



In the Dark

How Much Do Power
Sector Distortions
Cost South Asia

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Outline

- What this study adds
- Three types of distortions: Institutional, regulatory, social
- Why it matters: households, firms, world
- Implications for electricity sector reform



What this study adds

Objective of the study

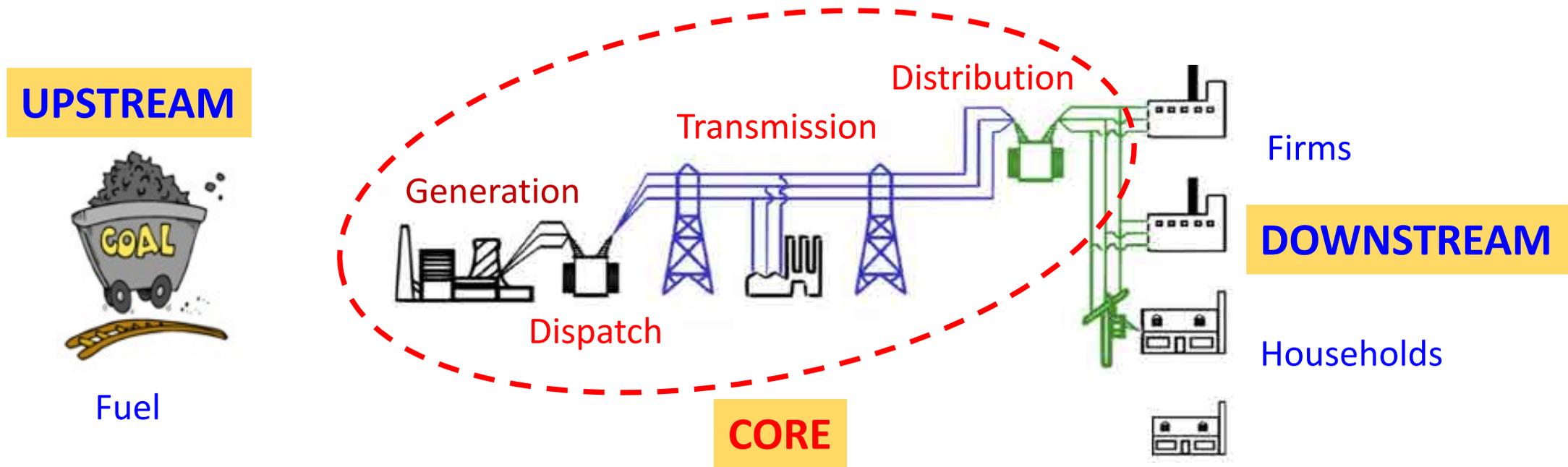
- To estimate the **economic cost of distortions** along the entire supply chain of electricity in the largest South Asian countries.
- There are multiple departures from the first-best equilibrium, but they can be regrouped under **three types of distortions**:
 - **Institutional**: ownership and governance
 - **Regulatory**: price setting and subsidization
 - **Social**: environmental and social externalities

Beyond fiscal costs

- The cost of electricity distortions has often been estimated on the basis of their **cost for the budget**. But this is a **partial measure**.
- Some economic costs do not have an impact on the budget. Examples:
 - **Lack of access**: affects the poor, and constrains economic activity
 - **Emissions**: have adverse health impacts and damage the environment
- Fiscal costs create losses for some but gains for others. Example:
 - **Subsidies**: taxpayers pay on behalf of consumers, a form of redistribution.
- A **fuller measure** is the foregone wellbeing, in terms of present and future consumption, expressed **in output-equivalent terms**.

Sectoral scope

- The **entire supply chain** of electricity is considered, from upstream fuel to downstream access and reliability.



- Traditional electricity studies generally cover **only the core** generation, dispatch, transmission and distribution links.

Estimating the cost

Methodology

- Construct counterfactuals based on estimates of key parameters in each country
- Estimate the gains from removing one group of distortions at a time

Data

- Aggregate data on energy production, consumption and price from the 1970s
- Disaggregated data on utilities, households, and firms
- 30,000 satellite images of South Asia at night, 1993-2013

Two dozens of background studies

The cost of distortions (Bangladesh)

Type of cost	Upstream	Core				Downstream	Total
		Generation	Dispatch	Transmission	Distribution		
Fiscal					0.15		0.15
Institutional	0.06	0.16	0.73		0.03	1.48	2.46
Regulatory	2.00	0.00	–	–	0.39	–	2.38
Social	0.16	0.01	–	–	–	0.0003	0.16
Economic	2.21	0.16	0.73	–	0.41	1.48	5.01

Underpricing of natural gas

Lack of reliable access for households and firms

The cost of distortions (India)

Type of cost	Upstream	Core				Downstream	Total
		Generation	Dispatch	Transmission	Distribution		
Fiscal					0.42		0.42
Institutional	0.06	0.10		0.02	0.10	1.42	1.70
Regulatory	0.19	0	–	–	0.02	0.10	0.31
Social	1.69	0		–	0.12	0.31	2.12
Economic	1.94	0.10	–	0.02	0.24	1.83	4.13

Coal-based power generation

Lack of reliable access for households and firms

The cost of distortions (Pakistan)

Percent of GDP	Upstream	Core				Downstream	Total
		Generation	Dispatch	Transmission	Distribution		
Fiscal cost					0.80		0.80
Institutional cost	0.41	0.35	NA	0.41	0.32	4.70	6.24
Regulatory cost	0.13	0.00		NA	0.13	NA	0.26
Social cost	0.03	0.00		NA	NA	0.001	0.03
Economic cost	0.57	0.35		0.41	0.45	4.75	6.53

Inefficient gas allocation

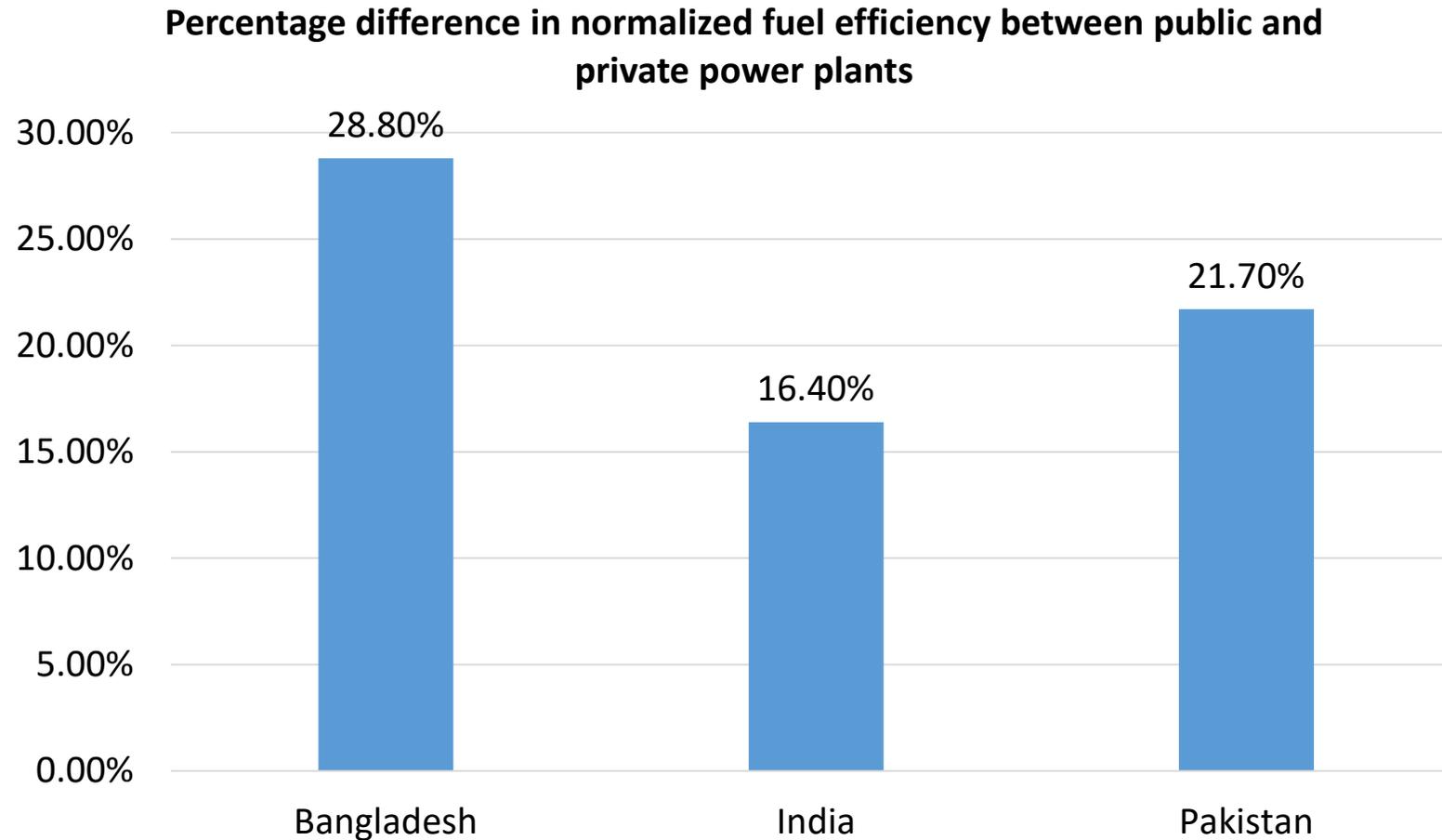
Underinvestment in transmission

Lack of reliable access for households and firms

Examples: three types of distortion

Institutional: no market, distorted allocation

Public power plants are much less efficient than private power plants

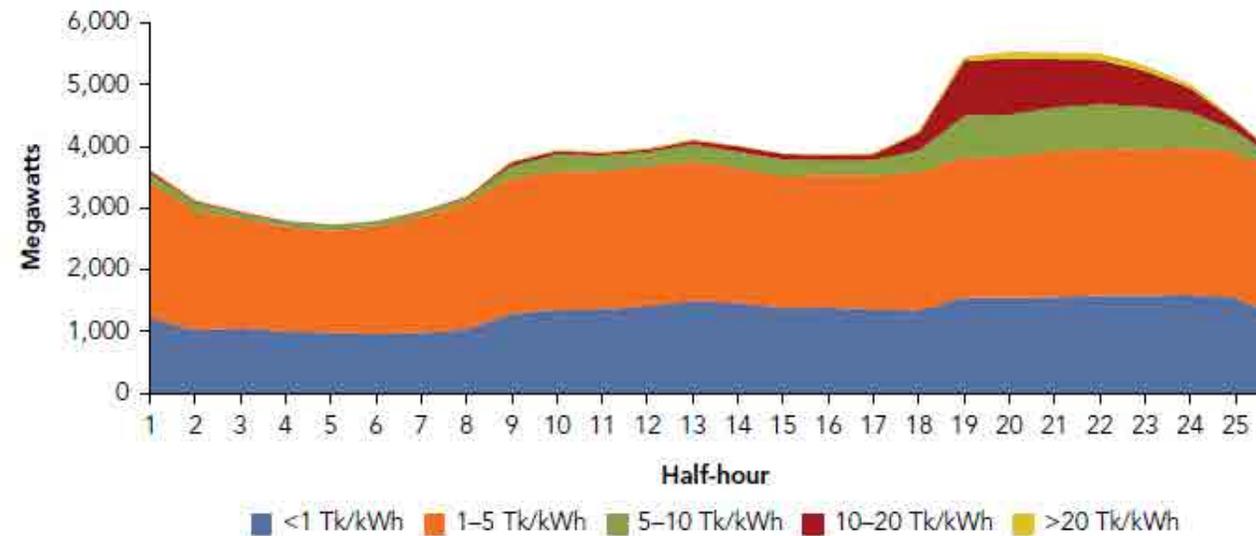


Institutional distortion (continued)

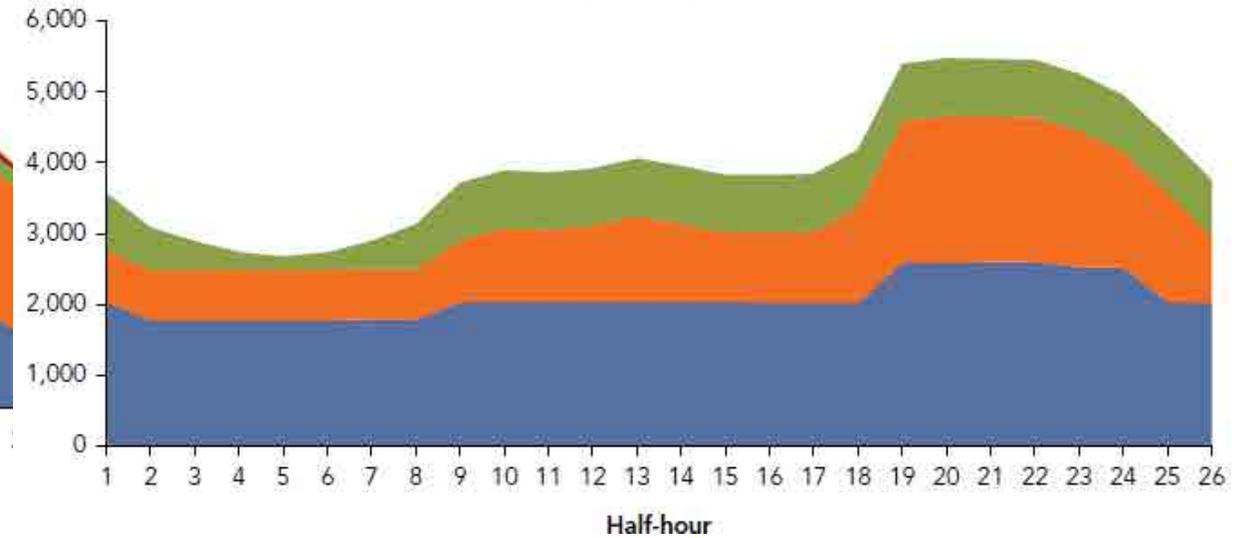
Inefficient dispatch of power plants contributes to high cost of electricity (Bangladesh)

More expensive oil-based units were dispatched in Bangladesh even though less costly capacity was available

a. Actual dispatch

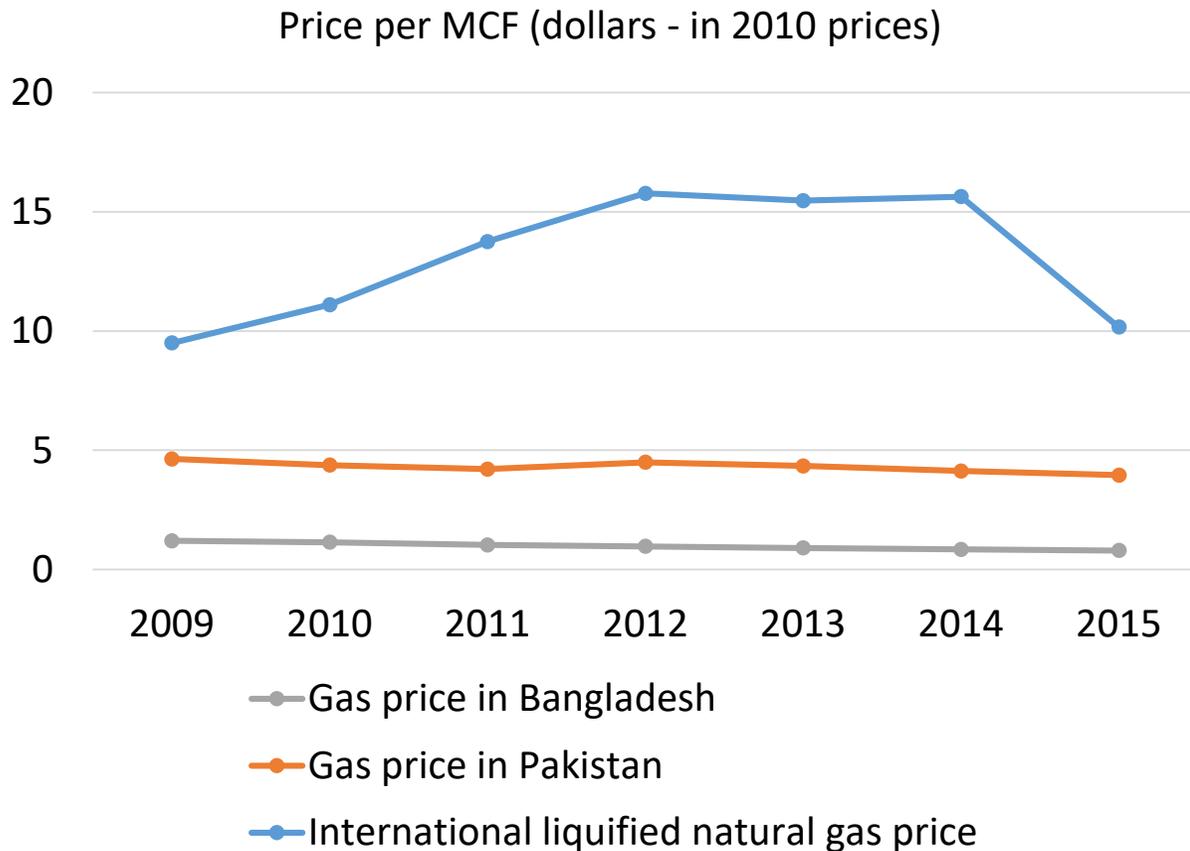


b. Optimal dispatch

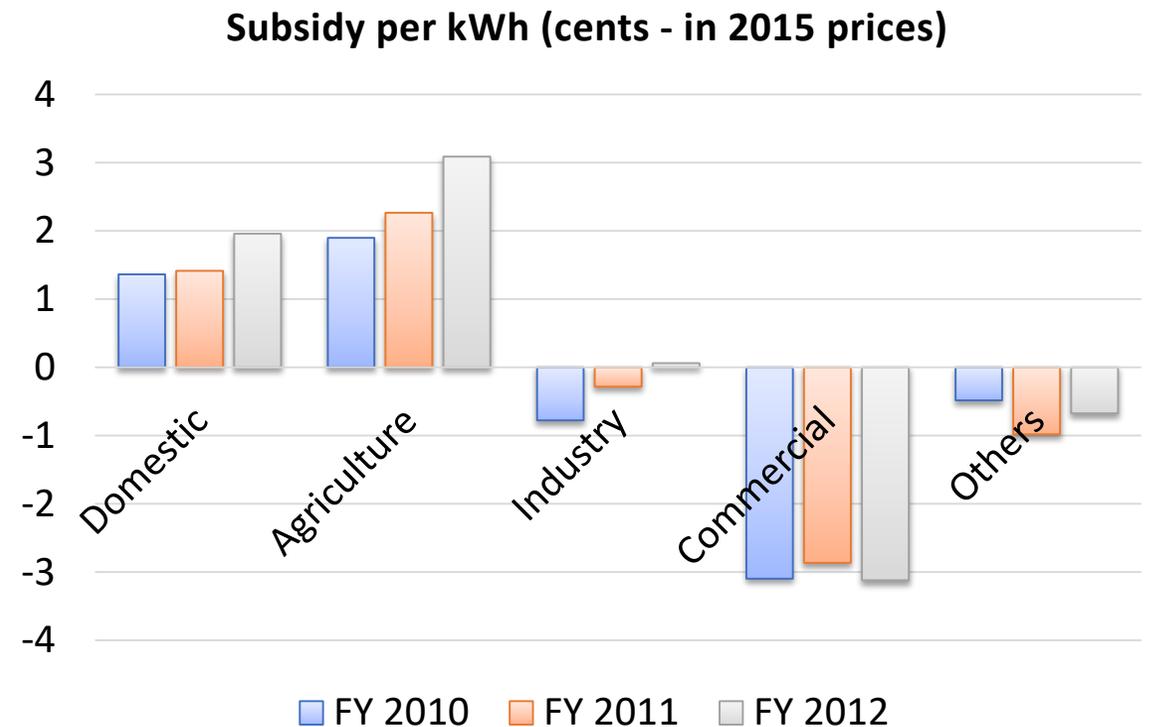


Regulatory: market, but distorted price

Significant underpricing of gas (Bangladesh and Pakistan)



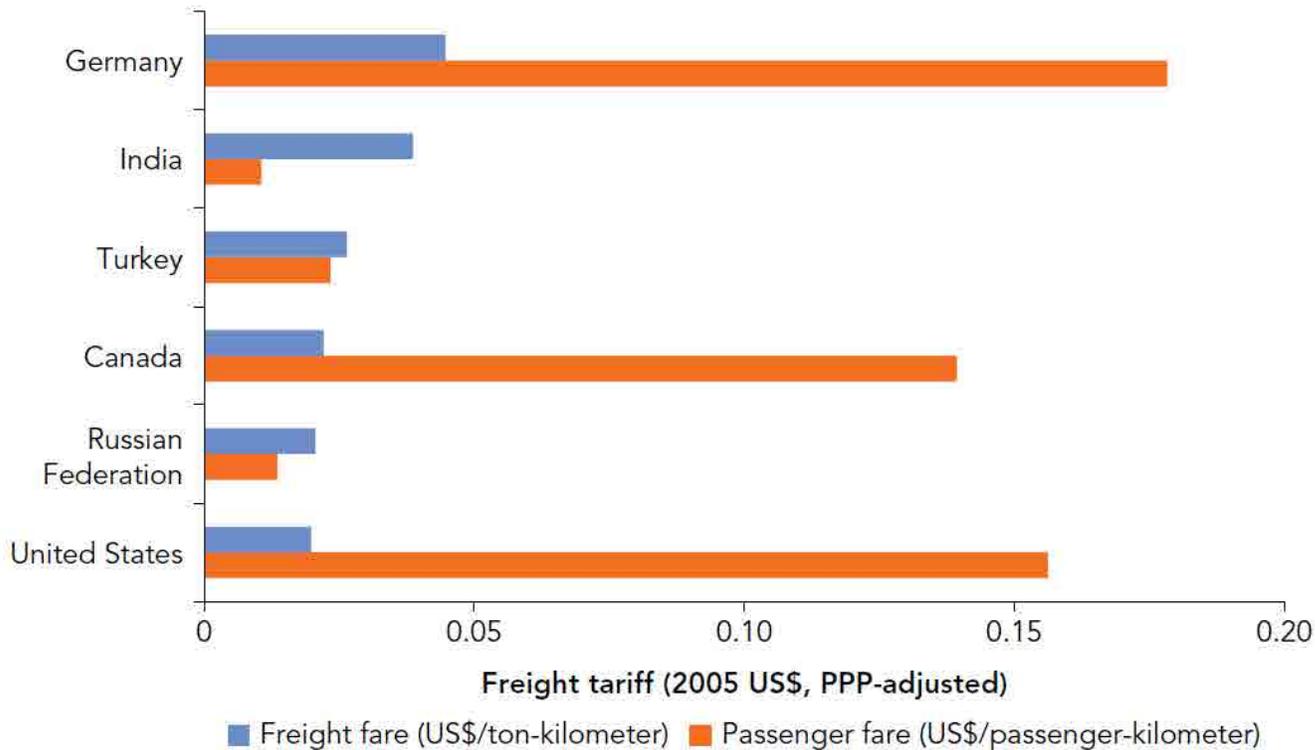
Implicit tax on industries due to cross-subsidies (Bangladesh)



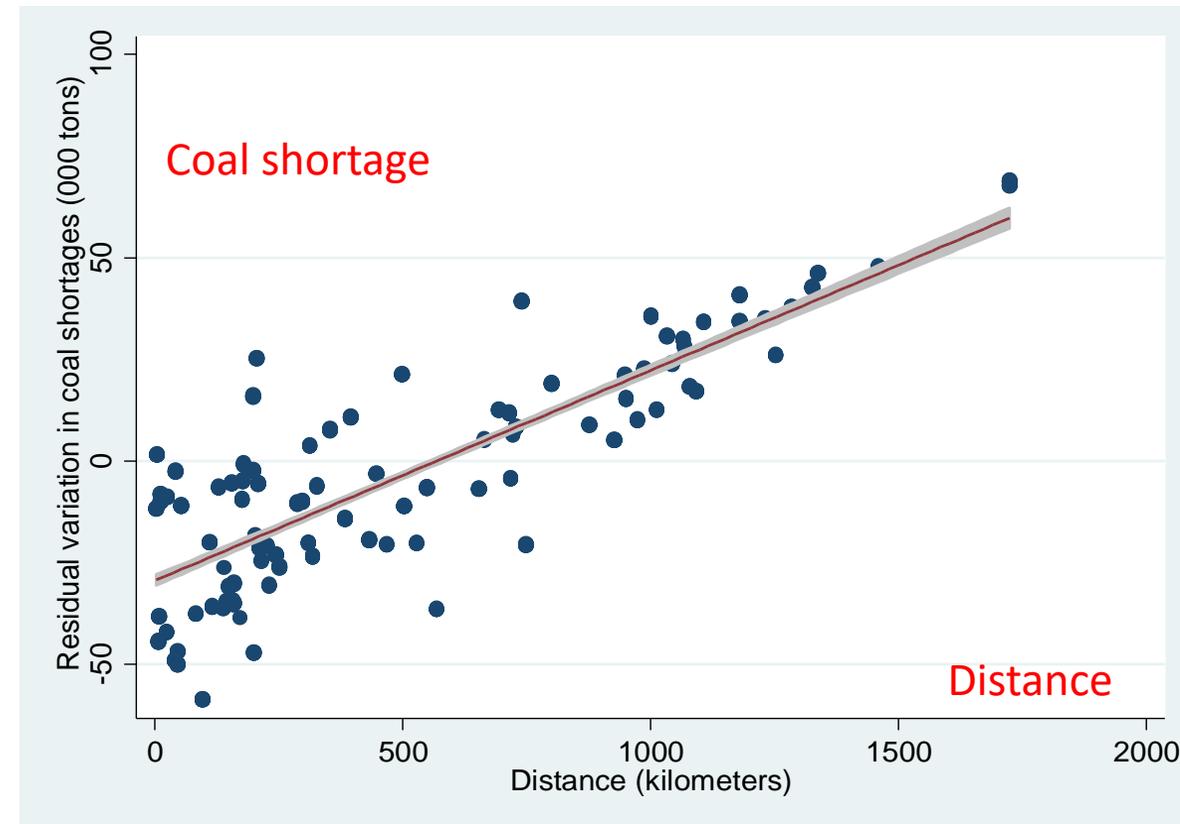
Regulatory distortion (continued)

Cross-subsidization of railway passenger tariffs by freight contributes to bottlenecks for coal transportation (India)

India's freight tariffs are among the highest in the world—and its passenger tariffs among the lowest

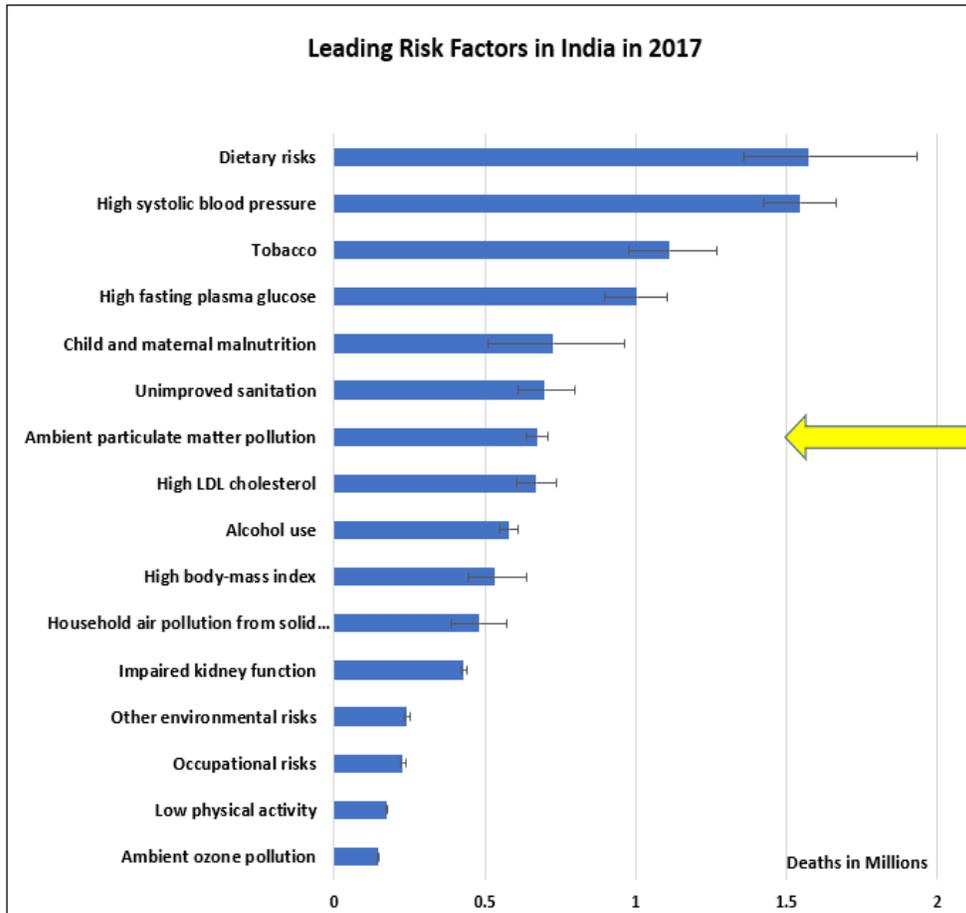


Coal shortage positive correlated with plants' distance to coal mines



Social: market, but externalities

Leading Risk Factors in India in 2017



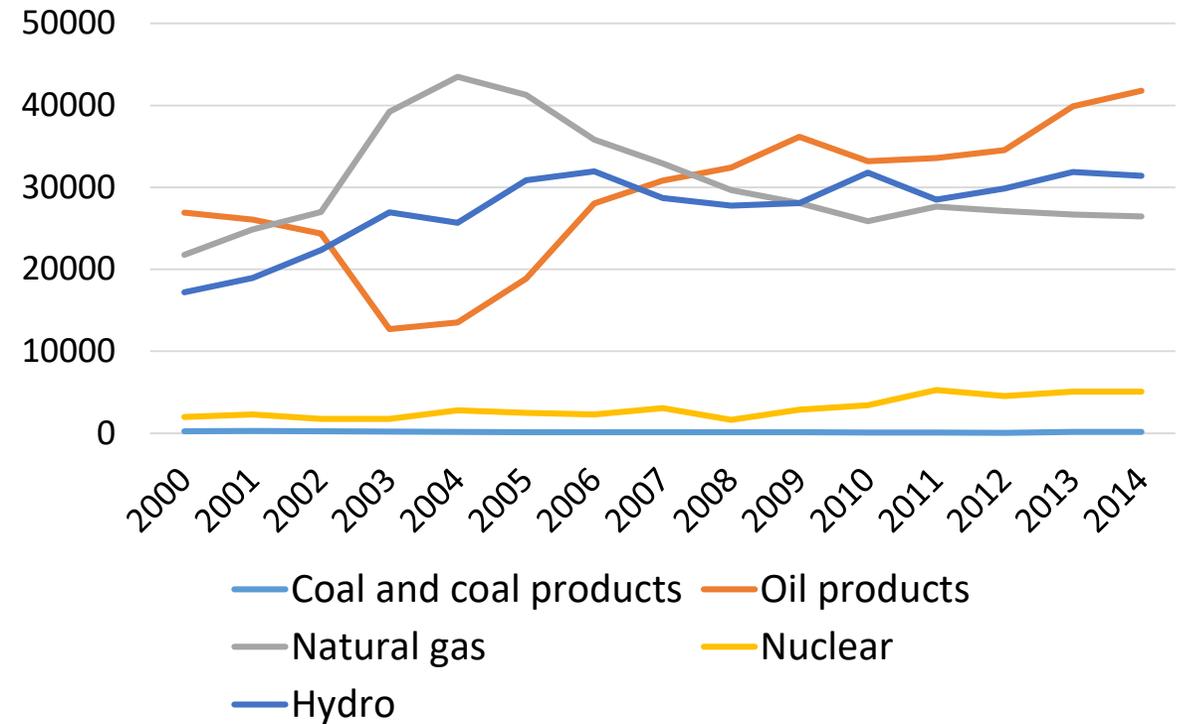
PM2.5 caused an estimated 82,900 death



Air pollution

Increasing reliance on oil for power generation (Pakistan)

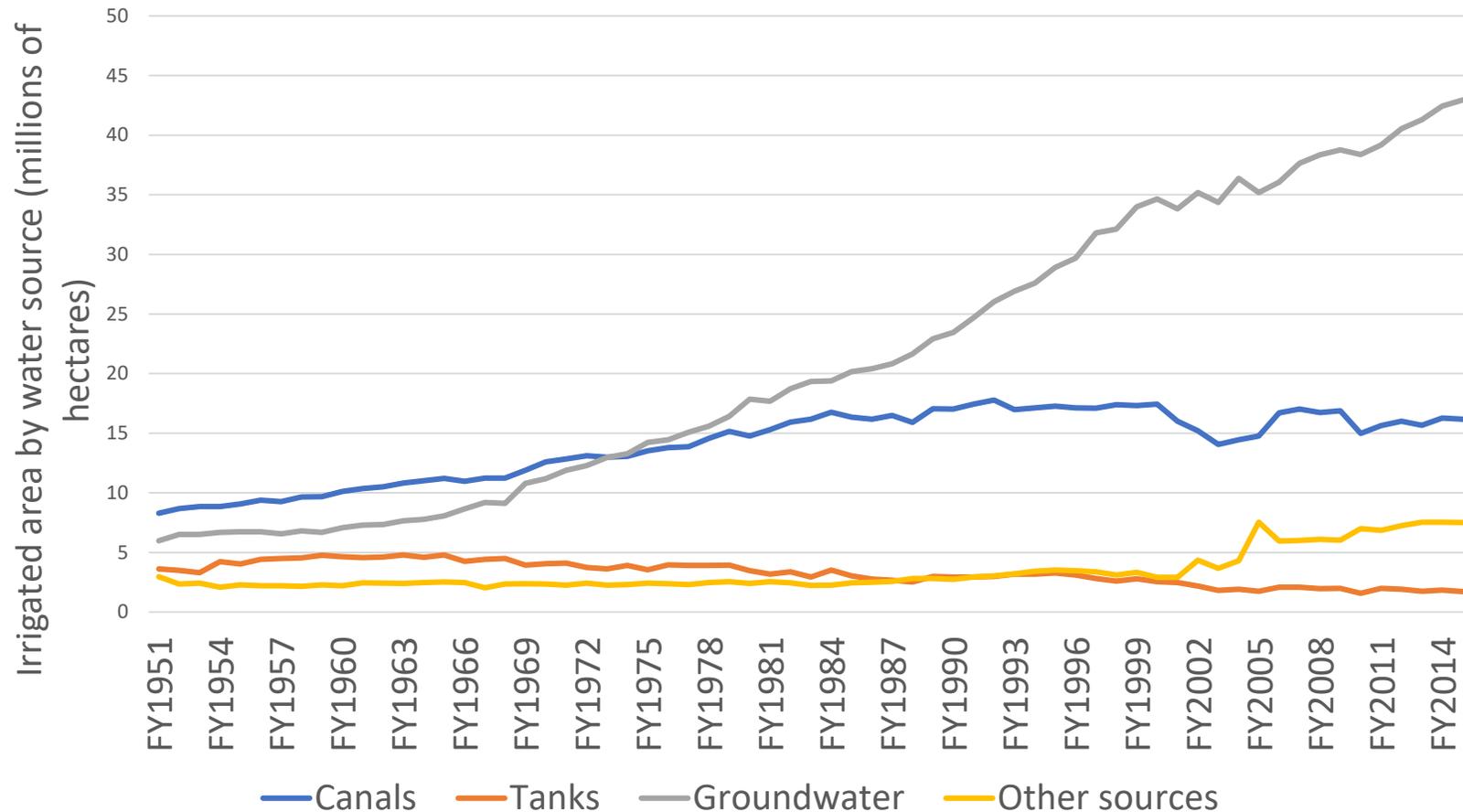
Fuel mix of Power Generation (GWh)



CO2 emissions

Social distortion (continued)

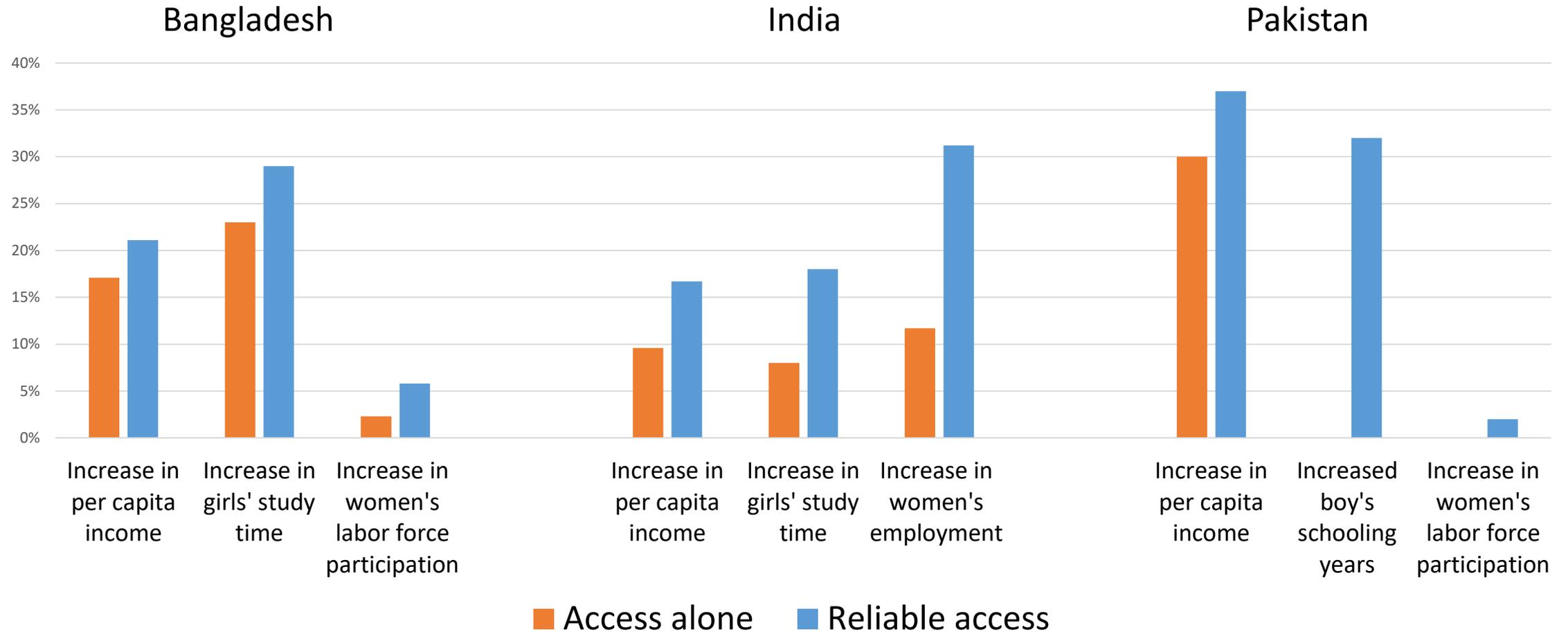
Free electricity for agriculture triggers groundwater depletion (India)





Why it matters: households, firms, world

Households: large gains from reliable power



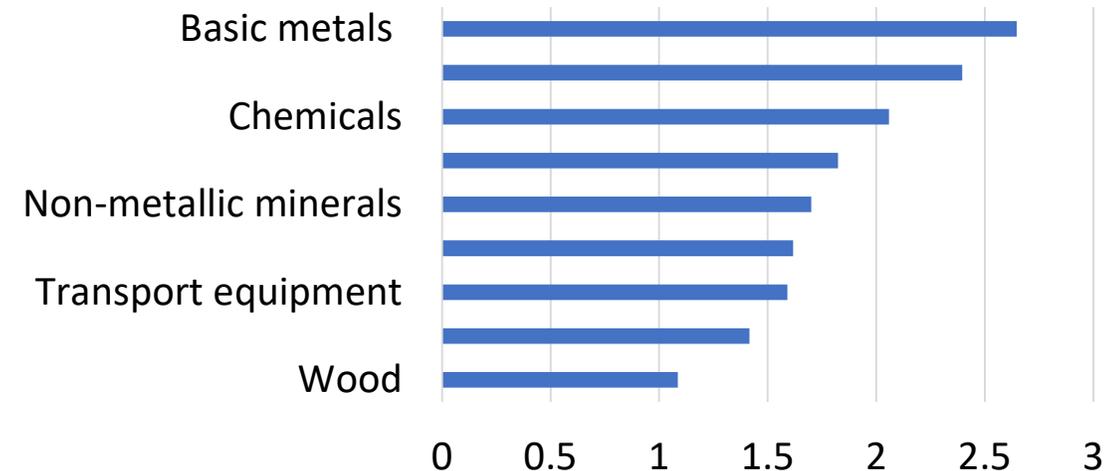
Firms: power distortions hinder business growth

Power shortages adversely affect firm productivity and profits

	1% increase in shortage	USD bn lost
Bangladesh	0.05% decrease in productivity	3
India	0.02% increase in input use	42
Pakistan	0.01% decrease in value added	11

Removing electricity cross-subsidies increases exports by 1-3 percent a year (India)

Change in net exports after removing cross-subsidies (percent)



The world: black carbon and CO2 emissions

- Upstream: fossil-fuel based power generation
 - *Bangladesh*: inefficient gas allocation leads to 0.6 mn ton of CO2 emissions
 - *India*: excess reliance on coal leads to 50 USD bn in health and environmental costs
 - *Pakistan*: inefficient gas allocation leads to 1.8 mn tons of CO2 emissions
- Downstream: kerosene lamps and diesel-based captive power
 - *India*: kerosene-lighting leads to 6 USD bn in health and environmental costs
 - *Everywhere*: Diesel-based captive power generation is a major source of black carbon



Policy implications

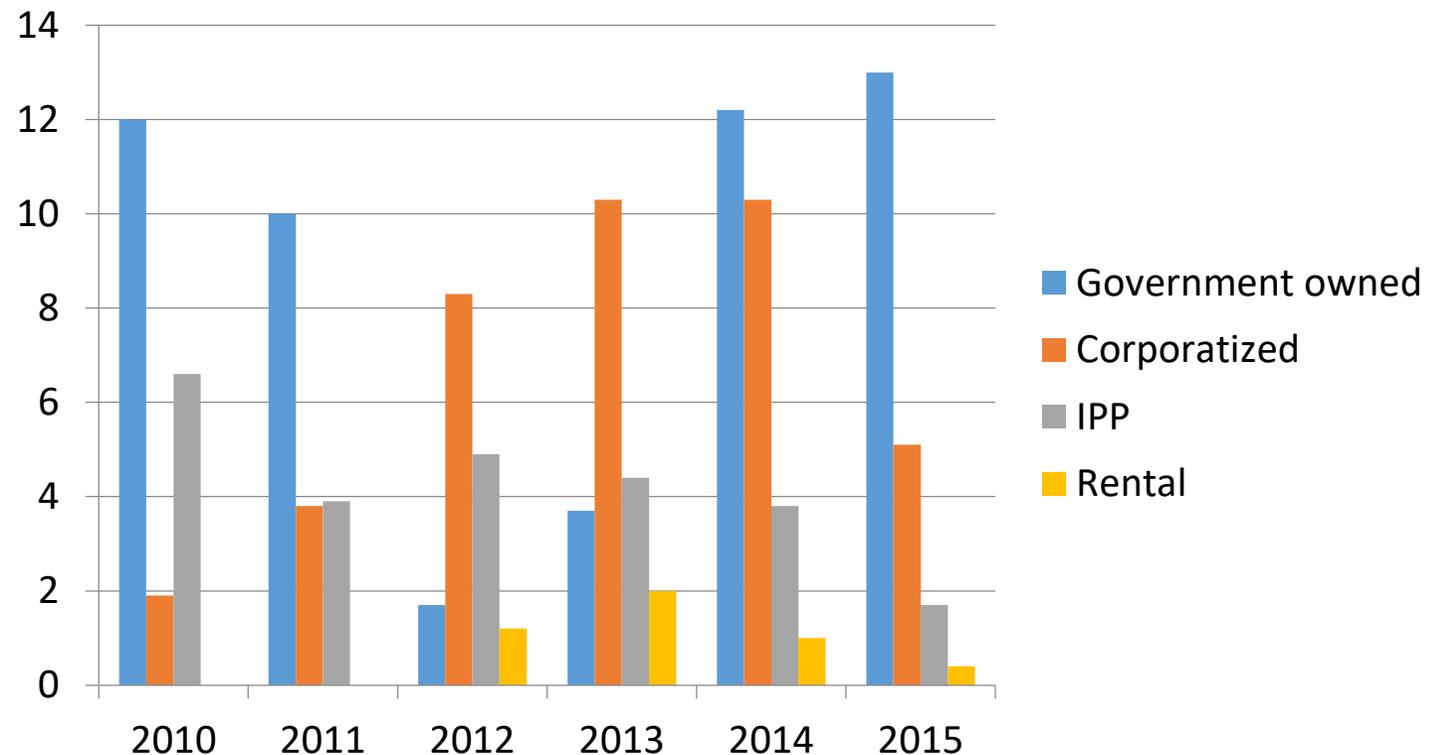
1. Focus beyond the core sector

Upstream distortions are often the largest sources of overall costs:

- Gas underpricing in Bangladesh
- Lack of full environmental taxation in India
- Inefficient gas allocation in Pakistan

Inefficient plants are favored in gas allocation (Bangladesh)

Capacity loss due to gas shortages, low gas pressure and gas line problems (%)



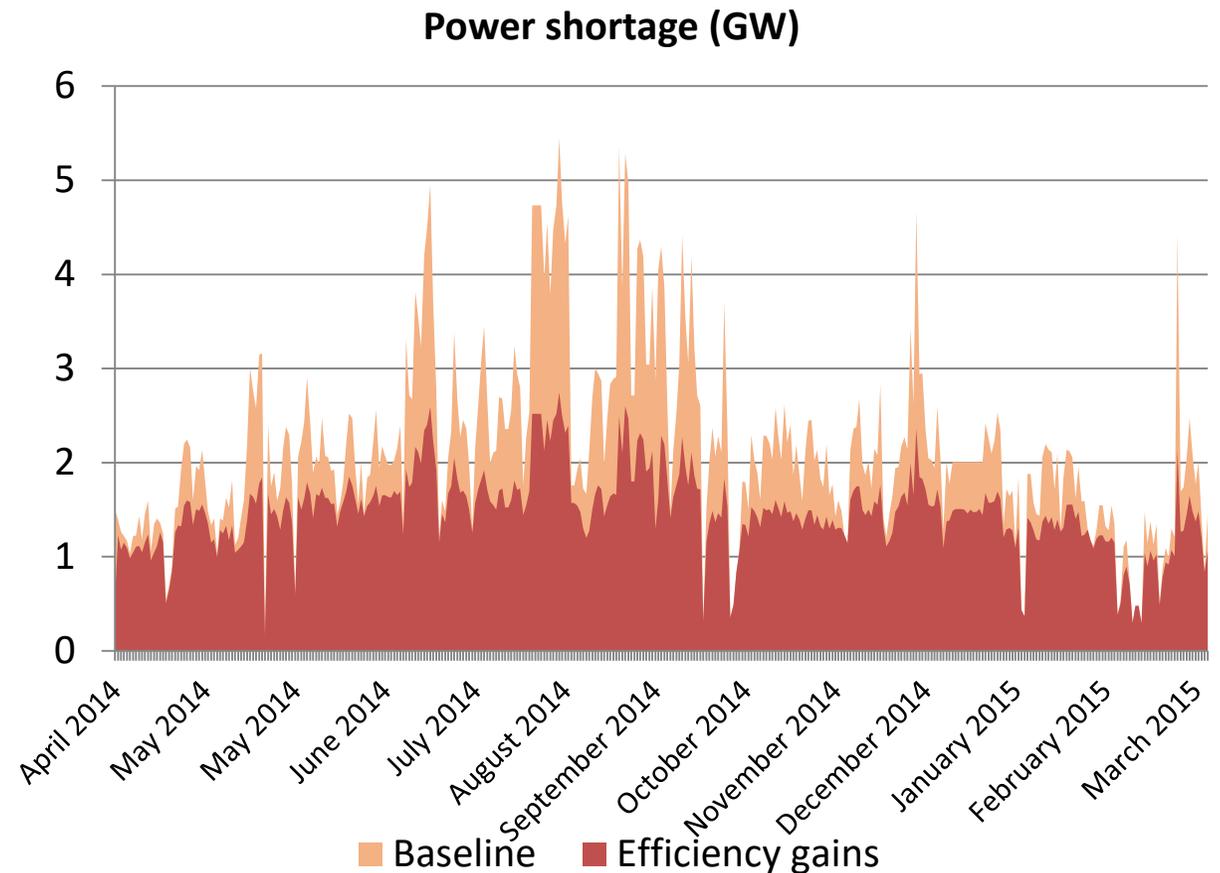
2. Think **beyond investment**

Generation is highly inefficient.

The removal of generation inefficiency could dramatically reduce power shortages.

Bringing shortages down, if distortions are not removed, requires huge investments.

Improving the fuel efficiency of state-owned power plants would significantly increase power supply (India)



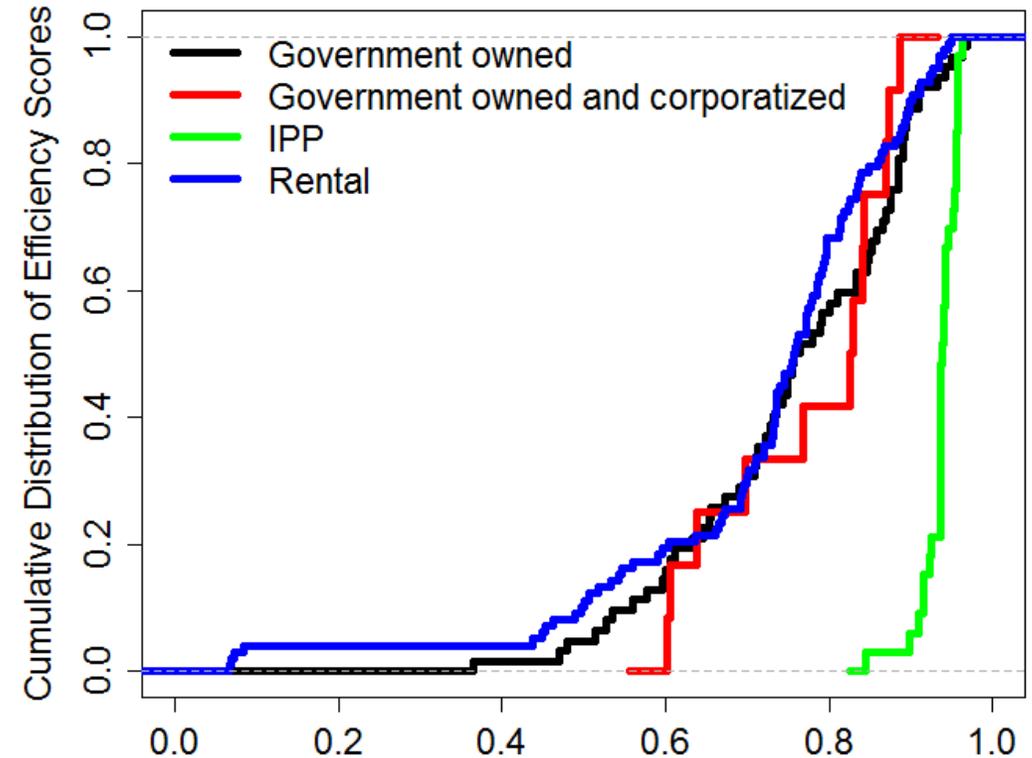
3. Reform beyond corporatization

Corporatized utilities in generation and distribution appear to perform better than state-owned ones.

But this is mainly because corporatized utilities were better to begin with.

Controlling for technical characteristics and looking at performance over time, the difference almost vanishes.

No significant difference between corporatized and non-corporatized plants after normalization (Bangladesh)

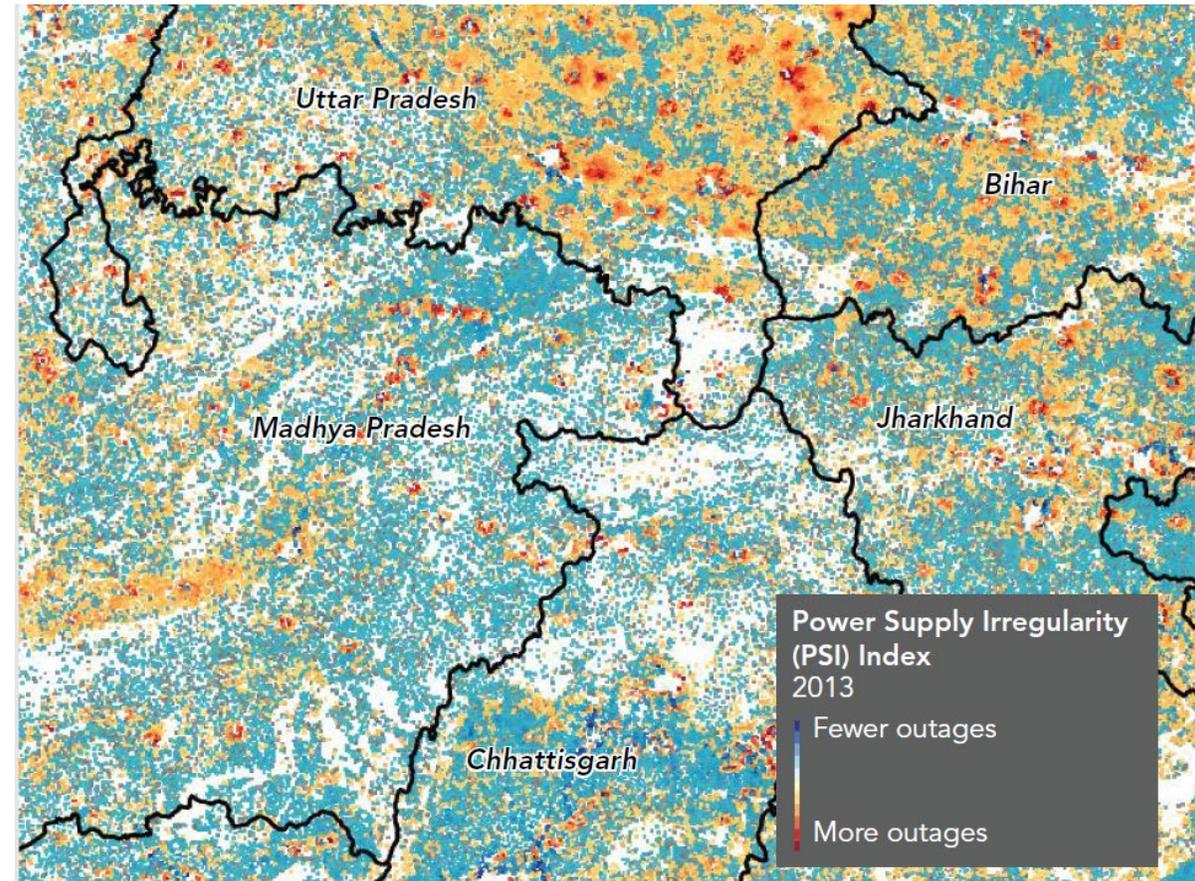


4. Prioritize **Quality**, not Just Access

Districts with more new electrification projects during 2005-12 experienced worse power outages in 2013
(India)

A new measure of power outage intensity

- It is important to improve quality of electricity supply
- The size of benefits of electrification depends critically on whether “connected” households receive adequate level of service



5. Accompany reforms with compensation

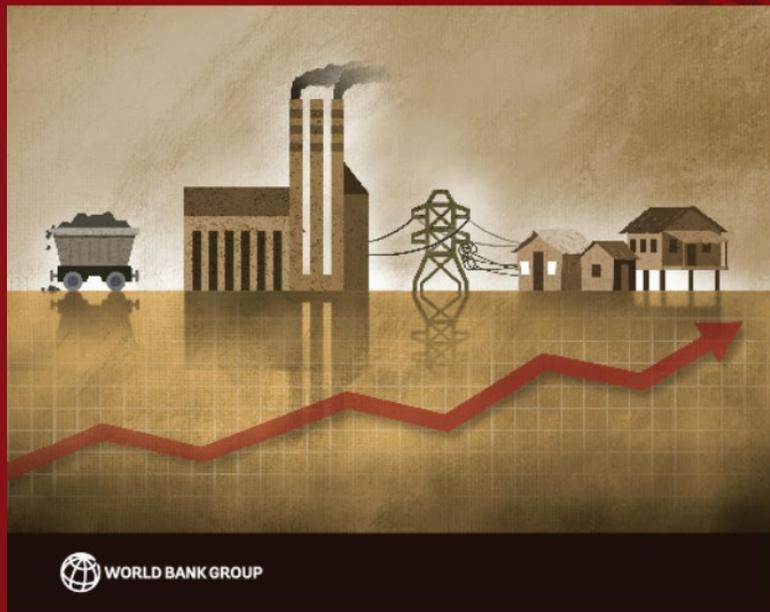
- Removing regulatory and social distortions would lead to a large price increase
- To offset this price increase, efficiency needs to improve
- In the meantime there will be distributional implications
 - Targeted social assistance are needed
 - India's Direct Benefit Transfer Scheme for LPG is an example of socially sensitive reform

SOUTH ASIA DEVELOPMENT FORUM

In the Dark

How Much Do Power Sector Distortions Cost South Asia?

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Thank you!

Contact: fzhang1@worldbank.org

Full report available at:

<https://openknowledge.worldbank.org/bitstream/handle/10986/30923/9781464811548.pdf>