Power Market Reform in China: Implications for ETS

LIN Jiang
China Energy Group, LBNL
Agricultural and Resources Economics, UC Berkeley
February 22, 2019

Background

- China is currently undergoing power sector reform
  - Change from planning to markets for both electricity pricing and dispatch

- Electricity market transition in China has the potential to further the country's environmental and economic aspirations
  - Stop excess investment in coal power
  - Reduce curtailment of solar/wind/hydro
  - Meet air quality and GHG targets
  - Increase efficiency of power system operation

- Guangdong power market reform
  - Focusing on electricity wholesale market and promoting demand side management
  - Among the first batch of pilots to launch real-time wholesale market in 2018

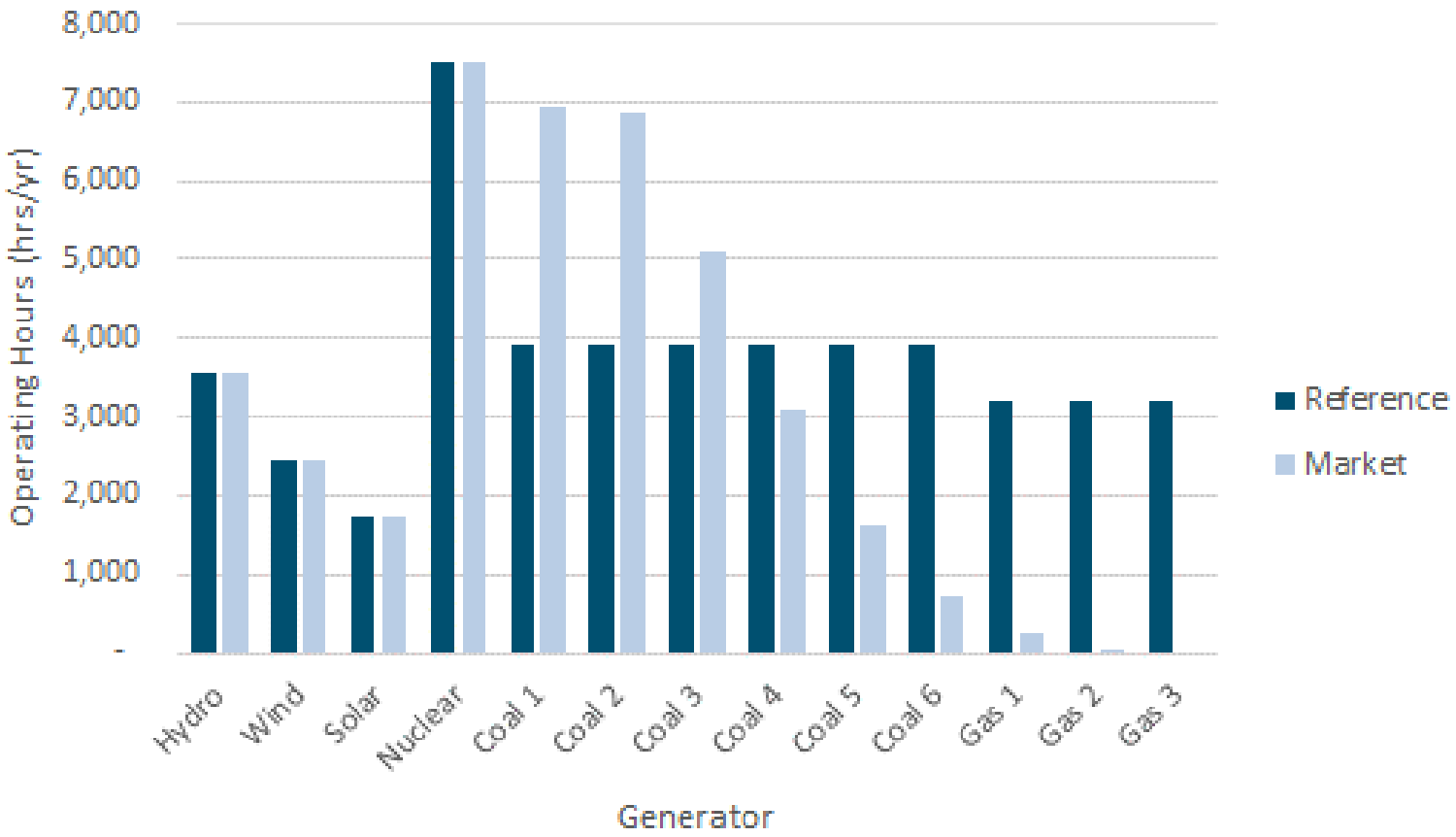
- Market reforms in China have started to run into political economy obstacles
  - Current discussion in China lacks a more quantitative sense of what the impacts on different stakeholders might be, and how these could be overcome

Approach

- Create relatively simple model of the Guangdong electricity system, focusing on structural differences between generators
- Assume convergence to economic (marginal cost-based) dispatch with a single market clearing price
- Examine total cost impacts relative to a reference scenario, impacts on net revenues for different types of generators

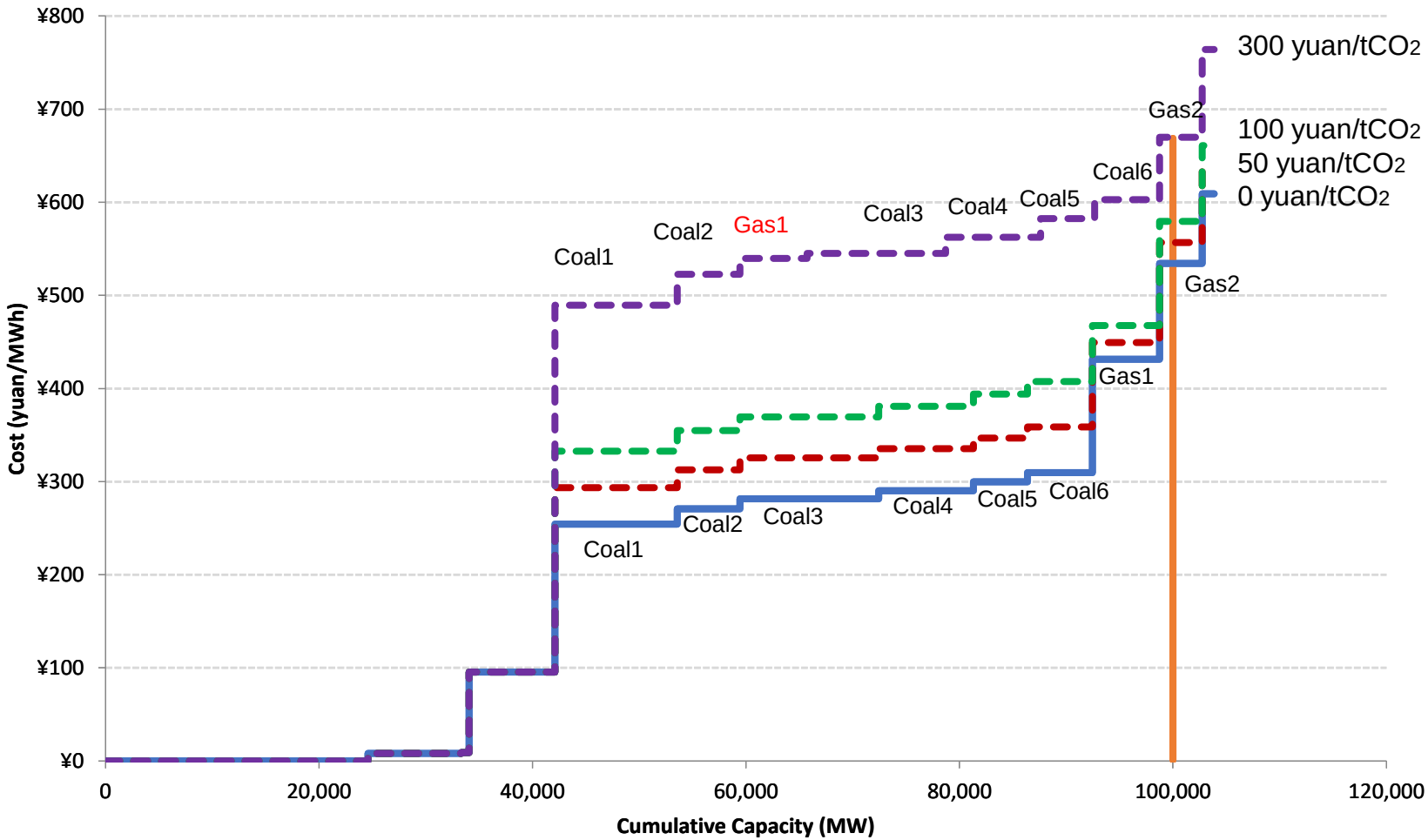
Impact of market transition on different type of generators

Annual Operating Hours in the Reference and Market Scenarios, by Generator Type



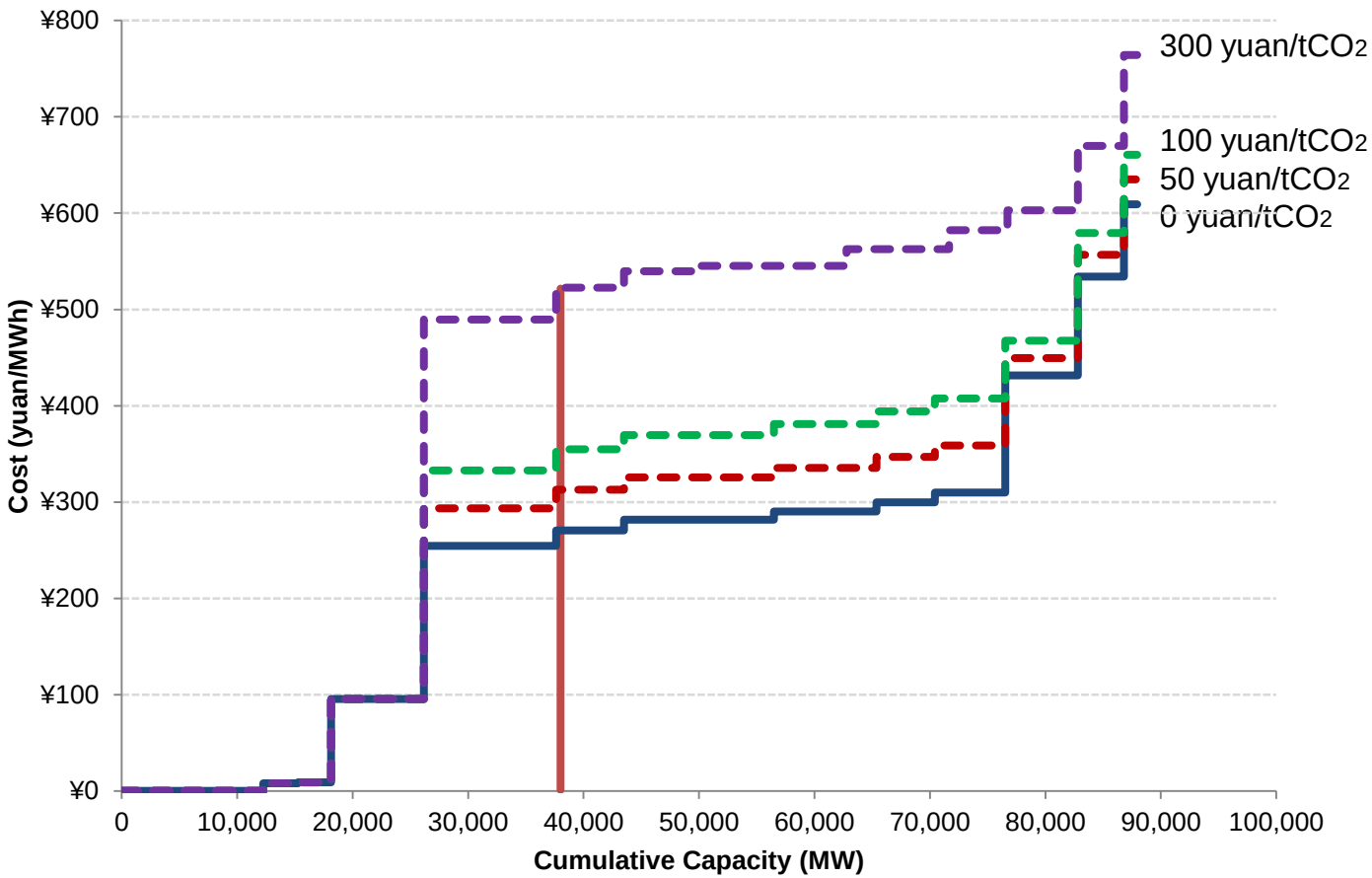
Market simulation– supply and demand for an hour

Supply-Demand Curve Illustration of Hourly Dispatch in the Stack Model, for Hour Ending 16:00 on July 1 (high load day)

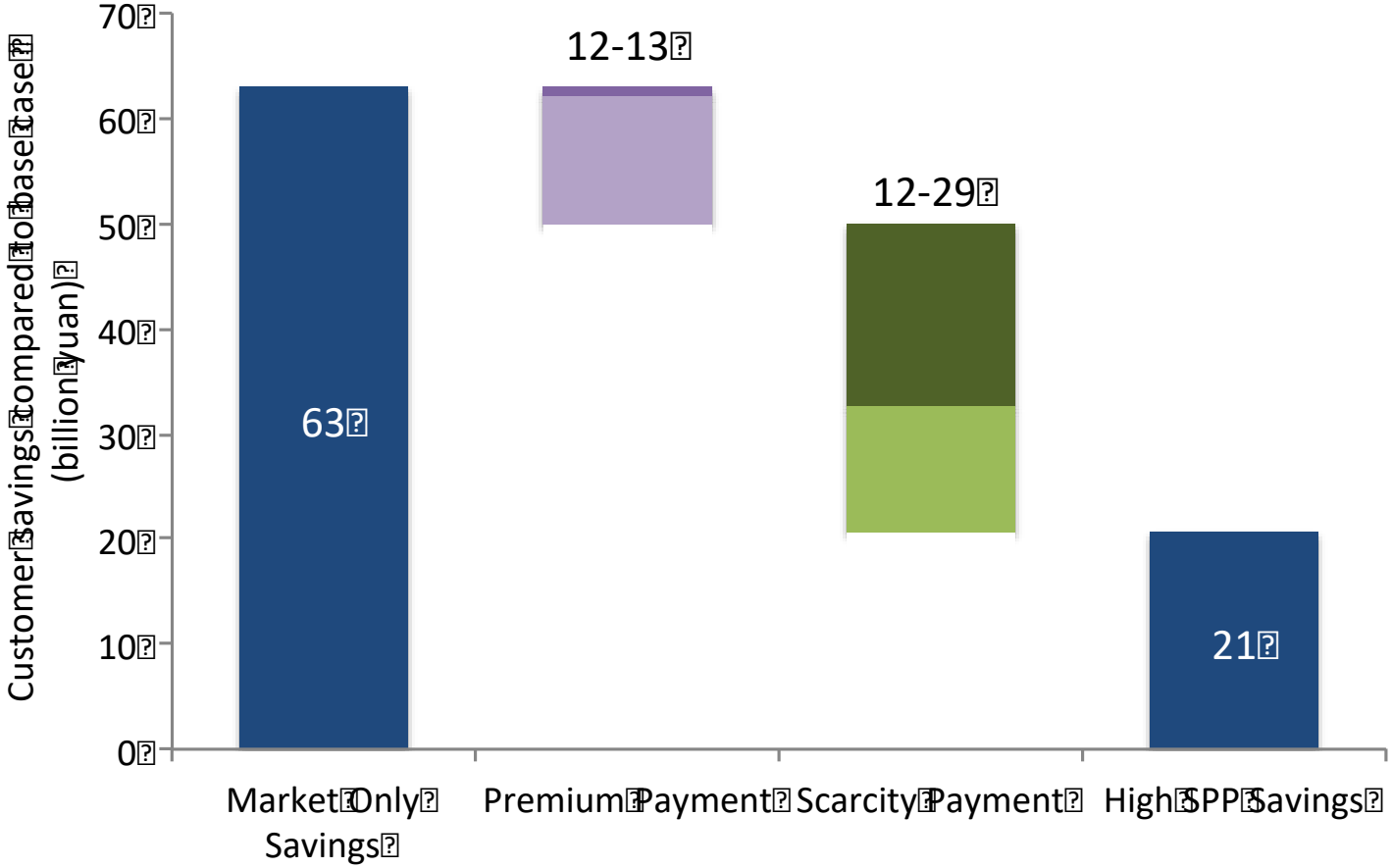


Market simulation– supply and demand for an hour

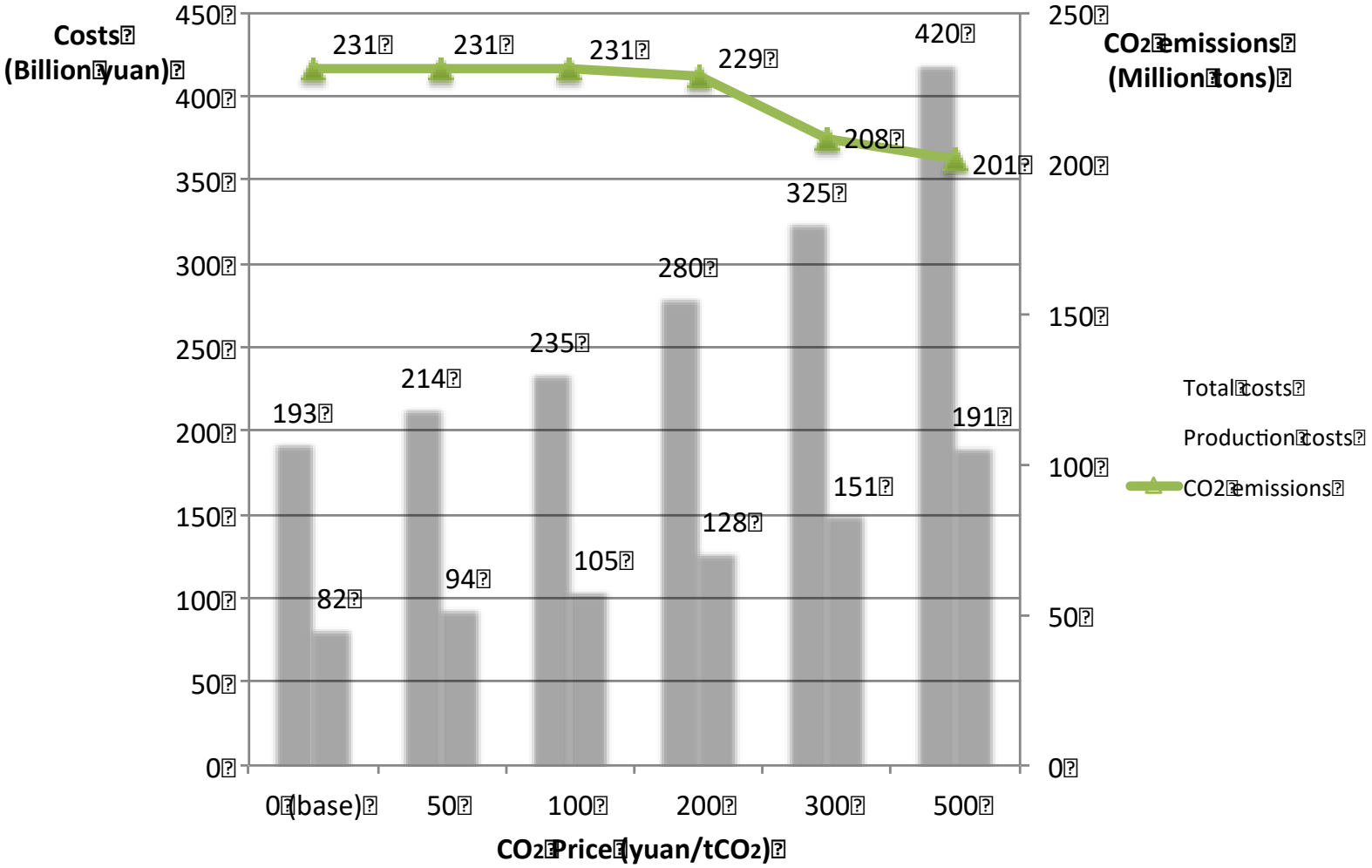
Supply-Demand Curve Illustration of Hourly Dispatch in the Stack Model, for Hour Ending 16:00 on Feb. 1 (low load day)



Transition towards market yield large cost savings (9-27%) for the society, but savings shrinks with additional payments

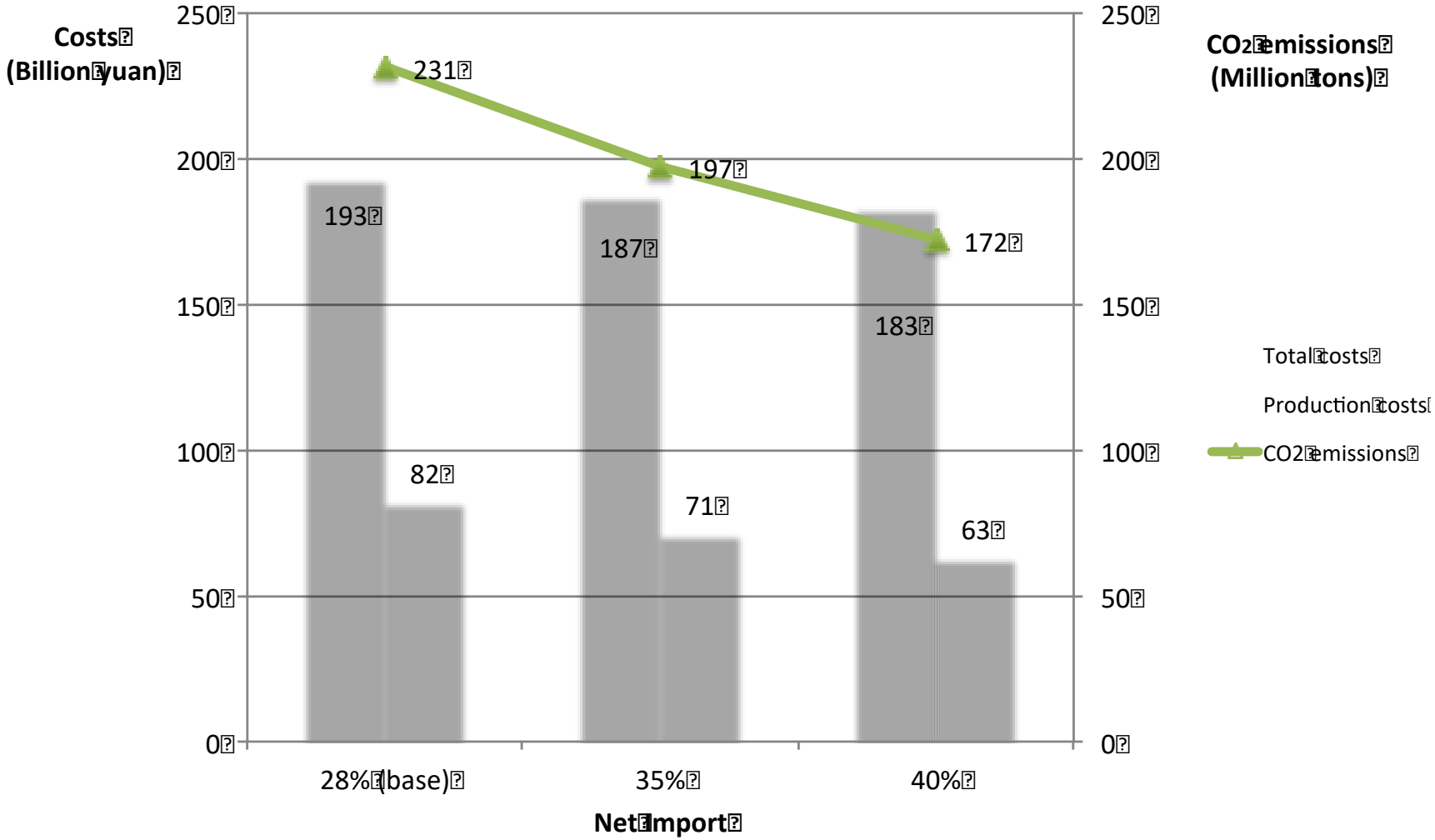


Sensitivity analysis – CO_2 prices



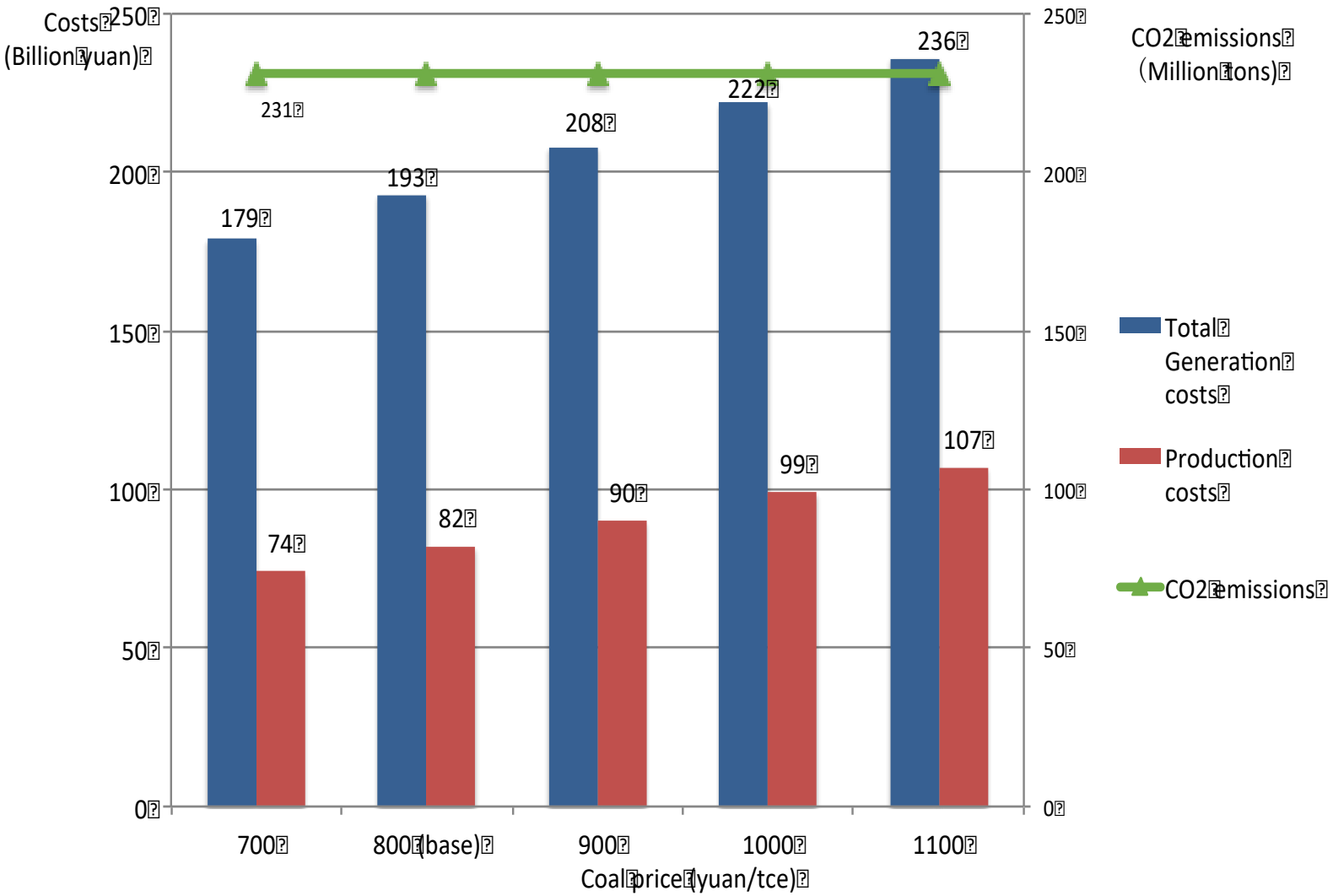
* Sensitivity analysis was based on the Low SPP scenario

Sensitivity analysis – net imports



* Sensitivity analysis was based on the Low SPP scenario

Sensitivity analysis – coal price



* Sensitivity analysis was based on the Low SPP scenario

Conclusions – overarching conclusions

- Significant potential gains (RMB 21-63 Billion) from implementing electricity markets in Guangdong (and China)
  - The extent of these gains depends on how much in savings must be paid out as premiums to clean generation and paid to generators in the form of scarcity payments
  - Even with these payments, significant savings are likely to remain

- Factors influencing savings
  - The most important factor influencing savings is likely imports (of hydro from Yunnan), which has significant implications for market design
  - Fuel prices will also matter
  - CO_2 pricing is likely to be an expensive strategy for reducing CO_2 emissions in Guangdong in ***the short run***

Conclusions – forward looking

- The most important benefit of economic dispatch: Providing an overall economic framework for investments in generation, transmission, and demand-side resources (needs further analysis)

- Least-cost operation influences both the level and composition of generation investment, should serve to guide investment in transmission planning
  - Coal investment and generation: market prices are too low to support new investment in coal and gas generation
  - Hydro, wind, solar, and nuclear generation: likely continue to be policy driven, but market prices can shape both the level and composition of new investment (e.g., the balance between wind and solar generation).
  - Market prices play an important role in guiding new investments in storage
  - **Carbon price can accelerate the grid-parity by solar and wind in the medium term**.

Thank You!

Jiang Lin
J_lin@lbl.gov

Nat Simons Presidential Chair in China Energy Policy

Berkeley Tsinghua Joint Research Center on Energy and Climate Change
China Energy Group
Lawrence Berkeley National Laboratory
Berkeley, CA 94720
http://china.lbl.gov
http://btjrc.lbl.gov