

Corn, millet and ... rooftop solar? Farm family's newest crop shows China's solar ascendancy

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Solar panels sit on the rooftop of a house in the rural outskirts of Jinan in eastern China's Shandong province on March 21, 2024. China is the runaway leader in supplying the world with the hardware to gather solar power. Now it's pushing to install more at home, and it's working so well that the grid now has more power than it can handle. Credit: AP Photo/Ng Han Guan

Shi Mei and her husband earn a decent enough living by growing corn and millet on their small farm in eastern China's Shandong province. In 2021, they diversified by investing in solar energy—signing a contract to mount some 40 panels on their roof to feed energy to the grid.

Now, the couple get paid for every watt of electricity they generate, harvesting the equivalent of \$10,000 per year that Shi can track through an app on her phone.

"When the sun comes out, you make money," Shi said.

The Shi family is on the leading edge of a solar boom in China, which has long dominated global solar manufacturing but didn't always install a lot of it at home. That's changing as the government focuses on the urgency of cutting its worst-in-the-world greenhouse gas emissions at the same time it grows its green economy. China wants one-fifth of its power to come from renewables by 2025, and it's offered a wide range of subsidies to local governments and businesses.

The push—in both industrial solar and in rooftop installations like Shi's—is working so well that the grid now has more power than it can handle. Shi was fortunate to get in early; some cities across Shandong province, including her village, are halting new rooftop [solar installations](#)

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Analysts and solar companies say the future remains bright if China can quickly adapt to the oversupply. Companies and utilities are scrambling to build [battery capacity](#) to store all the power being generated. They'd like to see more flexible energy pricing that could shape demand to better match supply. And they'd like technology that makes it easier to start and stop coal power so it's not always the clean energy of solar power that gets "curtailed"—in industry jargon—when the grid can't take any more supply.

"China has the great potential and opportunity to make its power sector achieve its carbon peak by 2025," said Grace Gao, a Climate and Energy senior campaigner at Greenpeace in China. "I am looking forward to seeing Shandong truly become a leader in renewable energy and showcase its best practices to the rest of China."



Farmer Shi Mei walks near solar panels on her rooftop in the rural outskirts of Jinan in eastern China's Shandong province on March 21, 2024. The Shi family is on the leading edge of a solar boom in China, which has long dominated global solar manufacturing but didn't always install a lot of it at home. She gets paid for every watt of electricity generated. Credit: AP Photo/Ng Han Guan

SOLAR POWERHOUSE

As with many [infrastructure projects](#) in China, it is installing solar at breakneck speed and scale. China added 216 gigawatts of solar in 2023, a little over half in large solar farms, according to the country's National Energy Administration. China's total is more than half of what the entire world added last year, according to research from the consultancy Wood Mackenzie.

A gigawatt of solar is enough to supply the energy needs of about 320,000 Chinese households for a year, Gao said.

Shandong province added about 14 gigawatts of solar in 2023, and the province now has the ability to produce more power than it can use at certain times during the day. It's the leading province for renewable energy capacity, but that also means it's the first to encounter the difficulties of rapid growth.

"Other provinces will also meet these problems, because there will be more and more [solar energy](#)," said Peng Peng, the secretary general of China New Energy Investment and Financing Alliance, an industry group.



Solar panels power a rest station and provide power for electric vehicles along a highway on the outskirts of Jinan in eastern China's Shandong province on March 21, 2024. Credit: AP Photo/Ng Han Guan

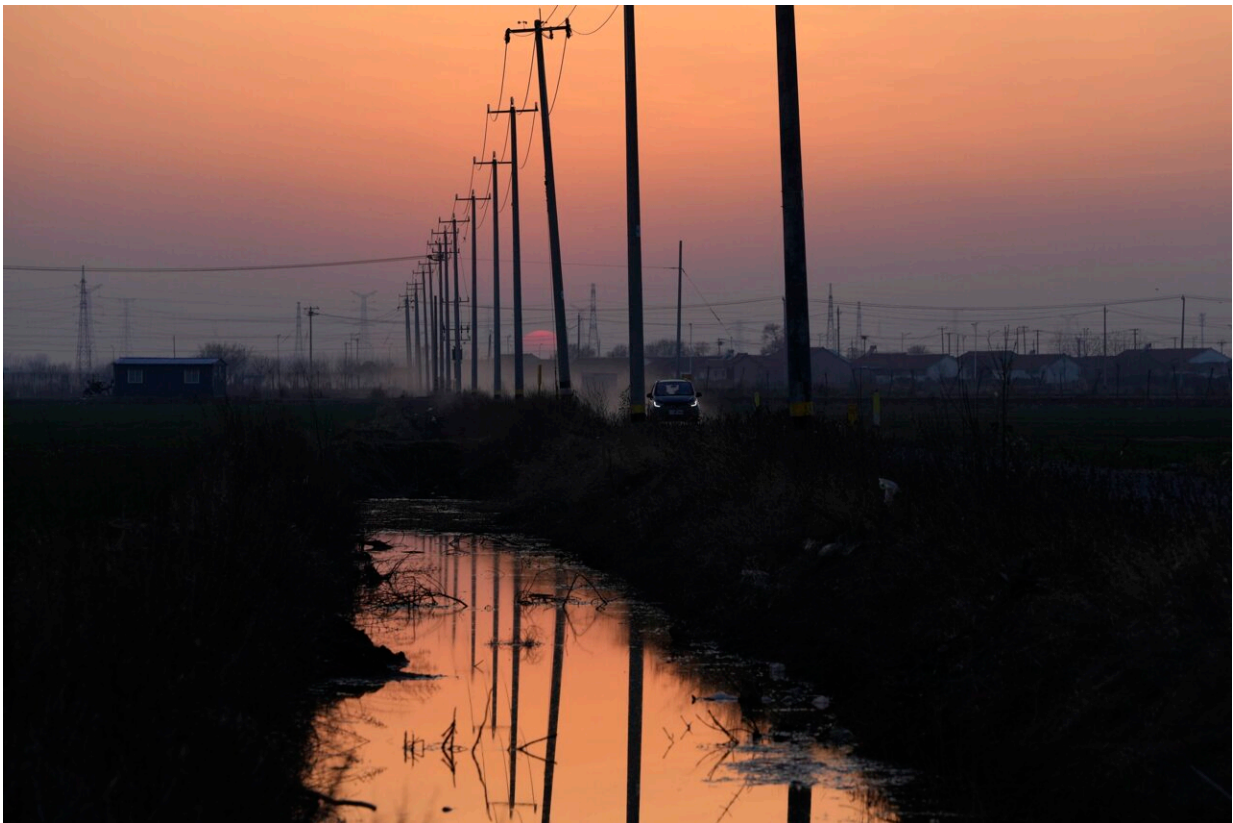
BOOM YEARS

After China announced subsidies for both rooftop and industrial solar in 2014, Shandong, with an advanced manufacturing industry, was a good candidate to take the early lead in solar development compared to less populous provinces like Qinghai or Inner Mongolia.

Wang Xingyong installs and maintains rooftop solar panels for clients ranging from villagers to factories, and said his business has doubled every year since 2016.

"In the beginning, maybe we'd just do a project for one client, a farmer, and it'd be worth ten thousand yuan, fifty thousand," he said. "Later, we'd do a couple hundred thousand, millions, for just one project."

The business model varies, but many companies like Wang's solicit villagers and factories for the chance to use their roofs. Villagers buy the systems and get payouts from selling the electricity to the grid. Wang gets paid to build and maintain the solar setups for factories that use the electricity they generate.



The sun sets near pylons as an electric vehicle passes a dirt road in the rural outskirts of Weifang in eastern China's Shandong province on March 22, 2024. Chinese battery companies, EV manufacturers and utilities are all racing to develop more advanced batteries to store the electricity from solar panels.
Credit: AP Photo/Ng Han Guan

Wang said the concept was a hard sell at first, with few people believing the government would pay them for generating electricity. Wang said he slowly won people over, starting with his family and friends, putting forward the money for the equipment himself, and then moving on to other villages with the results.

While pitching, few talk about big concepts like the country's target to ensure carbon emissions peak at 2030. It comes down to cash in people's pockets. Shi, the farmer, said her neighbors installed solar panels on their roofs after seeing her investment do well.

"Compared to just putting your money in a savings account, the rate of return is higher," she said. Thanks to her contract from 2021, she's still earning money even though the village has stopped allowing new installations.

A second model allows families to basically get paid rent to allow solar to be installed on their roof—as much as 3,000 yuan (\$414) a month, said Liu Wenping, an investor in solar companies. They might also get a free air conditioner or refrigerator as an extra incentive, and get a small percentage from the electricity sold, though not as much as people who buy the solar equipment.



A solar farm stretches out near a chemical plant in the outskirts of Weifang in eastern China's Shandong province on March 22, 2024. It's the leading province for renewable energy capacity, but that also means it's the first to encounter the difficulties of rapid growth. Credit: AP Photo/Ng Han Guan

SOLUTIONS IN PROGRESS

Chinese battery companies, EV manufacturers and utilities are all racing to develop more advanced batteries to store the electricity from [solar panels](#). Batteries are getting cheaper, but still affect the overall model's profitability. The Shandong provincial government is running a pilot program in Dezhou with lithium iron phosphate batteries that can store power during peak production and feed it to the province's grid later as needed.

Other fixes include moving to what's called spot market pricing, with the price fluctuating in an open market. China currently uses prices set by regulators for its electricity, updated after intensive research. Without pricing flexibility, China can't incentivize customers to shift some use to non-peak times by lowering prices during those times.



Solar panel installer Wang Xingyong stands near the electric panels connecting the rooftop solar panels he helped install for a farmer to the power grid in the rural outskirts of Jinan in eastern China's Shandong province on March 21, 2024. Wang installs and maintains rooftop solar panels for clients ranging from villagers to factories, and said his business has doubled every year since 2016. Credit: AP Photo/Ng Han Guan

But just last year, regulators in Shandong introduced trough pricing, with prices slashed sharply to encourage people to use electricity right when it was being generated abundantly but use was very low—in this case, the lunch period when factories typically all break at the same time. Factories responded by shifting some of their use to get some of the cheaper power.

Solar analysts say they expect China to eventually move towards completely market-driven pricing with the grid.

Meanwhile, China is intent on improving its grid. The National Development and Reform Council, which oversees economic policy and implementation, in February called on provinces to focus on increasing flexibility to the grid. It included a call to retrofit old coal plants with new technology so they can power up and down much more quickly. The council also wants a "smart" grid that can quickly decide the best time to distribute the power being generated.



Workers cut metal parts at a factory that produces many things including brackets for rooftop solar panels in the rural outskirts of Jinan in eastern China's Shandong province on March 21, 2024. Credit: AP Photo/Ng Han Guan



Wind turbines dot the coastline along a giant solar farm near Weifang in eastern China's Shandong province on March 22, 2024. Chinese battery companies, EV manufacturers and utilities are all racing to develop more advanced batteries to store the electricity from solar panels. Credit: AP Photo/Ng Han Guan



Solar panel installer Wang Xingyong walks near a mural depicting revolutionary leader Mao Zedong and cherry blossoms in the rural outskirts of Jinan in eastern China's Shandong province on March 21, 2024. Wang installs and maintains rooftop solar panels for clients ranging from villagers to factories, and said his business has doubled every year since 2016. Credit: AP Photo/Ng Han Guan



The sun sets over electric pylons along a solar farm near Weifang in eastern China's Shandong province on March 22, 2024. Chinese battery companies, EV manufacturers and utilities are all racing to develop more advanced batteries to store the electricity from solar panels. Credit: AP Photo/Ng Han Guan



Workers cleaning solar panels work on the rooftop of the factory of energy equipment manufacture Iraeta on the outskirts of Jinan in eastern China's Shandong province on March 21, 2024. It's the leading province for renewable energy capacity, but that also means it's the first to encounter the difficulties of rapid growth. Credit: AP Photo/Ng Han Guan

"Every country in the world that is installing a lot of renewables and then facing the challenges that arise from all this variable intermittent generation, is searching for smart ways, intelligent AI-enabled or at least model-backed approaches to distributing this power and using it in the most efficient and effective way," said David Fishman, a senior manager at the Lantau Group consultancy who tracks China's energy industry. "Certainly that's where China is heading."

There's no sign of a pause in China's solar buildout. Companies are flocking to other provinces in the south that aren't as far along as Shandong.

And in Shandong, Wang, the solar installer, is optimistic about his prospects despite the halt in new projects, because he still has industrial clients. He's already planning to invest in upgrading transformers. And he's intrigued by a trend driven by China's electric car explosion, with the installation of all-in-one stations that combine solar generation, battery storage and electric vehicle charging.

"I trust the future will be better and better," he said.

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