Crossing the River by Touching the Stones: China’s Climate Change Governance

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"Crossing the River"

- Control and reduce greenhouse gas emission
- China is the world largest greenhouse gas emitter;

Source: EDGAR v5.0 (CO₂: IEA and others), v4.3.2 (CH₄, N₂O) FT2017 (EC-JRC/PBL 2018).
Why “Touching the Stones”

• Few experience to learn from other countries.
  • Economic growth is highly dependent on coal consumption;
Why “Touching the Stones”

- Few experience to learn from other countries.
- Economic growth is highly dependent on coal consumption;
- Most of thermal power plants are “young” coal power plants;
Green transformation of electricity sector

• Several choices to make the electricity generation power greener:
  • Adopt Carbon Capture and Storage (CCS) technology;
  • Use less coal power plants;
  • Use more efficient coal power plants or switch to gas power plants;
  • Adopt more renewable energy power plants.
China’s coal miracle

• **Coal power plant reform** since 2007: Encourage big and discourage small policy;

• Efficiencies of top 100 coal power plants are all below 300 g/kWh.
Renewable energy development

- High annual growth rates in last decade:
  - More than 42% for wind power capacity;
  - Nearly 90% for solar PV capacity.
Renewable energy development

• Ratio of renewables rises to 28% in 2017.
• Ratio of renewables (excluding hydro) rises to 10% in 2017;
Existing problems

• China promises to generate 15% of its energy from renewables by 2020 and reach 20% by 2030;
  • Over-investment in renewable energy power plants and coal power plants;
  • High curtailment rate for wind and solar PV.

<table>
<thead>
<tr>
<th>Year</th>
<th>Shanxi</th>
<th>Shaanxi</th>
<th>Inner Mongolia</th>
<th>Ningxia</th>
<th>Qinghai</th>
<th>Gansu</th>
<th>Xinjiang</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td></td>
<td>5</td>
<td></td>
<td>10</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

Province-wise curtailment rate for wind power and solar PV.
Centralized vs. Decentralized Governance

• Centralized: China’s **Renewable Energy Law** took effect on January 2006 and an amendment was adopted in 2009.
  • Include **Renewable Energy Surcharge**, a fixed tariff added to the price of each kWh of electricity sold through the grid (**feed-in-tariff**);
  • Require electricity grid companies to **buy all the power** produced by renewable energy plants.

• Decentralized: Local administrations **act strategically** according to their own interests.
  • Overinvest in renewable energy plants;
  • Local protectionism: Protect local thermal power plants.
Overinvestment

- Driven by the profit seeking behavior:
  - Stable feed-in-tariff rates;
  - Dramatical decreases in renewable energy costs;
Local protectionism

• Protect interests of local coal power plants:
  • Administrative approval shift from central government to provincial government since 2013, newly built coal power plants are in debt-serving period;
  • Increasing endogeneity: Severe overcapacity and rising coal price in recent years have increased the resistance from coal power plants.

![Graph: Thermal coal price vs. Utilization hour](chart.png)
Solutions

• Increase centralized governance: to reduce the implementation gap.
• Introduce market based policy instruments
  • National Ultra-high voltage (UHV) transmission network: Long distance transmission of renewable energy power from the northwest to the east.
  • National emissions trading scheme (ETS): Control total CO₂ emissions from coal power plants in the first phase;
  • “Safeguard mechanism” of renewable energy consumption: China’s version of Renewable portfolio standard (RPS). Set minimum renewable energy consumption rate targets.
National UHV transmission network

• Transmitting low cost renewable power from renewable resource rich regions to the rest of the country.
From pilot ETSs to the national ETS

- **Pilot ETSs**: China launched eight pilot ETSs since 2013:
  - Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, Tianjin and Fujian.
- **National ETS**: Officially announced in the end of 2017:
  - In the first phase, only include electricity sector;

<table>
<thead>
<tr>
<th>Pilot ETS</th>
<th>Number of entities</th>
<th>Common covered sectors</th>
<th>Differential covered sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>947</td>
<td>Electricity and heat production, petrochemical, iron and steel</td>
<td>All other industrial sectors, public transportation and service sectors.</td>
</tr>
<tr>
<td>Chongqing</td>
<td>230</td>
<td></td>
<td>Industrial sectors.</td>
</tr>
<tr>
<td>Guangdong</td>
<td>218</td>
<td></td>
<td>Cement and aviation.</td>
</tr>
<tr>
<td>Hubei</td>
<td>236</td>
<td></td>
<td>Chemical, cement, nonferrous metal, Manufacture of universal equipment, construction, pulp and paper, food production</td>
</tr>
<tr>
<td>Shanghai</td>
<td>312</td>
<td></td>
<td>All other industrial sectors, transportation sector and commercial buildings.</td>
</tr>
<tr>
<td>Shenzhen</td>
<td>824</td>
<td></td>
<td>All other industrial sectors and commercial buildings.</td>
</tr>
<tr>
<td>Tianjin</td>
<td>109</td>
<td></td>
<td>Chemical, metal production, oil and gas production, manufacture of special equipment and commercial buildings.</td>
</tr>
<tr>
<td>Fujian</td>
<td>277</td>
<td></td>
<td>Chemical, cement, metal production, nonferrous metal, pulp and paper and aviation.</td>
</tr>
</tbody>
</table>

Construction and transportation (Planned).
From pilot ETSs to the national ETS

• Hot debates in China’s pilot ETSs: double counting issue.
  • Regulate CO₂ emissions not only in electricity production side but also in electricity consumption side;
  • Retail prices of electricity are highly regulated in China: increased costs of coal power plants can not be passed through to downstream industries;
  • Inter-sectoral carbon leakage effect: increase in CO2 emissions in sectors as a result of regulating the electricity sector.
“Safeguard mechanism”

- China’s National Energy Administration officially issued the final policy document on May 15, 2019.
- Include both grid companies and large electricity consumers;
- Provincial minimum rate targets can be determined by both local energy administrations and other local administrations.
Numerical simulation

- Dynamic Regional Economy-Energy-Environment Analysis Model (DREAM).
  - A large-scale mathematical simulation model for policy evaluations;
  - Based on general equilibrium theory and other economic theories.

- Policy scenarios setting
  - National Determined Contributions (NDCs);
  - Increased investment in renewable energies.

<table>
<thead>
<tr>
<th>GHG Target</th>
<th>China</th>
<th>India</th>
<th>Russia</th>
<th>Brazil</th>
<th>Mexico</th>
<th>EU28</th>
<th>US</th>
<th>Canada</th>
<th>Australia</th>
<th>Japan</th>
<th>South Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target type</td>
<td>Intensity Trajectory</td>
<td>Intensity</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
<td>Overall emission</td>
</tr>
<tr>
<td>Target year</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
<td>2025</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
</tr>
<tr>
<td>Reduction</td>
<td>60% to 65%</td>
<td>33% to 35%</td>
<td>25% to 30%</td>
<td>43%</td>
<td>25%</td>
<td>40%</td>
<td>26% to 28%</td>
<td>30%</td>
<td>26% to 28%</td>
<td>25.4%</td>
<td>37%</td>
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<tr>
<td>Policy instruments</td>
<td>Carbon tax</td>
<td>Energy tax</td>
<td>/</td>
<td>Carbon tax</td>
<td>Carbon tax</td>
<td>Carbon tax</td>
<td>Carbon tax</td>
<td>Carbon tax</td>
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<td>Carbon tax</td>
<td>Carbon tax</td>
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</table>
Illustration of DREAM
Simulation results

- Reduction in GDP growth rate compared to BAU scenario.
Simulation results

- Reduction in welfare growth rate compared to BAU scenario.
Conclusion

• Although China’s has experienced a rapid development of renewable energies, a large proportion of them was just wasted.
  • Curtailment of renewables;
  • Overinvestment in renewables and resistance in coal power plants.

• Market-based policy instruments and other supportive actions should be taken as early as possible.
  • National ETS and “Safeguard mechanism”;
  • Construction of national UHV transmission network.

• If all resources are fully utilized, NDCs can be realized effectively for countries who have taken active climate actions.
Thanks!