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China's Equity Investments in Overseas Coal, Wind, and Solar Energy Projects

Energy, climate, and finance researchers at Greenpeace East Asia's Beijing office collaborated with the Sichuan Province Cyclic Economy Research Center on a series of reports that evaluate in equity investment in overseas solar, wind, and coal projects from Chinese enterprises.

Key findings:

1. Chinese equity investment in solar, wind, and coal altogether grew 1,370% from 2014 to 2018, the first five years of the Belt and Road initiative, with 12,622 megawatts of new wind and solar and 67,900 megawatts of new coal brought online via equity investment.
2. South and Southeast Asia are the primary destinations for these equity investments, with 93% of the total invested capacity installed in these two regions. About 80% of wind investments went into South and Southeast Asia, with a current installed capacity of 397.5 megawatts.
3. The new wind and solar projects will offset 3,157 megawatts of coal-fired electricity -- displacing about 15 million tons of carbon dioxide every year. Over the typical 25 year life cycle of these projects, that amounts to 380 million tons of carbon dioxide taken out of the atmosphere.
4. Solar investments in the first five years of the Belt and Road Initiative (2014 - 2019), are 2.8 times the installed solar capacity from 2009 - 2013. Installed wind power capacity amounts to 432.5 megawatts -- the first wind power projects brought online by equity investment in Belt and Road countries.
5. Equity investment – where investors front capital in exchange for shares in a company or project – ties investors to companies or projects in the long-term. This rise in equity investment comes at a time when coal projects have greater and greater risk of becoming stranded assets due to overcapacity, environmental risks, and regulation. This means that Chinese equity investors assume high levels of financial risk in these coal investments. More than 100 global financial institutions now restrict new coal investments due to financial risk.

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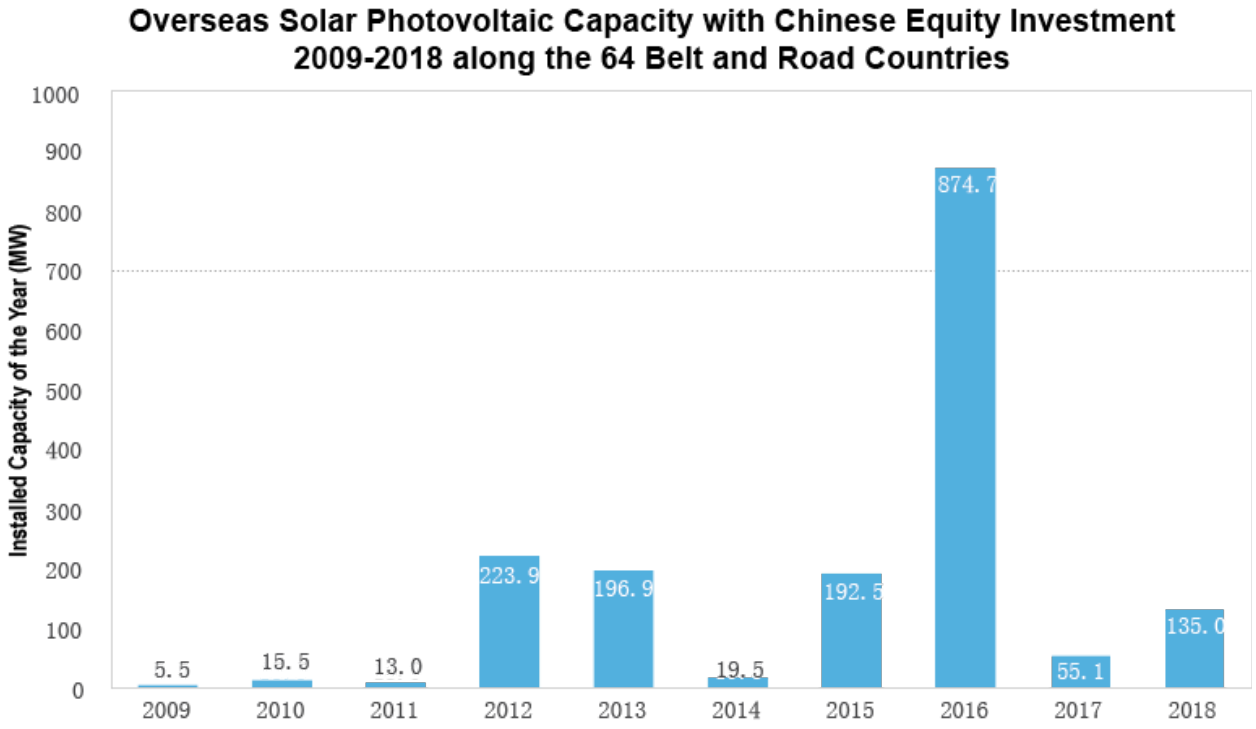
12.6 gigawatts[1] of wind and solar capacity via equity investment

From 2014 - 2018, Chinese companies have invested in wind and solar projects totaling about 12.6 gigawatts of capacity combined.

From 2014 to 2018, 1,709 megawatts of that capacity has been constructed, with 1,277 megawatts of solar already installed and 432.5 megawatts of wind installed. This wind energy capacity is the first built through equity investment from China in Belt and Road countries. The 1,277 megawatts of solar presents a 280% growth in solar capacity financed by equity investment.

A further 10,813 megawatts of wind and solar is in the pipeline, as of the end of 2018, in Belt and Road countries with Chinese equity investment.

Chinese companies invest in overseas wind and solar power projects in the form of equity investment; engineering, procurement, & construction (EPC); financial support and equipment exports. Equity and EPC



[1] 1 gigawatt = 1,000 megawatts

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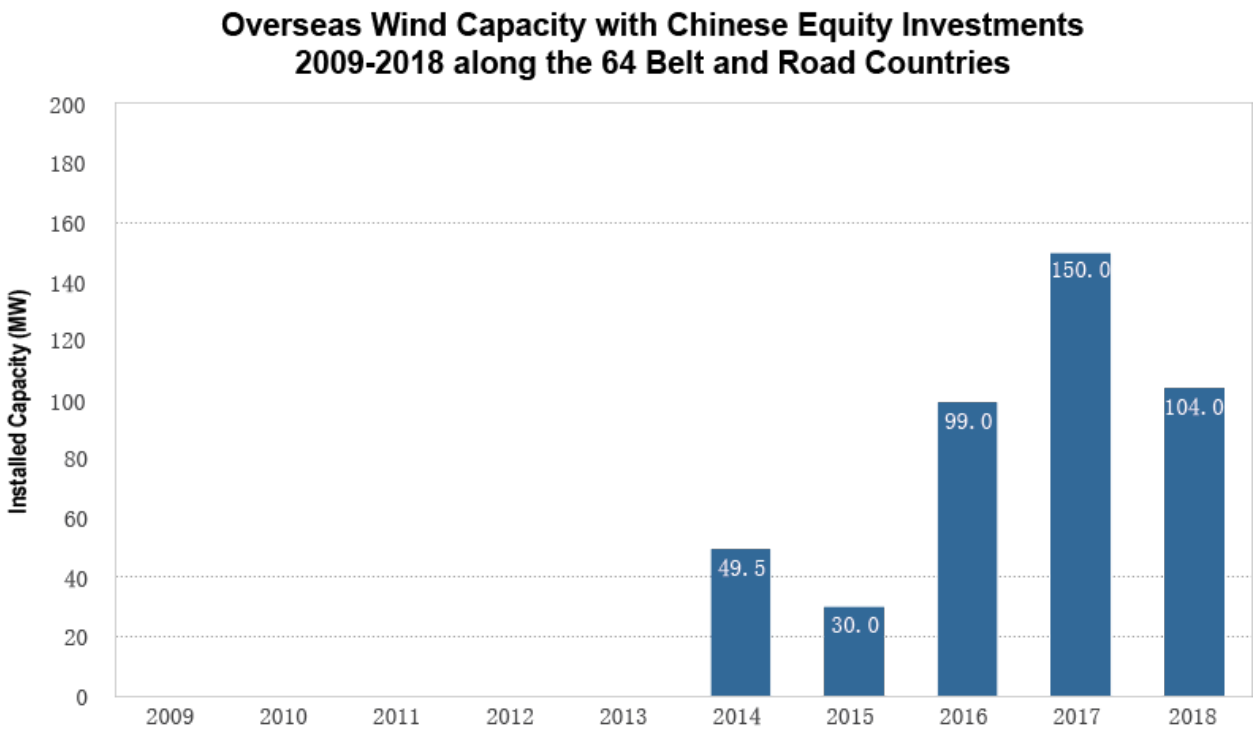

Equity investments surpass EPC for coal

In the past decade, the Chinese overseas coal investors shifted from primarily EPC investments to primarily equity investments. From 2009 to 2018, the capacity of coal-fired power built with equity investments from Chinese state-owned enterprises shot up to 10.8 gigawatts, with 26 times more equity invested from 2014 - 2018 than the previous five years. In 2018, for the first time, installed capacity funded by equity investment had greater year-on-year growth than EPC.

Over the next five years, Chinese overseas coal investors will focus on equity investment. From 2019 to 2023, we estimate that 39.8 gigawatts of coal fired power will be installed, under construction, or in pipeline, with another 24.1 gigawatts of EPC-invested projects put into operation.

South Asia and Southeast Asia

South and Southeast Asia are the primary destinations for these investments by far, accounting for about 93% of total wind and solar investment from 2014 to 2018.

Pakistan is currently the primary recipient of these investments. And the 397.5 megawatts of wind power invested in Pakistan via Chinese equity investment accounted

for 36.8% of the country's new wind power capacity from 2014 to 2018. Before 2015, only 200 megawatts of solar energy and no wind had been installed via these kinds of investments in Pakistan. By 2016, there were 800 megawatts of capacity, with financing from three different Chinese companies.

South and Southeast Asia are also primary destinations of overseas coal equity investments, with 94% of overseas coal equity investments between 2009 and 2018 going to one of the two regions. South and Southeast Asia will remain primary destinations for overseas coal investments over the next five years, followed by Europe and Central and West Asia.

Environmental benefits of wind and solar

The 12.6 gigawatts of wind and solar will together offset 3,647 megawatts of coal-fired power, which will cut about 15 million tons of carbon dioxide emissions every year. The typical lifespan of these projects is 25 years, so the expected emissions reduction is 380 million tons of carbon dioxide.

The current 1,709 megawatts of wind and solar will offset 490 megawatts of coal-fired power. The 10,913 megawatts of pipeline projects will offset another 3,157 megawatts of coal.

Coal risk

Equity investment brings long-term to Chinese companies who put equity into these overseas coal projects. The equity model, where investors exchange capital for shares in companies or projects, ties these investors to these coal projects in the long-term, compared to EPC investment.

Financial and policy constraints on wind and solar

Chinese investors still face several hurdles when investing equity in overseas energy projects, which mainly stem from excessive financing costs.

The current financing model is mainly based around commercial bank loans, which have a relatively high loan costs, particularly in countries with lower credit ratings. Between financing risks and a lack of commercial attractiveness, Chinese companies do not often meet full project financing with overseas equity investments. These investments require group financing, between overseas projects and domestic, Chinese

insurance entities and guarantors. The financing procedures detract new investors because they are complicated and the potential of these investments has not yet been realized.

In the long-run, renewables still have a small share of the global energy mix.

From 2002 - 2011, Chinese companies invested in at least 124 solar and wind power industries in 33 countries and about $40 billion in total investments, according to the World Resources Institute.

Domestically, China has had the highest installed wind and solar power capacity of any country since 2015. In 2018, new capacity in China accounted for 46.9% of the world's new solar projects, and 41.4% of new wind projects. At the same time, China's renewable energy enterprises have pursued a "going out" policy, with a deepening and diversifying arenas of involvement.

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Geographic Distribution of Overseas Solar Photovoltaic Projects with Chinese Equity Investments, by Country 2014-2018

Distribution		Capacity (MW)		
Continent	Country	Installed	Under Construction and Planning	Total
Central Asia	Kazakhstan		173	173
			Total	173
Europe	Czech Republic		61	61
	Poland	35	141	176
	Romania	32	17. 79	49. 79
	Turkey	4. 71	60	64. 71
	Ukraine		1692	1692
	Hungary		19. 8	19. 8
	Serbia		30	30
			Total	2093. 3
South Asia and Southeast Asia	Pakistan	900	50	950
	India	267. 4	190	457. 4
	Malaysia	12	5. 5	17. 5
	Maldives	2. 7		2. 7
	Thailand	3	40	43
	Bangladesh		490	490
	Sri Lanka		29. 4	29. 4
	Vietnam		80. 6	80. 6
	Philippines		70	70
	Afghanistan		40	40
			Total	2180. 6
	Egypt		1360	1360
	Jordan		117	117
	Iran	20	1100	1120
			Total	

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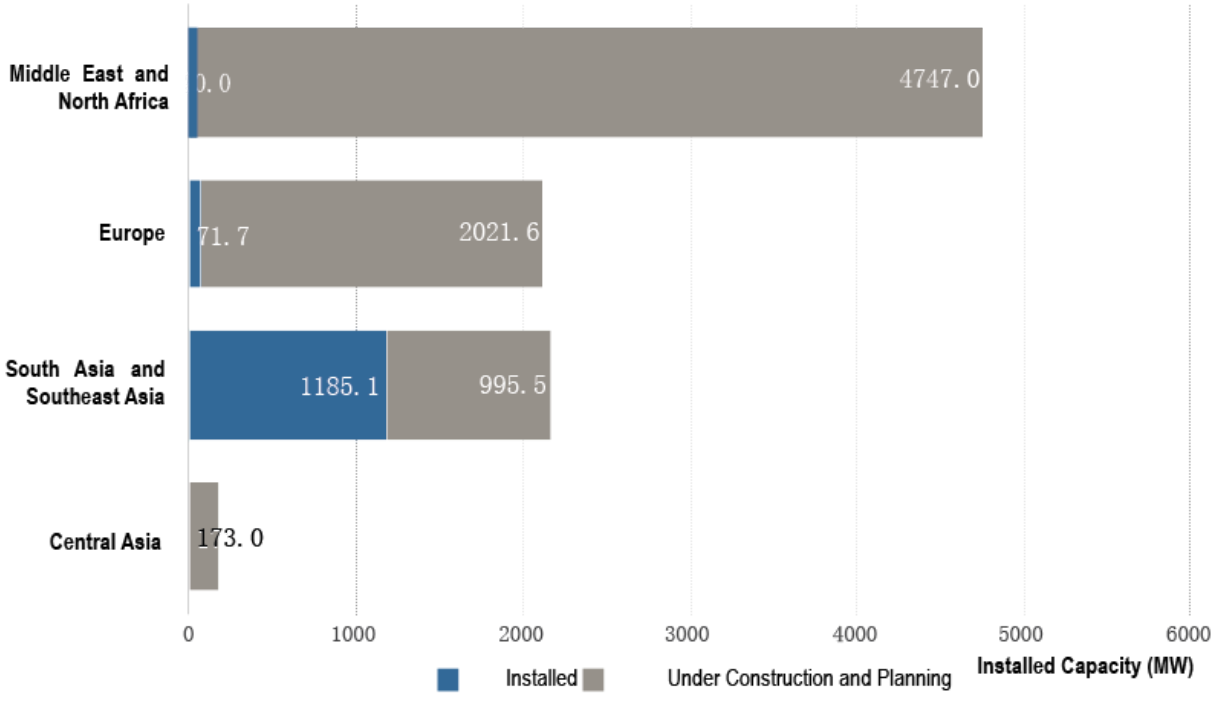
Geographical Distribution of Overseas Wind Projects with Chinese Equity Investments, by Country 2014-2018

Distribution		Capacity (MW)		
Continent	Country	Installed	Under Construction and Planning	Total
Central Asia	Kazakhstan	5	150	155
			Total	155
Europe	Croatia		312	312
	Montenegro		46	46
	Poland	30	606	636
	Ukraine		500	500
			Total	1494
South Asia and Southeast Asia	Pakistan	397. 5	350	747. 5
	India		30	30

Geographical Distribution of Overseas Solar Photovoltaic Projects with Chinese Equity Investments 2009-2018



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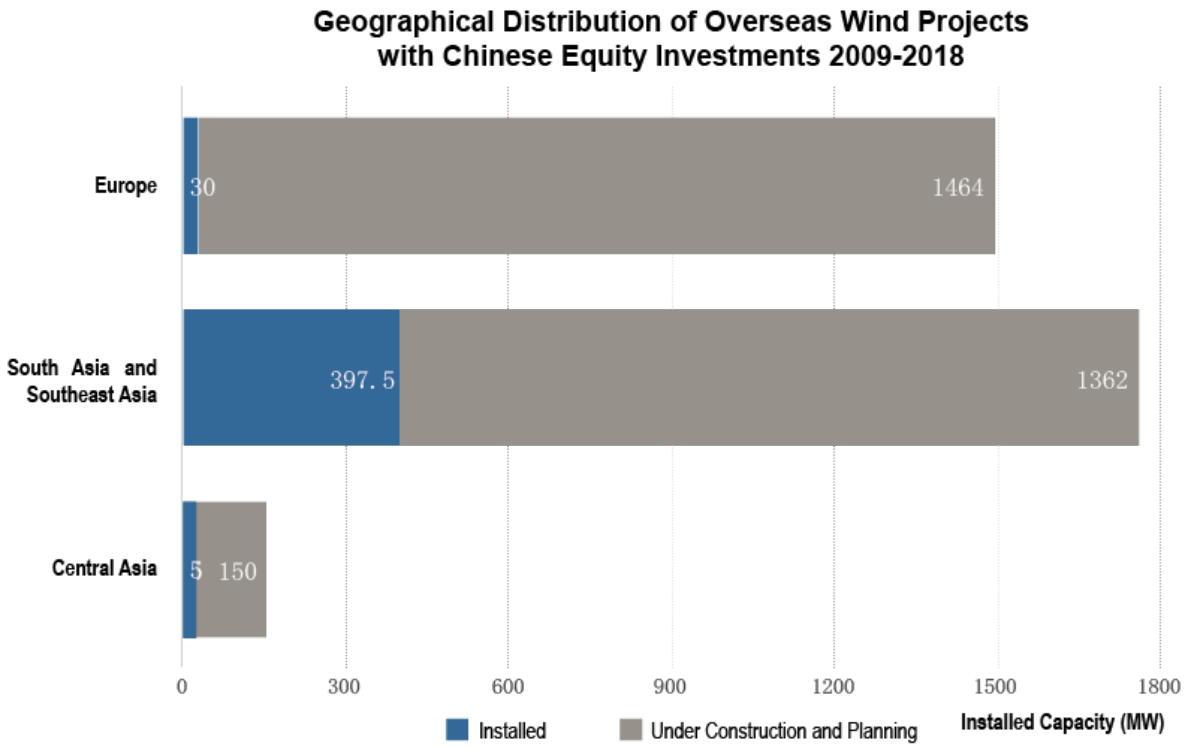

Project Installed with Chinese Equity Investment as a Percentage of Total Capacity, 2014-2018

Country	Installed Capacity as of the end of 2018 (MW)	Chinese Equity Investment Capacity (MW)	Equity's percentage of Total Capacity
Pakistan	1568	950	61%
India	26869	457.4	2%
Malaysia	437.8	17.5	4%
Maldives	9.4	2.7	29%
Thailand	2720	43	2%
Bangladesh	201.1	490	244%
Sri Lanka	159.1	29.4	18%
Vietnam	106.4	80.6	76%
Philippines	886.4	70	8%
Afghanistan	22.01	40	182%

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Appendix 1: Wind power installation and planning in countries with a high potential for wind power development in South and Southeast Asia.

Country	2018 wind installation （megawatts）	Scheduled wind energy development and further potential	Existing installed capacity, as a percentage of total planned capacity（%）
Pakistan	1185.9	2,500 megawatts by 2025	47.4
Thailand	1017.8	3,000 megawatts by 2036	33.9
Sri Lanka	145.9	514 megawatts of large-scale wind power by 2020, as outlined in the National Independent Contribution under the Paris Climate Agreement, t	28.4
The Philippines	107.7	1,049 megawatts by 2040.	10.3

Vietnam	**236.7**	**2,730 megawatts by 2030, with a theoretical reserve of 2,099,000 megawatts (2099 gigawatts), with 8.6% of Vietnam's land area suitable for wind power generation.**	**8.6**
Indonesia	**76.1**	**Excess of 1,800 megawatts by 2028, with around 60,600 megawatts of potential wind energy resources**	**4.2**
Bangladesh	**2.9**	**400 megawatts by 2030, as outlined in Bangladesh's National Independent Contribution under the Paris Climate Agreement**	**0.7**
East Timor	**Unavailable**	**Plans to develop 72 megawatts of wind power, as outlined in East Timor's National Independent Contribution under the Paris Climate Agreement**	**Unavailable**
Laos	**Unavailable**	**73 megawatts by 2025**	**Unavailable**

Appendix 2: The formula for calculating carbon emissions is as follows:

Carbon emissions from unit of coal-fired power generated (kg CO2) = assembled unit capacity (kilowatt) x coal-fired carbon emission factor (kg CO2/kilowatt-hour) x average time online per year (hours/year) x life cycle (years)

Solar energy investment (2014 - 2018):

(325 mw = 165 mw) x 5500 hours/yr x 750 g CO2/kwh x 25 years =
505 million tons of CO2

Solar and wind energy investments (under construction and newly built)

(2020 mw + 1136 mw) x 5500 h/yr x 750 g CO2/kwh x 25 year =
325 million tons of CO2

Disclaimer: This analysis aims to understand the investment trends and destinations of Chinese enterprises' overseas energy investments based on reliable, available information. The results of

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this analysis are based on the information available to Greenpeace East Asia at this time. If you are suspicious of the results of this analysis, please feel free to contact us.