

## The "Greening" of China's Black Electric Power System

Insights from 2014 Data

By <u>Hao Tan</u> and <u>Prof. John A. Mathews</u> Asia-Pacific Research, March 30, 2015 <u>The Asia-Pacific Journal, Vol. 13, Issue 10</u> 16 March 2015

			a fossi fuels but particularly cogli.	and solar as it cleans its energy system. Hany people have recently been avid viewers of Chai jing's riveting documentarystalk "Under the Dome" where she brings home the temble costs of Chair's pollution and
min in the pollution is the necessity of building as alternative energy system, one which is based on renewable black character of Chara's electric poser reptern - but ignore (average) the testing ht of the greening tende interpretation of what has been happening in China's power sector is arong. We use the laters 2014 data to de electric power of d. All Three shares designed as a sector of the sector of the sectors designed as a sec-	Is sources that do not emit carbon or other generihous agains. It is a fact that China's energy system ge- noise, is a widely reproduced biogonizing, Armonic Chines (Rescurve Rotector et Hin China Ar Tank Fon monstrate why it is words The data for China's electric power vactor are none to hand, power should be than the tendency that outparks a blackming tendence. We hadden to add that baladina a prevenency sub	ntry, it's time to grow up, the seems to be telling her mostly young audiences, nearily, and its electric power system in particular, is still largely based on fossis on in the USI classed that in 244, "the amount of new coal energy added to th Drive Electricity Council. We use three sources of data to demonstrate that gree m is only one assets of the orabients, and last Chai in instatut the existing soll	And the phenomenal success her wides has had in China Itself shows that she h f have consumption - just like every rising industrial power since the industrial or China gift - accessed in two since mercy by 7 times, new wide every by m ening tendencies outmark blackening (bash-fuelied) tendencies. These are data tion meet to be enind in, and new inser-oblicities tendencies to be into	The total series and indicated application of the series o
				power generation from non-thermal sources increased by 10% - and strictly green sources, encompassing water, wind and solar (NWS), increased by 200 TWh, or 20%. This is the greening edge of a huge power
Here are the data. China's power system generated 5,545 TWh of electricity in 2014, an increase of 172 TWh	over the 2013 total, or growth of 3.2%. So the system as a whole is still growing - but not as fast as the 2013 total. Strictly	economy as a whole (an important disjunction). Thermal (mainly coal burning) mean sources (8085) repertated 1245 T8th in 2014 up 201 T8th on the 2013 t	sources generated 4173 TWh in 2014, down by 48 TWh from the 2013 total (or total (an increase of 2014), Murilear generated 126 T&h, up 14 T&h on the 2013	ra decreases of 1.316 - the first reduction in thermal power generation in recent times. Non-thermal sources by contrast accounted for 1372 TWh of electric energy generated in 2024, up 221 TWh on the local (+12%.).
	Expressed in terms of percentage cha We present these data as	arges to the system in 2014, thermal generation declined by 1.1% while WWG is in Charts 1a and 1b. The charts show the 2014 additions localitive as well as nec	ncreased by 20%. The most disamatic growth was seen in solar power generation pative) to the Chinese electric power generation system, in TWH, and in terms of	on, which nose a staggering 175%.
		Fig 1. China electric generation	on additions (real) in 2014	
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			trily General Rig. 28 Personal changes Service of primary data. China Electricity General	
	addition of 42 TWh. He concludes to	that China added an extra (notional) 240 TWh from coal and only (notional) 136	TWh from WWS (plus 42 TWh from nuclear), so according to Cohen the system	apability additions". His chart shows notional additions to thermal generation of 240 TWh compared with notional additions for water of 65 TWh, wind 57 TWh and salar 14 TWh; nuclear he shows as a notional is getting increasingly "black".
We argue that this modelling approach has mi				ch higher than Cahen allowed for with his notional data. We await Cohen's public response to our refutation of his widely reproduced blog posting. This result belies arguments that China will be dependent on nuclear for non-cation sources of electric power.
	We elaborate on these data by showing	phistoric trends in China's thermal (Fig 2) and non-thermal (WWS plus nuclear)	generation (Fig. 2) and the changes in the system's composition (thermal vs. no	co-thermal) coer the past six years.
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We also under West Was Researce also I have be sure (de Was word accounts from chiles of the screenth annihile) is a	(Note: The share of the focul fuel-base	ed power generation has failen from 81.2% in 2008 to 75.2% in 2014; while the	share of the total non-fossil fuel-based electricity generation increased from 18.	LBN to 24.7% for the same period) prevation in China has in fact fallen from BL2N in 2008 to 75.2% in 2004, roughly 1% per year. That is a significant rate of change for any power system, let alone the world's largest. One would think the KA
We and have the the rights card ment provide the most account remained in the cardina contraction	to communications to came theretic parent generation. The control proportion is 7.2.2.9, and not the w			ferminant in constructions in a transition at a second coupling a state to be transition or coupling to any potenticities of a second rest or second to a second
A second source of data on the green	ing of China's electric power system is data on generating capacity itself. This does not give as accurate	Constanting     a picture of greening or blackening tendencies because of varying capacity fa	ctors for wind, solar, nuclear and thermal and their varying utilization hours from	in time to time - but when compared year by year the data do indeed indicate a trend in the generating capacity of the different sources.
				a row. This is a second indicator of greening. In 2014 China increased its thermal generating capacity by 45 GW, reaching a total of 916 GW, while it increased non-thermal capacity by a larger amount, 56 GW,
There is an immediate issue to address in these data. How could China add thermal capacity in 2014 but d	ecrease its actual electric energy generation from thermal sources? There is an entirely plausible reason (Curtailment refers to non-use of an energy source, by switching off its connection to the			ad power, as well as because of central government mandates. By contrast the utilization of WWS capacity was increased, diminishing the cutaliment levels that had been keeping wind power under-utilized, is astrong more diminishing the cutaliment levels that had been keeping wind power under-utilized.
	Canadiana the second of the Paral of an intergy basis, by second g on its control of a second s	ration capacity can be elaborated as per the following charts 5 (thermal capaci	by(, 6 (non-thermal capacity) and 7 (proportions between thermal and non-therm	s inclusion tensis, unclusion ancore, and our results canne un accur generation and.
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Fig. 1 China: Food feel based power presenting separity and provide 2006-2014 (kine i			making thermal power facilities/Source of primary data. China Electricity Council Phys. 6. Online Total	A new final field financial checkelary generating a specific generating and the structure of the specific generating a specific generating and the specific generating a specific generating a specific generating and the specifi
China's non-thermal generating capacity, at 444 GW, is far higher than that of any other country. Its strictly go	reen generating capacity (from WWS sources) stands now at <b>424 GW</b> , with capacity addition in 2014 of be "doing nothing" until 2020. On the contrary. China is building the largest green power 1	51 GW (meaning that a 1-GW non-thermal power station was added each week source on the planet. But again we must add that enforcement of pollution laws	and introduction of pollution-controlling technologies in the burning of fassil fue	Invest of proving standing control Investigation (Investigation Control Contro
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