ELECTRICITY IN INDIA: TRENDS AND CHALLENGES

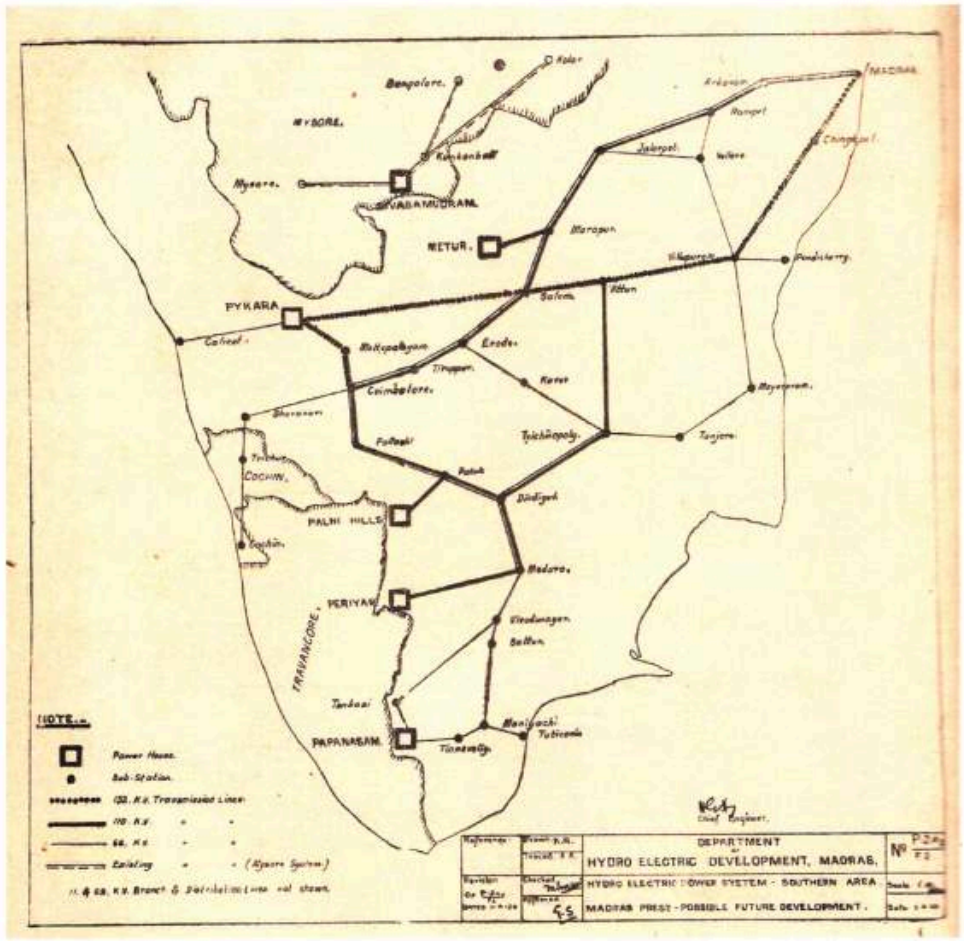
SUDHIR CHELLA RAJAN

HUMANITIES AND SOCIAL SCIENCES

IIT MADRAS, CHENNAI

A RAPIDLY MODERNISING ENERGY SYSTEM

- Grid electricity came to India first in 1889 in Calcutta, when the first few streets were electrified.
- By 1933, there were a handful of mostly hydropower plants from Darjeeling and Jammu to Mettur.
- The 1948 Supply Act treated electricity as a dual subject and set up State Electricity Boards. SEB expansion and the associated political economy of electricity mark an important chapter in India's institutional history

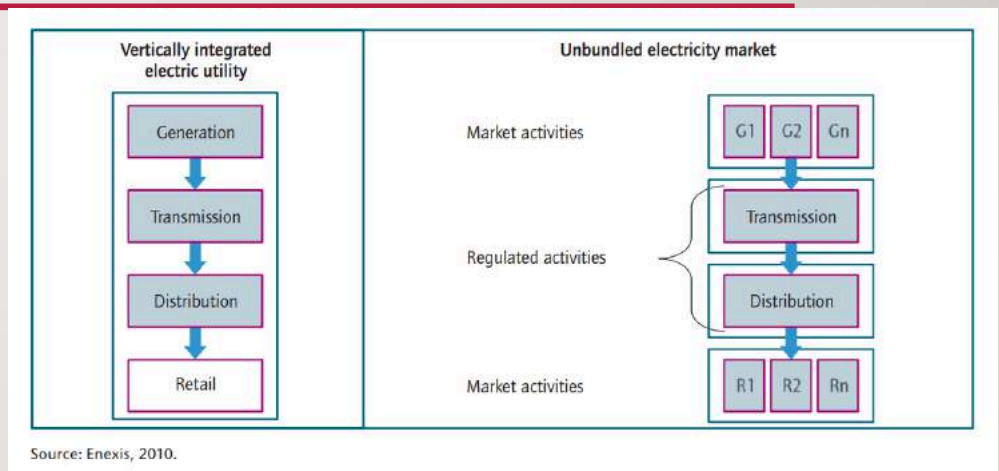


Water Power development in Southern India (1933)
(Indian Water Power Plants, Shiv Narayan)

Source: Madan et al (2007)

THREE PHASES OF POST-INDEPENDENCE DEVELOPMENT

- Context
  - Capacity and access growth
  - Investments
  - Fiscal and other governance structure
  - Planetary context

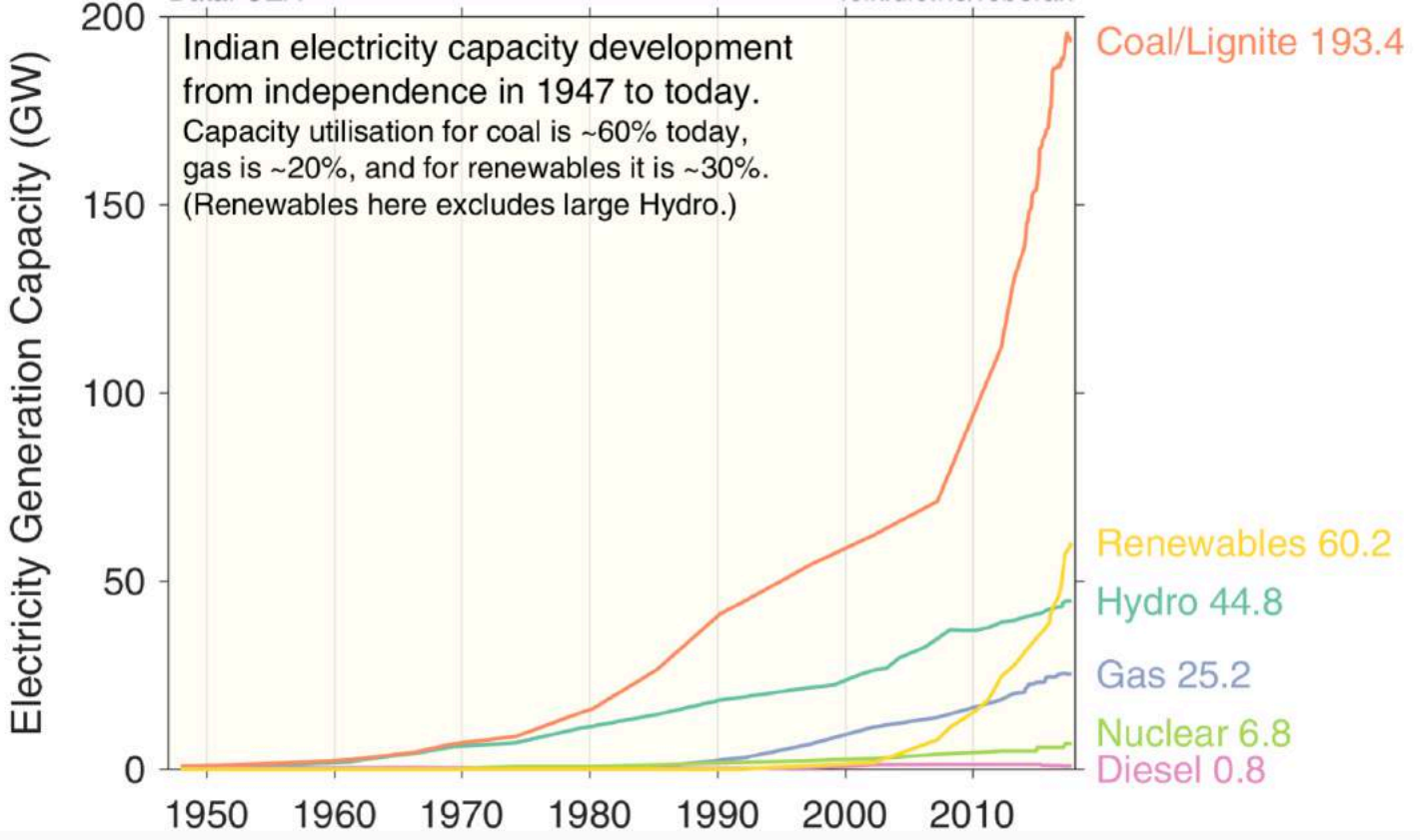


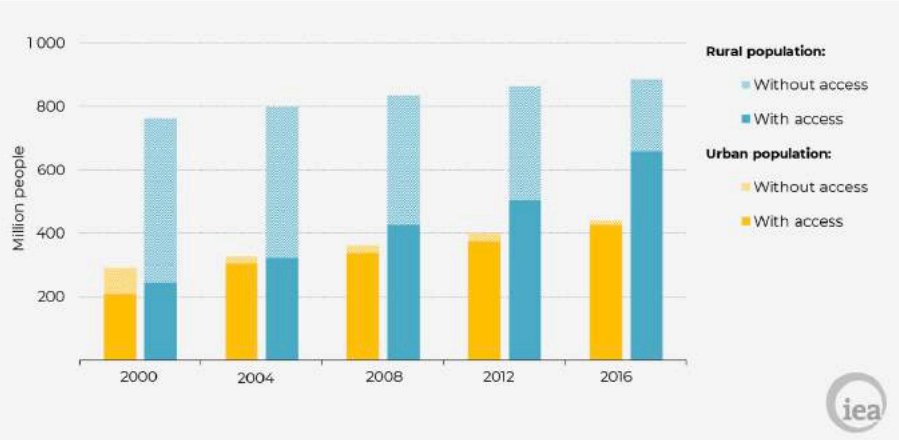
Source: Enexis, 2010.

- 1948-1994 – vertically integrated state utilities, debt financing
- 1995-2004 – national grid, SEB fiscal crisis, unbundling, IPPs, independent regulation
- Post 2004 – increasing role for private power, significant drive towards electrification, renewables, bulk trading through reverse auction, move towards 'open access' and retail competition.

TRENDS

- India's electricity generation expansion has been most dramatic post 2005, particularly for coal and renewables
- Energy access has also seen substantial growth
- Losses remain high





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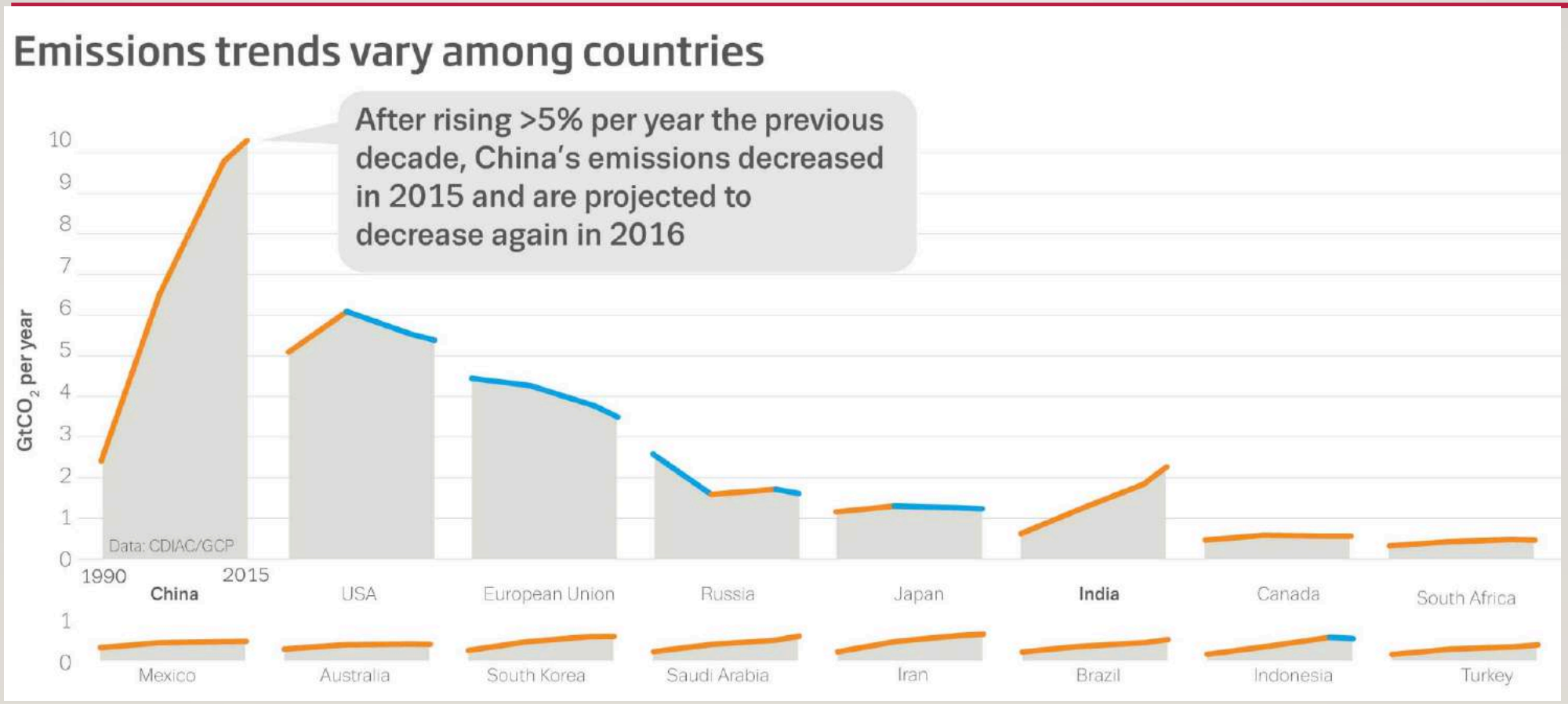
International Energy Agency

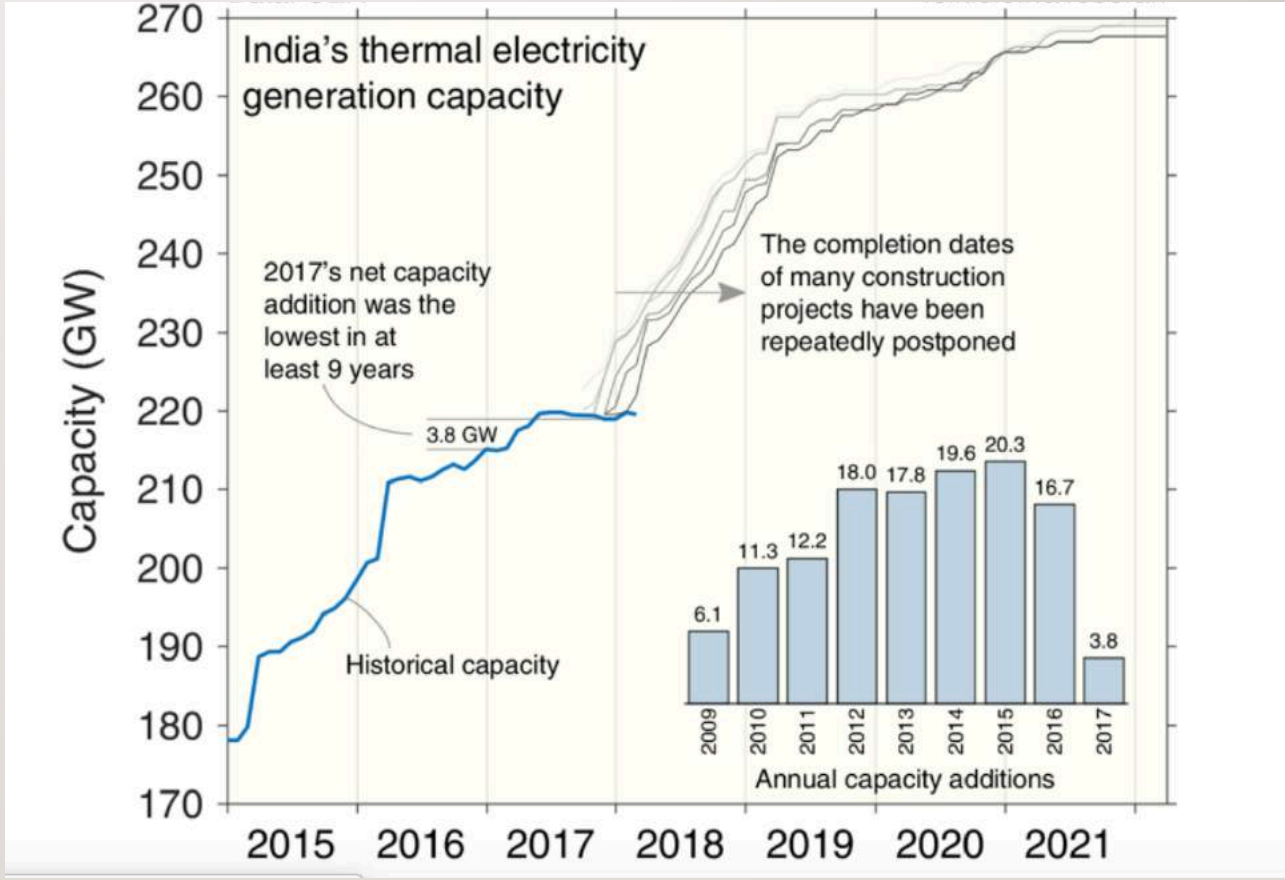
INDIA'S EMISSIONS – LATE TO THE PARTY?



Global Carbon Project

A SCHIZOPHRENIC ENERGY SYSTEM?

- NDC at Paris 2015: 175 GW of renewables in 2022
- No new capacity for coal required between 2017-2022, but 50GW of *commitment*
- 2030 target – 40% of capacity non-fossil (currently 27% capacity and about 10% generation) → 22% generation



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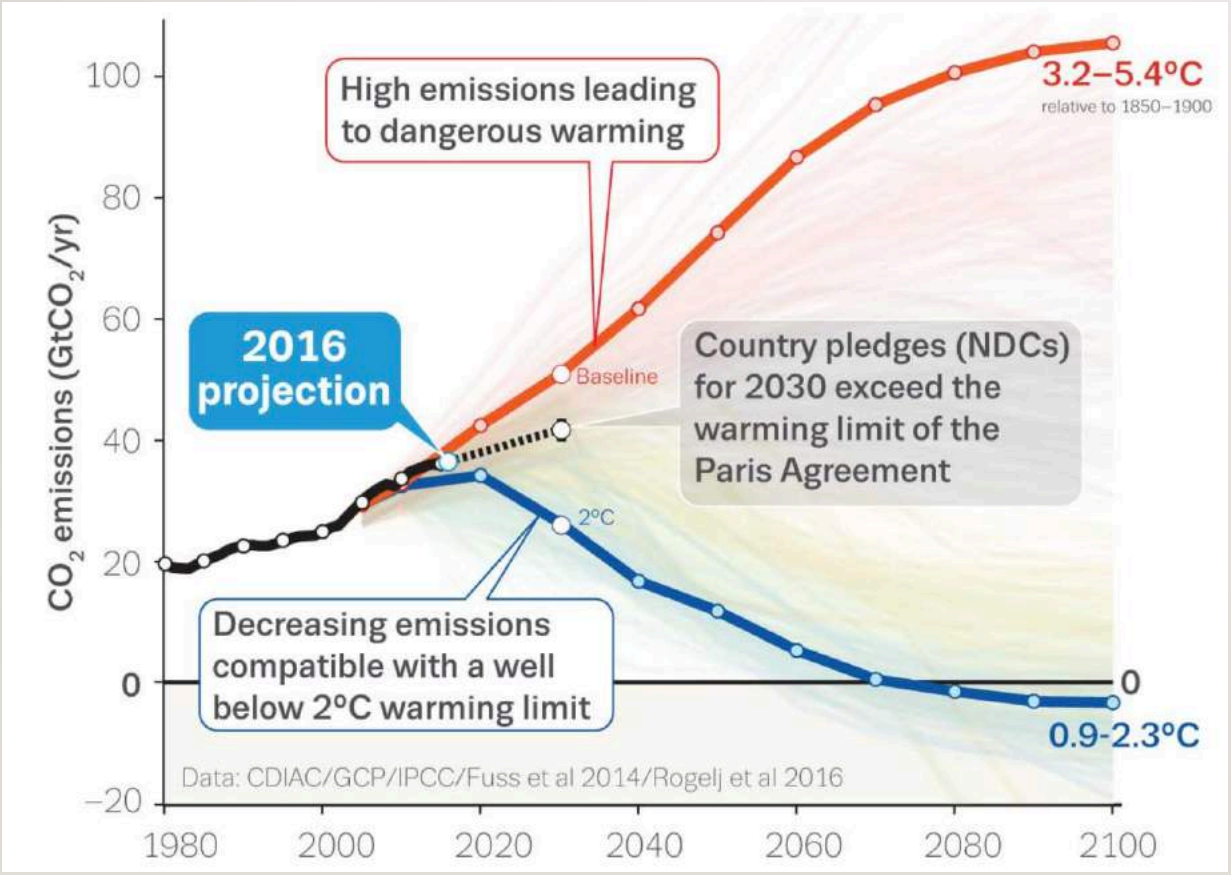
PLANETARY BUDGET



- A global CO2 emissions peak in 2020 at a 2.5-3% annual decline will still require annual negative emissions of about 20GtCO2 by the end of the century…
- …in order to give us a bett er than 50-50 chance of avoiding 2 degrees warming.
- Alternative is ‘hothouse Earth’ or ‘runaway warming’ (Rockstrom et al 2018)

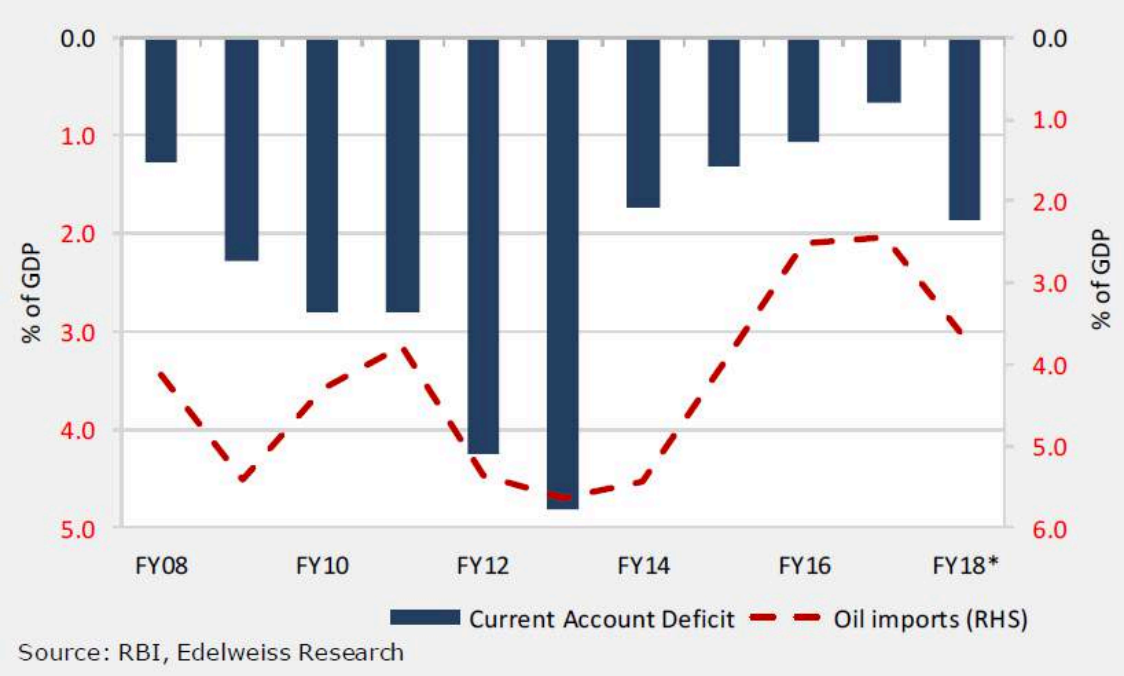
Global Carbon Project

TECHNOLOGICAL, FISCAL AND OTHER INSTITUTIONAL LOCK-INS

- In the 1980s, a few targeted promises for free electricity to farmers cascaded out of control into a historic political compromise➔ de-metering of irrigation pump-sets, fiscal challenges for SEBs, heightening cross-subsidies from industry and commercial segments to mostly wealthy farmers and the growing perception of the public utility as an inefficient and incompetent enterprise (Dubash and Rajan 2001)
- Since the 2000s, with massive investment in refineries, LNG and natural gas pipeline infrastructure, carbon-intensive development patterns and an increasing reliance on fossil fuel imports, the country is getting locked into a long-term fossil-fuel technology 'fix'. This potentially raises the spectre of a future 'stranded asset' challenge.
- 75% of building stock in 2040 still to be built, but if current trends in cement and iron and steel were to continue, this would lock in a considerable amount of carbon.

TECHNOLOGICAL, FINANCIAL AND OTHER INSTITUTIONAL LOCK-INS (*CONTD.*)

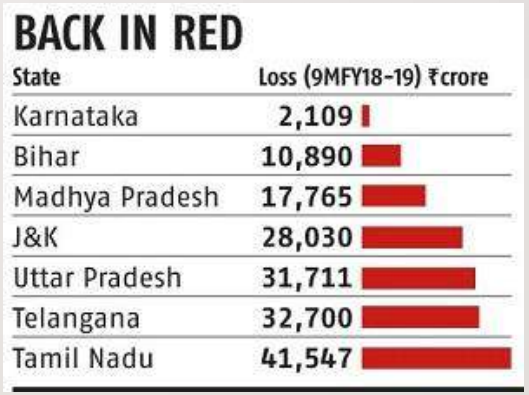
- Electricity Act 2003 introduced several much needed reforms – independent regulation, distributed generation and supply, rural electricity expansion
- Challenges associated with weakening public sector institutional development, financial stability of distribution segment, which largely remains in the hands of the public sector
- Market institutions and subsidies have been grafted onto statist system (subsidies for politically powerful consumer groups and politically connected producer elites) (Chatterjee 2017)



Source: RBI, Edelweiss Research

SUSTAINABILITY CHALLENGES

- Fiscal condition of DISCOMs
- Affordability
- Climate change
- Energy imports
- Resource use (water, land)
- Environmental pollution



Business-standard (2019)

Pollutant	INR crore	USD million
SO_2	67,416	9,438
NO_x	15,430	2,231
PM	3,289	476
Total	**86,135**	**12,059**

Capex cost of abatement from power plants (IISD 2019)

PATHS TO SOLUTION

- Improve the finances of DISCOMs:
  - Allow them to capture energy efficiency gains
  - Decrease their exposure to subsidies
  - Enhance the scope of distributed power and community-scale micro-utilities
  - Use efficiency and distributed renewables as a way to avoid large capex investments
- Improve access and affordability/environmental management
  - Integrated Resource Planning at regional scale
- Reduce portfolio risk
  - Avoid securitization of power sector assets/enhance joint ownership
  - Increase share of decentralised, grid-connected renewables for energy independence