Power Sector Reform in China: Policy and Progress

Renewable Energy Markets Conference
San Francisco
18 October 2016

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The Regulatory Assistance Project
China’s Power Sector

• Two grid companies: State Grid (85%) and China Southern Grid (15%), both state-owned
• Five major state-owned generating companies, which account for about 50% of installed capacity
  – The remainder belongs to provincial and municipal power companies, and to renewables developers (also mostly state-owned)
• Total capacity was 970 GW in 2010 and will top out at nearly 1,500 GW this year, a 53% increase in five years
• 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
• In 2015, China installed 32.5 gigawatts of wind and 18.3GW of solar, both world records; coal consumption dropped 3.7%
China’s Primary Energy Consumption

Source: Our Finite World; based on BP Annual Statistical Yearbook
Electric generating capacity by fuel type (2000-2013)

Source: CEC, NEA

*Thermal includes ~7% non-coal-fired power (e.g., natural gas, biomass, etc.)
Electric generation by source in China (2000-2013)

Source: CEC, NEA
## The world's top carbon dioxide emitters in 2013

<table>
<thead>
<tr>
<th>Country</th>
<th>Million Metric Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>9,977</td>
</tr>
<tr>
<td>USA</td>
<td>5,233</td>
</tr>
<tr>
<td>India</td>
<td>2,407</td>
</tr>
<tr>
<td>Russia</td>
<td>1,812</td>
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<tr>
<td>Japan</td>
<td>1,246</td>
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<tr>
<td>Germany</td>
<td>759</td>
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<tr>
<td>S. Korea</td>
<td>616</td>
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<tr>
<td>Iran</td>
<td>611</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>519</td>
</tr>
<tr>
<td>Canada</td>
<td>503</td>
</tr>
</tbody>
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Data: Global Carbon Atlas

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*Energy solutions for a changing world*
Recent Policy Announcements in China

**Xi-Obama Agreement, November 2014**
- 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.

**Deepening Reform of the Power Sector released by CPC and State Council, 19 March 2015**
- Environmentally sustainable power sector development
- Grid company reform
- Improved generator dispatch/operations
- Demand-side management
- Developing market mechanisms
- Renewables integration
- Improved planning

**Air Quality Rules**
- Progressively more stringent regulations over the last three years, to address local air pollution
- Regulations specifically allow for investment in renewable energy and end-use energy efficiency as means of avoiding emissions of pollutants
- Amendments to the Air Law were adopted in August 2015, furthering these reforms

**Xi-Obama Agreement on Climate Change, 25 September 2015**
- National CO₂ emissions trading
- Green dispatch
- Green buildings
March 2015: New Round of Power Sector Reform

State Council and Communist Party Central Committee statement (Document #9) on policy reform. Articulates five principles:

- The need for reliability;
- Increased 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.

中共中央、国务院共同发布的电力改革政策文件（简称9号文），清楚表达了5大基本原则：

- 坚持安全可靠，
- 坚持市场化改革，
- 坚持保障民生，
- 坚持节能减排，提高可再生能源发电和分布式能源发电在电力供应中的比例，
- 坚持科学监管，包括更好的规划和提高监管水平。
China’s Near-Term Energy and Environmental Goals

中国近期的能源和环境目标

- Carbon intensity reduction by 40-45% from 2005 levels by 2020
- By 2020, 15% of its 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 2017
  - As part of this, it has set 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)
- 到2020年碳排放强度在2005年基础上降低40-45%
- 2020年，可再生能源占到一次能源需求的15%：
  - 风电从2010年的31 GW，增加到2015年的100 GW，2017年的150 GW，以及2020年的200 GW；
  - 太阳能从2010年的0.86 GW，增加到2015年35 GW，以及2017年的70 GW；
- 2017年，煤炭占一次能源消费总量比重降低到65%以下：
  - 为三个人口最密集的区域制定了煤炭消费总量控制目标：京冀，长江三角洲，珠江三角洲。
What near-term reforms are needed to make the long-term vision possible?

为实现长期愿景所需要的近期改革

• Grid system operations (“dispatch”) based on the relative economics of generators
  – Can be achieved through either competitive or administratively-set pricing

• Increased flexibility in thermal generation and the use of customer demand response, to enable greater integration of renewable generation in system operations
  – Economic dispatch helps reveal the true value of flexibility
  – For example, combined heat-and-power (CHP) can be more flexible, with technical changes and some storage (e.g., Denmark)

• 基于发电机组经济性的电网系统运营（调度）：
  – 可以通过竞争性或行政定价实现。

• 提高火力发电的灵活性以及采用客户需求响应，在电力系统运营中促进可再生能源并网：
  – 经济调度帮助反映灵活性的真实价值；
  – 比如，热电联产机组（CHP）通过技术更新和储能等（如，丹麦），可以变得更加灵活。
What near-term reforms are needed to make the long-term vision possible?

为实现长期愿景应实施的近期改革

- Improved long-term planning and resource acquisition process
  - Planning to determine what you need
  - Competitive acquisition to make sure you get it at lowest cost

- Steady change in distribution company business operations
  - Not just supplying power
  - Becoming a “platform” for new services, provided by the utility, third-parties, and the customers themselves
    - Demand response, end-use energy efficiency, electric vehicles, etc.
  - Regulatory reform to change the distribution company’s financial incentives
    - Reward them for doing what you want them to do

All of these things are envisioned by Document #9 and some are now being tested in provincial pilots.

- 改善长期电力规划和资源获取流程：
  - 利用规划确定所需；
  - 通过竞争获取资源，确保以低成本采购。

- 配电公司业务运营模式的稳定改变：
  - 不只是电力供应；
  - 成为电网公司、第三方以及客户自身提供新服务的“平台”：
    - 需求响应，终端能效，电动汽车，等等
  - 改变配电公司财务激励措施的监管改革：
    - 奖励他们达到你的目标

以上这些在9号文件中提出，目前正在一些省级试点项目中实施。
Two Views of China’s Power Future

“Reinventing Fire in China,” Rocky Mountain Institute
The China 2050 High RE Penetration Studies: Energy Research Institute of China
Power Sector Emissions Scenarios

Power Sector CO₂ Emissions

- RF China - Reference
- RF China - RF
- ReHP - Reference
- ReHP - HP

- 6,952 Mt at 2040
- 5,157 Mt at 2030
- 4,784 Mt at 2025
- 3,947 Mt at 2027

- Million tonnes of CO₂
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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。

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