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Making Solar Power More Economically Viable: Recent Developments in the Chinese Electricity Market

By
David Blumental, Boyd Carano and Richard Berberian

Introduction

Recent developments in China indicate that the government is taking steps to make solar power-generated electricity more economically viable for project developers. As a sign of the rising importance of solar power-generated electricity in China, the government has recently made strides toward setting feed-in tariffs; the government also recently signed an agreement to develop a 2,000 MW photovoltaic farm in the Mongolian desert, the world's largest. The drive to economic viability also flows directly from the objectives underpinning China's *Renewable Energy Law*.

While the Chinese electricity market has largely been dominated by less expensive coal, China plans to grow rapidly its solar power generation capacity. Two years ago, the government targeted 300 MW of solar generation capacity by 2012 and 1,800 MW by 2020. A recent report shows that China may far exceed the 2012 target and have 1,000 MW of solar power generation capacity by 2011.¹ In line with the government's policy, in September officials signed an agreement with First Solar, Inc., the world's largest photovoltaic cell manufacturer, to build a 2,000 MW photovoltaic farm in Inner Mongolia. The project is to be implemented in three phases: 30 MW by mid-2010; an additional 970 MW by 2015; and the final 1,000 MW by 2020.²

According to First Solar CEO, Mike Ahearn, Sino-U.S. cooperation in the solar power sector, including the Mongolian project, will help reduce the cost of solar power-generated electricity to the level of more traditional means of generating electricity.³

A. Feed-In Tariff Developments

One way in which the Chinese government is seeking to encourage the development of solar power projects is through the use of feed-in tariffs. While China has not set a national feed-in

tariff, China's National Energy Administration (NEA) this summer announced a RMB 1.09/kWh feed-in tariff (approximately US\$0.16/kWh) for a local project. This project—a 10 MW solar power plant project located in the Dunhuang, Gansu Province in northwestern China⁴—involves an estimated investment of RMB 200 million (approximately US\$29 million), an annual power production of 16.37 million kWh, and a franchised operation term of 25 years. The project feed-in tariff was approved by China's National Development and Reform Commission (NDRC) in June. As a sign of China's commitment to making solar power-generation more economically viable for project developers, the government rejected a bid to set the feed-in tariff for the Dunhuang Project at RMB 0.69/kWh (approximately US\$0.10/kWh); the government considered the bid too low to spark development of the photovoltaic industry in China.

China's approach to feed-in tariffs may not result in one unified national feed-in tariff, but rather feed-in tariffs that vary by region based on the results of bid solicitations reflecting local solar conditions.⁵ The Chinese government's approach to feed-in tariffs uses both government-mandated prices and competitive bidding to set fixed feed-in tariffs. Upon government approval of a project, a fixed price tariff rate is determined by a bidding process based on the principle of "reasonable costs plus reasonable profits."⁶ This approach was prompted by the NDRC's 2007 *Notice of Large-Scale PV Power Station Construction Requirement*, which was issued to eight provinces in western China and required that the feed-in tariff for desert solar stations be determined by "public offering."⁷

B. The Renewable Energy Law

The drive to make solar power-generated electricity more economically viable also flows directly from China's first *Renewable Energy Law*. This law, effective as of January 1, 2006, provides a comprehensive renewable energy

policy framework by institutionalizing various policies and instruments for renewable energy development and utilization and addressing key issues, including renewable energy targets, planning, education, and training, grid connection of renewable power projects, and feed-in tariffs for renewable power generation. The *Renewable Energy Law* aims to promote the development of renewable energy by removing market barriers, creating a financing system to promote innovation, and establishing a self-sufficient manufacturing industry to improve research capabilities and increase market competitiveness.

The *Renewable Energy Law* invigorated the Chinese renewable energy industry by: (i) guaranteeing a market for renewable power generation enterprises by requiring on-grid companies to purchase all energy produced by renewable energy generators established and located on their power grid; (ii) requiring on-grid companies to provide grid connection services to renewable energy power producers within their coverage area; (iii) allowing the cost of services to be factored into sale prices; and (iv) establishing measures to create grid prices for electricity produced from renewable sources, which allows renewable energy producers to compete with cheaper coal-produced energy resources.

C. Representative Chinese Solar Power Projects

China's drive to utilize solar power-generated electricity is tied to China's vast solar power resources, which average 4 kWh/m² of radiation in most areas—comparable to the United States.⁸ In recent years, China has employed its rich solar resources to fulfill domestic energy demands, particularly in the area of rural electrification. With 2.7 million Chinese rural households (about 11 million residents) still living without electricity, there is a great domestic need for solar power investment and development, especially in stand-alone distributed photovoltaic systems, because of the cost to connect rural residents to power grids.⁹ Recognizing this need early on, the NDRC announced plans in May 1997 to spend US\$1.21 billion on installations of solar power systems in rural areas of western China.¹⁰

The “Township Electrification Program” implemented in 2002-03 is a concrete example

of the NDRC's efforts. The program aimed to solve power supply issues by utilizing photovoltaic and small-scale wind electricity generation in more than 721 townships in Tibet, Xinjiang, Qinghai, Gansu, Inner Mongolia, Shanxi, and Sichuan.¹¹ It initially led to the installation of 19 MW of solar photovoltaic panels¹² and by its completion at the end of 2003 resulted in a cumulative installed capacity of 55 MW.¹³ This program marked the world's largest rural electrification project using solar photovoltaic and wind power combined and provided electricity to 300,000 households or 1,300,000 people.¹⁴ Two other rural solar projects originated in Beijing: the “Lighting-up Program” in 2006 encouraged the construction of solar street lights in new rural developments and the “Solar Lighting in 100 Villages” project invested RMB 250 million in thirteen counties and districts, resulting in the installation of nearly 40,000 lights in the rural areas surrounding Beijing.¹⁵

Domestic solar power projects have not been limited to remote rural areas. The 13th People's Congress of Beijing passed the “100 Sunshine Schools” project in 2008, which allows select schools to use solar powered street lamps, lawn lamps, bathrooms, information boards, and clocks on a trial basis.¹⁶ Shanghai initiated its “Million Solar Roofs Program” in 2005, and Jiangsu province also proposed a smaller-scale “Ten Thousand Solar Roofs Program.”¹⁷ Additionally, plans for a “Green Energy Counties” program strive to make full use of all kinds of renewable energy in select counties across the country.¹⁸ Lastly, China has also partnered with the Global Environment Fund in launching the Renewable Energy Development Program through the World Bank to help promote household solar photovoltaic systems in Inner Mongolia, Tibet, Qinghai, Gansu, Xinjiang, Shaanxi, Yunnan, Ningxia, and the west part of Sichuan.¹⁹

In 2004, Shenzhen built a 1 MW grid-tied solar photovoltaic plant on its World Garden Expo building.²⁰ It was the first grid-connected solar photovoltaic power station in China and the biggest in Asia at the time. With its 1 MW output (equal to 384 tons of coal), it annually prevents the emission of 4.8 tons of dust, 101 tons of waste, 170 tons of carbon dioxide, and 7.68 tons of sulfur dioxide.²¹ Another city project, currently placed on hold, is to develop the first private solar power plant with an installed capacity in

excess of 1 MW. Xintian Sun Power Science and Technology Co., Ltd. would invest RMB 80 million (with RMB 30 million support from the local Longgang government) to build the 15,000 square meter facility, which should help alleviate the power supply crunch in the region.²²

Other notable solar projects include the following:

- Qidong Lingyang New Energy Company built China's largest private solar power plant in Qidong on June 28, 2007, generating approximately 110,000 kWh/year;²³
- In Wuwei, a desert solar farm was completed in 2008 and currently generates 500 kWh of electricity;²⁴
- A new facility built in the Jiangsu Province by Glory Silicon Energy Co., Ltd. and joined by GT Solar Incorporated is slated to become one of the world's largest solar cell wafer factories. It began operations in its first-stage on August 3, 2008, and will eventually reach an annual production output capacity of 1,500 MW,²⁵ and
- The Qingzang railroad is the highest altitude railroad in the world and with its 30 photovoltaic power stations is also the highest photovoltaic application in the world.²⁶

Conclusion

China has made a commitment to increase significantly its solar power-generated electricity production. The recent agreement with First Solar to build the world's largest photovoltaic power project highlights the emphasis that China is placing on solar power as a long-term energy source. The key to the continued development of the solar power industry in China will be to find ways to make solar power competitive with coal – both for power generators and for Chinese consumers. The Dunhuang Project feed-in tariff is the first of its kind for solar power in China²⁷ and marks a significant step towards making solar power an affordable, accessible, and viable source of renewable energy.

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¹ Uclia Wang, *China Report: Solar Capacity Could Jump to 1GW or More by 2011* (Oct. 1, 2009).

² Todd Woody, *U.S. Solar Firm Cracks Chinese Market* (Sep. 8, 2009).

³ See <http://solar.ofweek.com/2009-09/ART-260005-8110-28418193.html> (Sep.11, 2009).

⁴ JLM Pacific Epoch, *CGN Invests in Ningxia, May Win Dunhuang Project* (May 26, 2009).

⁵ New Energy Finance, *Tariff for China's First Solar Concession Project Revealed* (June 4, 2009).

⁶ Article 9 of the *Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation*.

⁷ 《国家发展改革委办公厅关于开展大型并网光伏电站建设有关要求的通知》. See Zhao Yuwen et al., *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, 48, 70 (June 2008).

⁸ Li Junfeng and Wang Sicheng, *2007 China Solar PV Report*, 25 (2007). The NDRC states the total solar radiation per unit area stands at over 5,000 MJ/m². Article 1.1.4 of the *Medium and Long-Term Development Plan for Renewable Energy in China*.

⁹ *Id.* at 25.

¹⁰ Called the “Brightness Program” 《光明工程》. Russell Hassan, *A Research Report on Solar Power Investment: The Dawn of Solar Power*, 4 (July 26, 2006).

¹¹ Li and Wang, *supra* note 8, at 15.

¹² Article 1.2.4(1) of the *Medium and Long-Term Renewable Energy Plan*.

¹³ Li and Wang, *supra* note 8, at 15.

¹⁴ *Id.* at 25.

¹⁵ *Id.* at 21.

¹⁶ *Beijing Will Build 100 Solar Campuses*, CHINACSR Jan. 29, 2008.

¹⁷ 《中国发展的动力 – 可再生能源之路》(Chinese translation of Worldwatch’s 2007 Report *Powering China’s Development*) 23.

¹⁸ Article 4.6(3) of the *Medium and Long-term Renewable Energy Plan*. The criteria for a Green Energy County will be: (i) more than 50 percent of household energy comes from renewable energy, and (ii) various biomass residues and wastes are treated and utilized in reasonable ways. The number of such counties is set for 50 by 2010 and 500 by 2020. *Id.*

¹⁹ Li and Wang, *supra* note 8, at 42.

²⁰ Renewable Energy World, *Powering China’s Development: The Role of Renewable Energy* (Mar. 20, 2008).

²¹ Li and Wang, *supra* note 8, at 26.

²² China Strategies, *China Renewable Energy and Sustainable Report*, 2-3 (Aug. 2007).

²³ *Id.* at 2.

²⁴ Jonathan Watts, *China’s New Faith in Solar Energy Projects Is Hailed by Environmentalists as a Milestone*, U.K. GUARDIAN, May 26, 2009.

²⁵ China Strategies, *supra* note 22, at 3.

²⁶ Zhao Yuwen et al., *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, 48, 80 (June 2008).

²⁷ China had enacted its first feed-in tariff in 2005, joining 40 other countries with similar feed-in policies, but it did not apply to solar power. As of today, there are 63 countries/states/provinces that have enacted feed-in policies. Renewable Energy Policy Network, *Global Status Report: 2009 Update*, 26 (2009).