China brings solar home

China is the biggest manufacturer of solar photovoltaics, and with declining local costs coupled with potential pollution reduction and health co-benefits, domestic use of solar photovoltaics might surge even more dramatically in the very near future.

For a while it looked like the world was comfortably settled into a bipolar order. The production pole was centred in and around China where many of the world's goods and toys were made. The consumption pole, while increasingly scattered, still centred on the United States and Europe. This applied to solar photovoltaics (PVs) as well, with the European Union — particularly Germany — catalysing massive uptake of household solar PV systems using significant subsidies. China was where most of these solar panels were being made. The manufacturing still continues to be concentrated in China, but now the consumption has shifted rapidly to China as well. In 2015, China had a total deployed solar capacity of 43 GW compared to more than 94 GW in the EU¹. Last year China's total deployed capacity of 175 GW dwarfed the EU's 115 GW (ref. ²). China is now not only the world's biggest producer of solar panels, but also of solar-generated electricity.

There are signs that the demand for solar PVs in China is far from fully expressed. Both the United States and Europe have been attractive markets for Chinese-produced solar cells. However, recent policy changes might incentivize producers to further target local Chinese markets. In the United States, the tariffs imposed on imports of solar panels in 2017 had a negative impact on solar system deployment and thousands of jobs were lost in the sector, mostly in installation³. Faced by rising stocks, China cut its own subsidies, leading solar panel producers to significantly reduce prices to offload large inventory internationally, despite tariffs⁴. Even then Chinese internal consumption and installations grew significantly through 2017 and 2018, showing greater viability of China as a competitive market². Increased intensity in trade wars and US policy discouraging the uptake of solar PV (such as tariffs on panel imports) may — by creating

unsold inventory — depress the prices of solar systems internally for China, further increasing local uptake. Removal or tapering down of subsidies in other markets in Europe may have a similar effect.

The low price of solar systems, as well as the low labour costs for installation, means that achieving cost parity with the grid may be easier in China than in Europe or the United States, where overall household solar system costs continue to be comparatively higher. An *Analysis* in this issue shows just that; Jinyue Yan and colleagues in Sweden and China estimate the costs for solar electricity derived from both household and grid-scale systems, in each prefecture or city in China. They find that in all of the 344 prefectures, household solar systems can now generate electricity at a cost equal to, or lower than, the local grid-supplied electricity. Grid-level solar electricity systems can also generate electricity at a cost lower than coal-generated electricity in more than 20% of the prefectures.

This grid parity is a critical milestone made even more remarkable by the fact that the solar electricity costs estimated by the researchers do not include subsidies. Doubtless these prices will continue to vary in the near future — depending on national and international policy — but the trend is downwards and continuing. Grid parity provides the economic incentive for domestic consumers to buy into solar home systems and signals a potentially massive uptake of the technology in households in the near future.

Future policy-making is also expected to benefit solar uptake in China, particularly because of solar co-benefits such as pollution reduction and consequent public health and urban liveability gains. Urban air pollution negatively affects the lives of tens of millions of Chinese city dwellers in particular and has emerged as one of the most important concerns facing the Chinese government in recent years.

In an *Article* in our July issue, Bart Sweerts and colleagues quantify the pollution reduction gains of solar energy uptake. They start with a recently compiled dataset of measured irradiance from 119 stations all over China between 1960 and 2015. Using irradiance data, they estimate solar energy potentials in 1960 and 2015 and find that the accumulated pollution due to coal power plant emissions during this period reduced solar energy production potential by close to 13%. Adopting solar PV thus creates a feedback loop where pollution reduction gains lead to greater solar energy production. Findings like this provide a clear signal to Chinese policymakers that mass-scale solar PV adoption reduces air pollution beside direct energy and climate gains.

With growing economic and social impetus, China might be on the brink of further exponential growth in solar PV deployment. It certainly has the industrial base to facilitate such an energy transition once the social and economic tipping points are reached. The scaling in production needed to meet the potentially rising demand is something that China has done in the past and is certainly capable of in the future. China is also a country that is reinventing itself physically faster than any other country in the world. Entire new cities appear to have emerged on the skyline in the past decade and while the pace of development may have slowed down recently there continues to be plenty of opportunity to build human habitats and energy systems in entirely new ways. A new world is afoot in China and it may be powered by solar energy. □

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