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

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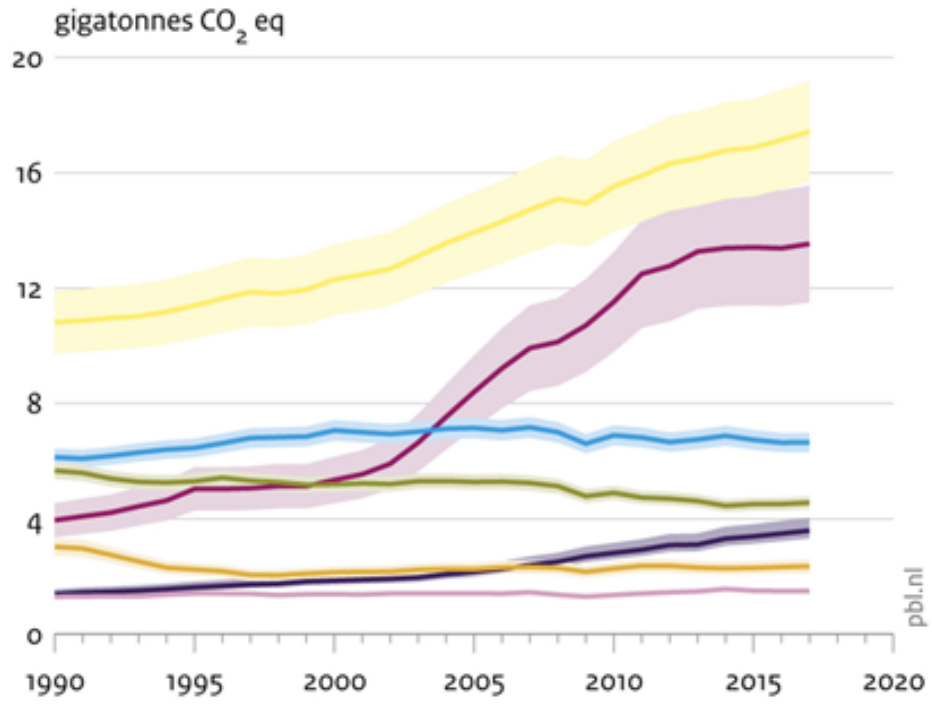
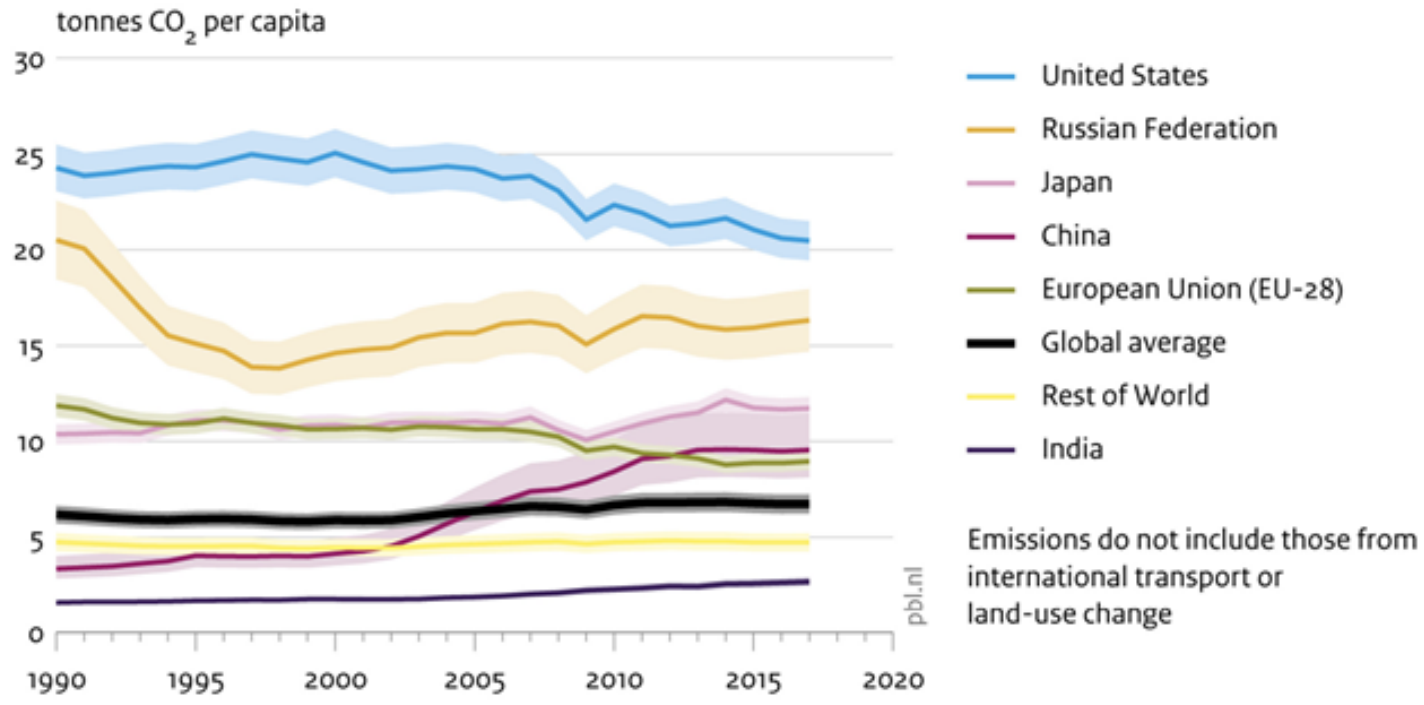
“Crossing the River”

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

Greenhouse gas emissions, per country and region



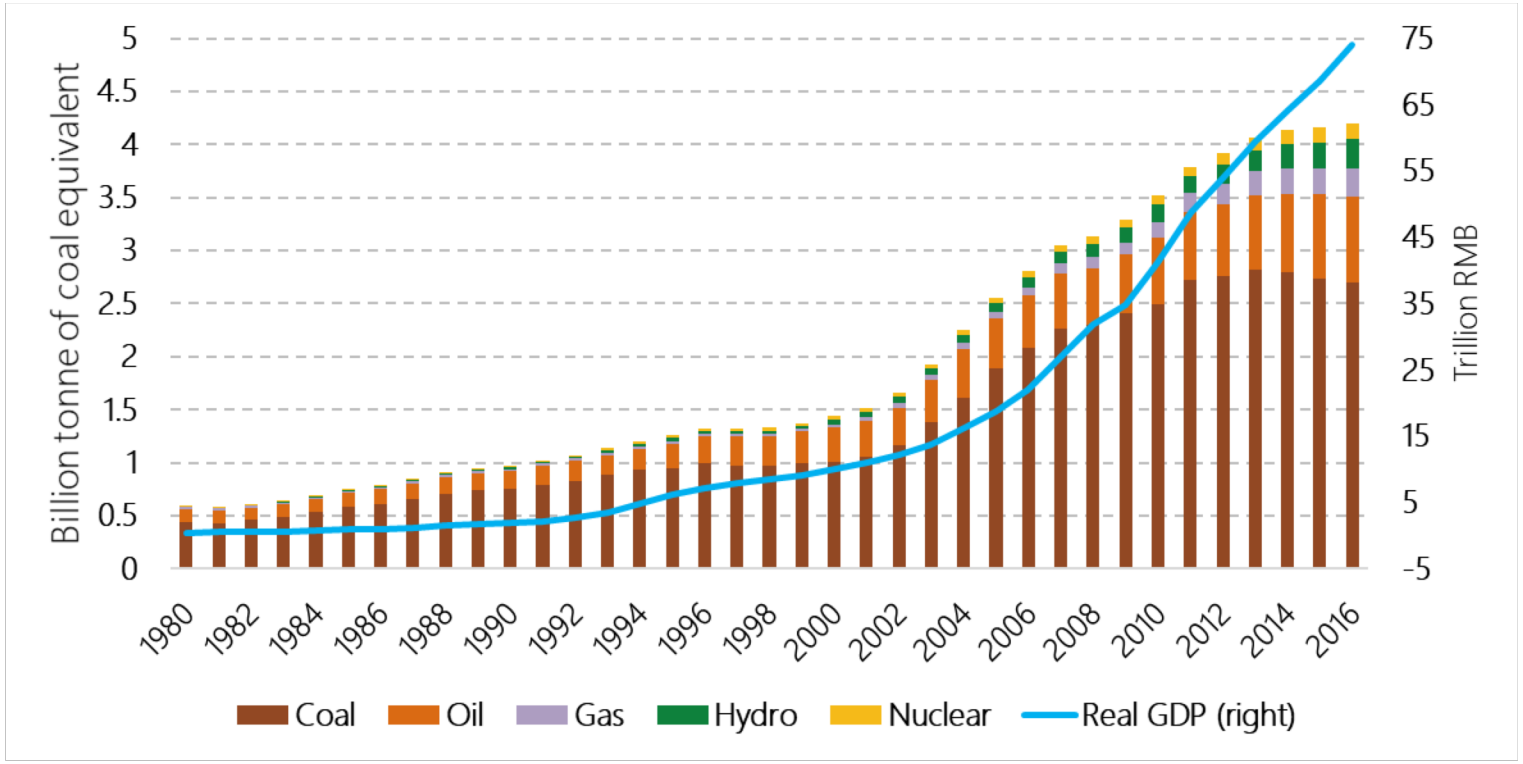
Greenhouse gas emissions, per capita, per country and region

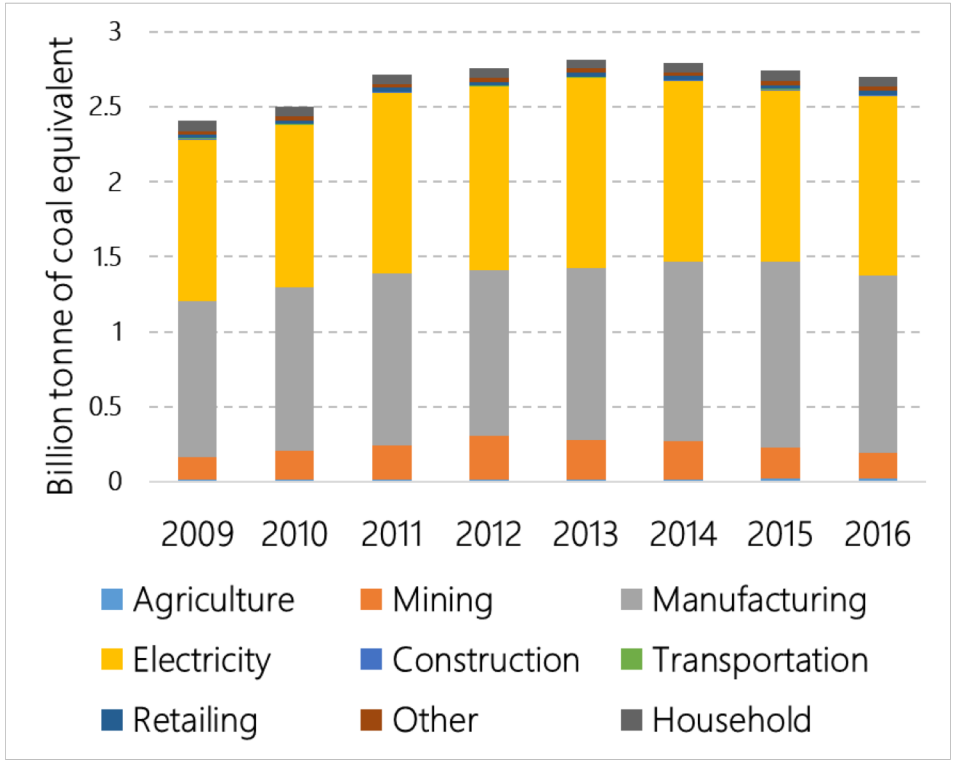


Source: EDGAR v5.0 (CO_2: IEA and others), v4.3.2 (CH_4, N_2O) FT2017 (EC-JRC/PBL 2018).

Why "Touching the Stones"

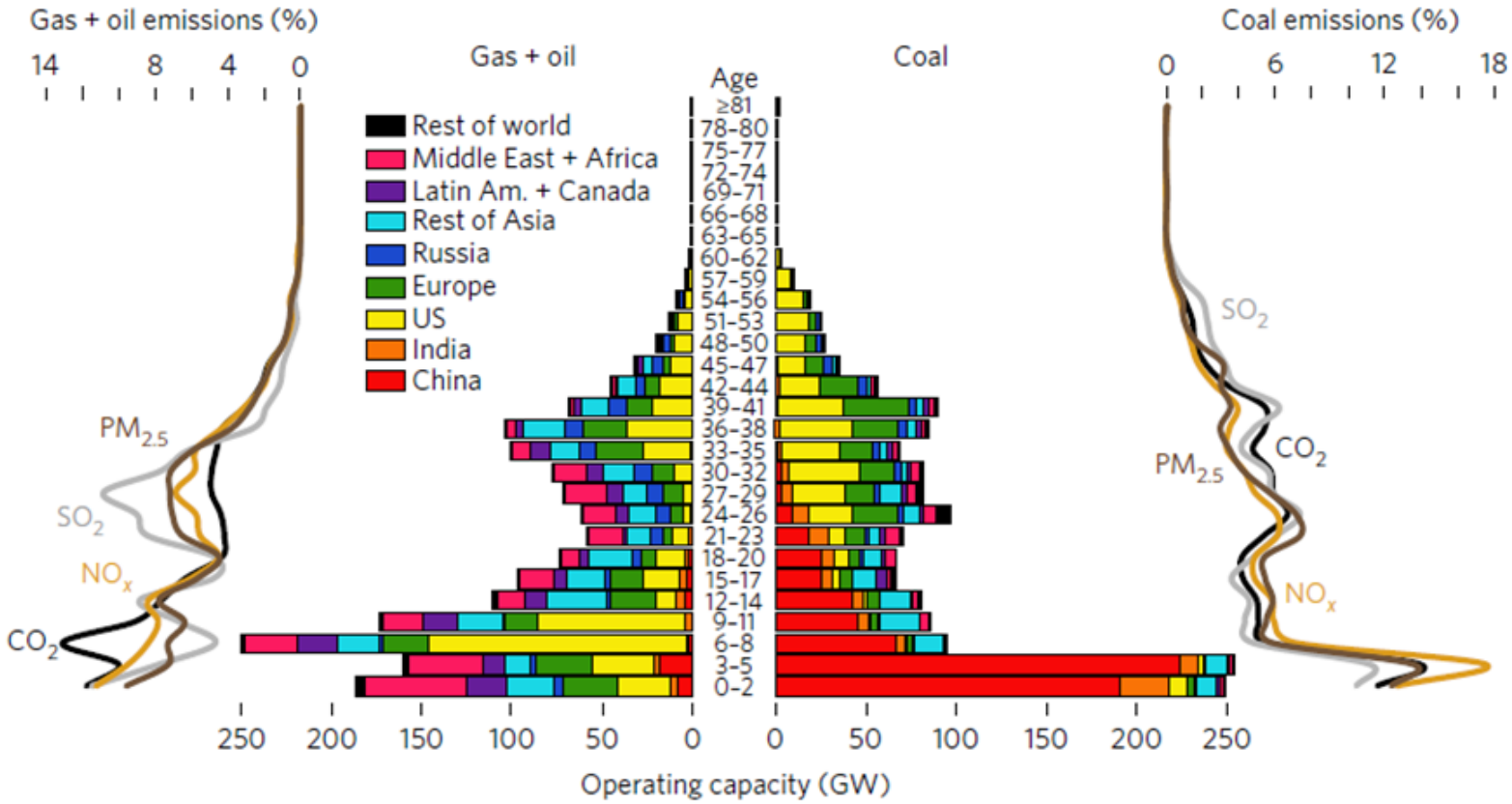
- Few experience to learn from other countries.
  - Economic growth is highly dependent on coal consumption;





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;

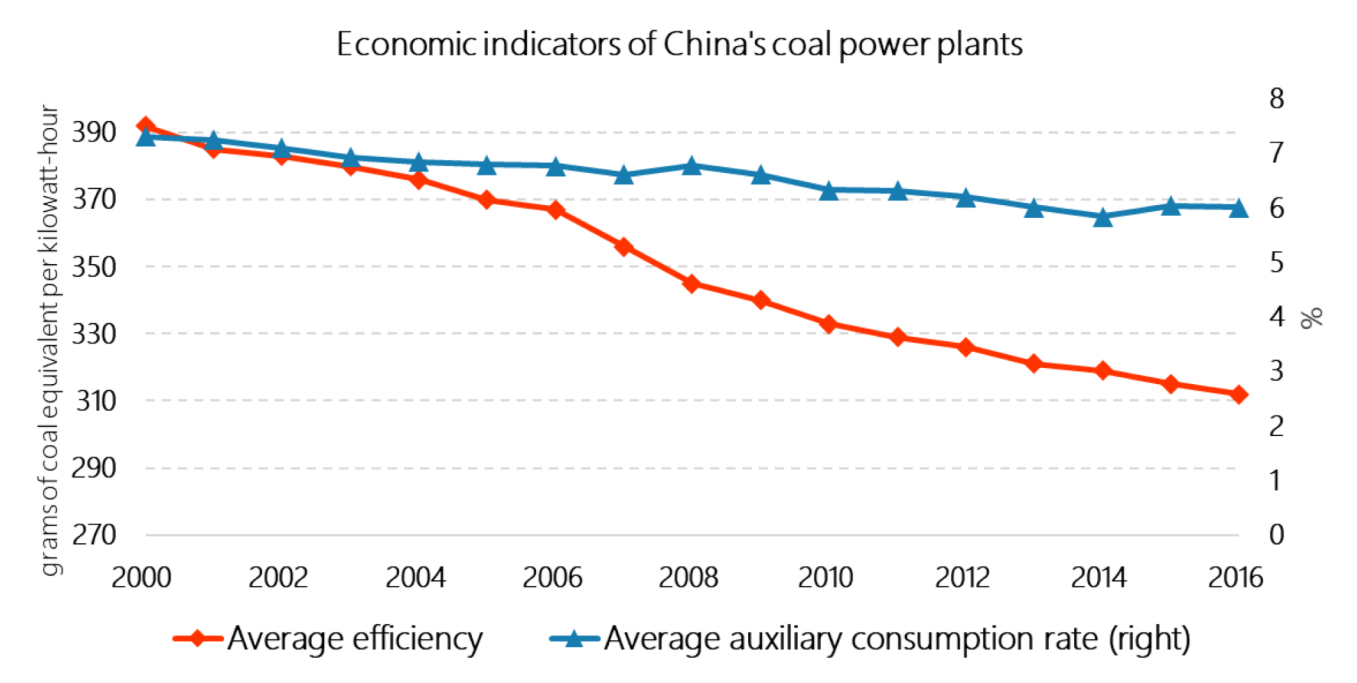


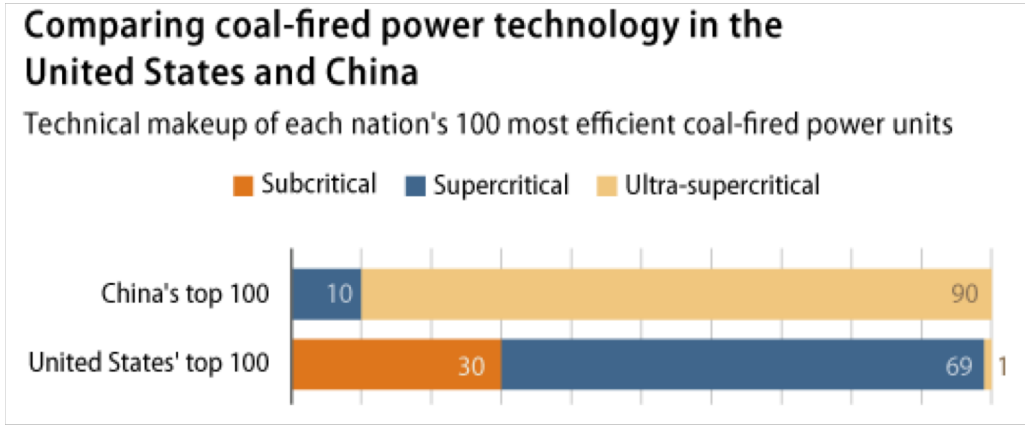
Green transformation of electricity sector

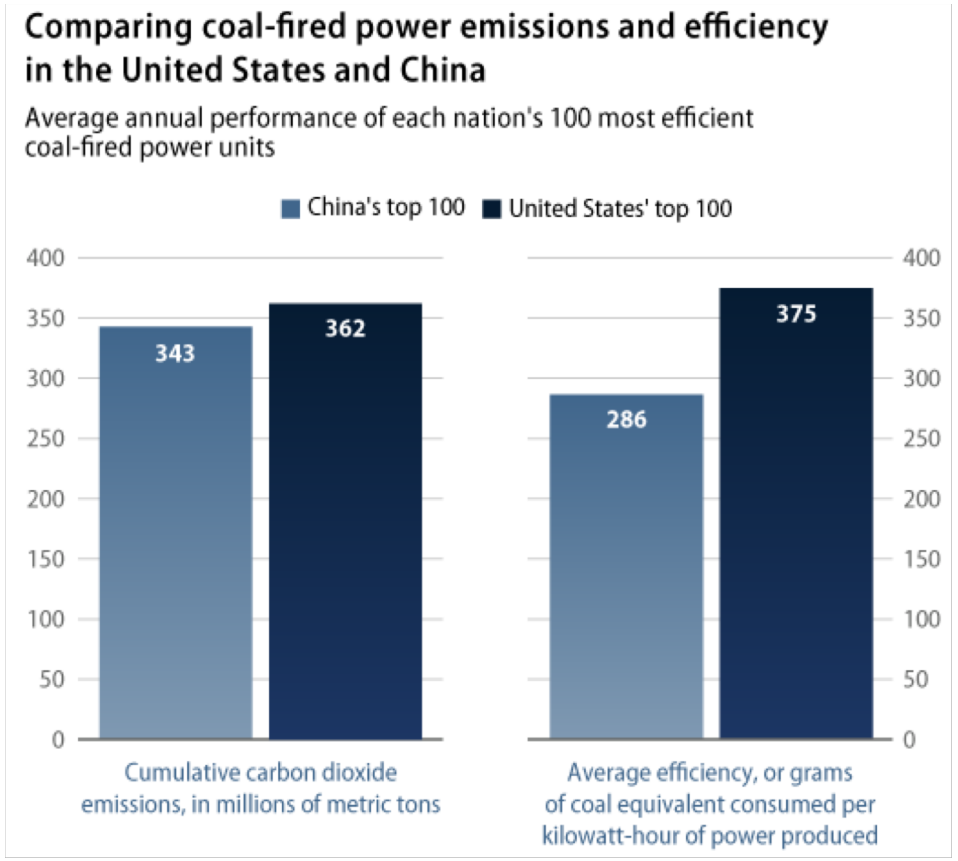
- Several choices to make the electricity generation power greener:
  - Adopt Carbon Capture and Storage (CCS) technology;
  - Use less coal power plants;
  - Use more efficient coal power plants or switch to gas power plants;
  - Adopt more renewable energy power plants.

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.

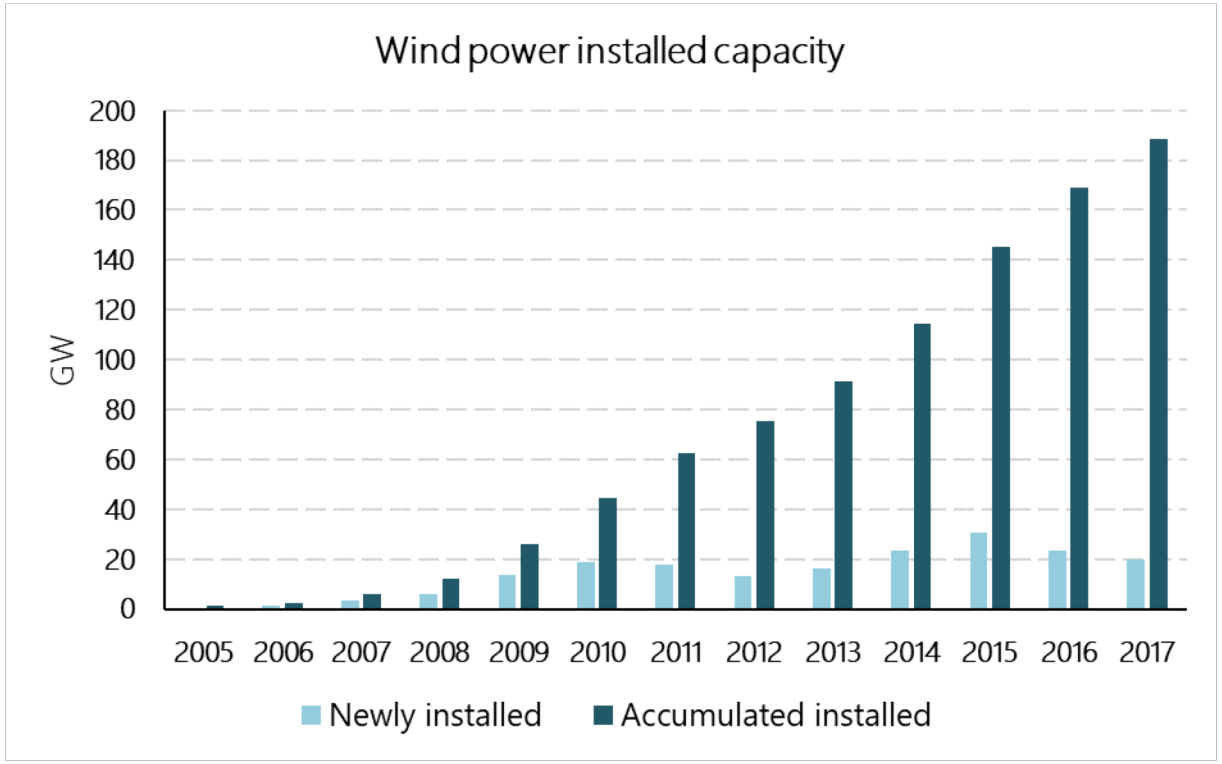


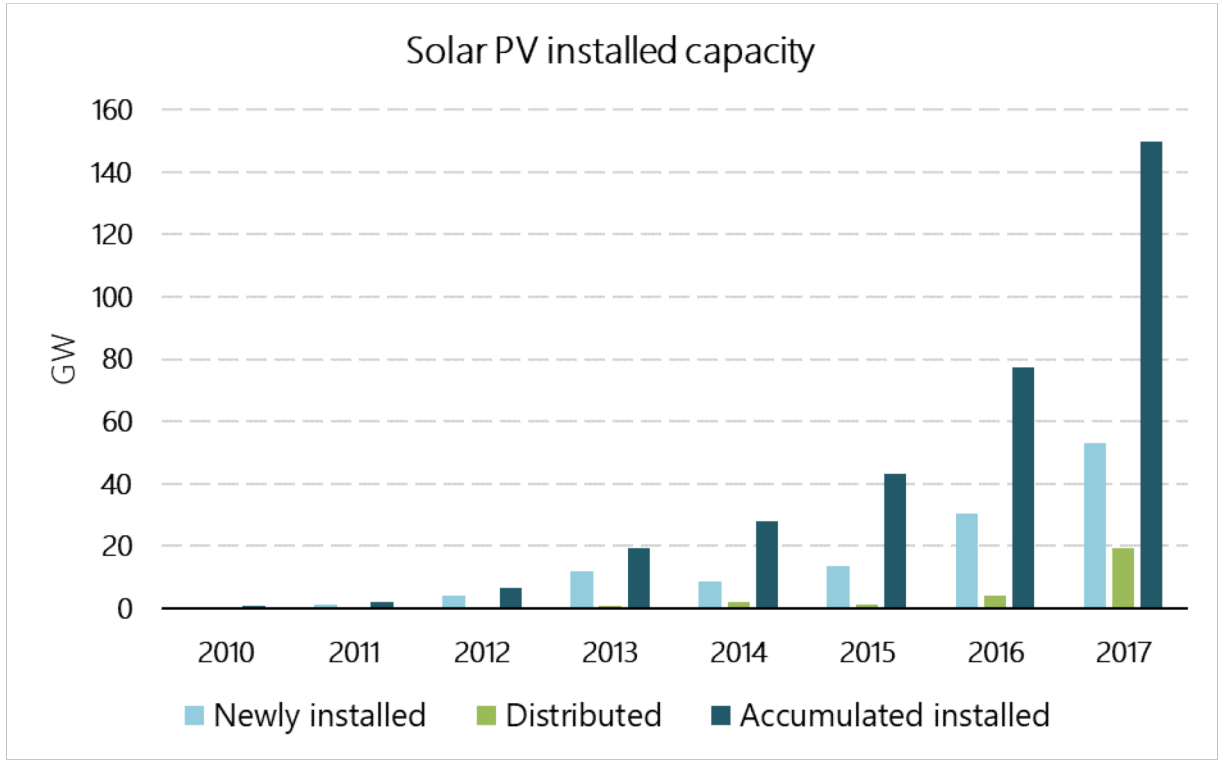




Renewable energy development

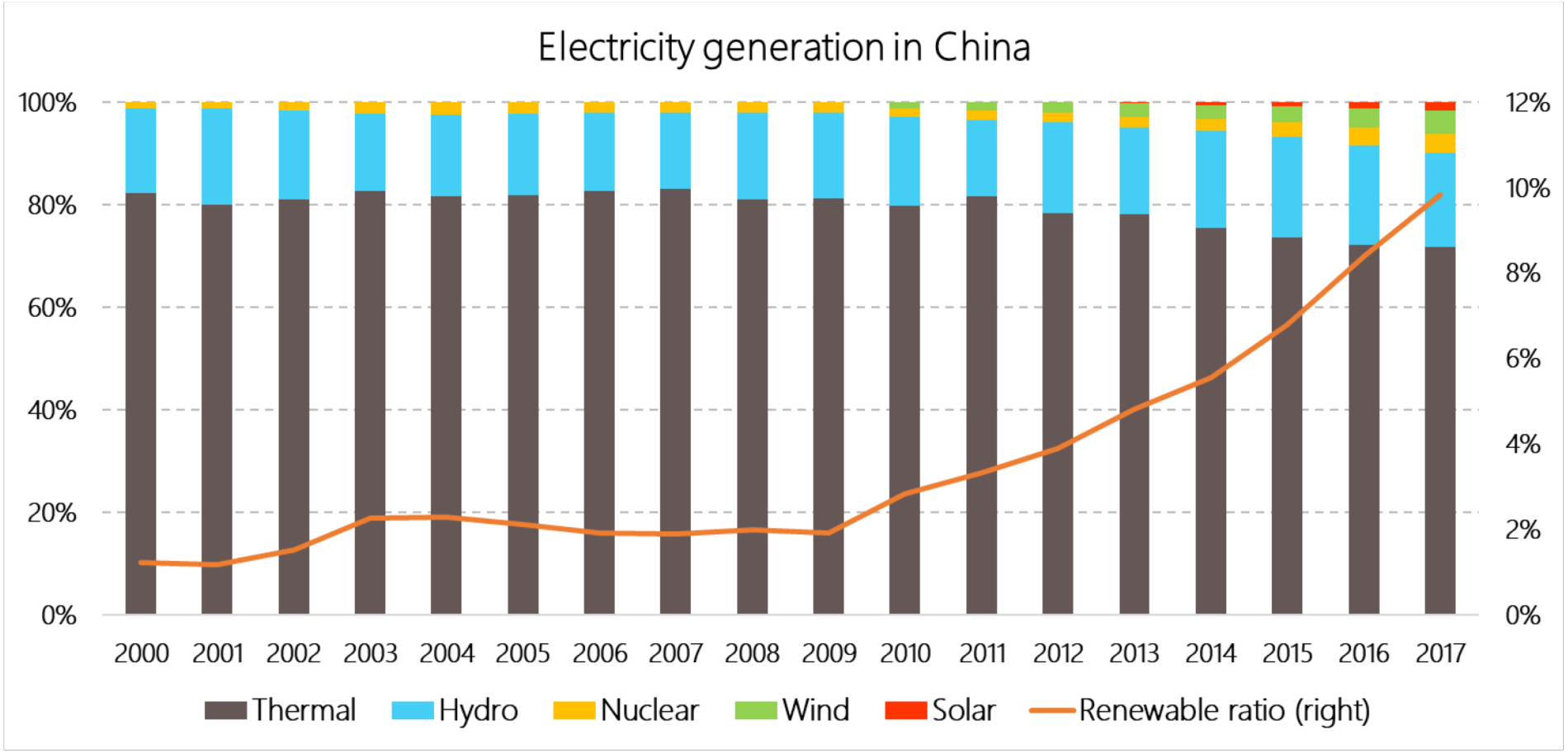
- High annual growth rates in last decade:
  - More than **42%** for wind power capacity;
  - Nearly **90%** for solar PV capacity.





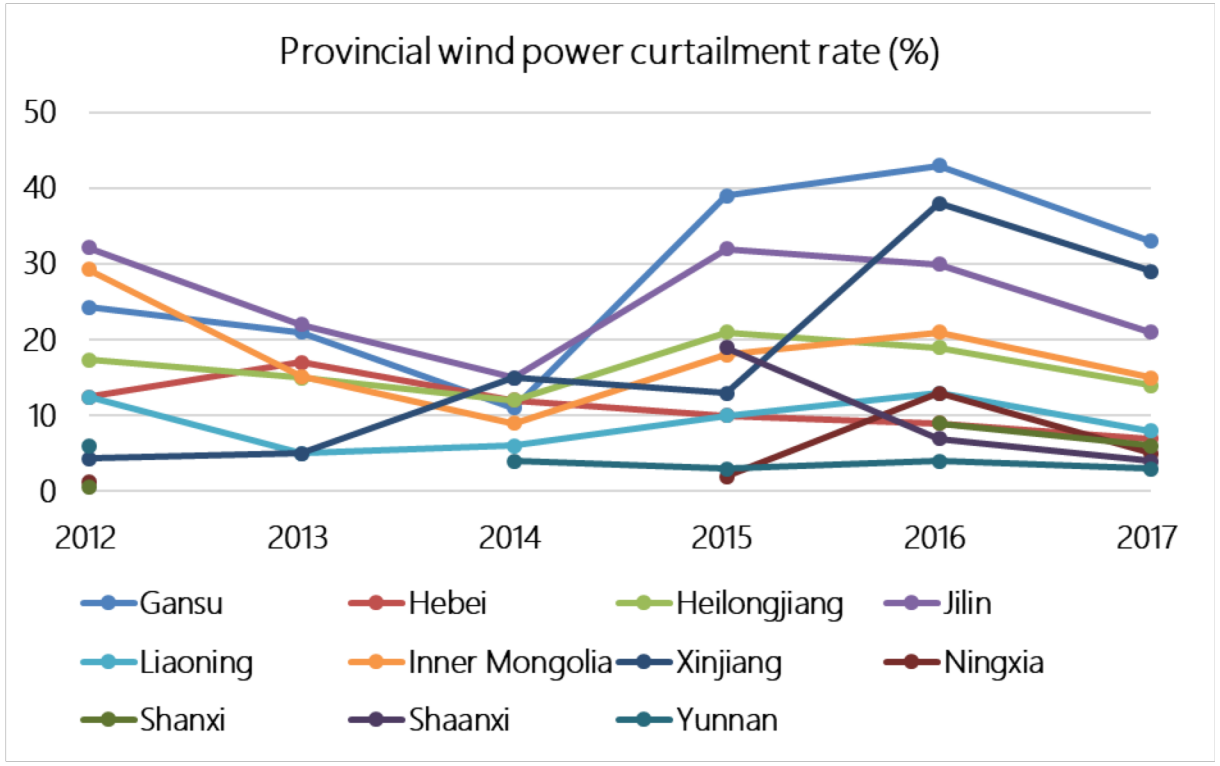
Renewable energy development

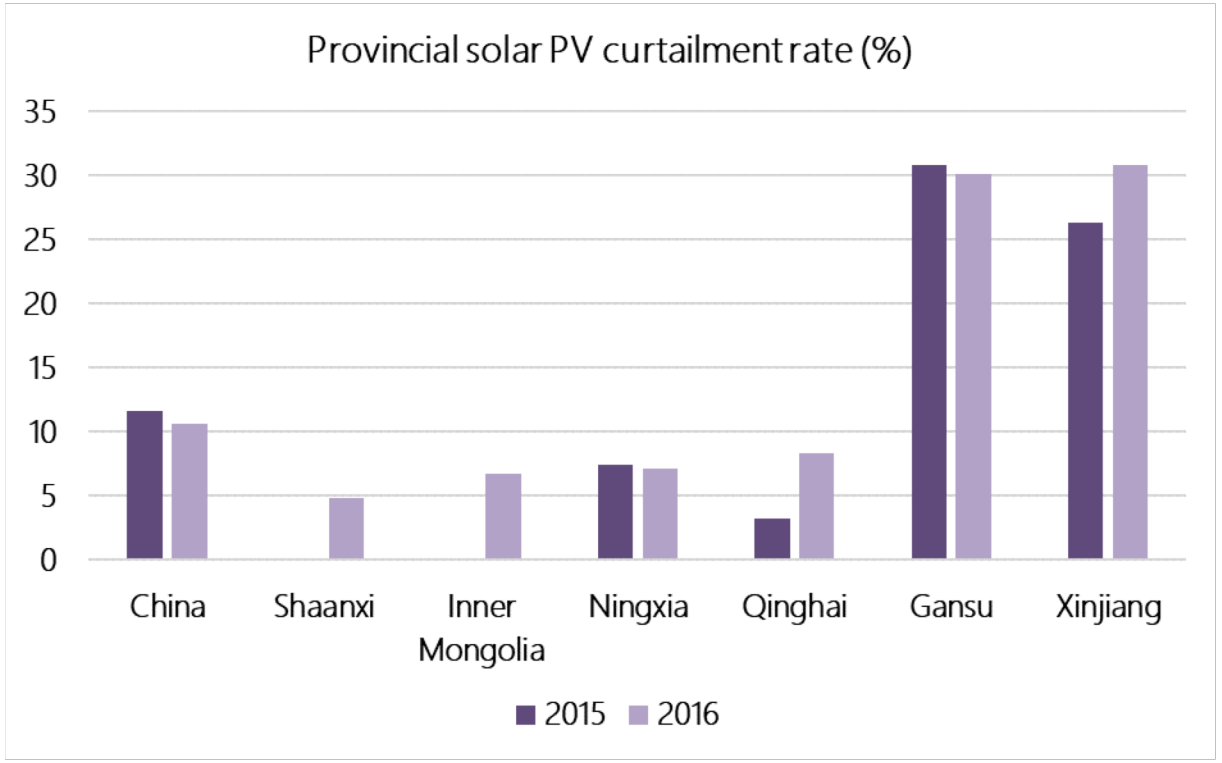
- Ratio of renewables rises to 28% in 2017.
- Ratio of renewables (excluding hydro) rises to 10% in 2017;



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.



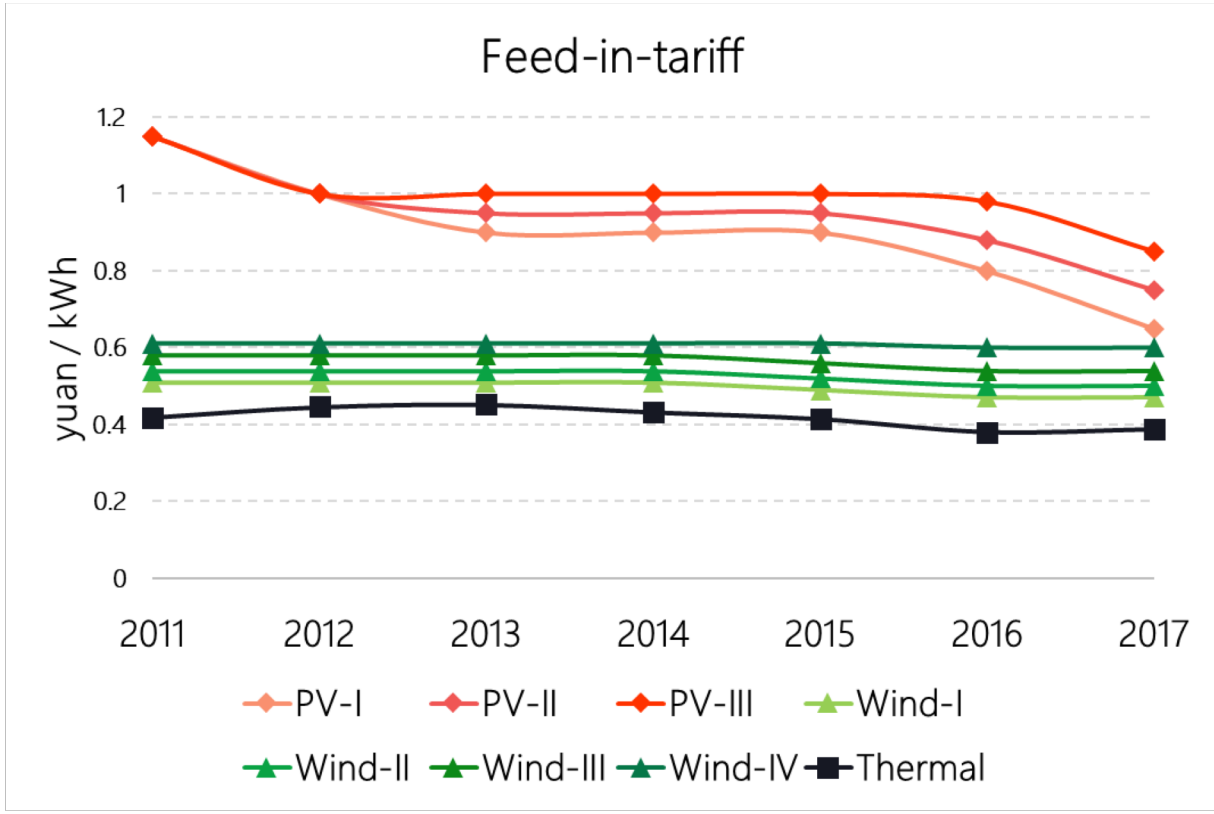


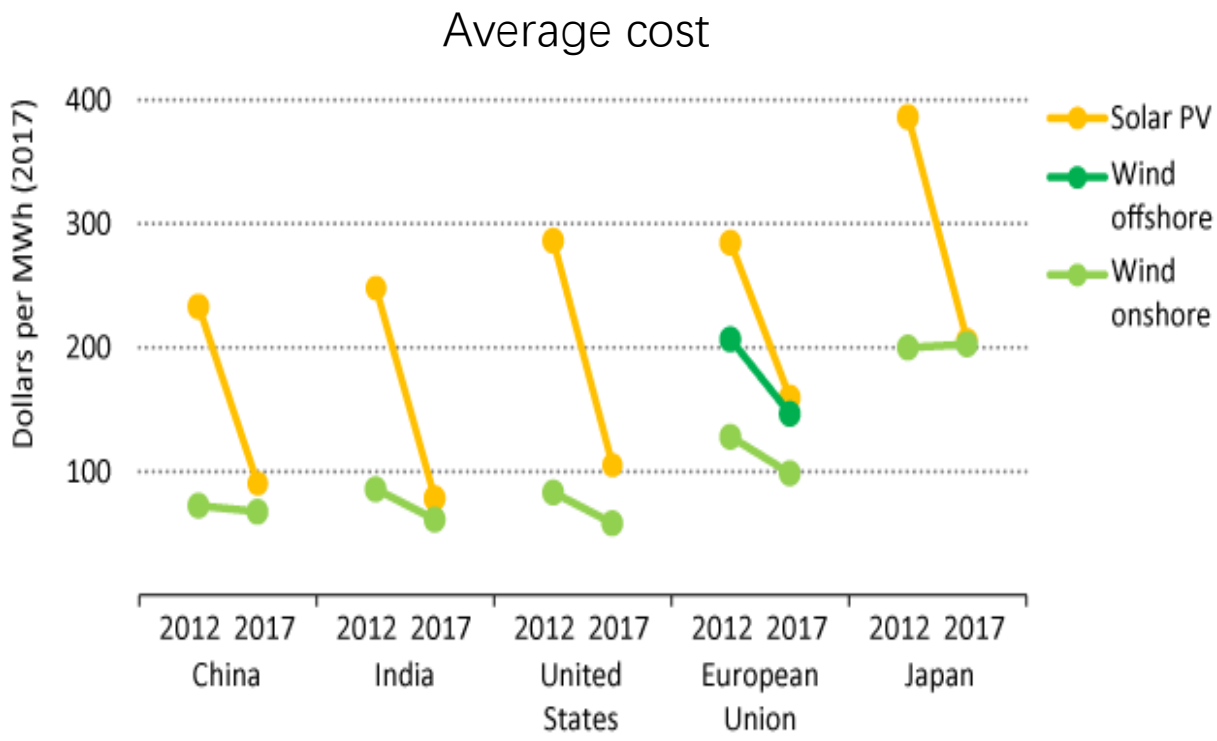
Centralized vs. Decentralized Governance

- 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

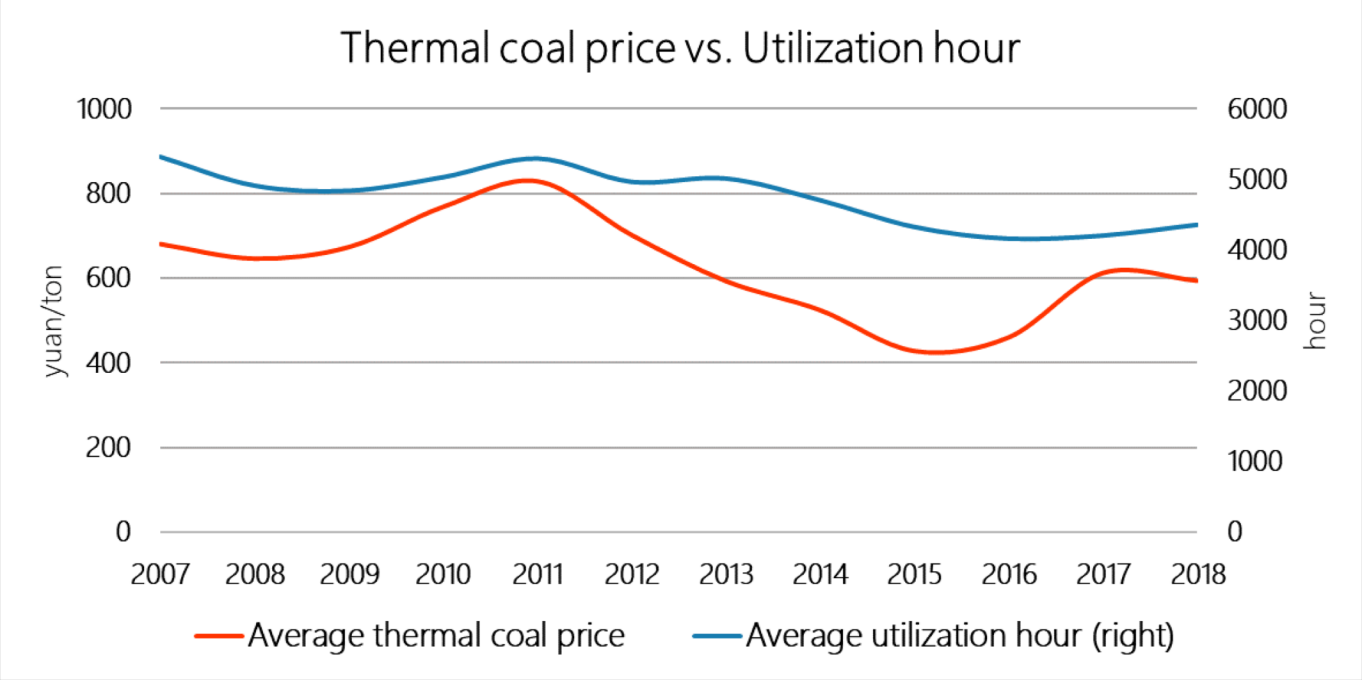
- Driven by the profit seeking behavior:
  - Stable feed-in-tariff rates;
  - Dramatical decreases in renewable energy costs;





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.

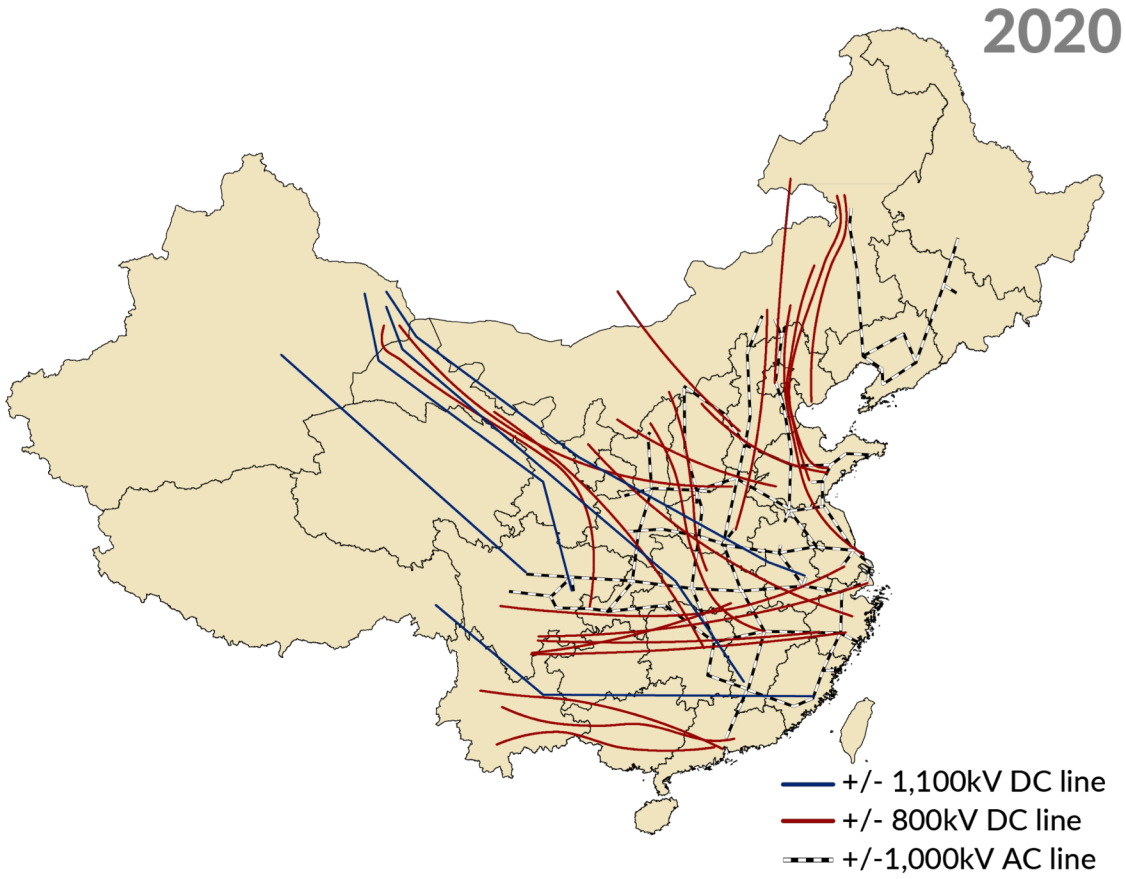


Solutions

- 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 CO_2 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;
  - Schedule: Data collection (2018), simulation (2019) and start trading (2020).

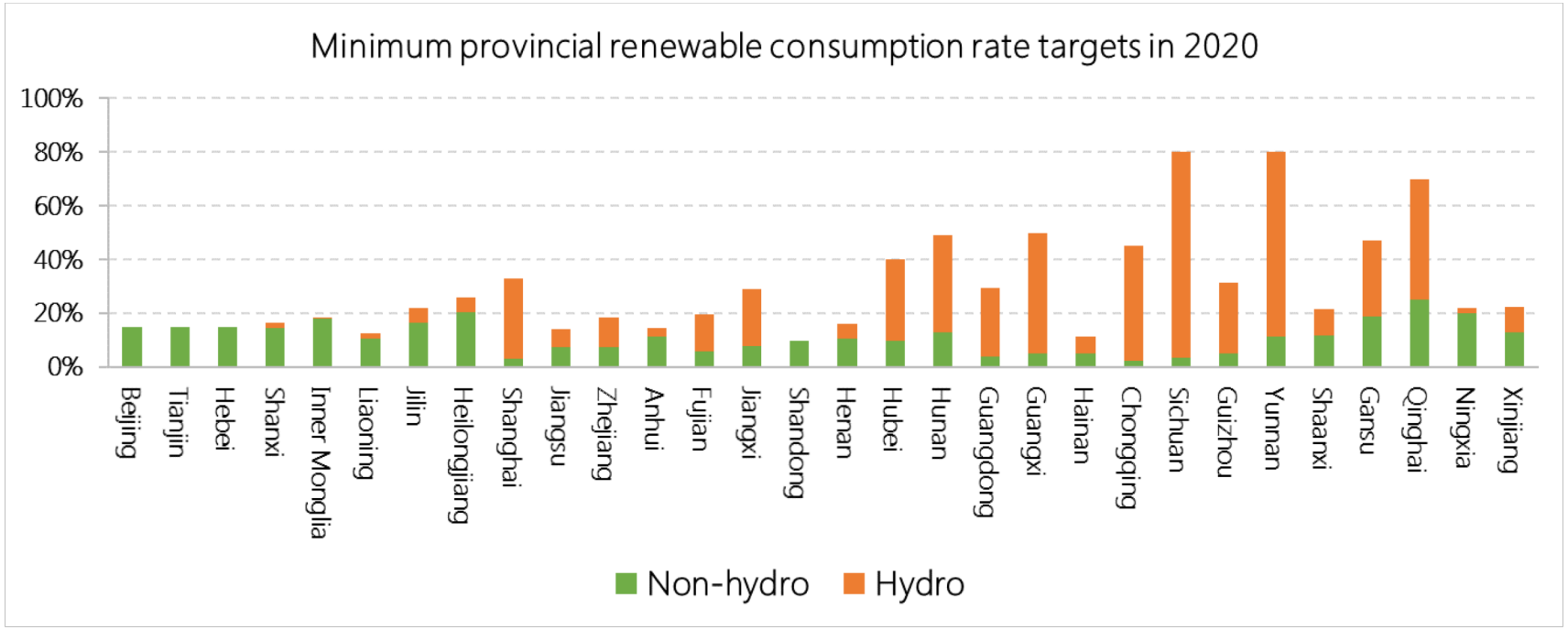
Pilot ETS	Number of entities	Common covered sectors	Differential covered sectors
Beijing	947	Electricity and heat production, petrochemical, iron and steel	All other industrial sectors, public transportation and service sectors.
Chongqing	230		Industrial sectors[a].
Guangdong	218		Cement and aviation.
Hubei	236		Chemical, cement, nonferrous metal, Manufacture of universal equipment, construction, pulp and paper, food production
Shanghai	312		All other industrial sectors, transportation sector and commercial buildings.
Shenzhen	824		All other industrial sectors and commercial buildings.
Tianjin	109		Chemical, metal production, oil and gas production, manufacture of special equipment and commercial buildings.
Fujian	277		Chemical, cement, metal production, nonferrous metal, pulp and paper and aviation. Construction and transportation (Planned).

From pilot ETSs to the national ETS

- Hot debates in China's pilot ETSs: *double counting* issue.
  - Regulate CO_2 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.

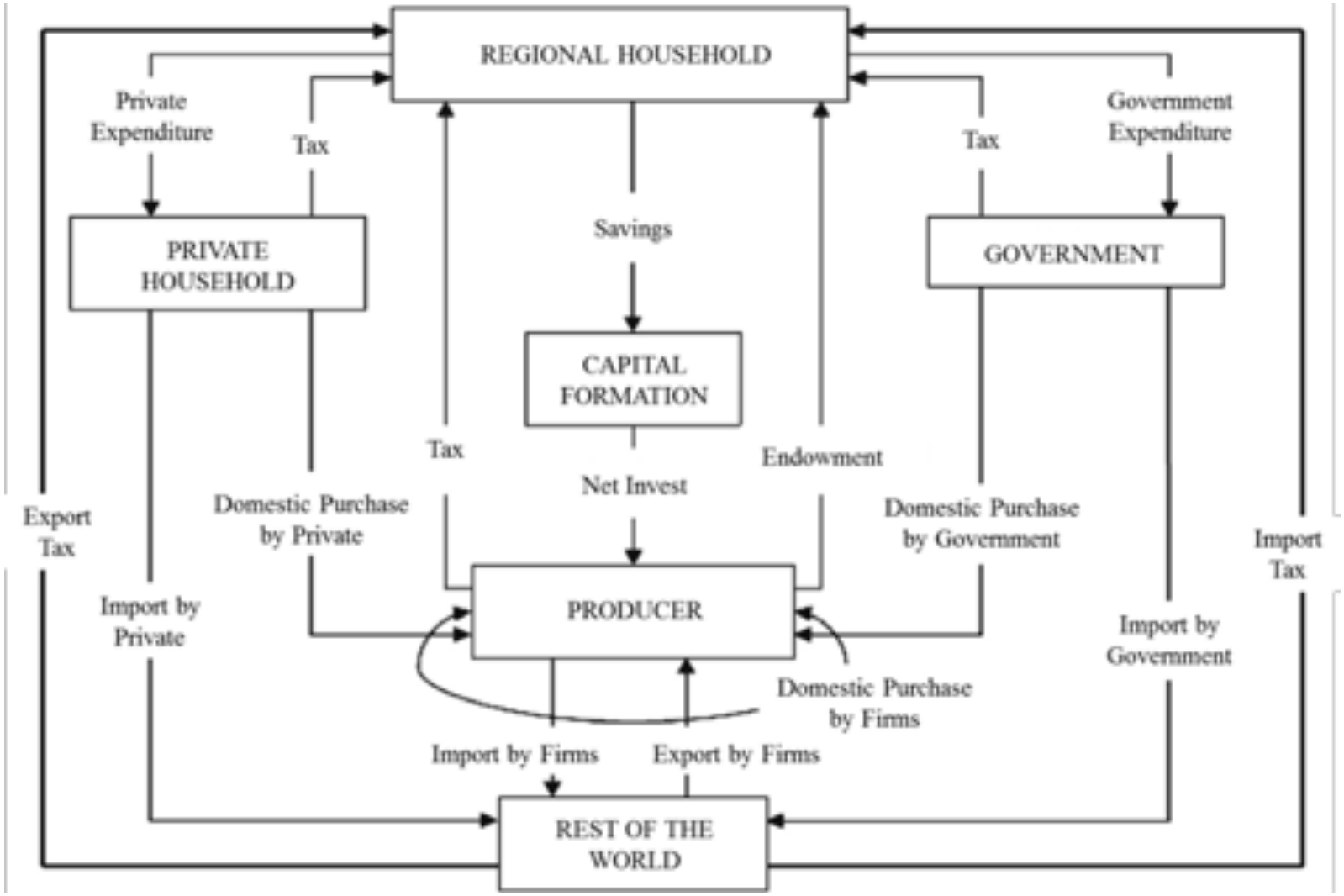


Numerical simulation

- 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.

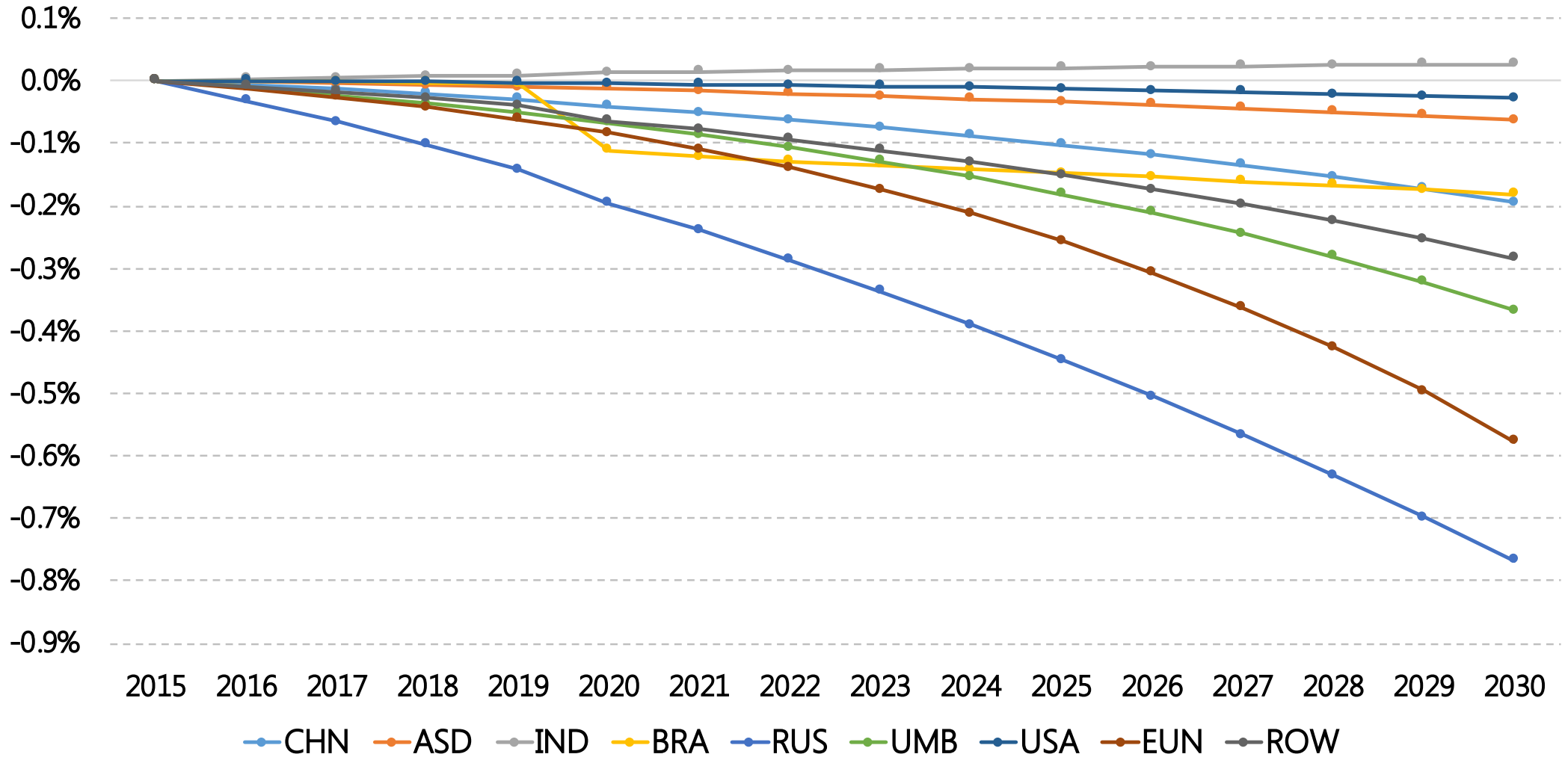
		China	India	Russia	Brazil	Mexico	EU28	US	Canada	Australia	Japan	South Korea
GHG Target	Target type	Intensity Trajectory	Intensity	Overall emission	Overall emission	Overall emission	Overall emission	Overall emission	Overall emission	Overall emission	Overall emission	Overall emission
	Base year	2005	2005	1990	2005	BAU	1990	2005	2005	2005	2005	BAU
	Target year	2030	2030	2030	2030	2030	2030	2025	2030	2030	2030	2030
	Reduction	60% to 65%	33% to 35%	25% to 30%	43%	25%	40%	26% to 28%	30%	26% to 28%	25.4%	37%
	Policy instruments	Carbon tax	Energy tax	/	Carbon tax	Carbon tax	Carbon tax	Carbon tax	Carbon tax	Carbon tax	Carbon tax	Carbon tax

Illustration of DREAM



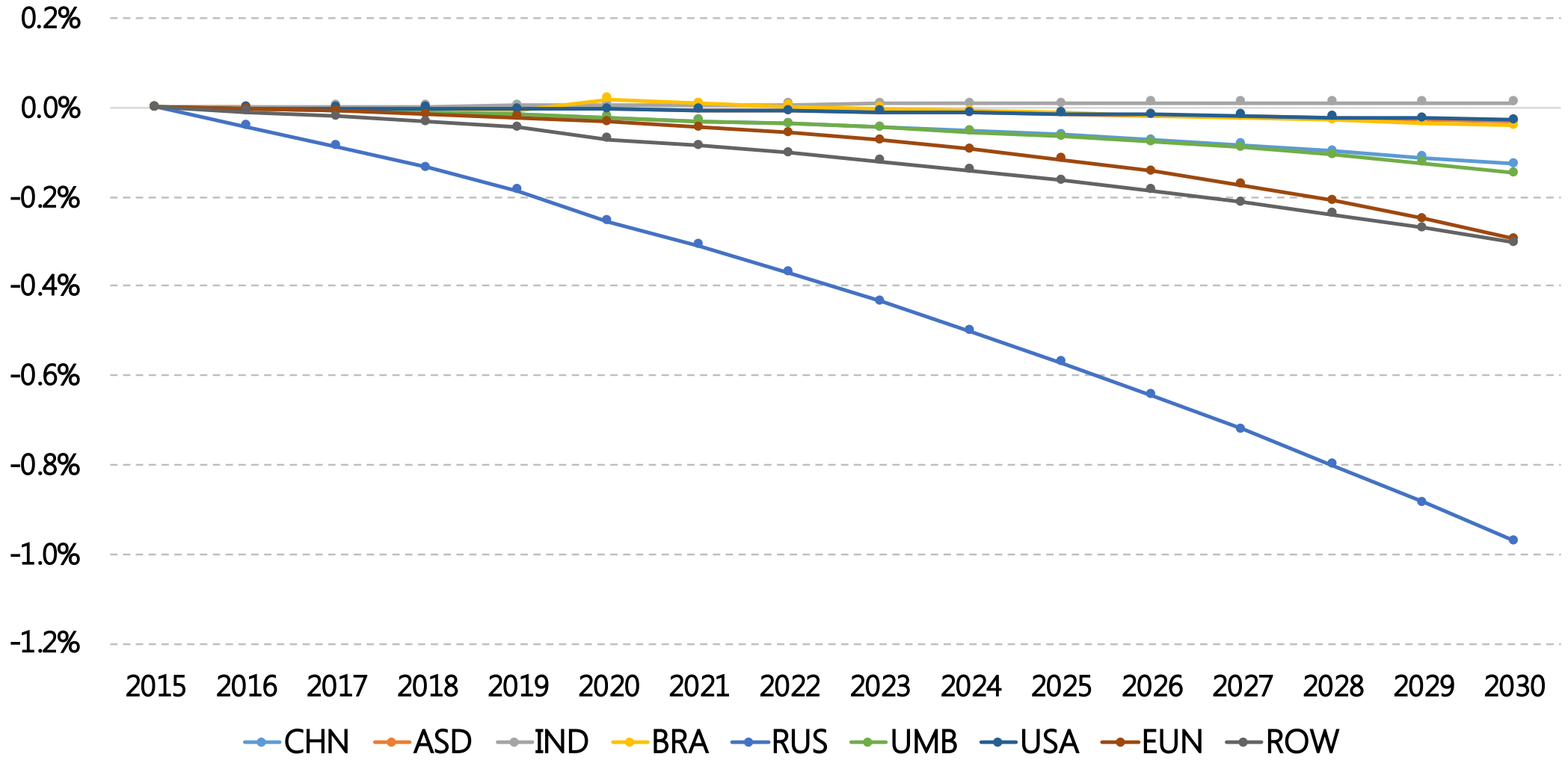
Simulation results

- 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!