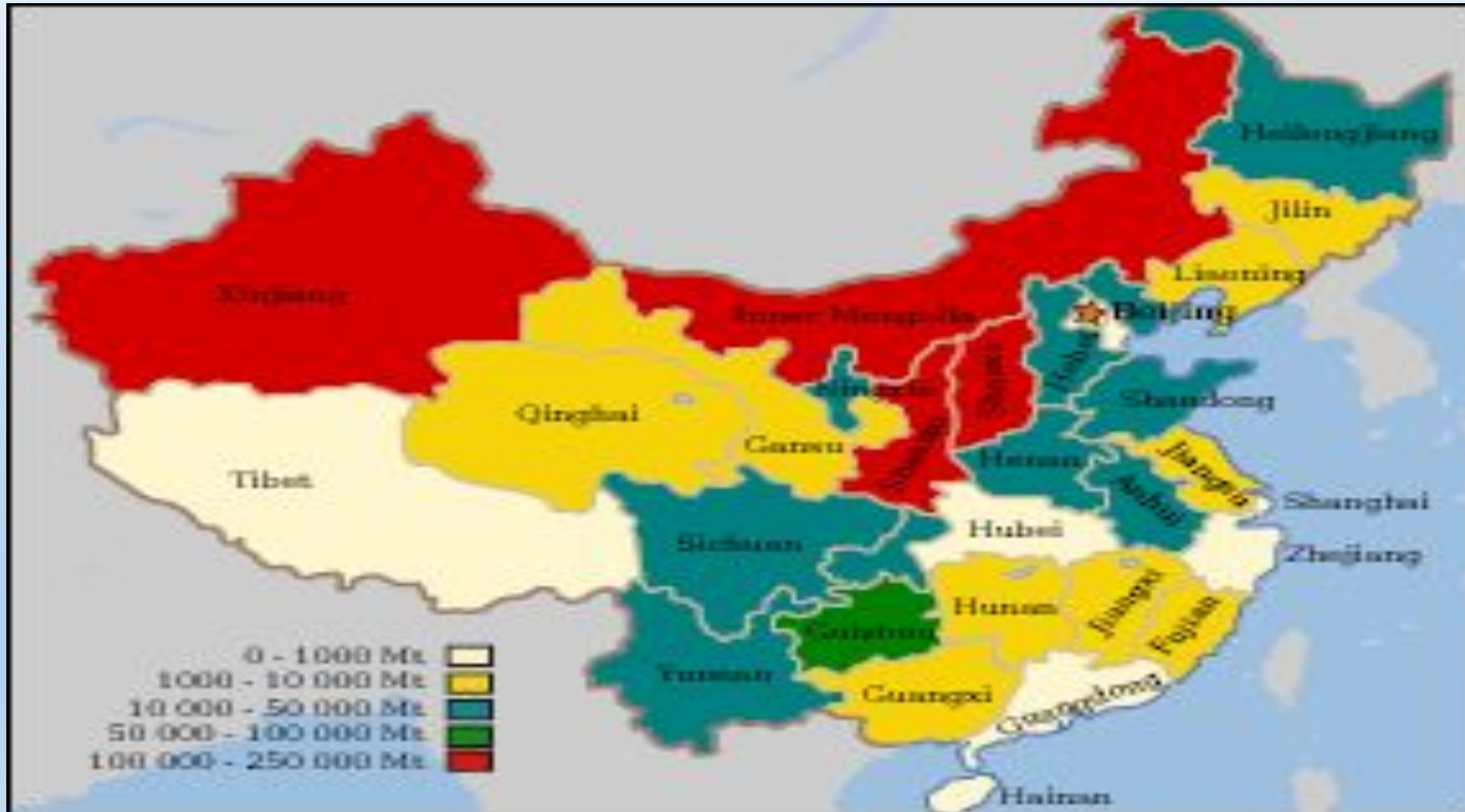


Seeing China's Economy Through Electricity

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March 22, 2017

China Coal Production Map



China Electricity Consumption Map

2017年各个省份全社会用电量情况 (单位: 亿千瓦时)



Figure 1. China Power Expansion in U.S. Perspective 1990-2017

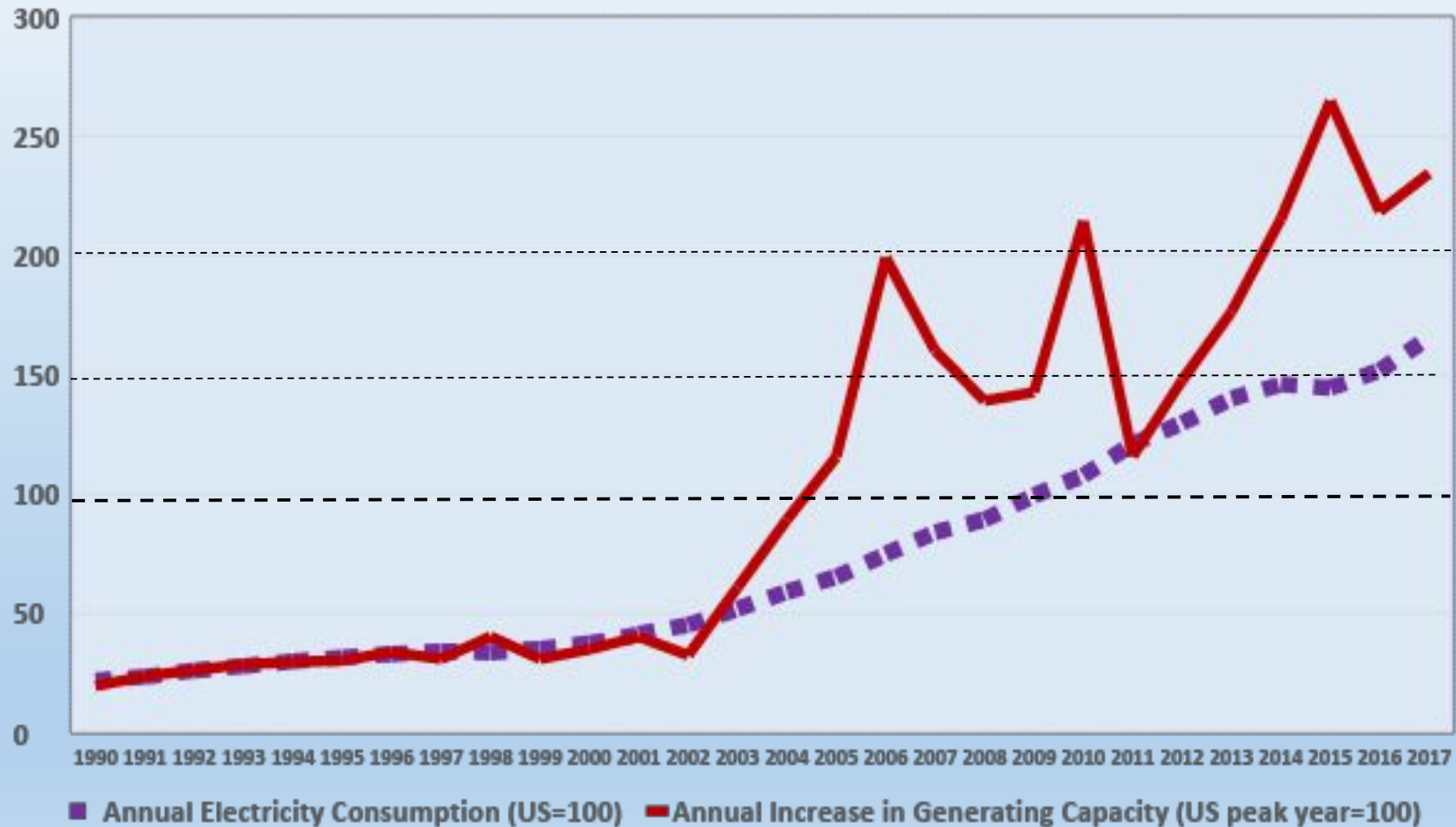


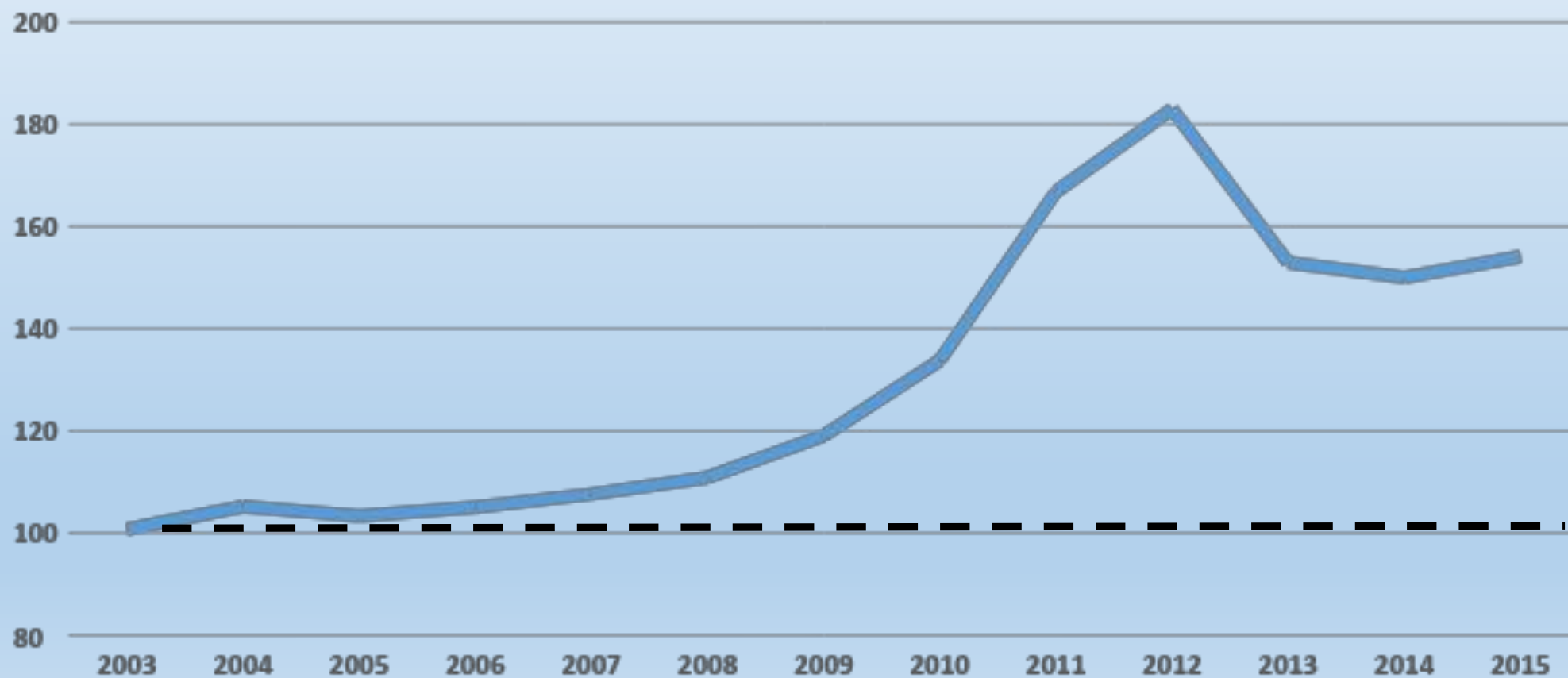
Table 1**Electricity price and fuel input price differential with US**

	<i>Industrial Electricity Price (US \$/kWh) In 2015</i>	<i>Coal price for generation (US \$/kWh)In 2015</i>	<i>Gas price for generation (US \$/kWh) In 2015</i>	<i>Residential Electricity Price (US \$/kWh)In 2015</i>
Texas	0.0554	0.0161	0.0094	0.1167
Guangdong	0.1394	0.0311	0.0884	0.1084
Guangdong <i>minus</i> Texas	0.0840 (152% higher)	0.0150	0.0790	-0.0083 (7% lower)

Sources: Fridley, David, Hongyou Lu, and Liu Xu. Key China Energy Statistics 2016. Berkeley, CA: Lawrence Berkeley National Laboratory, 2017 (p.28) ; Guangdong NDRC website: <http://www.sz.gov.cn/szzt2010/zdlyzl/sfxx/bz/jg/index.htm>; Zhang et al. (2013); EIA (2017); OECD energy price & taxes (pp.317-18); 1 USD = 6.2284 RMB.

Average Power Price for China ???

U.S. average industrial price = 100



Profitability of Chinese and U.S. Electric Utilities 2005-2015

• Ratios: US to Chinese electric utility	Average	Median
• Profit Margin	1.43	1.02
• Pre-tax Profit Return on Assets	1.89	1.30

Chinese Electricity: A **HIGH COST** Industry



- Cost = Revenue – Profit
- China – Unit revenue > US (industry consumes 70% of Chinese power)
- China – profits < US
- Surprise conclusion: **China cost of generating and delivering electricity HIGHER THAN IN U.S.!**
- How much higher? **30% or more!!**

Locus of Excess Costs? No Clear Answer, But...

- Cost of railway shipment of coal – China \approx 75% higher than US!!
- System costs??



China and U.S. Electricity Sectors: Employment and Proportion of Managers, 2014

	Employment (1000s)	Of which: managers (percent)	number (1000s)
China: Electric Power Sector	2600.1		
Total for 16 large firms	2084.2	17.76	370.1
Five Big Generation Firms	589.8	17.95	105.9
Two Major Grid Firms	1067.3	15.61	166.6
3 Regional Electricity Firms	43.7	20.80	9.1
3 Construction Firms	343.4	24.62	84.5
Others	40.0	9.79	3.9
China National Nuclear	8.9	14.24	1.3
China General Nuclear	29.8	7.69	2.3
Shenhua Energy	1.3	27.49	0.4
U.S: Electricity Generation & Transmission	389.8	6.77	26.39

From 2015 – New Electricity Reform Unfolds

- Regulators extract cost data from grid companies, set **fixed & transparent grid charges**.
- Fixed grid charges + excess power supply opens the door to negotiated (i.e., **reduced**) prices for big users.
- Shift from gridco retail monopoly → retail competition.

From 2015 – New Electricity Reform Unfolds

- Regulators extract cost data from grid companies, set **fixed & transparent grid charges. Nationwide by 2017**
- Fixed grid charges + excess power supply opens the door to negotiated (i.e. **reduced**) prices for big users. **Share of market transactions 2014 10% 2015 22% now ≈ 30%**
- Shift from gridco retail monopoly → retail competition. **Early stages**

Electricity Reform Impact

Power generating companies:

- Excess capacity → falling hours → growing cost pressures
- Mismanagement of coal sector → higher coal prices → more pressure
- Power companies willing to lower prices to protect hours
- High cost → room for cost cuts in thermal power
- Price pressure spreads to nuclear plants, which **cannot cut costs**

Guangdong: Estimated Cost Decline from Marketization

Generation cost -27%

Production cost -13%

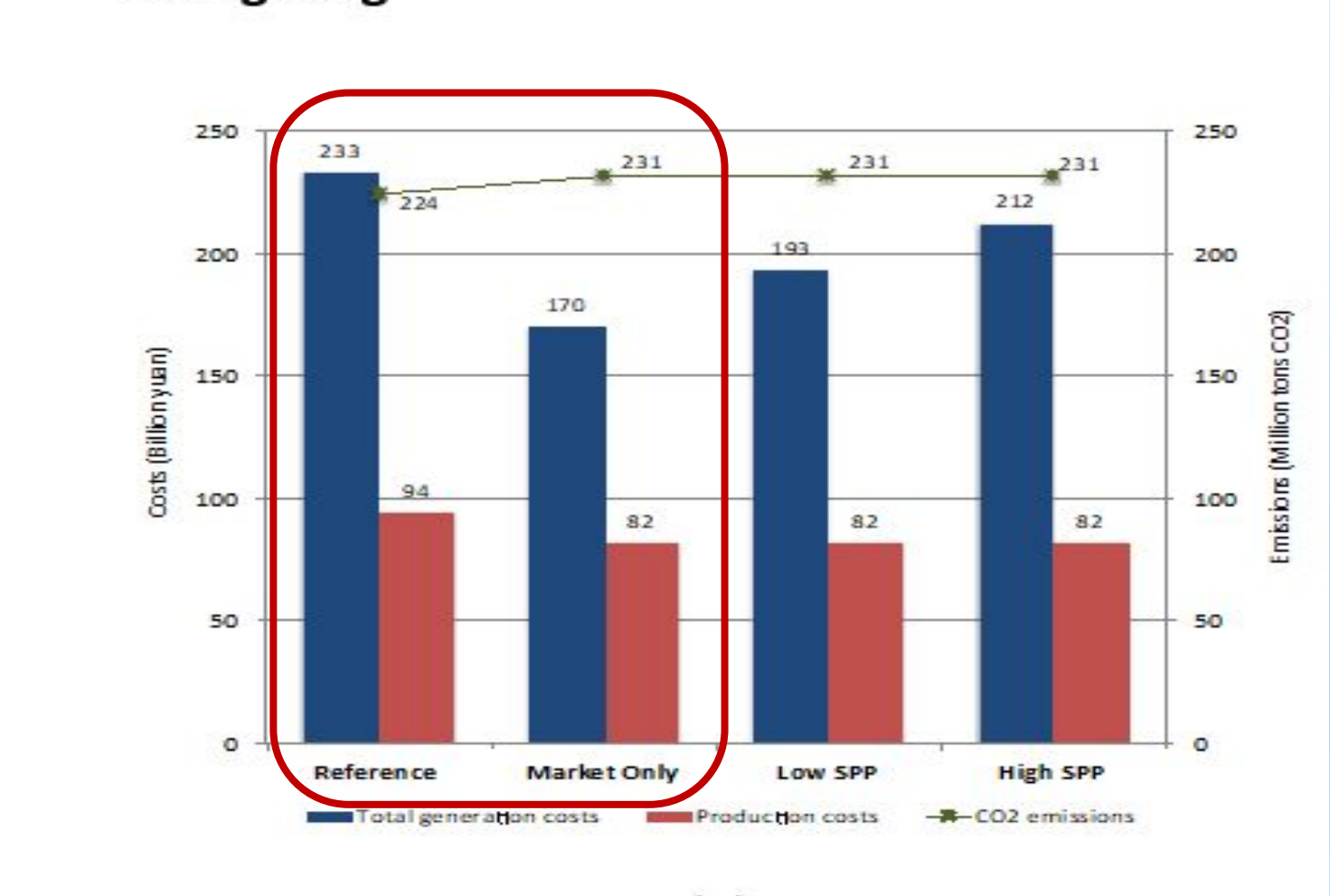
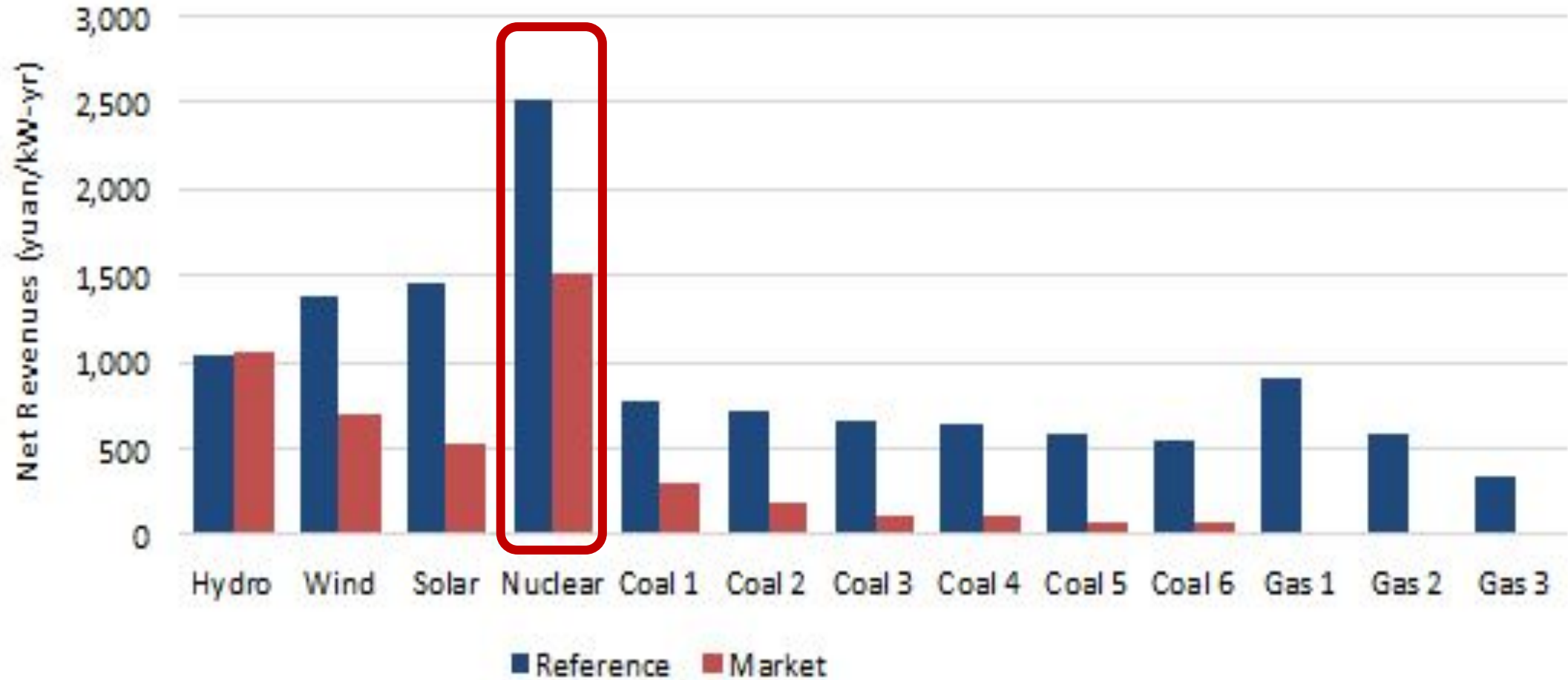


Figure 3. Net Revenues for Each Generation Type³



Average Wholesale Electricity Prices

On-grid price RMB per MWH

Coal Generation

Nuclear Power

2015

2016

2015

2016

Liaoning	376.49	351.46	411.09	386.16
Jiangsu	414.95	377.22	453.98	452.71
Zhejiang	460.6	411.53	428.23	414.04
Fujian	395.86	354.22	430.99	422.61
Guangdong	495.71	460.87	440.95	433.45
Guangxi				369.41

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Recent Contract Prices for Nuclear Power

- February 2018:
- In the 2017-2018 heating season, Hongyanhe nuclear power has an on-grid tariff of RMB 0.18/kWh
- March 2018: Jiangsu Purchases Fujian power
 - **Nuclear power price 0.34 per kWh (14% below the 0.43 benchmark)**

Nuclear Power Commercial Foundation At Risk

- Prices falling
- Hours flirting with 7000 break-even
- Market prospects frightening unless government steps in with guaranteed purchase; carbon tax; subsidy; more effluent fees
- Absorption of nuclear power **mainly depends on gov't departments**

One Country, Three Years, Two Strategies

2013 – World Bank-DRC Report; CCP Central Committee Decision

- “deepen economic system reform by centering on the decisive role of the market in allocating resources” (Decision item 2)
- Will “promote market-oriented reform in width and in depth [by] greatly reducing the government’s role in the direct allocation of resources” (Item 3)
- welcome “all kinds of market players. . . on an equal basis. . . (item 9).
- “increased competition in all sectors, including in strategic and pillar industries” (WB-DRC)

2015-now Xi Jinping Strategy – Made in China 2025

- Expand planning, focus on state enterprises, push import substitution
- Bifurcate economy into priority and remaining sectors
- Priority sector: quotas and plan targets multiply

Response to Excess Energy Capacity Mirrors Choice

Electricity expanding market forces, with mixed results

- Prices, costs down
- But renewables feeling the pain; possible revival of coal
- Unwanted investment boom in dual-use thermal plants

Coal Mining – state attempts to manage adjustment

- Partial closure of modern, low cost, efficient mines
- Shortages → price spikes and increased imports
- Capacity reduction quotas parceled out to provinces
- Reported coal output rose in 2017

Where is this Headed? Personal Guess

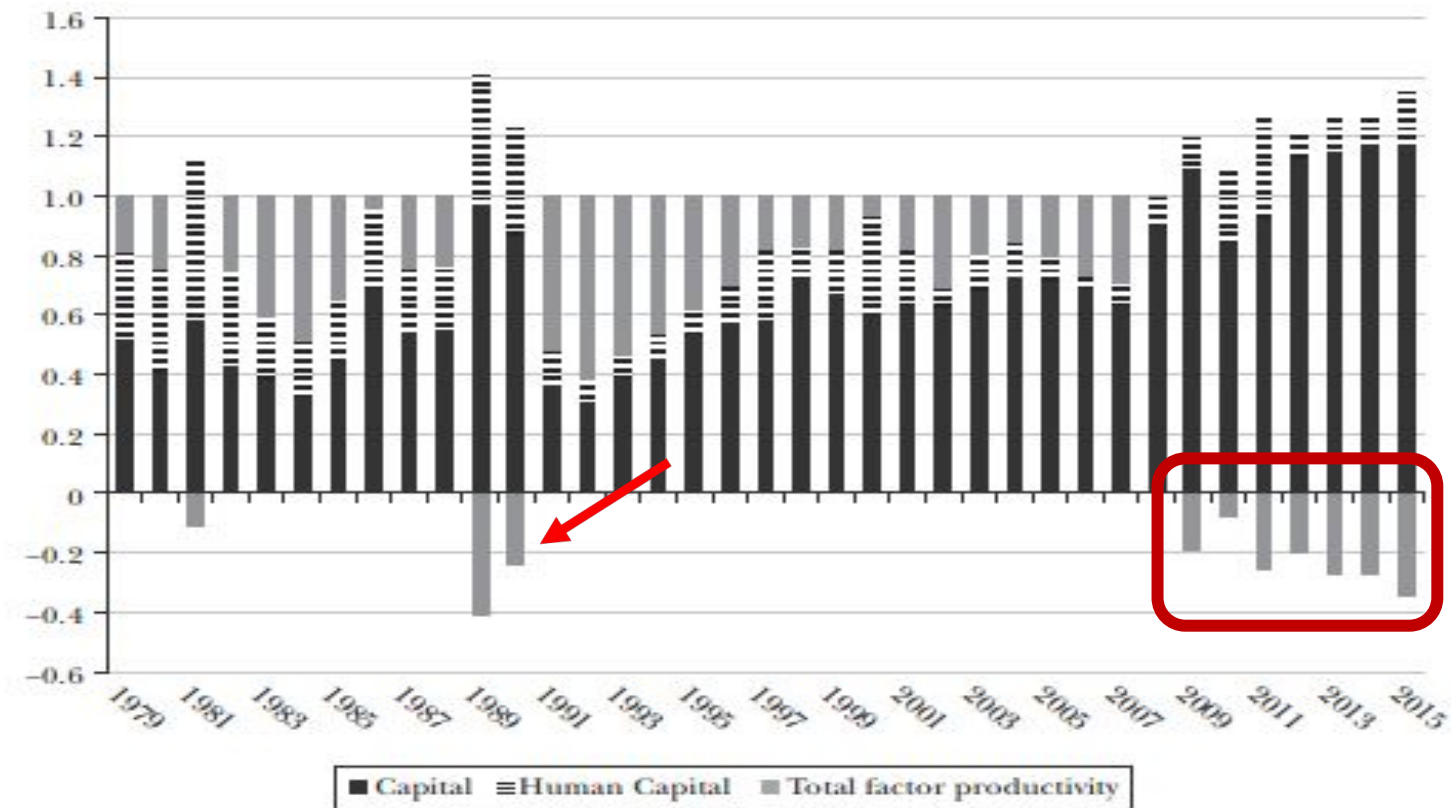
- **Familiar story:** a complex mix of growth drivers and blockages
- **Looking backward:** best results linked to openness and competition
- **Current policy:** is shrinking both openness and competition
- **Plausible outcome:** downward pressure on productivity growth (TFP)

Shang-jin Wei et al, J. of Econ Perspectives, 2017

Figure 1

Contributions to GDP Growth of Physical Capital, Human Capital, and Total Factor Productivity, 1979–2015

(share)



Source: Authors' calculations based on the methodology and data sources detailed in Online Appendix A.
Note: See Appendix for details of the estimation.

Equipment Supply

Import replacement + Quality issues → RISK

Deputy Machinery Minister SHEN Liechu (2016):

- Customer view: Chinese-made equipment
- OK to use, but not too reliable
- Why not? Small defects persist!

China Machine Industry Association head WANG Ruixiang (2018)

- Industry is large but not strong
- Quality and reliability are “not high”
- Must shift from speed to quality improvement (sounds like 1950s!)

The End

- Work in progress
- Comments welcomed