

## Water Demands of Coal-Fired Power Drying Up Northern China: Scientific American

**Notebook:** Chinese Connection

**Created:** 6/29/2013 4:46 PM

**URL:** <http://www.scientificamerican.com/article.cfm?id=water-demands-of-coal-fired-power...>

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# Water Demands of Coal-Fired Power Drying Up Northern China

The coal industry withdraws 15 percent of China's water, much of it in arid northern China

By [Coco Liu](#) and [ClimateWire](#)

**ClimateWire**

SHANGHAI -- The world's biggest coal consumer now has a new incentive to take a cleaner energy path, as China's coal-fired power [plants](#) are drying up the country's already scarce [water](#) resources.

A report published today by Bloomberg New Energy Finance notes that the top five Chinese power generators -- China Huaneng Group, China Datang Corp., China Huadian Corp., China Guodian Corp. and China Power Investment Corp. -- have hundreds of gigawatts of coal-fired power plants in the country's



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**DRYING UP:** China's total water reserves dropped 13 percent from 2000 to 2009, with the water shortage being particularly severe in the north. Pictured: coal-fired power plant outside of Beijing.

dry north and that retrofitting them with water-efficient solutions could cost billions of dollars.

*Image: Flickr/Bret Arnett*

"Today, 85 percent of China's power generation capacity is located in water-scarce regions and 15 percent of this still relies on water-intensive, once-through cooling technologies," said Maxime Serrano Bardisa, one of the report's authors as well as Bloomberg New Energy Finance's water analyst.

At the same time, the nation is seeing less and less water. According to separate research by the China Environmental Forum, an initiative of the U.S.-based Woodrow Wilson International Center for Scholars' global sustainability and resilience program, China's total water reserves dropped 13 percent from 2000 to 2009, with the water shortage being particularly severe in the north.

The coal industry has played a big role in the shortage, the report says. Northern China has 20 percent of the country's freshwater supply, but its coal mining and coal-fired power generators are thirsty for water. Bloomberg New Energy Finance estimates that in 2010 alone, the two sectors combined withdrew 98 billion cubic meters of fresh water across the region -- or nearly 15 percent of China's total freshwater withdrawals in the year.

If the five Chinese power giants continue their current development of coal-fired plants, the report predicts, the sector's water withdrawals will exceed 25 percent of China's 2030 target to cap its national water withdrawals at 700 billion cubic meters per year. Some Chinese regions have already extracted underground water faster than it is being replenished, and any increase in water withdrawals could further push China away from an environmentally sustainable future.

### **No easy solutions**

There are solutions to ease the water [stress](#), but each comes with major trade-





offs.

For instance, if China's coal-fired power producers move their future buildup from the dry north to parts of the water-abundant south like Jiangxi and Fujian provinces, they will have less trouble with water use but more challenges to sell the electricity they produce, as those regions are not industrial hubs. And replacing coal-fired power plants' once-through cooling systems with water-saving solutions like air-cooled systems will decrease the plants' thermal efficiency and as a result increase greenhouse gas emissions, the report notes.

Fixes for this carry a high price tag. The report says that if Chinese policymakers were to force the retrofitting of existing once-through cooling systems, more than 100 gigawatts of coal-fired power plants would be affected at a cost of \$20 billion -- not including the cost of a 10 GW reduction in power generation capacity due to lower efficiency.

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**1. sault**  
11:40 AM 3/25/13

Water intensity is one of the advantages of solar and wind power that hardly gets discussed. Since thermal plants like coal, nuclear and even gas plants need a lot

of water for cooling, they are a risky bet in arid regions or in places where water availability is uncertain due to various factors such as climate change. And water certainty is unstable since EVERYBODY starts withdrawing more and more water from rivers / lakes / etc. during droughts, leading to stiff competition for the stuff. And it's not like we can say, "Well, we'll do without irrigation so we can keep our nuclear plant running to keep the A/C on." because starvation and heat stroke are BOTH bad ways to shuffle off. And since water is ANOTHER aspect of fossil fuel use that is MASSIVELY subsidized, the true cost of water scarcity and uncertainty is not incorporated into the cost of running a power plant. In an increasingly water scarce world, solar and wind make more sense that a lot of people realize.

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**2. syzygygyzys**  
12:58 PM 3/25/13

How many wind turbines would it take to generate that much power and what would it cost?

- The largest wind turbine I found with a price was the Enercon E-126 rated at 7.5 MW.
- I found a price of 11,000,000 Euros (\$14,284,000) each for them.

$$100 \text{ GW} \div 7.5 \text{ MW} = 13,333 \text{ wind turbines}$$

$$13,333 \times \$14,284,000 = \$190,453,333,333$$

Now apply the real world factor of 22.5% of rated capacity over a year.

So,  $13,333 \div 0.225 = 59,260$  units to actually produce 100 GW.

So, the purchase cost is increased by the same factor to \$846,459,259,259.

You can't know that many significant digits so let's call it \$850 billion for 100 GW of power capacity.

Now this doesn't address the issue of when the wind blows, when you need the power, power transmission, or power storage.

I found an estimate for average world power usage of 1.5 TW. So multiply \$850B by 150 and you get about \$127 trillion.

Somebody check my math, but I think that's about right.

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**3. Sisko**  
03:23 PM 3/25/13

China will do what it believes is in the best interest of China. This is no different than India, Pakistan, etc, etc.

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**4. chandlerw74**  
03:58 PM 3/25/13

In this once-through power generation, where does the water go? Before I can become indignant at China for wasting its water, I need to know what the coal plants do with it. Is it all evaporated?

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**5. greenhome123**  
04:23 PM 3/25/13

I believe wind and solar energy will be the major future power sources of China. The incentive for the Chinese to use wind and solar will not be Global warming or pressure from other countries, it will be

the desire of Chinese people to breathe clean air and have access to clean water.

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**6. Crasher**

**04:23 PM 3/25/13**

Because of the speed of the development in China they are becoming the earliest to see the destruction of the environment that comes with out of control over use of resources. The west has till now been able to smooth over our destruction as we have been doing it at a much slower pace. However it is catching up fast. We need to see what is happening in China a react to it to try and save all of our environments before we make this planet hostile to our existence. We need the earth it doesn't need us!

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**7. syzygygyzys**

**05:24 PM 3/25/13**

Here's a link to the E-126 wind turbine. That puppy is 650 feet tall.

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**8. sault  
in reply to**

**syzygygyzys**

**06:04 PM 3/25/13**

You're using the WRONG capacity factor. New wind turbines are significantly above 30% capacity factor average and the 7.5MW models are probably pushing 50%. So let's even be generous and say the TRUE cost for that 100GW of baseload wind will cost \$650B. By comparison, new nuclear reactors are being built in Georgia, USA for \$8B a GW or \$800B for 100GW. Since both sources have negligible fuel costs (for now), wind comes out on top. But as I said previously, this price does not take into account that nuclear plants put stress on water supplies and wind turbines do not. And these nuclear plants still

accumulate waste that either has to be stored FOREVER or reprocessed through an ENTIRE other industry that the government would have to stand up because reprocessed fuel is 10x the cost of virgin nuclear fuel. And nobody really knows how much it costs to decommission these plants at the end of their lives since the only plant to be even partially decommissioned was Chernobyl. (Fukushima might give us more insight into how much decommissioning will actually cost.)

New coal power plants shouldn't even be built given what we know about climate change and natural gas plants are acceptable as long as methane leakage, groundwater contamination and earthquakes from fracking can be controlled.

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**9. sault**  
in reply to  
[chandlerw74](#)  
06:07 PM 3/25/13

Look at the huge cooling towers of the hundreds of power plants China has. All that steam coming out of them, and the vapor you can't see, is ALL lost water. Exhaust from the steam turbines is also probably not recovered. Finally, they dump a lot of hot water back into their intake source, leading to a lot of thermal pollution as well.

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**10. spartyb**  
06:41 PM 3/25/13

can someone please explain why a coal-fired power plant is so thirsty for water? why couldn't it run on a closed system, like a car for example.

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