Coal Consumption Control and Power Sector Policy

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The global electricity industry accounts for more than:

- a third of the world’s energy-related carbon emissions and
- two-thirds of the world’s coal consumption.

In China, the power sector accounts for about half of total coal consumption, and rising.

=> Coal control requires policies that will transform the power sector.

=> 煤炭控制需要政策转变电力行业。

Energy solutions for a changing world
Power Sector Reform Debate in China

• Power sector reform is under discussion in China.

• How to make sure that power sector reform supports the government’s coal cap and air quality objectives?

• Developments in the US illuminate some important themes that should inform the power sector reform discussions in China.

• 中国的电力体制改革正在讨论中。

• 如何使电改做到支持政府的煤炭消费总量和空气质量达标目标？

• 中国电力行业改革在讨论时值得考虑到美国发展道路上遇到的一些重要主题。
In June, the United States Environmental Protection Agency (EPA) issued proposed greenhouse gas regulations called the Clean Power Plan.

EPA expects the plan will decrease carbon dioxide emissions from the power sector 30% below 2005 levels by 2030.

Under the proposal, EPA will establish binding state-specific emissions reduction targets.

Each state will be allowed flexibility in developing plans to meet the target.
Change in emissions from 2012 to 2030, under one potential compliance scenario from the EPA (% of 2012 emissions)

Note: Darker colors indicate deeper emissions cuts; yellow states may actually increase their overall emissions, while remaining in compliance with the EPA’s Clean Power Plan.

Source: Bloomberg New Energy Finance; used with permission.
EPA Clean Power Plan Components
美国环保署清洁电力计划的构成

Source: Synapse Energy
US EPA Clean Power Plan
美国环保署清洁电力计划

Design elements worth noting:

• EPA jointly considers the costs and benefits of not just carbon emission reductions, but also associated air quality improvements.

• EPA targets energy efficiency as a power sector resource: envisages building low-cost EPPs to displace coal.

• EPA calls for adjustments to power plant dispatch to displace coal.

值在意的特征：

• 该计划既考虑到碳排放的成本和效益，也考虑到空气质量提高等协同效益。

• 美国环保署将能效作为电力行业的资源为目标：用建设低成本的“能效电厂”来取代煤的使用。

• 美国环保署号召调整发电厂调度来取代煤的使用。
EPA Cost-Benefit Analysis of Clean Power Plan (2030)
美国环保署清洁电力计划之成本效益分析 (2030)

- Compliance costs 合规总成本: $9
- Air pollution benefits 空气污染效益: $27-62
- Climate Benefits 气候效益: $31

Note: Refers to “State Compliance Approach”. 

单位：十亿美元 (按照2011年美元价值)
Energy Efficiency As A Resource
将能效作为一种资源

• In many US states, utilities use end-use energy efficiency as a resource in meeting customers’ needs for energy services.
• Energy efficiency is a cost-effective alternative to building power plants.
• This is the "efficiency power plant" (EPP) concept.
• An EPP is a portfolio of energy efficiency projects that can be compared to a conventional power plant.
• EPPs can be "built" and financed in the same way as conventional power plants.
• EPPs are cheaper than conventional power plants.
• EPPs have zero emissions.
• EPA's proposal explicitly recognizes EPPs.

• 在美国许多州, 电网公司将终端能效作为一种资源, 来满足客户对能源服务的需求;
• 能效是比建造发电厂更具有成本效益的替代方案;
• 这就是“能效电厂”的概念;
• 能效电厂是由多个能效项目组合而成, 可以与传统电厂相比较;
• 能效电厂可以通过传统电厂一样的方式进行“建造”和融资;
• 能效电厂比传统电厂更便宜;
• 能效电厂拥有零排放;
• 美国环保署草案明确地肯定了能效电厂概念;
EPA Clean Power Plan: Building EPPs to Displace Coal

建设能效电厂取代煤的使用

Base Case (No Clean Power Plan)
常规情景（非清洁能源计划）

Clean Power Plan Case
清洁能源计划情景

Source: Bloomberg New Energy Finance; used with permission.
Note: Clean Power Plan case refers to EPA’s “Option 1, State”.
Improving Dispatch Saves Coal
优化调度，节省煤炭消费

• Dispatch: which power plants are used at a given time.

• Different power plants have different costs and emissions.

• Lower-cost and lower-emission plants should be used more often.

• EPA's plan calls for gas plants to be dispatch more often and coal plants correspondingly less often.

• China's power plants are often dispatched without consideration for relative costs or relative emissions.

• Reforming dispatch: a "free" way to save coal in China.

• 调度：在特定时间内使用哪家发电厂来发电；

• 不同的发电厂各自成本和排放量不同；

• 应该更多使用低成本和低排放的发电厂；

• 美国环保署的方案要求更多的调度燃气发电厂，煤电厂相对少一些；

• 我国的发电厂调度通常不考虑相对成本和排放量；

• 改革调度：节省煤炭消费的一条“免费”道路
Merit Order Dispatch Curve
优先调度曲线

Hypothetical dispatch curve for summer 2011
variable operating cost (dollars per megawatthours)

- renewables
- nuclear
- hydro
- coal
- natural gas - combined cycle
- natural gas - other
- petroleum

demand = 67 GW; early morning hours
demand = 114 GW; afternoon on a hot day

system capacity available to meet electric demand (GW)
Improving Dispatch Saves Coal

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Energy solutions
for a changing world
Traditional Utility Business Model
传统电网公司业务模式

Source: HEI
Traditional Utility Business Model
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Traditional Utility Business Model

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Utility Business Model: Forces for Change

电网公司业务模式：新的趋势

- Utilities investing in end-use energy efficiency (building EPPs).

- Customers increasingly producing energy with distributed resources.

- Need to integrate large amounts of variable renewables...

- 电网公司投资终端能效（建设“能效电厂”）；

- 分布式太阳能在发展。近年来电力消费者也开始扮演发电角色。

- 需要整合大量的可再生能源…
Utilities and End-Use Energy Efficiency

电网公司和终端能效

• How to mobilize grid companies for energy efficiency?

• Many years of experience in various parts of US with “performance-based regulation”.

• Basic idea is to change the utility business model by changing the way utility earns revenue.

• 如何动员电网公司实施能效？

• 美国不同地区实施“基于绩效的监管”拥有多年经验

• 改变电网公司业务模式的基本思路是改变电网公司的盈利模式
Utilities and End-Use Energy Efficiency
电网公司和终端能效

In China:
- 2010 DSM Rule requires gridcos to meet an annual target for investment in EE

- October, 2014: NDRC published *Notice for Transmission and Distribution Rate Reform Pilot in Shenzhen*
  - Caps the total revenue of the gridco
  - Begins to shift the gridco business model away from selling electricity...
  - ...and toward end-use energy efficiency and distributed renewables.

中国:
- 2010年国家发改委下发《电力需求侧管理办法》，要求电网公司达到投资能效的年度目标;

- 2014年10月，国家发改委下发《关于深圳市开展输配电价改革试点的通知》
  - 对电网公司实施总收入监管;
  - 开始转变电网公司依靠售电量的业务模式;
  - 朝向终端能效和分布式可再生能源发展。
Conclusions: Ideas for China
结论：对中国的建议

How to design power sector reform to meet coal caps?

• EE as a power sector resource: EPPs can compete against conventional power plants.

• Reform power system operations/dispatch.
  – Need changes to wholesale pricing in order to support improved dispatch.

• Reform gridco business model: refine and expand the Shenzhen pilot.

• Renewable resource integration.

煤炭总量控制如何在电力体制改革中发挥作用？

• 将能效作为电力行业的一种资源：能效电厂可以和传统电厂竞争；

• 改革电力体制运营/调度：
  – 需要改变上网电价，以支持优化调度

• 改革电力公司业务模式：改善和发展深圳试点；

• 可再生能源并网。
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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，从而为中国显著和长期地减少温室气体排放作出贡献。

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