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China's Wind Farms Come With a Catch: Coal Plants

SHANGHAI—China's ambition to create "green cities" powered by huge wind farms comes with a dirty little secret: Dozens of new coal-fired power plants need to be installed as well.

Part of the reason is that wind power depends on, well, the wind. To safeguard against blackouts when conditions are too calm, officials have turned to coal-fired power as a backup.

China wants renewable energy like wind to meet 15% of its energy needs by 2020, double its share in 2005, as it seeks to rein in emissions that have made its cities among the smoggiest on Earth. But experts say the country's transmission network currently can't absorb the rate of growth in renewable-energy output. Last year, as much as 30% of wind-power capacity wasn't connected to the grid. As a result, more coal is being burned in existing plants, and new thermal capacity is being built to cover this shortfall in renewable energy.

In addition, officials want enough new coal-fired capacity in reserve so that they can meet demand whenever the wind doesn't blow. This is important because wind is less reliable as an energy source than coal, which fuels two-thirds of China's electricity output. Wind energy ultimately depends on wind strength and direction, unlike coal, which can be stockpiled at generators in advance.

Further complicating matters is poor connectivity between regional transmission networks, which makes it hard for China to move surplus power in one part of the country to cover shortfalls elsewhere.

China may not be alone in having to ramp up thermal power capacity as it develops wind farms. Any country with a combination of rapidly growing energy demand, an old and inflexible grid, an existing reliance on coal for power, and ambitious renewable energy-expansion plans will likely have a similar dilemma. What marks China out as different is the amount of new coal-fired capacity that needs to be added.

The China Greentech Initiative, a group made up of more than 80 mostly large Western companies and organizations with interests in the environmental sector, said in a report earlier this month, "China's increased focus on renewable energy exerts yet greater demands on China's electric power infrastructure. Power generation based on renewable energy sources ... necessitates greater use of intermittent generation management and storage."

"China will need to add a substantial amount of coal-fired power capacity by 2020 in line with its expanding economy, and the idea is to bring some of the capacity earlier than necessary in order to facilitate the wind-power transmission," said Shi Pengfei, vice president of the Chinese Wind Power Association.

Largely due to its reliance on coal, China is the world's biggest emitter of greenhouse gases in absolute terms. Last year, the country accounted for more than 85% of global growth in coal demand, according to BP PLC's statistical review of world energy.

Facing pressure from abroad over the pace of China's emissions growth, President Hu Jintao used a speech to the United Nations last Tuesday to stress his country's commitment to tackling climate change. He said China will lower energy intensity as the country grows, while raising output of renewable energy and nuclear power. China aims to cut carbon dioxide emissions per unit of gross domestic product by a "notable margin" by 2020, Mr. Hu said, without setting a concrete cap.

The city of Jiuquan, in the flat and arid northwestern province of Gansu, shows the complexities that crop up when implementing such plans. The city is meant to showcase the strides China is making in renewable energy. Wind turbines with a combined capacity of 12.7 gigawatts are due to be installed there by 2015—more than the country's present nuclear-power capacity.

But the Jiuquan government wants to build 9.2 gigawatts of new coal-fired generating capacity as well, for use when the winds aren't favorable. That's equivalent to the entire generating capacity of Hungary.

Construction of these thermal power plants is pending approval by Beijing, an official with the Energy Department under the Jiuquan Development and Reform Bureau said Tuesday.

The heavy reliance on coal-fired power plants to add to the power supply from large wind farms in order to meet minimum power demand is essential to grid safety, said Mr. Shi of the Chinese Wind Power Association.

To be sure, any kilowatt hour of wind power consumed by end users ultimately replaces a kilowatt hour of electricity generated by other, possibly dirty, sources such as coal, and the huge power supply expected from the new wind farms represents a major stride in China's clean energy push.

In addition to Jiuquan, there are plans for six other wind farms in China with a capacity of more than 10 gigawatts each, mostly in sparsely populated inland regions such as wind-swept Inner Mongolia and Xinjiang.

Several gigawatts of new thermal power capacity will need to be built at these sites as well, Mr. Shi said.

China has plenty of windswept plains and sun-baked deserts like the Gobi which can host turbines or solar panels, but these are often far from cities and existing infrastructure for shipping power. Sebastian Meyer, director of research and advisory services with clean-energy consultancy Azure International, says China needs a more modern and flexible grid if it wants to raise the share of renewable power in its energy mix.

So-called smart-grid technology aims to modernize the power sector by overlaying digital communications onto the grid, enabling utilities to manage supply more efficiently and compensate for any variance. But while the U.S. and many countries in Europe are lining up spending to exploit the technology, China is lagging behind.

State Grid Corp., China's monopoly power distributor in all but five provinces, says it wants to build a nationwide "strong smart grid." But while it is investing heavily in grid improvements, its immediate focus is the construction of ultrahigh-voltage lines linking China's coal production and hydropower centers in inland areas to the densely populated east.

A single such line can carry up to 6.4 gigawatts of power, which makes it even more important that generation at its starting point is stable and reliable.

—Jing Yang

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