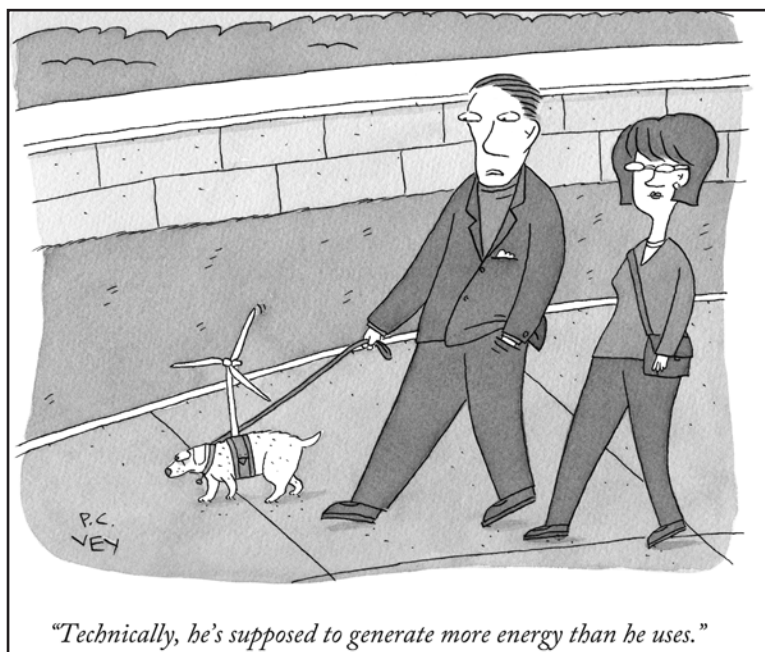




Energy

# ENERGY RESTRUCTURING CONTINUES

**After complaining that the agreement** was too weak, Nicaragua finally gave in and joined the Paris Agreement last year. So did Syria, which had otherwise been bogged down by its civil war. That left the U.S. as the **only country** not in the global deal to reduce global carbon emissions. Meanwhile, the Trump administration has abandoned the Obama administration's emissions targets for both cars and power plants, while also imposing tariffs on overseas solar panels. Does the apparent political headwind in the U.S. threaten the viability of the global energy industry's restructuring and the shift toward more green energy? The answer to that is hinted at in the actions last year of the **Kentucky Coal Museum**, which installed 80 solar panels on its roof to save \$8,000 in annual electricity costs. (*New York Times* 11/7/17; *Washington Post*, 10/24/17; *Time*, 1/22/18; *Wired*, 1/18; *USA Today*, 4/8/17)



## TAKEAWAYS

- Despite a White House that has shown little interest in addressing climate change or in adopting "green" energy, the strong economic case for renewables has encouraged their continued rollout in the United States, creating hundreds of thousands of jobs and changing the U.S. mix of fuels for electricity generation.
- Due to technological advancements, renewables are financially competitive with hydrocarbons and offer the benefit of long-term contracts and freedom from geo-political risk; businesses are increasingly turning to renewables to benefit from these low and stable costs.
- The emerging world is aggressively adopting renewables for a variety of reasons, including national energy security efforts (e.g., China), plans to reduce pollution (e.g., India) and economic diversification (e.g., Saudi Arabia).

## IMPLICATIONS

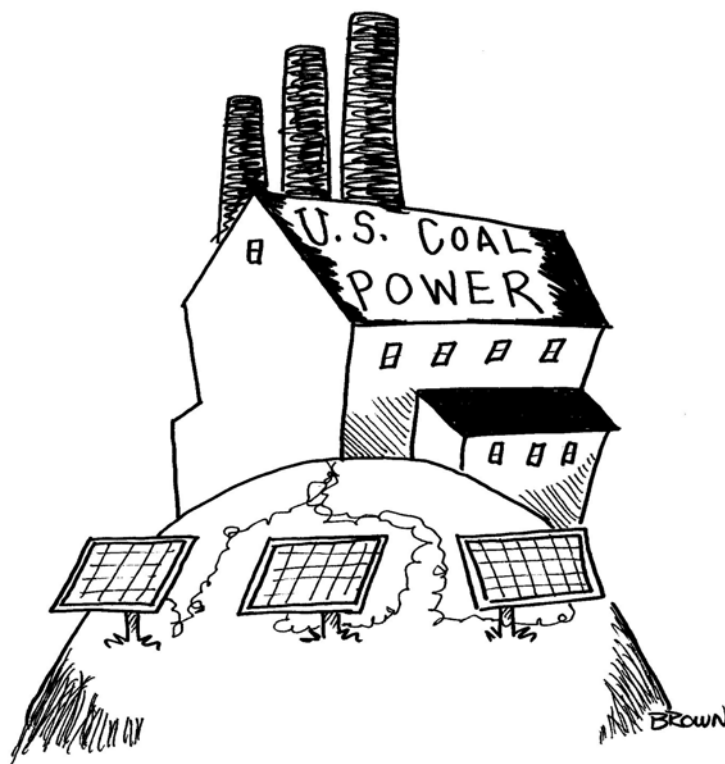
- The use of coal and natural gas in electricity generation will continue to become a less important part of the U.S. energy mix.
- The growth in U.S. renewables is now boosting the market for power storage, a still nascent industry.
- The use of renewables in the U.S. could accelerate – if further action is taken to build the necessary transmission infrastructure from rural to populated areas.
- China, Germany, India and other countries are ramping up their construction of large-scale transmission needed to make renewables work, which can benefit providers of high-voltage DC transmission equipment.
- Utility companies face major restructuring costs, with those that have invested in capital-intensive hydrocarbon and nuclear production plants facing the need to rationalize those investments and in some cases shut down plants before the end of their natural lifespan.

## "Green" Is Already Big Business in the U.S.

In 2016, we shared several observations that suggested the "lower for longer" hydrocarbon prices being orchestrated by the Saudis couldn't, as we said then, "derail the renewables revolution." Although world fossil-fuel prices plunged from June 2014 to January 2016, that reality did not slow the global scramble to deploy renewables, which, in countries such as the United States, was driven by a desire for electricity cost savings, and in countries such as China and India, was driven by a desire to reduce air pollution and rely less on foreign energy. Most startlingly, in Saudi Arabia the drive for green technology was attributable to a desire to create a more efficient and robust economy, one less dependent on hydrocarbons. (see [IF 3705](#))

Our current observations suggest that, much in the way low hydrocarbon prices did not thwart the growth of renewables in recent years, neither will current political roadblocks in the U.S. Although climate-change skepticism and tough trade rules are in vogue at the White House, the economics of renewables gives the industry political clout in the United States, and that clout often goes unrecognized. For instance, the U.S. solar industry currently employs 374,000 people, and the U.S. wind industry employs 102,000. By comparison, the U.S. coal industry including mining, distribution and use at power plants, employs 160,000, somewhere between solar and wind. Moreover, many of those "green" wind and solar jobs are in politically conservative "red" states in rural or sunny geographical parts of the U.S. In fact, almost 90 percent of the wind capacity added in the United States in 2016 was in states that voted for President Trump. Consider conservative Texas, which in 2017 tripled its solar-power generation from 2016, increasing it from 0.2 percent of all electricity production to 0.6 percent. Texas also increased its wind-power generation, from 15.1 percent to 18.8 percent, in the same year. Meanwhile, Luminent, Texas' largest electricity generator, announced plans to close three coal-fired power plants. (*Dallas Morning News*, 8/2/17, 10/29/17 and 10/30/17)

Luminent's planned coal-plant closures are a microcosm of the overall direction of the U.S. electricity-generating mix. In 2017, U.S. electricity generation from both natural gas and coal fell, 7.7 percent and 2.5 percent, respectively. This is the first time that both declined in the same year since 2008, during the height of the Great Recession, when overall power consumption dropped. (*Scientific American*, 3/25/18)



Such actions may continue because both wind and solar energy continue to get more and more efficient. Over the past several years, the largest wind turbines have continually grown in size, with an average capacity of 7.5 MW for the largest turbines today, versus 2 MW in 2005. Offshore turbines can go a bit bigger, with 9.5 MW of capacity. Meanwhile, solar is advancing on multiple fronts. The use of diamond cutting wire is now making possible ultra-thin slabs of silicon wafers that produce high energy yields with minimal raw material. Also, monocrystalline solar cells, before typically used only in satellites, now record up to 26.7 percent efficiency in converting sunlight to electricity, versus 21.9 percent for polycrystalline. China has launched a program to mass-produce these high-performance monosolar cells. At present, a Chinese-made mono cell is \$0.32 per watt, versus \$0.23 per watt for polycrystalline solar. Notably, it was China's ramp-up of polycrystalline solar-panel production starting around 2008 that helped drive down the price of those panels. (*Wired*, 1/18; *Reuters*, 9/14/17)

## "Green" Is About Financial "Green"

This ongoing deployment of renewables is driven in part by the savings they can offer businesses, as illustrated, ironically, by the Kentucky Coal Museum. Even without any public subsidies, it costs \$47 per MW hour to generate electricity from wind in North America, versus \$63 for natural gas and \$102 for coal. Beyond simply

installing on-site renewables, businesses can contract for renewable power through the utility grid by making power purchase agreements (PPAs), which pay renewable generators a guaranteed rate to provide electricity supply to the grid used by those companies. These are often long-term fixed-rate contracts that insulate companies from the fluctuations and geo-political instability of global hydrocarbon prices. Companies such as Amazon, AT&T and Google have purchased a cumulative 20 GW of green-power PPAs, while other companies, including AB InBev, T-Mobile and First Third Bank, all plan to shift to 100 percent renewable power consumption in the coming years. As we noted previously in an *inFocus*, some companies, such as MGM Resorts, are even willing to pay termination penalties to get out of their utility contracts and switch to green-energy suppliers. (see [inF 1109](#); *Economist*, 6/10/17; *Wall Street Journal*, 9/7/17; *MF*, 3/18/18)

The business case for green energy, in certain parts of the U.S., continues to drive a change in how the country generates power:

- More than half of new electric generation in 2016 came from wind and solar. (*Popular Science*, 2/18)

- As of March 2017, wind and solar accounted for 10 percent of the U.S. electricity generation, up from less than one percent in 2000. (*Time*, 7/10/17)

- About half of all utility-scale electricity-generating capacity in the U.S. installed during 2017 was renewable. When looking at **net** new generating capacity (taking into account decommissioned hydrocarbon plants) **renewables made up 94 percent of net electricity installations** in 2017. (*U.S. Energy Information Administration*, 1/10/18; *Popular Mechanics*, 2/18)

- NV Energy has plans to build 100 MW of solar capacity in Nevada to fulfill a long-term PPA from what they call a “major customer.” (*Energy Manager Today*, 11/9/17)

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## The Emerging Markets Lead the Way

As U.S. companies continue their rollout of “green” electricity – despite hydrocarbon prices and White House leadership – consider this: While the U.S. was on track for 52 GW of total installed solar capacity at the end of 2017, China was on track for 123 GW of total installed solar

capacity. In April of this year, China’s National Energy Administration announced that the country installed 9.65 GW of new solar PV capacity in the first quarter, up 22 percent on the same period in 2017. The U.S. is pursuing these renewables apace, but many countries in the emerging world feel an even more pressing need to pursue them as a way to reduce pollution, increase energy security with domestically produced power and diversify economies away from hydrocarbons. China’s aggressive move toward renewables is already helping to meet those goals, as the country passed its peak coal consumption a few years ago. Four years after declaring a “war against pollution,” Chinese cities have seen concentrations of fine particulates in the air drop 32 percent. (*Futurity.org*, 3/18/18; *Clean Technica*, 4/24/18; *Motley Fool*, 9/17/17)

Other emerging-market countries are following suit:

- Egypt is working on the largest solar park in the world, which could provide 1.6 to 2 GW of solar power by the middle of 2019. A consortium of banks (including the Asia Infrastructure Investment Bank and Africa Development Bank) are funding the projects. (*Egypt Independent*, 2/25/18)

- **India is now the third-largest solar market**, behind the U.S. and China, and is surpassing Japan, after doubling its capacity between 2016 and 2017, from 10 GW to 20 GW of production. India is also working on what could be one of the world’s biggest solar parks, a 2 GW project that would power 700,000 Indian homes. Meanwhile, India hosted the inaugural International Solar Alliance conference, which aimed to raise \$1 trillion to promote solar generation in 121 countries. Prime Minister Modi has called for the country to have 100 GW of solar capacity by 2022. (*Los Angeles Times*, 3/19/18)

- Riyadh and Softbank announced plans to spend \$200 billion by 2030, building solar generation in Saudi Arabia. The first phase would cost just \$5 billion, with the first project beginning this year; by 2019 the venture will be producing 7.2 GW of power. (*Financial Times*, 3/29/18; *The National*, 3/28/18)

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## Next Steps for Renewables – Transmission and Storage

One of the reasons Texas has been able to leap to the forefront of U.S. renewable generation is because the state controls its own electricity transmission grid.

The state has invested in the long-distance transmission necessary to bring solar and wind power from the rural western part of the state to the populous east. The rest of the continental U.S. is on one of two large regional grids, which have struggled to build new long-distance transmission, in spite of ambitious plans. Such development may require a national strategy, versus the current list of local and state permits needed to build transmission networks and a “not in my backyard” mentality that pushes against new power lines. That is a problem Beijing, with its strict governmental control, does not have. President Xi has identified transmission as a priority, and so transmission development is happening. State Grid, China’s state-owned electricity utility, is halfway through a plan to be finished by 2020,

to spend \$88 billion on ultra-high-voltage direct current (UHVDC) lines that crisscross the Middle Kingdom. Can the growing blue/red clout of renewables in the U.S. eventually see America pursue this strategy as well? (*Economist*, 1/14/17)

Storage is another issue. We are starting to see some small utility-scale storage projects, and many private companies have demonstrated proof-of-concept microgrids and storage in Puerto Rico, in the aftermath of Hurricane Maria. Again, it is perhaps China that will make storage availability more widespread, similar to the way the country did for solar. Under the auspices of Beijing, Chinese companies plan to produce 120 GW-hours of batteries per year by 2021. (*Bloomberg*, 6/28/17)