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Driving electricity decarbonisation in India

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IEA Expert Workshop: Challenges in Electricity Decarbonisation
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Risks & Adaptation

Technology, Finance, & Trade

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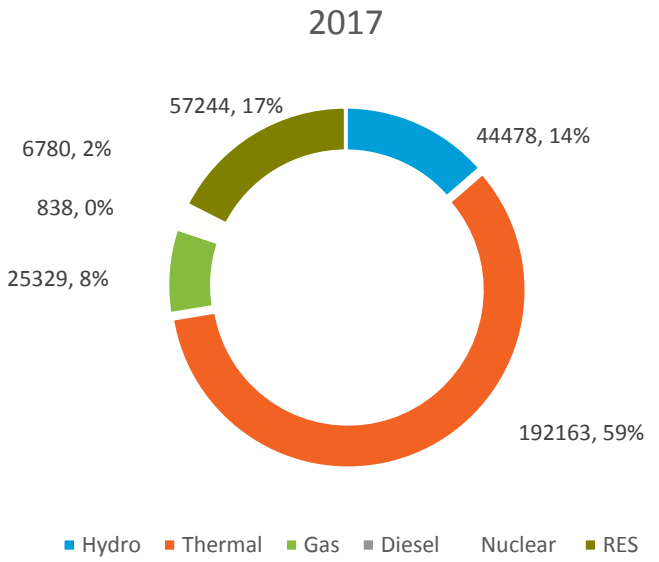
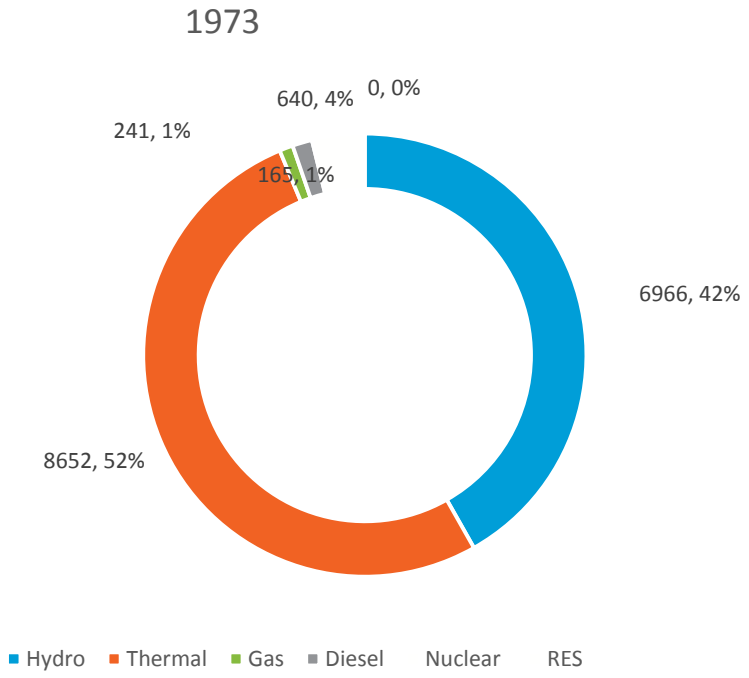
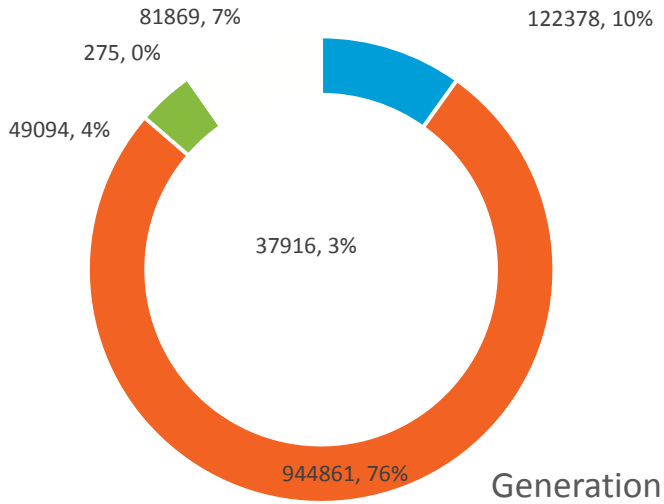
What's the end game?

Electricity mix ….. yesterday and today







Generation Share, 2017

SOURCE: CEEW; CEA

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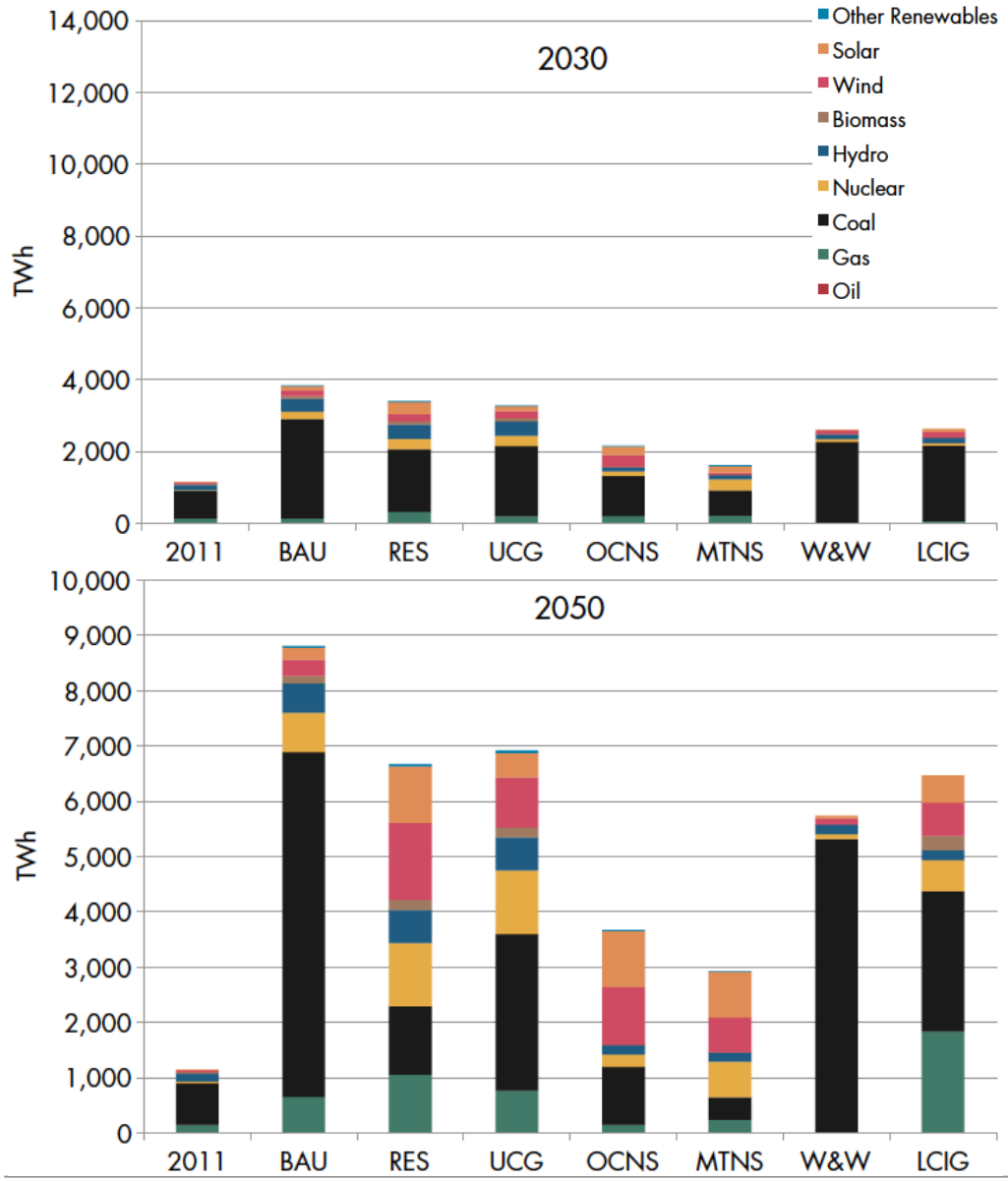
Electrification to increase energy system resilience



- A range of generation options are required, whichever scenario is followed
- Clean coal, gas, nuclear will be needed to supply base-load and can be the basis for a low-emissions system
- **Five of the seven scenarios show significant future generation coming from renewables (wind and solar)**
- Both BAU and W&W are unsustainable from a coal consumption perspective. Coal generation capacity would be mothballed without significant coal imports

SOURCE: Bery, Ghosh, Mathur (2017)

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Electricity mix ….. today and tomorrow

Source	2010	2015	2020	2025	2030	2035	2040
Biomass	1%	0.5%	0.2%	0.2%	0.4%	0.4%	0.3%
Coal	67%	77.0%	72.1%	66.5%	59.7%	53.1%	47.1%
CSP	0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.3%
Gas	12%	4.1%	5.9%	4.2%	3.2%	2.4%	1.7%
Geothermal	0%	0.0%	0.3%	0.5%	0.4%	0.4%	0.3%
Hydro	14%	10.5%	8.3%	6.5%	5.1%	4.1%	3.5%
Nuclear	3%	3.1%	5.0%	5.5%	5.5%	5.3%	5.1%
Oil	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PV	0%	1.0%	4.5%	10.4%	16.9%	23.4%	29.7%
Wind	3%	3.8%	3.8%	6.1%	8.8%	10.8%	12.1%
TOTAL	100%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

SOURCE: Chaturvedi et al / CEEW (2018)

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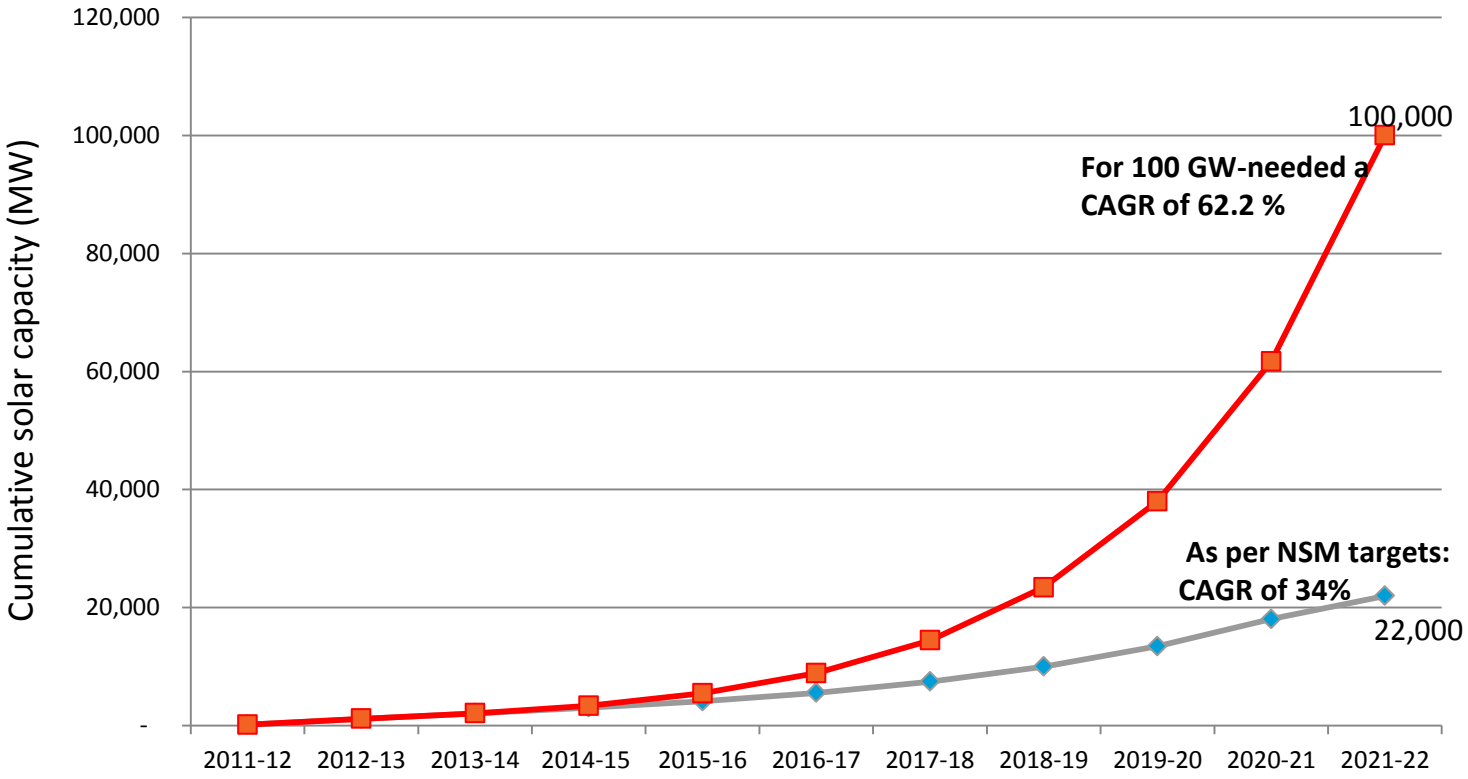
Driver 1: Ambition

Tapping every ray of the sun



- In getting to 100GW of solar capacity, the required CAGR of 62.2% will mean cumulative installed capacity doubling every 18 months.

SOURCE: CEEW (2014)

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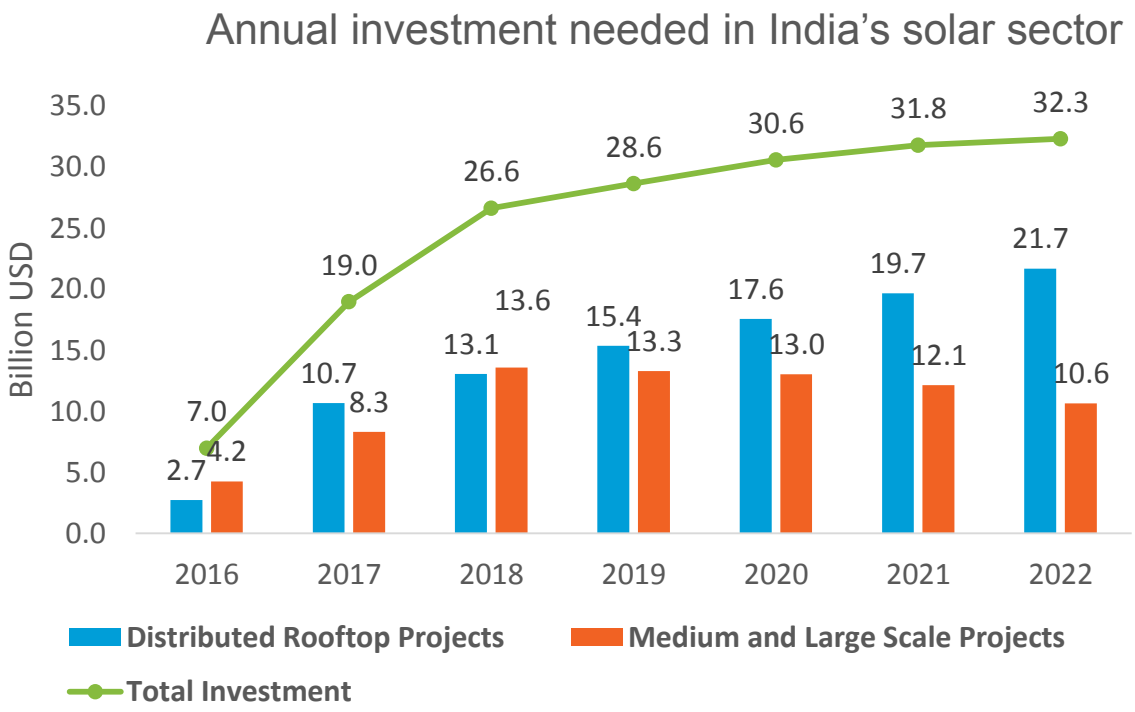
Investment requirements ….. to fund a revolution

RE Investment Flows	Average 2013-2017 (USD Billion)	2017 (USD Billion)
India[1]	10.0	10.9
Global[2]	321	334



1 Source: BNEF (2018); Chawla (2016)

2 Incudes large hydro investments

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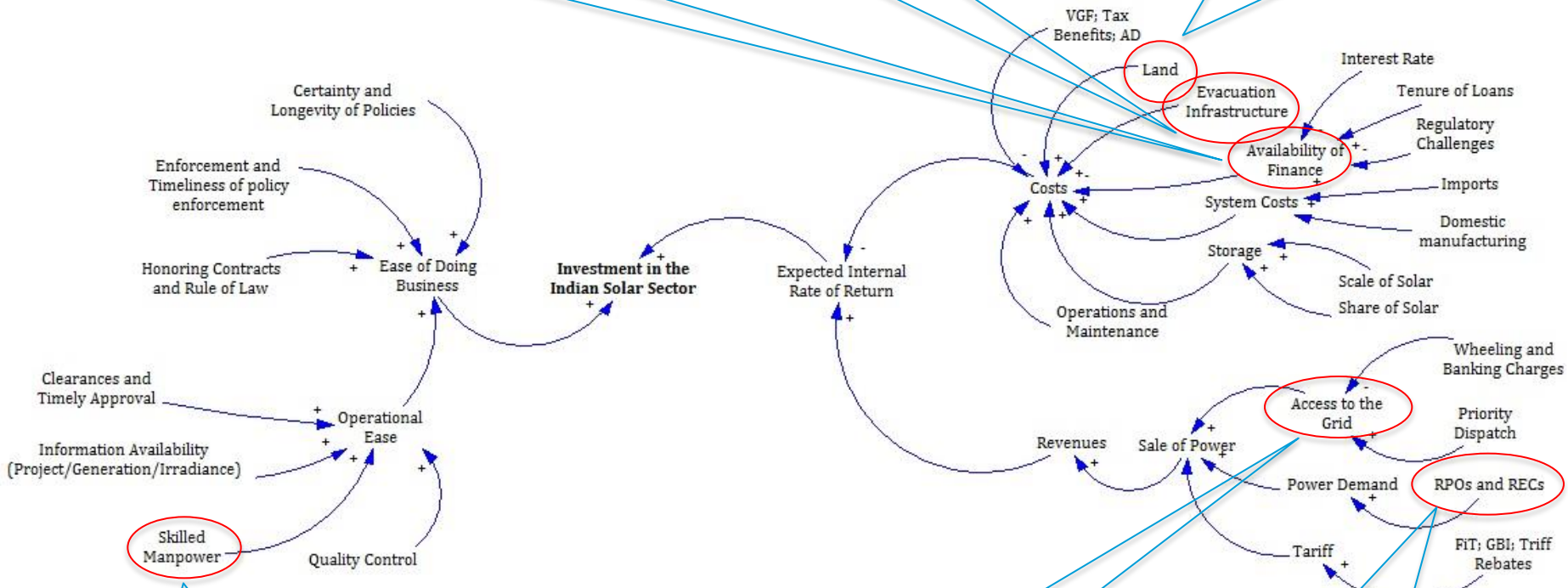
Driver 2: Perception

What factors determine returns in renewable energy?

Offtaker risk
Evacuation infrastructure risk
Foreign exchange risk
Construction & regulatory risk
Technology risk

Evacuation infrastructure within solar parks
Green Energy Corridor
Deemed generation

Solar Parks; Mega Solar Parks
Rajasthan land leasing
Karnataka aggregation & leasing
Madhya Pradesh exemptions on stamp duty



1,116,400 jobs for 100 GW solar
180,000 jobs for 60 GW wind
50,000 *Surya Mitras*
Skill Council for Green Jobs
National Certification Programme for Rooftop Solar PV Installer

Forecasting of RE generation
Renewable sources exempted from inter-state transmission charges – National Tariff Policy
Pilots on energy storage

8% by 2019 (National Tariff Policy)
Extended to open access users and captive power (draft RE Act)
DISCOMs can now procure bundled solar power on a cost plus basis
REC price band revised downwards to stimulate active REC trading

SOURCE: CEEW analysis

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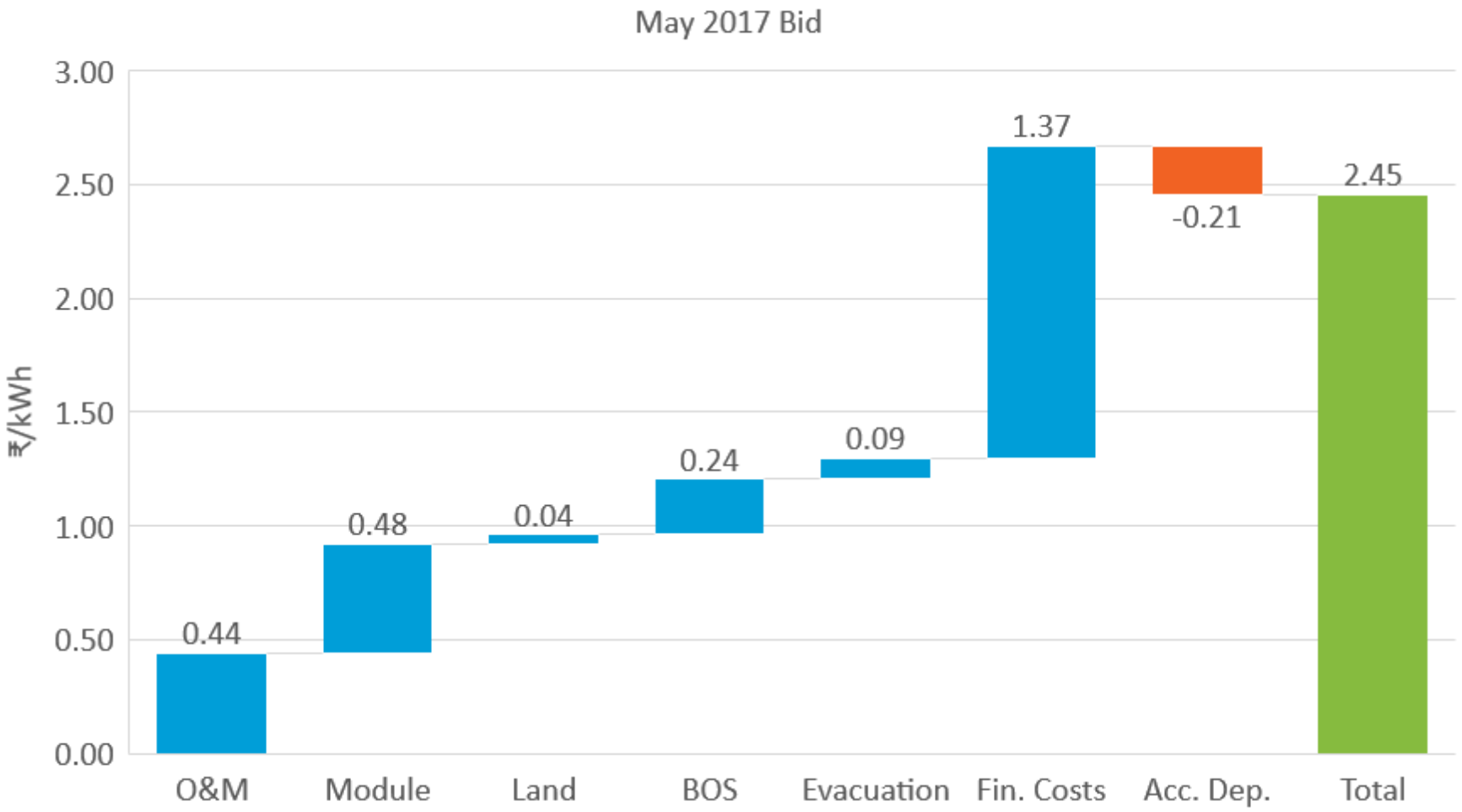
Anatomy of an RE tariff: risk perceptions determine costs of finance



SOURCE: CEEW (2017)

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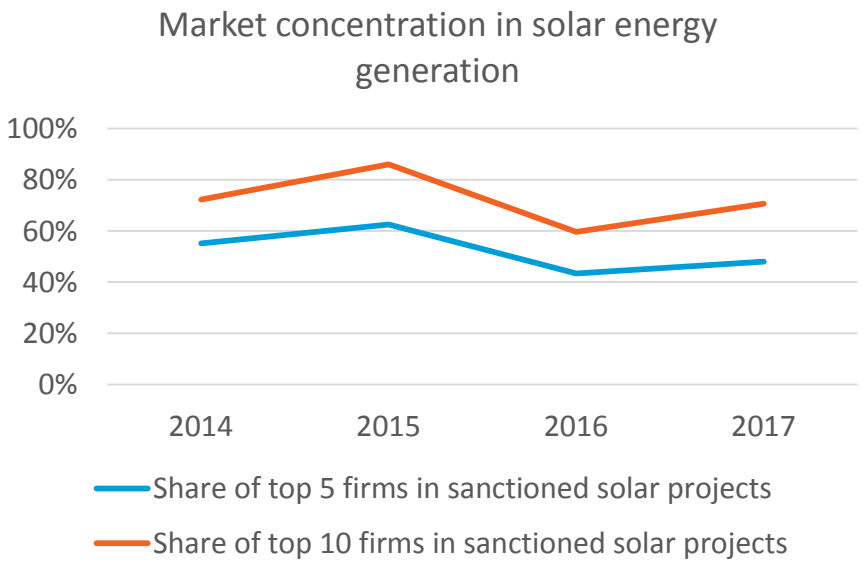
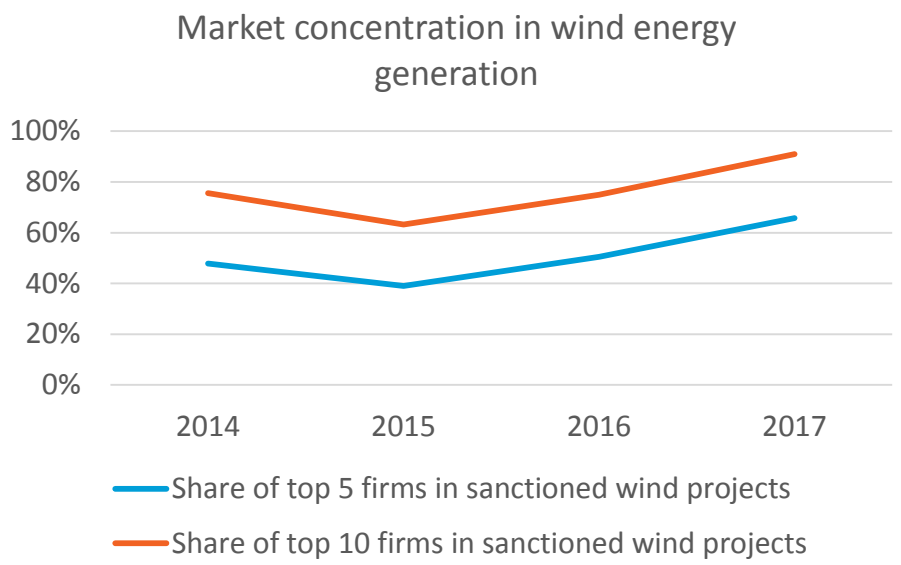
Greater market concentration among RE developers

Access to finance on favourable terms is key

- Well-established industry players with access to favourable sources of finance through foreign sources of capital, balance sheet strength or by virtue of being state-owned enterprises have been instrumental in driving RE deployment in India





Source: CEEW and IEA (2018)

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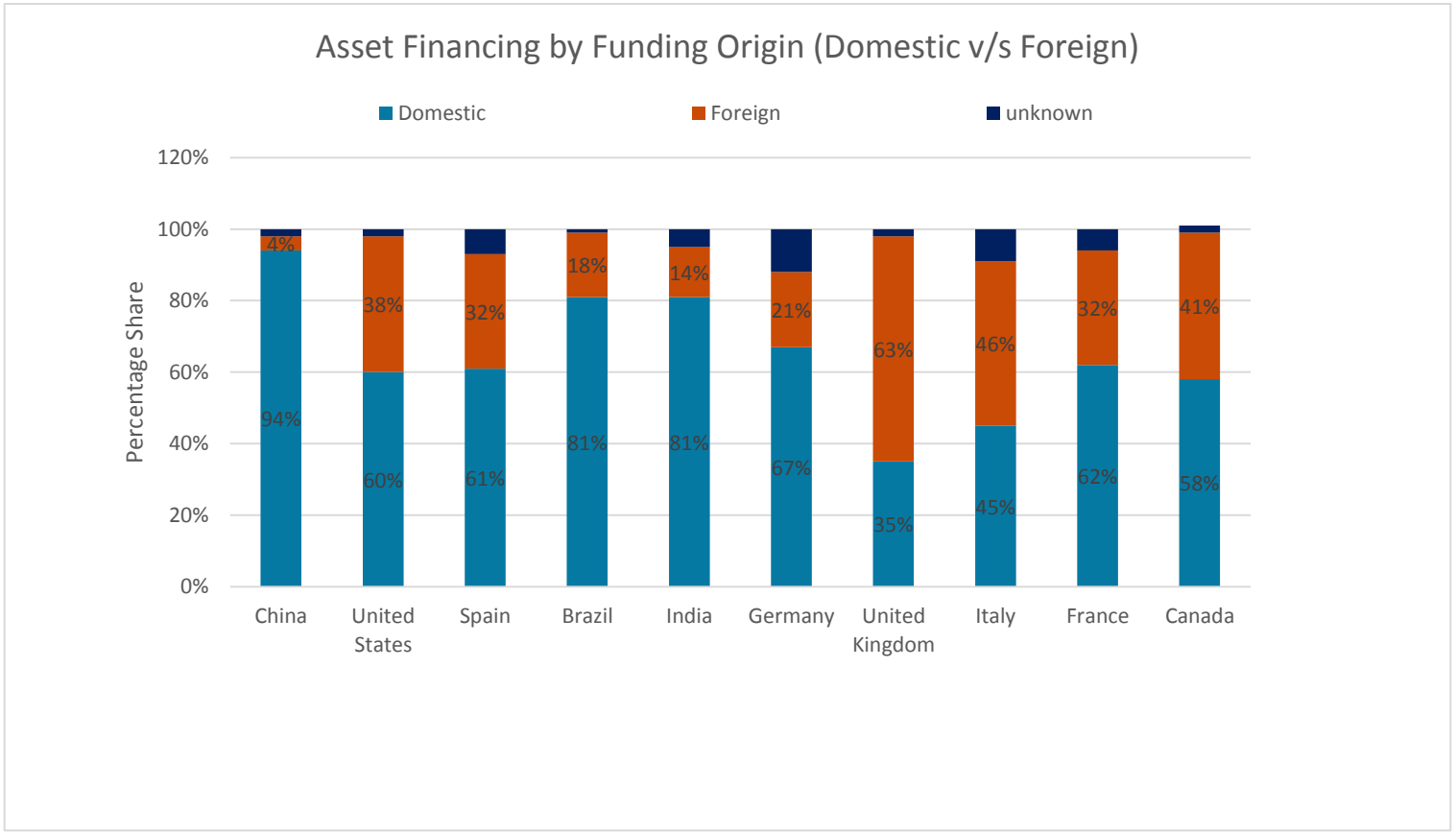
Emerging economies receive only a small share of foreign funding



SOURCE: Ghosh and Chawla (forthcoming); BNEF (2016)

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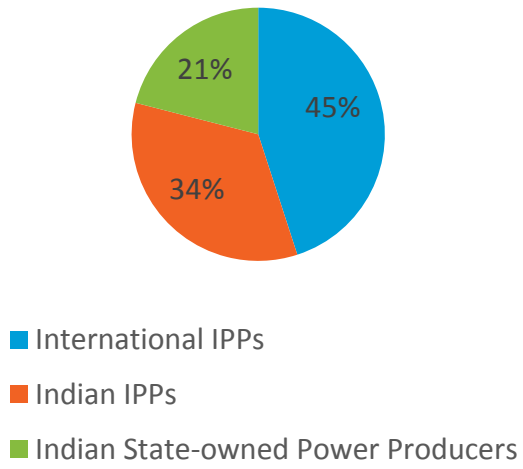
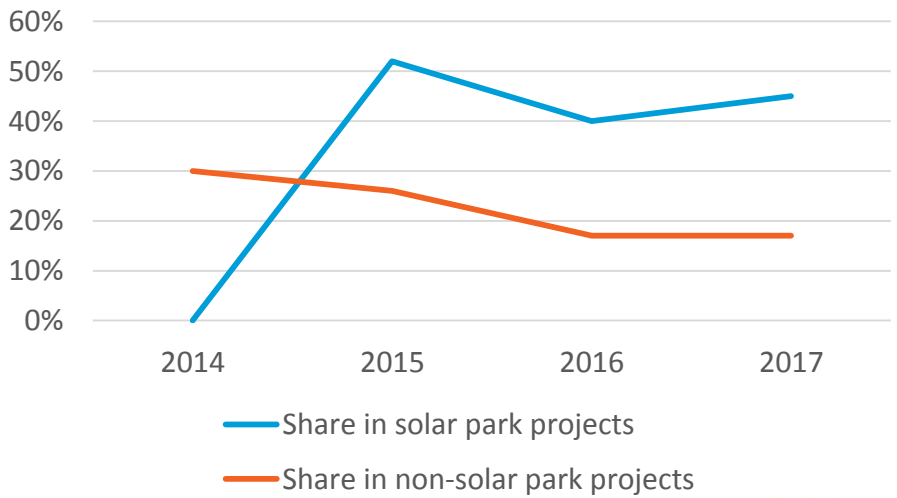
The role of solar parks in investment decisions is growing

- Solar parks are increasingly helping to managing land acquisition and evacuation infrastructure risks for solar PV projects. Over half of solar PV projects sanctioned in 2017 were based on solar parks.
- Share of solar parks in overall projects sanctioned rose from 38% in 2015 to 54% in 2017
- The plug-and-play model offered by solar parks has helped attract foreign investment in solar energy
- High solar park charges are a matter of concern for the industry

Share of projects at solar parks (2014-2017)



Solar investments by international IPPs



Source: CEEW and IEA (2018)

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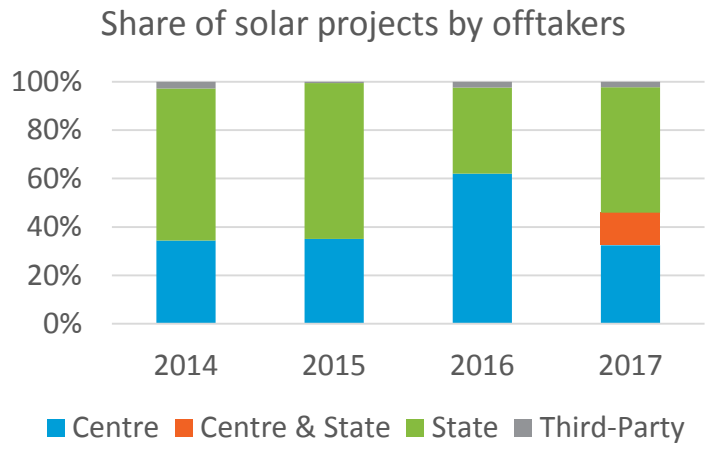
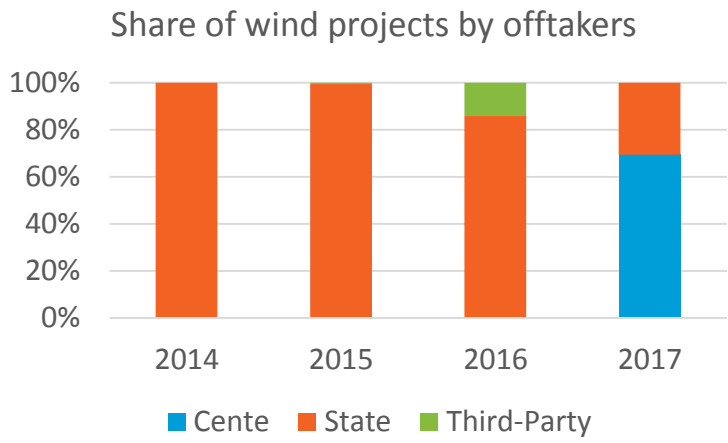
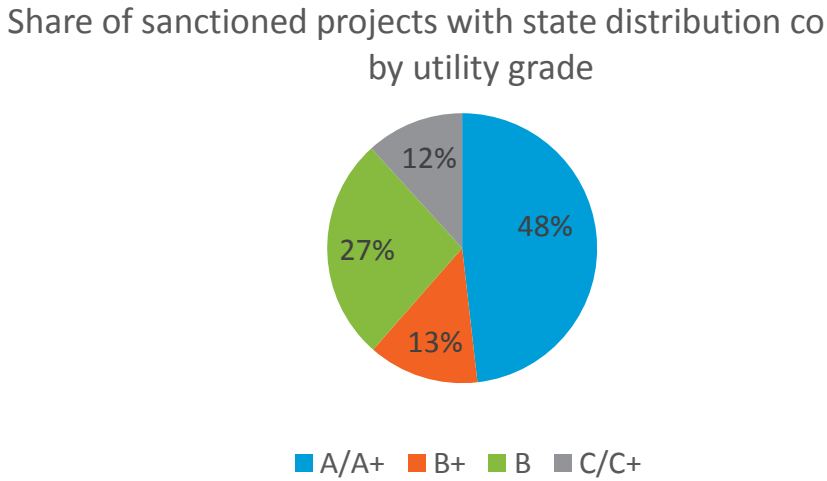
Creditworthiness of offtakers strongly impacts investment

- Preference for creditworthy central offtakers for solar and wind projects
- Creditworthy state DISCOMS account for the majority of state offtakers







As per Ministry of Power's Fifth Annual Integrated Rating for State DISCOMs, 2017

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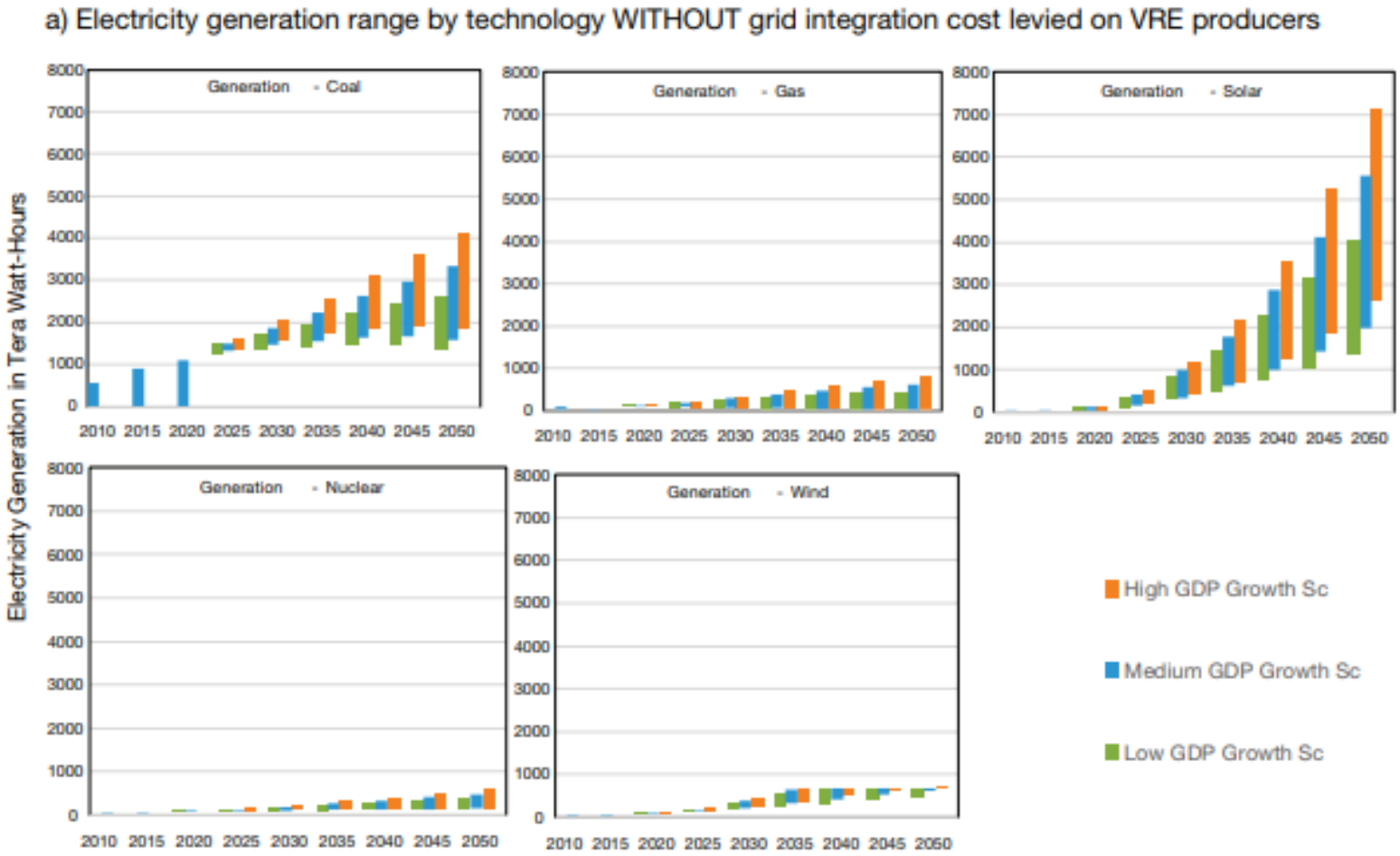
Driver 3: Integration

What gets built and used: who bears integration costs?



SOURCE: Chaturvedi et al / CEEW (2018)

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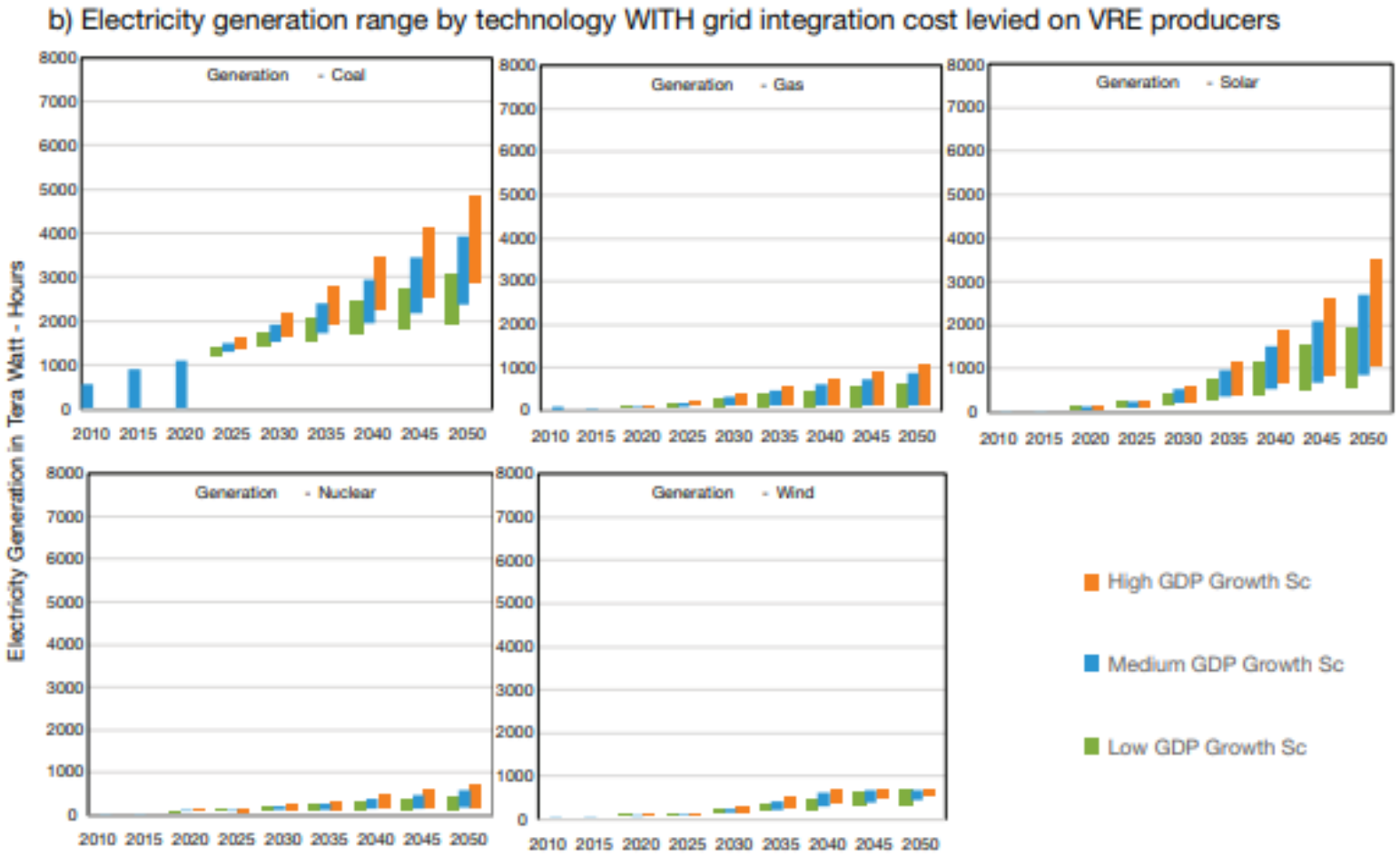

SOURCE: Chaturvedi et al / CEEW (2018)

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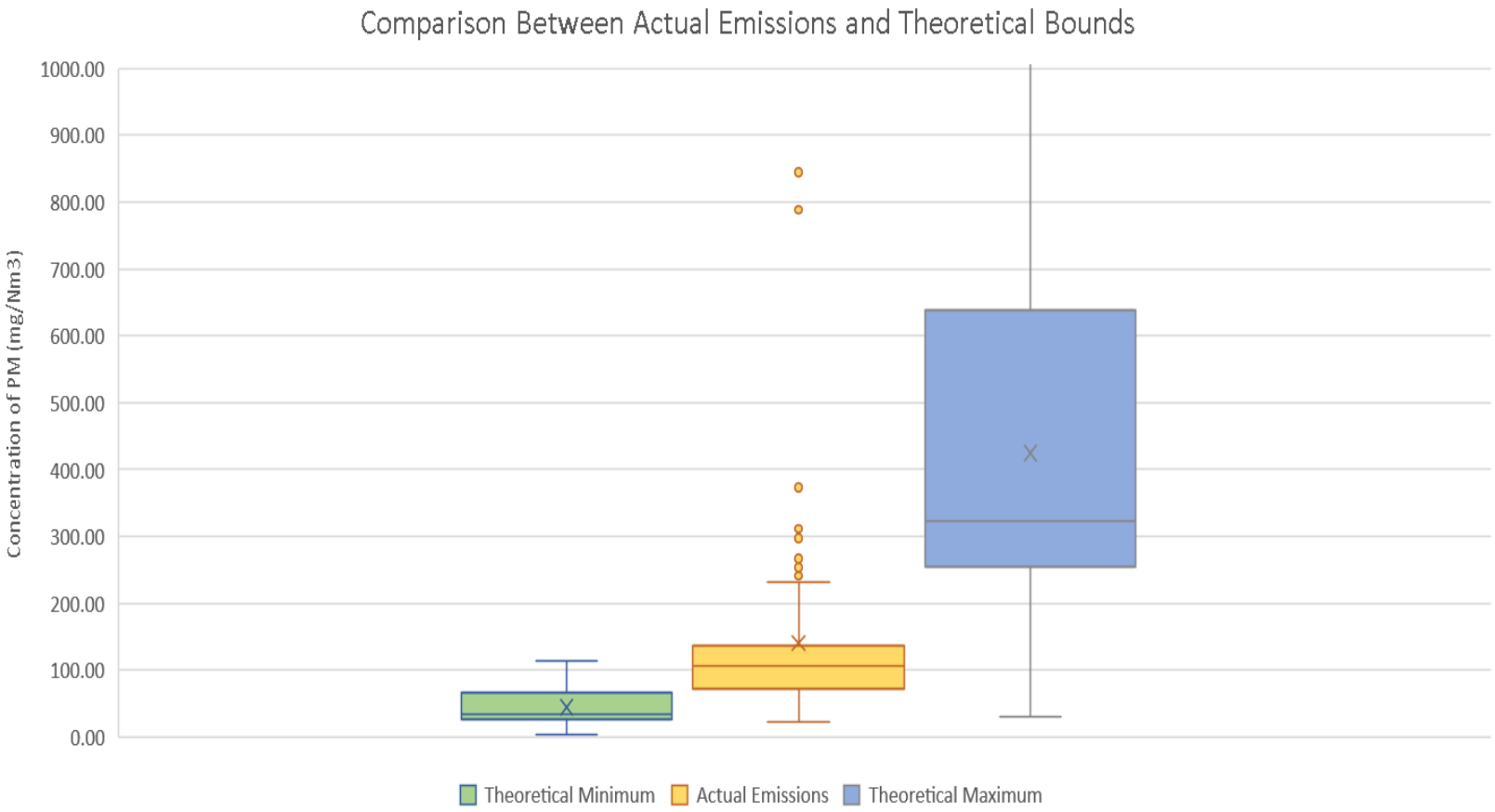
Driver 4: Emissions

Current emissions performance



- Incremental investment to comply with SOX norms is USD 7300 – USD 10000 / MW
- Incremental investment to comply with PM2.5 norms by retrofitting ESPs is USD 1500 – USD 2200 per MW
- Total investment requirement could be ~ USD 11 Billion if all notified plants are to be retrofitted

SOURCE: CEEW anaysis of CEA data; Ghosh and Ganesan (2018); ICRA 2016, CSE 2018

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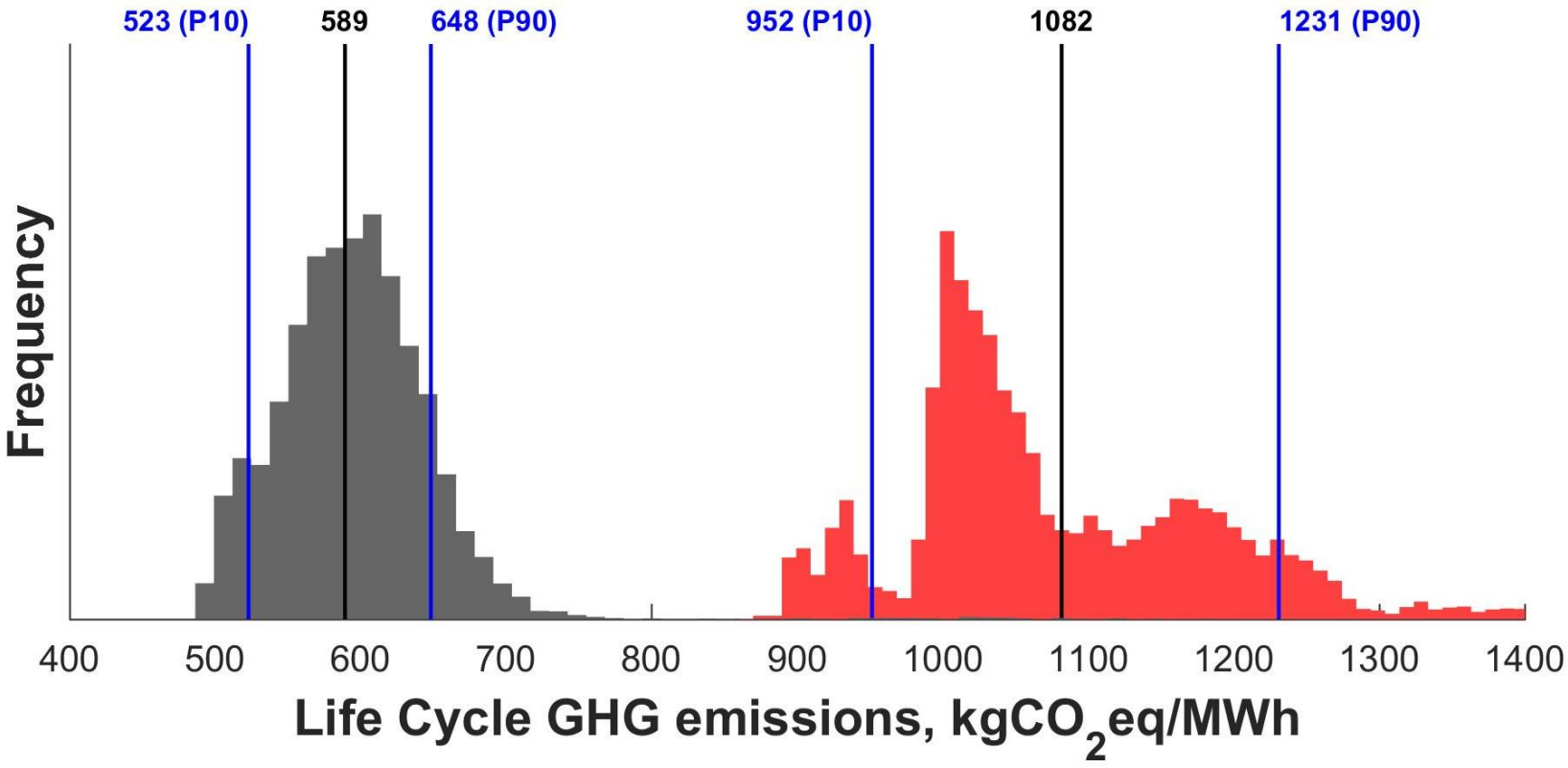
Indian coal power has ~2X GHG emissions of gas-based generation



SOURCE: CEEW, ExxonMobil, IITB (Forthcoming)

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Driver 5: Taxation

What role can a carbon price play?

- Factoring in central and state levies
  - For gasoline – the tax rate is effectively 50% of the market price of the commodity
  - For diesel – the tax rate is ~ 45% o the market price of the commodity
  - In addition there's a levy of 75 US cents on every tonne of crude
  - 20% excise duty on domestically produced crude
  - Royalties, pollution taxes and other cesses are not included in this list
  - Latest cuts in petrol and diesel duties could result in loss of USD 1.13 billion of tax revenue by end-FY19

- Do we really need more taxes to control the demand for these fuels?
  - The income inequality in India dictates that even at these levels, these are still within the reach of the average Indian you will run into at any COP
  - It will be irrational to impose any more taxes in the name of pricing carbon
  - The existing pool of money goes to a consolidated fund / the treasury. How can it be channelled to promote low carbon development?

SOURCE: CEEW; Ghosh (2018)

Renewing our vows on renewables

- No backsliding
  - Continue raising ambition
- No failed contracts
  - Tackle risk perceptions
- No lost electrons
  - Deal with integration
- No false binaries
  - Deployment versus manufacturing
  - Coal versus RE or Efficient TPPs *and* RE

SOURCE: Ghosh (2018)

Thank you

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