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Solar Energy Firms Leave Waste Behind in China

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GAOLONG, China -- The first time Li Gengxuan saw the dump trucks from the nearby factory pull into his village, he couldn't believe what happened. Stopping between the cornfields and the primary school playground, the workers dumped buckets of bubbling white liquid onto the ground. Then they turned around and drove right back through the gates of their compound without a word.

This ritual has been going on almost every day for nine months, Li and other villagers said.

In China, a country buckling with the breakneck pace of its industrial growth, such stories of environmental pollution are not uncommon. But the Luoyang Zhonggui High-Technology Co., here in the central plains of Henan Province near the Yellow River, stands out for one reason: It's a green energy company, producing polysilicon destined for solar energy panels sold around the world. But the byproduct of polysilicon production -- silicon tetrachloride -- is a highly toxic substance that poses environmental hazards.



"It's poison air. Sometimes it gets so bad you can't sit outside. You have to close all the doors and windows," says Qiao Shi Peng, 28, shown in front of a dumping site in his village, who worries about his 1-year-old son's health. (Zhang Quanfeng - Photo By Zhang Quanfeng)

"The land where you dump or bury it will be infertile. No grass or trees will grow in the place. . . . It is like dynamite -- it is poisonous, it is polluting. Human beings can never touch it," said Ren Bingyan, a professor at the School of Material Sciences at Hebei Industrial University.

The situation in Li's village points to the environmental trade-offs the world is making as it races to head off a dwindling supply of fossil fuels.

Forests are being cleared to grow biofuels like palm oil, but scientists argue that the disappearance of such huge swaths of forests is contributing to climate change. Hydropower dams are being constructed to replace coal-fired power plants, but they are submerging whole ecosystems under water.

Likewise in China, the push to get into the solar energy market is having unexpected consequences.

With the prices of oil and coal soaring, policymakers around the world are looking at massive solar farms to heat water and generate electricity. For the past four years, however, the world has been suffering from a shortage of polysilicon -- the key component of sunlight-capturing wafers - - driving up prices of solar energy technology and creating a barrier to its adoption.

With the price of polysilicon soaring from \$20 per kilogram to \$300 per kilogram in the past five years, Chinese companies are eager to fill the gap.

In China, polysilicon plants are the new dot-coms. Flush with venture capital and with generous grants and low-interest loans from a central government touting its efforts to seek clean energy alternatives, more than 20 Chinese companies are starting polysilicon manufacturing plants. The combined capacity of these new factories is estimated at 80,000 to 100,000 tons -- more than double the 40,000 tons produced in the entire world today.



Cornfields in China's Henan Province died after a green energy firm dumped industrial waste inside a nearby village. The liquid waste evaporated and left white powder. Tests of the soil where the dumping occurred showed high concentrations of chlorine and hydrochloric acid, which do not exist naturally. (Zhang Quanfeng - Photo By Zhang Quanfeng)

But Chinese companies' methods for dealing with waste haven't been perfected.

Because of the environmental hazard, polysilicon companies in the developed world recycle the compound, putting it back into the production process. But the high investment costs and time, not to mention the enormous energy consumption required for heating the substance to more than 1800 degrees Fahrenheit for the recycling, have discouraged many factories in China from doing the same. Like Luoyang Zhonggui, other solar plants in China have not installed technology to prevent pollutants from getting into the environment or have not brought those systems fully online, industry sources say.

"The recycling technology is of course being thought about, but currently it's still not mature," said Shi Jun, a former photovoltaic technology researcher at the Chinese Academy of Sciences.

Shi, chief executive of Pro-EnerTech, a start-up polysilicon research firm in Shanghai, said that there's such a severe shortage of polysilicon that the government is willing to overlook this issue for now.

"If this happened in the United States, you'd probably be arrested," he said.

An independent, nationally accredited laboratory analyzed a sample of dirt from the dump site near the Luoyang Zhonggui plant at the request of The Washington Post. The tests show high concentrations of chlorine and hydrochloric acid, which can result from the breakdown of silicon tetrachloride and do not exist naturally in soil. "Crops cannot grow on this, and it is not suitable for people to live nearby," said Li Xiaoping, deputy director of the Shanghai Academy of Environmental Sciences.

Wang Hailong, secretary of the board of directors for Luoyang Zhonggui, said it is "impossible" to think that the company would dump large amounts of waste into a residential area. "Some of the villagers did not tell the truth," he said.

However, Wang said the company does release a "minimal amount of waste" in compliance with all environmental regulations. "We release it in a certain place in a certain way. Before it is released, it has gone through strict treatment procedures."

Yi Xusheng, the head of monitoring for the Henan Province Environmental Protection Agency, said the factory had passed a review before it opened, but that "it's possible that there are some pollutants in the production process" that inspectors were not aware of. Yi said the agency would investigate.

In 2005, when residents of Li's village, Shiniu, heard that a new solar energy company would be building a factory nearby, they celebrated.

The impoverished farming community of roughly 2,300, near the eastern end of the Silk Road, had been left behind during China's recent boom. In a country where the average wage in some areas has climbed to \$200 a month, many of the village's residents make just \$200 a year. They

had high hopes their new neighbor would jump-start the local economy and help transform the area into an industrial hub.

The Luoyang Zhonggui factory grew out of an effort by a national research institute to improve on a 50-year-old polysilicon refining technology pioneered by Germany's Siemens. Concerned about intellectual property issues, Siemens has held off on selling its technology to the Chinese. So the Chinese have tried to create their own.



(Photos By Zhang Quanfeng)

Last year, the Luoyang Zhonggui factory was estimated to have produced less than 300 tons of polysilicon, but it aims to increase that tenfold this year -- making it China's largest operating plant. It is a key supplier to Suntech Power Holdings, a solar panel company whose founder Shi Zhengrong recently topped the list of the richest people in China.

Made from the Earth's most abundant substance -- sand -- polysilicon is tricky to manufacture. It requires huge amounts of energy, and even a small misstep in the production can introduce impurities and ruin an entire batch. The other main challenge is dealing with the waste. For each ton of polysilicon produced, the process generates at least four tons of silicon tetrachloride liquid waste.

When exposed to humid air, silicon tetrachloride transforms into acids and poisonous hydrogen chloride gas, which can make people who breathe the air dizzy and can make their chests contract.

While it typically takes companies two years to get a polysilicon factory up and running properly, many Chinese companies are trying to do it in half that time or less, said Richard Winegarner, president of Sage Concepts, a California-based consulting firm.

As a result, Ren of Hebei Industrial University said, some Chinese plants are stockpiling the hazardous substances in the hopes that they can figure out a way to dispose of it later: "I know these factories began to store silicon tetrachloride in drums two years ago."

Pro-EnerTech's Shi says other companies -- including Luoyang Zhonggui -- are just dumping wherever they can.

"Theoretically, companies should collect it all, process it to get rid of the poisonous stuff, then release it or recycle. Zhonggui currently doesn't have the technology. Now they are just releasing it directly into the air," said Shi, who recently visited the factory.

Shi estimates that Chinese companies are saving millions of dollars by not installing pollution recovery.

He said that if environmental protection technology is used, the cost to produce one ton is approximately \$84,500. But Chinese companies are making it at \$21,000 to \$56,000 a ton.

In sharp contrast to the gleaming white buildings in Zhonggui's new gated complex in Gaolong, the situation in the villages surrounding it is bleak.

About nine months ago, residents of Li's village, which begins about 50 yards from the plant, noticed that their crops were wilting under a dusting of white powder. Sometimes, there was a hazy cloud up to three feet high near the dumping site; one person tending crops there fainted, several villagers said. Small rocks began to accumulate in kettles used for boiling faucet water.

Each night, villagers said, the factory's chimneys released a loud whoosh of acrid air that stung their eyes and made it hard to breath. "It's poison air. Sometimes it gets so bad you can't sit outside. You have to close all the doors and windows," said Qiao Shi Peng, 28, a truck driver who said he worries about his 1-year-old son's health.

The villagers said most obvious evidence of the pollution is the dumping, up to 10 times a day, of the liquid waste into what was formerly a grassy field. Eventually, the whole area turned white, like snow.

The worst part, said Li, 53, who lives with his son and granddaughter in the village, is that "they go outside the gates of their own compound to dump waste."

"We didn't know how bad it was until the August harvest, until things started dying," he said.

Early this year, one of the villagers put some of the contaminated soil in a plastic bag and went to the local environmental bureau. They never got back to him.

Zhang Zhenguo, 45, a farmer and small businessman, said he has a theory as to why: "They didn't test it because the government supports the plant."

Researchers Wu Meng and Crissie Ding contributed to this report.