Center for Energy Economics and Strategy Studies

Interactive Policy Scheme of Power Sector Reform and ETS In China

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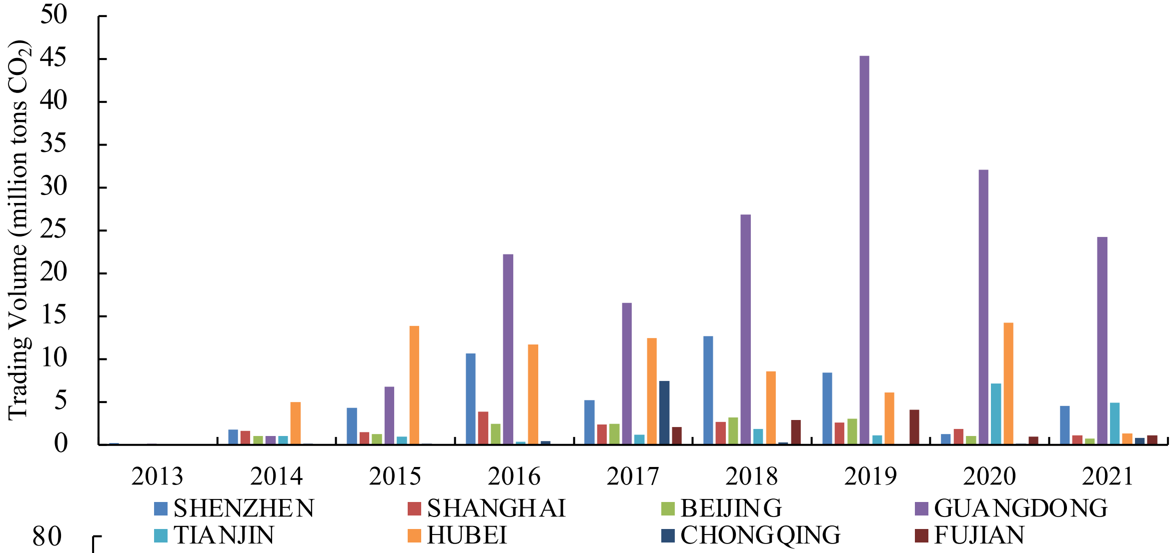
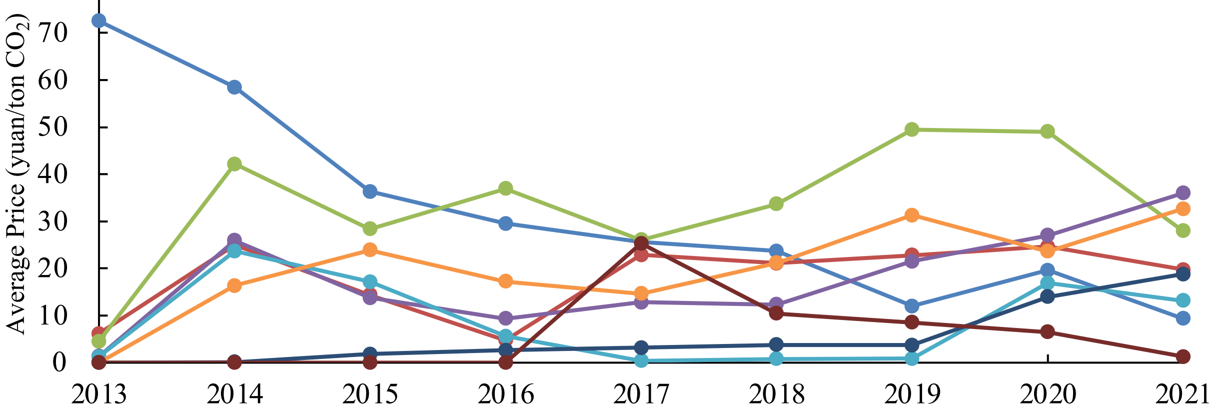
China ETS: from regional pilots to national market

- **Pilot ETS** (operational since 2013)

✓ 8 regional ETS pilots with different features



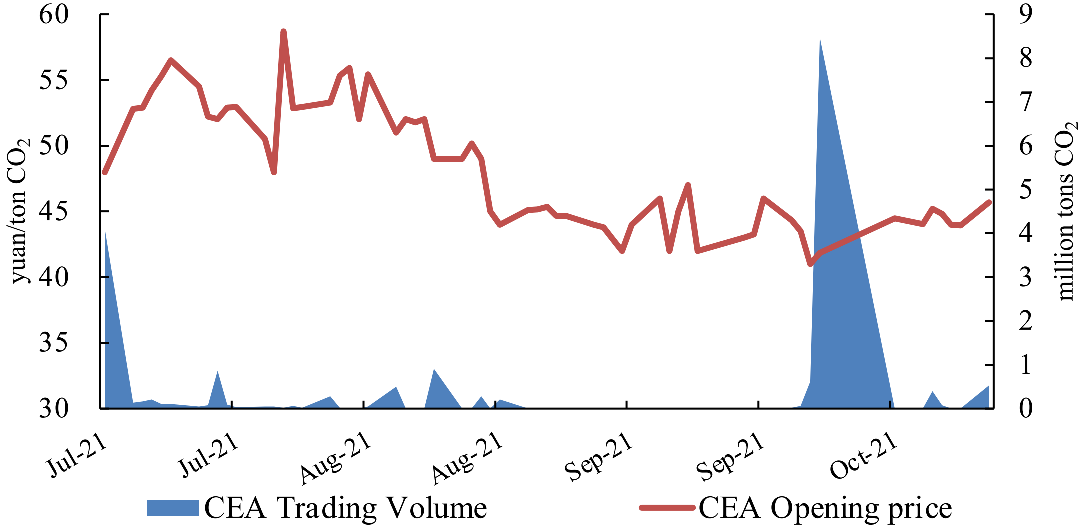


- **National ETS** (operational on July 16th 2021)

✓ Covers 2000+ entities in the power sector with annual emissions ≥ 26,000 tons CO_2, or comprehensive energy consumption ≥ 10,000 tons standard coal

✓ Free allocation with "benchmarking" approach

✓ CCER allowed for offsetting up to 5% of emission



DID design for evaluating ETS pilot effect

- **Evaluation of ETS pilot effect with DID design**

$$Y_{it} = \alpha_0 + \alpha_1 Treated_{it} Post_{it} + \alpha_2 Treated_{it} + \alpha_3 Post_{it} + \sum_k \beta_k X_k + \mu_i + \tau_t + \varepsilon_{it}$$

✓ where $Treated_{it}$ represents for whether province i is in ETS pilots or not, $Post_{it}$ represents for whether it is in 2013 or thereafter, as 7 pilots announced their inclusion criteria in 2013.

- **Data and Variable**

✓ A firm-level panel sourcing from Qian et al. (2021), covering firms' SO_2 emission and removal amounts, energy consumptions (coal, oil and electricity), direct CO_2 emissions (from fossil fuel consumption) and total CO_2 emissions (from fossil fuel and electricity consumption) from 2011-2014.

✓ After 1-on-1 matching according Mahalanobis distances of total CO_2 emission, SO_2 removal rate and SO2 emission factor (using average of 2011 and 2012), for pilot provinces, 251 non-power firms and 89 coal-fired power plants are kept for the regression.

- **All results we presents following passed the parallel trend test.**

Pilot effects: Non-power firms reduced their emissions

- In pilot provinces, firms in non-power sector **reduced SO_2 and direct CO_2 emissions**, both in emission quantity and intensity perspectives (columns 1-2, 4-6).

- Those firms reduced SO_2 and CO_2 emissions by 16% and 13% on average (columns 1-2).

Table: Emission Reduction Effect in Non-power Sector

	(1) $lnSO_2$	(2) $lnCO_2$	(3) Int_{so2}	(4) Int_{co2}	(5) $lnInt_{so2}$	(6) $lnInt_{co2}$
Treated × *Post*	-0.16**	-0.13*	-0.00	-0.33**	-0.24***	-0.21**
	(0.08)	(0.08)	(0.00)	(0.16)	(0.08)	(0.08)
EOP	1.40***	-0.90***	0.02**	-0.98**	1.27***	-1.02***
	(0.18)	(0.22)	(0.01)	(0.41)	(0.20)	(0.21)
EF	0.42***	-0.58***	0.00***	-0.60***	0.48***	-0.51***
	(0.06)	(0.06)	(0.00)	(0.08)	(0.06)	(0.06)
a, b, c & d	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.28	0.34	0.06	0.13	0.27	0.26
Obs.	1,940	1,940	1,940	1,940	1,940	1,940
Other cases for fixed-effect items: Coefficients for *Treated* × *Post*						
a, b	-0.15**	-0.13*	-0.00	-0.30*	-0.22**	-0.19**
	(0.08)	(0.08)	(0.00)	(0.16)	(0.09)	(0.08)
a, b & c	-0.16**	-0.13*	-0.00	-0.33**	-0.24***	-0.21**
	(0.08)	(0.08)	(0.00)	(0.16)	(0.08)	(0.08)
a, b & d	-0.16**	-0.14*	-0.00	-0.30*	-0.23***	-0.20**
	(0.08)	(0.08)	(0.00)	(0.16)	(0.08)	(0.08)

Notes: **and *** denote significance at the 10%, 5%, and 1% levels. The robust standard deviation of clustering at the cities level is given in parenthesis. *a* – d *stands for* firm-fixed, year-fixed, industry-year fixed and region-year fixed effect.

Source: Working Paper of CEESS

Pilot effects: Non-power firms change energy consumption behavior

- In pilot provinces, firms in non-power sector **reduced their energy intensity** (column 2).

- Changes in energy consumption:
  - ✓ Firm in pilots **reduce** their **fossil fuel consumption** by 14% on average (column 6).
  - ✓ Firm in pilots **increase** their **electricity consumption** by 6% on average (column 5).

Table: Pilots effect on Emission-related Factors in Non-power Sector

	(1) ES	(2) EI	(3) *ln*EI	(4) *ln*TP	(5) $ln\text{EC}_{ele}$	(6) $ln\text{EC}_{fossil}$	(7) $ln\text{EC}_{total}$
Treated × *Post*	-0.03	-0.13*	-0.14*	0.08	0.06***	-0.14*	-0.05
	(0.02)	(0.07)	(0.07)	(0.07)	(0.01)	(0.08)	(0.07)
EOP	-0.14***	-0.35**	-0.67***	0.13	0.03	-0.87***	-0.55***
	(0.04)	(0.17)	(0.16)	(0.16)	(0.02)	(0.22)	(0.17)
EF	-0.07***	-0.25***	-0.28***	-0.07***	0.00	-0.58***	-0.35***
	(0.01)	(0.04)	(0.05)	(0.02)	(0.00)	(0.06)	(0.05)
a, b, c & d	Y	Y	Y	Y	Y	Y	Y
R-squared	0.20	0.12	0.20	0.08	0.66	0.34	0.24
Obs.	1,940	1,940	1,940	1,940	1,940	1,940	1,940
Other cases for fixed-effect items: Coefficients for *Treated* × *Post*							
a, b	-0.03	-0.11*	-0.10	0.07	0.06***	-0.13*	-0.04
	(0.02)	(0.07)	(0.07)	(0.06)	(0.01)	(0.08)	(0.07)
a, b & c	-0.03	-0.13*	-0.13*	0.08	0.06***	-0.13*	-0.05
	(0.02)	(0.07)	(0.07)	(0.07)	(0.01)	(0.08)	(0.07)
a, b & d	-0.03	-0.11*	-0.11	0.07	0.06***	-0.14*	-0.04
	(0.02)	(0.07)	(0.07)	(0.06)	(0.01)	(0.08)	(0.07)

Notes: **and *** denote significance at the 10%, 5%, and 1% levels. The robust standard deviation of clustering at the cities level is given in parenthesis. *a* – d *stands for* firm-fixed, year-fixed, industry-year fixed and region-year fixed effect.

Source: Working Paper of CEESS

✓ Energy structure (ES) is defined as the amount of fossil fuel consumption divided by the amount of total energy consumption (EC); Energy intensity (EI) is defined as energy consumption divided by total product (TP).

Pilot effects: Coal-fired plants were less affected

- In pilot provinces, coal-fired power plants were **less affected**, their SO_2 and CO_2 emissions did not change significantly (columns 1-4).
- Coal-fired power plant in pilots **increase their emission intensities**, though very slightly (columns 5-6).

Table: Emission Reduction Effect for Coal-fired Power Plants

	(1) *ln*SO_2	(2) *ln*CO_2	(3) Int_{SO2}	(4) Int_{CO2}	(5) *ln*Int_{SO2}	(6) *ln*Int_{CO2}
Treated × *Post*	0.02 (0.06)	-0.04 (0.05)	0.01 (0.01)	0.13 (0.09)	0.07** (0.03)	0.01* (0.01)
EOP	2.26*** (0.25)	-0.35** (0.16)	0.18*** (0.06)	-0.32 (0.39)	2.58*** (0.29)	-0.03 (0.04)
EF	0.68*** (0.11)	-0.13* (0.08)	0.15* (0.09)	-0.30 (0.21)	0.78*** (0.09)	-0.03 (0.02)
a, b & c	Y	Y	Y	Y	Y	Y
R-squared	0.56	0.06	0.20	0.08	0.78	0.07
Obs.	612	612	612	612	612	612
Other cases for fixed-effect items: Coefficients for *Treated* × *Post*						
a, b	0.02 (0.06)	-0.04 (0.05)	0.00 (0.01)	0.13 (0.09)	0.07** (0.04)	0.01* (0.01)

Notes: **and *** denote significance at the 10%, 5%, and 1% levels. The robust standard deviation of clustering at the cities level is given in parenthesis. *a* – c *stands for* firm-fixed, year-fixed and region-year fixed effect.

Source: Working Paper of CEESS

Pilot effects: Coal-fired plants were less affected

- **In pilot provinces, coal-fired power plants went through a very slight increase in energy intensity (column 2), seems almost no effect.**

- **Some possible explanations:** 1. Abundant in allowance; 2. Non-power sector went through a electricity substitution, offsetting the production reduction effect **(if it happened, this will affect the ETS' interaction with other policy related to environment, e.g. electricity market or pollution allowance trading market).**

Table: Pilots effect on Emission-related Factors for Coal-fired Power Plants

	(1) EI	(2) *ln*EI	(3) *ln*TP	(4) *ln*EC_{fossil}
Treated × Post	0.05 (0.03)	0.01* (0.01)	-0.05 (0.06)	-0.04 (0.05)
EOP	-0.12 (0.15)	-0.03 (0.04)	-0.32** (0.16)	-0.35** (0.16)
EF	-0.11 (0.08)	-0.03 (0.02)	-0.10 (0.08)	-0.13* (0.08)
a, b & c	Y	Y	Y	Y
R-squared	0.08	0.07	0.05	0.06
Obs.	612	612	612	612
Other cases for fixed-effect items: Coefficients for *Treated × Post*				
a, b	0.05 (0.03)	0.01* (0.01)	-0.05 (0.05)	-0.04 (0.05)

Notes: **and *** denote significance at the 10%, 5%, and 1% levels. The robust standard deviation of clustering at the cities level is given in parenthesis. *a* – c *stands for* firm-fixed, year-fixed and region-year fixed effect.

Source: Working Paper of CEESS

19 Years Evolution of Electricity Market Reform in China

- **What we have done and what we are going to do**

Government Regulation

1979 — Initial stage: Adjusting the pricing mechanism

1985 — Multiple price: one plant one price

1998 — Bidding price Pilot reform in Dongbei and Huadong

2001

2002 — First Reform: Separation of generation and transmission

2004 — Pilot reform of retailing price

2013 — Feed-in tariff for RE; Initiating seven pilots of ETS

2015 — Second reform: Reform of wholesale and retail pricing mechanisms; Construction of spot electricity market

July 2021 — National ETS for electricity sector

Oct 2021 — Third reform: Cancelling planned price of industrial & commercial sectors. Removing invisible inhibition of upward fluctuation of price

Centrally planned economy

National wide supply shortage of supply due to backward Electricity generation industry

Chaotic prices and ever rising price level

- *Rapid expansion of electricity demand*
- *Vertical integration and entry barriers deterred investment*
- *Lagged development of transmission network*

- *Lack of trading system lead to low efficiency of resource allocation*
- *Mixed pricing system lead to cross subsidy & abnormally high transmission and distribution costs*
- *Dispatch system lead to curtailment of RE and hamper their integration into network*

- *Top-down pressure from peak & neutrality of carbon emissions.*
- *World-wide shortage in primary energy and expanded exports threaten the security of power supply.*
- *"Impact-response" mode in policy decision.*

- **Three main policy objectives (multi-objective optimization):**

  (a) Improving competition (spot pricing and investment guidance)

  (b) Ensuring system security (reliability price, ancillary service market, etc)

  (c) Promoting green & low-carbon transition(full procurement, renewable portfolio standards)

Tasks of Reform

Planned System	First & Second Reform (2002-2006；2015-2021)	Third Reform (2021-)
Dispatching the electricity by ensuring certain operating hours	Ensuring operating hours of RE and generators meeting peak demand by using priority dispatching	Mixed dispatching: RE and neo-participants entering spot market. Market selection and future technique portfolio ‘emerges’
Regulate the wholesale and retail price by central and regional government	Industrial and commercial sectors: spot market and bi-lateral contract price	Expansion of market scale and removing invisible inhibition of price rise compared to planned prices.
Gird company serve as the purchasing agent for all users and monopolize the final consumption	Grid company mainly serve as non-profit public utility. Retailors start business.	Entry-exit effect takes place in the retail market under increased competition

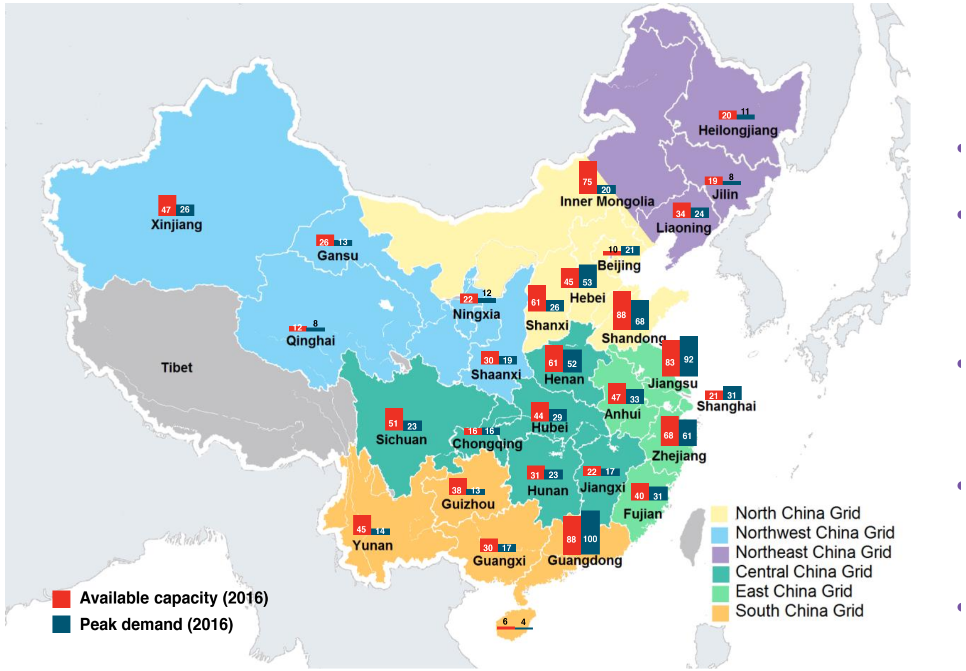
What can we expect in a liberalized electricity market ?

- **More appropriate electricity price.** Extremely important under expansion of VRE generation and national ETS.
- **Pass-through of carbon cost.** “True” electricity market is the premise of well-functioned national ETS.
- **Crowding out of low efficiency generating units .** Excessive capacity of coal-fired power plant
- **Revealed demand signal for green energy.** Rising public awareness about the environmental impacts of fossil fuel consumption
- **Favorable competition condition for RE.** Low marginal cost strengthen the competitiveness of RE in spot market
- **More efficient cross-subsidy.** production side: removal of subsidies among fossil-fuels and RE; consumption side: achieving gradual optimization of subsidies from industrial users to residential users by balancing efficiency and social equality targets.

Power Sector Reform ： Prominent Motivations

- **Severe over-capacity throughout the whole country**

Available capacity versus peak demand by province, 2016 (GW)

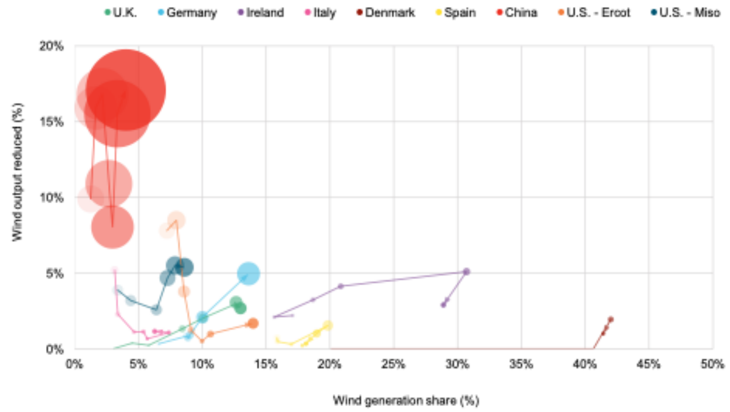


Source: Bloomberg New Energy Finance, CEC. Note: Based on the global standard, we assumed available load factor of hydropower =50%, pumped hydro =100%, coal 90%, gas 90%, nuclear 80%, wind 10%, solar 30%, biomass 70%.

By the end of 2016, the national electricity supply surplus rate was 35%.In 2016, only four coastal provinces and cities in Guangdong and Shanghai were in short supply

- **Lack of compatible policy and market scheme supporting renewable energy**

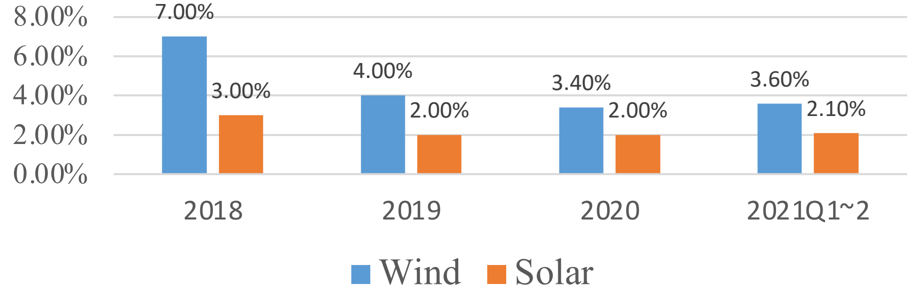
China's renewables curtailment



- Curtailment – wind farms and solar plants are forced to reduce their output.
- Even though variable renewable electricity penetration is still at a low level (less than 5% of the total electricity generation) in China, the country's wind and solar curtailment is the worst in the world. China's annual average wind curtailment exceeded 17% in 2016 largely due to the record number (30GW) of wind projects built in 2015.
- As curtailment goes uncompensated, China's renewable energy asset owners bear big financial uncertainties.

2018-2021 Curtailment of RE generation (%)

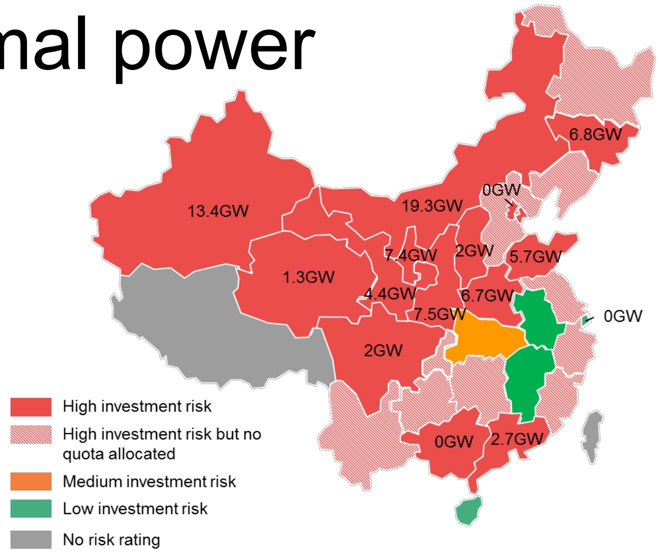
Data source: Wind Co.



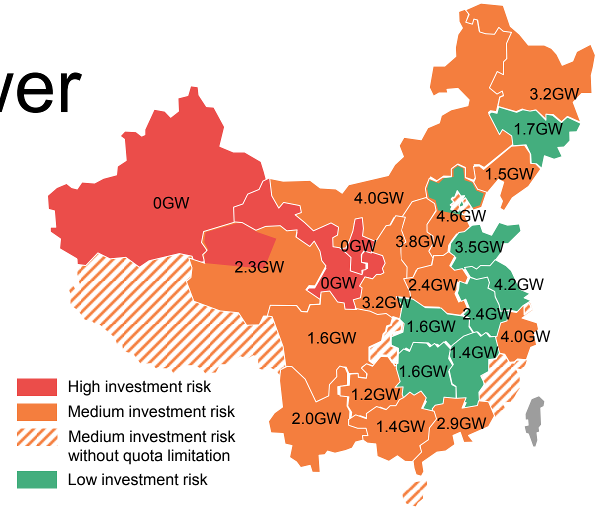
Investment risks of thermal power, wind power and PV

More free trading is required to reduce over capacity and investment risks

Thermal power

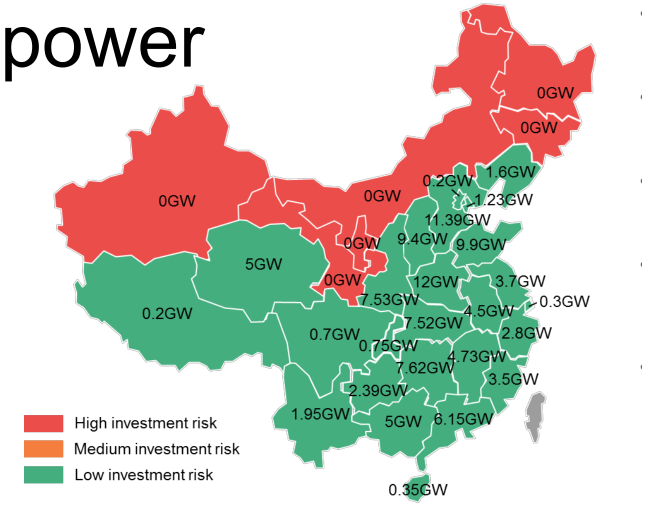


PV power



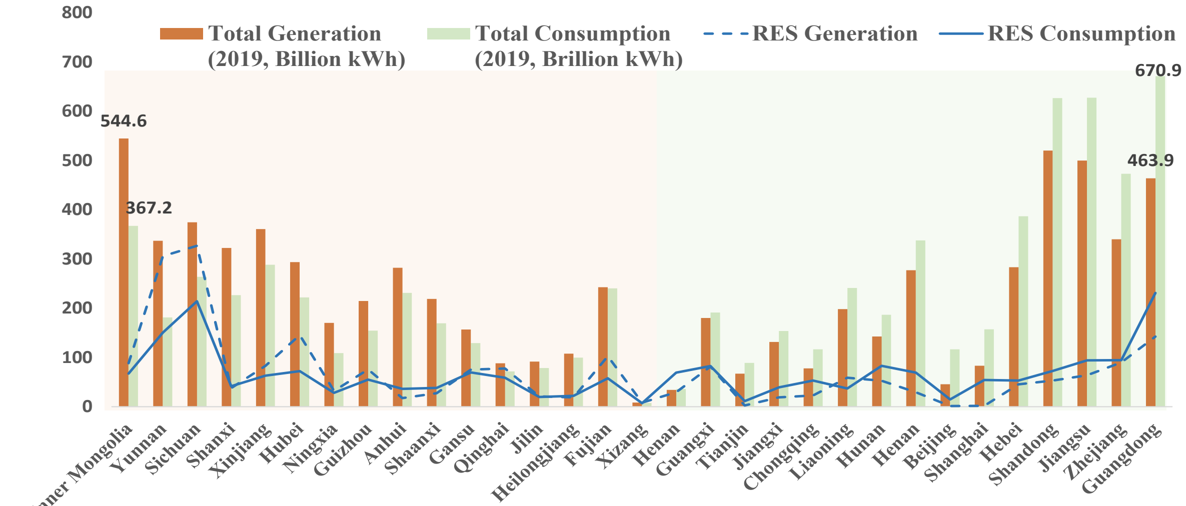
Source: NEA, Bloomberg New Energy Finance

Wind power



Source: NEA, Bloomberg New Energy Finance

Higher demand (eastern) vs. higher endowment in generation (western)



Data source: Wind Co.

Interaction between ETS and Power Sector

- **Production channel**: The policy raises the costs and product prices of regulated sources (s.t. Coal fired power generation) which causes production to shift to less stringently regulated sources and reinforce the development of high efficiency units.
  - **UK plants increased gas use by 19 to 24% and reduced coal consumption by 16 to 18% (McGuiness and Ellerman 2008).**
  - **Delarue et al (2008) likewise observe switching from coal to gas across the European electric power sector during the first phase of the ETS.**

From 2021 to 2030, coal-fired power generation will gradually lose its cost advantage (in terms of LCOE) over RE power generation

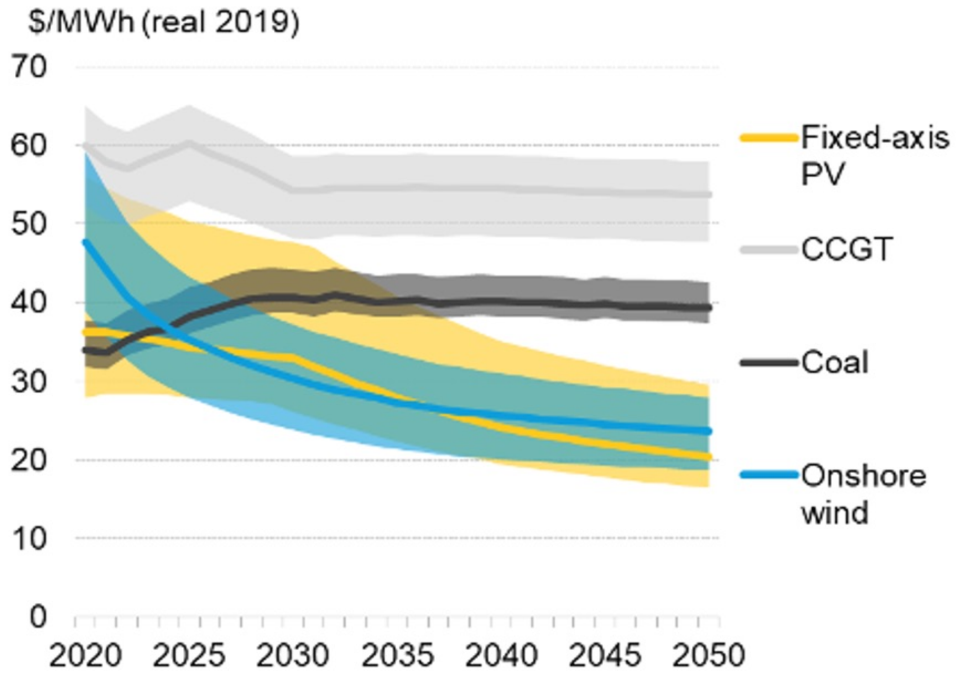
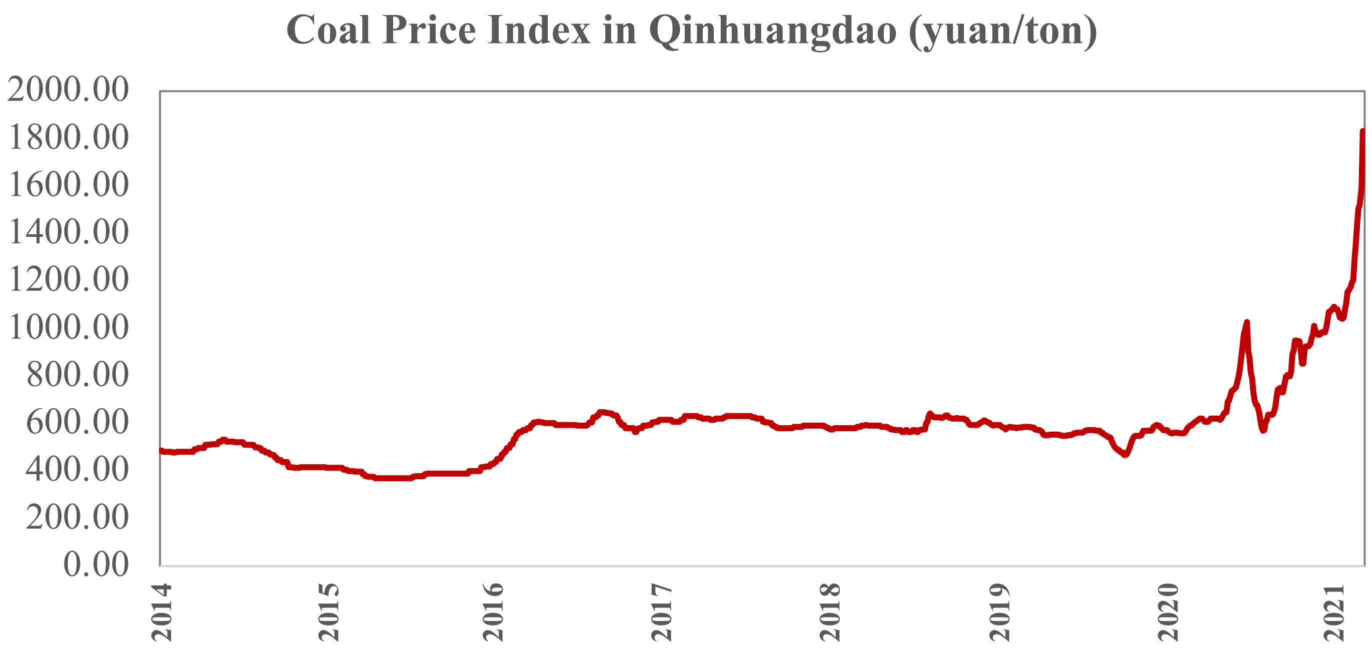


Figure is quoted from BNEF

Interaction between ETS and Power Sector

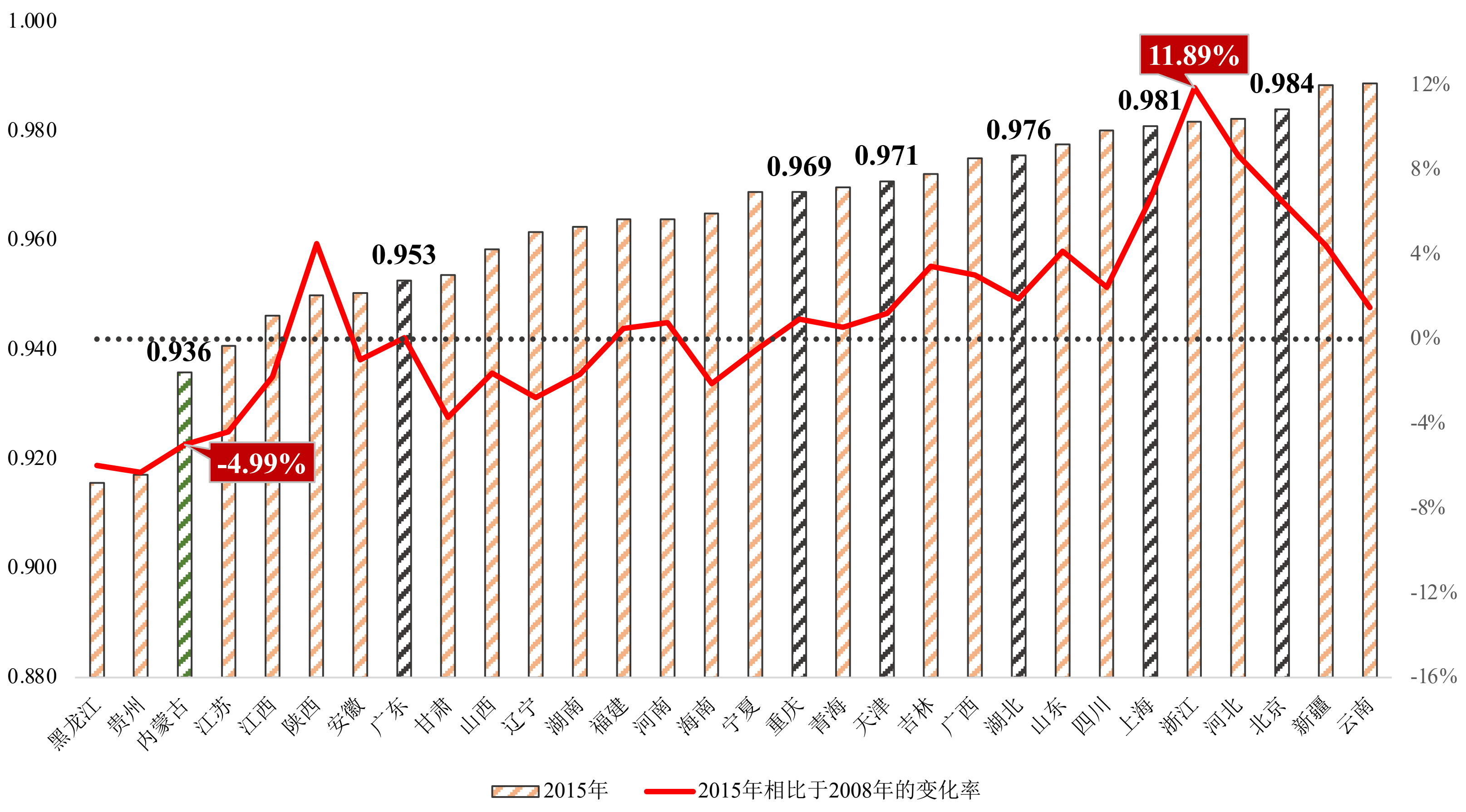
- **Consumption channel:** Regulated sources reduce their fossil fuel use, which lowers fossil fuel prices and may increase consumption by unregulated users.
  - At present, the national carbon market only includes the power industry. If the carbon market cost cannot be transferred to the non power sector, it may increase the demand for coal in the non power sector through instead.
  - **It is urgent for other high energy consuming industries to join the national carbon market**
  - In the short term, this mechanism will not be significant due to global coal shortage and rising carbon prices.



Data source: Wind Co.

Interaction between ETS and Power Sector

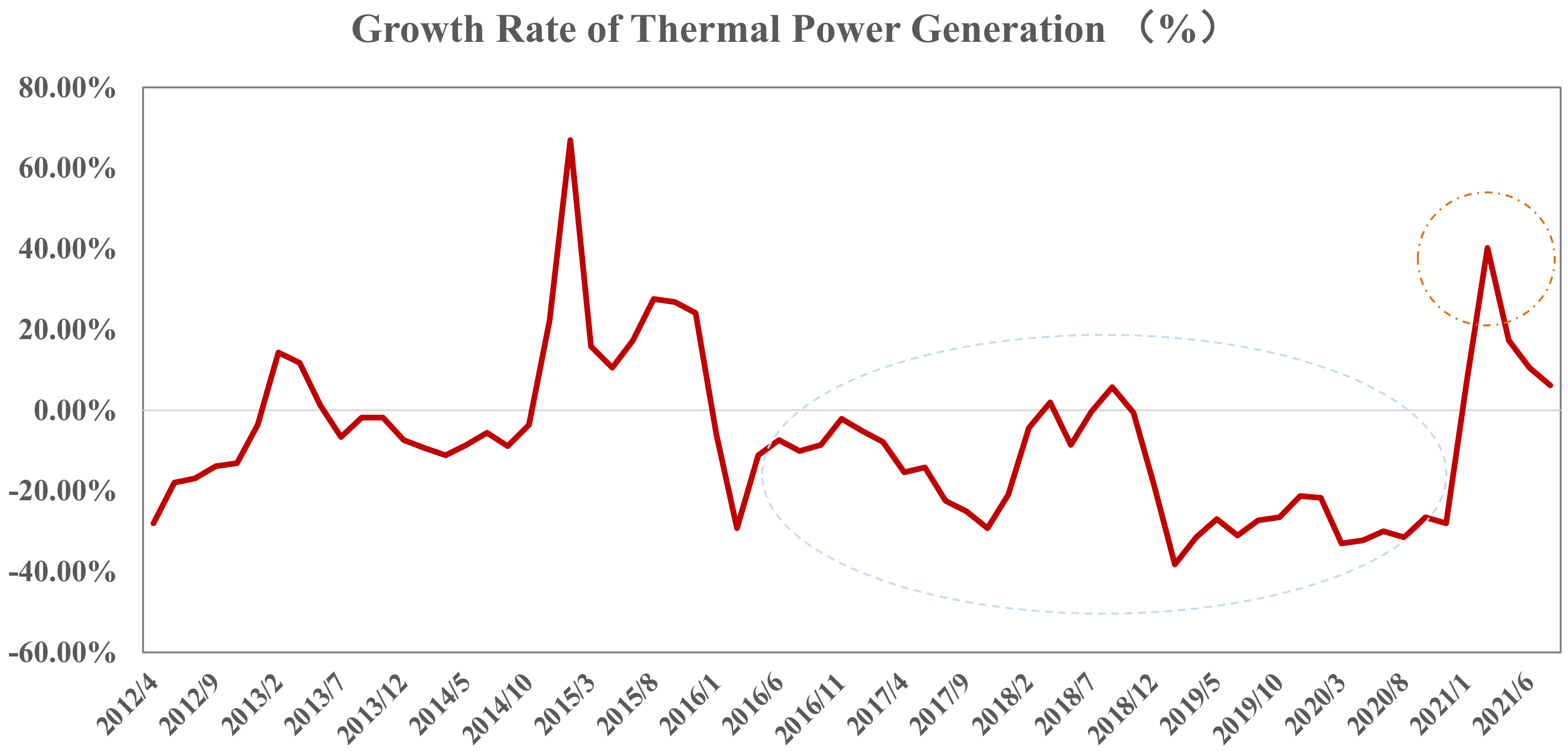
- **Competitiveness channel**: provinces with low production efficiencies will suffer from loss in both markets



Data Source: estimated by CEESS

Interaction between ETS and Power Sector

- **Intertemporal channel:** Capital stocks of all sources are fixed initially but change over time. Under the condition of low electricity price, ETS will reduce the ability of enterprises to recover the investment cost and improve the risk of capacity adequacy of power industry.



Data source: Wind Co.

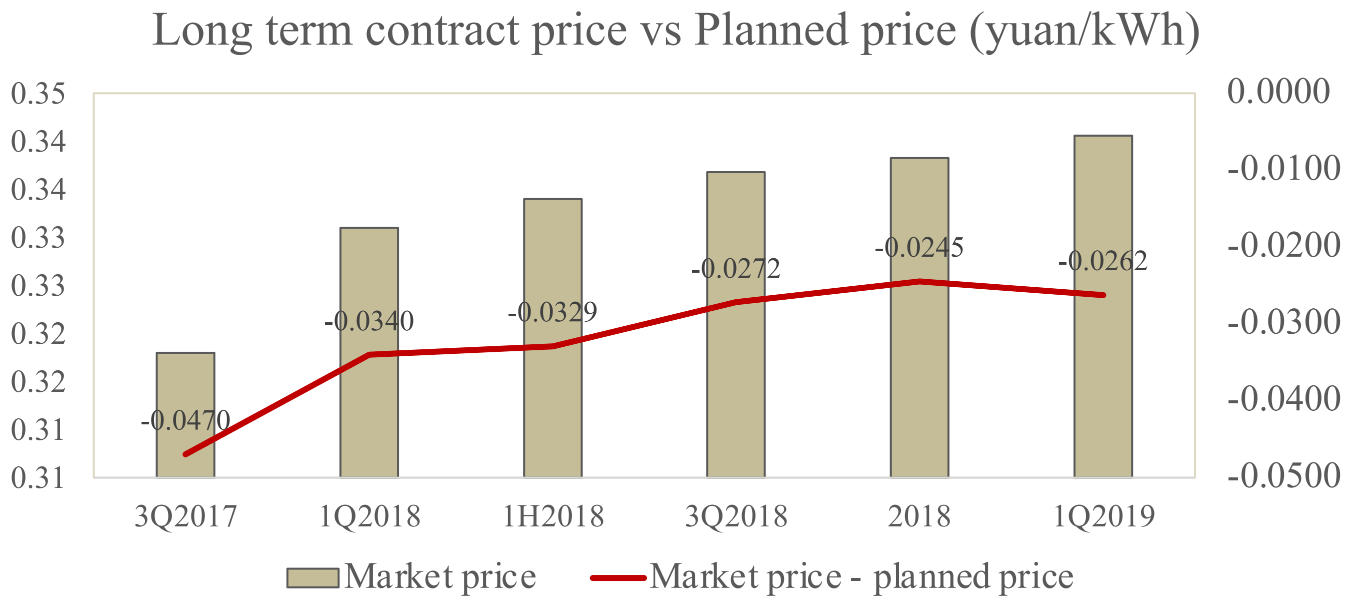
Interaction between ETS and Power Sector

- **Technology channel:** Mitigation policy induces low carbon innovation, which reduces emissions by unregulated sources that adopt the innovations (s.t. Renewable energy power generation and energy storage technology).
  - According to the documents of the National Energy Administration:
    - By 2030, the installed capacity of wind power and photovoltaic will exceed 1.2 billion kw.
    - In 2025, China's pumped storage capacity will be put into operation with a total scale of more than 62 million KW and 120 million kW in 2030
  - The pressure of the carbon market will encourage large fossil energy enterprises to invest in new energy technologies and try to seize the market share.

  - At present, the carbon market allowance is allocated free of charge.
  - After the introduction of paid auction in the future, the auction income can be used to support the R&D of RE technologies.

Problem: pass-through was deterred.

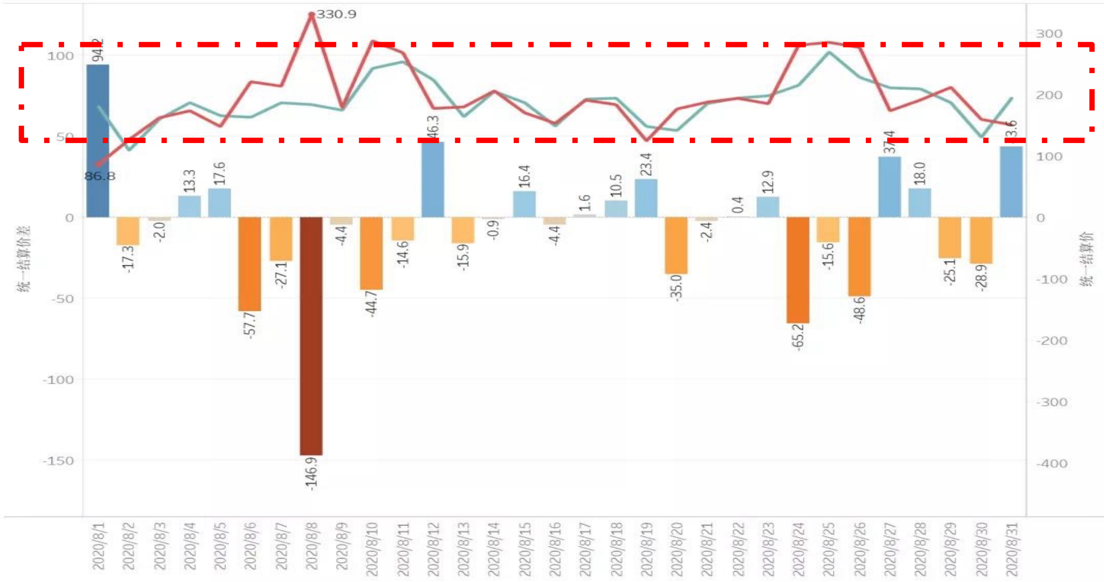
- **From 2017 to the first half of 2021, the price of power direct trading market in all provinces was lower than the original planned price.**
  - Not only is the average market price lower than the planned price, but also the price of each user is lower than the planned price regardless of power consumption characteristics.



Data Source: CEC

Problem: pass-through was deterred.

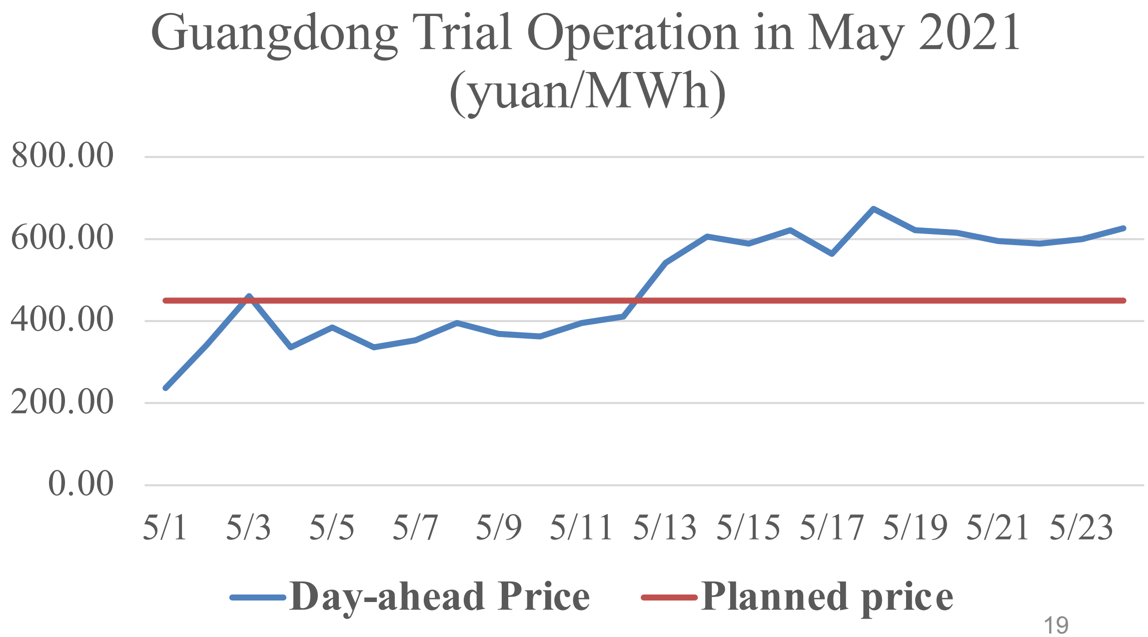
- **Eight representative provinces or regions are selected as the spot market reform pilot.**
  - Southern China (starting from Guangdong), Western Mongolia, Zhejiang, Shanxi, Shandong, Fujian, Sichuan, Gansu;
  - Spot prices in those pilots are very low (**0.2-0.3 yuan/kWh**), lower than the long-term price, and close to the variable cost of coal-fired units.
  - In addition to the **general oversupply**, local governments' **pursuit of reform performance** has depressed spot prices.
  - In 2021, due to the rise of coal price, the spot pilot price began to break through the planned price, but the increase of electricity price is still far less than that of coal price.



Daily Average price：0.1-0.2 yuan/kWh

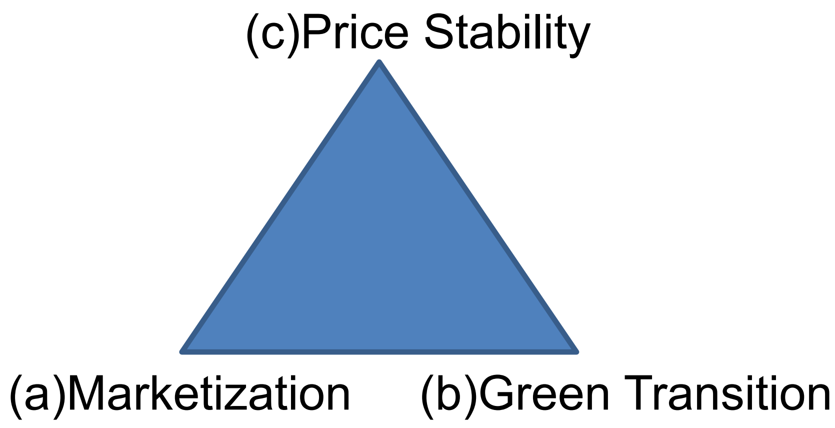
2020.08 Guangdong Trial Operating

Source: https://mp.weixin.qq.com/s/LY7U36ppwLwMF6SzvZlavA



Why was the reform in a long stalemate?

- **Without additional financial subsidies and long-run technology improvement, the power industry faces direct trade-offs between different policy objectives in short-term. We use an "impossible triangle" to represent the problem:**
  - **(a) Marketization.** Market is a kind of decentralization mechanism (Aoki, 2001). Market participants will be able to determine prices, especially for oligopoly power generation companies.
  - **(b) Green transition**. Higher ratio of unstable renewable energy brings a higher proportion of capacity redundancy and operating costs. There is no price competitiveness of renewable energy except hydro power at this stage..
  - **(c) Price stability**. Low electricity prices are seen as an institutional advantage.



Why was the reform in a long stalemate?

- From the politics-economy viewpoint:
- Neglecting policy failure when dealing with market failure.
  - The market concentration on the power generation side is high.
  - Immature market governance capability.
  - In order to ensure the realization of reform performance, local governments set strict ex ante restriction rules.

- Neglecting scientific nature of mechanism and emphasizing price reduction (result-oriented). .
  - Price reduction had become the only standard for reform performance evaluation.
  - Lack of scientific evaluation methods for reform performance.
  - According to social beliefs, price increases caused by reform will lead to public opinion disputes.

Why was the reform in a long stalemate?

- **Complexity in cross-subsidy:**
  - **For a long time, electricity price has played the role of other policy tools**
    - **Industry support tools**
      - For instance, in 2021, due to export growth, power demand in most provinces increased more than expected.
      - By the second half of 2021, the power consumption of many provinces has exceeded the quota previously allocated by the central government.
      - More importantly, low coal storage in power plant may lead to insufficient coal supply in winter.
      - **In contrast to the global energy shortage, some province had set preferential low electricity prices for high energy consuming industries such as electrolytic aluminum (which was main source of local tax income).**
    - **Supplementary means of transfer payment**
      - Industrial and commercial subsidies to residents
      - Failed to realize the function of income distribution by increasing the step price of residential departments (because of great policy resistance)
- **There are rare theoretic guidance for optimization of implicit policy targets.**

Uncertainties of RE development in a competitive market

Uncertain Price Signal

– **Raising variable renewable energy(VRE) penetration on wholesale electricity market may lead to decreased average spot price**

- With merit order system, VRE is usually dispatched in priority and replaces electricity generated by the marginal thermal plants that set the spot price. (Hu et al. 2018)
- VRE penetration will result in price decline, thus reduce market revenue for VRE plants.(IEA-RETD, 2016; Zipp, 2017)
- Empirical econometric analyses also have indicated a correlation between the increased penetration of VRE and the decreased average spot price in many EU Member States. (Saenz de Miera et al., 2008; Clo et al., 2015; Cludius et al., 2014)

Uncertainties of RE development in a competitive market

Uncertain Connection to Grid

- As one kind of LMP, zonal pricing is inefficient in limiting grid costs.
  - Associated with the feed-in of VRE into the grid, zonal pricing increases the chance of congestion in meshed networks, because its price signals fail to inform the actual state of power flows. (Henriot and Glachant., 2013)
  - Zonal pricing fails to incentivize VRE investments to efficiently use existing grid infrastructure within the same zone. (Hu et al. 2018)

Uncertainties of RE development in a competitive market

Uncertain demand

- liberalization of a retail electricity market can increase consumer's welfare
  - In competitive retail market, consumer can choose the most suitable service for them and improve the utility. (Shin and Managi, 2017; Zarnikau, 2011)
  - Customers can achieve economical benefit through various electricity service programs from different service providers. (Defeuilley, 2009; Joskow, 2005)
  - Introduction of foreign IPP and retail competition will lower electricity prices in some regions. (Nagayama, 2007; Steiner, 2000)

- With green labels, selling green products can be profitable for retailers as several groups of consumers are prepared to pay extra for renewable energy (Yang et al., 2015). But the impact of the green electricity labels is modest, because of the low WTP for green electricity. (Hast et al., 2015; Mulder and Zomer , 2016)

Uncertainties of RE development in a competitive market

Uncertain competitiveness

- **Change in power plant production efficiency**
  - Economist argue that Competitive markets help optimize resource allocation, improve market efficiency and encourage enterprises to innovate. (Leibenstein, 1966)
  - Razeghie et al. (2017) show that **competitive electricity market can help enterprises to increase their investment in efficient power generation units** and thus increase the overall production efficiency of power generation enterprises .
  - However, some researchers argue that production efficiency is not only related to market competition, but **also rely on regulation structure**. (Levy and Spiller, 1996; Villalonga, 2000; Bortolotti et al., 1998; Zhang et al., 2008)

- From this point, when competitive electricity markets promote technological innovations in thermal power units, thus thermal power units would take place of renewable energy power unit. (Arango and Larsen, 2010; Cheng et al., 2017)

Uncertainties of RE development in a competitive market

Uncertain policy impacts

- FIT may deteriorate RE's long-term competitiveness

  – Government subsidies may have a **positive impact on the firm's investment and scale but have a negative impact on the firm's productivity** (Bernini and Pellegrini 2011; Bondonio and Greenbaum 2014)

  – Traditional feed-in **scheme discouraging developers from adopting more system-friendly technologies and arrangements and selecting generation sites that maximize the market value of VRE**. (Hu et al., 2018)

  – fixed feed-in schemes will produce **perverse incentives that deviate from the objective of market value maximization for firms**. (Oliveira., 2015)

Uncertainties of RE development in a competitive market

- Optimal RES support scheme research.
  - Andor and Voss (2016) suggest that **generation subsidies should correspond to externalities of electricity generation** (e.g., greenhouse gas reductions),and **investment subsidies should correspond to externalities of capacity**
  - Some researchers use the method of discounted cash flow to assess the return on investment, but this method always **undervalue such generation assets** as they **ignore the value of flexibility** (Deng and Oren, 2005)
  - Because of the market uncertainty, researchers build real option models and analyze the net present value of investments (Dixit and Pindyck, 1994; Fleten et al., 2007; Ritzenhofen and Spinler, 2016). Besides, scholars also considered the effects of "learning by doing" and "economies of scale" to study the optimal feed-in tariffs (Shrimali and Baker, 2011)

Uncertainties

- **In summary, the impact of electricity reform on ETS and carbon peak:**
  - **Political constraints.**
    - Marketization increases the uncertainty of electricity prices, and local governments will take a more cautious attitude towards the carbon market.
    - The third reform in electricity sector will partly **“liberate”** the operation of the national carbon market.
  - **Competiveness effects**.
    - Competition among power generation companies may rise in short-run or fall in long-run, yet depending on whether there is market collusion and the ability of regulators.
    - If the reform goes smoothly, the market competition will be improved and the excess capacity of thermal power industry will be gradually eliminated or solved. This helps to improve efficiency and reduce emissions.
  - **Technology innovation.**
    - Power system reform will promote the development of renewable energy quota trading system and energy storage technology, reduce the cost of power system and carbon emissions in the long term.

Thank you！