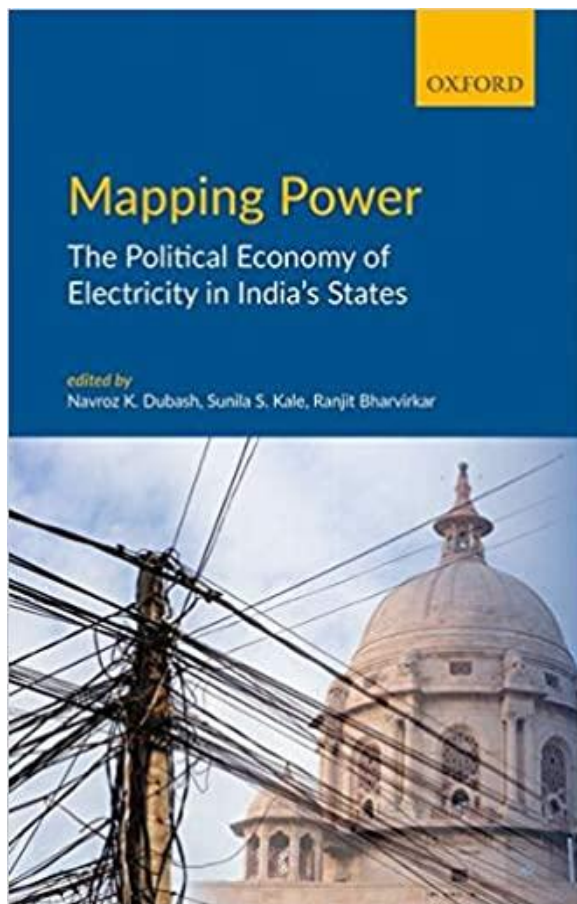
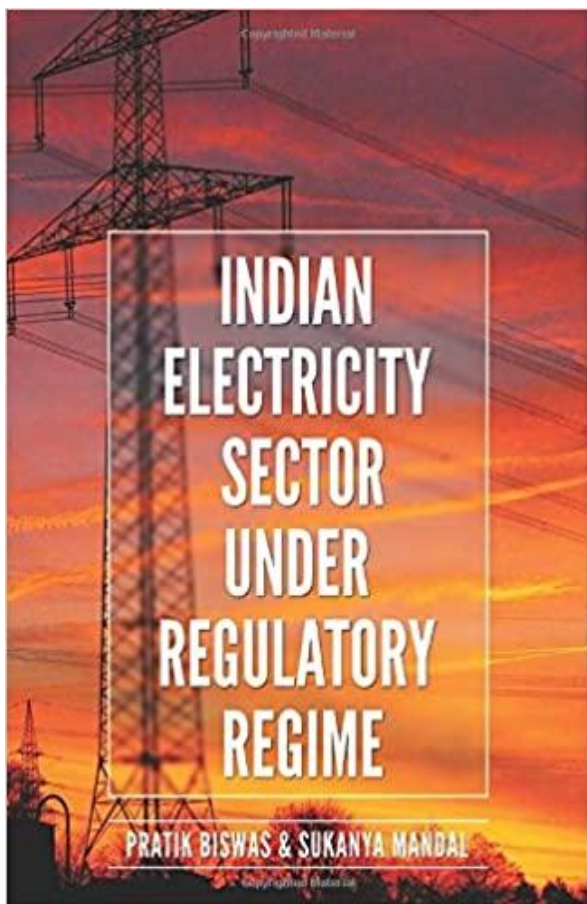


Indian Power Sector 2.0

Synopsis of Indian power sector



Power sector and its menace in India



The image shows a YouTube video player interface. The video content features a man with dark hair and glasses, wearing a white shirt, speaking into a microphone. The video title is "Power sector and its menace in India". Below the video, the text "Financial Opportunities Forum" and "August 20, 2015" is displayed. The video player includes a progress bar at 1:10 / 22:45, a play button, and various control icons. The video has 68 likes and 0 dislikes. The upload date is August 29, 2015. The channel name "VIVID Mutual Fund" is visible in the bottom right corner of the video player.

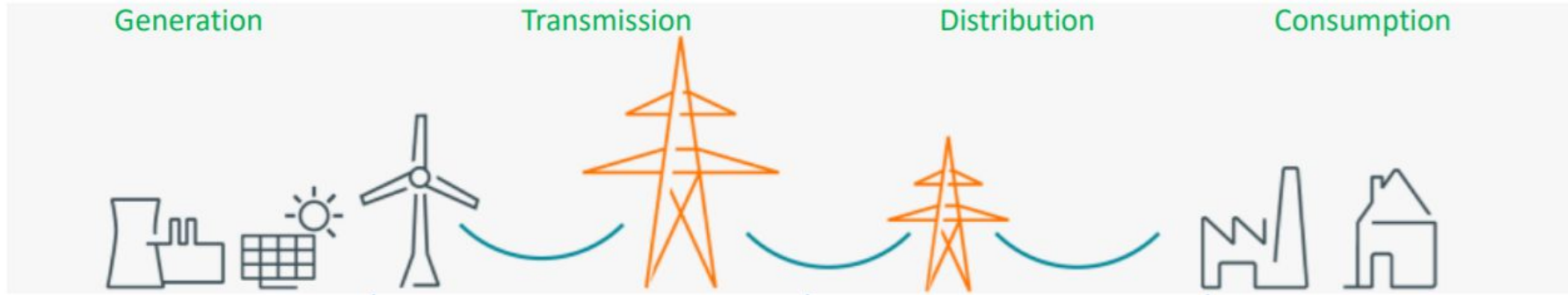
Power sector and its menace in India

Financial Opportunities Forum
August 20, 2015

1:10 / 22:45

68 DISLIKE SHARE SAVE ...

VIVID Mutual Fund



375 GW installed capacity:

- 90 GW renewables
- 47% private
- 20 GW merchant

Generation de-licensed activity

World's largest network

Interstate transmission: 8094 circuit kms

One nation one price

Transmission is licensed

Distribution licensed

Distribution reforms underway:

- Privatisation/ Franchising
- Tariff reforms

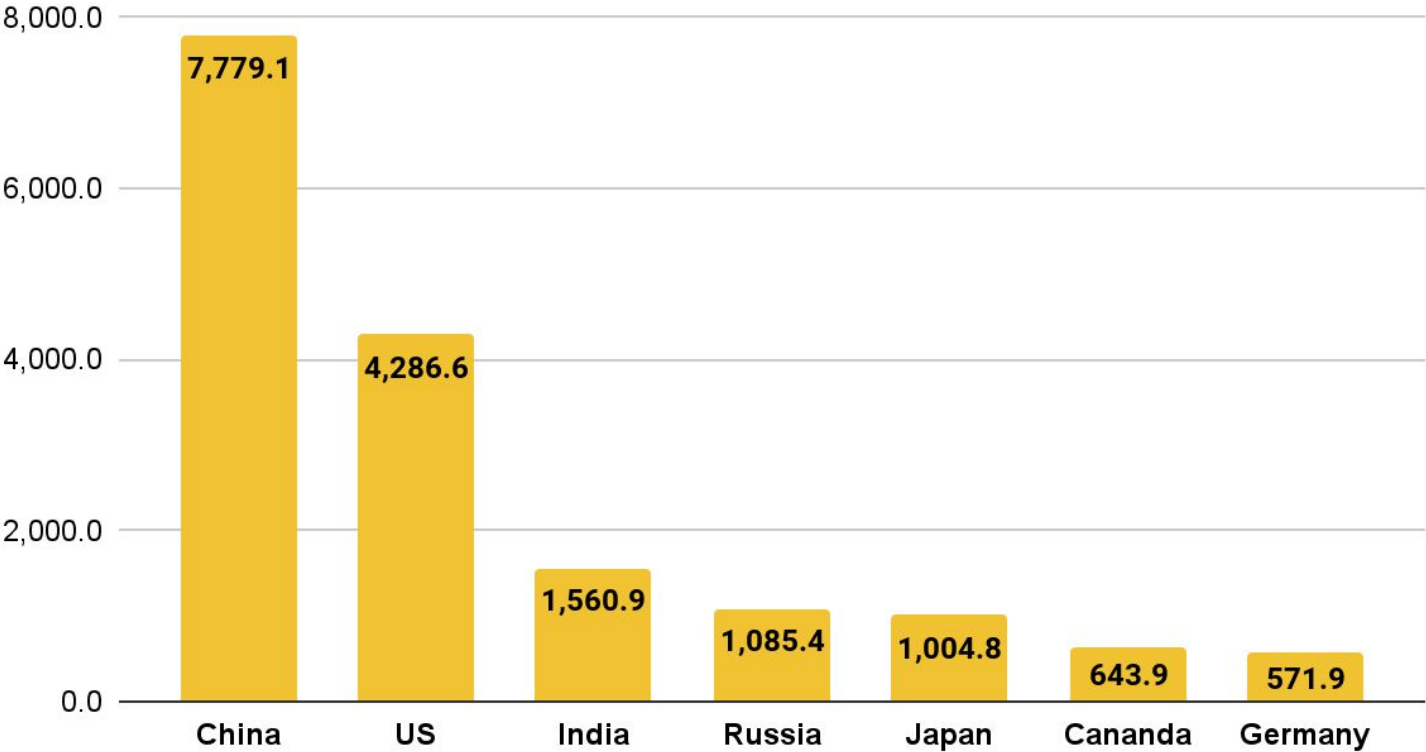
Regulatory strengthening

Power surplus nation

Peak demand at 188 GW

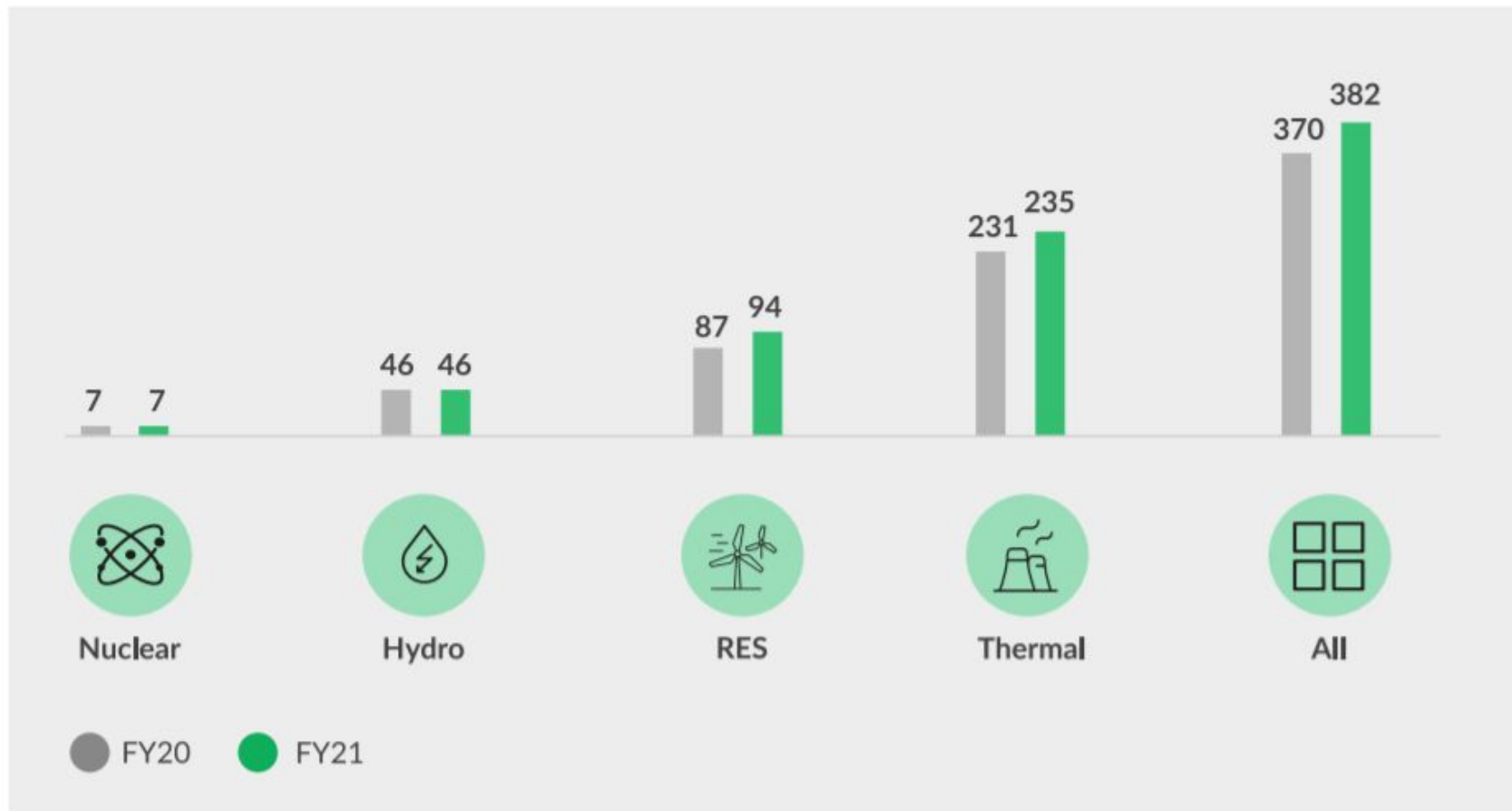
Net exporter of electricity

Countries leading in electricity generation in 2020 (TWh)

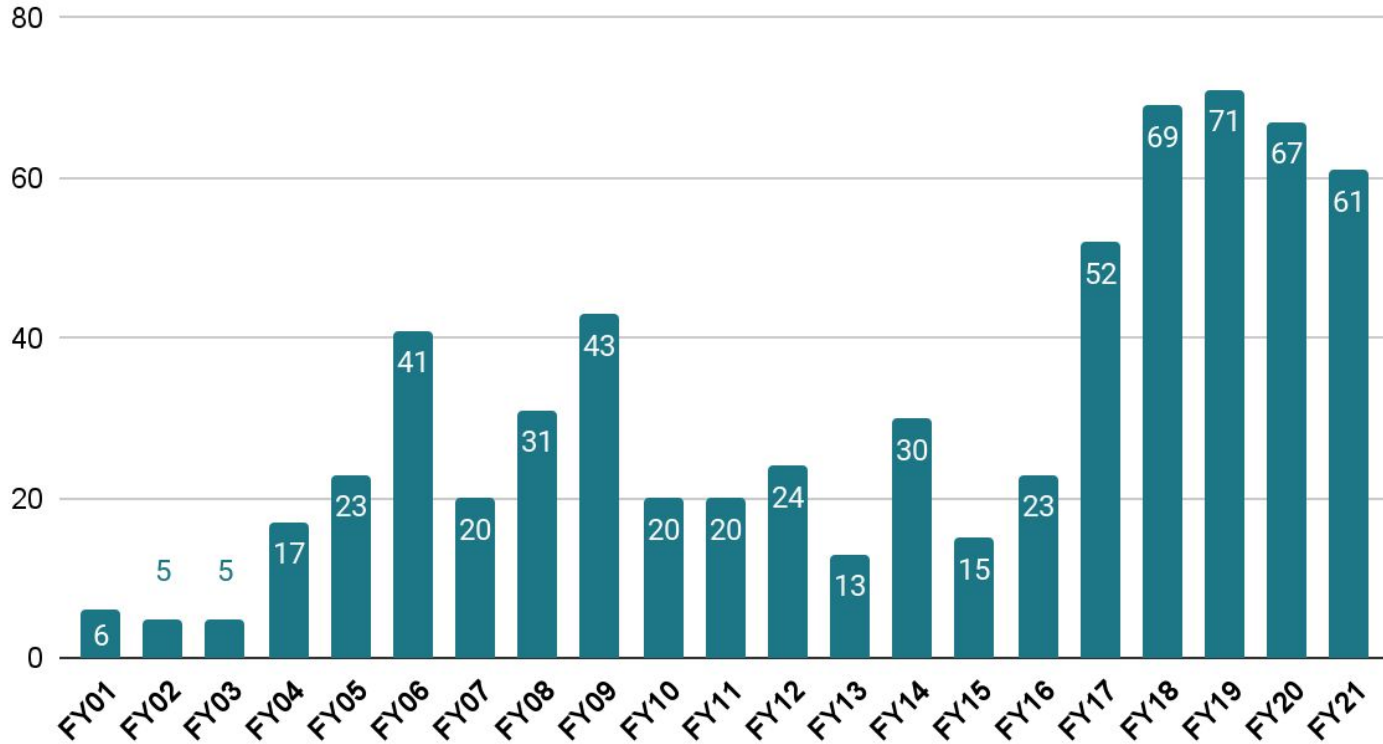


Source: ibef.org

Total Installed Capacity (GW)



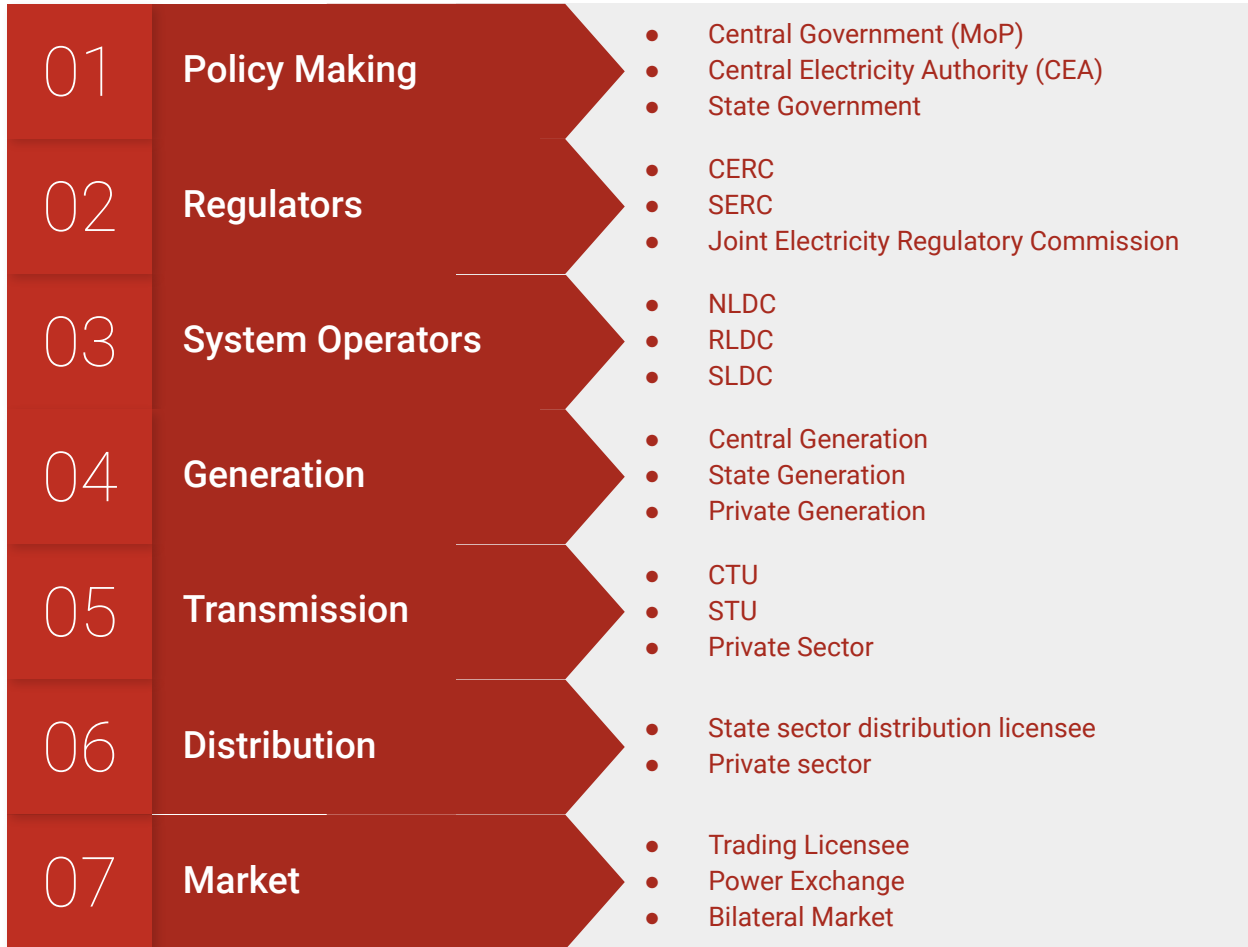
Renewable capacity addition share in total



Source: CEA

Renewable capacity addition

| Year | Target Installed Solar Capacity (MW) | Actual Solar Capacity Installed (MW) | % achievement | Target Installed Wind Capacity (MW) | Actual Wind Capacity Installed (MW) | % achievement |
|--------------|--------------------------------------|--------------------------------------|---------------|-------------------------------------|-------------------------------------|---------------|
| FY16 | 5,000 | 6,763 | 135.3 | 75,000 | 26,777 | 35.7 |
| FY17 | 17,000 | 12,289 | 72.3 | 75,000 | 32,280 | 43.04 |
| FY18 | 32,000 | 21,651 | 67.7 | 75,000 | 34,046 | 45.39 |
| FY19 | 48,000 | 28,181 | 58.7 | 75,000 | 35,626 | 47.50 |
| FY20 | 65,000 | 34,628 | 53.3 | 75,000 | 37,694 | 50.25 |
| FY21 | 82,500 | 40,508 | 48.6 | 75,000 | 39,247 | 52.32 |
| FY22 | 100,000 | 45,612 | 45.6 | 75,000 | 39,691 | 52.92 |
| Total | 100,000 | 45,612 | 45.6 | 75,000 | 39,691 | 52.92 |



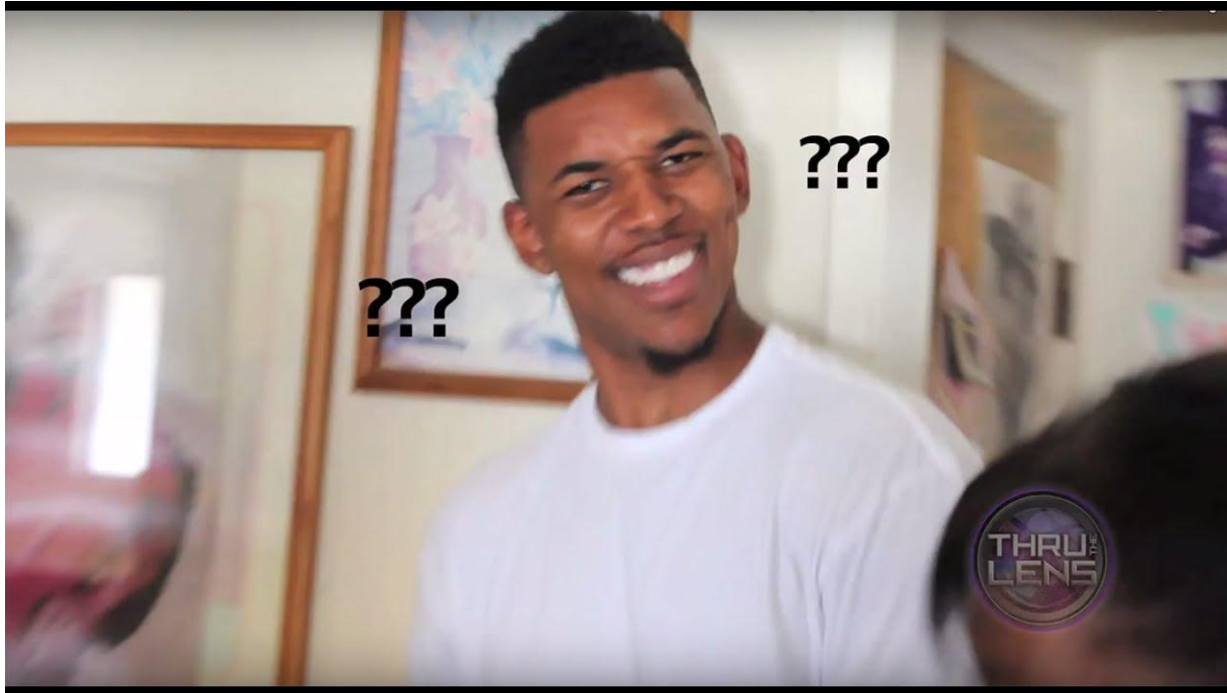
With a liberalised power sector, comes a need for power exchange....

Shortcomings of the Self scheduling mechanism

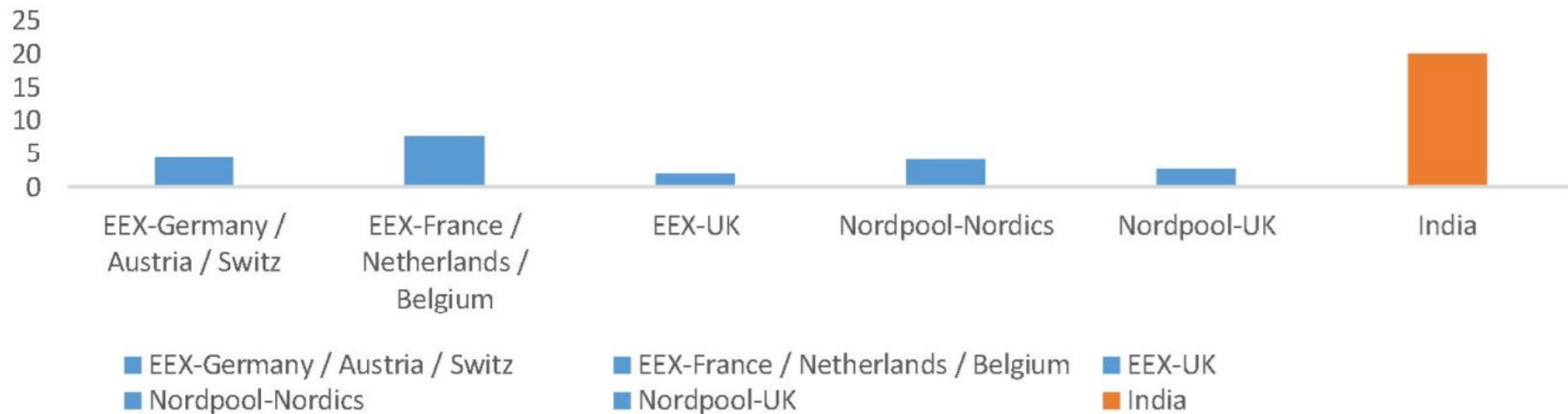
Market Based Economic Dispatch

- Efficiency in power procurement and cost saving
- "One Nation, One Grid, One Frequency, One Price"
- Better integration of renewable energy.
- Improved discipline would be achieved in merit-order based scheduling and transparency of system marginal price

Price coupling, New Exchanges, Transaction Charges ???



Transaction charges by Power exchanges (Rs / MWh)



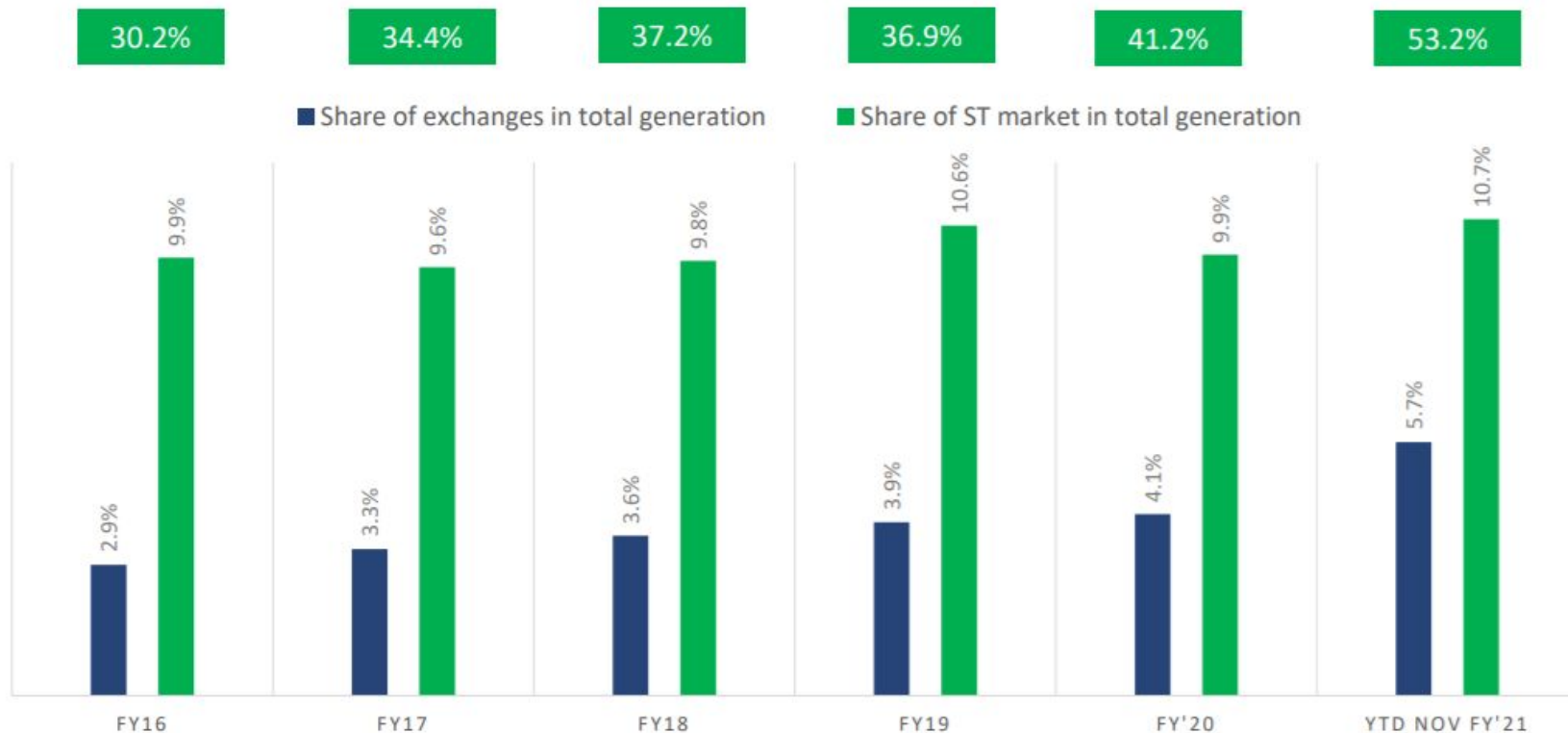
Source: MBED Draft

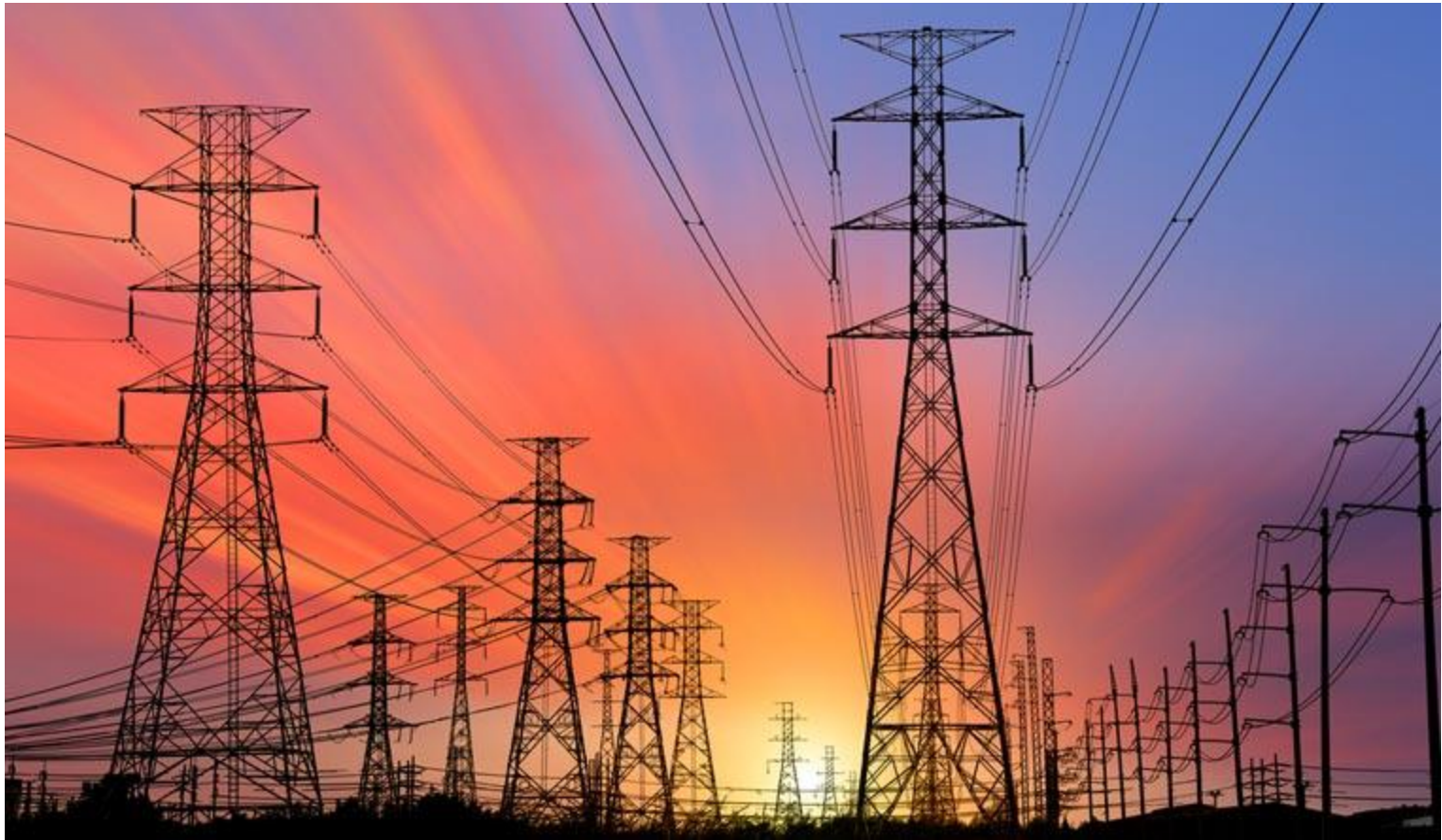
Is Coupling necessary ?

- Contradictory & backtracking it's own statements?
- No congestion , no benefit.
- No incentive left for the power exchanges to innovate since the coupler would centralise the platform.
- States oppose MBED implementation

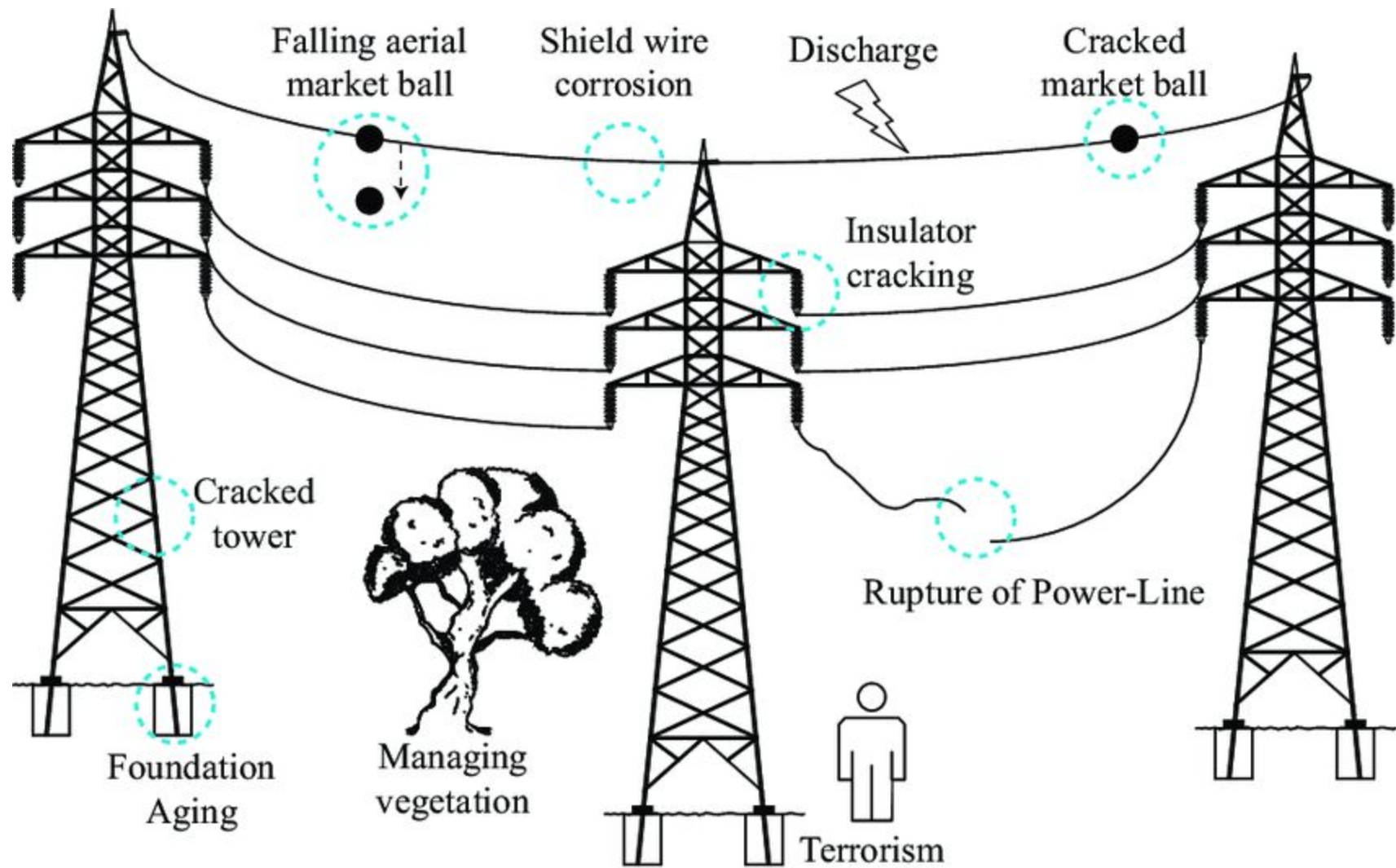
Exchange Market and ST Market - % of Total Generation (incl. RE) – India

Share of exchanges
in short-term market

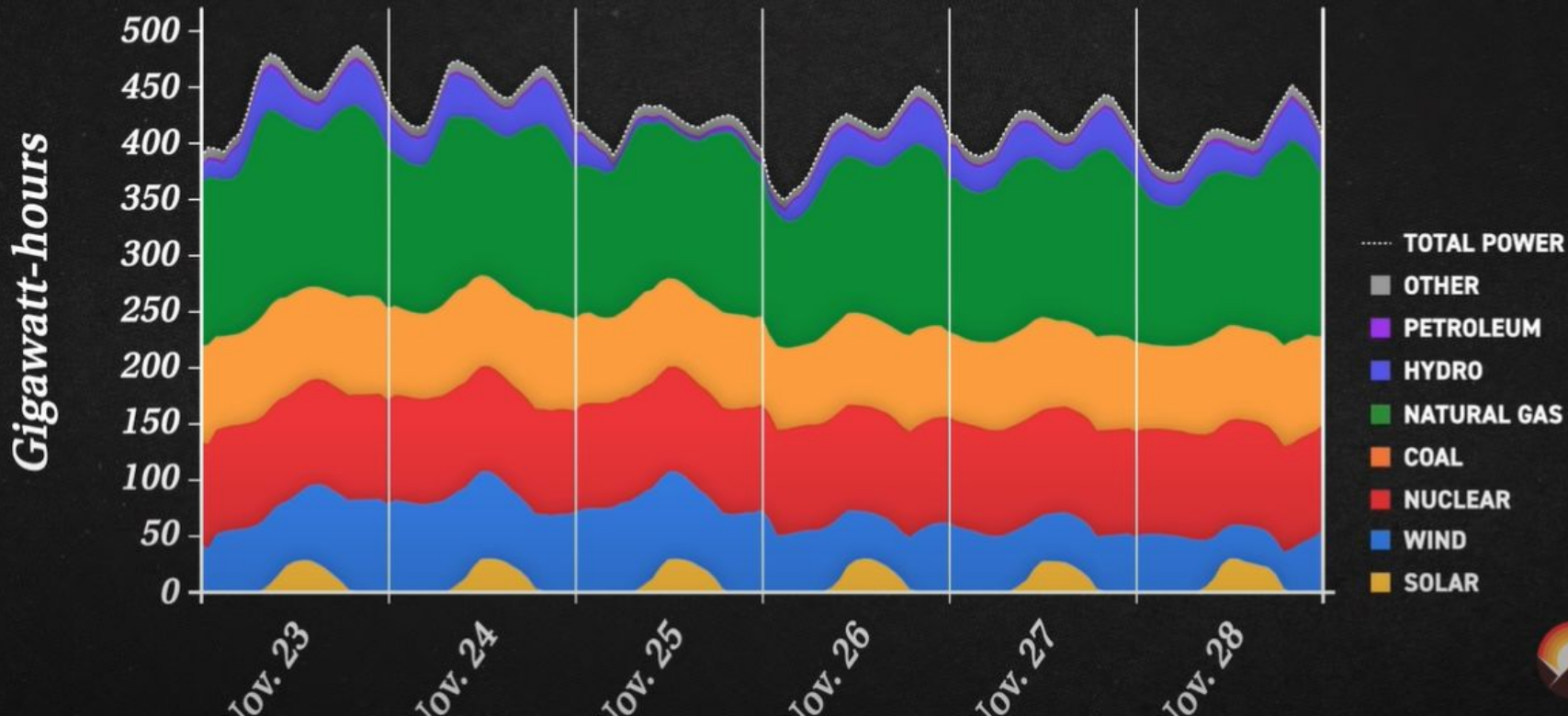




- A complex system
- Ensuring **demand = supply** at any given time.
- Poor storage infrastructure means, excess supply must be used and the grid must be balanced.
- Variability in demand & time zones
- Proliferation of renewable sources.



U.S. Power Mix by Day (November 2021)



A 2016 BILL GATES PICK

THE GRID

THE FRAYING WIRES
BETWEEN AMERICANS AND OUR
ENERGY FUTURE

"The Grid is a lucid and thought-provoking book."
—THE WALL STREET JOURNAL

GRETCHEN BAKKE, Ph.D.

How electricity gets to us - YouTube



Need for growth in Transmission Sector assets

- Growing per capita demand
- Incorporation of RE in grid connectivity - Interstate transmission
- Cross border linkages
- Incorporation of electric mobility in the grid
- One nation, one grid.

Storage solutions ... Tidying over peak deficit

- Sun isn't always shining, wind isn't always blowing.
- But, we need energy on demand...
- Li - ion battery , the super saver we need ? is it Tesla powerwall ?

| Technology | Efficiency (%) | Cost range (US\$/kWhr) | Life (cycles) - at 80% depth discharge |
|----------------|----------------|------------------------|--|
| Lead acid | 70-75 | 120-291 | 900 |
| Li-ion | 85-95 | 223-323 | 3,500 |
| Sodium Sulphur | 70-80 | 400-1,000 | 4,000 |
| Flow Batteries | 60-75 | 435-952 | 10,000 |
| Flywheel | 60-80 | 4,320-11,520 | 200,000 |
| Compressed Air | 50-65 | 94-229 | 10,000 |
| Pumped Hydro | 70-80 | 106-200 | 15,000 |

Source: CEA



What happening in India ?

Digitisation and Revival of Distribution industry

When electricity is finally restored after 2 hours:





- Rs. 3tn government distribution sector scheme over a period of 5 years.
- Targeting AT&C losses
- The Draft Electricity (Amendment) Bill 2021 also seeks to de-license the power distribution sector
- Increasing focus on decarbonization and decentralization requires India to increase its focus on automation and technology in the value chain across generation, transmission, distribution and consumption
- Feeder separation - will help in reducing downtime for specific set of consumers.

Loss making DISCOMs hearing the proposition of Smart Meters:



Mobility Space

- Ev's are considered high load, affecting the power distribution system.
- Increase in peak demand will require increase in grid capacity
- Vehicle 2 Grid
- Virtual power plants - aggregates the capacities of heterogeneous distributed energy resources (DER)

CLEAN DISRUPTION

OF ENERGY AND TRANSPORTATION

Tony Seba

How Silicon Valley
Will Make Oil, Nuclear,
Natural Gas, Coal,
Electric Utilities and
Conventional Cars
Obsolete by 2030.



Rethinking The Future Clean Disruption and the Collapse of the Oil, Coal & ICEV Industries

1st World CleanTech Week eConvention
#EarthDay2020

22 April 2020

RethinkX
Disruption, Implications and Changes

Rethinking Transportation 2020-2030
The Disruption of Transportation and the Collapse
of the Internal Combustion Vehicle and ICEV Industry
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▶ ⏪ 🔊 0:05 / 58:36



#CleanDisruption and the Collapse of the Oil, Coal & ICEV Industries. #1stWCWeC #EarthDay2020

Path towards efficient power sector...

Thank you!