

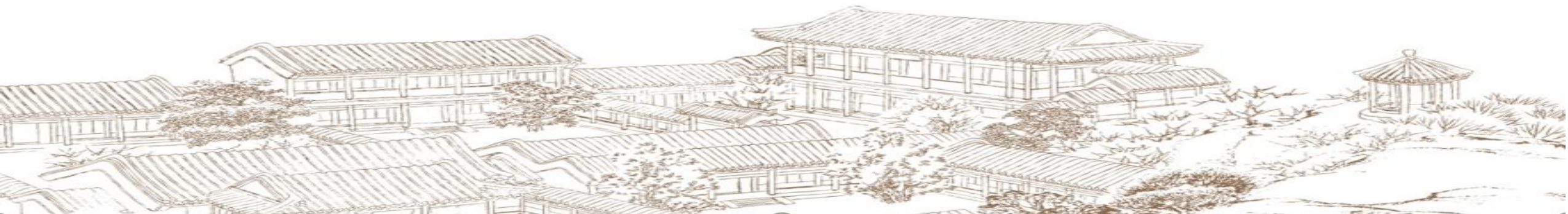


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Chinese Solar PV Development: Success and Lessons Learnt

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Outline of Presentation



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Part 1: Success of China's Solar PV Development

Part 2: Factors behind China's Success: Energy Policy vs. Industrial Policy









Part 3: Issues of sustainability: Feed-in-Tariff vs. Auction

Part 4: Concluding Remarks

Part 1: China's Success in Solar PV Development

TOP 5 COUNTRIES 2017

Annual Investment / Net Capacity Additions / Production in 2017

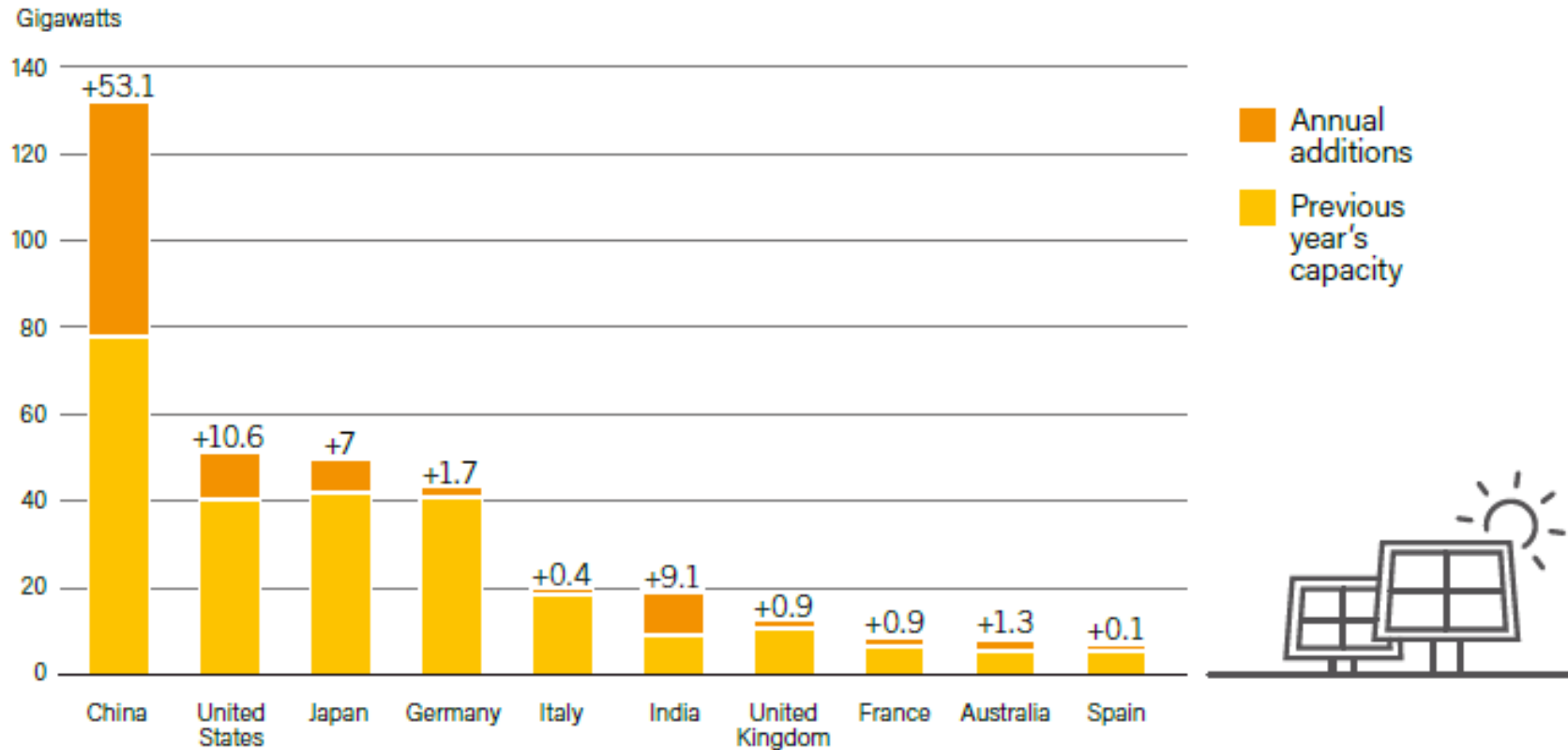
	1	2	3	4	5
Investment in renewable power and fuels (not including hydro over 50 MW)	China	United States	Japan	India	Germany
Investment in renewable power and fuels per unit GDP ¹	Marshall Islands	Rwanda	Solomon Islands	Guinea-Bissau	Serbia
 Geothermal power capacity	Indonesia	Turkey	Chile	Iceland	Honduras
 Hydropower capacity	China	Brazil	India	Angola	Turkey
 Solar PV capacity	China	United States	India	Japan	Turkey
 Concentrating solar thermal power (CSP) capacity ²	South Africa	-	-	-	-
 Wind power capacity	China	United States	Germany	United Kingdom	India
 Solar water heating capacity	China	Turkey	India	Brazil	United States
 Biodiesel production	United States	Brazil	Germany	Argentina	Indonesia
 Ethanol production	United States	Brazil	China	Canada	Thailand

Source: Renewables 2018: Global Status Report, REN21



Part 1: China's Success in Solar PV Development

FIGURE 26. Solar PV Capacity and Additions, Top 10 Countries, 2017

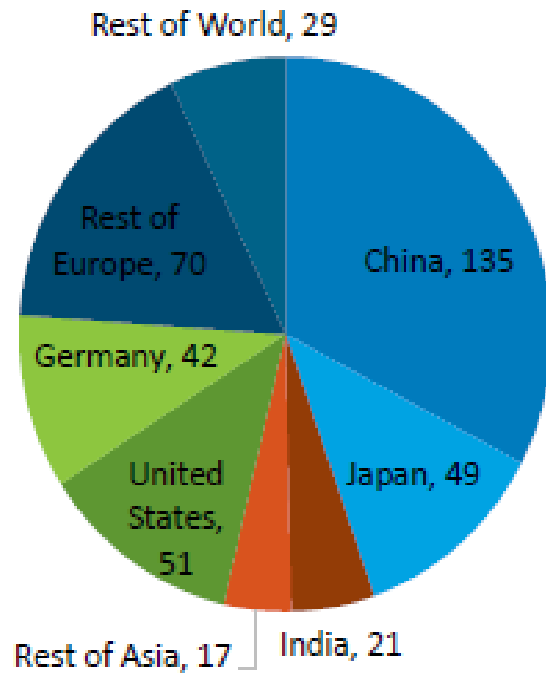


Source: Renewables 2018: Global Status Report, REN21

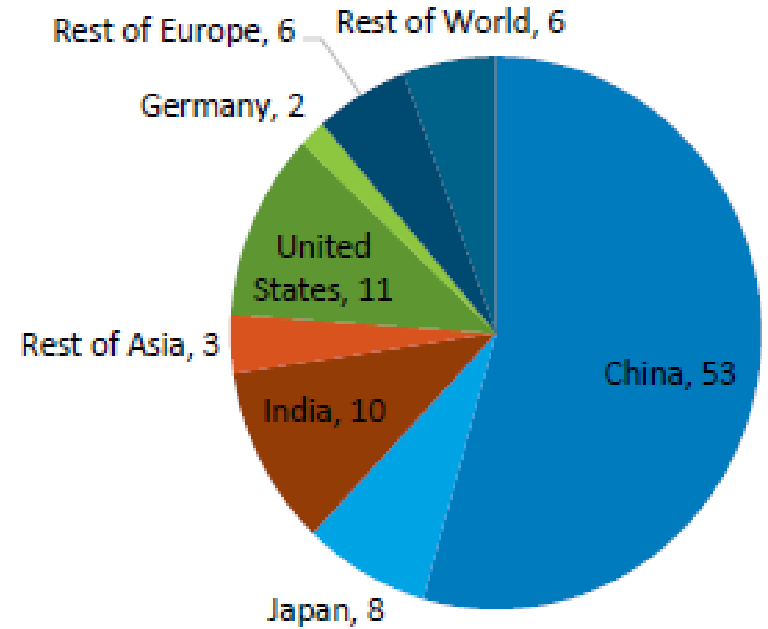


Part 1: China's Success in Solar PV Development

Cumulative PV Deployment - 2017 (415 GW)



Annual PV Deployment - 2017 (98 GW)



Source: BNEF (2018).

Source: Renewables 2018: Global Status Report, REN21



Part 2: Factors behind China's Success: Energy Policy

- Determination in pursuing low carbon energy transition as part of China's commitment under Paris Agreement
- Need to improve air quality in Chinese cities
- **Very high incentives to encourage solar PV with generous feed-in-tariffs (FiTs, around US\$ 0.08-0.10/KWh for utilities scale PVs; and US\$0.05 for distributed solar PVs)**

	Utility Scale PV FiTs (RMB/KWh)			Distributed PV FiT (RMB/KWh)
	Region I	Region II	Region III	
2011.7	1			None
2013.8	1	0.95	0.90	0.42
2015.12	0.98	0.88	0.80	0.42
2016.12	0.85	0.75	0.65	0.42
2017.12	0.75	0.65	0.55	0.35



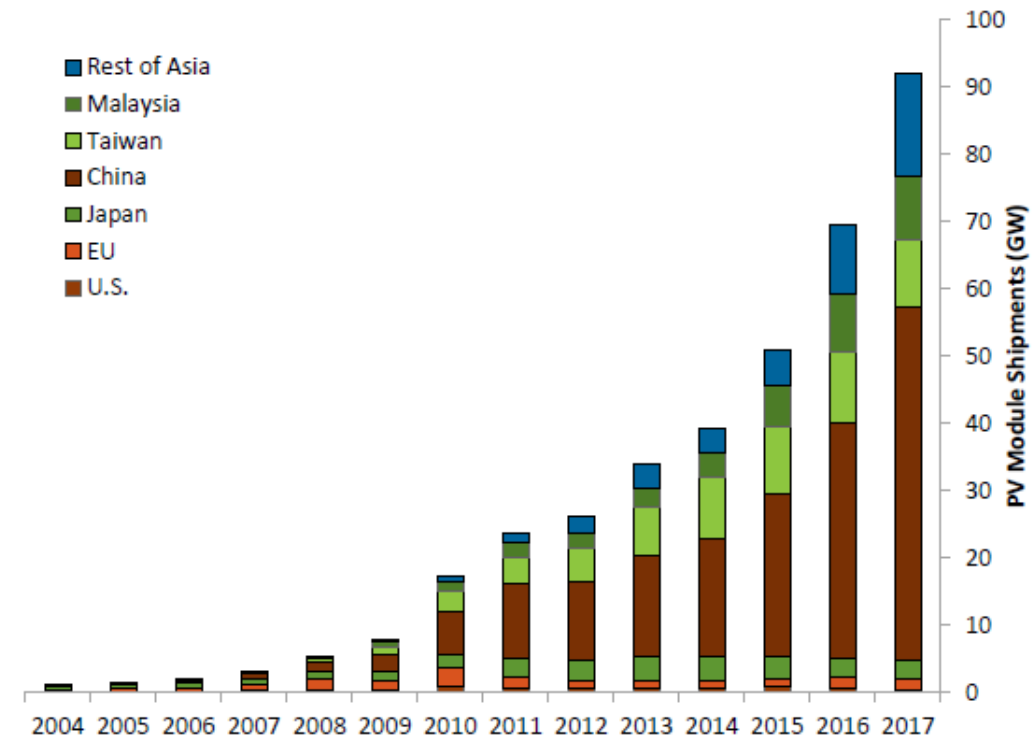
Part 2: Factors behind China's Success: Industrial Policy

- Chinese manufacturers dominate the solar PV in the world. In 2017, global PV shipments were approximately 92 GW, with China supplying 57%.

Global Leading PV Manufacturers, by Shipments

Rank	Manufacturer (2017)	Shipments (GW)	Manufacturer (2016)	Shipments (GW)	Manufacturer (2007)	Shipments (GW)
1	JA Solar	6.5	Trina	5.0	Sharp	0.4
2	Canadian Solar	5.4	JA Solar	4.9	Q-Cells	0.3
3	Zhongli Talesun	5.0	Hanwha	4.0	Suntech	0.3
4	Jinko Solar	4.9	Jinko Solar	3.9	Kyocera	0.2
5	Trina Solar	4.8	Motech	2.9	First Solar	0.2
6	LONGi	4.5	First Solar	2.7	Motech	0.2
7	Hanwha	4.2	Longi Lerrri	2.7	Sanyo	0.2
8	Tongwei	3.8	Canadian Solar	2.4	SolarWorld	0.1
9	Motech	3.2	Yingli	2.4	Mitsubishi	0.1
10	Aiko	3.1	Shunfeng-Suntech	2.2	SunPower	0.1
Other		45.5		36.4		1.0
Total		91.9		69.5		3.0

Global Annual PV Shipments by Region*



Source : NREL

Part 2: Factors behind China's Success: Industrial Policy

- Job creations in solar PV: 2.2 million jobs, 66% of the total solar PV jobs in the world

■ TABLE 1. Estimated Direct and Indirect Jobs in Renewable Energy, by Country and Technology

	World	China	Brazil	United States	India	Japan	Germany	Total EU ^k
Thousand jobs								
☀️ Solar PV	3,365	2,216	10	233	164	272	36	100
🌿 Liquid biofuels	1,931	51	795 ^g	299 ^h	35	3	24	200
🌀 Wind power	1,148	510	34	106	61	5	160	344
☀️ Solar thermal heating/cooling	807	670	42	13	17	0.7	8.9	34
🌿 Solid biomass ^{a, b}	780	180		80 ⁱ	58		41	389
🌿 Biogas	344	145		7	85		41	71
🌊 Hydropower (small-scale) ^c	290	95	12	9.3	12		7.3 ^j	74 ^l
🌋 Geothermal energy ^{a, d}	93	1.5		35		2	6.5	25
☀️ CSP	34	11		5.2			0.6	6
Total	8,829^f	3,880	893	786	432	283	332	1,268

Source: Renewables 2018: Global Status Report, REN21



Part 3: Issues of sustainability: FiTs Funded by Renewable Energy Surcharges

- The feed-in-tariffs in China are funded by Renewable Energy Surcharge RMB0.019/KWh (US cent 0.3/KWh), charged on industrial and commercial customers
- The Renewable Energy Surcharge has been increasing (from RMB 0.008/KWh in 2011 to RMB 0.019/KWh, but not enough to provide needed subsidies (In Germany, the renewable energy surcharge is US cents 0.34/KWh, 10 times higher!)
- The arrears in disbursing the subsidies currently amount to about RMB 100 billion (US\$16 billion), affecting most of the utility scale solar PV projects

Surcharge collection cannot cover the strong growth of subsidy demand



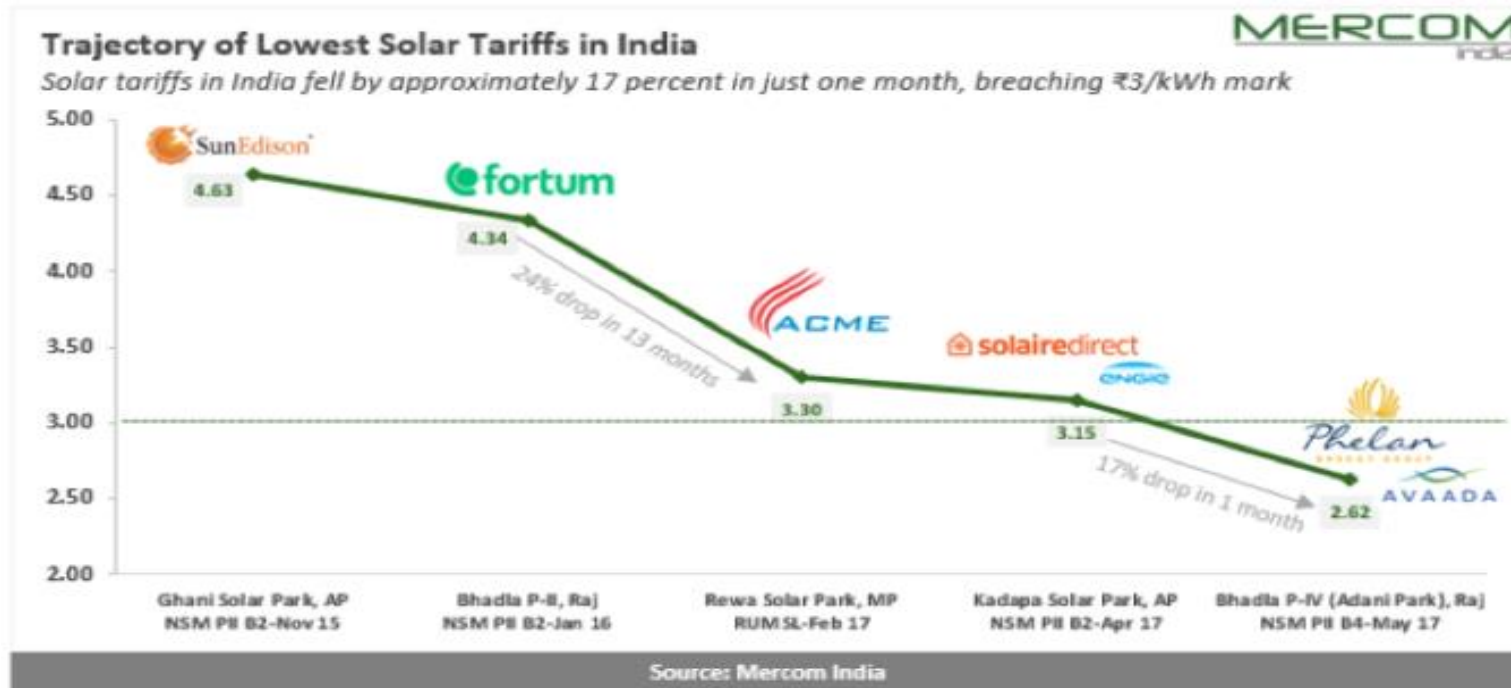
Source: NEA, BNEF

- Recent regulation to put cap on solar PV projects and further reduce Feed-in-Tariffs: China's solar PV installations in 2018 may drop by a third



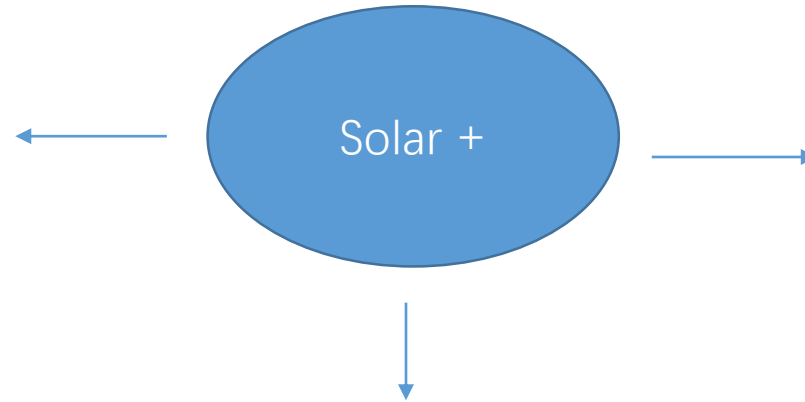
Part 3: Issues of sustainability: FiTs vs. Auctions

- Some countries, such as India, have started using auction mechanism to award solar PV projects, that led to much lower and competitive prices – more sustainable than the feed-in-tariff mechanism



Part 3: Issues of sustainability: « Solar + » Model

- “Solar +” model, i.e. “Solar + Farming”, “Solar + Fishing”, “Solar + Sheep raising” etc, can provide viable business models for expanded solar PV markets in China, and reduce dependence on subsidies



Part 4: Concluding Remarks

- Solar PV development has been largely driven by energy policy (low carbon transition and clean air) in China
- In China, solar PV development is also part of industrial policy (more jobs)
- Feed-in-tariff mechanism is very effective to start a market; however, it is not sustainable
- Solar PV auctions can lead to more sustainable renewable energy development
- Most important factor: stable, transparent and predictable policy and regulatory framework so developers can assess the risks and make their investment decisions
- “Solar +” can offer viable business models to reduce the dependence on subsidies



Thank you!

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