In late 2016, Denbury Resources Inc. completed construction of a natural gas liquids extraction plant at its Delhi oil field in Louisiana. Jacobs Engineering provided detailed engineering design services for the facility's combined heat and power process, which converts the waste methane stream into electric power and useful thermal energy.

PHOTO: JEFFREY BUEHNER

Petrochemical/Energy Construction Update

A Global Model Of Energy Prosperity

Abundant raw materials fuel competitiveness in U.S. oil and natural gas markets

WHAT'S INSIDE

Growing Competition in U.S. Oil And Natural Gas Markets Boosts Economic Confidence

Due to higher crude oil and natural gas prices, a boon of construction projects in states bordering the U.S. Gulf Coast (USGC) are in the works. Also, the combination of technological improvements and heightened environmental stewardship is gradually steering the industry toward a more decarbonized fuel mix.

While significant strides have been made in advancing clean energy solutions, the U.S. Energy Information Administration (EIA) reports that oil, gas and coal will remain the dominant sources of energy powering the world economy in the foreseeable future.

Hence, the USGC's continued vitality in the energy market is setting a strong standard for other states—and nations—to follow.

U.S. on Track to Become Net Energy Exporter by 2026

The EIA's 2017 Annual Energy Outlook, which provides modeled projections of domestic energy markets, predicts strong domestic production and relatively flat demand through 2050. Assuming that known technologies are improved—and if insights gleaned from today's leading economic forecasters and demographers prove accurate—the U.S. is on track to becoming a net energy exporter by 2026.

"The United States is a leading producer of oil and natural gas, which is incentivizing U.S. manufacturing to invest and grow," says ExxonMobil Corp. Chair and CEO Darren Woods. "We are using new, abundant domestic energy supplies to provide products to the world at a competitive advantage resulting from lower costs and abundant raw materials. In this way, an upstream technology breakthrough has led to a downstream manufacturing renaissance."

PHOTO: COURTESY OF FLUOR

Chevron Phillips Chemical Co. is developing a 1.5-million-metric-tons-per-year ethane cracker at its existing Cedar Bayou complex in Baytown, Texas. Shown here is the 250-ft-tall, 570-ton C2 Splitter used for olefin separation.

Last year at TransCanada Corp.'s crude oil tank terminal in Houston, a new interconnect system was installed. Key components include one mainline pump, two 350,000 oil-barrel tanks, and two 2,000-horsepower booster can pumps.

The consumption of fossil fuels—most notably coal—appears to be a driving force in electric markets and utility planning, notes Utility Analyst Tom Schubbe, NV5 BES Division. "Political events notwithstanding, oil prices will likely maintain the present moderate trends, with similar expectations for natural gas," he says.

Schubbe predicts that the U.S. energy market will likely mirror global trends, where utility planning and capital expenditures are typically based on a much longer time scale compared to those correlating with presidential election cycles.

"Globally, lower oil and gas prices have challenged many energy companies' balance sheets and their abilities to move forward with projects," says Dan Spinks, vice president and general manager of Fluor Corp.'s office in Houston. "However, with the relative stability in oil prices over the past year, our clients are gaining confidence to move forward with higher-return projects."

Natural Gas Exports Drive Demand for Midstream Infrastructure

As the world's biggest energy consumer, the United States depends on natural gas as an affordable, clean and domestically abundant source of power. By 2020, our country is expected to become the world's third-largest exporter of liquefied natural gas (LNG), according to S&P Global Platts. As these exports continue to drive domestic natural gas markets, many companies are focusing on LNG developments along the USGC, the nation's largest storage hub for export-bound natural gas.

One such company is Houston-based Texas LNG Brownsville LLC (Texas LNG), which has proposed construction of a 4-MTA (million tons per annum) LNG export facility at the Port of Brownsville in South Texas, one of the U.S. ports closest to the Panama Canal. Samsung Engineering Co. Ltd. and KBR Inc. will provide preliminary final investment decision (FID) detailed engineering this year, followed by post-FID engineering, procurement and construction (EPC) services in 2018. If approved, the two-phased project would include construction of a natural gas pipeline receiving and interconnect station, a gas treatment plant, a liquefaction plant, two aboveground single-containment LNG storage tanks and marine-loading facilities.

Recently, one of North America's largest energy infrastructure companies joined forces with the nation's largest natural gas liquids (NGL) producer to develop a new natural gas pipeline in Texas. In April 2017, Kinder Morgan Texas Pipeline LLC, a subsidiary of Kinder Morgan Inc., and DCP Midstream LP (DCP) executed a letter of intent for DCP to participate in the development of the Gulf Coast Express Pipeline Project. The venture is designed to transport up to 1.7 million dekatherms per day of natural gas through approximately 430 miles of 42-in. pipeline from the Waha area to Agua Dulce. While the project's exact cost is yet to be determined, the pipeline is expected to be in service in the second half of 2019, subject to shipper commitments.

Right-of-way preparation and construction activities commenced earlier this year on the Leach XPress and Rayne XPress expansion projects. The combined $1.8-billion investments will provide additional outlets to transport domestic, clean-burning natural gas from the prolific Marcellus and Utica production areas to higher-value Midwest and USGC markets. The undertaking includes construction of two new compressor stations in Rayne, La., alongside TransCanada's existing Columbia Gulf Pipeline, which extends from Kentucky to Louisiana. The developer has proposed an in-service date of Nov. 1, 2017.

A New Tide in Petrochemical Investments

According to the American Chemistry Council, chemical manufacturing is one of America's top exporting industries, accounting for 14% of overall U.S. exports in 2015. Exports of specific chemicals linked to shale gas are projected to reach $123 billion by 2030—more than double the total amount reported in 2014.

"One of the greatest strengths of Texas and Louisiana are the states' proximity to shale gas resources and these advantageous feedstocks," says Spinks, who further indicates that there are early signs of a "second wave" of significant investments in U.S.-based chemical and petrochemical markets. As these supply systems become more sustainable and efficient, the nation's energy portfolio becomes more diversified—increasing competitiveness in the global race for clean energy solutions.

Currently, Chevron Phillips Chemical Co. is developing one of the largest ethane crackers in the country.

PHOTO: COURTESY OF STRIKE

The $6-billion USGC Petrochemicals Project is located across two sites in Texas—Old Ocean and Cedar Bayou—and consists of building an ethane cracker that will yield 1.5-million metric tons of ethylene annually, as well as two polyethylene units, each one producing 500,000 metric tons of resin annually. All facility components are expected to turn operational by the end of 2017.

Another colossal ethane cracker and derivatives project is taking shape next door in southwest Louisiana, where Sasol is constructing a petrochemical complex near its existing site in Westlake. The $8.9-billion project's focal point is an ethane cracker with an expected annual output of 1.5-million tons of ethylene. Also, six chemical manufacturing plants will be added to the site to produce high-value derivatives, such as ethylene oxide, monoethylene glycol (MEG), and low-density and linear low-density polyethylene. Per the developer's March 2017 report, the project is roughly 70% complete and is expected to turn operational in 2019.

Rising Demand for Integrated Project Delivery Solutions

Nearly a year ago, construction began on a new 700-kt MEG manufacturing plant at The Dow Chemical Co.'s Oyster Creek site in Freeport, Texas. The petrochemical complex—anticipated to be online by mid-2019—will be MEGlobal's first manufacturing unit in the United States.

Through a long-term ethylene supply agreement with Dow, the new site will be the first to use Dow's proprietary METEOR™ RETRO Ethylene Oxide (EO)/Ethylene Glycol (EG) plant process and METEOR RETRO EO catalyst-based technology. Dow's METEOR technology combines a high-activity, high-selectivity catalyst with a streamlined process design that has inherent safety and environmental features. Other advantages include lower capital and energy costs, high raw material efficiency and enhanced operational reliability. Jacobs Engineering Group Inc. (Jacobs) is providing engineering, procurement and construction management (EPCM) services on this greenfield project, following the successful delivery of a front-end loading engineering package that included non-process equipment and piping both inside and outside the new facility's battery limits. This approach resulted in a cost savings of $30 million.

"The current oil, gas and petrochemical markets are very competitive, increasing the demand for integrated EPC and EPCM delivery solutions," says Mark Bello, Jacobs' senior vice president and general manager of downstream petroleum and chemicals. "These markets are driving toward more lump-sum work to lower owners' costs and transfer risk to the contractor. In addition to risk allocation, owners are forming opportunistic joint ventures in order to share owner risk, while at the same time retain their economic return on investment. EPC firms must be willing to take on more risk and deliver projects from early phases through commissioning."

Potential for Massive Job Growth in the Gulf

Out of all the challenges currently affecting the engineering and construction trades, ongoing skilled labor staffing shortages remain one of the most significant. Consequently, this has resulted in large gaps in experienced labor, forcing employers to hasten onboarding and training procedures to meet project demands.

"Across the U.S. Gulf Coast, major petrochemical projects are either at or past peak staffing levels," Bello says. "In addition, there is a localized labor demand in areas such as Lake Charles, La., and in the Texas cities of Beaumont and Corpus Christi. The disproportionate needs in these areas are resulting in competitive wages and lower project efficiency."

Bello expects that these staffing dilemmas will persist until both owners and construction contractors increase investments toward recruiting, training and retaining high-performance construction talent. "Many construction firms, ours included, have invested in tools, systems and training to recruit and retain high-performing labor," he says. "You also must continuously develop the knowledge and skills of your incumbent workforce, with the intent to move employees up in order to move new employees in."

Employers will certainly have to step up their game to fill jobs created by ExxonMobil's Growing the Gulf initiative. Through planned investments of $20 billion over a 10-year period, the expansion program is expected to create more than 35,000 construction jobs and upward of 12,000 full-time positions.

A total of 11 major chemical, refining, lubricant and LNG projects are associated with this initiative, including a proposed petrochemical complex in San Patricio County, Texas. In April 2017, ExxonMobil and Saudi Basic Industries Corp. (SABIC) selected the site in anticipation of building an ethane steam cracker capable of producing 1.8 million tons of ethylene per year, in addition to an MEG unit and two polyethylene units. ExxonMobil and SABIC will make a final decision on the multibillion-dollar investment after necessary air and wastewater permits have been acquired.

Infrastructure Investments Beget a Prosperous Economy

When it comes to employment associated with infrastructure development, Louisiana and Texas boast the highest percentages in the nation, followed by Pennsylvania, California and Ohio, according to a recent study by the American Petroleum Institute. Private investments in U.S. natural gas and oil infrastructure play a big role in this statistic. In fact, there is potential for these investments to exceed $1.3 trillion by 2035—creating more than 1 million jobs stateside.

As companies continue to pour capital into all sectors of energy operations, long-term achievements in terms of energy independence and economic vitality will serve as a global model of prosperity. ◆