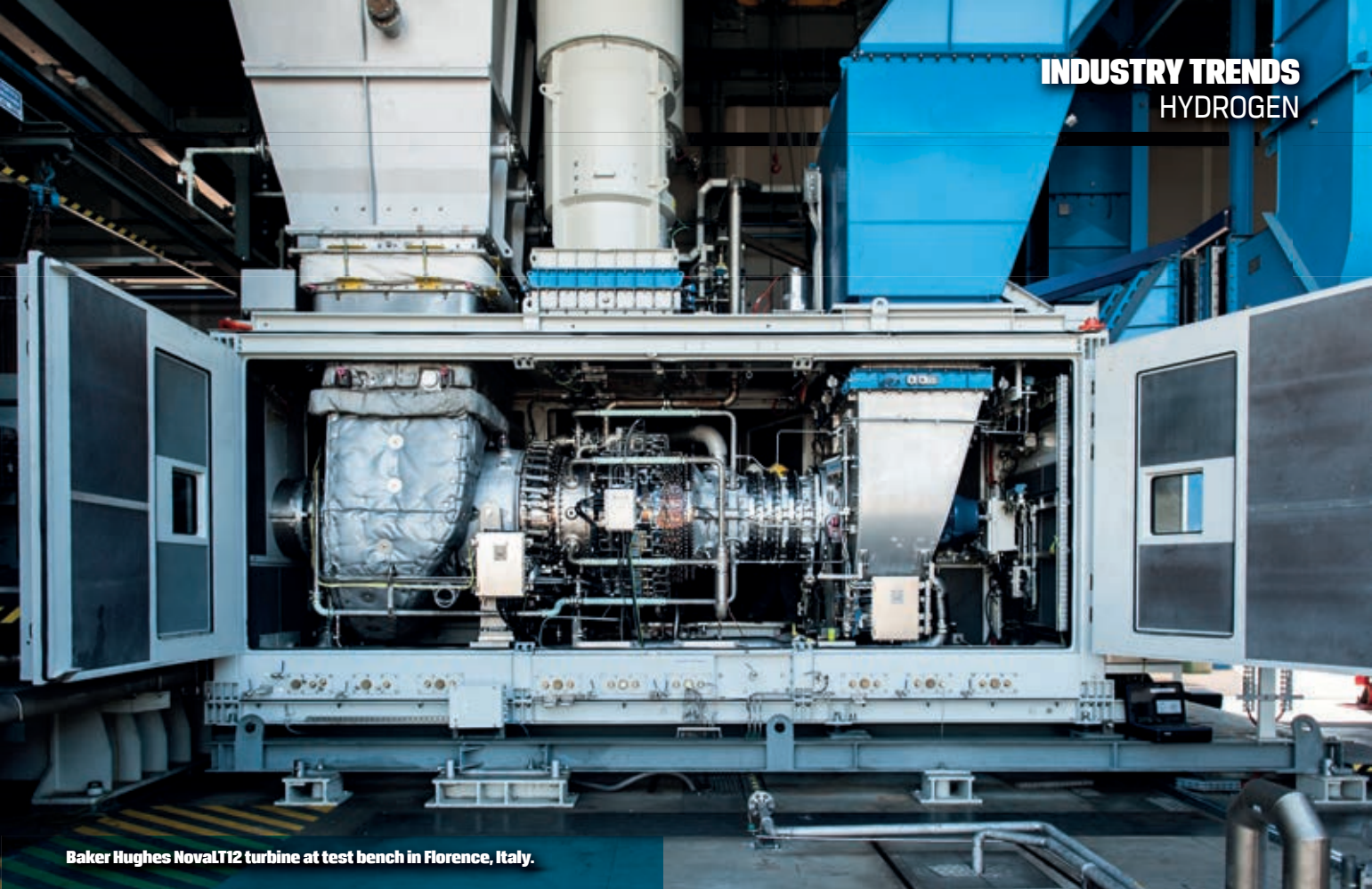
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Baker Hughes NovalT12 turbine at test bench in Florence, Italy.

Hydrogen gaining momentum in Europe

European Union, companies develop strategies for green resource. By **Anna Kachkova**

Hydrogen has steadily gained prominence in the global energy outlook. Europe already has carbon neutrality as its long-term energy goal. In July, the European Union (EU) unveiled its hydrogen strategy, saying it would prepare a package of legislative measures aimed at decarbonization within 12 months. This move is one of several steps occurring on the country and company level to advance decarbonization efforts and integrate hydrogen into energy networks.

Setting goals

Interest in hydrogen and its role in decarbonization has grown substantially over

the past year. Since 2017, Asian countries, such as Japan and South Korea, led the way in publishing national hydrogen strategies, but the momentum has shifted to Europe. So far this year, the Netherlands, Germany, Portugal and Norway – which is not an EU member – have all published national hydrogen strategies, with more countries set to follow suit.

The EU's strategy identifies the development of renewable – or green – hydrogen as a priority but acknowledges that "other forms of low-carbon hydrogen" are needed in the short and medium term. The bulk of hydrogen produced today (grey hydrogen) relies on fossil fuels as feedstock,

especially natural gas. Green hydrogen, by contrast, is produced via the electrolysis of water, with a renewable source used for generating the electric current.

The development of blue hydrogen – which is produced from natural gas with a carbon capture and storage (CCS) component to minimize emissions – is being touted as a low-carbon option. One concern raised by the EU's hydrogen roadmap, however, is that renewable hydrogen could deter blue hydrogen investments, despite the acknowledgment that it will be needed in at least the medium term.

The European Commission anticipates Europe's cumulative investments in



Pictured is Uniper's Irsching power plant, which uses a Siemens turbine

renewable hydrogen could reach €180 to €470 billion (US\$213 to US\$557 billion) by 2050. Its projection for low-carbon, fossil-based hydrogen investments by that year, however, is smaller at €3 to €18 billion (US\$4 to US\$21 billion). The risk is that if blue hydrogen is seen as no more than a stepping stone to the widespread adoption of renewable hydrogen, companies will be unwilling to commit to it in a meaningful way. On the other hand, green hydrogen is significantly more costly to develop, meaning would-be developers appear likely to turn to the more affordable of the two.

"The EU strategy was more encouraging for blue hydrogen than, say, the German hydrogen strategy," said Martin Lambert, a senior research fellow at the Oxford Institute of Energy Studies (OIES). "The EU strategy did recognize that some blue hydrogen is likely to be required. How much and for how long probably depends on how costs evolve."

The European Commission estimates costs for fossil-based hydrogen to be around €1.5/kg (US\$1.8) for the EU, with fossil-based hydrogen with CCS comes in around €2/kg (US\$2.4) and €2.5 to €5.5/kg (US\$3 to US\$6.5) for renewable hydrogen. With these costs, the commission said carbon prices in the range of €55 to €90/T (US\$65 to US\$107) of carbon dioxide (CO₂) would be needed to make fossil-based hydrogen with CCS competitive with fossil-based hydrogen.

"It is possible, but by no means certain, that the costs of green hydrogen could fall substantially, similar to the way they have for wind and solar power over the last 10 to 15 years," Lambert said. "For example, it is possible that mass-produced electrolyzers in China could be much cheaper and drive down costs globally."

Next steps

Different variants of hydrogen will appeal to different types of players. Green hydrogen is expected to appeal more to utilities, electric grid operators and those involved in existing renewable energy projects, whereas blue hydrogen could generate more interest



among natural gas companies. There is significant scope for overlap, however, among those companies involved in power and gas transmission.

In the natural gas space, incorporating hydrogen into the existing infrastructure appears to be among the obvious next steps. Plans for realizing this are already underway, with a growing number of companies indicating their willingness to participate.

In July, a group of 11 European gas infrastructure companies from nine EU countries unveiled a plan to modify existing gas infrastructure across the continent, allowing it to transport hydrogen at an affordable cost.

The plan envisions a hydrogen pipeline network gradually emerging across Europe from the mid-2020s and connecting "hydrogen valleys", or local hydrogen clusters. The plan proposes that this network reaches 4225 miles (6800 km) by 2030 and expands to 14,292 miles (23,000 km) by 2040. Around 75% of this network would consist of converted natural gas pipelines. The companies behind the plan estimate this development will cost €27 to €64 billion (US\$32 to US\$76 billion) by 2040.

"These costs are relatively limited in the overall context of the European energy transition and substantially lower than earlier rough estimations. The relatively wide range in the estimate is mainly due to uncertainties in (location dependent) compressor costs," the companies said in their European Hydrogen Backbone report.

The report suggests that blending hydrogen with methane in existing gas

networks initially makes sense in the 2020s when the hydrogen volumes involved are small. But as hydrogen volumes increase and natural gas volumes decrease, the companies expect dedicated hydrogen transport to emerge and local clusters to evolve into regional and national hydrogen infrastructures.

Making moves

Most of the companies involved in the European Hydrogen Backbone plan have already started making initial forays into hydrogen. Some are considering incorporating hydrogen into their existing gas networks, while others are already working on dedicated hydrogen infrastructure.

For example, Enagás and ONTRAS have announced separate initiatives to develop green hydrogen using solar and wind power, respectively, that will be injected into their existing gas networks. Meanwhile, GRTgaz is collaborating with Creos Deutschland to create a 43 mile (70 km), 100% hydrogen infrastructure in the region where the French, German and Luxembourg borders meet to support the development of a cross-border hydrogen hub.

Hydrogen-capable turbines

In one of the most recent examples, Snam announced in July that, together with Baker Hughes, it had completed testing of the world's first hybrid hydrogen turbine designed for a gas network. The two companies said the test paved the way for blending hydrogen with gas in Snam's existing transmission network.



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The test occurred in Italy using a Baker Hughes' NovalT12 gas turbine. The companies said this was the first time that a gas infrastructure operator such as Snam had tested this type of turbine for use at its existing assets. By 2021, Snam will install one of these turbines at its Istrana compressor station in Treviso, Italy, allowing hydrogen fuel blends to be compressed and moved through its transmission network.

The timing worked well for the Istrana compressor station, which needed a new turbine before considering the NovalT12, Snam said.

"Further tests are planned to cover most of the turbine models in our portfolio," the company said, adding that it expects that the tests will show compatibility up to 10% hydrogen without a need for modifications. For higher percentages, Snam expects that modifications will likely be required, but views such modifications as more of a long-term project once Italy develops a national hydrogen plan that can help guide the work.

Snam has more than 25,476 miles (41,000 km) of pipeline across Europe and 706 Bcf (20 X 10⁹ m³) of global natural gas storage capacity. About 70% of Snam's pipelines are built with hydrogen-ready pipes. Snam estimates it could introduce up to 247 Bcf (7 X 10⁹ m³) of hydrogen into its network each year by blending 10% hydrogen into its total annual gas transportation capacity.

"The vast majority of the pipelines are made of steel grades allowed by the specification and within a range of pressure and thickness suitable to ensure compliance," Snam said. The company added that pipelines not deemed to be compliant are typically "very old" and will need to be replaced in the coming years. Snam also issued internal piping material specifications applicable to 100% hydrogen service piping, which it will use for all new pipelines.

For Baker Hughes, Snam's compressor station is one of several facilities it is supplying hydrogen-capable turbine technology to. The company said there are around 70 projects worldwide that use its gas turbine technology to burn a variety of fuel mixtures with hydrogen content.

"Hydrogen applications clearly go beyond



Baker Hughes NovalT12 turbine at test bench in Florence, Italy, ready for hydrogen testing for Snam's Istrana project

pipeline and domestic use so the demand for turbines able to manage 100% of hydrogen are coming from different types of customers for different applications," Baker Hughes said. "Customers interested to leverage the existing infrastructure to transport hydrogen blended with natural gas are mainly pipeline operators so they will be targeting turbomachinery technology able to leverage hydrogen percentages such as 10 or 20%."

Power fleet decarbonization

Gas companies are not alone in exploring how hydrogen can fit into their existing infrastructure. In recent months, German utility Uniper announced two separate ventures with Siemens and GE aimed at decarbonizing its gas-fired power plants and gas storage facilities.

None of the companies involved were able to provide updates on the work they are partnering on, as it is all still at an early stage. However, some initial details are available. Within the Siemens partnership, the companies said they would evaluate the potential to use hydrogen in Uniper's existing gas turbines and gas storage facilities. One further area identified for co-operation is the production and use of green hydrogen. Siemens and Uniper said they intended to develop projects in this area that would encompass the entire value chain.

Siemens said green hydrogen is the target

for its New Energy Business unit, adding that it "sees the market for hydrogen migrating from grey to blue and then to green, with each having its own role utilizing different transition technologies". Siemens said it is "currently talking to many users and customers" about hydrogen and is involved in several projects to support its development.

With GE, Uniper said it would develop technology options for decarbonization, which includes assessing the increased use of hydrogen in GE gas turbines and compressors at Uniper's European power plants and gas storage facilities. This is GE's first fleetwide decarbonization agreement to be signed with a major power producer.

Uniper confirmed that blue hydrogen had a "significant" role to play in its strategy, certainly in the shorter term. "While green hydrogen is our end-goal, blue hydrogen is needed in the interim to ramp up the use of green hydrogen," the company said. "This is why we are also planning to develop blue hydrogen projects, notably in countries with CCS capacity, such as the U.K. and the Netherlands."

Uniper has earmarked €1.2 billion (US\$1.4 billion) worth of investment into new, primarily green growth projects by the end of 2022.

"How much of this sum will be spent on hydrogen is currently still up for evaluation," the company said.



"GE Gas Power continues to see global interest in the potential use of hydrogen/natural gas blends and 100% hydrogen to reduce CO₂ emissions," the company said. "For now, there is a limited number of projects that are examining a phased approach to the use of hydrogen – start with a limited capability and increase over time as more hydrogen becomes available."

Support needed

Initiatives by gas companies, power generators and others will require significant levels of policy support on the country and regional levels if they are to become more widespread.

"Decarbonization has to be almost entirely policy driven," Lambert said. "Some renewable power generation may now be cheaper than more polluting alternatives, but moving beyond power generation, the low-carbon alternatives are higher cost and so require policy drivers to be implemented.

It doesn't need to be direct government funding (e.g. it could be quotas, feed-in-tariffs, contracts for differences to enable private sector investment) but it will not happen if left to commercial players."

Comments by companies venturing into hydrogen also illustrate the scale of the task at hand.

"For hydrogen to make a significant contribution, it needs to be adopted in sectors where today it is absent, such as transportation, buildings and power generation," Baker Hughes said. However, the company thinks hydrogen's potential is "huge" and could meet 18% of the world's energy demand by 2050.

Lambert said that instead of slowing decarbonization, the COVID-19 pandemic has the potential to help by resulting in additional EU funding for a green recovery, including hydrogen development.

"But the overall scale of the challenge remains enormous," he said.

CT2

GE, for its part, confirmed that it had received inquiries from other customers interested in developing similar agreements for its GE gas turbines.

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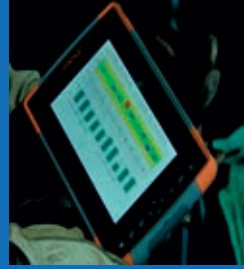
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The process behind putting variable frequency drives into service

TMEIC provides tips for VFD startup. By **Manish Verma**, Manoj Kumar Varanasi, TMEIC, **Jeffrey Waller**, Control Technology Co.



Equipment commissioning is a significant milestone in the life of any heavy industrial project. This activity brings the end user one step closer to project completion and achieving return on investment. However, this step is often misunderstood, resulting in unmet expectations. Successful project commissioning is a balance of several moving parts that must be completed in the right sequence at the right time.

Medium-voltage variable frequency drives (VFDs) are commonly applied to electric motor-driven rotating machinery, such as compressors, pumps, extruders and others. VFDs form a critical link

between the electric utility and the motor/driven equipment as shown in Figure 1. While many in the industry are familiar with starting up mechanical equipment, starting up electrical equipment is not as common. In this article, the authors offer guidance on commissioning medium-voltage VFDs. The scope and applicability of this article covers medium-voltage drives rated 250 hp (186.4 kW) and larger at a minimum 2.3kV voltage level.

Air-cooled medium-voltage VFDs usually take several weeks to engineer and manufacture, and several more days to install. Months often pass between the installation and commissioning dates. While VFD installation is beyond the scope of this article, we outline the activities the VFD purchaser or the end user must complete to successfully commission the equipment. Note that during all phases of equipment handling and commissioning, maintaining a safe working environment is critical.

What is commissioning?

Equipment commissioning, commonly known as "startup," is a series of activities performed by the field-service engineer of the equipment manufacturer in concert with the end user, engineering consultant and/or the driven original equipment manufacturer

Variable frequency drives typically are applied to electric motor-driven rotating machinery.

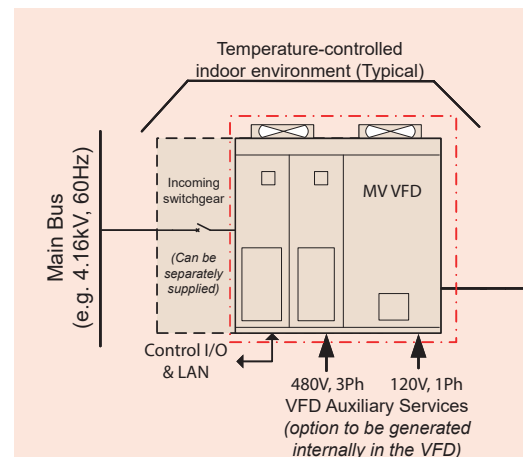
(OEM). The purpose of commissioning is to safely put the equipment into service to meet process functionality and overall project objectives. The "commissioning process comprises the integrated application of a set of engineering techniques and procedures to check, inspect and test every operational component of the project, from individual functions, such as instruments and equipment, up to complex amalgamations, such as modules, subsystems, and systems" [1]. A safe and efficient startup will bring together select personnel from the equipment vendor, equipment purchaser and their representative for the following benefits:

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PRE-COMMISSIONING TIMELINE AND CHECKLIST (ADMINISTRATIVE)	
APPROXIMATE WEEKS FROM MEDIUM-VOLTAGE VFD COMMISSIONING START DATE	ACTIVITY
10 – 12 weeks prior	<ul style="list-style-type: none"> - Request for commissioning quotation from VFD manufacturer - Sort out commercial terms and agreement
8 – 10 weeks prior	<ul style="list-style-type: none"> - Request for VFD commissioning plan - Review in detail all aspects of the commissioning plan and set up a conference call to discuss. - Identify and clarify the roles and responsibilities of commissioning personnel for each equipment that interfaces with the VFD (see Figure 2) - Request for a checklist of installation activities to be completed before the arrival of the VFD field-service engineer (FSE). Below is a representative list.
6 weeks prior	<ul style="list-style-type: none"> - Schedule VFD FSE for site arrival - Provide field-service engineer with guidance on safety-related training, need for special entry permit (e.g. TWIC card, permanent residence card (green card), passport, driver's license)
2 weeks prior	<ul style="list-style-type: none"> - Site supervisor's contact details - Lodging guidance and others

- Confidence that the equipment performs as expected under the full range of the foreseeable operating envelope.
- Opportunity for the end user's operator, maintenance and service personnel to gain familiarity with the key components of the equipment, receive training and become familiar with system operation.
- From an equipment manufacturer perspective, record and capture:
 - Field markups and changes to generate a set of "as installed" electrical elementary drawings.
 - "As installed" parameter settings and configuration data, such as drive files.
 - "As installed" performance trend data.

When dealing with high levels of complexity, such as starting up a new plant, site or a medium-voltage motor and VFD service, a system is required to facilitate productivity. Checklists are a surprisingly simple solution to breakdown that complexity. A series of checklist items for a safe, reliable and efficient medium-voltage VFD startup are shown below.

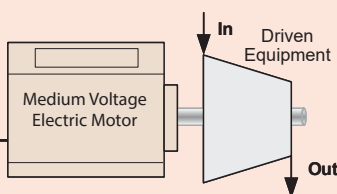
Pre-commissioning checklist (site)

- While the foregoing checklist is mostly administrative, the series of activities below detail steps that must be taken at the site by the end user or the contractor before the VFD field-service engineer arrives onsite.
- Medium-voltage VFD is physically installed in the building.
 - Secure VFD frame as per manufacturer guidance.
 - Interconnect power and control cabling between VFD shipping splits (if applicable).
 - Mount and complete electrical connections of the blower fans.
 - Clean surroundings and panel interior to ensure it is free from dirt and debris.
 - Verify all wire and cable entry points are sealed against weather, humidity, and rodents.
 - High voltage cabling terminated between

"The purpose of commissioning is to safely put the equipment into service."

- the VFD output and the motor observing the phase connections as per the VFD elementary drawings.
- Megger cables between the VFD and motor.
- HVAC system commissioned and ready to provide necessary cooling or heating.
- Run the HVAC system for at least 24 hours prior to VFD energization. This ensures the VFD installation environment is free of condensing humidity.
- Motor might need to be detached from the driven equipment for initial testing depending on the VFD manufacturer.
- All voltage levels, such as medium voltage (e.g. 4.16 kV), low voltage (e.g. 480 V) should be available and locked out/tagged out. If redundant power supply (primarily 120 V) is made available, the associated UPS system must be checked out.
- Control wiring between the VFD and

FIGURE 1 Illustration of a typical medium-voltage VFD driven electric motor service



Scope of the article

customer DCS/SCADA or PLC system completed and ready to supply commands, references and permissives.

- Incoming switchgear and feeder protection must be checked out and commissioned.
- Verify E-stop loop is wired and ready to be checked out.
- Speed reference signal is available from the control system.
- The following personnel are scheduled to arrive or be present when the VFD field-service engineer arrives:
 - Driven equipment OEM (such as pump, compressor, fan, extruder, etc.)
 - Process control representative
 - Craft labor
- Verify any drawings, manuals, kirk keys and other items that were shipped with the VFD are available and not misplaced.
- Motor lubrication system is fully checked and commissioned.
- For water-cooled VFD, depending on type and method, cooling system external to the VFD must be commissioned and ready.
- Motor commissioning report available for review.

Common issues that lead to medium-voltage VFD commissioning delay and expense

It is not uncommon for the VFD field-service engineer to arrive onsite only to discover that the site is not prepared for startup. Below are some items that commonly delay equipment startup:

- Control systems beyond the VFD scope not complete and still in the process of being wired/terminated, and in some cases, software being developed onsite.
- VFD blower fans not mounted.
- Incoming power not available.
- Process not ready for full operating range. This is quite common and the field-service engineer will often have to make a second trip to the site to tune the VFD for rated load and speed.
- VFD energized in absence of field-service engineer leading to damaged components.
- Motor not commissioned, mounted or aligned.
- Incoming switchgear, if outside the scope

"A medium-voltage VFD is often critical to the operational process for the end user."

of the VFD, is not commissioned.

- Absence of the manufacturer's field engineer. It is always best practice to overlap the presence of the VFD, motor and driven equipment service engineers. It should be noted that unless otherwise supplied by the VFD manufacturer, troubleshooting the driven equipment, electric motor, sync-transfer switchgear and external control systems is not included in VFD commissioning.

Conclusions and end-user perspective

Starting up a medium-voltage VFD is often critical to the operational process for the end user, which means it is typically on the critical path for the project to begin

creating product and generating revenue. The process applications that are driven by the mechanical rotating equipment are also complex processes that require expertise from field engineers from each piece of corresponding equipment. Therefore, the complexity of starting the process requires an extensive coordinated effort. Figure 2 provides an overview of key personnel that typically participate in a VFD commissioning and each should be clearly aware of their roles and responsibilities.

The integrated effort for control communication between the end-user's site communications and each piece of equipment is important for sequencing activities and can prove to be a challenging part of the startup. Pre-commissioning integration meetings via phone/digital media are a cost-effective method for starting the process of facilitating communication between suppliers and ensuring the integrity of the equipment.

All foreseeable process scenarios should also be documented by the engineering consultant/end user and communicated to all parties involved. For example, when a

Several steps must be taken before the VFD field-service engineer arrives onsite.



drive starts multiple motors and runs on the drive, as well as synchronous transfers to utility, it is essential to communicate and test the scenarios for starting each motor based on process requirements. Does one motor always start first? What signals are sent to the drive to start the second motor, and what happens to the first motor? The drive and site communications can meet process requirements. However, this can often lead to additional time and cost for the field service team onsite if the required process scenarios are not identified and notified ahead of time regarding the number of process-related scenarios that need validation.

Understanding and communicating the startup requirements for the mechanical and rotating equipment is also important for the VFD field engineer to ensure the quoted costs are accurately captured. If the rotating equipment requires a multiple long run-in duration or if there is a significant pause between starts required for process

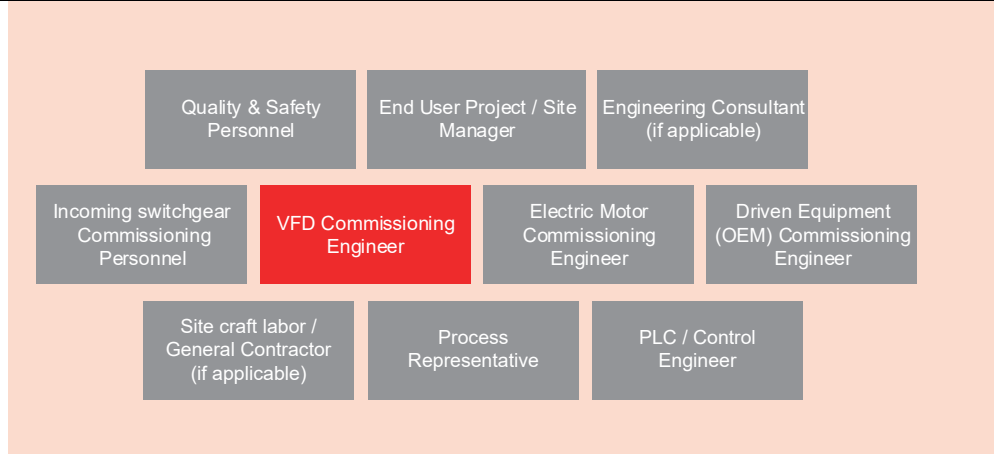


FIGURE 2 Personnel participation in medium-voltage VFD commissioning

equipment that will limit the number of daily starts, the time required for the VFD field service engineer to be onsite might be longer than expected. This additional time should be budgeted and accounted for so there are no surprises in the field.

There are a variety of factors that need to be identified and communicated between the field service engineers, engineering

consultant and the end user for the startup to run smoothly and effectively. Based on experience, the better the process scenario is mapped out and communicated, the more efficient the startup process becomes. **CT2**

References:

[1] "PROJECT COMMISSIONING." *Definitions.net*. STANDS4 LLC, 2020. Web. 3 May 2020. <<https://www.definitions.net/definition/PROJECT+COMMISSIONING>>.

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Siemens Energy focused on compression technology, decarbonization

Investments target rotating equipment, electrification, automation and digitalization. By **DJ Slater**

Thorbjoern Fors knows all about the inner workings of Siemens Energy. For the past 17 years, Fors has been under the Siemens umbrella in several senior management positions. From 2009 to 2013, he served as executive vice president of global marketing and sales for the New Equipment division.

Thorbjoern Fors,
Executive Vice
President,
Siemens
Energy,
Industrial
Applications
division



From October 2013 to April 2015, he held the title of executive vice president and general manager of medium-size steam and gas turbine service, responsible for the growth and development of the industrial power generation and compression business. In 2017, he became CEO of the service distributed generation and oil and gas business unit, the same year Siemens merged Dresser-Rand Services, Rolls-Royce Energy Services and Siemens Distributed Generation Services.

Fors obtained the role of executive vice president again on April 1, 2020, this time for the Industrial Applications division of Siemens Energy. While he's seen his share of changes at the company during his tenure, he embraces them and anticipates several more on the horizon. The key, he said, is evolving with the changes.

YOU TOOK THE HELM OF THE OIL & GAS (NOW INDUSTRIAL APPLICATIONS) DIVISION OF SIEMENS ENERGY BACK IN APRIL. HOW HAS THE ROLE BEEN THUS FAR FOR YOU? I IMAGINE THE TIMING (APRIL BEING RIGHT IN THE MIDDLE OF THE PANDEMIC) MADE FOR AN INTERESTING START.

Thorbjoern Fors: It certainly has been an interesting few months. COVID-19 has magnified the supply and demand imbalance across the globe, creating a challenging environment,

particularly for upstream producers. On top of this, we also see an aggressive push towards decarbonization.

Together, these factors have presented the industry with many challenges. However, it has also given organizations opportunities across the supply chain to leverage new technologies and drive towards a more sustainable and viable future. Siemens Energy is uniquely qualified to help our customers achieve these goals. As the head of the Industrial Applications division, I look forward to leading that charge and am excited about what the future holds.

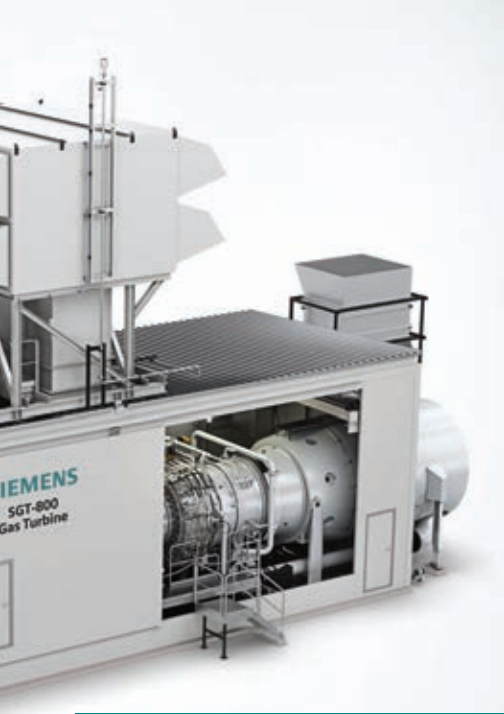
SIEMENS ENERGY WAS SPUN OFF AND PUBLICLY-LISTED AS AN INDEPENDENT COMPANY IN SEPTEMBER. WHAT SORT OF CHALLENGES DID COVID-19 PRESENT DURING THIS PROCESS?

There were undoubtedly some unique factors we had to contend with. As I'm sure you can imagine, not being able to travel extensively and limiting interaction with stakeholders did not exactly facilitate the listing process. I'm very proud that we were able to stay on schedule with our initial timeline, which was established well over a year ago.

I'm also pleased with the fact that we've been able to maintain operational continuity for our customers during these trying times. Much of this can be attributed to our adoption of new and digitally-enabled ways of working.

For instance, one of our North Sea oil and





Siemens' SGT-800 gas turbine is suited for power generation and oil & gas applications.

gas customers was unable to travel to their offshore platform, which made it impossible for them to participate in a traditional witness test. Instead of waiting until travel restrictions were lifted, which could delay start-up, we used digital collaboration tools to successfully perform a remote factory acceptance test (FAT) of the facility's automation system. The customer now uses our approach as a best practice example internally and will continue to perform digital FATs even after traveling is permissible again.

For another customer in China, we leveraged remote services to support onsite teams with a full compressor section inspection of two gas turbines.

It's examples like these that demonstrate how we've used technology and digitalization to remain agile and avoid significant disruptions to our day-to-day operations and our customers'.

THERE DON'T APPEAR TO BE TOO MANY PLAYERS THAT CAN COMPETE FROM UPSTREAM TO DOWNSTREAM IN QUITE THE SAME WAY AS SIEMENS ENERGY. WHAT ADVANTAGES ARE THERE FOR SIEMENS ENERGY BECAUSE OF THAT CAPABILITY, AND WHERE ARE THE CHALLENGES?

You are correct. Siemens Energy is a pure-play energy company whose portfolio spans not only upstream, midstream and downstream oil and gas, but also renewable energies, such as wind and hydrogen, and

the marine and fiber markets. Our reach extends across almost the entire energy value chain.

This – coupled with our broad capabilities in the areas of digitalization, rotating equipment, automation and electrification – uniquely positions us to help the oil and gas industry decarbonize and facilitate the world's transition to a lower-carbon energy system.

The challenge and excitement we face are in our own transformation. Like many companies across oil and gas and other industries, we are committed to decarbonization and emissions reductions. However, with intentions to achieve carbon neutrality by 2030, the timeline we have laid out for ourselves is much more aggressive.

ARE THERE SPECIFIC DIRECTIONS YOU WANT TO TAKE SIEMENS ENERGY'S INDUSTRIAL APPLICATIONS DIVISION? WILL THINGS LIKE THE PIPELINE 4.0 AND DIGITAL PROGRAMS REMAIN A SIGNIFICANT FOCUS?

As an organization, we will continue to remain obsessive about listening to our customers' needs and helping them address their challenges. As far as our portfolio goes, our focus will be on investing in solutions in the areas of rotating equipment, electrification, automation and digitalization, or "R-EAD" as we call it. Pipelines 4.0 is one of many examples that illustrate the value that can be generated by bringing all of these facets together into a single offering.

With Pipelines 4.0, we can offer operators a solution that addresses not only the entire midstream value chain but also the complete project lifecycle. This multi-dimensional approach allows our customers to unlock value and take advantage of new services and capabilities that would otherwise not be possible using traditional tools and methodologies.

WHAT ABOUT YOUR COMPRESSION OFFERINGS? WILL THEY CONTINUE TO BE A FOCUS AREA OF SIEMENS ENERGY AS WELL?

Yes it will be. When Siemens acquired Dresser-Rand in 2015, we became a global leader in compression for industrial applications. With the formation of Siemens

Energy earlier this year, the integration of our two businesses is now fully complete.

Some of our recent project wins speak to our strength in the compression market. For example, earlier this year, we were awarded a large contract to supply 20 centrifugal compressor systems for Saudi Aramco's Hawiyah Unayzah Gas Reservoir Storage (HUGRS) project in the city of Riyadh. The plant will take surplus pipeline gas in the winter months and inject it into an existing depleted field. From there, it can be withdrawn when needed to meet high summer demand.

We also had a notable win in the LNG space where we were selected to provide a cryogenic boil-off gas (BOG) compression train for a plant expansion project in West Africa. The solution will play a key role in reducing emissions from the plant by capturing boil-off gas from warm LNG tankers that would otherwise be flared. In fact, Siemens Energy retains more than 90% share in the BOG market.

And finally, we had a significant win in the midstream sector, where we were awarded a contract to supply two SGT-400 gas turbine compression packages for Midcoast Energy, LLC's CJ Express pipeline expansion project in east Texas.

These projects, and many others, speak to our extensive reach and capabilities in the compression market, and also to the value our technology can provide customers across the oil and gas value chain.

DECARBONIZATION CAN BE SEEN AS BOTH A CHALLENGE AND AN OPPORTUNITY FOR THE OIL & GAS INDUSTRY. HOW DO YOU VIEW IT?

I view it as more of an opportunity. There are certainly hurdles that we (Siemens Energy) and our customers face on the decarbonization journey, but through the application of new technologies and approaches, for example – increased electrification, digitalization and the burning of hydrogen fuel in gas turbines – we can overcome these challenges.

I think most companies now realize that the extent to which they can decarbonize is becoming a competitive advantage, and this will continue to be the case in the coming

years. I, for one, think it is fascinating to see how organizations across oil and gas and other industries are transforming to remain viable in a low-carbon world, and overall, I remain very optimistic about the future.

THERE APPEARS TO BE A GROWING ENVIRONMENTAL CONCERN ABOUT THE USE OF NATURAL GAS. DO YOU THINK THOSE CONCERNS ARE VALID, AND HOW DO YOU SEE THEM POTENTIALLY IMPACTING THE INDUSTRY – AND SIEMENS ENERGY SPECIFICALLY?

Let me first start by saying that I think natural gas will be a crucial pillar of the global energy system in the coming decades.

There are still roughly 850 million people on the planet who do not have access to reliable power. The global population is also increasing and is expected to reach 9.7 billion by 2050. At the same time, countries are facing pressure to reduce greenhouse gas emissions by moving away from feedstocks like coal and heavy fuel oils in favor of renewables, like wind and solar. However, the transition cannot happen overnight.



Natural gas will be needed to meet the world's growing demand for power in the coming years. It can serve as a sustainable bridge fuel to a future where renewables dominate the energy system. With that said, the industry does need to look at how it can apply new technologies to reduce emissions associated with producing gas and transporting it to destination markets – whether that is through pipelines or in the form of LNG. At Siemens Energy, and particularly within the Industrial Applications group, this is something we are focused on helping customers achieve.

For example, we recently entered into an agreement with global energy leader, Total, to advance new concepts for green LNG. As part of the contract, we are conducting studies to explore a variety of possible liquefaction and power generation plant designs, with

the ultimate goal of decarbonizing the LNG production. More recently, we were selected to implement a low-emissions power generation solution using our SGT-800 turbines for an LNG project in East Africa.

In the future, I believe there will be more opportunities for this type of co-creation and collaboration. With our extensive portfolio of emissions-reducing technologies, Siemens Energy is positioned to serve as a strategic partner that can facilitate the industry's transformation.

HOW DOES YOUR CURRENT ROLE COMPARE TO THOSE THAT YOU'VE SERVED IN BEFORE? DID THOSE PAST ROLES PREPARE YOU WELL FOR THIS ONE, AND HAVE THERE BEEN ANY SURPRISES OR UNEXPECTED CHALLENGES?

I started my career with ABB and then joined Alstom, which Siemens acquired in 2003. While every role has been different, they all provided me with the opportunity to work alongside very talented people, and that is something I thoroughly enjoy.

In the end, I believe it is all about people. I can't say enough about the fantastic team we have here in the Industrial Applications division. Transitioning into this new role during the pandemic has not been easy. Travel restrictions and social distancing have limited the extent to which I have interacted with colleagues face-to-face. But the process of finding new solutions and innovations, and the flexibility the team has shown in handling the daily work has truly been inspiring.

I'm curious by nature. I like turning over every stone and talking with employees and customers about how we can solve problems and develop solutions to today's pressing issues. At Siemens Energy, we are now addressing one of the biggest dilemmas, and that is how we can meet the world's growing demand for power sustainably and economically. I think I can speak for all our employees when I say that no matter how difficult it may be, we are up to the challenge.

Siemens' SGT-400 compressor package features DLE combustion technology for emissions compliance.



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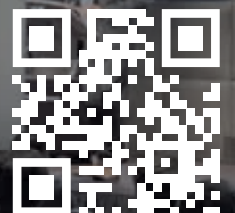
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Dover Precision Components establishes Innovation Lab

Facility designed to test, validate, improve and develop company products. By DJ Slater

The road to new fluid film bearing materials and compressor-related technologies runs through Houston, Texas, thanks to a move by Dover Precision Components.

The company, which specializes in products for rotating and reciprocating machinery, has built a dedicated Innovation Lab to support its research and development initiatives. The 12,000 sq.ft. (1115 m²) facility brings together Dover Precision Components' research and product development teams from other locations and centralizes its test rigs for hydrodynamic fluid film bearings and reciprocating compressor components.

"The Innovation Lab is forward-looking," said Krista Betts, marketing communications manager of Dover Precision Components. "It's not just about maintaining our technology or leadership. It's about the next-generation technology."

The Innovation Lab is an amalgamation of Dover Precision Components' research capabilities across the United States. The company moved its bearing test rigs from its Pewaukee, Wisconsin location, and its reciprocating compressor rigs from Knoxville, Tennessee. The purpose is to foster further collaboration across the company's product lines, said Jane Kober, Dover Precision Components' vice president of marketing and innovation.

"We felt that putting them all in one place was the best thing to do," she said. "We get the best ideas when we're close together talking about our developments."

The Innovation Lab allows Dover Precision



Dover Precision Components' Innovation Lab in Houston, Texas features four independent test bays and control rooms, as well as additional rooms for inspection and component testing.

Components to test and validate new products, materials and processes under real-life conditions. Additional functions include validating design codes, providing root-cause analysis, discovering upgrades and supporting customer testing.

Test equipment

To achieve these functions, the Innovation Lab features two reciprocating compressor units – one large, two-stroke, medium speed compressor and one small, high-speed compressor – to test valve and sealing technologies under various lubrication schemes and operating conditions. Additional test setups are available to measure valve flow dynamics and performance parameters; impact resiliency of materials used in valve plates and sealing elements; piston and rod ring wear resistance; valve leakage rates; and component longevity and performance.

The facility also includes fluid film bearing test rigs to develop and validate bearing designs, analysis tools and materials. Horizontal test rigs are used for journal and thrust bearings, while the vertical test rigs evaluate thrust bearings. These

units can handle large and small bearings.

With the bearing test rigs, Dover Precision Components can simulate the speeds and loads on a variety of rotating equipment in oil, water, glycol or multiphase lubricants to improve and upgrade fluid film bearing technology.

The Innovation Lab has four independent test bays to allow work on multiple rigs at once, as well as control rooms for each bay. Four additional rooms are dedicated to inspection and component testing.

"With the lab, it will allow us to move into markets that we don't work in right now, as well as one that are emerging," said Barry Blair, chief engineer with Dover Precision Components. "We'll have an opportunity to develop new products for new markets."

Dover Precision Components is also thinking beyond new market expansion. The company built the facility with enough surrounding land to expand its footprint if needed.

"The Innovation Lab is a big win for us," Kober said. "Product development is key to sustained growth, and we see a lot of potential for our technology and products." **CT2**

Developments continue for MAN Energy Solutions' HOFIM compressors

Equipment part of subsea installations, unmanned platforms. By **Roberta Prandi**

MAN Energy Solutions' all-electric and hermetically-sealed HOFIM compressors made headlines in 2015 when they were first installed in a subsea compression facility at the Åsgard oil field in Norway. Since then, the two HOFIM compressors, powered by M43 electric motors, have worked for 70,000 operating hours with an availability above 99% at a depth of 984 feet (300 m).

According to Equinor, Åsgard's operator, the subsea technology will increase recovery from the oil field by around 282 million barrels of oil equivalent.

"With Åsgard subsea gas compression, we are one step closer to realizing our

vision of a subsea factory," Equinor said. "Subsea processing and gas compression, in particular, are important advances to develop fields in deep waters and harsh environments."

MAN, in cooperation with Aker Solutions, carried out the Åsgard pioneer project. The Equinor gas field represents the world's first reference case for subsea gas compression and the MAN subsea gas compression technology achieved the seal of 'proven technology' TRL7 by API.

Subsea benefits

Alexandre de Rougemont, head of sales, Turbo Solutions at MAN Energy Solutions in Zurich, Switzerland, is responsible for the global sales of subsea compression. He explained that the subsea compression technology brings significant improvements in energy consumption and consequently lowers CO₂ emissions. "Compared to

conventional topside gas compression, the savings in energy consumption for the gas compression work alone can reach 30 to 70%, depending on how the power is generated, over the entire project lifetime, which leads to a substantial reduction of CO₂ emissions," he said.

The hermetically-sealed compressor technology is also ideal for use in topside applications – with a special focus on unmanned platforms.

"Remote-operated platforms clearly represent the future of offshore oil & gas production as they tackle the highest concern of the industry: the safety of personnel," de Rougemont said.

MAN is also working on studies for LNG applications and for using HOFIM compressors in MAN's Electro-Thermal Energy Storage (ETES) technology, which is a trigeneration energy storage and management system for the simultaneous storage, use and distribution of electricity, heat and cold (see **COMPRESSORTECH**², July 2020, p. 43). According to MAN, it has great potential for mid- to large-scale thermal and electrical consumers, such as process industries, power producers/utilities and data center operators, among others.

The first installation of MAN's HOFIM compressors in unmanned platforms went into operation in 2017 at the Ivar Aasen oilfield by Aker BP in the North Sea. The production, drilling and quarters (PDQ) platform was constructed with two identical control rooms, one on the platform and one ashore in Trondheim, Norway. The oilfield owner Aker BP stated in 2019 that it always intended to migrate management of the platform to land and claimed to be the first company on the Norwegian Continental Shelf to operate a platform from an onshore control room.



MAN's HOFIM compressors have been installed for the first time in an unmanned platform at the Ivar Aasen oilfield by Aker BP in the North Sea in 2017. The installation on the PDQ platform is a tandem HOFIM compressor with an M43 electric motor.



MAN Energy Solutions' HOFIM compressors are part of a subsea compression facility at the Åsgard oil field in Norway. Since 2015, the two HOFIM compressors have clocked 70,000 operating hours.

With regards to further developments in the subsea compression technology, de Rougemont said MAN is working on its next project – the Jansz-Lo gas field. Operated by Chevron in Western Australia, the project will feed gas to one of the largest LNG plants in the world (Project Gorgon). Jansz-Lo will be the first gas field outside Norway where the subsea compression technology comes to use. MAN's scope of work within the front-end engineering and design (FEED) of the first Gorgon campaign consists of three subsea compression units, used for maintaining output as the reservoir pressure drops over time. MAN will install the units 99.4 miles (160 km) offshore at a depth of 4429 ft. (1350 m).

"The product technology for the subsea compression systems has undergone

some evolution. The system for the Jansz-Lo/Gorgon project will be reduced in size and weight and yet it will keep all important functionalities, such as the high performance of the compressor, high power, large volume flow, and high-pressure ratio capabilities," de Rougemont said. "We are able to reach these results thanks to a simplified configuration set-up, which results from a reduced number of modules and consequently reduced connections among modules.

"Our next frontier for our hermetically-sealed HOFIM compressors is well stream compression. Our path is to simplify the system even more, basically working on getting rid of the pump and its associated components (variable frequency drive, cables, and so on)," he said. The idea, according to de Rougemont, is the compressor will be able to run the gas and liquid portion from the wells without separating them.

"We see considerable potential for increased revenues because the subsurface experts are closer to the control room, which can give better mutual understanding and common goals," Aker BP said in 2019. "Cost cuts can also be achieved over time through the development of new digital solutions that change the way we work."

MAN's next subsea project

The installation on the PDQ platform is a tandem HOFIM compressor with an M43 electric motor developed by MAN.

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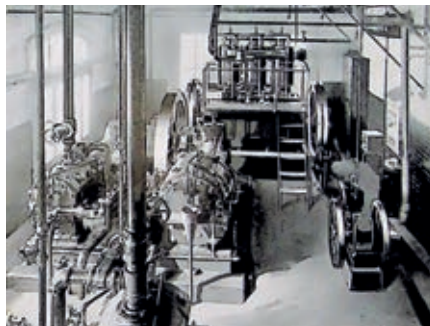


Reeves/Hope gas engines and compressors

Company among the first to produce angle-type gas engine-compressors

The discovery of natural gas in Ohio led to the thriving glass and ceramic industries that required an abundance of the fuel. It was also a significant factor in causing C. & G. Cooper, a steam engine builder, to switch to the production of gas engines and compressors. The gas boom encouraged two other companies – Reeves Gas Engine Co. and the Hope Forge and Machine Co. – to open plants in Mount Vernon, Ohio.

Reeves started in 1905. In 1914, it sold to Hope Forge & Machine Co., organized in 1906 by Will Hammon, who had previously operated the Hammon Coupler Co. The company later became Hope Engineering Co., broadening its field into the construction of oil and gas pipelines, pumping stations, gas compressing and boosting plants, and gasoline recovery plants in the southwest United States.

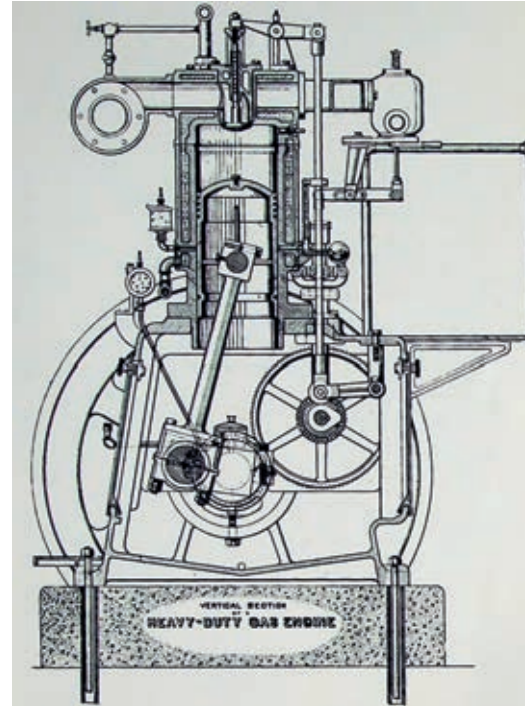


Reeves engines were used for driving generators, pumps and horizontal compressors. Shown here is one of two 100 hp (75 hp) engines driving horizontal duplex compressors with a cog belt. The compressors provided air for operating locks on the Ohio River near West Bellevue, Pennsylvania.

The first Reeves engine

The first Reeves vertical four-cycle gas engine was introduced in 1906. It was described as neat and compact yet powerful, occupying a minimum amount of floor space and fitting in even the smallest power plants. Its features included a patented Reeves fly-ball governor that "controlled speed within 2% regardless of the load on the engine."

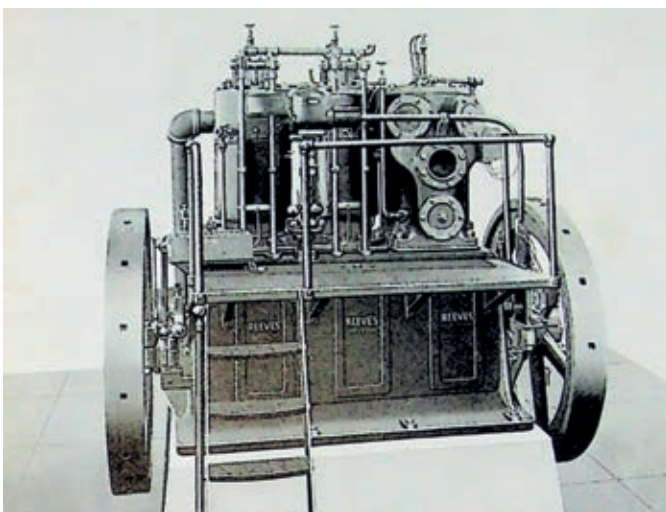
Early Reeves gas engines were built in



The Reeves four-cycle vertical gas engine included a patented fly-ball governor and gear-type oil pump driven off the crankshaft for pressure lubrication of the engine bearings.

one- to four-cylinder versions, generally running at 275 rpm with bore diameters of 11.5 to 14 in. (292 to 356 mm) and strokes of 13 to 14 in. (330 to 356 mm). Several early Reeves engines survive in museums. Two are preserved and operable at the Coolspring Power Museum. One is a 35 hp (26 kW) two-cylinder engine built in 1906 and used to drive a DC generator, as well as power lighting and the carbon arc movie projectors at a theater in Johnstown, Ohio. The other is a 40 hp (30 kW) two-cylinder model built in 1910 and used to provide electricity at an Ohio Fuel Gas Co. compressor station near Athens, Ohio. The Knox County Historical Society has displays of a two-cylinder Reeves as well as a four-cylinder 140 hp (104 kW) model manufactured in 1915 and used to drive a generator at a Toronto, Ohio, tile company.

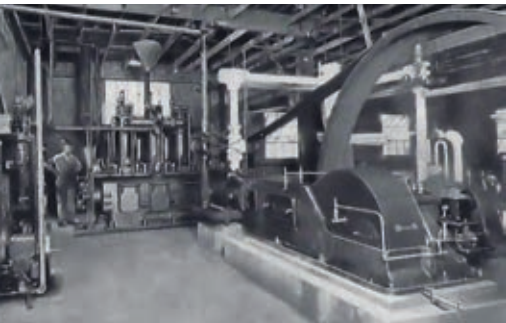
After acquiring Reeves, Hope continued to develop the gas engine line. By 1917, then operating as the Hope Engineering & Supply Co., the company offered 10 different Reeves engine models. Models with 9.5 in. (241 mm) bore and 11 in. (279 mm) stroke operated at 300 rpm, ranging from an 18



This 65 hp (48 kW) Reeves gas engine-compressor, introduced in 1915, had two power cylinders and one double-acting compressor cylinder that could deliver 500 ft³/min (14.2 m³/min) at 50 psig (3.4 bar).

CORNERSTONES OF COMPRESSION

Cooper-Bessemer's first and only right-angle gas engine-compressor, the GMR, combined many of the features of the Hope right-angle engines with Bessemer's two-cycle engine technology.

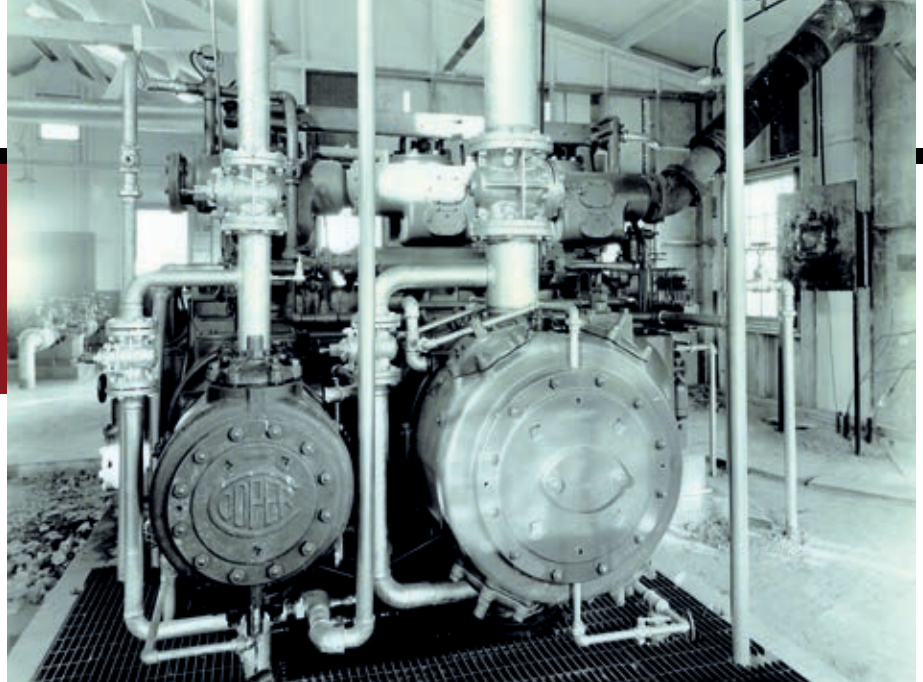


Shown here is a Hope/Reeves three-cylinder gas engine belt-driving a horizontal duplex ammonia compressor at an ice company plant in Texas.

hp (13 kW) single-cylinder to an 80 hp (60 kW) four-cylinder. Several 13 in. (330 mm) and 14 in. (356 mm) stroke models ranged from a 11.5 in. (292 mm) bore three-cylinder rated at 100 hp (75 kW) to a 14 in. (356 mm) bore four-cylinder rated at 200 hp (149 kW). Interestingly, the 200 hp (149 kW) engine weighed 40,000 lb. (18,141 kg) and had a list price of US\$9020 in 2019.

Compressor development

In addition to growing opportunities for air compression, Hope's focus on the oil and gas industry led to the development of Reeves vertical compressors and gas engine-compressors. Vertical gas engine-compressors were much more compact and lower cost than horizontal engine-compressors or belt-driven compressors. These were built with two or three power cylinders and one compressor vertically mounted on the engine frame. The compressor cylinder could be a single-stage double-acting or two-stage tandem



configuration for compression of either air or gas. In addition to powering the compressor cylinder, the engine had enough power to also drive a generator through a flexible coupling.

The first Reeves engine-compressors were built in 50, 90 and 160 hp (37, 67 and 119 kW) sizes, but a 1920 drawing showed four-cylinder units up to 200 hp (149 kW) at 275 rpm. Two-stage tandem cylinders were matched to the engine ratings for air compression applications and custom cylinder sizes were offered as required for other applications. Hope also manufactured two-throw vertical compressors that were direct connected to four-throw gas engines with a flywheel between them.

Reeves to Hope

Sometime after 1922, the Reeves name disappeared and Hope's name appeared on its engines and compressors. Engine ratings had increased to 170 hp (127 kW) at 257 rpm for a 14.75 in. (375 mm) bore x 16 in. (406 mm) stroke three-cylinder engine and 250 hp (186 kW) for a four-cylinder.

By 1928, right-angle gas engine compressors with vertical in-line power cylinders and horizontal compressor

cylinders had appeared in the gas industry, and Hope was among the early developers of these novel machines.

Before moving its headquarters to Houston, Texas, in 1928, Hope sold its foundry and the rights to its manufactured engines to the C & G Cooper Co., located less than a mile from the Hope engine plant. This acquisition added a vertical gas engine line to Cooper's prominent horizontal engine and compressor portfolio, several months before its historic merger with the Bessemer Gas Engine Co. in 1929.

Cooper-Bessemer (C-B) continued manufacturing the Hope/Reeves line, adding 18 in. (457 mm) bore x 20 in. (508 mm) stroke models available in three to six cylinders rated 280 to 565 hp (209 to 421 kW) at 275 rpm. About 750 Reeves and Hope vertical engines were estimated to have been built before the sale to Cooper, and 120 more were built by C-B as its own brand through 1934. After 1934, C-B replaced the Hope line with its 12 in. (305 mm) bore x 14 in. (356 mm) stroke 300 rpm, 75 hp (56 kW) per cylinder GMR angle engine-compressor, which combined many of the features of the Hope angle engines with Bessemer's two-cycle engine technology.

CT2

1905

Reeves Gas Engines Co. begins operations at its plant in Mount Vernon, Ohio.

1906

The first Reeves vertical four-cylce gas engine debuts.

1914

Hope Forge & Machine Co. purchases Reeves Gas Engines.

1928

Hope moves its headquarters to Houston, Texas.

1929

C & G Cooper Co. merges with Bessemer Gas Engine Co.

1934

Cooper-Bessemer replaces the Hope line with its GMR angle engine-compressor.



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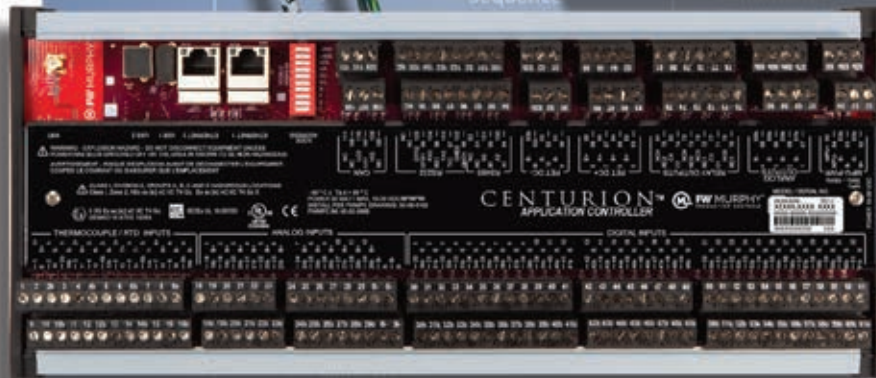
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