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CHINA'S OVERSEAS INVESTMENTS IN THE WIND AND SOLAR INDUSTRIES: TRENDS AND DRIVERS

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EXECUTIVE SUMMARY

Shifting to a low-carbon economy will require current emitting countries and projected future emitters to rapidly scale up their investments in renewable energy. In recent years, major emerging economies like China, India, and Brazil have been catching up with leading developed country investors in Europe and the United States. By some estimates, China is already the leading global investor in renewable energy infrastructure, and is increasing its overseas investments in renewable energy, particularly solar and wind. If China achieves its goal of sourcing 15 percent of its energy mix from renewables by 2020 and 30–45 percent by 2050, renewable energy will become closer to a mainstream energy resource within the country. Cost reduction incurred in this process would benefit not only China, but also the rest of the world.

This working paper aims to help policymakers, investors, and researchers better understand the trends in China's overseas investments in the wind and solar industries, and the factors behind those trends. It examines the scale, nature, and types of China's overseas investments in the wind and solar industries, and identifies the policy and market factors that drive these investments.

China has made at least 124 investments in solar and wind industries in 33 countries over the past decade. Of the investments for which data were available, the cumulative value amounted to nearly US$40 billion in 54 investments, and the cumulative installed capacity added was nearly 6,000 MW in 53 investments. Of the 124 investments, 41 were in the wind industry, 81 in the solar industry, and 2 in both the wind and solar industries.

CONTENTS

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The majority of investments were in electricity generation. Twenty-seven of the wind investments were in wind farms predominantly carried out through joint ventures, as were most of the 41 solar investments. Several investments were made in manufacturing facilities and to establish sales and marketing offices. Most of the investments were concentrated in a few developed countries: the United States, Germany, Italy, and Australia. A handful of developing countries, including South Africa, Pakistan, and Ethiopia, also attracted investments.

China's investments in the wind and solar industries are driven by a multitude of factors including macroeconomic conditions; industry conditions; policies (both general and specific to the wind and solar industries) that "push" Chinese companies to invest overseas; policy incentives in host countries that "pull" Chinese investors; and financial support from Chinese banks that "enables" these investments.

China is driven to seek solar and wind markets overseas largely because its manufacturing capacity exceeds domestic demand. The Chinese government's policy support and financial support—mainly from state-owned banks that respond to government policy—encourage this overseas investment trend. Host countries' policies have also attracted investments from China's solar and wind industries, either advertently through tax breaks, feed-in tariffs, or bilateral cooperation agreements, or inadvertently as a "side-effect" of policies discouraging imports.

Although the analysis in this working paper points to interesting trends and provides useful insights that enhance our understanding of China's role as an overseas investor in the wind and solar industries, it is limited by a paucity of information. Beyond the data collected for the 124 investments, the authors also reviewed literature and carried out interviews to deepen the analysis. The analysis is confined to a subset of the renewable energy sector rather than the full range of possible low-carbon investments. The inadequacy of the data does not allow an analysis of the emissions impact of these investments. These limitations suggest areas for further research that could help improve an understanding of China's potential to reduce emissions beyond its borders, and would allow policy analysis on how China could increase this positive impact, particularly in developing countries.

INTRODUCTION

An accelerated shift to a low-carbon economy will require rapidly scaled-up investments in renewable energy industries. Investments in low-carbon technologies will need to be scaled up from roughly US$200 billion a year in 2011 to nearly US$2 trillion a year over the next few decades—a tenfold increase—to keep the world within a greenhouse gases stabilization pathway of 450 parts per million (ppm) CO_2e, or global average temperatures within 2 degrees Celsius over pre-industrial levels.[1] Whereas the United States, Japan, and some European countries have been leading investors, major emerging economies like China, India, and Brazil are ratcheting up their investments in the renewable energy sector.

Over the past several years, China has become a leading investor in global renewable energy infrastructure,[2] and is increasingly investing in the sector outside its territory. This investment is consistent with a broader trend of major emerging economies like China, India, and Brazil becoming important sources of global overseas investments—globally their outward foreign direct investment flows ranked 5th, 21st, and 25th respectively in 2010. China was one of the few countries to increase its overseas investments through the global financial crisis in 2008 (UNCTAD 2012). China has become a major source of investment for the renewable energy sector globally and is increasingly a major renewable energy investor overseas, including in other developing countries.

This working paper reviews China's overseas investments in the wind and solar industries. This area of research is new and complements research on China's investments overseas, especially in extractive industries, as well as China's domestic investments in the renewable energy sector. The purpose of the working paper is to help policymakers, investors, and researchers better understand the scale, nature, and types of China's overseas investments in the wind and solar industries, and the policy and market factors driving these investments. It is a step toward enhancing our understanding of China's overseas investments in renewable energy industries more broadly. However, it does not include the hydropower or biofuel industries, nor does it compare China's overseas investments in the solar and wind industries with the fossil fuel-based energy industries. Where relevant, China's overseas investment in the wind industry is compared with India's. The authors set out to consider Brazil's overseas investments in the wind and solar industries for the sake of comparison, but no data were available on investments from Brazil, which

suggests that Brazilian investors have not yet invested in the wind and solar industries overseas.

The working paper is organized in three parts. In the first part, findings from the data collected on China's overseas investments in the wind and solar industries are presented. The second part focuses on the policy and market factors driving China's overseas investments, including the role of China's financial sector in enabling these investments. The final section presents conclusions and suggestions for further research and analysis.

1. TRENDS IN CHINA'S OVERSEAS INVESTMENTS IN THE WIND AND SOLAR INDUSTRIES

To ground the research for this working paper, the authors created an investment-level database that captured information on China, India, and Brazil's overseas investments in the solar and wind industries from 2002 to 2012. This database includes investments where "an enterprise resident in one economy invests in an enterprise resident in another economy with the objective to establish a long-term interest and control, and holds at least 10 percent, or the equivalent, of the voting stock or ordinary shares of the enterprise" (OECD 2008). Such investments may include greenfield[3] investments in infrastructure projects, manufacturing units and subsidiary offices, or mergers and acquisitions. The database includes 134 investments: 124 by China and 10 by India. No data on overseas investments by Brazil in the solar and wind industries were available.[4]

Although the dataset is fairly comprehensive, there are several gaps. Table 1 provides an overview of the number of investments for specific categories for which information was available. Although basic information on the source and the destination of the investment is available, information on the scale and type of investments—overall and by the Chinese entity—is limited, and the roles of financiers are even more opaque.

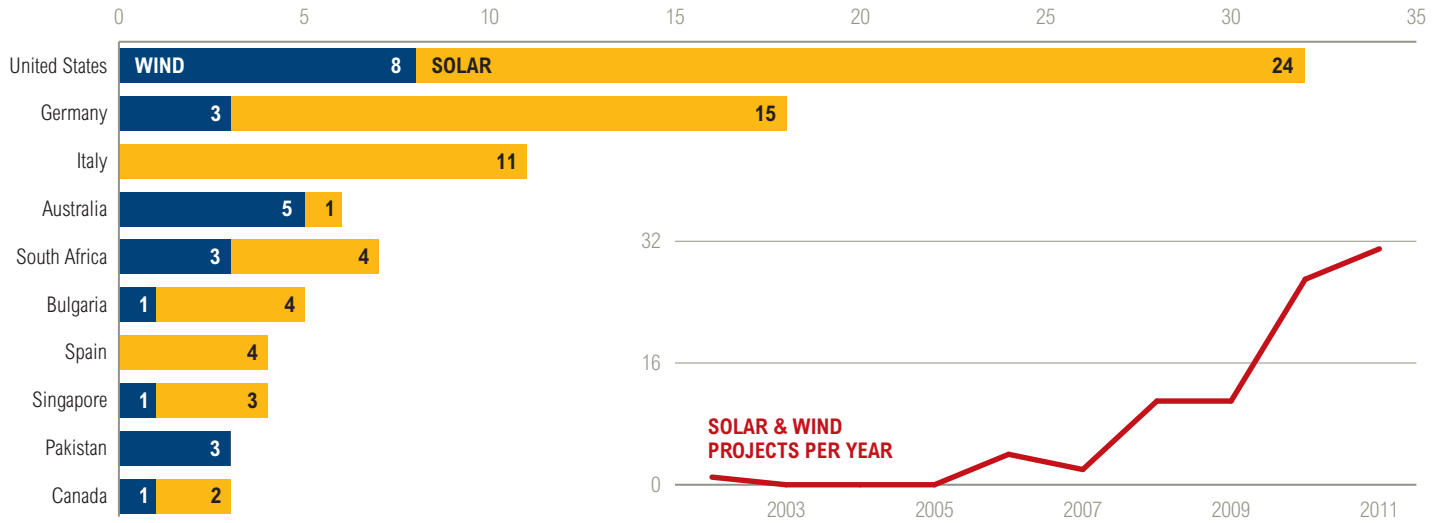
Of the 124 Chinese investments surveyed, 41 were in the wind industry, 81 in the solar industry, and 2 covered both the wind and solar industries.[5] Collectively, these investments have been channeled to 33 countries—22 developed (including Hong Kong and the Cayman Islands) and 11 developing economies (see Figure 1).[6] The United States was the leading destination, with 8 wind and 24 solar investments. Countries with a high level of solar energy penetration, such as Italy and Spain, attracted only solar investments from China; Germany also attracted mostly solar investments.[7] The three developing countries to host the highest number of China's investments were South Africa, Bulgaria, and Pakistan.

Table 1 | **Number of China's Investments for which Specific Categories of Information are Available**

INVESTMENTS	QUANTITY
Investments	124
Function of the investments	124
Destination country	124
Year of the investment	94
Installed capacity (only in power plant investments)	53
Mode of entry	77
Investing company	124
Functions of the investing company	74
Total investment amount	54
Capital investment made by the Chinese investor	44
Financier of the deal	14
Financing amount	8

The number of investments rose steadily since 2005 (see inset in Figure 1). Based on available data, roughly US$10 billion was invested in 16 wind projects and US$27.5 billion in 38 solar investments.[8] The total capacity installed (for which data were available) was larger for wind (6,000 MW — 4,700 MW in 26 investments) than for solar (1,336 MW in 27 investments).

Figure 1 | **Number of China's Overseas Investments in Solar and Wind Industries in the Top 10 Destination Countries, 2002-12**



1.1 The Wind Industry

Of the 43 investments in the wind industry, 90 percent were undertaken to perform three functions: electricity generation; manufacturing; and sales, marketing, and other support (see Figure 2). In the 27 investments in electricity generation (wind farms), the predominant mode of investment was joint ventures (see Figure 3). Five of the six investments in manufacturing units were through acquisitions of foreign firms, and all of the six investments in sales, marketing, and other support were greenfield investments by the parent Chinese companies establishing foreign subsidiaries. Joint ventures have been a preferred mode of investment in wind farms because companies can rely on local partners to engage with stakeholders and comply with local laws (Chester 2011).

Figure 2 | **Percentage of Wind Investments by Function**

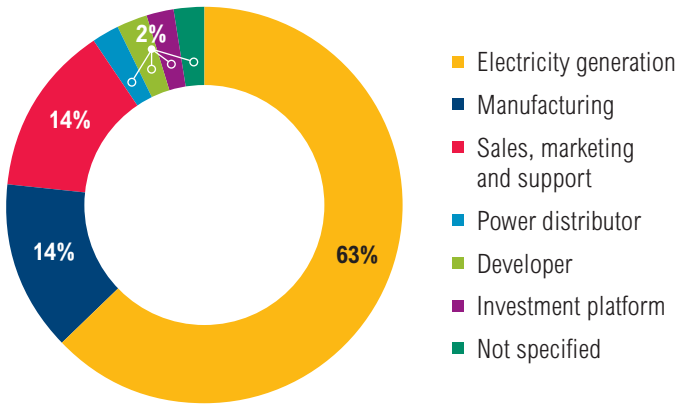


Figure 3 | **Matching Functions with Modes of Investments**

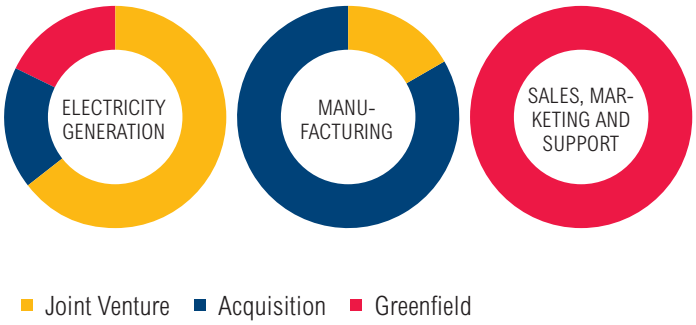
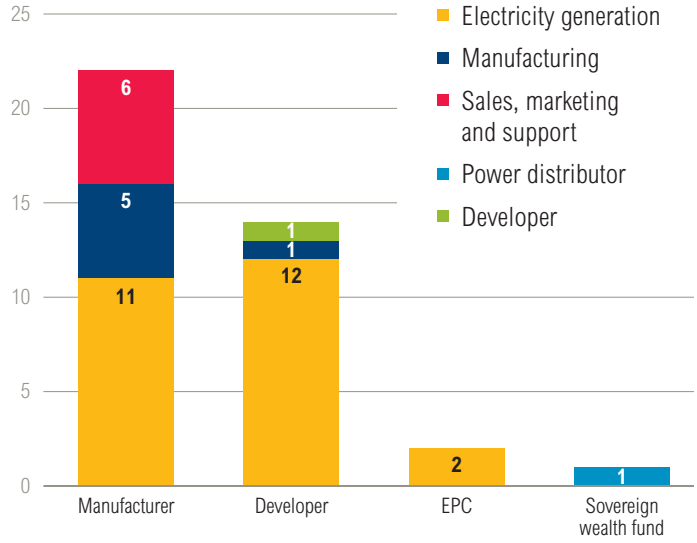


Figure 4 | **Matching Functions of Investing Companies with Functions of Investments**



Chinese wind farm developers have generally invested in electricity generation, accounting for 12 out of the 14 investments (see Figure 4). In one case, in 2011, the Three Gorges Corp., an ambitious new developer, acquired a 20 percent stake in a Portuguese developer, Energias de Portugal SA, to gain access to its assets in Brazil (Ma and Kowsmann 2011). In another case, Datang Corp, a major wind developer in China, formed a joint venture with the REA Group of UK, a manufacturer, acquiring a minority stake of 49 percent and infusing capital into REA to expand its operations (Chua 2010).

Figure 4 also shows that, interestingly, Chinese manufacturers invested more in electricity generation than in manufacturing bases or sales and marketing subsidiaries, both of which stand closer to their core business of producing and selling turbines. This trend is driven by the need to create markets for their products, a model pioneered by Goldwind and emulated by XEMC and Sinovel, which will be explained later in section 2 (see Figure 5). The Chinese companies' investments in foreign manufacturers, mostly through acquisitions, have been strategically driven with the aim of securing technologies and research and development (R&D) capacities (see section 2.2.1).

Figure 5 | **Functions of Investments for Companies with Multiple Investments**

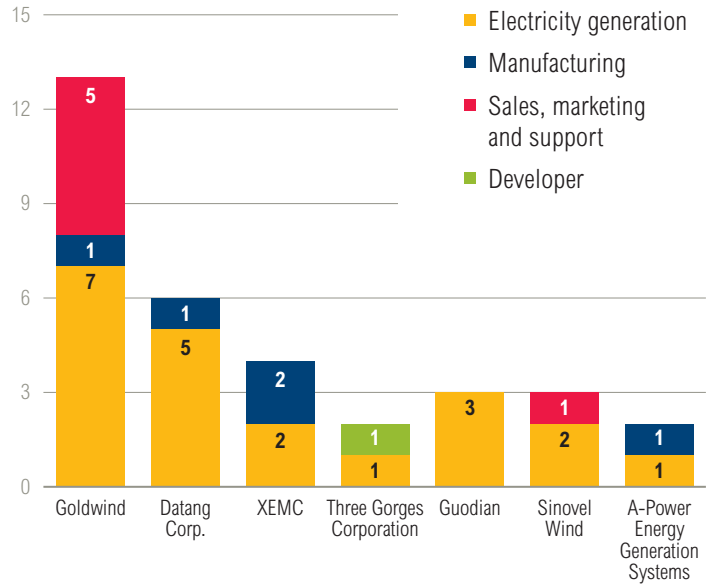
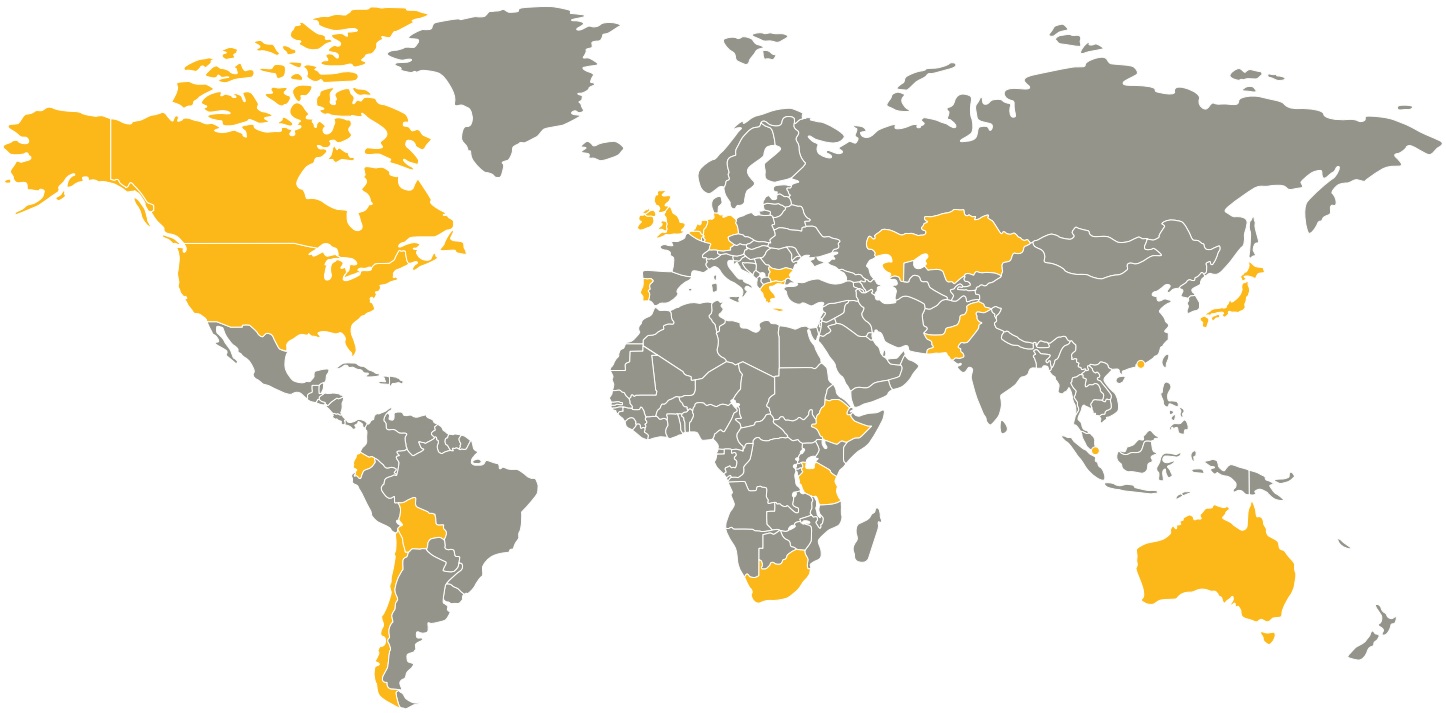


Figure 6 | **Overview of China's Overseas Investment Destinations in the Wind Industry, 2002-12**



Note: For specific information on which companies have invested in each country, see Annex 1.
Source: World Resources Institute.

1.2 The Solar Industry

As in the wind industry, 86 percent of China's investments in the solar industry were made in companies performing three functions: electricity generation; sales, marketing, and support; and manufacturing (see Figure 7).[9] Nearly half of the 83 investments were made in new photovoltaic (PV)-based electricity generation plants either as greenfield investments or through joint ventures (see Figure 8). The investments in manufacturing facilities and in foreign subsidiaries for sales, marketing, and other support follow an entry pattern similar to that in the wind industry—acquisitions and greenfield investments respectively.

Figure 7 | **Percentage of Solar Investments by Function**

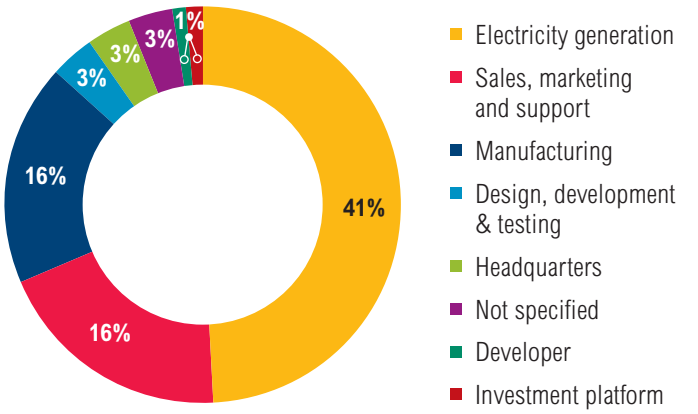


Figure 8 | **Matching Functions with Modes of Investments**

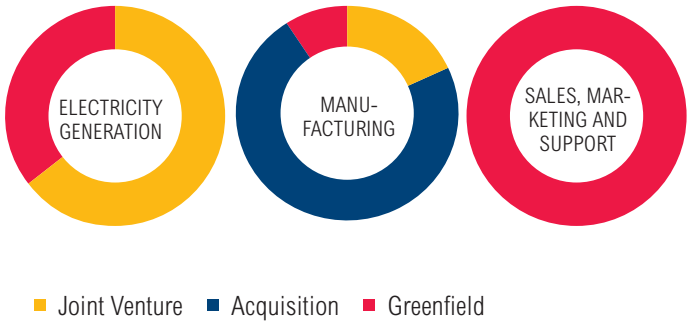


Table 2 | **World's Top 10 Solar Cell Manufacturers by Output**

RANKING	NAME	COUNTRY
1	Suntech Power	Mainland China
2	JA Solar	Mainland China
3	First Solar	United States
4	Trina Solar	Mainland China
5	Q-Cell	Germany
6	Yingli Solar	Mainland China
7	Motech	Taiwan
8	Sharp	Japan
9	Gintech	Taiwan
10	Kyocera	Japan

Source: Li and Wang et al. 2011.

In a few cases, Chinese solar companies have invested in ancillary industries in the supply chain. In 2008, Suntech Power partially acquired KSL Kuttler in Germany to gain new production technologies and localize production. KSL Kuttler also gained access to the solar industry (China Securities 2008). In 2011, China National Bluestar Company acquired the silicon operations of Norway's Elkem to enhance competitiveness in the industry (Bloomberg Professional service database). Also notably, while most Chinese companies have been using first-generation crystalline-silicon PV cell technology, a few of them acquired

Figure 9 | **Functions of Investments for Companies with Multiple Investments**

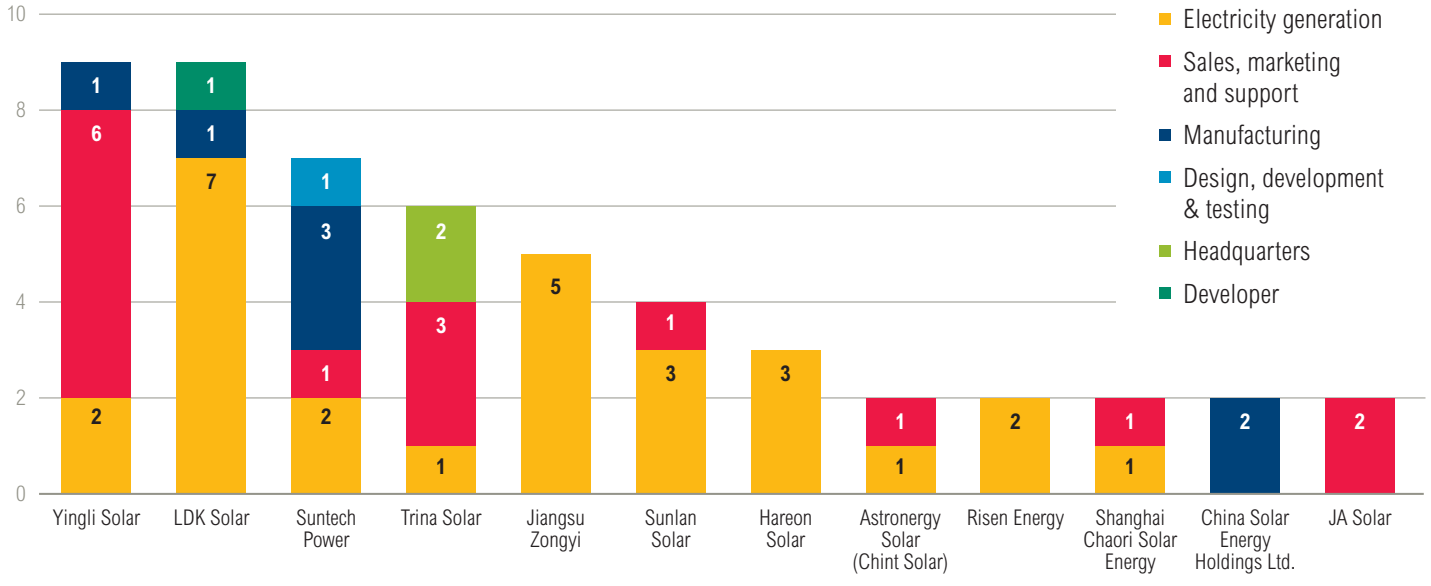
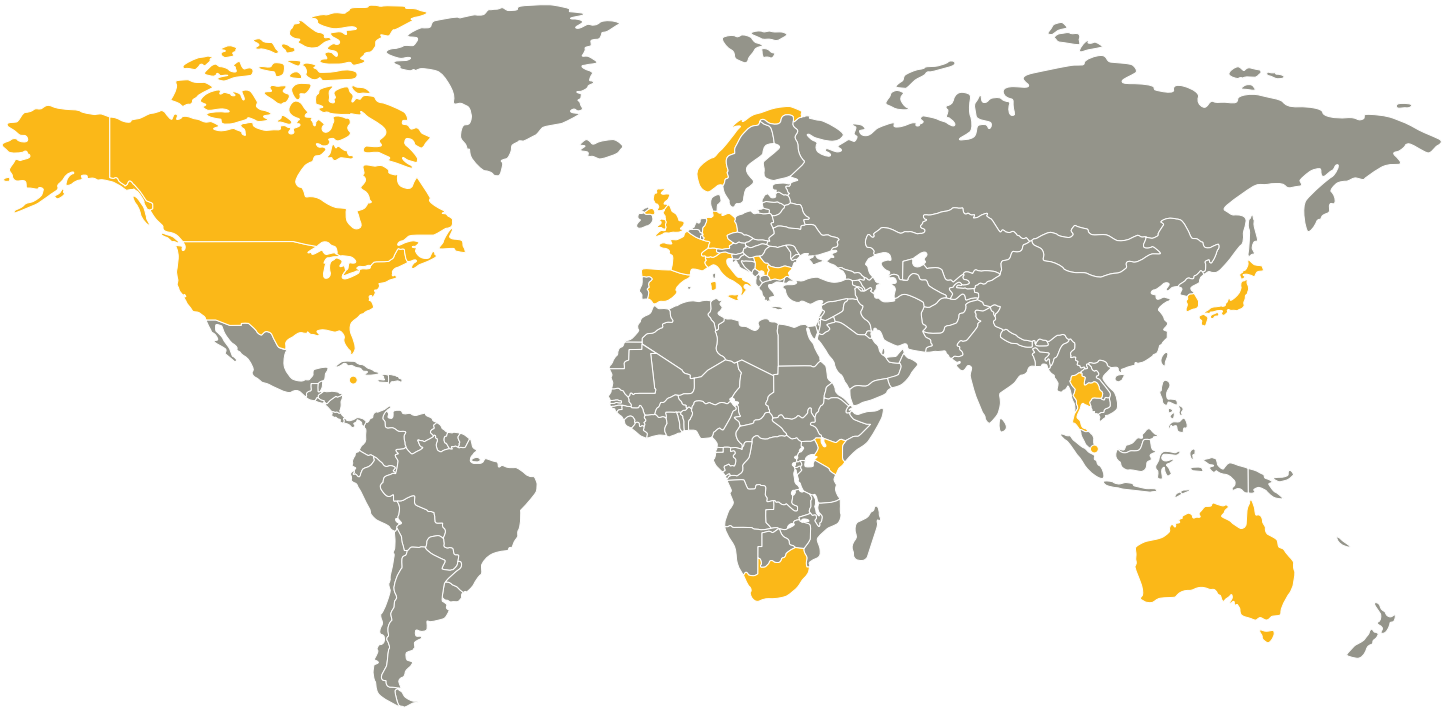


Figure 10 | **Overview of China's Overseas Investment Destinations in the Solar Industry, 2002–12**



Note: For specific information on which companies have invested in each country, see Annex 2.
Source: World Resources Institute.

U.S. companies to access second-generation thin-film PV cell technologies. China Solar Energy Holdings Ltd. has acquired stakes in two companies —100 percent in ThinSilicon Inc. and 51 percent in Terra Solar Global Inc. (Bloomberg Professional service database).

China's leading solar manufacturers globally are also their leading overseas investors. Suntech Power, Trina Solar, and Yingli Solar are among the top 10 global manufacturers (see Table 2), and are ranked 3rd, 4th and 1st respectively in the number of overseas investments (see Figure 9). These three companies and JA Solar, also in the top 10, collectively made 24 investments overseas, 12 of which created foreign subsidiaries for sales and marketing to support the exports of their products. In contrast, relatively smaller companies like LDK Solar, Jiangsu Zongyi, Sunlan Solar, and Hareon Solar put most of their overseas investments (18 out of 21) into building solar power plants. Thus, it appears that the top solar exporters set up foreign subsidiaries mainly to support the export of their products manufactured in China, whereas the smaller manufacturers invested in constructing solar power plants to open up new markets for their products.

2. FACTORS DRIVING CHINA'S OVERSEAS INVESTMENTS IN THE WIND AND SOLAR INDUSTRIES

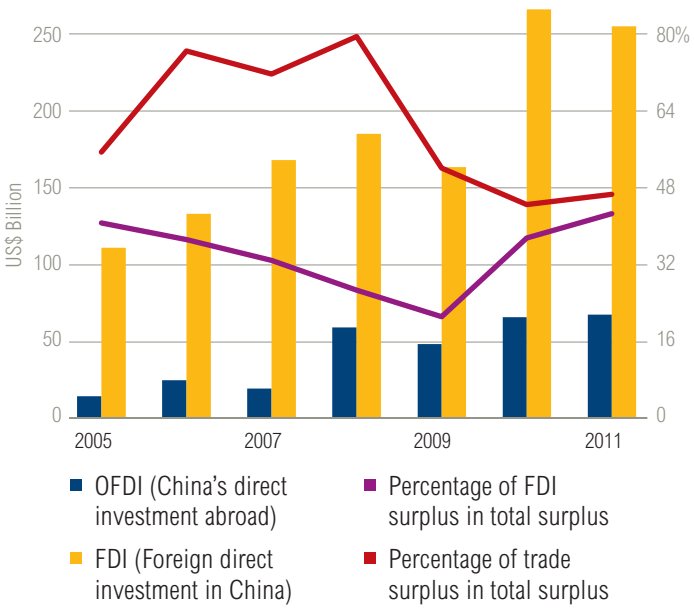
Several factors have contributed to China's increased overseas investments in the wind and solar industries. These factors can be separated into "broad drivers" that propel China's increased overseas investments generally, and "specific drivers" that speak directly to the wind and solar industries. Favorable macroeconomic conditions and government policies encouraging greater foreign direct investment are broad drivers of increased overseas investments. Drivers specific to the wind and solar industries include industry conditions and policy incentives that "push" Chinese companies to invest overseas, enabling financial support from Chinese banks, and attractive host country policy and market conditions that "pull" Chinese companies to these destinations. The specific drivers are not relevant in every investment, and each of them influences investments in varying degrees.

2.1 Broad Drivers of China's Overseas Investments

China's direct investments overseas climbed from around US$15 billion in 2005 to over US$67 billion in 2011, a more than fourfold jump (SAFE 2012b). The rapid growth in recent years is a result of changing macroeconomic conditions as well as a sustained policy push from the political leadership in Beijing that sees an opportunity for furthering China's growth and its role in the global economy.

China's economic development pattern of sustained trade and direct investment surpluses has distorted its balance of payments situation resulting in a vast accumulation of foreign exchange reserves and creating both pressure on appreciation of the renminbi, China's currency, and domestic inflation (Yao 2011). Since exports and foreign investments are strategically important for China's economic growth, and imports cannot be rapidly scaled up in the short-term,[10] increasing its overseas investments remains an effective short-term option to rebalance the country's balance of payments (Yang 2008). (See trends illustrated in Figure 11.) The appreciation of the yuan (Y) against the U.S. dollar by 20 percent between 2005 and 2008 has already lowered the costs of U.S. dollar-denominated assets for Chinese companies, making overseas investments relatively more attractive during this period.

Figure 11 | **Trade, Investment, and Contribution to China's Balance of Payments Surplus**



Source: SAFE 2012a, SAFE 2012b.

This macroeconomic trend has coincided with the Chinese government's decision to prioritize overseas investments as part of its "Go Global" strategy proposed in the 10th Five-Year Plan in 2001 and followed by a series of supportive policies (see Figure 12). This strategy marked a gradual turnaround in policy from 1979 to date, with the Chinese government first forbidding outward foreign direct investment, then legalizing and encouraging it, and eventually treating it as a national strategic priority. The overriding objectives of the new strategy are to create Chinese multinational corporations, increase their global market share, and enhance China's global competitiveness.[11] The new strategy has been markedly successful in encouraging Chinese companies to invest overseas (Economist Intelligence Unit 2010).[12]

Chinese state-owned enterprises (SOEs) have been on the frontlines of implementing the "Go Global" strategy and they accounted for more than two-thirds of China's overseas investment flows in 2010 (MOFCOM 2011b). The State-owned Assets Supervision and Administration Commission (SASAC)[13] has been promoting the creation of "dragon heads" (national champions) since 2006 and confirmed the strategy of "developing globally competitive, world-class enterprises" as the core goal of the 12th

Figure 12 | **Policy Development of China's Overseas Investments**

LEGALIZING

- **1979:** Outward foreign direct investment was legalized by the State Council in the 15 Measures to Reform China's Economy.

LOOSENING CONTROL

- **1991:** On Strengthening the Management of Overseas Investment Projects promulgated by the State Planning Commission.
- **1999:** Mandates on Encouraging Enterprises to Develop Overseas Processing and Assembly Businesses by the State Council.

"GO GLOBAL" STRATEGY

- **2001:**"Go Global" strategy was proposed in the 10th Five-Year Plan.
- **2004:** MOFCOM releases Guidelines for Investments in Overseas Countries Industries.
- **2006:** "Go Global" strategy emphasized again in 11th Five-Year Plan
- **2009:** MOFCOM released Measures for the Administration of Outbound Investment; State Administration of Foreign Exchange issued Notice on Certain Issues Relating to Foreign Exchange Administration on Offshore Lending by Domestic Enterprises.
- **2011:** The Notice on Delegating Approval Authority over Overseas Investment Projects by NDRC.
- **2012:** State-owned Assets Supervision and Administration Commission completed its preliminary supervision system of overseas assets with Interim Measures for the supervision and administration of central SOEs overseas assets.

Source: Chinese government websites. Accessed in April 2012.

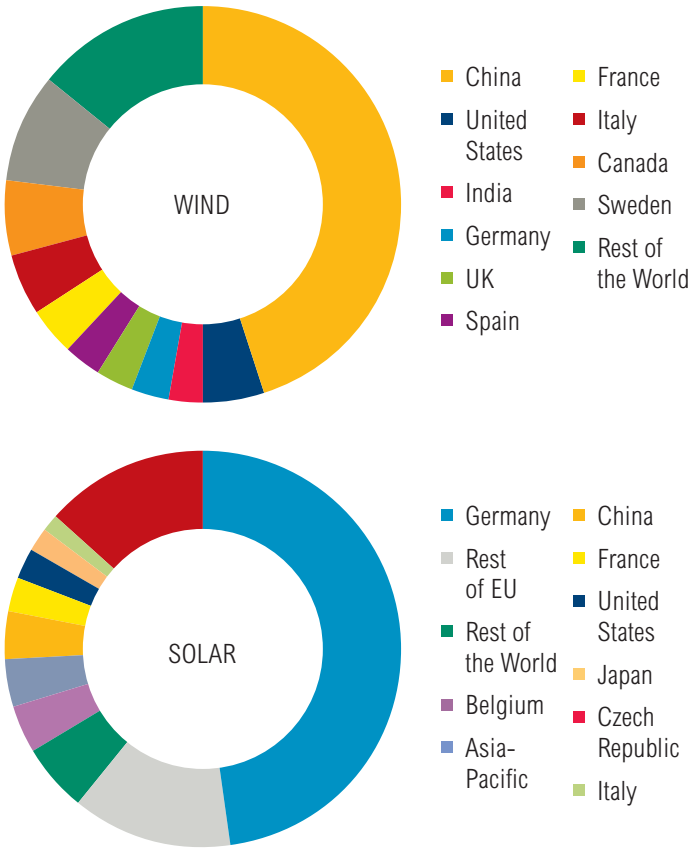
Five-Year Plan (2011-2015) for SOEs (SASAC 2006 and 2012). SOEs that are not globally competitive face the risk of being merged into other more competitive companies (SASAC 2006). Several major state-owned utility companies with large portfolios of renewable energy investments — Huaneng, Guangdong Nuclear, and Datang Corp.—ranked among the top 50 Chinese companies with the largest stock of foreign direct investments overseas in 2010, and are also among the top wind developers globally (CWEA 2011; MOFCOM 2011b).

2.2 Drivers Specific to the Wind and Solar Industries

Consistent with China's role as the world's largest manufacturing base, both wind turbine and solar cell manufacturing industries have grown substantially. However, their market base is quite different— China's solar industry relies on the international market for 95 percent of its sales, whereas its wind industry relies predominantly on its vast domestic market (see Figure 13). This situation mirrors a broader global trend: cross-border investment rather than trade is the dominant mode of global integration in the wind industry, whereas trade is relatively more dominant in the solar industry (Kirkegaard et al. 2009 and 2010).

Despite this difference, common factors drive both industries to invest overseas. These factors include a "push" by the industry to increase sales and revenue resulting from

Figure 13 | **Top Consumers of Wind and Solar Products**



Source: Li & Wang et al.; 2011, Li et al. 2011.

Table 3 | **World's Top 10 Wind Manufacturers and Developers by Installed Capacity, 2010**

RANKING	MANUFACTURER			DEVELOPER	
	NAME	COUNTRY	MARKET FOCUS	NAME	COUNTRY
1	Vestas Wind Systems	Denmark	Global	Iberdrola Renewables	Spain
2	**Sinovel**	**China**	**Domestic**	NextEra Energy	United States
3	GE	United States	Regional	**Longyuan**	**China**
4	**Goldwind**	**China**	**Domestic**	EDP Renovaveis	Portugal
5	Enercon	Germany	Regional	Acciona	Spain
6	**Suzlon**	**India**	**Regional**	**Datang Corp.**	**China**
7	**Dongfang Turbine**	**China**	**Domestic**	E.ON Climate & Renewables	Germany
8	Gemesa	Spain	Regional	**Huaneng**	**China**
9	Siemens	Germany	Regional	ENEL	Italy
10	**United Power**	**China**	**Domestic**	**Guangdong Nuclear**	**China**

Note: Companies in bold are from China or India.

Source: BTM data quoted in Li et al. 2011.

changing circumstances in the market, a "push" by the Chinese government to develop these strategically emerging industries and address the problem of excess capacity, the availability of enabling support from China's financial sector through access to abundant and relatively low-cost capital, and measures by host country governments to "pull" (attract) investments. Although explored separately here, these factors are interrelated.

2.2.1 Industry "Push"

WIND

Previously strong government support to Chinese wind turbine manufacturers enabled companies to grow rapidly, resulting in several turbine-producing giants, four of which are ranked among top 10 suppliers globally (Table 3). China was also the largest wind turbine consumer in the world in 2010, larger than the next nine largest consumers combined. However, as supply has outstripped demand, there has been a glut in the domestic market, resulting in lower domestic prices caused by fierce competition. Coupled with curtailed installed wind power, a stricter government policy on approving and building new wind farms, and diminishing funding due to the global financial crisis, these companies have been pressured to seek markets and revenues overseas.

Domestic competition and the fact that wind turbine supply has outgrown the domestic market is reflected in comparative prices and recent profitability figures for leading manufacturers. The global average price for wind turbines at the end of 2010 was US$1.33 M/MW. In contrast, prices in China were around Y3700–4000 Yuan/kW (US$0.56–0.60M/MW) down 30 percent from 2008 (based on Li et al. 2011).[14] As a result, profit growth has been falling and has even been negative recently. For example, Goldwind's year-on-year profit growth rate fell from 93 percent in 2009 to 31 percent in 2010 and actually contracted in 2011 by 74 percent (Goldwind 2011). Sinovel witnessed a similar drop in profits by 49 percent in the first three quarters of 2011 (Caijing 2011). Experts estimate that three leading manufacturers alone can meet the demand of the domestic market,[15] increasing the pressure on companies to find new markets.

Box 1 | India: the Case of Suzlon

Most of India's overseas investments in wind and solar went to developed countries. The data include select investments in wind electricity generation in the Czech Republic and Thailand; solar electricity generation in Portugal, Spain (two investments), and Germany; a sales and service branch in the United Arab Emirates; Suzlon's new headquarters in Denmark; a turbine manufacturing base in Germany; and solar cell manufacturing in Singapore.

One of the Indian wind industry's top companies, Suzlon has grown into a leading turbine maker and one of India's largest outbound foreign investors. In 2006, Suzlon ranked as the 10th largest foreign investor from India with foreign assets worth US$140 million. Its overseas investment focuses on manufacturing bases and providing services, which strengthened its ties with major markets in China, Brazil, the United States, and European countries (see Table B1.1). Suzlon has taken advantage of local low-cost production with its manufacturing base in Tianjin, China, and accessed advanced technologies through the acquisition of REpower in Germany. Suzlon also plans to fulfill Brazilian wind turbine orders of up to 120 MW from its production facility in China. This pattern is consistent with Indian multinational companies' tendency to provide services in developed countries and invest in manufacturing in developing countries (Sauvant and Pradhan 2010).

DESTINATIONS	INVESTMENTS
BRICS[a]	■ Turbine manufacturing base with a market share of 38 percent established in 2006 in Brazil. ■ Wholly-owned subsidiary – Suzlon Energy (Tianjin) Limited, with supply contracts signed of 929 MW in China.
Europe	■ Subsidiaries established in Spain, Italy, and Portugal. ■ Invested in European headquarters in Denmark. ■ Acquired 66 percent of REpower for US$1.7 billion in Germany in 2007.
North America	■ Suzlon Wind Energy Corporation (SWECO) was established to mainly provide EPC services.

[a] Brazil, Russia, India, China, and South Africa
Source: http://www.Suzlon.com, Satyanand and Raghavendran 2010.

Chinese wind companies have grown to become capable of competing internationally. However, they are relatively new entrants in the international market, and remain largely oriented toward the domestic market – all four Chinese companies on the top-10 list are categorized as domestic suppliers by BTM Consult, whereas their competitors on the list are more oriented toward supplying regional or global markets. Whereas most of the competitors are based in developed countries, there is one notable exception, Suzlon, which is based in India and seen as a strong regional player (see Box 1).

The need to boost sales in this already oversupplied market is driving companies to invest overseas. Quality issues have limited their ability to directly export products overseas (Lin and Meng 2010). As a result, some companies have been investing in electricity generation projects overseas to create demand for their products (see Box 2). Investments in manufacturing units overseas could also help alleviate quality and servicing concerns and lower shipping costs.[16] In practice, however, investments in manufacturing units have been largely for the purpose of acquiring new technologies. Germany and Scandinavian countries have become "hunting grounds" for manufacturing-related technologies (EIU 2010). For example, Chinese turbine maker XEMC Windpower acquired Darwind, the leading Dutch offshore wind turbine producer, for US$13.6 million in 2009 for its 5 MW offshore turbine technology; subsequently XEMC Windpower became the industrial leader in offshore wind turbine development in China (NewEnergy 2010a; XEMC). Goldwind, Suntech Power, and LDK Solar have similarly acquired stakes in German and Japanese companies to gain access to more advanced technologies.

While turbine makers are struggling for market share, wind developers are also facing stiff competition to secure development rights for new wind farms in China. As a result, some of them, mostly state-owned developers, have already started investing overseas. For example, among the "big five" utilities, Datang Corp. has expanded its wind development business into Australia, the United States, Canada, and Europe, and Guodian Longyuan (a subsidiary of Guodian) has expanded into South Africa, the United States, Europe, and Australia. Should this trend continue, it is promising that Chinese wind-project developers will scale up investments in overseas wind projects (see Table 3).

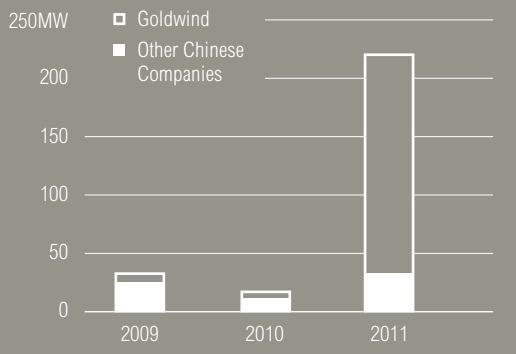
Box 2 | The Demand Creation Business Model

Wind turbine maker Goldwind is a pioneer of the demand creation business model. Although manufacturing brings in 97 percent of the company's revenue and wind farm development and investment brings in less than 1 percent (IFC 2010), the latter has greatly increased Goldwind's sales revenue.[a]

In 2007, Goldwind Xinjiang incorporated a wind development company, Beijing Tianrun New Energy Investment Corporation, as a fully owned subsidiary. Beijing Tianrun leveraged Goldwind's experience in the development, construction, and management of wind farms and procured turbines from the parent company. Similarly, Goldwind International develops projects overseas, including the 106.5 MW Shady Oaks Wind Farm in the United States, thereby strengthening the integrated business model. The Goldwind group has since supplied wind turbines to its own development projects in Australia, the United States, Ecuador, and Chile.

Goldwind has also increased the demand for its products by piloting small-scale or high-profile projects to demonstrate the viability of products. According to Goldwind International, the demonstration Uilk Wind Farm project (4.5 MW) in the United States helped further sales in the market, as seen in the spike in Goldwind's exports following the Uilk investment (see Figure below).

EXPORT OF CHINESE WIND TURBINES



[a] Goldwind International, personal communication, March 2012.
Source: China Wind Energy Council.

SOLAR

In contrast to the wind sector, the Chinese solar industry has always been internationally oriented and suppliers compete globally. The industry relies mainly on exports to the German, Italian, Spanish, U.S., Czech and other emerging markets. Chinese companies have developed manufacturing, sales, and service capacity in these countries to support their exports. Along the solar value chain, competitive Chinese solar companies have started providing engineering, procurement and construction (EPC) services and developing solar PV plants.

Recent antidumping measures have resulted in the United States imposing 35 to 200 percent tariffs on solar-cell imports from China, and Europe plans similar measures to protect its domestic manufacturers (Chaffin 2012). These tariffs have prompted China to stimulate its domestic demand to offset these impacts (see Table 4). As the domestic market grows, shifting manufacturing overseas might be a short-term measure to continue to service its existing markets and retain its market share, but this trend is not yet evident.

Table 4 | Chinese Government Incentive Programs for Developing its Domestic Solar Market

PROGRAM	STRUCTURE
Concession for grid-connected solar PV plants	Before setting fixed feed-in tariff, reverse bidding for PV concession was implemented. About 130 MW of projects were approved in 2009; 280 MW in 2010, and 500 MW in 2011.
"Golden Sun" demonstration projects	The program is designed to subsidize 50–70% of the initial costs of connected solar PV power plants. First tranche of the program supported 294 projects with total capacity exceeding 632 MW.
Building integrated solar demonstration program	First tranche of the program invested Y1.27 billion to support 111 roof-top solar installation projects with total capacity of 91 MW.
Solar feed-in tariff	Y1-1.15 /kWh, paid with renewable energy premium charged on all end users.

Note: All incentives are designed to be streamlined under the National Renewable Energy Development Fund. The fund sources from specialty funding allocated in national budget and renewable energy premium charged on all end users (Y0.008/kWh).

Source: Information compiled from Ministry of Finance, National Development Reform Commission websites.

Moreover, declining subsidies in Germany, Spain, Italy, and other major markets have hit their domestic solar industries, providing an opportunity for Chinese companies to invest in these markets since they are known to accept lower returns.[17]

2.2.2 Government Policy "Push"

The Chinese government has taken several steps to "push" its wind industry overseas, partly to combat domestic oversupply, but also in recognition of the fact that the size and maturity of the industry offers an opportunity for them to compete internationally. To a lesser degree, the solar industry has also been encouraged to invest overseas. The timeline of the policy development is shown in Figure 14 and described in this section. The varying levels of government emphasis on internationalization in the solar and wind industries reflect the challenges facing those industries domestically.

Policies supporting the development of the renewable energy industry have been in place in China since the 2005 renewable energy law. On the domestic side, policies have been guiding wind development to grow toward healthy development. The National Energy Administration's 2010 ruling, "Interim Measures for Management of Developing Wind Power," restricted unapproved projects from benefiting from the national feed-in tariff, thus limiting the industry's domestic expansion (National Energy Administration 2010). In March 2012, the National Energy Administration issued an emergency notice, "Relevant Policies on Management of the Development of Wind Power," forbidding the approval of new projects in areas where more than 20 percent of installed capacity had been curtailed (National Energy Administration 2012).

The first direct major policy push for the wind industry to invest overseas came in September 2009 when the State Council approved recommendations by the National Development and Reform Commission and other ministries[18] and issued a circular to "curb excess capacity and redundant construction in several industries and [promote] the healthy development of industries" (State Council 2009). The polysilicon (solar) and wind equipment industries were two of six industries targeted under the policy. The policy directed the wind equipment industry to move toward large-scale, internationalized development.

Figure 14 | **Relevant Policies for Solar and Wind Industry Development Resulting in Overseas Investment**

KEY POLICY DEVELOPMENTS

- **2012:** 12th Five-Year Plan for the Solar Photovoltaic Industry
- **2012:** Draft 12th Five-Year Plan for the Renewable Energy Development
- **2012:** 12th Five-Year Plan for Strategic Emerging Industries Development
- **2011:** Guidelines on Enabling Strategic Emerging Industries to Go Overseas, encouraging renewable energy industries to acquire key technology overseas.
- **2010:** Decision of the State Council on Accelerating the Fostering and Development of Strategic Emerging Industries, including solar PV and wind.
- **2010:** Opinions on Promoting Healthy Development of the Wind Equipment Industry, called for internationalization.
- **2010:** National Law for Renewable Energy amended, guaranteed electricity generated from renewable sources to be purchased in full amount.
- **2009:** Curbing Excess Capacity and Redundant Construction of Several Industries and Promoting Healthy Development of Industries, including wind equipment and polysilicon.
- **2009:** Notice on Policy to Improve Grid-Connected Power Pricing for Wind Power, set feed-in tariff for wind.
- **2008:** Interim Measures on Management of Special-Project Funds for Industrialization of Wind Power Generation Equipment encouraging R&D in China.
- **2008:** Renewable Energy Development under the 11th Five-Year Plan published; National Renewable Energy Development Fund established.
- **2007:** Medium & Long-Term Renewable Energy Development Plan, 2007-2020.
- **2005:** National Law for Renewable Energy established.

Source: Chinese governmental websites, accessed in November 2012.

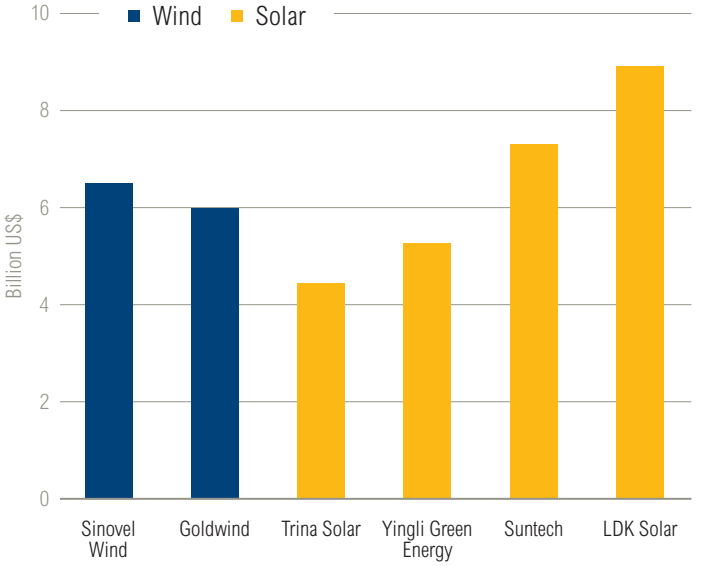
In October 2010, the State Council gave the strategic emerging industries a further impetus to go overseas when it decided to "accelerate the fostering and development of strategic emerging industries" targeting seven priority industries including new energy – nuclear, solar thermal, solar PV, wind, smart grid, and biomass (State Council 2010). A year later, MOFCOM provided guidelines to these strategic emerging industries requiring the solar industry, in particular, to acquire key technologies to enhance international cooperation and to build power plants overseas to restructure its exports (MOFCOM 2011a). There was no specific guidance for the wind industry. Further guidance is expected from the "New Energy Industry Development Plan" to be approved by the State Council in 2012 (Xie 2010).

2.2.3 The Financing "Enabler"

Access to abundant and relatively low-cost capital provided by Chinese financial institutions, especially the China Development Bank (CDB), has enabled Chinese SOEs, and to a lesser extent privately-held solar and wind companies, to invest overseas. Financing has been available both as lines of credit to corporate entities and as project financing specifically to acquire and develop overseas power plants. It has also been available as credit support to overseas buyers who import Chinese wind and solar products and to EPC companies building projects overseas, which can catalyze overseas investments.

Although not specifically for the purposes of overseas investments, other capital available to these industries has allowed them to expand their businesses overseas. This capital includes the US$46 billion "green stimulus" package announced in 2009, US$5.9 billion from the capital markets in 2009 through initial public offerings (IPOs), and Chinese government loan guarantees worth US$36 billion in 2010 (Bloomberg New Energy Finance 2010; McCrone et al. 2011).[19] Access to such flexible capital has enabled these companies to finance overseas investments on their balance sheets without the need for project financing.[20] Chinese banks also prefer lower-risk corporate financing to limited or nonrecourse project financing. For industry, the former option also has lower transaction costs (i.e. approval time and bank fees) and lower interest rates (Dai and Wang 2009). For Chinese companies, this access to capital makes their returns on investments more attractive than it was for developers in European and U.S. markets, who have to rely on relatively higher-cost project financing.

Figure 15 | **CDB's Credit Lines to Chinese Wind and Solar Companies in 2010**



Source: McCrone et al. 2011; Goldwindglobal.com 2011; Sinovel.com 2010.

The policy banks, in particular the China Development Bank (CDB) and the Export-Import (ExIm) Bank of China, and several commercial banks including the Bank of China, Bank of Shanghai, China CITIC Bank, and the Bank of Communications, have provided huge credit lines and loans to solar and wind companies (Pentland 2011). Some of these loans were specifically designed for the overseas expansion of some companies. In 2010, the solar industry saw four significant credit lines from CDB (see Figure 15). On the wind side, Goldwind and CDB signed a strategic cooperation agreement, including a credit line of US$6 billion, to support the company's expansion into international markets. Goldwind secured a similar deal with the ExIm Bank (Quilter 2012). CDB also financed Sinovel's US$2.2 billion joint venture with Mainstream, an Ireland-based global renewable energy developer with a 16 GW portfolio of projects in Europe. Sinovel is also supplying wind turbines to this joint venture and such integrated packages have tended to be "deal clinchers" (Clark and Hook 2011). Thus, CDB has played a catalytic role. It has explicitly prioritized supporting strategically emerging industries and companies seeking to "Go Global." Moreover, as the only bank in China allowed to issue sovereign debt, it can raise low-cost capital; its bonds are ranked at the highest level on every credit agency's list.

Chinese financial institutions have also been indirectly supporting foreign wind and solar investments by financing EPC companies, and by offering export credit. Many wind and solar manufacturers have been bundling their products and investments with state-owned developers and EPCs to expand overseas. This bundling has allowed them to benefit from interest rates of 1.6 percent paid by SOEs when borrowing from state banks, which is lower than the rate of 4.7 percent for private companies (Economist 2012). For example, ExIm Bank provided state-owned EPC CDIG US$97 million to construct a 50 MW wind farm in the Singida region of Tanzania (Wind Power Monthly 2011). Similarly, ExIm Bank financed state-owned developer HydroChina to invest in the Adama Wind Farm Project in Ethiopia, which included a supply contract with Goldwind, 85 percent of which was paid for by ExIm Bank financing (Qi 2011). In at least one case, CDB also lent US$44 million directly to a foreign company, the U.S.-based SPI, to build a solar power project in New Jersey due to its close working relationship with LDK Solar, which in turn strengthened cooperation between the two companies (Solar New Jersey 2012). Thus, in the context of the global financial crisis, these loans from Chinese banks have opened many doors for solar and wind companies to expand overseas.

China's central bank, the People's Bank of China, has also played its part. It has been advising the country's financial sector to adopt the principle of "differentiated treatment with support and control," which allows "strategically emerging industries" to receive preferential access to finance. Thus, with preferential treatment, financing from Chinese banks, and other forms of access to low-cost capital, Chinese wind and solar companies have leveraged their local financial sector to invest overseas. Financing from local banks in host countries is still a rare phenomenon, but Chinese companies are actively pursuing such opportunities. For example, Sinovel received its first non-recourse loan from Standard Bank of South Africa in 2012. (World Wind Energy 2012).

2.2.4 Host Country Policy and Market "Pull"

Several policy and market factors in host countries have attracted or "pulled" Chinese investments into their solar and wind industries. These factors include regulatory and price incentives, import barriers and local content requirements that make local production more attractive, and a credit crunch and undervalued assets in Organisation for Economic Co-operation and Development (OECD) country markets resulting from the financial crisis.

REGULATORY AND PRICE INCENTIVES

Supportive policies, including preferential taxes, feed-in tariffs and renewables portfolio standards have encouraged Chinese investments even if they did not exclusively target Chinese investors. For example, Illinois' Renewable Portfolio Standard enabled Goldwind to secure a 20-year electricity supply contract with Commonwealth Edison

Table 5 | **Select Policies in Major Markets**

PROGRAM	STRUCTURE
Japan	Goal of developing 28 GW of solar and 5 GW of wind by 2020; pledge to install solar systems on 70% of new homes by 2020; R&D and initial investment subsidies; new Feed-in-Tariff Act in 2012.
United States	Mandatory renewable portfolio standards in 21 states and renewable energy targets in additional 8 states; tax credits and loan guarantees under the Energy Policy Acts of 1992 and 2005; investment tax incentives, loan guarantees and grants under The American Recovery and Reinvestment Act of 2009.
Germany	Goal of expanding renewable electricity capacity to 35 percent by 2020; feed-in-tariffs, priority connection to grid, and dispatch guaranteed under the Renewable Energy Act.
India	"Jawaharlal Nehru National Solar Mission," aiming for 20 GW of solar installed capacity by 2020; state-level incentives in forms of feed-in tariff and tax benefits.

Note: This is not a comprehensive collection of renewable energy policies in major markets, but rather an illustration of policies benefiting investment.

Source: Barua et al. 2012.

Company starting in 2012, which facilitated its investment in the Shady Oaks Wind Farm (Davidson 2010). This contract was a first-of-its-kind investment for Chinese overseas wind development whereby a Chinese company will sell the electricity generated directly to the grid. In another case, Arizona's 2009 renewable energy manufacturing tax credit enabled Suntech Power to open a US$30 million factory for the final assembly of solar panels in Goodyear, Arizona in 2010 (Trevizo 2010). U.S. federal tax credits for wind farm development have not benefitted new entrants without a tax history, but a variation in the policy, which returned 30 percent of the value of the investment to investors in cash, has benefited Chinese investors (Zhou 2010).

Like the United States, several countries offer incentives that are attracting overseas investments into their solar and wind industries (see Table 5). One is South Africa. In 2003, the South African government announced in its White Paper on Renewable Energy a 10,000 GWh renewable energy target to be achieved by 2013; a goal supported by a feed-in tariff (Department of Minerals and Energy 2013). Chinese companies Yingli Solar and Suntech Power invested in solar PV plant and Goldwind and Guodian Longyuan invested in a wind farm development in South Africa. In some cases, bilateral cooperation agreements have been used to formally guarantee support and attract investments from China. For example, the trade-promotion agency of Kazakhstan signed a memorandum of understanding (MOU) with Goldwind to encourage it to develop wind power projects in the country. In the same year, China's premier Wen Jiabao listed climate change as one of eight measures for cooperation between China and Africa, and committed to help countries in Africa build 100 new clean energy projects (People's Daily 2009). Such cooperation could result in further scaling up China's investments overseas, particularly in other developing countries.

IMPORT RESTRICTIONS

Policies and measures discouraging imports from countries including China have had the "side effect" of shifting China's production activities directly to destination markets or third countries not subject to these restrictions in order to maintain their market share. Such measures include local content requirements and antidumping duties. Local content requirements are present or under consideration in some of China's major markets including Brazil, Canada, and India.[21] The impacts of these policies are being reflected in recent deals. For example, Sinovel won a bid to supply turbines to a wind power project in Brazil, but will have to produce and procure turbines locally to fulfill local content requirements in Brazil; Sinovel is reportedly in the process of selecting a site for its Brazilian production base (Yu 2011).

Similarly, recent antidumping duties by the United States on China's solar and wind products are creating incentives for Chinese companies to shift their production to jurisdictions not covered by the duties, such as Taiwan and Thailand, and to export their products to the United States from those locations.[22] While these measures have not yet shifted production, several top Chinese solar manufacturers have been reported to be considering opening manufacturing factories overseas (Guo 2012). Several Chinese companies already have manufacturing facilities in Canada and the United States that could scale up production.

OPPORTUNITIES ARISING FROM THE FINANCIAL CRISIS

The 2008 financial crisis and its ongoing effects made many European and North American financial institutions more risk averse. This aversion to risk led to a higher cost of capital for investors from these regions. The interest rate they could get from their financial institutions for a wind farm project was 15 times higher than the average levels prior to the crisis, and deals would only be obtained with far more constraining conditions (Harvey 2009)[23]. This shift opened a door for Chinese investors who had access to relatively low-cost capital from their financial institutions.

Although no case has been identified in the wind and solar industries where an acquisition occurred due to undervalued assets, at least two such investments were made by the State Grid Corporation of China in 2012 when it acquired electricity transmission assets in Brazil from the debt-laden Spanish construction firm ACS and again when it acquired a 25 percent stake in Portugal's national power company REN, which was forced into privatization under the EU bail-out plan (Dominguez and Ho 2012). Both of these companies are also solar and wind investors and own assets in these industries. China's National Energy Administration is encouraging Chinese developers with extensive wind development experience to capitalize on these opportunities (New Energy 2010b).

3. CONCLUSIONS

China is emerging as an important overseas investor in the wind and solar industries. Over the past decade, it has steadily increased its investments in these industries, driven by policy "push" and "pull" factors, domestic and overseas market conditions, and a supportive financial sector. Although China's investments have been concentrated in the United States, Germany, Italy, Australia, and other developed countries, its investments in developing countries such as South Africa, Pakistan, and Ethiopia are increasing and appear likely to continue increasing in the coming years.

China is driven to seek solar and wind markets overseas largely because its manufacturing capacity exceeds domestic demand. Although increasing exports can partially address the situation, it is not alone a solution; industries face import restrictions in some major markets, particularly the United States. As a result, investments are seen as a way of retaining and expanding market share, strategically acquiring new technologies, filling the financing gap, acquiring undervalued assets in the wake of the financial crisis, and even creating demand for the export of products, as has been seen particularly in the case of Goldwind.

The Chinese government's policy support and financial support mainly from the country's state-owned banks, which are responsive to government policy, have encouraged this overseas investment trend. China's policies, which are linked to its strategy of "Going Global" and focus on strategically developing "emerging industries," including the wind and solar industries, have had the effect of "pushing" Chinese companies to invest overseas. This push has been aided by financial support, particularly from the China Development Bank, in some cases specifically for overseas investments, but in most cases for these companies to grow their businesses, which may include overseas investments.

Host countries' policies have also attracted or "pulled" investments from China's solar and wind industries, either explicitly through tax breaks and feed-in tariffs, or through bilateral cooperation agreements, or as a "side-effect" of policies discouraging imports. Although such policies have been prevalent in developed country markets, they are now increasingly being put in place in developing country markets. These policies are likely to increase China's investments in developing countries as Chinese solar and wind industries continue to expand their markets, and as incentives are scaled back in developed-country markets. Overseas investments in solar and wind projects could release the excess capacity in the domestic manufacturing sector and make good use of China's foreign reserve. Organizations with international presence can bridge the gap between resources in China and needs in other developing countries to create "win-win" situations.

4. THREE AREAS FOR FURTHER RESEARCH AND ANALYSIS

As a new area of research, this analysis uncovered trends and insights that enhance our understanding of China's role as an overseas investor in the wind and solar industries. However, the data are limited and the scope of the research is constrained. Further research and analysis is required to deepen the understanding of China's role as a low-carbon investor more broadly. This research would entail looking at China's investments in other low-carbon technologies in the electricity and other sectors, as well as the relative importance of China's low-carbon investments to its investments in conventional fossil fuels and the resulting impact on reducing greenhouse gas emissions.

Specific recommendations for further data collection, research, and analysis are given below.

Improve data on China's overseas wind and solar industries. Specific disaggregated data particularly on the scale and nature of investments on China's overseas investments in the solar and wind industry were not easily available. As a result, this analysis has relied on incomplete data, as noted in Table 1. Finding data on the solar industry's overseas investments has been more challenging than finding data on the wind industry. The Chinese solar and wind industry associations collect data on domestic production, installation, and export. Overseas investment data could be integrated into these surveys. In addition, data provided by the National Development and Reform Commission and the policy banks in China should be held to international best-practice standards to provide consistent and comparable project-level data.

Expand research and analysis of investments in other low-carbon technologies. Compare China's overseas investments in these technologies with overseas investments in conventional high-carbon energy technologies. The analysis in this working paper also did not include other renewable energy industries like biomass and small hydro, nor did it include other energy-efficient technologies

or industrial process technologies that also reduce emissions. Further research could include these technologies and industries. Further analysis could assess the emissions impact of these investments, especially relative to the emissions effect of China's investments in conventional fossil fuel industries. The comparative analysis would provide a more holistic picture of the impact of China's overseas investments on emissions. Research could also be conducted to analyze the environmental and social impacts of low-carbon technologies, including in the supply chain. Further research could then compare China to other major emerging economies as well as to developed countries.

Conduct policy-oriented research on ways in which China could scale up overseas investments, particularly in other developing countries, to enhance energy access and reduce emissions. Due to the limitations in data, particularly the scarcity of data on investments in other developing countries, it has not been possible to draw definitive policy recommendations from this analysis. The drivers analysis in section 2 indentifies Chinese government policies and host country policies that have worked to encourage investments. Further research through case studies could help verify the impact of these policies on driving investments not only in wind and solar development in developing countries, but also on enhancing access to clean energy technologies, such as clean cook stoves, solar lanterns, and solar home systems.

Our research showed that China is driven to seek solar and wind markets overseas largely because its manufacturing capacity exceeds domestic demand. The Chinese government's policy support and financial support mainly from the country's state-owned banks, which are responsive to government policy, have encouraged this overseas investment trend. Host countries' policies have also attracted or "pulled" investments from China's solar and wind industries, either explicitly through tax breaks and feed-in tariffs, or through bilateral cooperation agreements, or even as a "side-effect" of policies discouraging imports. Research should also be conducted on low-carbon investment from other emerging countries in order to facilitate cross-border clean energy investment and disseminate best practices in renewable energy industry development globally.

ACRONYMS AND ABBREVIATIONS

CDB	China Development Bank
CDIG	China Dalian International Economic & Technical Cooperation Group Co., Ltd.
EPC	engineering, procurement, and construction
Exim Bank	Export-Import Bank of China
FDI	foreign direct investment
GHG	greenhouse gas
GW	gigawatt
GWh	gigawatt hours
IPO	initial public offering
kW	kilowatt
LIBOR	London Interbank Offered Rate
M&A	mergers and acquisitions
M/MW	million per megawatt
MOFCOM	Ministry of Commerce
MOU	memorandum of understanding
MW	megawatt
OECD	Organisation for Economic Co-operation and Development
OFDI	outward foreign direct investment
R&D	research and development
SAFE	state administration of foreign exchange
SASAC	State-owned Assets Supervision and Administration Commission
SOE	state-owned enterprise
SPC	state planning commission

ENDNOTES

1. Compare estimates of current investments in McCrone et al. 2011 with projections for investment needs in the International Energy Agency's reports World Energy Outlook up to 2035 and Energy Technology Perspectives up to 2050. Estimates suggest that investments needs are in the order of US$100–200 billion a year in coming years, US$1–2 trillion by 2030, and US$2–5 trillion by 2050. See http://www.iea.org/techno/etp/iew_paper.pdf , in particular.
2. See annual G-20 renewable energy investment reports for the past several years.
3. Greenfield investment refers to "creation of a subsidiary from scratch by one of more nonresident investors." (DITEG2004)
4. The data on China's 124 investments came from a variety of sources including commercial databases of Financial Times LTD'sfDi Intelligence and the Bloomberg Professional service, as well as from the website of China's National Development and Reform Commission for approved investments over US$10 million. The authors compiled additional information from company and bank reports, major business publications, industry association reports, and interviews with industry contacts in China.
5. For the industry-specific analysis later in this section, the two investments that cover both wind and solar technologies are counted in both industries.
6. Developed countries are defined as high-income economies in the World Bank's country group classification by income; developing countries include low-income economies, lower-middle-income economies, and upper-middle-income economies. Classification in this paper was quoted from the World Bank website in July 2012 using 2011 gross national income (GNI) per capita, see http://data.worldbank.org/about/country-classifications.
7. According to REN21 (2012), as of end of 2011, Germany, Italy, and Spain ranked 1st, 2nd, and 5th respectively in terms of per capita solar PV capacity in the world.
8. Information on investment size and installed capacity is available for a limited number of investments (see Table 1)
9. We focus on solar photovoltaic technologies in this paper, including crystalline silicon and thin film. Concentrated solar power and solar thermal heating and cooling technologies are not included here.
10. Import levels are constrained by the global availability of resources that China needs and has limited access to. The government has been exploring alternative approaches to gain access, including its "Loans for Oil" deals and foreign direct investment.
11. The "Go Global" strategy is reflected in many key government documents. However, there is no dedicated document outlining its goals and implementation plan. The Central Party Literature Office identified the motives for the "Go Global" strategy under President Jiang as "acquiring natural resources, developing China's own multilateral companies, and gaining access to technology." See Chen 2009.
12. In 2010, The Economist reported that 51 percent of surveyed Chinese corporations viewed government encouragement as a motivation to invest overseas.
13. Authorized by the State Council, SASAC performs investor's responsibilities, supervises and manages the state-owned assets of the enterprises under the supervision of the Central Government (excluding financial enterprises), and enhances the management of the state-owned assets.
14. The dollar price of wind turbine price in China is calculated with historical US$/ Y exchange rate (US$1 dollar = Y6.59) on December 31, 2010, quoted from exchange-rates.org. 1 MW = 1000 kW.
15. China Wind Energy Association, personal communication, March 2012.
16. According to Crooks (2011), the chief executive of Vestas Wind System, the world's largest turbine company, told the Financial Times that manufacturers in the United States and Europe can succeed in their home market because of the prohibitive cost of shipping turbines from China. This view is also reflected in Kirkegaard 2009.
17. There are a variety of reasons for this phenomenon, including lower costs for Chinese companies with access to cheaper labor, construction services, and supply contracts according to personal communications with experts from the China Renewable Energy Industry Association.
18. Ministry of Industry and Information Technology, Ministry of Supervision, Ministry of Finance, Ministry of Land and Resources, Ministry of Environment Protection, People's Bank of China, General Administration of Quality Supervision, Inspection and Quarantine, China Banking Regulatory Commission, and China Securities Regulatory Commission.
19. In 2008, Chinese banks loaned nearly US$1 billion to solar supply chain companies, including module, raw silicon, and wafer producers, as a stimulus in the wake of the financial crisis. Large companies raising capital in public markets include Sinovel Wind (US$1.4 billion), Goldwind (US$1 billion), and China Ming Yang Wind Power (US$350 million).
20. According to the International Project Finance Association, project finance is "the financing of long-term infrastructure, industrial projects and public services based upon a non-recourse or limited recourse financial structure where project debt and equity used to finance the project are paid back from the cash flow generated by the project."
21. According to McCrone et al. 2011, in Brazil, the Proinfa wind feed-in tariff program, which was replaced last year by a tendering system, also stipulated 70 percent local content, but the requirement was later dropped—at least for 1.5 MW-plus turbines—after it became clear that there was insufficient local factory capacity to meet the program target. In 2009, the Canadian province of Ontario introduced a rule that its generous feed-in tariff for solar PV projects of more than 10 kW would only be available for developers using modules with at least 50 percent of their cost based on local goods and services. On January 1, 2011, that proportion rose to 60 percent. In July 2010, India announced that PV project developers participating in the first 150 MW phase of its Solar Mission initiativewould only be eligible for support if they used locally assembled modules. For the main 296 MW phase, which will be allocated by March 2012, both cells and modules have to be produced locally.
22. The U.S. Department of Commerce reached a preliminary ruling that 2.9–4.73 percent tariffs can be imposed on Chinese solar cells imported for countervailing duty and 31.34–249.96 percent for antidumping. Preliminary conclusions are presented in ITA 2012a, 2012b, and 2012c.
23. LIBOR is he London InterBank Offered Rate for deposits, such as the six-month dollar LIBOR.LIBOR is a reference rate for the international banking markets and is commonly the basis on which lending margins are fixed. Thus, an original loan agreement or a rescheduling agreement may set the interest rate to the borrower at six-month dollar LIBOR plus 1.5 percent, with semiannual adjustments for changes in the LIBOR rate. (OECD Glossary of Statistical Terms.)

ANNEX 1: CHINA'S OVERSEAS INVESTMENT DESTINATIONS IN THE WIND INDUSTRY, 2002-12

HOST COUNTRY	CHINESE INVESTORS
Australia	Goldwind, Datang Corp., Baoding Tianwei
Belgium	Sinovel
Bolivia	Sinomach
Bulgaria	XEMC
Canada	Guodian Longyuan
Chile	Goldwind
Ecuador	Goldwind
Ethiopia	Hydro China
Germany	Goldwind, China National Building Material Group
Greece	Sinovel
Hong Kong	Goldwind, Three Gorges Corp.
Ireland	Sinovel
Japan	A-Power
Kazakhstan	Datang Corp.
Pakistan	Three Gorges Corp., A-Power, Najing Sunec Wind
Portugal	Three Gorges Corp.
Singapore	Titan Wind Energy
South Africa	Guodian Longyuan, Goldwind
Tanzania	MCC 20-Hainan International, CDIG
The Netherlands	XEMC
United Kingdom	Datang Corp.
United States	Goldwind, XEMC, Shenyang Ruixiang, China Investment Corp.

ANNEX 2: CHINA'S OVERSEAS INVESTMENT DESTINATIONS IN THE SOLAR INDUSTRY, 2002-12

HOST COUNTRY	CHINESE INVESTORS
Australia	Suntech Power, Datang Corp.
Bulgaria	Hareon Solar Corp., Chaori Solar
Canada	Daqo New Energy, Suntech Power
Cayman Islands	CDB Capital, Jiangsu Huasheng Tianlong
France	Yingli Solar
Germany	LDK Solar, Shanghai Alex Solar, Everbright, Zhejiang ToPoint, Risen Energy, ET Solar, Jiangsu Zongyi, Goldoly, CTDC, TBEA, SunOasis, Suntech Power, Astronergy, Trina, JA Solar, Yingli Solar, Jintech
Italy	LDK Solar, CDB, Winsun New Energy, Suntech Power, Jiangsu Zongyi, Yingli Solar
Japan	Suntech Power
Kenya	Trony
Norway	China National Bluestar Group
Serbia	Huadian
Singapore	Sichuan Honghan Solar, Perfect Field Investment, Yingli Solar
South Africa	Yingli Solar, Suntech Power
South Korea	Trina Solar
Spain	Zhejiang Chint, Trina Solar, Yingli Solar
Switzerland	Trina Solar
Thailand	Astronergy Solar, PT Drive
United Kingdom	Risen Energy
United States	LDK Solar, Sunland Solar, Jiangsu Shenglong, Guodian, China Solar Energy Holdings, Sichuan Dongjia, Suwei, Wanxiang, Suntech Power, Linuo, Trina Solar, Sunlan, Suntech Power, Chaori Solar, JA Solar, Yingli Solar

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