

**FLOW REVERSAL**

ExxonMobil and Qatar Petroleum plan to add export capability to their Golden Pass import terminal in Sabine Pass, Texas.

THE GAS WARS

The U.S. oil and gas industry sees big dollars in **LIQUEFIED NATURAL GAS** exports; chemical companies see trouble

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THE U.S. IS IN THE MIDST of an energy transformation. Technologies that free fossil-fuel reserves, once trapped in shale, have radically shrunk natural gas imports. By 2020, the nation is expected to produce more gas than it needs. As the country approaches this milestone, it faces a question long asked in other countries with abundant energy resources: How much should we use at home and how much should we sell abroad?

Some chemical companies and other industrial natural gas consumers worry that large amounts of exports, in the form of liquefied natural gas (LNG), will raise domestic prices, hike manufacturing costs, and undercut their international competitiveness. They would like to see the Department of Energy slow projects planned by energy companies to export natural gas.

Oil and gas companies, on the other hand, say exports will have little impact on domestic prices. They are pushing for more than 15 new shipping terminals, sufficient to send a full third of current domestic LNG consumption around the world. They believe free LNG trade will benefit the U.S. economy and foster job creation.

Politicians are on both sides of the argument. DOE is treading carefully. But all involved realize that their actions around this important new resource could have a big impact on the health of the U.S. economy.

Peter R. Huntsman, chief executive officer of chemical maker Huntsman Corp., says the company's board has already approved \$200 million in natural-gas-related expansions and is considering \$300 million more. "Four years ago, 90% of our discretionary growth capital was spent outside the U.S.," he says. "Today, 70% is being spent within the U.S., just because of gas. That is the same with virtually any company."

All of this has come to a head in just the past half-dozen years. Although hydraulic fracturing, or fracking, techniques were known as far back as the 1940s, it wasn't until the late 1990s that the technology showed true promise. A small exploration firm, Mitchell Energy, is credited with sparking the present boom then, when it drilled the first commercially successful wells in North Texas shale formations. Things took off from there, and by the middle of the past decade, the technology was vigorously put to work in oil and gas fields.

By forcing millions of gallons of water under high pressure deep into the earth, energy firms fracture rock and nearly impenetrable sands, freeing previously untapped fossil fuels and driving them to the surface. Microseismic technologies find promising reservoirs, and horizontal drilling bores into narrow formations, making these unconventional wells economical.

The technique has been controversial. Some people living in communities where fracking is taking place say their drinking water has been contaminated, gases have leaked into their homes, property values have sunk, and quality of life has been ruined.

Despite these concerns, the shale gas industry has grown to massive scale in short order. More than a half-million gas wells are operating in the U.S., a 50% increase since 2000, according to the Energy Information Administration, an independent research arm of DOE. EIA says the U.S. has 300 trillion cu ft of gas in proven reserves and potentially 10 times that amount in unproven reserves, much of which is in shale deposits. By comparison, the U.S. currently consumes about 25 trillion cu ft of natural gas annually.

If current trends continue, EIA estimates, the U.S. will be producing more gas than it consumes within the next seven years.

This abundance of natural gas has led to a turnaround in the fortunes of U.S. petrochemical makers. These firms primarily crack the natural-gas-derived feedstocks ethane and propane to make ethylene, propylene, and derivatives such as polyethylene and polypropylene. Petrochemical makers in Europe and Asia typically crack oil-derived naphtha.

Natural gas prices that are low relative to oil prices are crucial for the competitiveness of the U.S. petrochemical sector. The ratio of the price of a barrel of oil to that of 1,000 cu ft of natural gas is often used as a rule of thumb to gauge U.S. competitiveness. A ratio of six to one is rough parity on an energy content basis.

From 2000 to 2008, that ratio often dipped below six, according to Brian Ames, president of olefins, aromatics, and alternatives for Dow Chemical. “At that level, we were better off investing in places other than the U.S.,” he says. Now, gas prices are about \$3.50 per thousand cu ft and oil prices hover near \$95 per bbl, for a much more favorable ratio of 27 to one. As a result, Ames notes, “we are investing here.”

Indeed, many large chemical firms are investing in the U.S. ChevronPhillips Chemical, Dow, ExxonMobil Chemical, Formosa Plastics, Occidental Chemical, Sasol, and Shell Chemicals are each spending billions of dollars on new ethylene crackers and derivatives complexes that are generally scheduled to open around 2017.

The American Chemistry Council (ACC), the industry’s main trade association, counts 50 projects, representing \$40 billion in invested capital, that are taking advantage of the low costs. Estimates of the impact of shale on the U.S. manufacturing sector climb as high as \$95 billion in new investment.

“As slow as the economy has been, over the last two years since we’ve seen natural gas prices fall and stabilize, we have seen manufacturing jobs increase for the first time in nearly 15 years,” Huntsman says. “It is not because of tax policy or our gross domestic product growth that manufacturing jobs are coming to the U.S.”

Chemical manufacturing isn’t the only

industry looking to seize the opportunity presented by cheap natural gas. Oil and gas companies want to cash in through another means: exports. Asian LNG import prices are \$15 per thousand cu ft or more, and European prices are above \$10. With U.S. prices under \$4.00, domestic companies want to take advantage.

A score of firms are seeking export licenses from DOE. If all of these licenses are granted, the gas industry will be permitted to export roughly 30 billion cu ft of gas per day, or about one-third of current U.S. consumption.

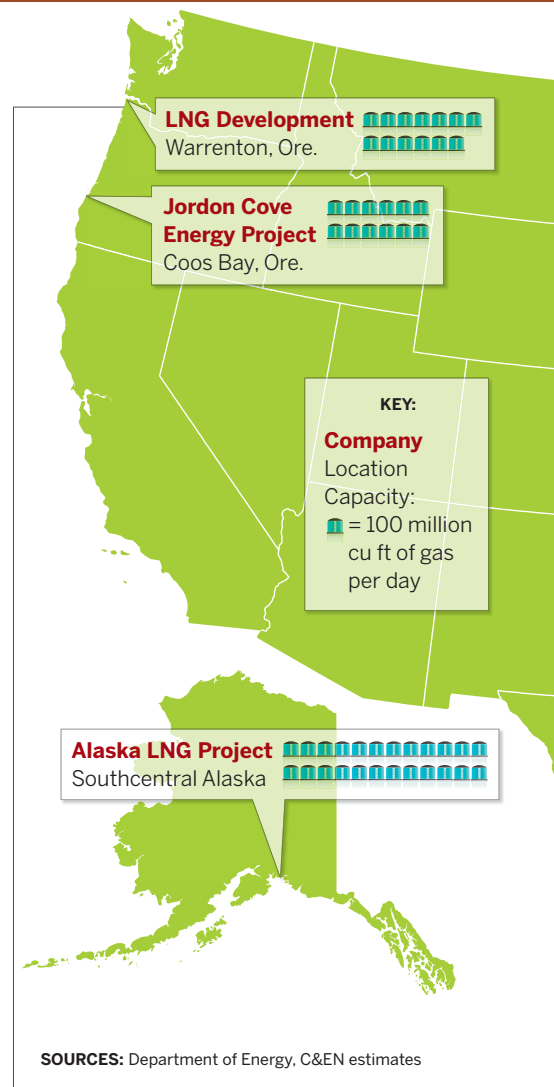
Most of the licenses are associated with enormous projects to build gas liquefaction plants. In a liquefaction plant, natural gas, mostly methane, is purified and cooled to -162°C , compressing its volume by a factor of 600. The gas is loaded into special tankers that carry it to a terminal overseas, where it is regasified and sold.

LIQUEFACTION PLANTS are extremely expensive. For example, ExxonMobil and Qatar Petroleum envision spending \$10 billion to install 2.6 billion cu ft per day of liquefaction capacity at their joint existing Golden Pass import terminal in Sabine Pass, Texas. It’s one of many projects meant to “reverse the flow” at import terminals that were built in the 2000s. With the emergence of shale gas, these terminals have fallen into disuse.

Cheniere Energy is seeking to export 2.2 billion cu ft per day from a terminal in Cameron Parish, La. The project was the first to apply for and receive regulatory approval and is already under construction. Its first phase is expected to begin operation in 2015 at a cost of up to \$6 billion.

As DOE approved a permit for the Cheniere terminal, more applications streamed in; it didn’t take long for government officials to realize they were dealing not with a single plant but a potential economic movement. DOE decided to put a temporary halt to its process of examining LNG permit applications. A DOE official tells C&EN the agency thought it prudent to take a break and consider the cumulative impact of selling large amounts of the nation’s newfound surplus of natural gas abroad.

“We recognized DOE was in an unprec-

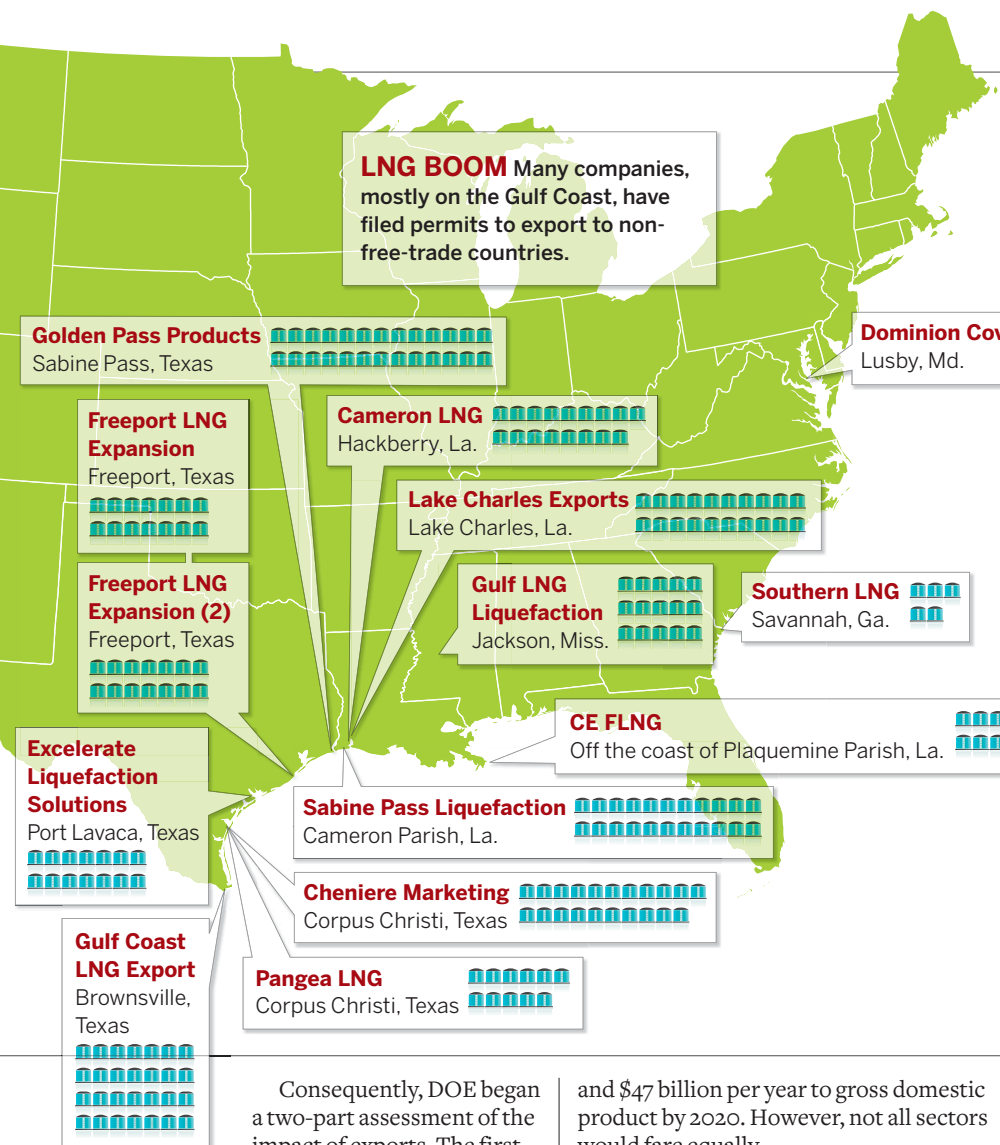


edented situation,” the agency official says. “We needed to assess the immediate applications, but we also needed to understand the cumulative effect.”

The authority to review projects is vested in DOE through the Natural Gas Act of 1938, which requires the agency “to ensure that authorizations to export LNG do not lead to a reduction in the supply of natural gas needed to meet essential domestic needs.” Its authority is clearest for exports to countries that lack a U.S. free-trade agreement (FTA).

The distinction between FTA and non-FTA countries is a big one. Only four FTA countries—South Korea, Australia, Mexico, and Canada—are large consumers of natural gas, and of these, only South Korea is a major LNG importer. Some of the world’s largest LNG importers, such as Japan, China, and the U.K., are non-FTA countries. Limiting the number of non-FTA licenses would severely crimp the market available to LNG exporters.

The flood of natural gas is “an extraordinary American success story.”



Consequently, DOE began a two-part assessment of the impact of exports. The first part was a microeconomic review of the effect of LNG exports on domestic consumption, production, and prices; the second was a study of macroeconomic impacts.

Both studies are now complete. The first, by EIA, found that more LNG exports would lead to moderately higher domestic gas prices, more domestic production, reduced domestic gas consumption, and increased natural gas imports from Canada via pipelines. Natural gas bills for all sectors of the economy would increase by 3 to 9%.

The second study, by the private firm NERA Economic Consulting, used data from EIA's study and looked at the cumulative macroeconomic impact of LNG exports on the U.S. economy.

In December, NERA released its assessment of LNG exports, which was upbeat for most of the economy. It found that exports would add between \$4.4 billion

and \$47 billion per year to gross domestic product by 2020. However, not all sectors would fare equally.

The chemical industry and other high energy users would face declines in profits and revenues. But the impact would be manageable, according to NERA, with a drop in forecasted growth of less than 1% annually. The report also noted that people working in areas unrelated to the gas industry would not gain from production and export growth, yet would still face higher gas prices.

AFTER THE RELEASE of the NERA report, DOE began a public comment period that ended on Feb. 25. It received some 400 comments from governors, state representatives, companies, environmental groups, and individuals. Many had multiple signers.

A large number of weighty commenters—including Dow, Sen. Ron Wyden (D-Ore.), and Rep. Edward J. Markey (D-Mass.)—argued that the NERA study was fundamentally flawed. They said the

data were old, the approach was incorrect, and peer review was lacking.

The oil industry's only big criticism of the NERA study was that it was overly conservative in its assumptions about natural gas reserves. "The enormous resource base allows for domestic natural gas development, the expansion of U.S. manufacturing,

increased use of natural gas in power generation, and LNG exports,"

wrote Theresa Fariello, vice president of ExxonMobil's Washington, D.C., office.

Anders Ekvall, vice president of LNG for the Americas at Shell, commented that few of the planned export terminals would actually be built, given their high cost. He estimated that only about 7 billion cu ft per day would be exported.

Supporting these firms' contention that supplies will remain plentiful is the fact that both are also planning U.S. ethylene crackers.

DOE is examining all of the comments, according to the official. However, the agency will do no more analyses nor will the department issue a new report, the DOE official says. Instead, it will now go through the applications one by one, deciding their fate in the order they were completed and using the studies and comments as a partial guide.

"When we make the first public determination on an application, we will include our rationale for the decision, and that will give insight into our approval process and our public interest determination based on the studies and comments," the official says.

Politicians have weighed in with opinions about the application process. One of the chief supporters of LNG exports is Alaska Sen. Lisa Murkowski (R). She has urged DOE to move ahead and start processing applications. She notes that DOE's decision is only one step and that a site-specific approval is also required from the Federal Energy Regulatory Commission (FERC), another independent agency within DOE.

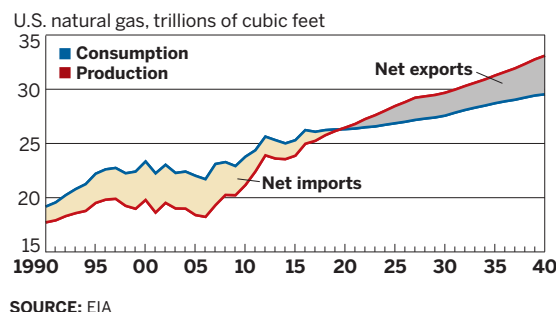
So far, owners of eight proposed LNG export facilities have applications pending before FERC and DOE. The FERC review takes a year to 18 months and includes environmental and safety considerations as well as an environmental impact statement, says Tamara Young-Allen, a FERC spokeswoman. Eventually, the five FERC commissioners will vote on each application, she adds.

Murkowski, when explaining her sup-

port for LNG during Senate hearings, noted Alaska's familiarity with LNG facilities: It was home to the nation's first and only LNG export terminal, now closed, and it has been proposed as the home of one of the nation's largest new terminals. Proposed by ExxonMobil, Conoco-Phillips, BP, and TransCanada, the facility would include an 800-mile pipeline, a liquefaction plant, and a terminal in Southcentral Alaska to ship 2 billion to 2.4 billion cu ft of gas per day. It has a price tag of \$45 billion to \$65 billion.

Other members of Congress don't share Murkowski's enthusiasm for LNG exports. Consider the difference between Wyden, who chairs the Senate Energy & Natural Resources Committee, and Murkowski, the committee's ranking minority member. Wyden rejects the NERA report and calls for a "fresh start" to re-examine how the nation uses the flood of natural gas, which he acknowledges is "an extraordinary American success story." The committee chairman has two LNG

GAS EXCHANGE By 2020, the U.S. is projected to be a net exporter of natural gas.



export facilities proposed for his state.

Wyden plans to hold a series of committee hearings and stakeholder meetings to examine how the U.S. should take advantage of the opportunity. But he has said he doubts that some sort of gas legislation is necessary.

The NERA report has galvanized chemical makers. Firms such as Dow are wary of the number of export terminals planned and the massive amount of gas they could take out of the U.S. They are hoping the

government will take a measured approach and limit the export licenses it grants. Four of the largest U.S. chemical firms—Celanese, Dow, Eastman Chemical, and Huntsman Corp.—joined a recently formed advocacy group, America's Energy Advantage, to advance their position.

A refrain among these firms is that the U.S. should add value to natural gas at home in the form of derivatives, such as chemicals. At recent hearings before Wyden's committee, Dow CEO Andrew N. Liveris called shale "a unique opportunity to export advanced products, not just 'Btus.'"

Most countries that export energy have grappled with this issue, Dow's Ames points out. Saudi Arabia, seeking to add value to its natural gas resources, established Saudi Basic Industries Corp. in the late 1970s. SABIC went on to become one of the world's largest and most profitable chemical companies. "It is not the first time we are hearing about this issue," Ames says. "But it is the first time here in the U.S. There are proba-

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bly lessons to be learned from the way other countries have handled it.”

Dow isn't dead set against exports. The company says the Alaska project should be allowed. It doesn't oppose exports to countries that have signed free-trade agreements, but it contends that DOE should carefully scrutinize the non-FTA proposals to consider the impact each would have on the rest of the economy. Ames says the natural gas industry could probably export 5 billion to 6 billion cu ft per day without hurting U.S. competitiveness.

MANUFACTURERS ARE NOT marching in lockstep on the issue. Dow pulled out of the National Association of Manufacturers over the trade group's stance that exports should not be restricted. There is also a rift within ACC over exports to non-FTA countries. In a statement last month, ACC said its executive committee “agreed to establish a senior-level committee to further discuss this issue and determine if a consensus can be reached.”

What Dow and some other chemical firms fear is that exports would ultimately cause domestic natural gas to be priced, on an energy content basis, at the same level as oil and remove the U.S. chemical industry's competitive advantage.

“Why does the gas industry want to export?” Huntsman asks rhetorically. “Do you think they want to export so that we as consumers can have more competitive prices? Of course not. They are trying to raise the price of natural gas. I suppose I would be doing the same thing if I was CEO of a gas company.” Huntsman says he supports a “one at a time” approach to export terminal approval.

Geography and market forces will ultimately protect the chemical industry's advantage, argues Kenneth B. Medlock III, a fellow at the James A. Baker III Institute for Public Policy at Rice University, who testified on the issue before the Senate last month. For one thing, the cost of liquefying LNG and transporting it to Japan and China from the U.S. will run about \$5.50 per thousand cu ft, he says. That will keep U.S. natural gas prices far below prices in these countries.

And the U.S. has competition. For example, Russian and Japanese officials just signed a memorandum of understanding to build an LNG export terminal in Vladivostok, Russia. Because the global LNG market, at about 30 billion cu ft per day, isn't that large, any market en-

trants will drive down prices, Medlock says.

Even if all of the permits are granted, he thinks only about 2 billion cu ft per day will end up flowing out of the U.S. because few of the terminals will be built, and those that are built won't see much action. This is well below what chemical industry executives say is a manageable level of exports. “A lot of this hand-wringing at the end of the day will

be proven to be for naught,” Medlock says.

But chemical executives such as Liveris and Huntsman have been through too many ups and downs in recent years to trust soothing analyses of the oil and gas market. To them, assurances from NERA, Medlock, and the oil industry will seem like wishful thinking until the realities on the ground prove otherwise. ■

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