

## Renewable energy in China: moving into the next great dynasty

*"The Changjiang River waves behind drive the waves ahead." – Ancient Chinese proverb*

China has a rich history filled with epic achievements. From engineering marvels such as the Great Wall of China to the technological advancements allowing the first Chinese to walk in space, China, with its rich wisdom and rapidly evolving technical capabilities, has seldom ceased to demonstrate its competencies to redefine possibilities.

Consuming [one-third of the world's electricity](#), the energy-hungry nation now faces a new challenge with even wider reaching consequences: developing a sustainable and [low-pollution](#) energy mix that will meet the needs of one-fifth of the world's population.

In an effort to step up to this challenge, China has become the world's leading investor in clean energy, ploughing [\\$89.5 billion into solar, wind and hydro power in 2015](#). To put this into perspective, this equates to 29% of total global spend on clean energy, with the next biggest spending being the US, which invested \$51.8 billion.

China's record-breaking level of investment isn't solely due to environmental issues. In a time of [economic downturn](#), the nation's government is ambitious to secure the future of its energy, relying on wind, water and sunlight for power, rather than on imported fossil fuels.

While the country looks on track to becoming a self-sufficient, clean energy superpower, there are some important issues it needs to tackle in order to rise to the challenge.

### Building more efficient solar farms

China is [planning to install](#) 15 GW of photovoltaic power in 2016, bringing an impressive total capacity to [43 GW](#). However, it poses challenges on the weak grid infrastructure. Close to [10% of China's solar capacity](#) remained unused during the first half of 2015 due to grid congestion. This lack of efficiency could spell disaster for China's renewable investment, as cost-effectiveness is just as important as output. If a plant isn't able to deliver at full efficiency, it could risk being shut down.

Smart plant control systems could help mitigate the challenge. With China's aging grid being so congested, it is important to control the output from its solar farms in order to ensure consistent base load delivered to the grid—during cloudy conditions, power output can be automatically raised to ensure it remains at the required level, further increasing plant efficiency. In reverse, the control system can also enable it to quickly react, based on grid condition, to avoid putting more pressure on already weak infrastructure or risk-causing grid congestion.

The prospect of [feed-in tariffs being cut for solar in 2016](#) is also about to hit the market. If China is to succeed in further expanding its power generation capacity, it must first focus on upping efficiency, as further spend could otherwise lead to an increase in unused capacity.

Intelligent inverters, such as [GE's solar inverters](#), are enabling more cost-effective solar farms worldwide. Higher voltage, such as 1,500 volts, compared to typical market offerings at 1,000 volts means 50% power output. Its 4-MW skid solution, consisting of four 1-MW inverters, means one inverter station instead of four—resulting in a more efficient farm layout and 3% lower cost of electricity thanks to reduced investment cost.

### Reducing the footprint of wind energy

China's renewable expansion isn't limited to solar. The nation is looking to expand its 120 GW of wind capacity a further [20 GW](#) this year. It faces similar challenges with an unstable grid, but also battles with another issue: real estate. The windiest areas where most power can be generated

tend to be furthest from the big cities where power is most needed, while wind farms near densely populated areas are becoming saturated.

One solution is to increase power density. This would allow a turbine to produce more power without upping its footprint. GE's low voltage wind converter offers a high power density solution, increasing power output by 25% compared to its previous generation, a key added value in such a densely populated area.

Another option is to move offshore and build on China's [10-GW target by 2020](#), but it looks as though the focus will [remain on dry land](#).

If China shifts this focus and looks to expand its offshore capacity, GE's converter, given its high reliability and power density, is well equipped to deal with the harsh conditions. The standard building blocks of these converters can allow operators as well as the local service team for better system management across on and offshore facilities.

GE has 10 years of offshore experience in the North Sea. Recently, GE is able to bring this technology to China, as the company has already begun [working with Sewind](#), one of China's largest offshore turbine suppliers, to provide 1 GW of LV3 wind converters for its turbines. As the converters are being manufactured in China, the country maintains local oversight of its energy operations.

### **Hydro is the king in China's renewable energy mix**

China has an incredible 320 GW of hydropower capacity. The jewel in its crown is the Three Gorges Dam, [which broke records in 2014 for its power output](#). However, hydro power is not without its challenges. It requires specific natural environments, which are relatively few and far between. It can also require the relocation of the local population and disruption of local ecosystems, neither of which is desirable. It is also extremely capital and resource intensive. The Three Gorges Dam used [21 million cubic yards of concrete](#)—another world record!

Nevertheless, given the enormous power output a single hydro project can achieve, hydro remains the most cost competitive and efficient energy source among renewable energy mix. To face China's ever increasing energy demand and pressure to reduce carbon emissions, coupled with the government's ambition to [develop 350 GW of hydro by 2020](#), hydro continues to be the leading power source among renewable energy.

Pumped-storage, another type of hydro technology, is also attracting efforts—the country aims to achieve [70 GW by 2020](#). It is an efficient and flexible form of energy storage, but on a very large scale, enabling utility companies to respond quickly to demand. However, most pumped-storage power plants deploy fixed-speed systems, meaning the only way to control pump output is to activate and/or deactivate individual machine sets. The use of GE Power Conversion's variable-speed drives can lead to higher efficiency. This is especially noticeable in partial-load operation, as the operating point can be perfectly adapted to grid conditions, an important factor considering the aging grid conditions in China.

### **"Waves behind drive the waves ahead"**

China is already establishing itself as a global renewable superpower, however, it now faces a different set of challenges, namely efficiency and scale, coping with an aging grid. It will need to meet these challenges head on to maintain its lead in renewable power generation.

"The Changjiang River waves behind drive the waves ahead." This ancient Chinese proverb says that each generation excels beyond the last one, driven by its wisdom and power. Considering the leaps that the current generation is making, perhaps the best is yet to come. Given the country's ambitious growth targets, China looks set to continue its long history of adapting to change as we move into the renewable age.

