The End of the Oil Crisis

BY PHILIP K. VERLEGER, JR.

For good and bad the earthquake has occurred; the tsunami is underway.

As a professional economist, I have been researching, writing, teaching, and speaking on energy issues for forty-one years. The first oil shock occurred roughly a year after I entered professional life. The oil price surge from $3 to $10 per barrel changed my career. For the next four decades, I watched as oil prices ratcheted higher and higher, strangling one industry after another while increasing hardship across the globe for those who could least afford the pain.

For forty years, rising oil prices have forced individuals, countries, and companies to make economic adjustments they preferred not to make. Auto firms had to redesign engine systems to economize on fuel use. Airplane manufacturers devoted countless hours and billions of dollars to building lighter fuselages for the same reason. Individuals have had to divert effort and income from important activities such as educating or feeding their families in order to purchase fuel. The list goes on and on.

The adjustments were made first because fuel prices kept increasing, and second because the elites kept warning that global oil and natural gas supplies were finite. The received doctrine was that scarce resources (capital) must be reallocated from activities such as constructing schools and roads to energy conservation and production projects of questionable economic merit. The citizens of many countries were told that living standards would at best increase very slowly and at worst fall because fossil fuels were scarce and prices would keep rising. Proponents for these views still exist today. Economist Jeff Rubin published *The Big Flatline: Oil and the No-Growth Economy* in 2012. In it, he predicted that continually rising oil prices would doom the U.S. economy.

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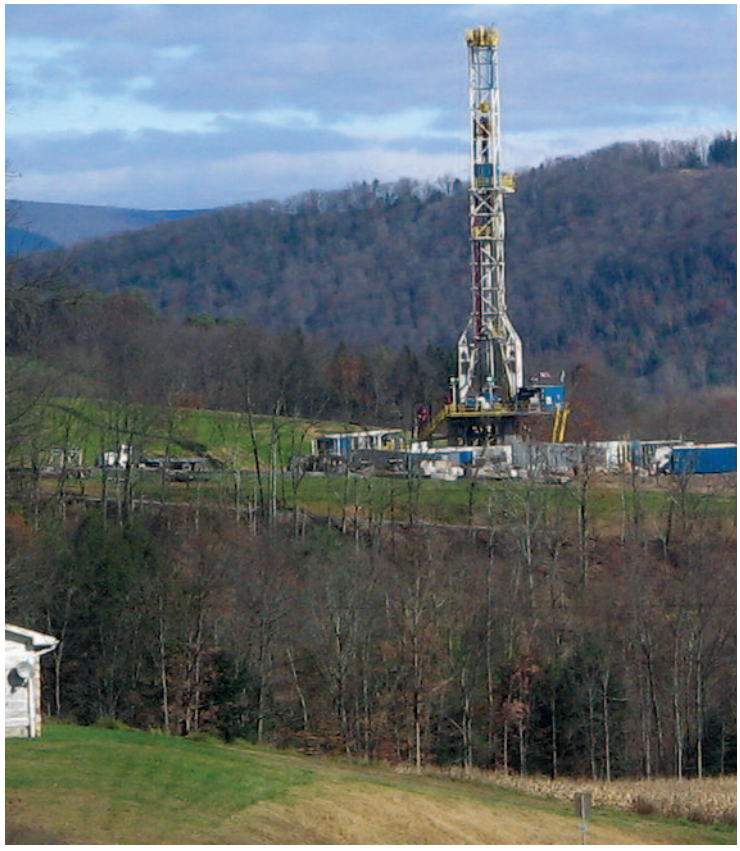
A horizontal drilling rig for natural gas in the Marcellus formation, Pennsylvania.



In his book, Rubin warns of America's poor prospects. His thesis is that world oil prices must rise given the consumption growth in China and other parts of the world. The higher prices will, he asserts, sap the U.S. economy and flatten growth. He envisions a future of energy scarcity that will alter the world we know, saying "We might find ourselves in that world of no growth much sooner than we ever could have thought."

Rubin, a Canadian, seems to relish the potential problems facing the United States. He describes a zero-sum world where China grows at America's expense. He entitled one chapter "Why China Can Afford Triple-Digit Oil Prices While America Can't." He suggests that the crude price rise will make gasoline too expensive for Americans and precipitate an economic slowdown. He also asserts that Americans have "closed their eyes" to growing global consumption:

> In a zero-sum world, if Chinese oil consumption doubles over time, the number of barrels going to the United States could be chopped in half (or something close) since the energy pie is only so big. It's a simple notion that will soon become a stifling reality for the United States and other OECD countries.
>
> If oil is the fuel that drives economic growth and oil consumption is a zero-sum game, then so is economic growth. Ultimately, that might be all the reason China needs to abandon its cheap yuan policy and turn its back on U.S. Treasuries.

Rubin's book is rife with unsupported claims and outright mistakes. Still, he illustrates the views of many who see dismal prospects for the United States.

Another such view comes from Robert Gordon, one of the world's experts on productivity. In a 2012 article, "Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds," Gordon lays out a plausible and troublesome case for why the United States may face a period of much lower growth. He notes that historically the United States benefited from three industrial revolutions. (His analysis focuses solely on America.) The first occurred between 1750 and 1830 with the invention of steam engines, the cotton gin, and railroads. The second and most important took place between 1870 and 1900 when indoor plumbing, electricity, and the internal combustion engine were introduced. The third began around 1960 with the advent of computers.

The first and second revolutions had "tails" that lasted decades as the economy transformed. For example, the impacts of the second revolution were still being felt between 1950 and 1970 as refrigeration and air conditioning use spread across the country.

The computer revolution, on the other hand, had a surprisingly short lifespan, according to Gordon. He argues that most invention has focused on entertainment and communication devices rather than on improving productivity or driving down costs.

Absent the latter development, Gordon suggests, growth in U.S. real consumption per capita, which reached 2.5 percent around the turn of the last century, could easily slump to around 0.2 percent per year going forward. He warns that faltering innovation will confront six "headwinds."

Gordon's and Rubin's views reflect thinking that has dominated macroeconomics for forty years. The "oil shock" of 1973 changed everyone's perception permanently. Two years after the shock, Edward Fried and Charles Schultze of the Brookings Institution edited a collection of essays by the best macroeconomists of the time.

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The increased oil and gas supplies will bring an economic renaissance to the United States.

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In their introduction to *Higher Oil Prices and the World Economy,* the editors made this declaration:

> No event of the period following the Second World War had so sharp and pervasive an impact on the world economy as the series of shocks to the oil market that closely followed the outbreak of the Arab-Israeli War on 6 October 1973.

Fried and Schultze noted that the quadrupling of oil prices caused a sharp decline in aggregate demand, which slowed the global economy. They predicted that the economy would recover in time but that problems would remain. They made their projection assuming prices would not rise further.

Within ten years, prices had quadrupled again, this time to $40 per barrel, extending the economic slowdown. Additional increases since 2000 have been an ongoing drag on economic activity in the United States and the world.[1]

The continued price rise and the pinch on economic activity have prompted analysts such as Rubin and Gordon to foresee further economic troubles for the United States and the world. Their assessment has been accepted as truth. National, state, and local governments have responded by adopting policies to cope with permanently higher energy prices. Individual consumers changed habits and lifestyles as well, abandoning exurbia and in some cases suburbia, for example. The greatest reaction, though, has occurred in the private sector. Manufacturing companies changed production processes to reduce energy consumption and make better use of computers. They also began to operate like nomads, moving from one location to another in search of low-priced energy. Transportation companies, particularly airlines, sought to reduce costs by retiring older, inefficient equipment prematurely in favor of more efficient aircraft. Office buildings were redesigned, and firms changed how they did business to cut travel costs.

Utilities also responded aggressively to rising energy prices, first by moving away from oil when the crisis started and then by constructing facilities that could use what might be called "advantaged" fuels, meaning feedstocks that for logistical reasons can be purchased at a discount to prices charged for oil moving freely in international trade. In the first years of the crunch, utilities saw their future in nuclear power and the fast breeder reactor, a generating plant that promised to produce more fuel than it consumed. Skyrocketing costs and accidents doomed the nuclear option, leaving coal as the remaining choice. From 1975 to about 1995 and no later than 2000, the U.S. and European governments strongly pushed coal substitution for higher-cost oil and natural gas in power generation. Today, many recognize that decision as a terrible mistake due to coal's contribution to global warming.

While my view may seem extreme,

I am not alone.

More recently, policymakers and the private sector have moved rapidly to reduce fossil fuel use by means of conservation and renewable fuels. One of the leaders in this push has been Amory Lovins, who cofounded and is now chairman and chief scientist of the Rocky Mountain Institute. Under his leadership, the Rocky Mountain Institute has advocated these changes. A recent RMI publication, *Reinventing Fire,* asserts that the U.S. economy could expand 158 percent by 2050 (2 percent per year) and yet need no oil or no coal, no nuclear energy, and one-third less natural gas. In a provocatively titled 2012 article, "A Farewell to Fossil Fuels," Lovins described the three steps required to reach his goal: radically improved automotive efficiency, better efficiency in buildings, and modernization of the nation's electric grid.

Some of the adjustments made and proposed to reduce oil and gas use are good and will serve the world well in the future. Most represent overkill. These divert scarce capital from more productive activities, effectively slowing the per capita income growth rate. Most of the RMI proposals fall in this category, dooming millions if not billions of the world's population to further decades of poverty. Lovins has been an extremist on the subject for at least thirty years.

Clearly, the substitution of renewables for fossil fuels can be justified given the clear and present problem of global warming and the extraordinarily compelling evidence that humans have caused much of the harm. However, many adjustments made in response to the energy crisis that began in 1973 have been blunders. Forests have been denuded in nations such as the Philippines by those who are desperate for fuel but cannot afford kerosene. Billions of tons of coal have been consumed to produce electricity by utilities wrongly required to abandon oil and gas. Trillions of dollars have been needlessly allocated to projects to produce substitutes for oil and natural gas.

Ten years from now, historians will ask, "What was that all about?" They may also ask, "How could officials

support policies that caused such serious long-term damage for so little short-term gain?" President Jimmy Carter's push to increase coal use in particular will be challenged even though the decision was taken before the impacts on global warming were understood.

Historians will be so curious because by 2020 or 2025 at the latest, the crisis associated with natural gas and petroleum shortages will have ended. Prices for these fuels will have sunk to extremely low levels. Natural gas prices in the United States have already dropped as much as 90 percent from peaks that once approached $20 per thousand cubic feet (equivalent to $120 per barrel for oil) to as low as $2 per thousand cubic feet. Crude oil prices are falling as well. Prices peaked at over $145 per barrel in June 2008. Today, some crudes can be purchased for less than $50. These prices will decrease further.

Credit for the end of the oil crisis belongs to the scientists and engineers who developed new technologies to tap shale oil and gas reserves. We have known about these reserves for decades. They were not counted, though, in the data published by the U.S. Department of Energy or the American Association of Petroleum Geologists because they could not be produced.

One person who anticipated the oil crunch demise was MIT's Morris Adelman. Adelman was a student of the oil industry long before the subject became popular. Trained in industrial organization, he wrote in the 1960s that oil industry costs would decline and that prices would decrease slowly over time. He was wrong for about forty years. As he later explained, prices were held higher because low-cost producers operated a joint monopoly.[2]

Adelman asserted the absence of a resource constraint as far back as 1970. While others argued that the United States would run out of oil, Adelman explained the nation had an essentially inexhaustible inventory that might someday be tapped through scientific and technology advancements. When others fretted that the United States had less than ten years of reserves left, Adelman asserted the number was actually one hundred years—and that figure did not include the shale oil that is now being aggressively developed across America.[3]

In a 1991 essay, Adelman expanded on this view, noting that few agreed with him, not even his MIT colleagues Robert Solow and Paul Samuelson: "My view of supply has not been shared by all. The 1973 price explosion was greeted by many economists, and not the least distinguished, as the long-delayed inevitable scarcity. In this view, temporary forces had just happened to keep all mineral prices flat or declining—for a remarkably long time."

Adelman's view that science and technology would unlock more oil was documented by J. Robinson West in the Fall 2012 issue of *TIE*. As he explains,

> It was [George] Mitchell and other small companies (not the government or the large oil companies) that, by trial and error and a concentrated focus first on the Barnett Shale near Fort Worth, Texas, were able to combine horizontal drilling (originally pioneered offshore and perfected in the nearby Austin Chalk play), hydraulic fracturing, and other technologies to force gas from shale and other tight formations.

Lovins and the RMI experts have predicted that technological applications will make oil and natural gas unnecessary. Indeed, Lovins chides the United States for moving too slowly: "The United States cannot afford to keep waiting for a gridlocked Congress to act while the global clean-energy revolution passes it by." The Rocky Mountain Institute is correct in the sense that technology has solved the energy crisis. However, the success has occurred on the supply rather than the demand side.

The recent flood of shale reserve production comes from the small entrepreneurial firms West describes being able to drill horizontally for greater and greater distances. The drillers guide their drill strings through very narrow shale layers. As Kemp notes, their productivity has increased thanks to silicone-controlled rectifiers and the replacement of DC motors on rigs with AC motors, which offer better precision and flexibility.[4] Down-hole instrumentation has also enabled drillers to

Coal Blunder

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—P. Verleger

Jimmy Carter

keep strings moving horizontally in close contact with the shale layer. In other words, technology has made it economically possible to produce large volumes of crude oil and natural gas originally thought unreachable. These are now flowing from the Bakken shale in North Dakota (oil) and the Marcellus Shale in Pennsylvania (natural gas). They will soon flow from other areas.

The increased oil and gas supplies will bring an economic renaissance to the United States, as I discussed in the Spring 2012 issue of *TIE.* Energy independence, once thought unrealistic, will be achieved. Moreover, firms operating in the United States will enjoy unique access to oil and gas supplies at lower cost than their counterparts in Europe, China, Japan, or other countries. The advantage will be greatest in natural gas, where costs in the United States for at least the coming decade will be one-half to one-quarter of those paid by firms elsewhere. Oil refiners and some oil consumers will also benefit.

The ultimate size of the benefit will depend on the oil price path over the next few years. By 2020, economic gains to consumers in oil-consuming countries could be enormous if oil producers attempt to sustain prices at or above current levels ($110 per barrel for Brent). The positive effects will be smaller, though, if producers boost production now and let prices ease back to, say, $70 for Brent by 2015.

While my view may seem extreme, I am not alone. Christof Rühl, chief economist for BP, wrote recently in the *International Herald Tribune* that "market-led innovation has brought us to a crossroads again." Rühl goes on to argue that governments with abundant resources must move quickly to address the economic issues.

Efforts to maintain higher prices will do the most good for consumers over the long term because the high prices will maximize the incentive to produce shale oil while supporting programs to replace fossil fuels with renewables and natural gas. With continued high prices, U.S. production could surpass twenty million barrels per day by 2020, as the National Intelligence Council projected in its December 2012 report. By 2020, oil-exporting countries could discover that shale and conservation have destroyed their market, just as the iPhone destroyed Kodak's film market.

A price collapse in seven to ten years is almost assured if today's high prices persevere. Steadier prices, though, may be possible if OPEC and other producers act today.

In either case, the United States will enjoy at least three benefits. First, lower prices will allow consumers to spend less on energy and more on other goods, services, and activities. Second, the nation's trade deficit will decrease as domestically produced oil and gas replace imports. The trade balance improvement, especially if accompanied by the industrial "reshoring" predicted by many observers, will leave the entire economy less vulnerable to foreign influences.

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Finally, the increase in U.S. oil and gas production will boost employment for decades. This effect has not been noticed, perhaps because energy exploration has not been known historically as a labor-intensive process. Shale oil and gas development is different, though, from the other types of energy production. It is labor- rather than capital-intensive. A shale well, for example, will produce 360,000 barrels over its life, more than half of it in the first year. The well's cost will be less than $9 million with a large labor input. A producer would need to drill a new well every year, maintaining employment, to sustain output of roughly 200,000 barrels per year.

In contrast, a firm developing an offshore well that produced the same annual amount would need to drill only one well every ten to fifteen years. The effort would also require leasing a very expensive drilling rig, but the number of workers employed would be far fewer.

The move to shale, as noted, is a shift from a capital-intensive process to a labor-intensive process. The benefit to the United States in the current circumstances cannot be underestimated, especially as oil prices fall.

Additional benefits to the economies of the United States and other large oil-importing countries will come as consumers spend less on oil and more on other goods and services. Lower oil prices may add as much as a percentage point to the global growth rate every year over the next decade.

OPEC members and other oil-exporting countries such as Russia need to respond now to the shale threat because production costs in the United States are so low. I calculate the breakeven number for shale production

today at $25 per barrel. Since the oil can be sold for approximately the same amount as West Texas Intermediate, currently $94, investors have every incentive to drill as fast as possible. Their motivation is magnified by the fact that much of a well's production occurs within twelve months of completion, meaning costs can be recovered in six months.

Incentives are further strengthened by the United States' robust futures markets, which enable producers to hedge production for up to two years. In other words, actions OPEC takes today to slow shale development will not show results until 2015 or 2016 at the earliest.

For OPEC and other oil exporters, the earthquake has occurred. The tsunami is underway, even if the wave does not hit for two years. The impact of lower prices on shale oil drilling in the United States may not be felt for several years because the firms drilling in shale have hedged much of their future production. They will still be paid high prices when oil-exporting countries are getting low prices.

This will be seen as a revolution, especially by individuals like myself who have followed the ups and downs of energy markets for the last four decades, fluctuations often due to the economic consequences of higher and higher prices.

However, the revolution will also have significant downsides. First, the inevitable lower oil prices will hamper efforts to address the increasingly critical problem of global warming. It will be harder and harder to push for renewable energy programs as hydrocarbon prices fall. The increased use of fossil fuels associated with falling prices will also make the problem worse.

Second, and more significant for the short term, the drop in world oil prices will probably increase instability in oil-exporting countries, particularly those in the Middle East. Thus the world could easily become even more volatile as more non-state actors disrupt world trade and the global economy.

If done improperly, oil and gas production via fracking could contribute more to global warming than coal burning.

The hydrocarbon revolution's impact on how fast the world might warm could be terrible. The new technologies that allow us to tap shale oil and shale gas could release vast quantities of methane, a gas fifty times more powerful than carbon dioxide as a warming agent. If done improperly, oil and gas production via fracking could contribute more to global warming than coal burning. This is a major concern given that fracking will inevitably spread across the world, especially to nations that seek independence from oil-exporting countries. There is a real risk that the technological breakthrough that breaks OPEC will accelerate climate change.

Unfortunately, Pandora's box has been opened. Policymakers must move quickly to address the potential problem of methane releases.

The hydrocarbon revolution's second impact will fall on nations such as Russia that have thrived on high oil prices. The per capita incomes of rapidly growing populations in many of these countries will fall sharply, perhaps as much as 50 percent. Social unrest, already observed in the Arab Spring of 2011, will worsen. The entire Middle East may be overwhelmed by uprisings as radical leaders seek to overthrow existing governments.

Again, we can do little to stop these forces. Technology has been employed to solve one problem. The solution opens the door to new ones.

By 2023 then, one can be reasonably confident that the economic difficulties that began with the first oil crisis fifty years earlier will be solved. Oil and natural gas supplies will be plentiful and relatively inexpensive in the United States and most other countries. The resolution of the oil crisis, though, will have opened up two equally difficult problems: accelerated global warming and great political instability in countries that built their economies on the expectation of ever-rising oil prices. ◆

NOTES

1. See James D. Hamilton, "Causes and Consequences of the Oil Shock of 2007-2008," *Brookings Papers on Economic Activity* (Spring 2009), pp. 215–261.
2. See Morris Adelman, "Introduction," *The Economics of Petroleum Supply* (Cambridge, MA: MIT Press, 1991), p. xiii.
3. Adelman, "Economics of Exploration for Petroleum and Other Minerals," *Geoexploration* 8 (1970), pp. 131-150, reprinted in *The Economics of Petroleum Supply,* pp. 65-87.
4. John Kemp, "Faster, Deeper, More Power in NA Rig Market," Reuters, December 11, 2012.