From Chicago to Chandigarh: A Comparative Analysis

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October, 2011

The view from my window

Nicholas Cage considerations

Favorite Nicholas Cage Movie

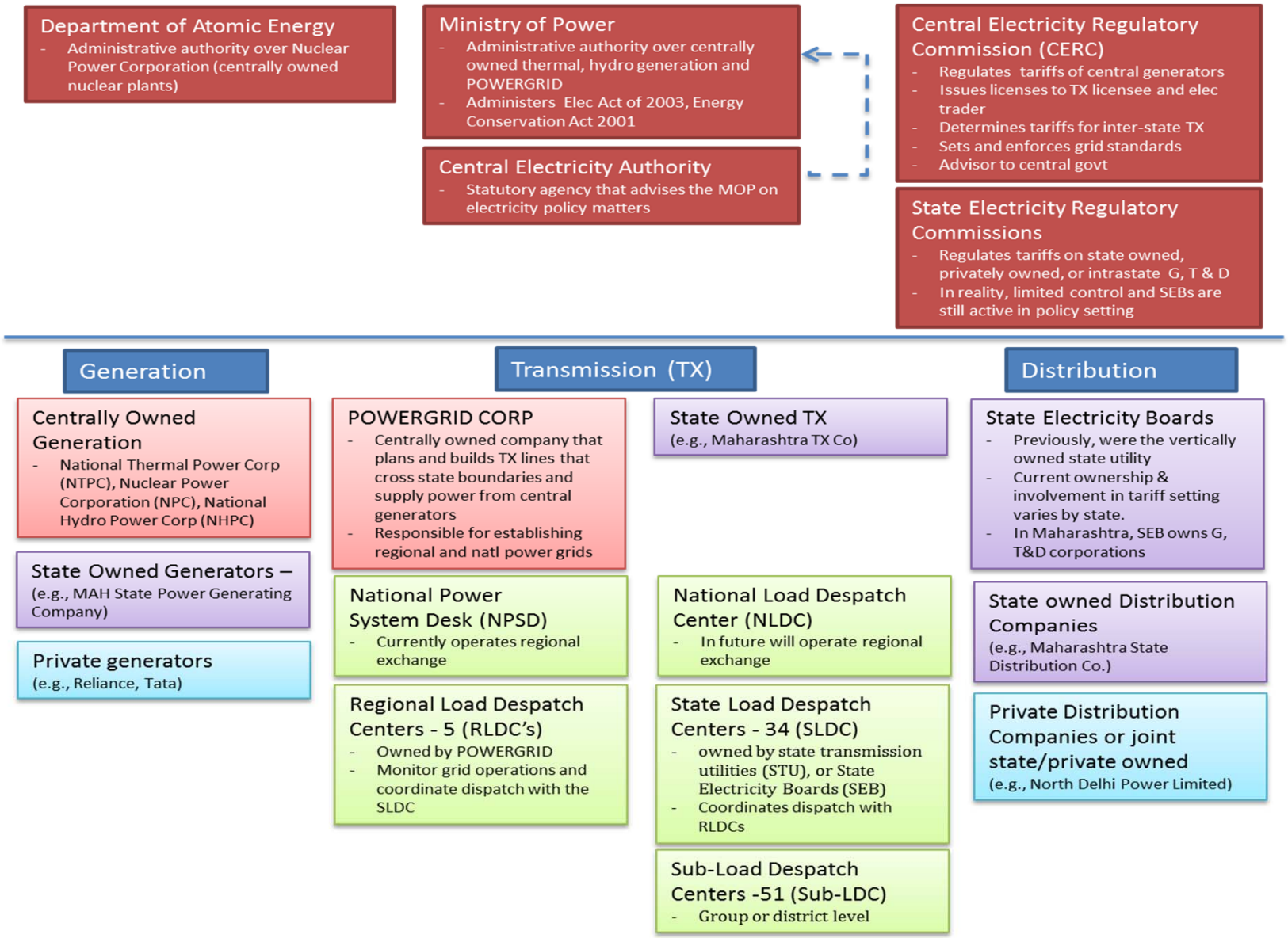
Least Favorite Nicholas Cage Movie

Decades pass, nothing happens
Weeks pass, decades happen

V. I. Lenin
1918


INDIA
The external boundaries of India on this map have not been authenticated and may not be correct.
TAJIKISTAN
AFGHANISTAN
Great Range
Himalaya
Leh
CHINA
Shimla
Chandigarh
PAKISTAN
Delhi
NEPAL
BHUTAN
Jaisalmer
Agra
Darjeeling
Jaipur
Udaipur
Varanasi
BANGLADESH
Khajuraho
Gandhinagar
Kolkata (Calcutta)
Bhopal
Kanha National Park
Mumbai (Bombay)
MYANMAR (BURMA)
ARABIAN SEA
Hyderabad
BAY OF BENGAL
Goa
Vijayawada
Panaji
Chennai (Madras)
Bangalore
Andaman Islands
Mysore
0 300 km
0 180 miles
Kochi (Cochin)
Kerala
Nicobar Islands
SRI LANKA
INDIAN OCEAN

Key regulatory and operational entities in Indian Power Sector

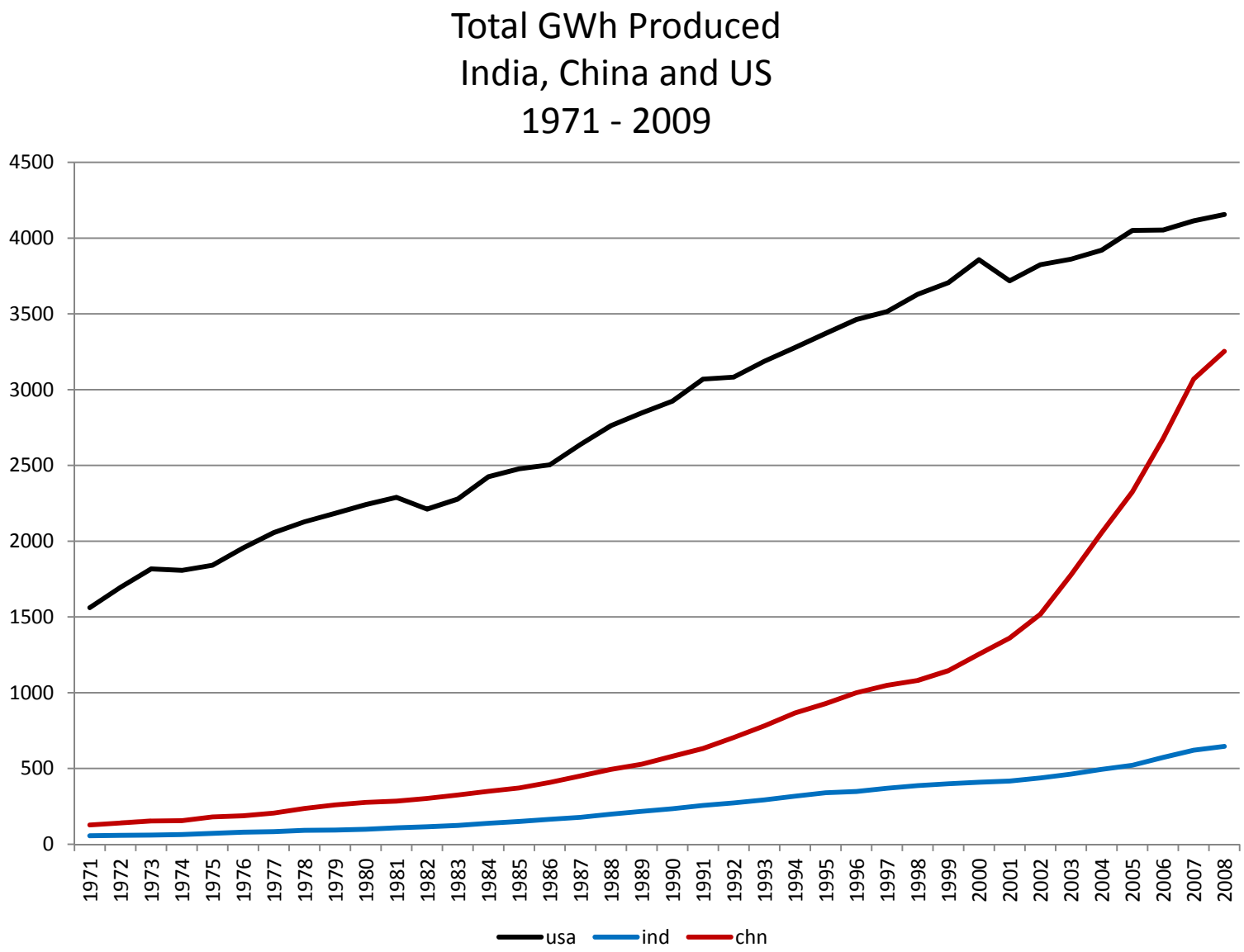


Facts and forecasts

	More or less current	2030 Base Case	2030 abatement case
Population	1.1 billion	1.5 billion	1.5 billion
Rate of GDP growth	8%	7.5%	7.5%
Electricity Consumption	700 TWh	3,870 TWh	2,910 TWh
Generating Capacity	150 GW	760 GW	640 GW
Carbon Emissions	1.6 billion	5.7 billion	3.1 billion

Basic Facts

	India	Illinois
Residential Prices	.066 - .22 cents per kwh	.12 per kwh
Per Capita Income	$1,200	$23,000
Per Capita Electricity Consumption	700 kwh/year	4,600 kwh/year
Per Household Electricity Consumption	1200 kwh/year	10,000 kwh/year
Saturation of Air Conditioning	.05	1.0


Total GWh Produced
India, China and US
1971 - 2009
4500
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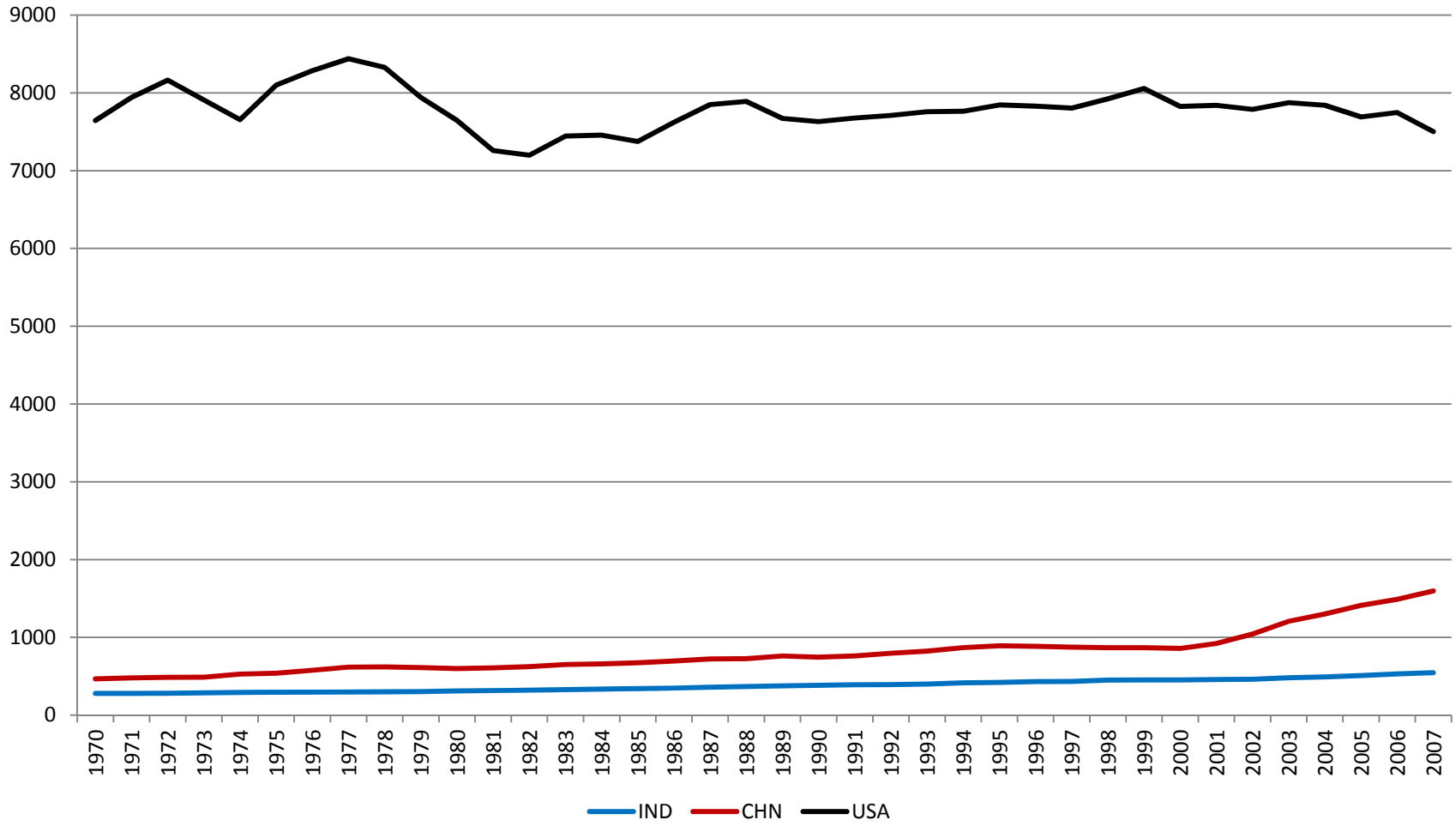
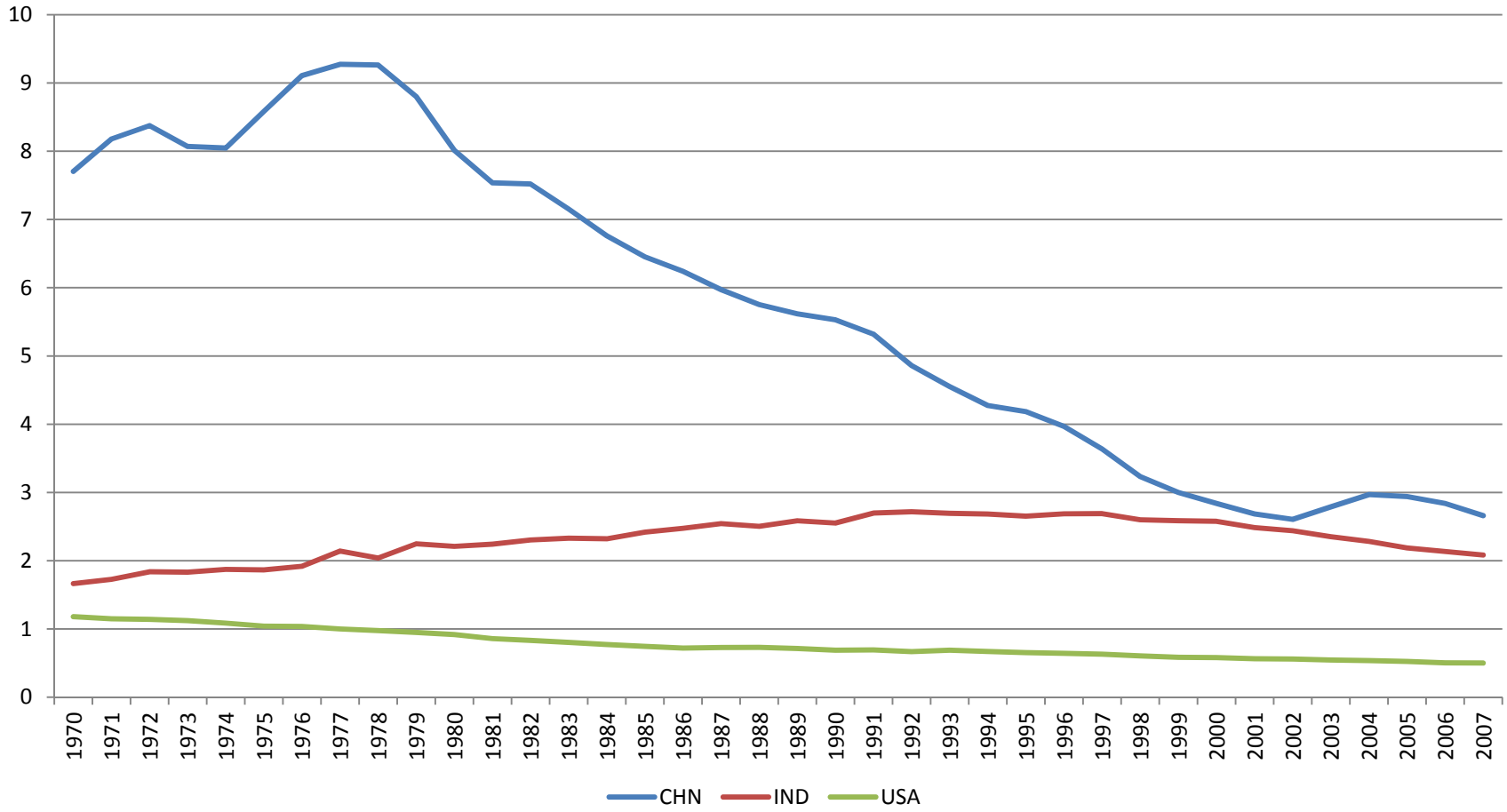
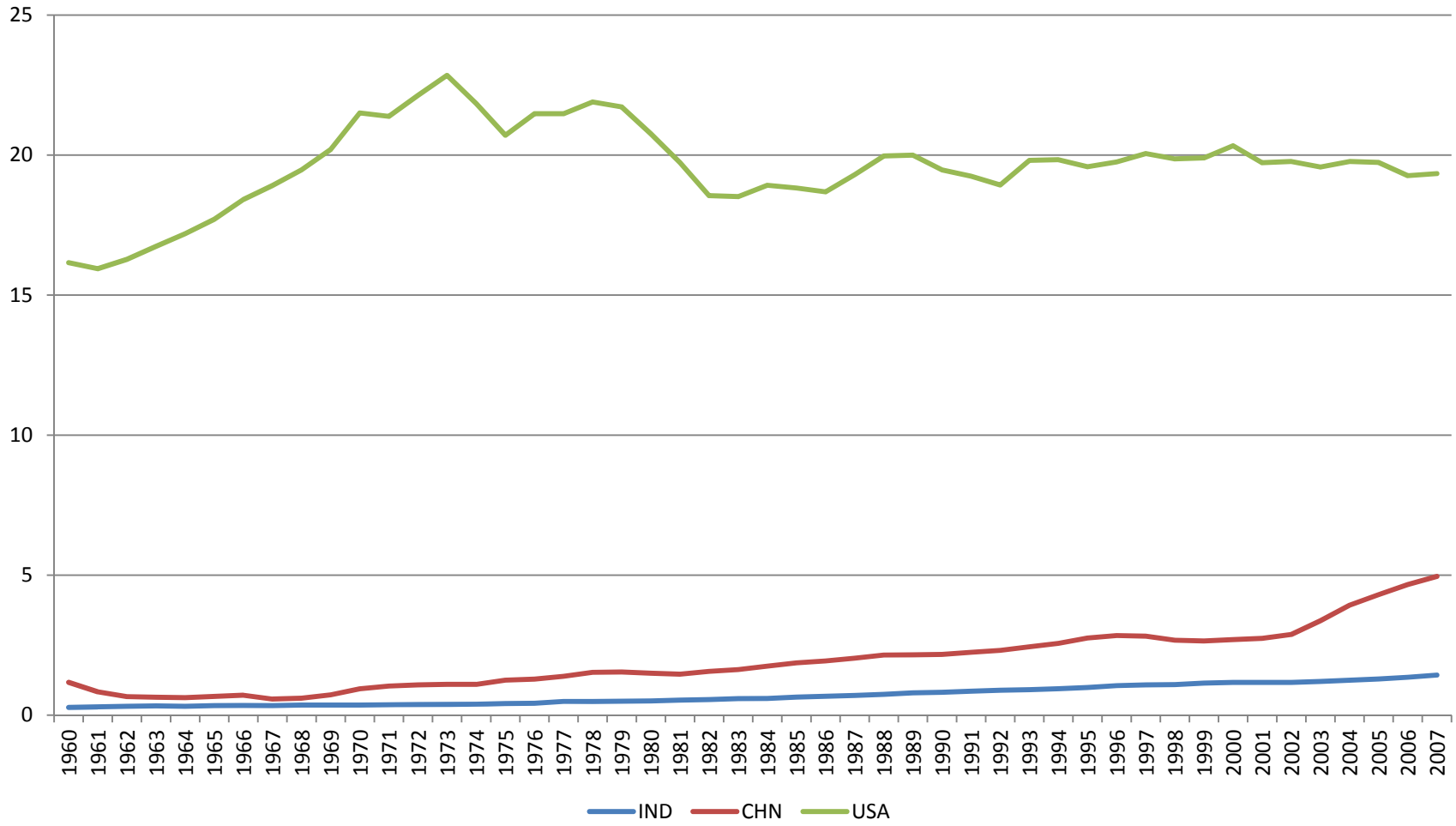
Electricity Use per capita
India, China and US



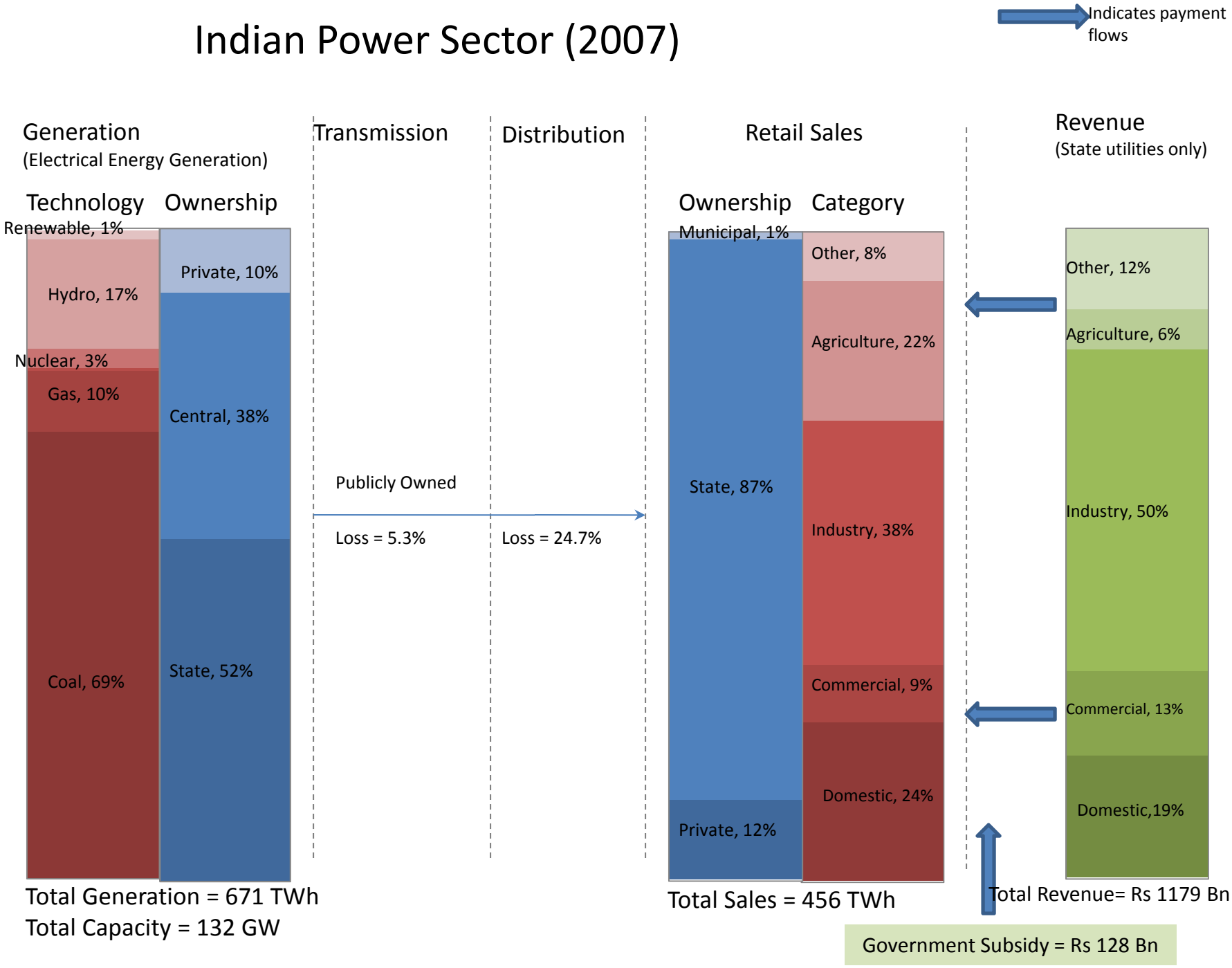
Carbon tons/$ GDP
China, India and US



Carbon tons per capita
India, China and US



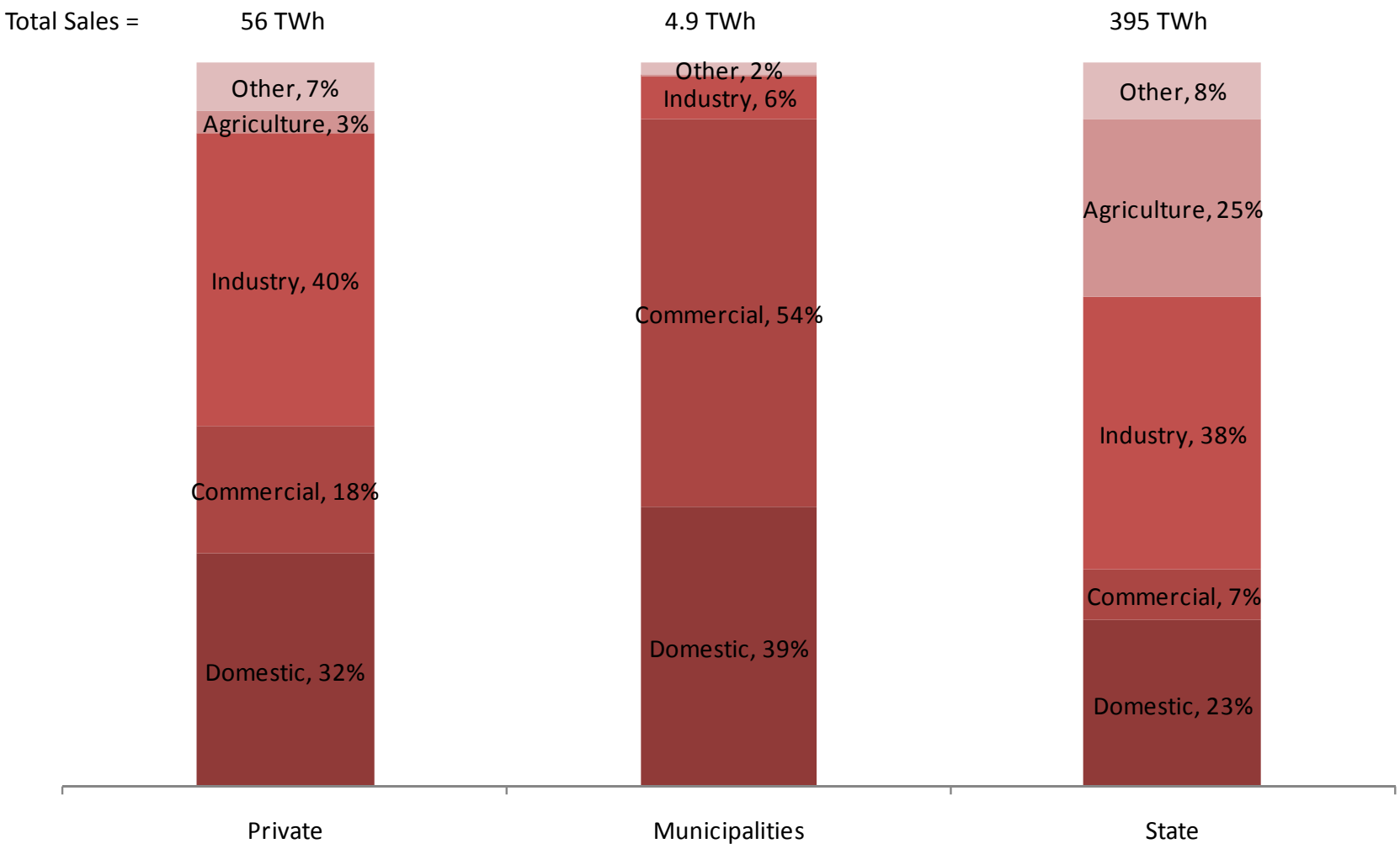
Indian Power Sector (2007)



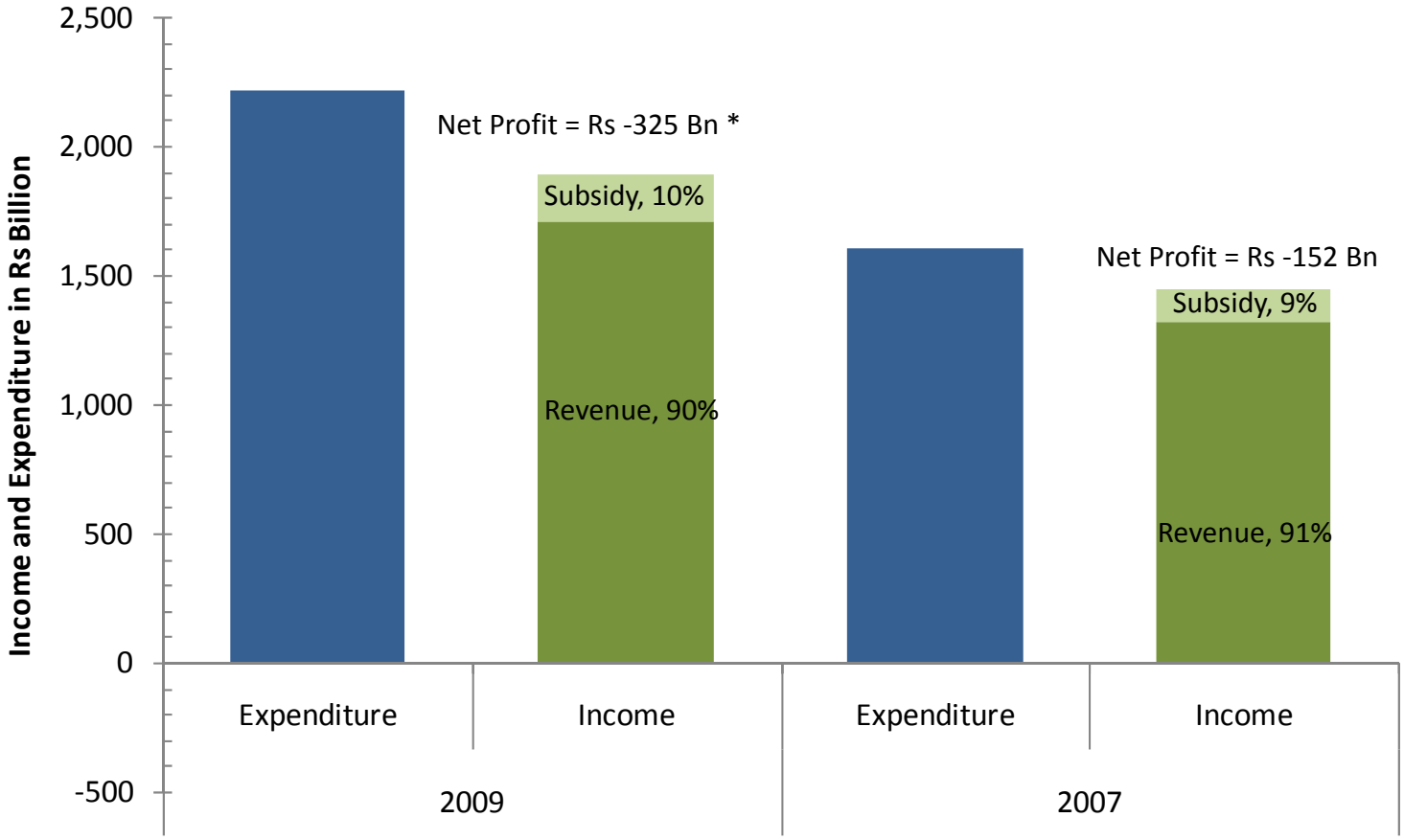
Income and Expenditure of State Utilities

	2007	2008	2009
Total Expenditure (Rs Cr)	159,941	183,604	221,267
Total income (excluding subsidy) Rs Cr	131,905	149,532	170,381
Subsidy Received (Rs Cr)	12,836	16,472	18,388
Tax (Rs Cr)	-143	166	-301
Net Profit (after tax and subsidy) Rs Cr	-15,200	-17,600	-32,498

Sales by Category and by Ownership (2007)



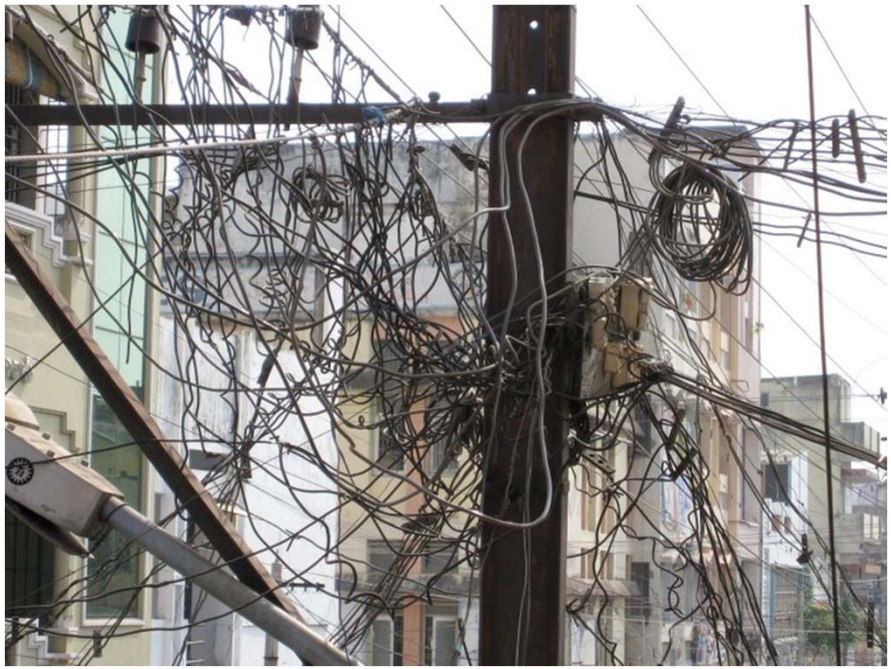
Income, Expenditure and Profits of State Utilities



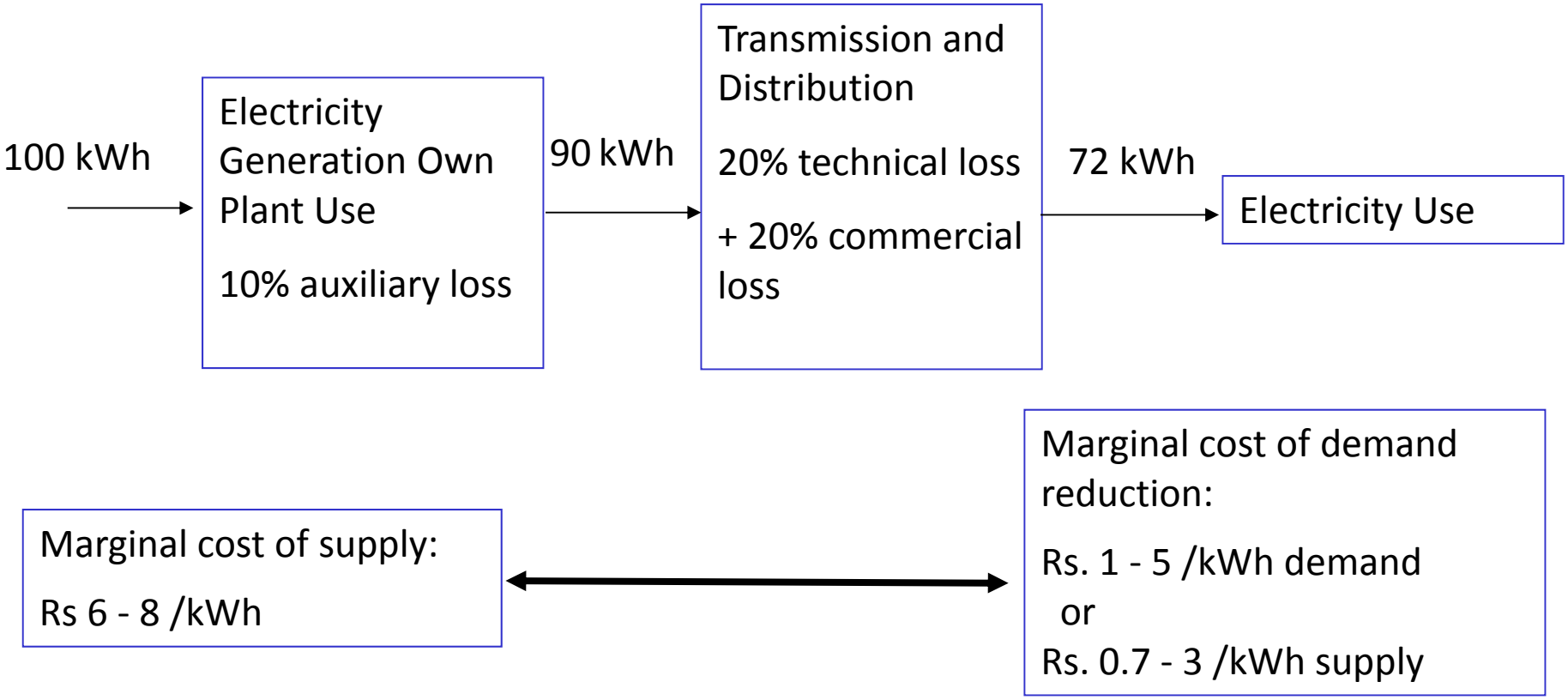
* Note that 2009 was the national election year. Therefore, one might expect increase in the quantum of expensive power purchase in that year, which might have made the state utilities worse off.

India's power sector: the challenge and opportunity

- Daily power outages
- Impedes productivity
- High business costs for self-generated power
- Half the population has no access to electricity
- Huge payback from investments in efficiency



Return on Investment: Typical India Values



Efficient Use: Lower cost and shorter construction lead time than new supply

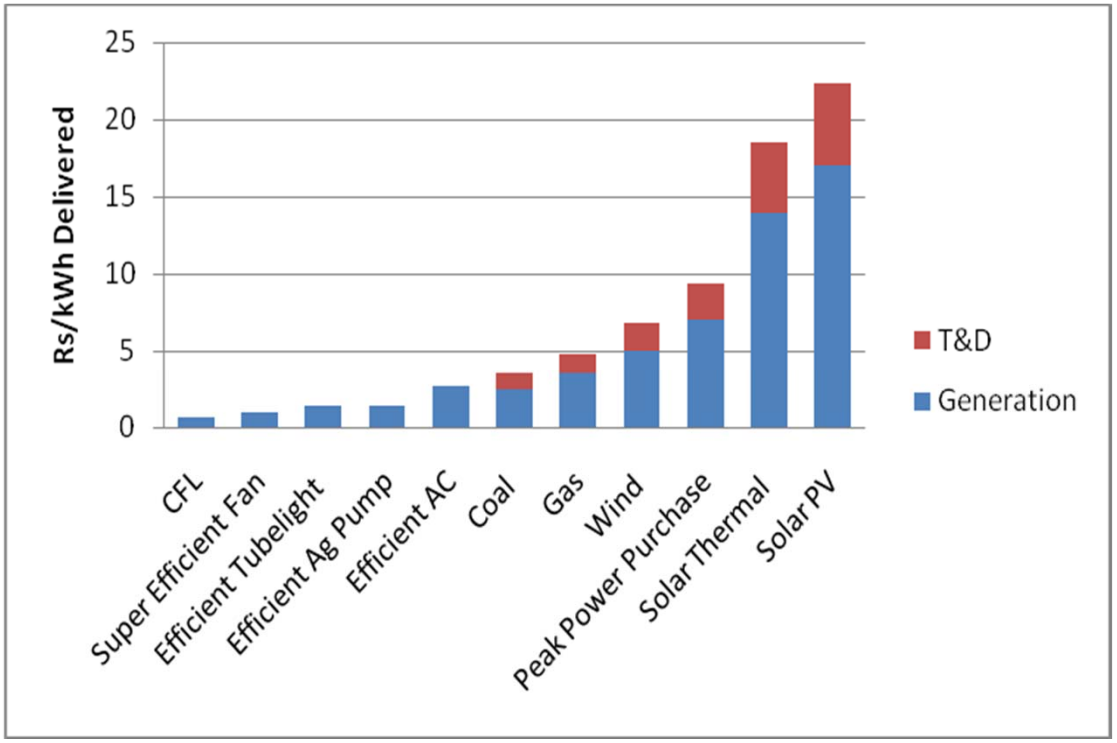

SHRI RAM

Cost of conserved energy is less than the cost of energy from new power plants

❑RESULT: An aggressive and successful energy efficiency initiative will result in lower bills for customers, lower operating costs for utilities, and lower environmental costs.

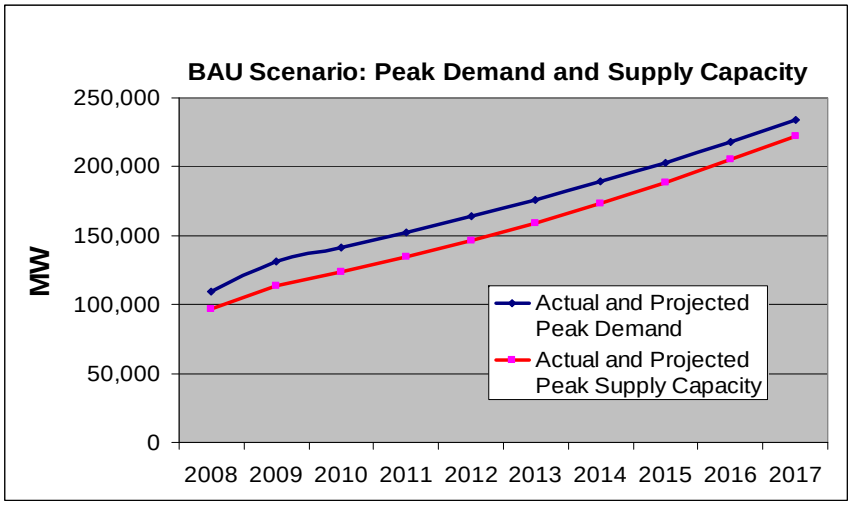
❑This concept is used by governments and regulators in other countries to make resource choices.

Figure 1. Comparing Energy Efficiency with New Supply Side Options

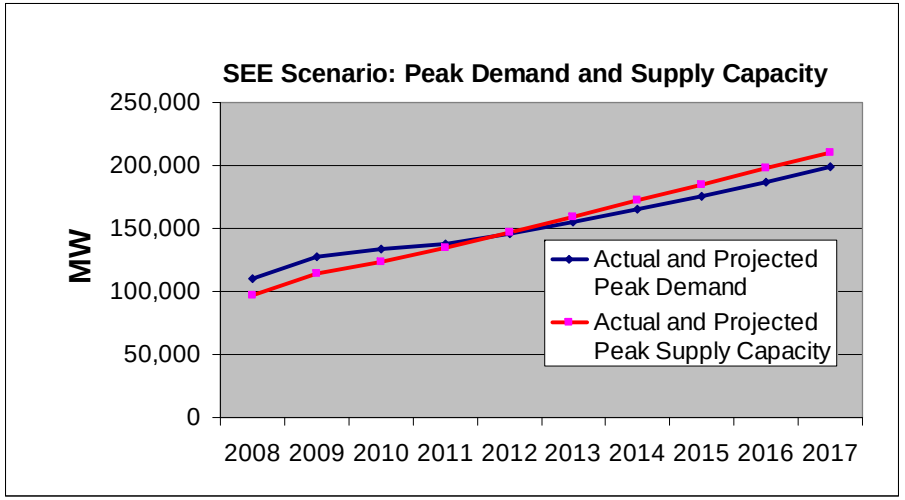


Note: Incremental cost estimates for energy efficiency options are based on typical retail price differences for efficient versus inefficient products, and apply to new purchase decisions and not retrofits. The numbers presented are only indicative. For retrofits, CCE is higher; however, in most instances it is lower than Rs 4/kWh.

BAU Scenario 1: Invest in supply capacity, but shortage continues



EE Scenario 2: Invest in efficiency, eliminate shortage by 2016 – plus bonus …



Scenario	BAU Scenario	EE Scenario
2017	**6% Deficit**	**2% Surplus**
Capex (2009-2017)	**Rs. 382 thousand crores**	**Rs. 378 thousand crores (incl. efficiency options)**
Efficiency Options		**Lighting, fans, refrigerators, motors, agricultural pumping**

Similarities

- Illinois
  - Little or no serious public planning
  - Disinclination to charge customers for infrastructure upgrades
  - Primacy of holding companies
  - Complex federalist structure of governance
  - Restructuring efforts hampered by Enron
  - Skewed income distributions
  - Don’t want to pay the extra cost for clean resources
  - Most repeated line from regulators: “We don’t have the legal authority”
- India
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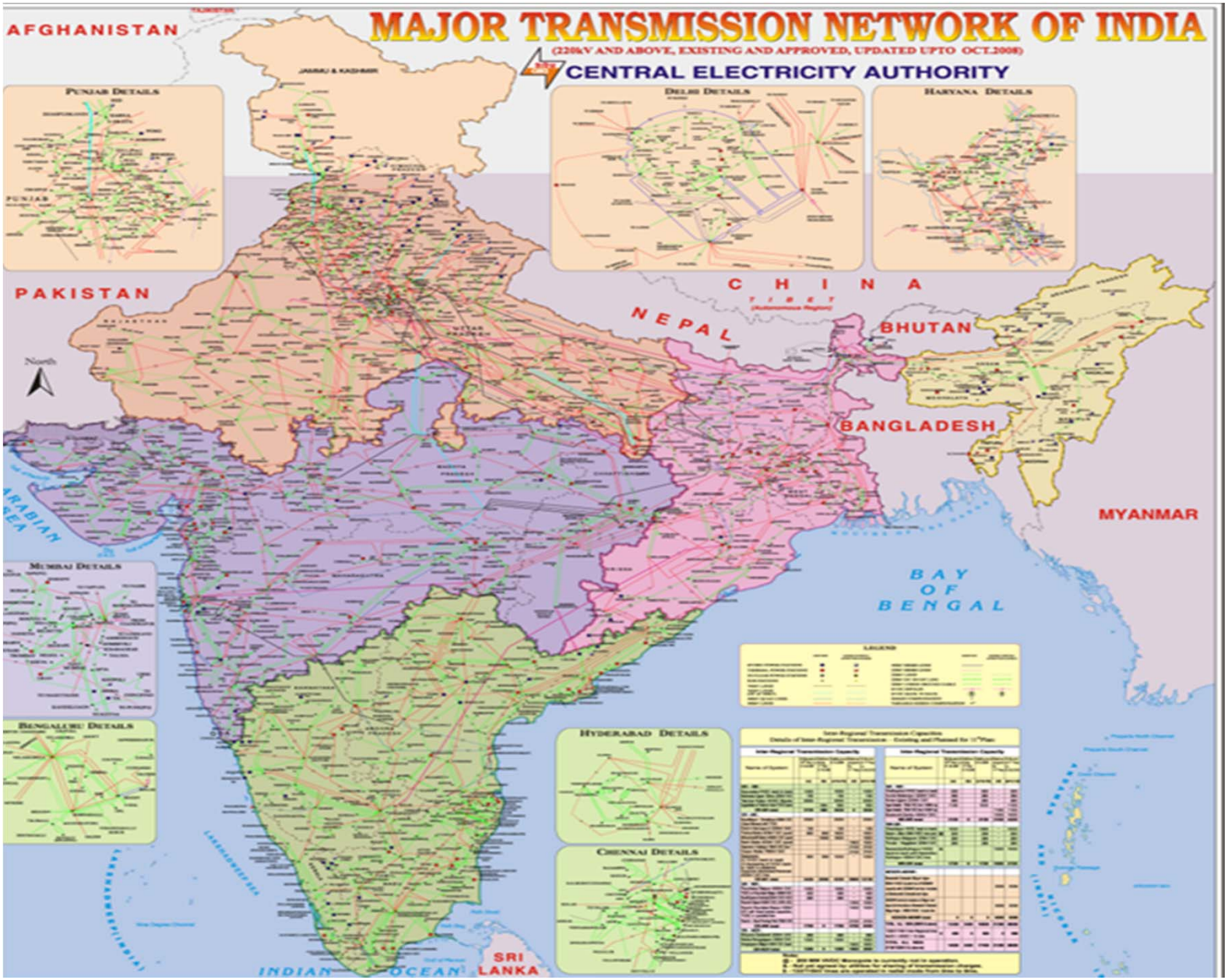
Another Similarity

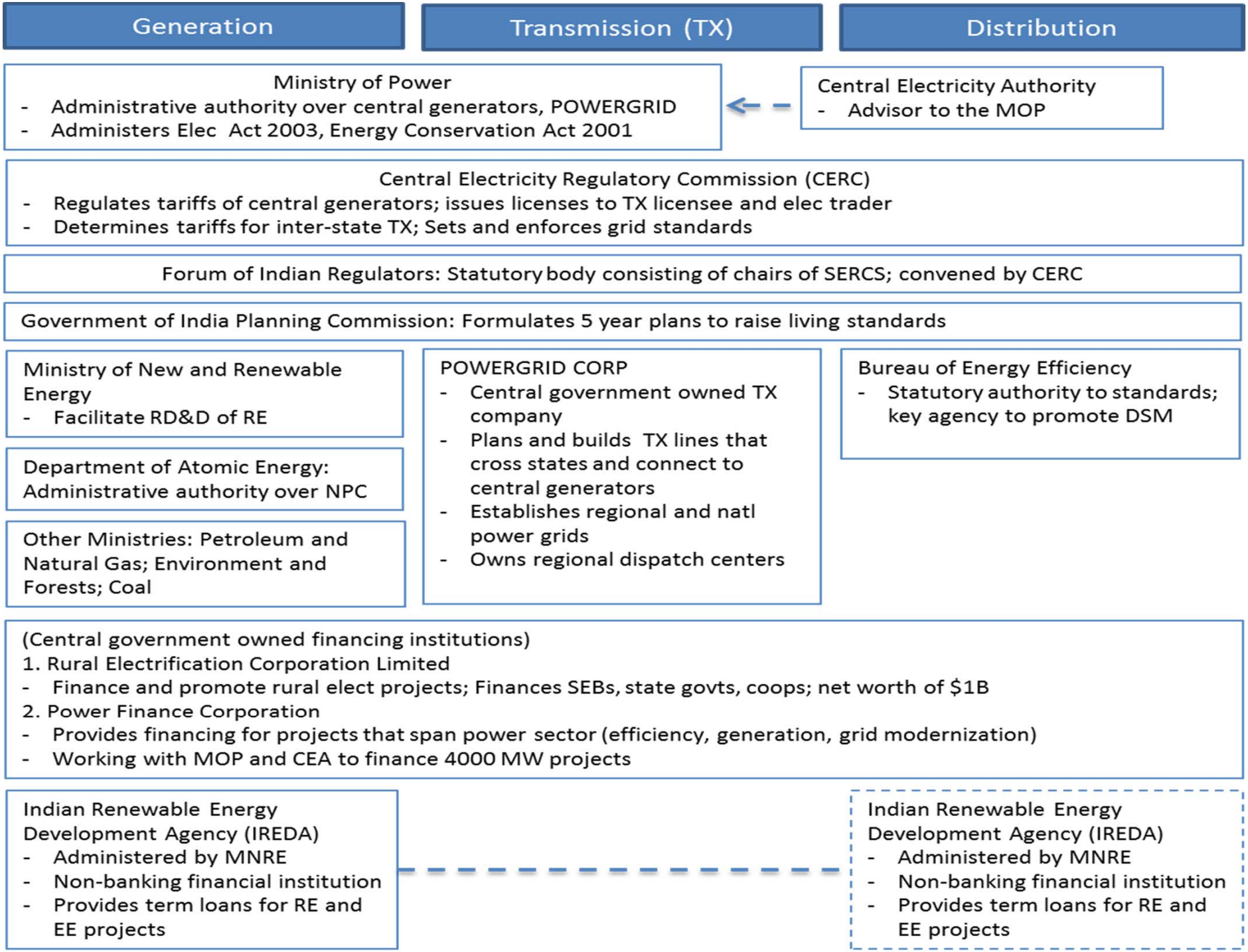
Former Karnataka chief minister BS Yeddyurappa

Former Governor Rod Blagojevich

Differences

- Illinois
  - Over-capacity
  - Everyone is served
  - Financial health of the system
  - Reliability is socialized
- India
  - Generation shortages
  - 50% of population currently unserved
  - Distribution utilities effectively bankrupt
  - Reliability is privatized


MAJOR TRANSMISSION NETWORK OF INDIA
(220kV AND ABOVE, EXISTING AND APPROVED, UPDATED UPTO OCT.2008)
CENTRAL ELECTRICITY AUTHORITY
AFGHANISTAN
PAKISTAN
CHINA
TIBET
NEPAL
BHUTAN
BANGLADESH
MYANMAR
SRI LANKA
INDIAN OCEAN
BAY OF BENGAL
ARABIAN SEA
PUNJAB DETAILS
DELHI DETAILS
HARYANA DETAILS
MUMBAI DETAILS
BENGALURU DETAILS
HYDERABAD DETAILS
CHENNAI DETAILS
LEGEND


Generation
Transmission (TX)
Distribution
Ministry of Power
- Administrative authority over central generators, POWERGRID
- Administers Elec Act 2003, Energy Conservation Act 2001
Central Electricity Authority
- Advisor to the MOP
Central Electricity Regulatory Commission (CERC)
- Regulates tariffs of central generators; issues licenses to TX licensee and elec trader
- Determines tariffs for inter-state TX; Sets and enforces grid standards
Forum of Indian Regulators: Statutory body consisting of chairs of SERCS; convened by CERC
Government of India Planning Commission: Formulates 5 year plans to raise living standards
Ministry of New and Renewable Energy
- Facilitate RD&D of RE
Department of Atomic Energy: Administrative authority over NPC
Other Ministries: Petroleum and Natural Gas; Environment and Forests; Coal
POWERGRID CORP
- Central government owned TX company
- Plans and builds TX lines that cross states and connect to central generators
- Establishes regional and natl power grids
- Owns regional dispatch centers
Bureau of Energy Efficiency
- Statutory authority to standards; key agency to promote DSM
(Central government owned financing institutions)
1. Rural Electrification Corporation Limited
- Finance and promote rural elect projects; Finances SEBs, state govts, coops; net worth of $1B
2. Power Finance Corporation
- Provides financing for projects that span power sector (efficiency, generation, grid modernization)
- Working with MOP and CEA to finance 4000 MW projects
Indian Renewable Energy Development Agency (IREDA)
- Administered by MNRE
- Non-banking financial institution
- Provides term loans for RE and EE projects
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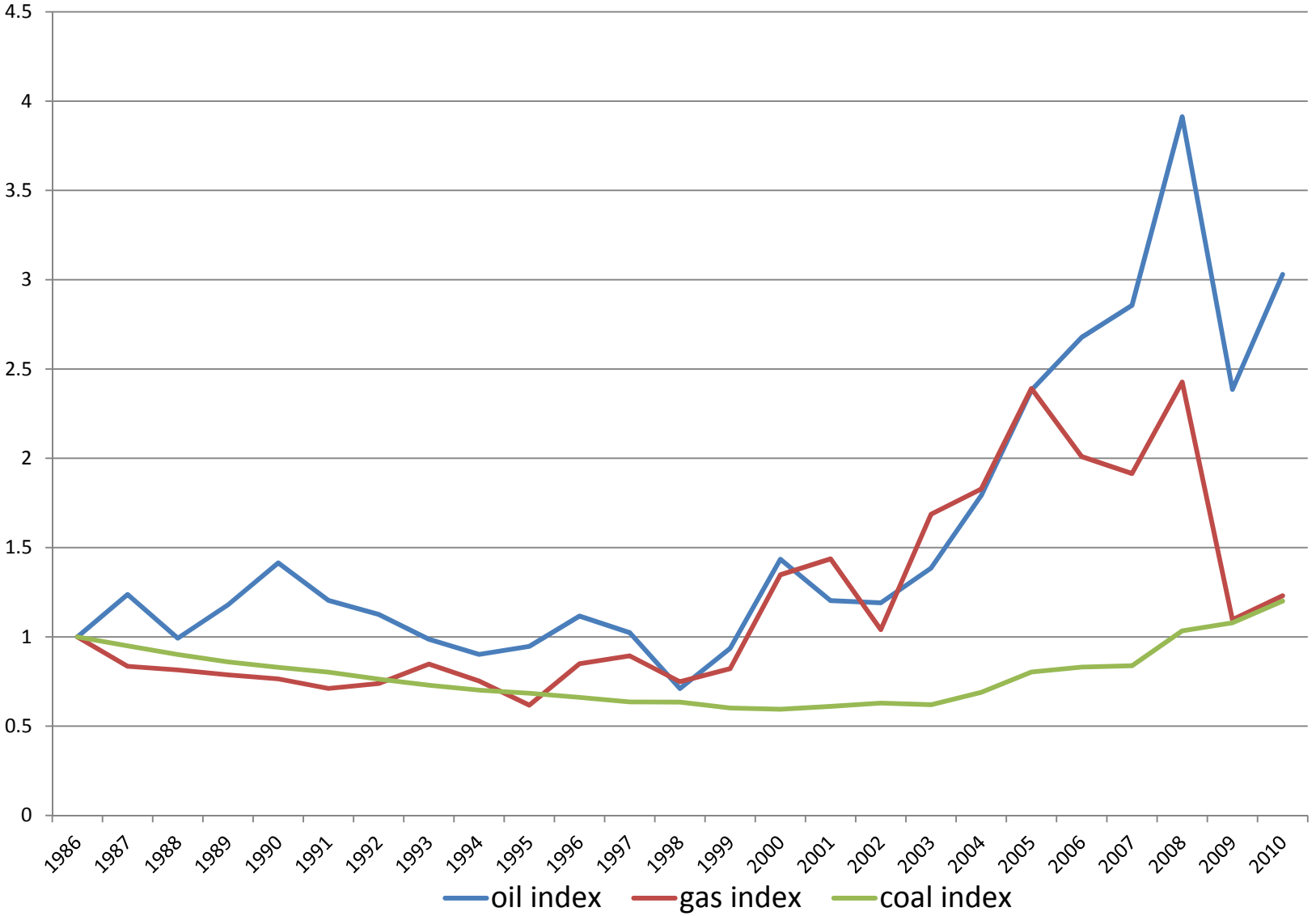
ENERGY SECURITY:

- Average Power Demand- Supply gap of 12%, peak gap of 16.7%!!
- Rate of economic growth is 9% p.a.while power sector growth is 5-6%.
- This, when 412 million Indians have NO access to electricity.
- India imports 78% of oil requirement. Will rise to 90% by 2030.
- 53% of power produced from coal, which will not last beyond 2040/50
- Nuclear will play a marginal role. (10% of total by 2030)
- Renewable Energy, Energy Efficiency and Conservation are key.


4.5
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oil index
gas index
coal index