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Congressional Testimony of

Jason E. Bordoff

Founding Director, Center on Global Energy Policy, and Professor of Professional Practice in International and Public Affairs, Columbia University School of International and Public Affairs

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Chairman Murkowski, Ranking Member Cantwell and Members of the Committee, thank you for inviting me here today to discuss challenges and opportunities for oil and gas development in different price environments.

In my testimony today, I would like to make three main points:

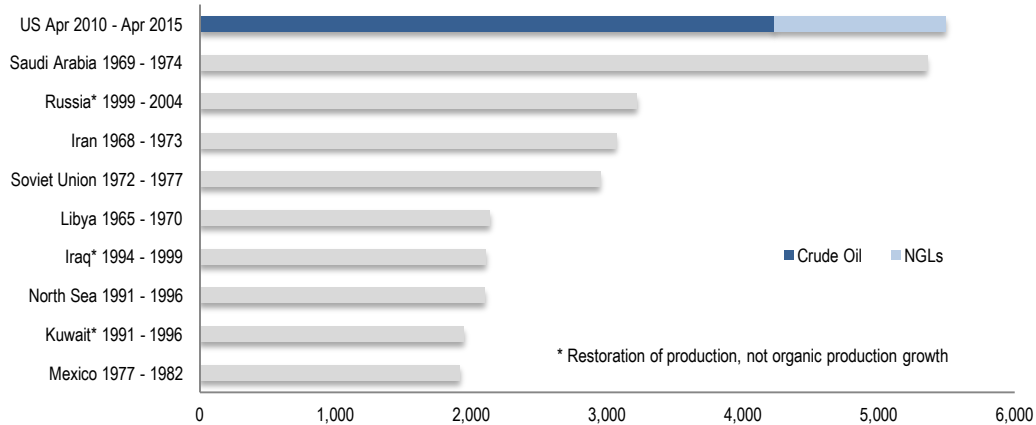
- First, the oil price collapse has hurt many workers, families and communities by causing job losses in oil-producing states, with U.S. oil production now falling sharply after a lag. While low oil prices, on net, are a boost to the U.S. economy, that benefit has been more muted than many expected based on past experiences.
- Second, while oil prices are low today, it is far from clear they will remain low. The oil industry has long known cycles of boom and bust, and there are many factors today that may combine to cause a price spike more quickly than anticipated. Moreover, oil prices moving forward may be more volatile than in the past.
- Third, as the committee knows, the federal government has a diverse set of responsibilities regarding energy production, including to protect air and water quality, regulate oil and gas production on public lands, correct market failures, and more. These roles are necessary, and government should design smart and cost-effective regulations regardless of oil prices, particularly as this commodity's future supply, demand, trade, and price trends are notoriously difficult to forecast.

Current Market Conditions and Economic Impacts

We are in the midst of one of the steepest oil price collapses in history. In June 2014, oil markets tipped into the current down cycle that has sent prices from over \$115 a barrel to lows in the \$20s in early 2016, before rebounding to their current level of around \$40-45 per barrel. Many factors contributed to this collapse, but perhaps the most significant was the unprecedented rise in U.S. oil production driven by the shale revolution. From 2010 to 2015, the U.S. experienced the largest five-year ramp-up in oil production of any country in history (Figure 1), rising to a peak of 9.7 million barrels per day (b/d) in April 2015. From 2005 to 2015, U.S. natural gas production increased more than 50 percent (Figure 2). Both of these production booms were made possible by technological advancements combining horizontal drilling and hydraulic fracturing that allowed oil and gas to be extracted economically from shale and other tight geologic formations.

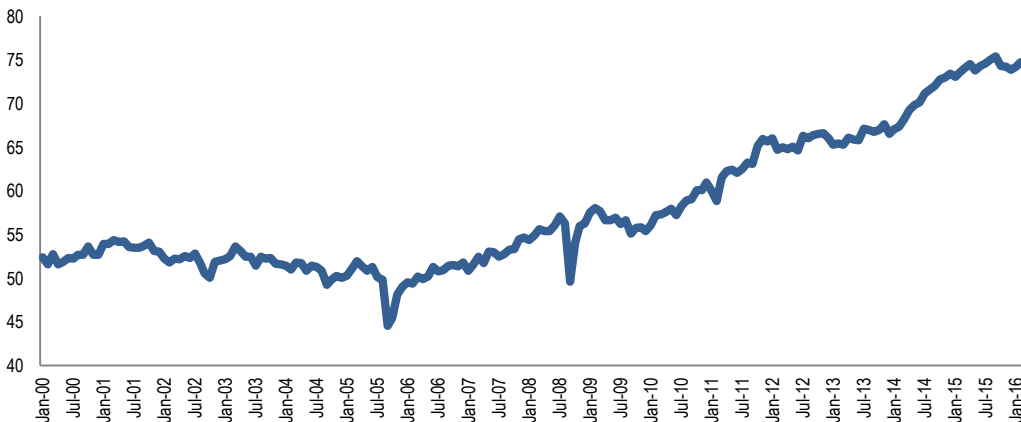


Figure 1: Largest Build-Outs in Oil Production over a Five-Year Period
(Thousands of barrels per day)



Source: BP Statistical Review of World Energy 2015, EIA

Figure 2: US Dry Natural Gas Production
(Billion cubic feet per day)



Source: EIA Short-Term Energy Outlook

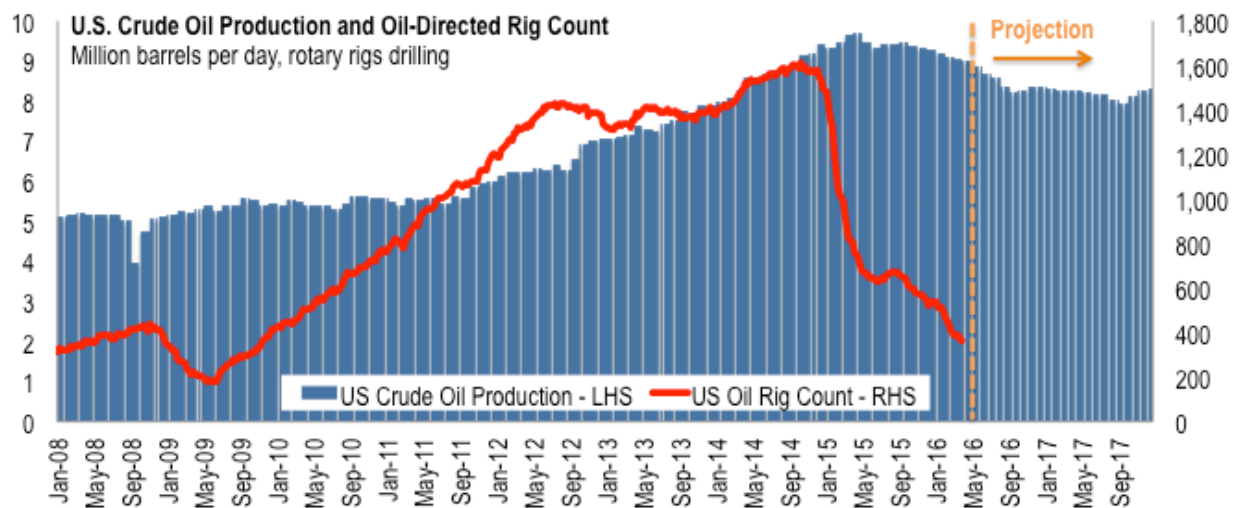
As prices started to slide in the summer of 2014, OPEC found itself confronted by surging high-cost supply, including from the U.S., and an inability to forge agreement among OPEC and certain non-OPEC countries to curb production, particularly with Iran’s looming return to the oil market post-sanctions. Consequently, OPEC took no action at its November 2014 meeting, and oil prices fell off a cliff. Indeed, in 2015, OPEC countries sharply increased production, with Iraq and Saudi Arabia together rising 1.2 million b/d from 2014 to 2015.

Many expected that US production would fall sharply as a result, as U.S. shale oil output was perceived to be high-cost supply that was not economic at lower prices. Analysts believed that tight oil supply required an average break-even price of around \$60 to \$70 per barrel range to be



economically viable.¹ In reality, U.S. tight oil production proved far more resilient than many expected. There were many factors driving this: producers rapidly improved drilling efficiency and productivity; service costs declined; producers shifted their focus to the most productive shale plays (aka “high-grading”); many producers had their production hedged in 2015; and some producers were required to drill certain areas in order to keep their leases. As a result, even with the price collapse, U.S. production kept rising in the first half of 2015, and then declined only gradually—even as the total rig count collapsed 78 percent (Figure 3).

Figure 3: US Crude Oil Production and Oil-Directed Rig Count



Source: EIA; Baker Hughes

Eventually, the reality of tight oil supply caught up with the collapse in the rig count. Tight oil production has much steeper decline rates than conventional oil wells. Output from a tight oil well can fall as much as 70 percent in the first year.² That means that in order to keep growing production, firms need to keep drilling more and more wells. But that is no longer happening. As a result, U.S. oil production fell from 9.7 million b/d in April 2015 to 9 million b/d in March 2016, and is projected by EIA to fall a further 1 million b/d by the middle of next year, before beginning to rebound.³

In one way, the oil price collapse may come to be seen in retrospect as an opportunity for the U.S. oil sector to make itself stronger and more resilient. Eventually, prices will recover, and U.S. output will start to rise again. And this will likely happen at lower prices than many previously believed because the intense economic pressure of this current downturn has forced oil companies to find new and innovative ways to improve their efficiency, productivity, and cost-effectiveness. The U.S.

¹ See, e.g., “Global liquids cost curve: shale is pushing out oil sands and Arctic, offshore is still in the race,” Rystad Energy, June 12, 2014, <http://www.rystadenergy.com/NewsEvents/PressReleases/global-liquids-cost-curve>.

² RBN Energy, “The Good, the Bad, and the Ugly: The Dynamics of U.S. Production Declines and Eventual Rebound,” 28 March 2016, p.6, https://rbnenergy.com/system/files/subscriber/rbn_good_bad_ugly_shale_decline_03282016.pdf.

³ EIA Short Term Energy Outlook database.



may be a short-cycle supplier, but it is most certainly not the high cost supplier (as some previously described it), and that may allow it to better weather future downturns.

The oil patch has been hit hard by the price collapse. The U.S. oil and gas sector has lost nearly 100,000 jobs since January 2015.⁴ Total employment impacts are larger than that because employees who lose their jobs in the oil and gas sector may reduce spending on other goods and services, such as restaurants, which can lead to reductions in local service sector employment. Economists at the Federal Reserve Bank of Dallas, for example, estimate that a 50 percent sustained drop in oil prices would reduce Texas employment by 1.2 percent, or 140,000 jobs.⁵ The economic impact would be even more severe in percentage terms in states in which oil and gas is a larger share of the economy, like Wyoming, Oklahoma, North Dakota, Alaska.⁶ U.S. oil companies are planning to cut back investments by 50 percent on average this year following a 40 percent average cut in capital expenditures last year, and nearly 60 American oil and gas companies filed for bankruptcy between January 2015 and April 2016.⁷

On net, however, the U.S. is still the world's largest oil consumer and a very large oil importer (even with the recent decline in imports), and thus a fall in oil prices offers a macroeconomic boost by reducing consumer spending on fuel. Americans today are spending \$180 billion less each year on energy goods and services than we were in July of 2014, which corresponds to about 1 percent of GDP.⁸ A year and a half ago, energy expenses constituted 5.4 percent of total consumer spending. Today that share is down to 3.7 percent.⁹

Yet the oil price fall is providing less of a macroeconomic boost than many had anticipated. The reason requires further study, but there appear to be several potential factors at work. First, while there was some boost to consumer spending from the lower gasoline price, it was much lower than would have been expected based on the historical relation between spending and energy prices.¹⁰ Second, the net benefit to the U.S. is smaller because the U.S. is such a larger producer, and the big employment gains from the shale boom are now being thrown into reverse.¹¹ Third, as the White House Council of Economic Advisers recently explained, because the U.S. is a much smaller net oil

⁴ Devashree Saha and Mark Muro, "Rigged: Declining U.S. oil and gas rigs forecast job pain," Brookings Institution, 16 March 2016, <http://www.brookings.edu/blogs/the-avenue/posts/2016/03/16-declining-us-oil-gas-rigs-saha-muro>.

⁵ Mine Yucel, "Plunging Crude Prices: Impact on U.S. and State Economies," August 7, 2015, https://www.dallasfed.org/assets/documents/research/events/2015/15vistas_yucel.pdf.

⁶ Stephen P.A. Brown and Mine K. Yucel, "The Shale Gas and Tight Oil Boom: U.S. States' Economic Gains and Vulnerabilities," Council on Foreign Relations, October 2013, <http://www.cfr.org/united-states/shale-gas-tight-oil-boom-us-states-economic-gains-vulnerabilities/p31568>.

⁷ Haynes and Boone, LLP Oil Patch Bankruptcy Monitor, 4 April 2016, http://www.haynesboone.com/~media/files/attorney%20publications/2016/energy_bankruptcy_monitor/oil_patch_bankruptcy_20160106.ashx.

⁸ James Hamilton, "Why no economic boost from lower oil prices?," Econbrowser Blog, April 10, 2016, <http://econbrowser.com/archives/2016/04/why-no-economic-boost-from-lower-oil-prices>.

⁹ Ibid.

¹⁰ Ibid.

¹¹ See, e.g., James Feyrer, Erin T. Mansur, Bruce Sacerdote, "Geographic Dispersion of Economic Shocks: Evidence from the Fracking Revolution," NBER Working Paper No. 21624, October 2015, <http://www.nber.org/papers/w21624> (finding that the shale boom caused the number of Americans working to be 750,000 higher and the unemployment rate to be 0.5 percent lower during the Great Recession than it otherwise would have been).



importer than it was before, when the price falls, more of the consumer benefit comes at the expense of domestic producer revenue, thus providing less of a macroeconomic boost.¹²

So far, I have discussed the supply impacts of the oil price collapse, but the demand impacts also represent a challenge. Consumers have responded to the lower prices. In the U.S., SUV sales were up 16 percent¹³ and plug-in electric vehicle sales were down by 17 percent in 2015.¹⁴ U.S. gasoline demand, which many thought had peaked in 2007, has been rising and is projected by EIA to equal 2007 levels again in 2016 and 2017. Overall, U.S. oil demand increased 1.5 percent in 2015 and is projected to increase further by 0.6 percent and 1.0 percent in 2016 and 2017, respectively. With falling domestic production and rising demand, U.S. net oil imports in January 2016 were up 650,000 barrels per day from a year earlier.

Increased petroleum dependence reduces our energy security. Despite today's low price, as I noted, the U.S. is still a significant consumer and importer of oil. Thus we increase our energy security if we reduce oil consumption and concomitantly the exposure of the U.S. economy to inevitable oil price fluctuations in the future—not to mention the climate and environmental imperative to reduce oil consumption. Policies to reduce oil demand and investments in alternative transportation fuel R&D not only increase our energy security, but also reduce greenhouse gas emissions that lead to potentially severe climate change impacts.

While I have focused on oil supply and demand, let me briefly say a word about natural gas. Domestic natural gas producers have also been impacted by the oil price drop. Natural gas prices in the U.S. have been very low for some time. Available evidence suggests that the U.S. has a large supply of inexpensive natural gas. Despite the loss of so-called “associated gas” production—gas produced as a byproduct of producing oil—even as oil output falls, U.S. gas output has continued to rise, and the EIA expects continuing increase in 2016-2017. U.S. marketed natural gas production reached a record high level of 79 billion cubic feet per day (Bcf/d) in 2015, an increase of 5% from the previous year, even as natural gas prices remained relatively low (Figure 4). U.S. natural gas consumption was weak as a result of the warm winter, but still rose 2.1 Bcf/d to 75.3 Bcf/d in 2015. Perhaps the primary implication of the fall in oil prices has been the sharp drop in natural gas prices elsewhere in the world, especially Asia, where gas prices are often linked to the price of oil. This changed market outlook has raised questions about the global market for liquefied natural gas (LNG) exports, including from the U.S. In late February, a historic milestone was reached when the first ever large-scale shipment of LNG from the lower 48 states set sail for export, a development that I believe may have significant geopolitical implications.¹⁵

¹² Council of Economic Advisers, “The All-Of-The-Above Energy Strategy as a Path to Sustainable Economic Growth,” 2014, p.3,

https://www.whitehouse.gov/sites/default/files/docs/aota_report_updated_july_2014.pdf.

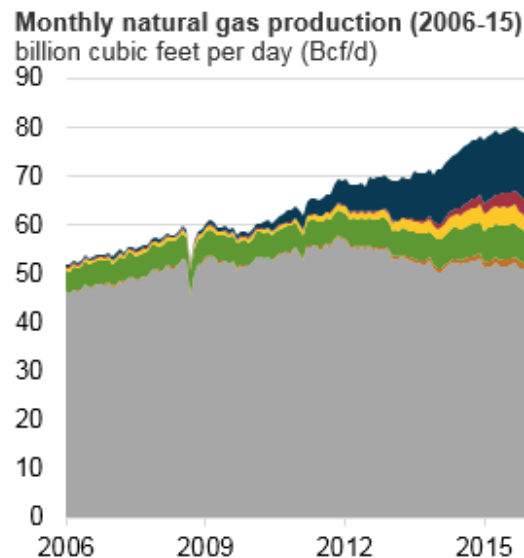
¹³ James B. Stewart, “The SUV Arms Race Goes Upscale,” *New York Times*, April 14, 2016, <http://www.nytimes.com/2016/04/15/business/the-suv-arms-race-goes-upscale.html>.

¹⁴ Dana Hull, “Plug-In Electric Autos Left Behind in Record U.S. Year,” *Bloomberg*, January 6, 2016, <http://www.bloomberg.com/news/articles/2016-01-06/plug-in-electric-vehicles-left-behind-in-u-s-autos-record-year>.

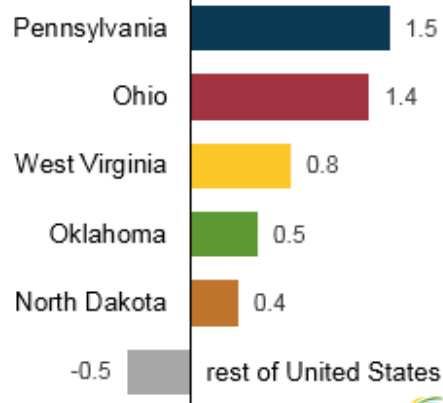
¹⁵ Jason Bordoff and Akos Losz, “The United States Turns On the Gas: The Benign Energy Superpower?,” *Foreign Affairs*, 4 March 2016, <https://www.foreignaffairs.com/articles/2016-03-04/united-states-turns-gas>.



Figure 4: U.S. Natural Gas Production Growth



Annual natural gas production growth in selected states (2014-15) billion cubic feet per day (Bcf/d)



Source: U.S. Energy Information Administration, *Natural Gas Monthly*



Source: Energy Information Administration

Lower for Longer?

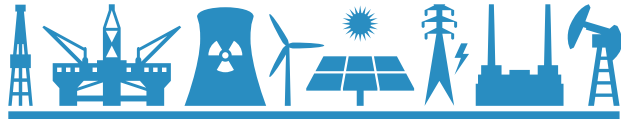
With the sustained drop in oil prices, “lower for longer” is the new mantra. The futures market, admittedly a poor predictor of future prices, is pricing oil below \$50 per barrel through 2019. That may prove to be true, but we should remember that the oil industry historically has been marked by boom and bust,¹⁶ starting with the discovery of oil in Pennsylvania in 1859, which helped crash the price of oil from \$16 per barrel in 1859 to 50 cents in 1861, before the onset of the Civil War brought a surge back to \$8 per barrel by 1864.¹⁷

Currently the global market is oversupplied and inventories are at a very high level, which will weigh on prices for some time to come. At the same time, the best cure for low prices, the saying goes, is low prices. U.S. production is falling sharply now. Further production declines are expected this year from China, Mexico, and Colombia. And roughly \$400 billion in global capital investment cuts means that less supply will be available in the years to come.¹⁸ Meanwhile, consumers are responding

¹⁶ Robert McNally, “Welcome Back to Boom–Bust Oil Prices,” *Center on Global Energy Policy Commentary Series*, 17 December 2015, <http://energypolicy.columbia.edu/sites/default/files/energy/Commentary-%20Welcome%20Back%20to%20Boom–Bust%20Oil%20Prices.pdf>.

¹⁷ James D. Hamilton, “Historical Oil Shocks,” University of California, San Diego, 1 February 2011, p. 2-3, http://econweb.ucsd.edu/~jhamilto/oil_history.pdf; U.S. Energy Information Administration, Domestic Crude Oil First Purchase Prices by Area, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=F000000__3&f=A.

¹⁸ “Deferred Upstream Projects Tally Reaches 68,” Wood Mackenzie, January 14, 2016, <http://www.woodmac.com/media-centre/12530462>.



to low prices: global oil demand, which grew only 0.9 million b/d in 2014, grew 1.8 million b/d last year, and is projected to rise another 1.2 million b/d this year.

Beyond market fundamentals, there are other factors that may cause prices to swing back up. Iran is ramping up production after the lifting of sanctions, but recent indicators suggest this will be neither as easy nor as quick as Tehran's lofty claims would suggest. Despite OPEC's failed effort to freeze production in Doha, it may yet try to reassert itself by curtailing output.

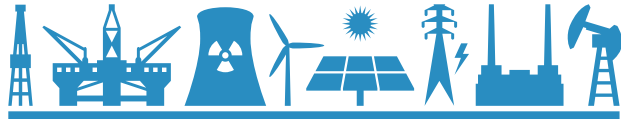
And geopolitical and economic risk to oil supply abounds. The conflicts that erupted in the aftermath of the Arab Spring across the oil-rich Middle East and North Africa region show little sign of abating. Libya remains mired in a protracted civil war. Recent supply disruptions and pipeline sabotage in Iraq and Nigeria remind of the supply risks from conflict, political dynamics and poor governance. Nigeria has seen rising militancy in the Niger Delta and growing risks highlighted by President Buhari's decision to redeploy troops from the North to the oil-rich South. Ongoing tensions and disagreements between Turkey, the Kurdistan Regional Government, and Iraq remain a continued threat to oil supply in Northern Iraq. Venezuela—the largest oil producer in Latin America and sixth largest within OPEC—is close to economic and social collapse. The country enters the third straight year of deep recession, the inflation rate is projected to exceed 200 percent in 2016, and the risk of sovereign default remains very high. A worker strike in Kuwait that slashed oil output by more than half last week was short-lived, but reminds of the potential for new and unexpected supply risks. In short, there are no lack of global problems that could impact supply and prices in the oil market.

If a significant supply disruption were to occur, there is also less of a cushion in the global oil market to handle it, with OPEC spare capacity—oil that can be quickly brought onto the market to compensate for production losses elsewhere—at historic lows. OPEC's effective spare capacity, most of which is held by Saudi Arabia, is currently estimated by the IEA to be 2.7 million b/d,¹⁹ although many believe it is actually much lower. Even the higher number represents less than three percent of global demand. By contrast, for most of the 1990s, OPEC spare capacity averaged closer to five percent of global demand.

In a world with very narrow spare capacity, any disruption to global supply can have an outsized impact on price because there is little buffer in the event of supply disruptions.

Once the market comes back into balance, likely later this year or next, and inventories begin to draw down, prices could rise more quickly than expected given all these factors. A key question then is whether the U.S. can act as a new sort of "swing supplier" to quickly ramp up production and stem the price rise. Because the decline rates are steep and upfront costs low, shale oil production, in theory, can rise quickly once companies start drilling again. In truth, we do not know how quickly U.S. production can start rising again or at what oil price that happens. Shale oil is a new phenomenon. Yet we know it will not happen overnight. It takes time for capital markets to open up, for companies to get the rigs and equipment, and for laid-off workers to return. Even if prices rise back to \$55 or \$60 per barrel, around the level at which many expect U.S. supply could begin rising again, it may take 9 to 12 months for domestic production to follow that market signal.

¹⁹ International Energy Agency, Oil Market Report, April 14, 2016, p. 17.



Historically, dominant producers have tried, with varying degrees of success, to curb boom and bust cycles by managing supply—from John Rockefeller and Standard Oil to the Texas Railroad Commission to OPEC. Today, the oil market is functioning more like a free market, as OPEC’s hold is loosened and it is letting low prices bring the market back into balance. If OPEC, particularly Saudi Arabia, continues to abstain from any effort to manage the market by hiking or cutting supply, and the U.S. has a notable lag in its ability to respond, the impact may be more price volatility ahead.

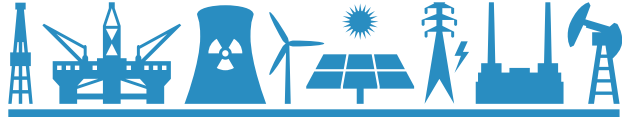
Policy Implications of a Low-Price Environment

The low oil price may have certain near-term implications for energy policy. For example, a lack of public concern with current low gasoline prices may have made it easier for Congress to repeal the ban on U.S. crude oil exports. Higher projected gasoline use creates a bit more headroom for biofuels to enter the fuel system before the so-called “blend wall” is reached. Reduced sales of fuel efficient cars will increase pressure by some to curtail fuel economy standards in the 2018 midterm review, even as it causes others to argue the standards should be ratcheted up to offset increased consumer preference for less fuel efficient cars. And potential geopolitical instability in key oil producing regions is a national security concern to which policymakers should be carefully attuned.

As a general matter, however, energy and environment policy should be formulated without excess consideration given to short-term fluctuations in oil prices. As noted above, prices will go up and down, often rapidly. Regardless of the price, government has a responsibility to ensure oil and gas production is done in a safe and responsible manner that protects precious air and water resources. Government has a role to correct market failures, like policies to reduce carbon emissions that contribute to climate change, a social cost that is not internalized in the price we pay for energy. Government has a role to determine which federal lands to open to energy exportation, based on a careful assessment of potential environmental risks and impacts, as well as the potential benefits that come from increased domestic energy supply and reduced import dependence. Government has a role to play in evaluating permit applications for new energy infrastructure projects, from pipelines to transmission lines and more, to ensure potential environmental impacts are understood and mitigated.

These fundamental roles for government do not change in different oil price environments. When oil prices are low, and industry is under acute economic pressure, there can be pressure to weaken environmental regulations, yet that would be short-sighted. Whether prices are high or low, government regulators must protect our air and water, and should do so with carefully crafted, smart regulations that achieve their environmental goals at the lowest cost to companies and consumers.

Consider the case of methane emissions from oil and gas production. Methane is a potent greenhouse gas. Yet excellent work from the Environmental Defense Fund and others has shown that methane leaks can be greatly reduced at very low cost. As a result, well-designed methane regulations are a cost-effective way to reduce greenhouse gas emissions when compared to the social cost of such emissions, and thus should be pursued even when oil prices are low and the industry is hurting.



Similarly, low gasoline prices have reduced demand for fuel-efficient vehicles, leading to arguments that the Obama Administration’s ambitious fuel economy standards should be weakened when they come up for a midterm review in 2018. Yet the entire point of a government regulation to increase fuel efficiency—thus reducing oil imports and pollution—is to push the automotive market to achieve a level of fuel efficiency that it would not on its own. A policy that induces car makers to produce and price vehicles differently to alter the mix of the fleet is more, not less, important when prices fall, precisely because the market would not achieve this result on its own. Even at today’s lower oil prices, increasing fuel economy standards still delivers net benefits to society and helps to protect consumers against future oil price volatility.²⁰

Nor should decisions about whether to open or not open particular areas to exploration, or approve certain pieces of infrastructure, be determined based on today’s outlook for production, demand, trade, and prices. As discussed above, today’s market conditions can and will change—it is only a question of when—and often those changes occur far more rapidly than many expect. Moreover, our ability to anticipate those changes is limited. Consider that a decade ago, in 2005, the EIA projected that the U.S. in 2015 would be a net importer of 19 billion cubic feet per day of natural gas. Instead, we just exported the first-ever large-scale LNG cargo from the lower-48 and will soon be a net exporter.

CONCLUSION

Today’s oil market is in the midst of a profound transformation, driven by new technologies, global efforts to transition to cleaner energy sources, a shale revolution in the U.S., a historic shift in OPEC’s market role, changing geopolitical and trade relationships, and many other factors. Predicting what the oil market, and certainly oil prices, will look like over the next several years is fraught with pitfalls. The oil price collapse of the last 18 months has brought hardship to companies, workers and communities in many oil-producing states, and is starting to cause U.S. oil production to decline. It has also brought many geopolitical and economic challenges to oil-producing countries globally, and undermined the push for alternative transportation fuels. At the same time, it has brought opportunities—providing a boost to U.S. consumers and GDP, making the U.S. oil industry far more efficient and lowering its costs, and enabling countries to remove economically and environmentally wasteful fuel subsidies.

Despite these near-term challenges and opportunities, the basic responsibility of the federal government to protect air and water quality, regulate oil and gas production on public lands, evaluate permit applications for energy infrastructure, correct market failures, and more, do not fundamentally change with oil prices. Whether oil prices are high or low, government should take care to design smart regulations as cost effectively as possible, and not let short-term fluctuations in oil prices unduly influence the formulation of energy and environment policy.

²⁰ Varun Sivaram and Michael Levi, “Automobile Fuel Economy Standards in a Lower-Oil-Price World,” Council on Foreign Relations Discussion Paper, November 2015, http://www.cfr.org/energy-policy/automobile-fuel-economy-standards-lower-oil-price-world/p37190?cid=otr-marketing_use-cafestandards.