

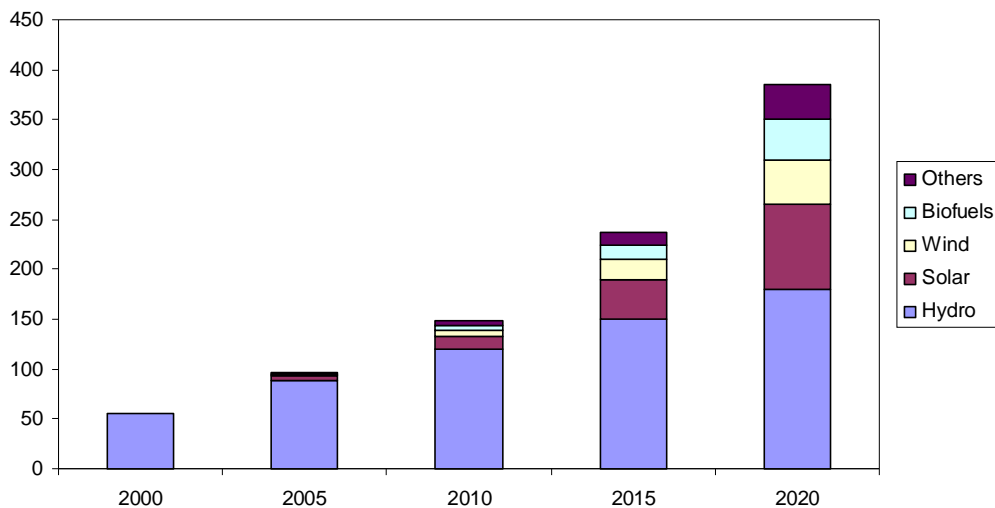
By Charles Bai, ReneSola CFO

## Solar Energy Demand in China

### Government Targets 15% Renewables by 2020

The Chinese government has signalled its strong desire to see a shift toward renewable energy, both for environmental and energy security reasons. The establishment of formal target for renewable energy -- from roughly 7% right now to 15% in 2020 -- will certainly require significant investment in renewable energy projects.

Figure 1. China Renewable Energy Output (mtoe), 2000-2020E



Source: BP and ReneSola Estimates

China energy demand for 2005 is estimated at around 1,460 million tons of oil equivalent (mtoe) of which roughly 97 mtoe comes from renewable sources – 7% of the total. 93% of this comes from hydro power. Even with a slow down in the rate of growth seen in the last five years, by 2020, China energy is expected to reach 2,500 mtoe. To reach the 15% target, renewable energy use must grow to 370 mtoe. Even if as expected hydro output doubles over that period it would still only be enough to meet 50% of the total. The rest must be shared between solar, wind and biofuels and other sources like biomass.

Solar is currently the second largest renewable energy source with a contribution of roughly 5 mtoe. However, nearly all of this comes from solar thermal (see section below). The government predicts that solar thermal use will rise to 20 mtoe by 2020. If as we predict, total solar energy use is up to 85 mtoe, solar PV would have to rise to an installed capacity of roughly 60,000MW by 2020.

## Renewable Energy Law Establishes Higher Feed-in Prices

The Renewable Energy Law, which came in to force this year, provides the framework for grid companies to start paying more for energy from renewable sources. The higher feed-in tariffs for these items will be financed by transfers from higher end-user charges.

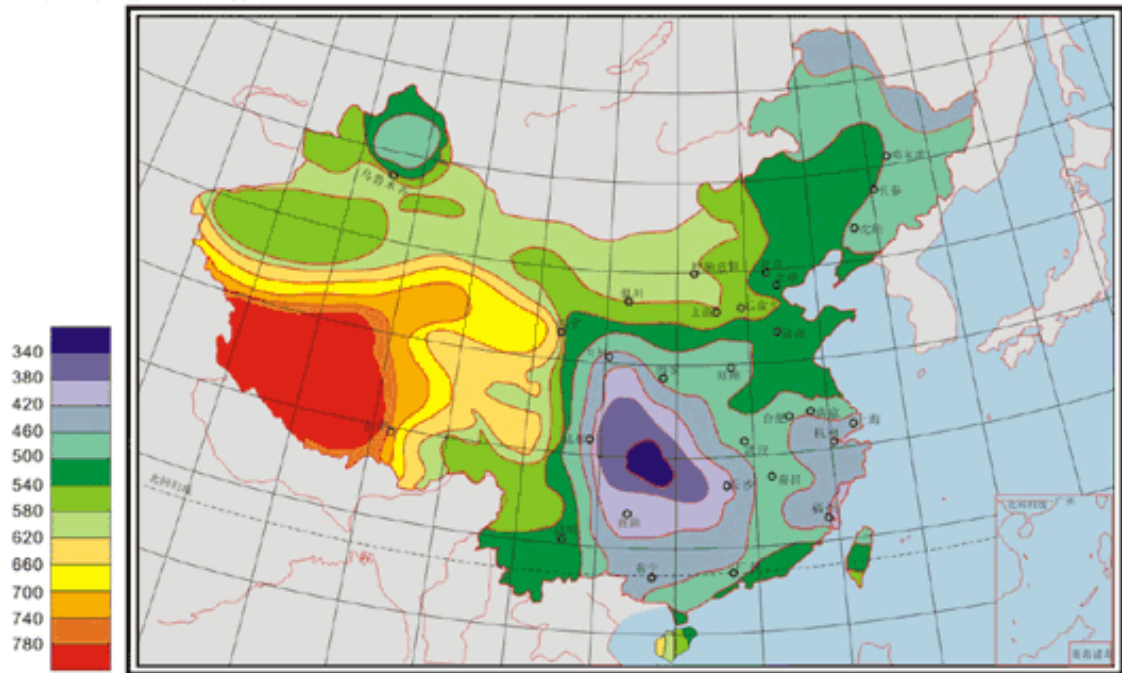
The prices for 2006 have been set at RMB0.49-RMB0.69/kWh (US\$0.06–US\$0.085/kWh) depending on which part of the country. This is roughly US\$0.03/kWh more than current grid prices. This will be in turn be financed by a general RMB0.01/kWh tariff increase for all end-users, except in the poorer western provinces. This subsidy represents a 1.5-2.0% increase in electricity bills. Given that the size of the electricity industry in total is around US\$100 billion, this means a total annual subsidy for the renewable energy industry of around US\$2.0 billion.

## Advantages of Solar in China

China has two big reasons to be a quick adopter of solar energy. Climatic conditions are good – the country, lies between 20N and 40N, and the North and West is almost completely cloudless. 70% of the country boasts solar resources in excess of 500KJ/cm<sup>2</sup>/year. By comparison solar insolation rates in Germany and Japan average only 400KJ/cm<sup>2</sup>/year and 450KJ/cm<sup>2</sup>/year respectively.

Another big advantage is that installation is so cheap. In many countries this can easily add \$2.00/watt to the cost of installing a residential system. In China we calculate that installation costs are at most US\$0.25/watt. This means that installed solar system prices in China are probably already the cheapest in the world at roughly US\$5.25/watt.

Figure 2. Solar Resources in China (KJ/cm<sup>2</sup>/year)



Source: ReneSola

### When Will PV Be Price Competitive?

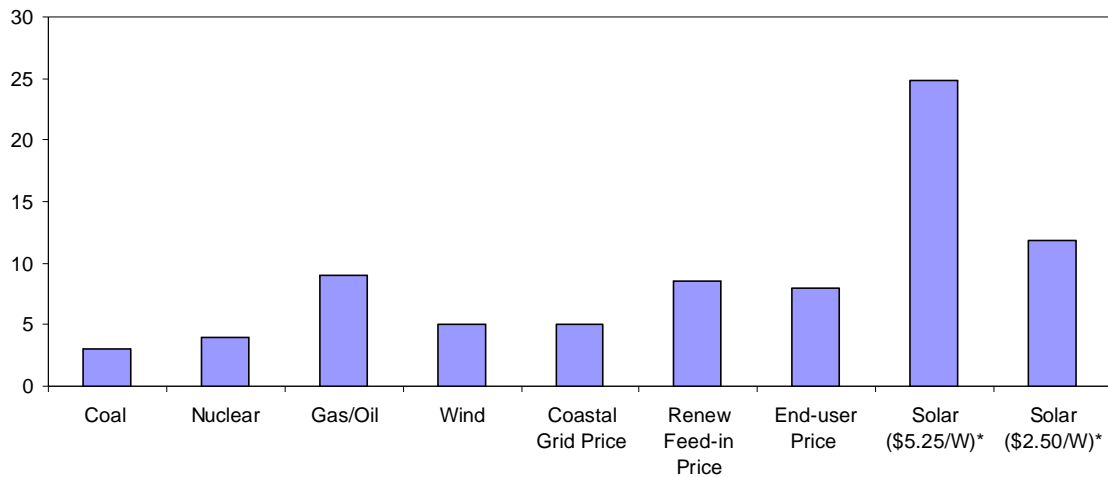
The current installation cost of US\$5.25/watt is equivalent to an average generating cost of around US\$0.25/kWh. If installed system prices were to drop to US\$2.50/watt (equivalent to a module price of around \$2.00/watt) then the implied generation price would drop to US\$0.12/kWh. With electricity prices -- particularly those paid for renewable electricity -- set to continue rising solar electricity should soon become a cost effective alternative.

Figure 3. China Solar Generation Prices, cents/kWh

	2005	2015
Price/watt	5.25	2.50
Price 1kW system	5,250	2,500
Output kWh/year	1,500	1,500
Year of service	25	25
Total output (kWh)	37,500	37,500
Leveled cost (cents/kWh)	0.140	0.067
Interest rate	5%	5%
Interest costs	4,375	2,083
Total costs 1kW system	9,625	4,583
Total cost (cents/kWh)	0.257	0.122

Source: ReneSola

Figure 4. China Electricity Prices, cents/kWh



Source: CLSA and ReneSola estimates  
\*Assumes 5% financing cost

## Sources of Demand

With an installation price of \$2.50/watt, it would still cost \$5,000 to install a 2kW system on your roof. This is roughly four times average household income in China and more than the price of a typical family house in many parts of the country. This would make it difficult to pay for the system with a home-equity style loan. As a result we expect most of the solar installations initially at large commercial and industrial facilities. Residential demand will likely come first in the large cities. For instance in Shanghai, a \$5,000 system only represents one years worth of income and is just a tenth of the average house price.

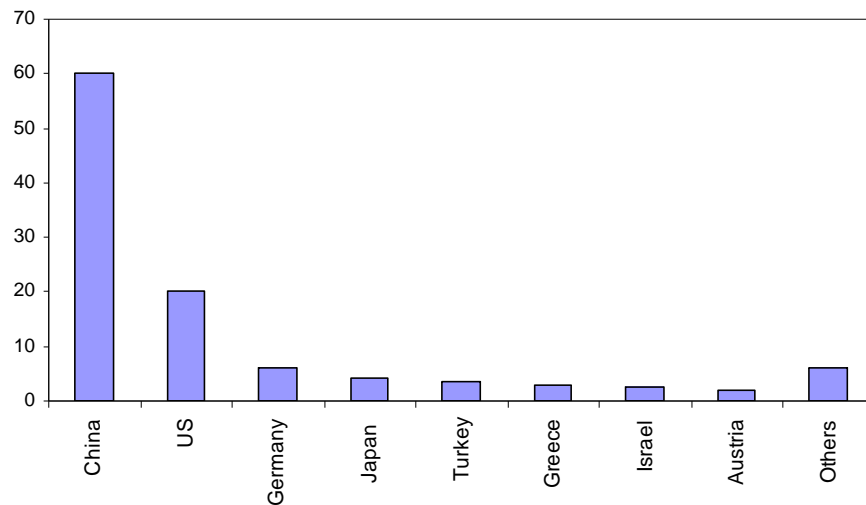
Several local governments are also doing their bit. Shanghai is leading the charge through its "100,000 roofs" initiative. Mirroring previous initiatives in Japan and Germany, this aims to have 300MW in installed capacity by installing an average of 2-5kW per roof. The total investment is put at US\$2 billion. The long-term goal is to have more than 20% of electricity consumption in Shanghai coming from solar energy in 2030. The city is show-casing its renewable credentials at the upcoming 2010 expo which should be carbon neutral.

## China is Already the World Solar Leader

There is an excellent precedent for a future solar electricity boom in from the country's adoption of solar thermal technology. In fact China is already the largest user of solar energy in the world, with total installed area with 60 million m<sup>2</sup>

(60km<sup>2</sup>). According to EIA guidelines this is equivalent to 4,900MW of coal generation capacity – equivalent to roughly 1% of China's total electricity generation capacity, making solar comfortably the second most important renewable energy source in China after hydro. Furthermore, annual installations are continuing at the rate of 10 million m<sup>2</sup> (10 km<sup>2</sup>) per annum. The solar thermal boom has come in the absence of any government incentives.

Figure 5. World Installed Solar Area (PV+Thermal), 2004 (km<sup>2</sup>)



Source: Sarasin, ReneSola estimates