The Power Sector in China: What a difference two years can make ... or not

New England Conference of Public Utility Commissioners
6 June 2017

Frederick Weston
Cocktail Party Fun Facts

• Annual global coal consumption: 8.7 billion short tons
• 50% in China
  – Half for industry and heating
  – The other half for electricity
• Global CO\textsubscript{2} emissions totaled roughly 36.2 billion tonnes in 2015—virtually the same amount as in 2014 and 61% higher than in 1990.
  – The lion’s share of that jump came from increased energy consumption in Asia—in India and mostly China
• China produces 29% of global CO\textsubscript{2} emissions
• The US is number two at 14%
  – We still win when it comes to per capita emissions

Sources: PBL Netherlands Environmental Assessment Agency and Index Mundi
CO$_2$ Emissions

Source: Global Carbon Atlas
Post hoc ergo propter hoc

Even Faster Growth in CO2 Emissions

Moskovitz and Weston start work in China

China

US

Energy solutions for a changing world
When last we saw our heroes
(June 2015)
China’s Power Sector: Much the same as it was in 2015, only bigger

• Two grid companies: State Grid (85%) and China Southern Grid (15%), both state-owned
• Five major state-owned generators, with 50% of installed capacity
  – The rest belongs to provincial and muni power companies, and to RE developers (also mostly state-owned)
• Total capacity was 970 GW in 2010 and topped out at >1,600 GW at the end of 2016, a 70% increase in six years
  – ~125 GW of new capacity—mostly unneeded—were added in 2016
  – Avg. thermal utilization rates down 200 hours/year, to 4,165 hours/yr
• Total consumption in 2016: 5,920 TWh
  – Industry 70%, households 14%, the rest commercial and agricultural
• Regulatory jurisdiction (both energy and environmental) is split (opaquely) between the provincial and central governments, but the central government has the final say
  – Provinces are given freedom to experiment with reforms, which, if successful, can become national policy
2016 Generation Portfolio

![Bar chart showing power generation capacity by source (Hydro, Coal, Gas, Nuclear, Wind, Solar) in GW for 2015 and additions in 2016, with year-on-year addition in percentage.]

Source: CEENews
March 2015: Document #9
“Deepening Power Sector Reform”

- State Council-Communist Party joint statement:
  - The need for reliability;
  - Use of market mechanisms;
  - Protection of residential and agricultural consumers;
  - Energy savings, emissions reductions, and increased use of renewable and distributed generation; and
  - Better governance and regulation, including better planning and strengthened regulatory capacity
Reform Progress?

- **Regulation**: Revenue-caps piloted in Shenzhen is now national policy
- **Direct access**: Large users bypass gridcos, buy directly from suppliers
  - Buyers & sellers screened for efficiency and environmental performance
  - Monthly & annual contracts give discounts from wholesale tariffs
- **Demand response**
  - Funded by government payments to end-users, not through the market
  - No link to wholesale market prices because there is no economic dispatch or market
- **Dispatch**: “Equal shares dispatch”
  - Unit commitment to assure annual operating hours (e.g., 4,500) and thus capital cost recovery, not to minimize total operating cost
  - No imbalance trading
- **Renewables**: Most investment in solar and wind in the world
  - But very high rates of curtailment (>25%), because of dispatch rules & no interprovincial trading
- **Power sector planning**: No least-cost integrated resource planning
China’s Energy & Environmental Goals

• Carbon intensity reduction by 40-45% from 2005 levels by 2020
• By 2020, 15% of China’s primary energy needs will be served by renewable resources.
  – Wind from 31 GW in 2010 to 100 GW in 2015, 150 in 2017, and 200 by 2020
  – Solar from 0.86 GW in 2010 to over 35 in 2015 and 70 GW by 2017.
• China will reduce coal consumption as a percentage of primary energy to below 65% by the end of this year
  – Absolute caps on coal consumption in the three most populated regions of the country: Beijing and environs (Jing-Jin-Ji), Shanghai and the Yangtze River area, and the Pearl River Delta (southern China surrounding Guangdong)
November 2014: Xi-Obama Agreement

• US to cut greenhouse gas emissions 26-28% below 2005 levels by 2025.
• China to hit a peak in its carbon dioxide emissions by 2030—possibly sooner—and to increase the non-fossil fuel share of energy to around 20% by 2030.
  – Modeling shows that a peak in carbon emissions must be preceded at least five years earlier by a peak in coal consumption
September 2015: The Second Xi-Obama Agreement

• Reaffirmation of US and Chinese post-2020 commitments to reductions in GHG emissions in lead-up to Paris

• China:
  – National CO$_2$ emissions trading
  – “Green” dispatch
  – Green buildings

• US:
  – Clean Power Plan
Et Voila! Chinese CO$_2$ Emissions: Pledges, Peaks, Needs?

Moskovitz and Weston leave China?

Source: Climate Change News
The beginning of a beautiful friendship?

• China and the EU to step into the breach?

• Premier Li Keqiang last Thursday: “Step by step, and very arduously, together with other countries, we will work toward the goals set.”

• But on Friday, China and the EU did not release a joint statement on climate change, because of a trade policy dispute.
Air Quality

• Since 2011, China has issued progressively more stringent AQ regulations
  – RE and EE recognized as means of avoiding emissions.

• In 2016, revisions to the Air Law went into effect
  – China is now implementing an emissions permitting system modeled in part on the Clean Air Act and in part on European regulations.
Immigration Policy?

- EPA: downwind air pollution from Asia may erase savings from domestic emissions programs
- Ozone, particulates, and mercury
  - 8-12% of pollutants in the Pacific NW have an Asian signature

Source: Dan Jaffe at UW-College of the Environment
There are two ways to look at this graph.
In conclusion: as in 2015, again

• Continue to reform your markets:
  – Design them to favor desired outcomes and capabilities: e.g., no-carbon and flexibility
  – Fully integrate environmental and energy policymaking
• Expand investment in end-use efficiency and renewables
• If you have the opportunity, engage with China
  – Fashion solutions that work for China
  – Help build institutional capacity
  – Remember that learning goes both ways
• Be a threat of a good example
关于睿博能源智库

睿博能源智库（RAP）是一个全球性专家咨询机构，主要关注全球能源政策下经济和环境的可持续发展。RAP 在能源政策方面有资深的经验，致力于促进经济效率、保护环境，确保电力系统的可靠性和扩大社会效益。

RAP 帮助中国政策制定者制定和实施相关政策，来促进可持续经济发展、增加能源系统可靠性、改善空气质量和公众健康，从而为中国大量和长期地减少温室气体排放作出贡献。

我们的网站：www.raponline.org
中文网页：www.raponline.org/cn
rweston@raponline.org