



Sunrise over wind turbines near Lincoln, Kansas, United States.

**An array of new energy supplies is shaking up today's economic establishment, creating winners and losers worldwide**

energy supplies are threatening powerful players at least as much as yesterday's energy crunches did. From a boom in fossil-fuel production to a flowering of renewable energy to the rollout of an array of contraptions and business models to cut energy waste, the new energy riches of the 21st century are doing what new riches typically do—destabilizing the old economic order.

To be sure, even as these new energy supplies emerge, the world faces fundamental energy challenges. Energy demand is rising in the developing world, particularly in China. That's squeezing global output and keeping oil prices stubbornly high—pressure that could intensify as global economic activity picks up. And global greenhouse-gas emissions continue to increase, in large part because the world fuels itself mostly from coal and other fossil fuels and is likely to do so for many years to come.

Yet, in certain places, the new resource riches are starting to remake the energy landscape. They're shifting the center of gravity of global oil production westward, to North America from the Middle East. They're reorienting the adolescent renewable-energy industry eastward, to China from the United States and Europe. They're curbing carbon emissions in some cases and exacerbating them in others, which means that their effect on today's signal environmental concern—climate change—will remain unpredictable for years to come. All the while, the proliferation of new resource riches is jeopardizing the bottom lines of long-dominant energy powers, including OPEC, leading electricity producers, and multinational manufacturers. All of them are scrambling to adapt rather than get crushed.

# New Powers

*Jeffrey Ball*

**L**AST year, a minister from the Organization of the Petroleum Exporting Countries (OPEC) called surging U.S. oil production a “grave concern” to the cartel. This spring, Barclays downgraded the debt of the U.S. electricity sector, warning that the increasing popularity of rooftop solar panels “is likely to disrupt the status quo.” Meanwhile, coal producers in the West are swimming in inventory, facing flat demand at home, and forced to look far afield, to Asia, for markets.

An energy revolution is rocking the world: one triggered by an explosion of new energy technologies and supplies. It's a stark contrast to the energy shifts of the past half century, which were sparked by acute supply shocks. New resource riches are popping up spottily across the globe, and they are beginning to have profound and messy geopolitical and environmental repercussions. So far, their most striking effect is economic: today's new

## Pushing ahead

Energy shifts historically have happened for two reasons. Sometimes there has been a push: a prevailing energy source has run out. Sometimes there has been a pull: a better energy source has come along. In the 1700s and 1800s, industrializing societies were both pushed and pulled to coal from wood. They were depleting their forests, and they found that coal, a more energy-rich fuel, was more efficient in factories. In the early 1900s, the British Navy was pulled to oil from coal—a decision that later prompted a similar shift in civilian transportation—because black gold is denser, cleaner, and easier to move around than the black rock.

In the second half of the 20th century, the big energy shifts were pushes: reactions to politically induced supply constraints. After their major cities were flattened by Allied bombs in World War II, Germany and Japan, both of which traditionally had to import most of the energy they consumed, rebuilt their infrastructures with energy efficiency in mind. And after the Arab oil embargoes of the 1970s, nations that at the time lacked their own known fossil-fuel supplies unleashed big national campaigns to ramp up alternative sources of power. France went nuclear, Brazil drove ethanol, and Denmark pushed wind. Necessity was the mother of invention.

As the 21st century dawned, the world appeared to be slamming up against an energy constraint far more structural than a war or an embargo: a natural-resource wall. Developing economies, particularly China and India, were slurping up massively more energy every year, and energy producers were struggling to unearth enough new fossil fuel to keep up. The trend lines pointed to a new era of energy scarcity—a fear that reached its apogee when, a decade or so ago, a geological term burst into the public lexicon: “peak oil.” The notion was that the world had consumed roughly half of all retrievable oil in the ground. Now at the top of that fateful supply curve, the theory went, humanity faced a future of rocketing pump prices and petroleum wars as it burned through the second half of Mother Nature’s petroleum gift. Many peak-oil acolytes predicted the future would be a road trip to Armageddon—a Malthusian comeuppance for a profligate world.

## A new era of plenty

What a difference a few years make. The high oil prices that peak-oil disciples saw as validation of their millennial predictions spurred technological breakthroughs that have, at least in much of the world, begun to vastly expand the economically producible energy supply. Today, production of the types of oil and natural gas industry insiders call “unconventional”—in plain English, hard to get out of the ground—is surging. That’s largely because the high prices made affordable the rollout of new production techniques such as fracking and horizontal drilling. The market, aided by government research spending, worked.

The upshot is evident in a flurry of excitement about unlocking vast stores of unconventional hydrocarbons across much of the planet—from the United States to China to Europe to Latin America. Less than a decade ago, American politicians were preoccupied with the country’s increasing

reliance on Middle East oil imports, and American industrialists were warning that high domestic energy prices were pushing manufacturing offshore. Today, politicians are debating whether to export large amounts of U.S. oil and gas, and all that domestic fossil fuel is leading some companies that might have located factories elsewhere in the world to keep or build them in the United States.

The fossil-fuel boom is evident too in a striking rhetorical shift by environmental activists and other promoters of low-carbon—mainly renewable—power. After years of arguing that renewable energy was necessary in significant part because fossil fuels were running out, they now contend that

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renewable energy is necessary largely because fossil fuels are ramping up. Across the world, they’re pushing for government caps on carbon emissions tough enough to make it uneconomic to burn those buried troves. Particularly in developing economies, whose energy appetite continues to grow, that argument is going to be a tough sell.

Renewable power itself is an important component of today’s nascent energy surge. Its production is soaring off a tiny base, so it remains a small slice of the global energy pie. But that slice has expanded far more quickly than many predicted, and today, quite mainstream projections for its future range from merely bullish to positively euphoric. Solar and wind power have been growing the fastest, driven by generous government subsidies. Three things have motivated those incentives: concern about climate change, a desire by many governments to promote domestic jobs, and nationalistic bids by those same countries to win what they have concluded will be one of the 21st century’s great technological races.

Yet economic forces, once unleashed, have a way of spinning out of control. And renewable energy has snowballed from a cute green dalliance to a cutthroat global industry with a speed and intensity that has sideswiped even many of its fans. Initially, European countries rolled out subsidies that made it profitable for companies both to manufacture wind turbines and solar panels and to peddle the higher-priced electricity that those contraptions cranked out. Then, countries with low-cost manufacturing, notably China, exploited the European incentives to ramp up big, export-oriented renewable-energy industries of their own. Later, as this global rush brought economies of scale to what had been inefficient infant industries, the cost of wind and solar energy came drastically down. Today, in a handful of places around the world that have lots of wind or sun, or have very high conventional-electricity prices, or have both, the cost of power from these renewable sources is competitive with the cost of power from coal or gas.

## A bright future—for some

The spread of new resource riches could be stopped by a host of technological, political, and economic barriers. But key players in the global economy are coming to believe it's a new normal they can't ignore.

OPEC is particularly worried. Last year, in widely reported remarks, the energy minister of Nigeria, an OPEC member, called surging U.S. shale oil production "a grave concern." Facts on the ground appear increasingly to justify those jitters. This June, the International Energy Agency

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(IEA, 2014) projected in a report that OPEC's share of the world's "productive" oil capacity will continue to fall, to 57 percent of global capacity in 2019 from 58 percent in 2013, while the share from non-OPEC countries will rise, to 43 percent from 42 percent. Those relatively tame statistics mask scarier shifts for the cartel that long has dominated global oil production. Between 2012 and 2013, as North America's oil production jumped 1.35 million barrels a day, OPEC's fell 850,000 barrels a day, according to the IEA. And although OPEC's capacity is projected to be 2.08 million barrels a day higher in 2019 than in 2013, that expected jump assumes that more than half the growth comes from Iraq, a country that isn't on stable footing. "Given Iraq's precarious political and security situation," the IEA warned in its report, "the forecast is laden with downside risk." Although the decline in OPEC production thus far is due chiefly to political and geological difficulties within OPEC countries, OPEC members are expressing growing worry that, with oil production rising in the United States, there will be less demand for oil from OPEC.

OPEC isn't the only power fretting about the jump in U.S. energy production. So is European industry, which fears that falling energy prices across the Atlantic will make Europe less competitive as a producer of global goods. This February, the chief executives of more than 100 energy-intensive companies with large operations in Europe—such giants as Rio Tinto Alcan, ArcelorMittal, BASF, ThyssenKrupp, Johnson Controls, and Merck—signed a letter calling on European policymakers to boost the continent's natural gas production and ease a raft of carbon-cutting mandates it has imposed. Those two moves, asserted the industry group that organized what it called this "manifesto," would reduce European energy prices, making European industry more competitive with factories in the United States.

The rise of renewable energy is fueling fights as intense as those raging over the resurgence of oil and gas. Solar power is a particularly fraught case in point.

Solar provides less than 1 percent of annual global electricity generation, according to the IEA. But even that rep-

resents a several-fold increase from solar's footprint just five years ago. And it masks higher penetration in certain places. Solar accounts for some 8 percent of total annual electricity generation in Italy, about 5 percent each in Germany and in Spain, and about 2 percent in Australia, according to the IEA. In California on some days, more than 6 percent of electricity comes from the sun. Globally, solar will account for more than 1 percent of annual electricity production by the end of this year, projects the IEA, which contends that, from there, solar's future will get significantly sunnier.

Solar has grown in large part because subsidies have spurred advancements that have pushed costs down. By many estimates, the average price of a solar panel has tanked 75 percent or more in the past few years. One of the main reasons for that price drop was an unexpected surge in Chinese factories making low-cost solar panels. That has infuriated the Western companies that dominated the solar industry in its early days. Several of those companies have filed complaints with international trade authorities, alleging that Chinese solar-panel makers got an illegal leg up through Chinese subsidies so generous that they violate World Trade Organization rules. China denies violating any law. Whoever is right legally, the allegations have set off a trade war pitting China against the United States and Europe, with each side slapping tariffs on solar components that it imports from the other. In July, the United States signaled it intended to ratchet up its tariffs on Chinese-made panels yet again.

## Dawn of a new era?

Beyond the clash over who will profit from producing solar panels is a battle over who will win and lose from selling solar power. Around the globe, dominant electricity producers are growing concerned that the spread of cheaper solar panels will encourage more customers to produce their own power, eroding the utilities' customer base. In Germany, the big utility E.ON has blamed the rise of rooftop solar panels for disappointing quarterly earnings. In the United States, David Crane, CEO of U.S. power producer NRG Energy, has called rooftop solar power "a mortal threat" to utilities' business. In Hawaii, the dominant power company recently announced it's strictly limiting the number of rooftop solar panels it will connect to the grid.

Energy can be dangerous and unpredictable. That's true at a wall outlet, and it's true for the globe. Not long ago, the prevailing concern was that there wasn't enough energy to power the world. Now, among players from oil producers to electric utilities to multinational manufacturers, there's a new worry: that a proliferation of new energy technologies and supplies is starting to undermine world powers. ■

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