

# The Natural Gas Boom: Questions and Complications

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America has been buoyed by an abundance of natural gas. The bulk of its vast resources of this precious fuel is locked in shale formations under more than 20 states, unable to escape without drilling horizontal wells through the most promising layers and fracturing the rocks surrounding the bores with highly pressurized mixtures of water, chemicals, and sand. Use of this process, decades in the making, expanded rather suddenly after 2007, and it has become widely known by the rather unappealing term “fracking.”

The facts are easy to summarize. Thanks to a rapid expansion of horizontal drilling and hydraulic fracturing, the United States in 2009 again became the world's top producer of natural gas. Gas imports (mainly by pipelines from Canada) peaked as recently as 2007 at nearly 20 percent of the total supply; in 2013 they were just 11 percent. In 2013, the gas supplied 27 percent of the country's primary energy use (compared to about 23 percent a decade ago), and its combustion generated 30 percent of the nation's electricity in 2012 and 27 percent in 2013 (compared to about 18 percent a decade ago). Coal-fired steam turbo-generators are being shut down as the capacity of gas turbines, the preferred machines for generating electricity from a fossil fuel, keeps on expanding.

Dreams of potential benefits are, as befits a gaseous substance, properly inflated. While nobody is repeating the famous claim advanced about nuclear energy in the 1950s (that it would be too cheap to meter), the fuel is predicted to remain inexpensive even as its domestic consumption rises and as intercontinental exports help to reverse America's balance of payments, to undercut the dominance of Russian exports to the European Union, to provide Asia with a cheaper alternative, and to assure America's strategic supremacy for decades to come. And domestically the cheap fuel — in 2013 its monthly averages fluctuated between \$3.3–4.2/million Btu while the EU paid \$11–12/million Btu for its imports and spot prices have recently surpassed \$20/million Btu in East Asia — will attract not only petrochemical industries, but also energize America's manufacturing renaissance and create large numbers of jobs.

There are certainly great benefits to such a boost in recoverable supply of the cleanest of all fossil fuels (especially after decades of slowly declining and stagnating extraction of conventional gas: the previous peak was reached in 1973 and was not surpassed until 2011). And the country deserves these benefits: gas-bearing shales are a common occurrence around the world, but only the United States has commercialized the resource on a large scale by persistent (and also government-aided) R&D, entrepreneurial boldness, huge investment, and continuing technical innovation. Complex changes do not bring unalloyed benefits, however, and rather than adhering to a simplistic infatuation with new riches, we should recognize a number of already obvious complications and ask a number of necessary questions.

### **Addressing concerns about natural gas**

Surely, hydraulic fracturing will not invariably poison the air, will not cause spates of local mini-earthquakes, and will not produce flaming faucets in all nearby areas (the

three frightening clichés advanced by its opponents) — but the activity, especially if done in thousands of hurried repetitions and sometimes without careful planning, has the potential to be often unpleasant and disruptive, and sometimes outright damaging. Many people want to know more about the true risks of hydraulic fracturing: in September 2013, the Pew Research Center found 49 percent of Americans opposed to the increased use of the activity, while, a year after the Fukushima nuclear disaster, 57 percent of Americans still favored the use of nuclear power. Such perceptions cannot be simply dismissed, and energy companies must address them and explain the true risks involved: Exxon, now America’s largest natural gas producer, has promised to disclose more of such information this year. While blanket bans on hydraulic fracturing (à la France) are a mistake, so too is insisting that the technique cannot cause any problems.

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Petrochemical companies and producers of ammonia are eager to build large plants close to an inexpensive supply of their preferred gaseous feedstocks (methane and ethane), but while building such plants may require many hundreds, or even thousands, of workers, they will employ relatively few people during their decades of operation. We should not exaggerate future long-term job opportunities, but nor should we deny that there is a potential for at least 250,000 (mostly indirect) jobs in the longer run (the American Chemistry Council predicts 17,000 jobs would be created in the chemical industry and 400,000 jobs elsewhere with an 25 percent increase of ethane production: impressive as that is, it is equal to only about 0.25 percent of the country’s current employment).

How long this boom will last and what levels the extraction will reach depends on the ultimately recoverable volumes of the shale gas, but specific estimates of its magnitude have already been revised both up and down. Biennial assessments of technically recoverable natural gas endowment remained fairly steady between 1990 and 2004, but the total rose by 70 percent in 2010 and the latest (2013) appraisal by

the Potential Gas Committee pushed the remaining potential gas resources another 25 percent higher, with shale gas accounting for 45 percent of that total. The shale gas is produced both in non-associated form (from formations containing just gas and natural gas liquids, as is the case in Marcellus shale in the Northeast) and as gas associated with crude (dissolved in the liquid, as is the case in Bakken shale).

For the past three years the best estimate offered by the Energy Information Administration had 64 percent of all of the country's technically recoverable shale oil resources in California's Monterey shale — but in May 2014 a revised estimate cut that total by 96 percent. While this huge accounting shift will have hardly any impact on shale and oil and gas output in the next few years, the long-term consequences are unclear. Future technical advances (making more oil and gas recoverable even under more taxing Monterey conditions) may cut the size of the announced reduction, or its extent may be confirmed as costs and production circumstances (lack of water supplies for fracking amid California's chronic droughts) may leave most of the Monterey shale hydrocarbons in place.

Arguing about specific numbers at what is still an early stage of shale gas development is counterproductive; appreciating the tentative nature of shale resource appraisals is imperative. Even conservative assessments of America's shale gas reserves make the continuation of relatively low prices highly probable but not inevitable. We should not deny the already manifest benefits of inexpensive natural gas, nor should we claim that the prices will stay very low, or keep declining, for years to come or that technically recoverable reserves will move only upwards.

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External consequences are equally uncertain. Rapid expansion of shale gas extraction leaves room for exports: of the two U.S. neighbors, only Mexico will need some gas imports, and hence most of the fuel will have to be exported as trans-oceanic shipments of liquefied natural gas (LNG), whose production (in large liquefaction plants) and transportation (in specialized tankers) requires large up-front infrastructural investment. But arguing that these high costs will preclude truly large-scale U.S. exports of LNG is no less questionable than to maintain that America's LNG will soon be a major tool of global strategic re-alignment.

And there are many more questions. Might an excessive number of export deals (currently there are nearly 40 applications to ship LNG abroad) lead to rising domestic prices, affecting the new petrochemical projects predicated on cheap natural gas? Dow Chemical certainly thinks so, arguing for restricted exports in order to protect the domestic feedstock and fuel availability. How much can American LNG exports change the EU's supply pattern dominated by Russia, Norway, the Netherlands, and Qatar? The EU now imports an equivalent of two-thirds of America's natural gas production, while many of the existing U.S. exports applications are intended for shipments to Asia.

That market (with Japan, China, South Korea, and Taiwan being the largest buyers) is now served by LNG exports from Australia, Indonesia, Malaysia, and Qatar, and by pipeline exports to China from Turkmenistan, Uzbekistan, and Kazakhstan. Russia has also now entered Asia with a major, strategic expansion, concluding a 30-year supply contract with China in May: its annual volume is nearly as high as China's total (pipeline and LNG) imports in 2012, yet its price is lower than Gazprom's gas sales to Europe. In order to maintain those sales will Russia's Gazprom, the world's largest exporter of natural gas, continue to insist on high long-term contract prices as the United States starts importing LNG into Europe's ports?

And will Qatar — a great energy power that shares the world's largest conventional gas field (South Pars/North Dome) with Iran, and the country that has recently spent billions to acquire the world's largest, most modern fleet of LNG tankers — just stand by as the U.S. exports take away its European and Asian market share? Will Iran, the country with the world's largest (and overwhelmingly undeveloped) conventional natural gas reserves, stay forever ruled by the mullahs? If not, its natural gas sales could easily surpass Qatar in total output and vie with Russia for global export primacy. Will Australia yield to America's moves to get a substantial share of China's LNG market, now heavily supplied by shipments from Australia's large gas fields?

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As is always the case in the early phases of any rapid development of new sources of energy, it is too soon to offer assured, balanced verdicts. Actual developments may disappoint or surpass the initial expectations — and either of these outcomes is much more likely than things turning out more or less as expected by an early consensus.

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*FURTHER READING:* Vaclav Smil also writes “[Hoping for China’s Success](https://www.aei.org/publication/hoping-for-chinas-success/) (https://www.aei.org/publication/hoping-for-chinas-success/),” “[Germany’s Energy Goals Backfire](https://www.aei.org/publication/germanys-energy-goals-backfire/) (https://www.aei.org/publication/germanys-energy-goals-backfire/),” and “[Memories of Peak Oil](https://www.aei.org/publication/memories-of-peak-oil/) (https://www.aei.org/publication/memories-of-peak-oil/).” Benjamin Zycher contributes “[LNG Exports: ‘A Good-Faith Test’ for President Obama](https://www.aei.org/publication/lng-exports-a-good-faith-test-for-president-obama/) (https://www.aei.org/publication/lng-exports-a-good-faith-test-for-president-obama/).” Kenneth P. Green and Alan W. Dowd consider “[Crude \(Oil\) Politics](https://www.aei.org/publication/crude-oil-politics/) (https://www.aei.org/publication/crude-oil-politics/).”

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