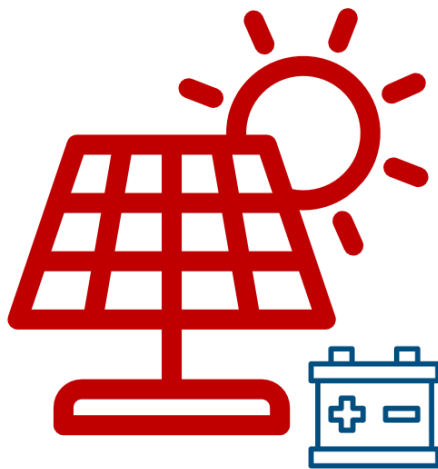




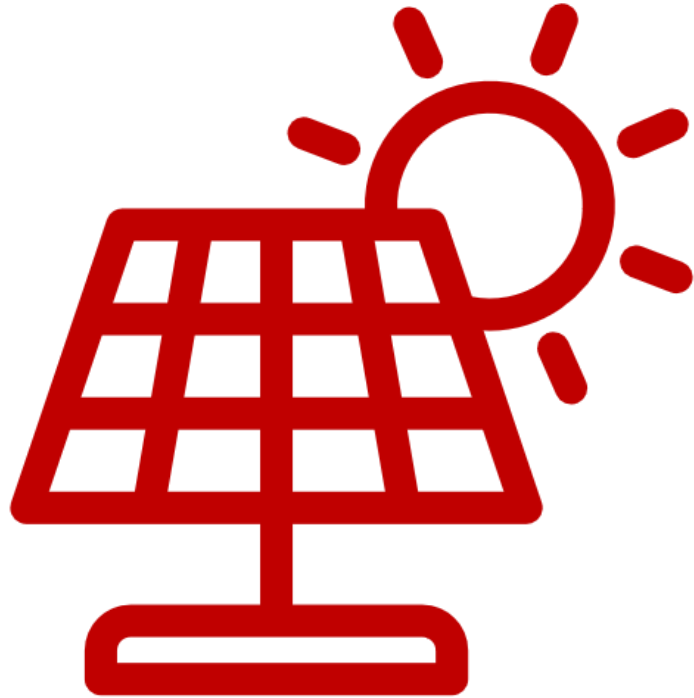
Cost of energy transition in India

Need of flexibility

1. Nov. 2019

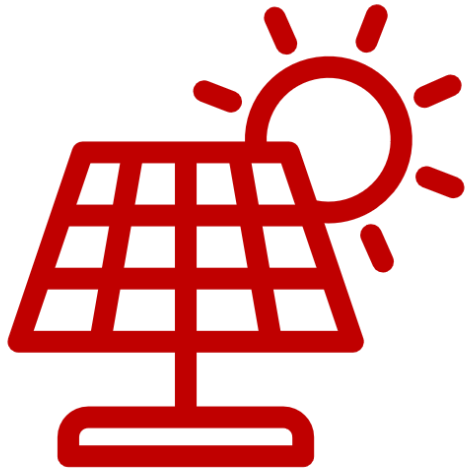


Since 2017 price per kWh PV reached low of 2.44 INR/kWh



2.44 INR/kWh

In 2019 price per new kWh coal approx. >4 INR/kWh



2.44 INR/kWh

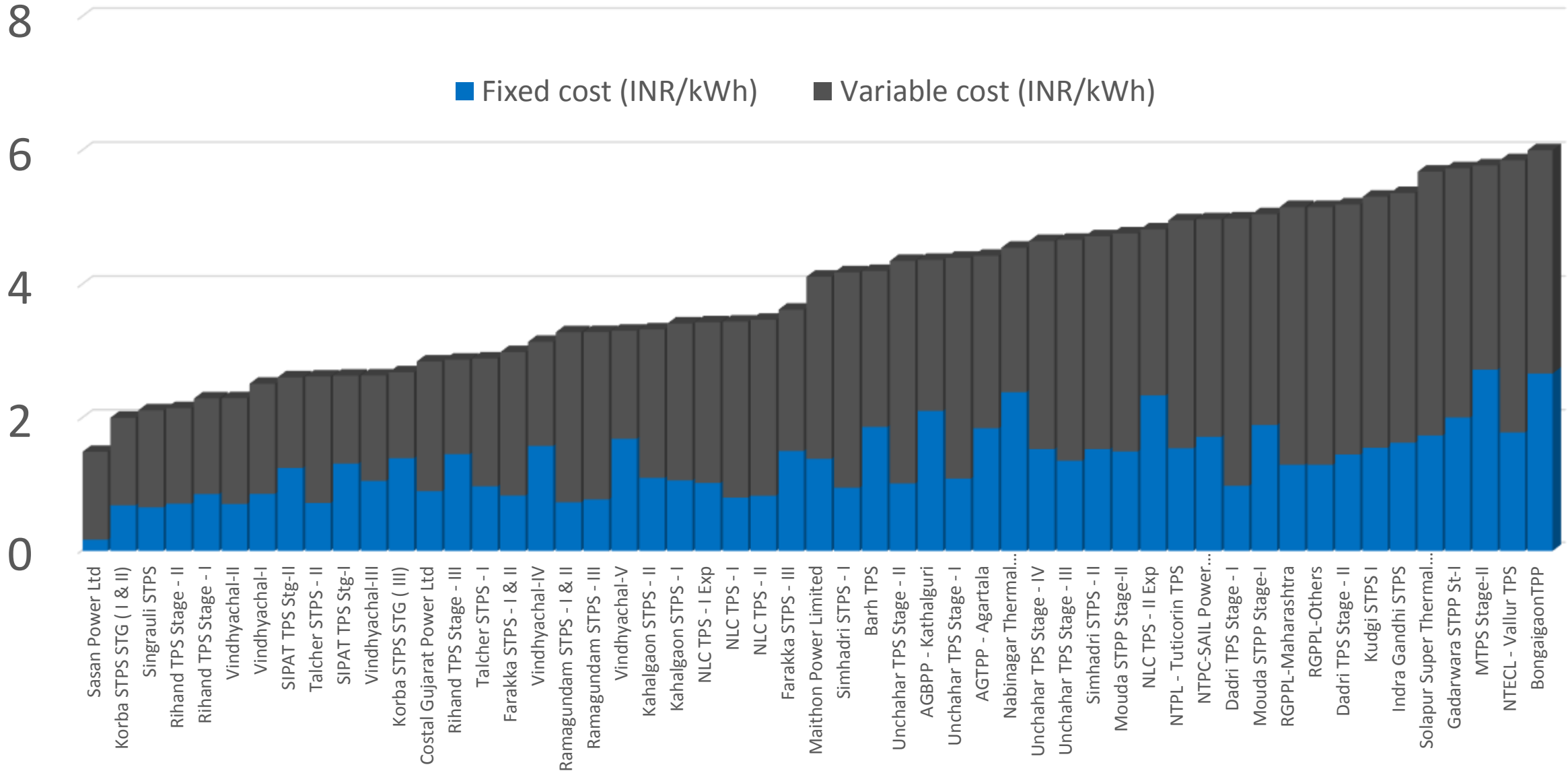
- + Cell and module prices have come down by about 20 % summer 2019
- + Interest rates are coming down
- + Cheaper imports/domestic production might occur
- + De-Risk sector by paying bills to generators according PPA



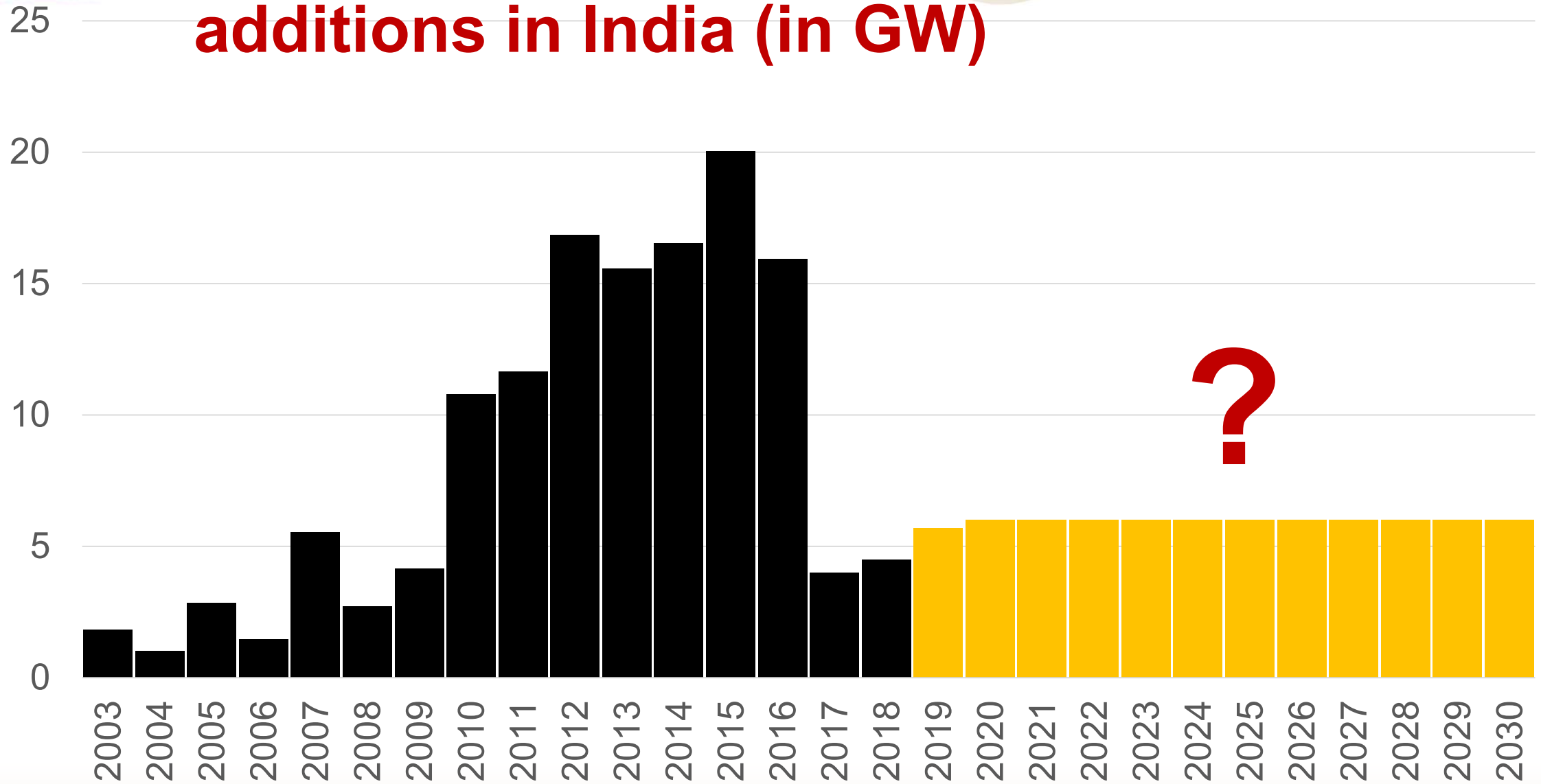
>4,x INR/kWh

- Cost increases if PLF < 85 %
- Future cost might increase (coal, labour, environmental constraints, CO2)

Cost for unit of coal power from total 56,4 GW India RRAS plants in INR/kWh (08/2019)



Projected net coal power capacity additions in India (in GW)

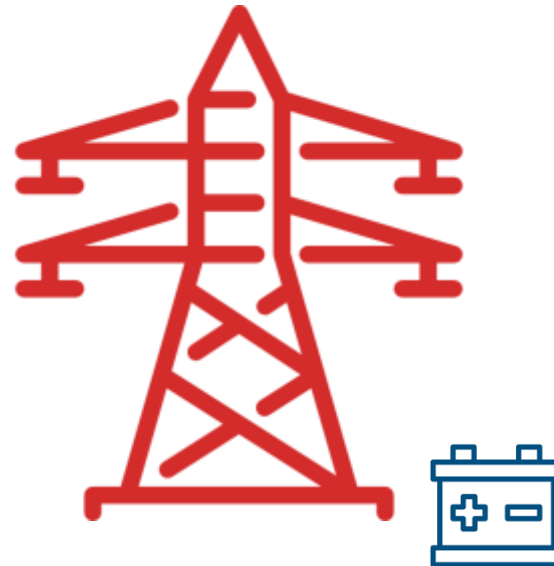




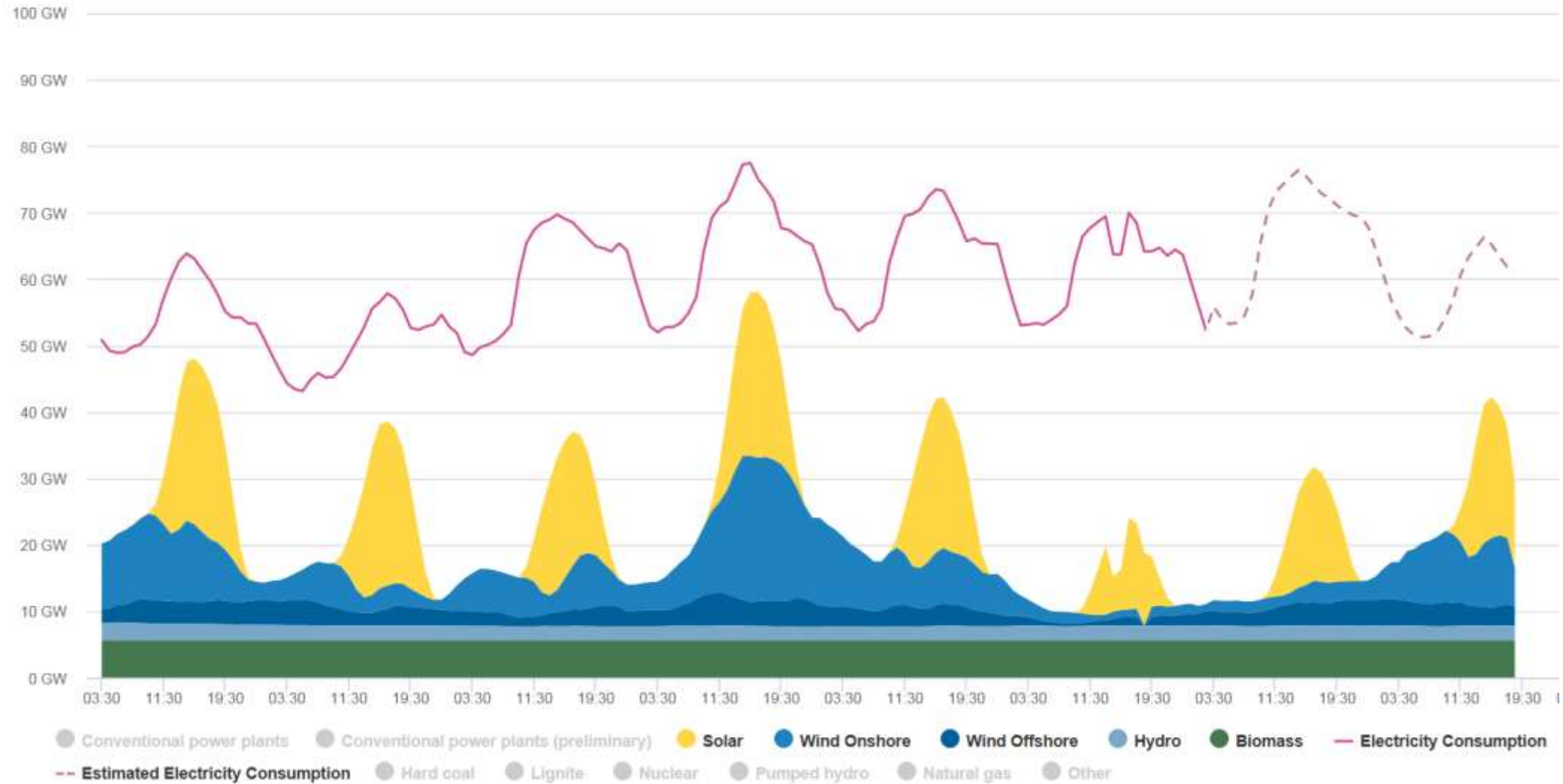
**The higher the investment in coal
the higher the costs for India to
exit coal -> stranded investments**



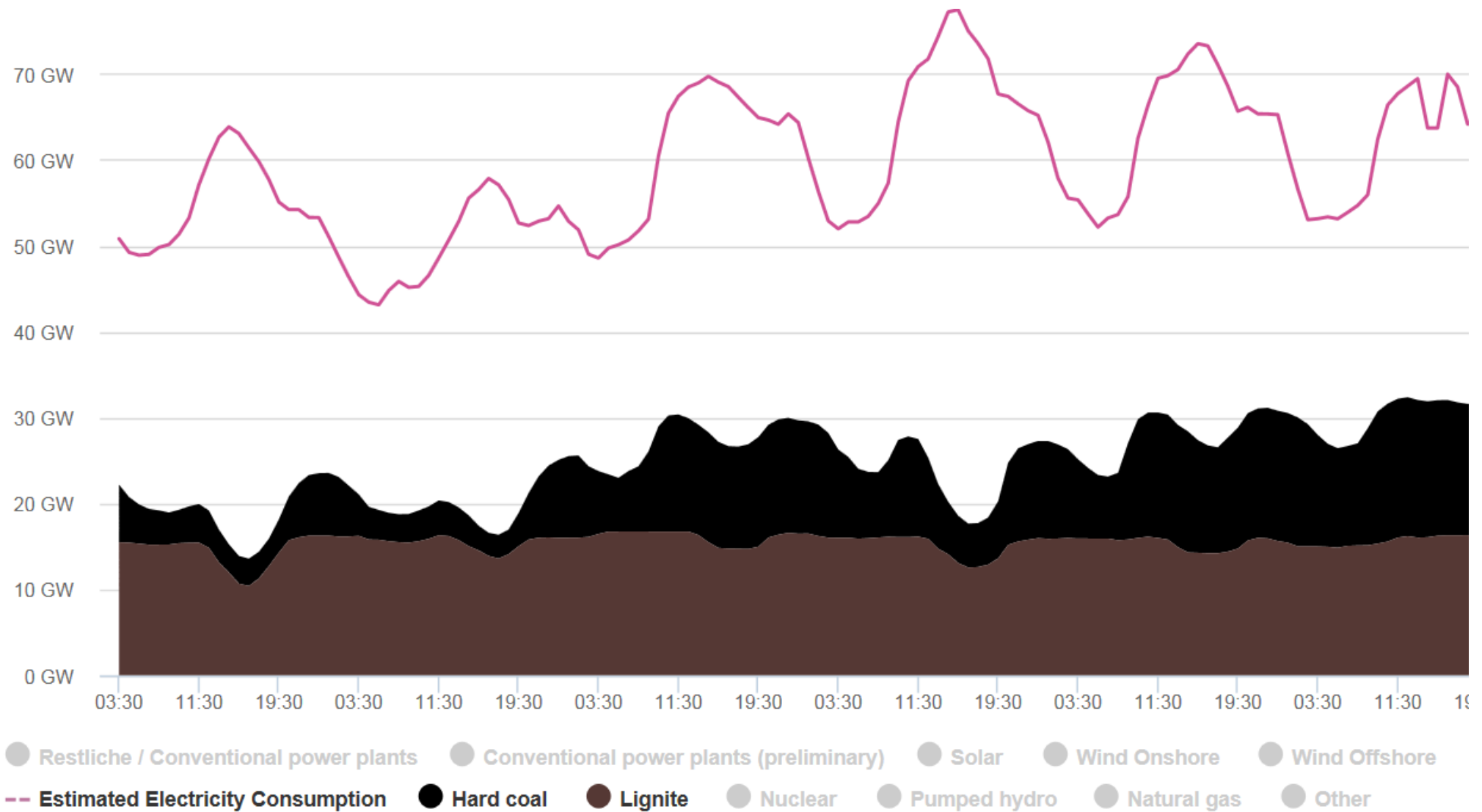
**BUT cost for flexibility of the system to adapt
to fluctuating solar and wind increasing**



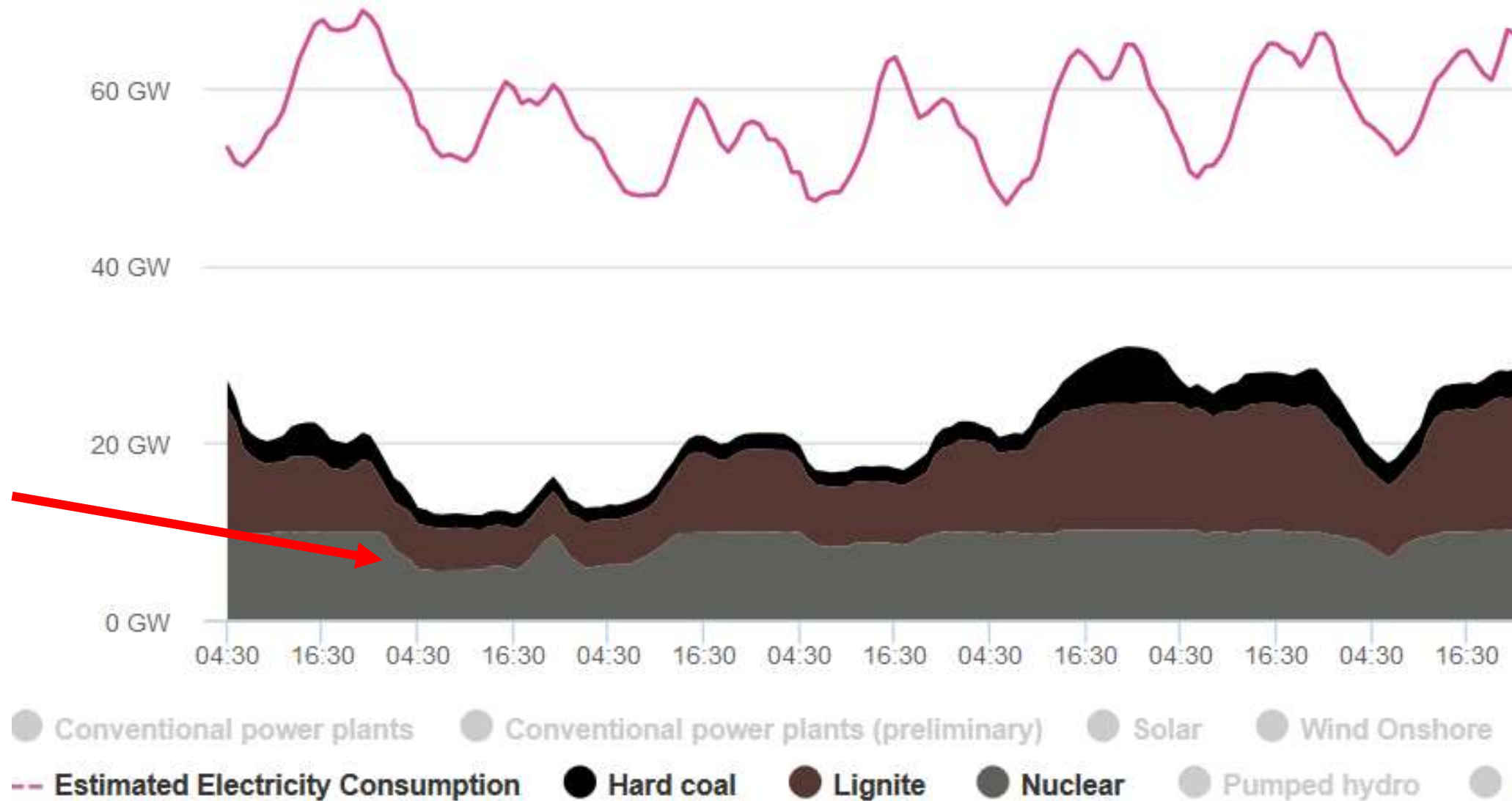
Renewables and load in Germany – a week in September 18



Coal and load in Germany – same week in September 18



Even nuclear is ramping up and down – a week in December 17



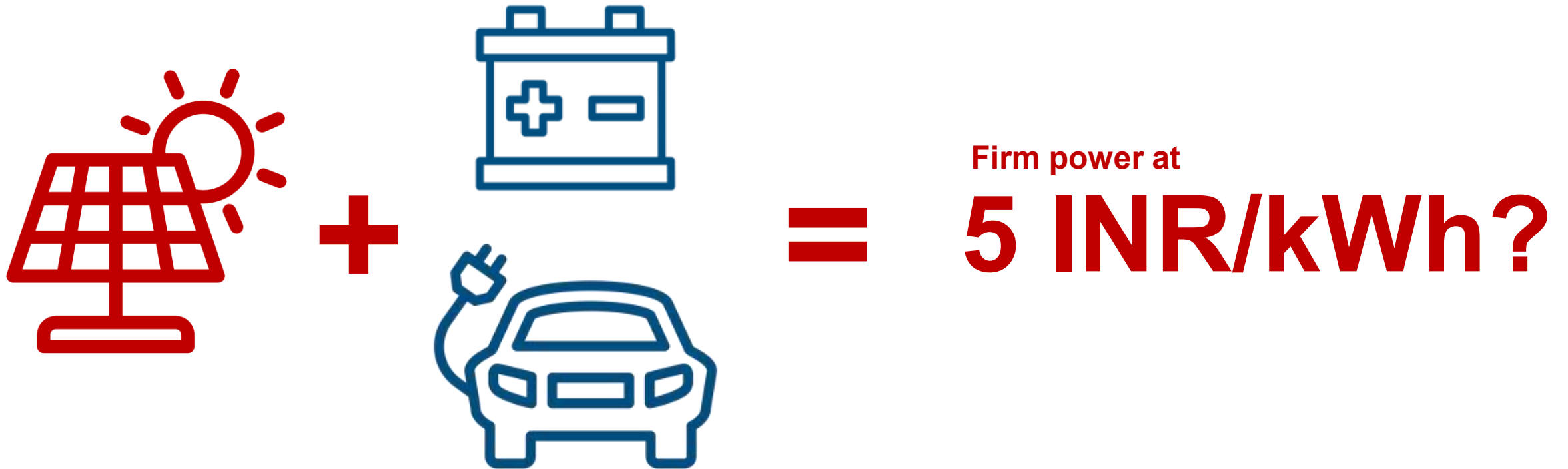
How to cater India's peak demand at night?

Best practice examples from India:

- **Agriculture pumps to run during the day with solar PV instead of coal power at night (~20-30 GW)**
- **Cooling devices in large scale cold storages, airports and shopping complexes to ramp down 1 °Celsius (~10 GW)**
- **Industrial Demand Response (~10 GW)**
- **Hydro to run at non-RE time only (~10 GW)**

Existing assets in India able to replace ~50 GW new coal capacity

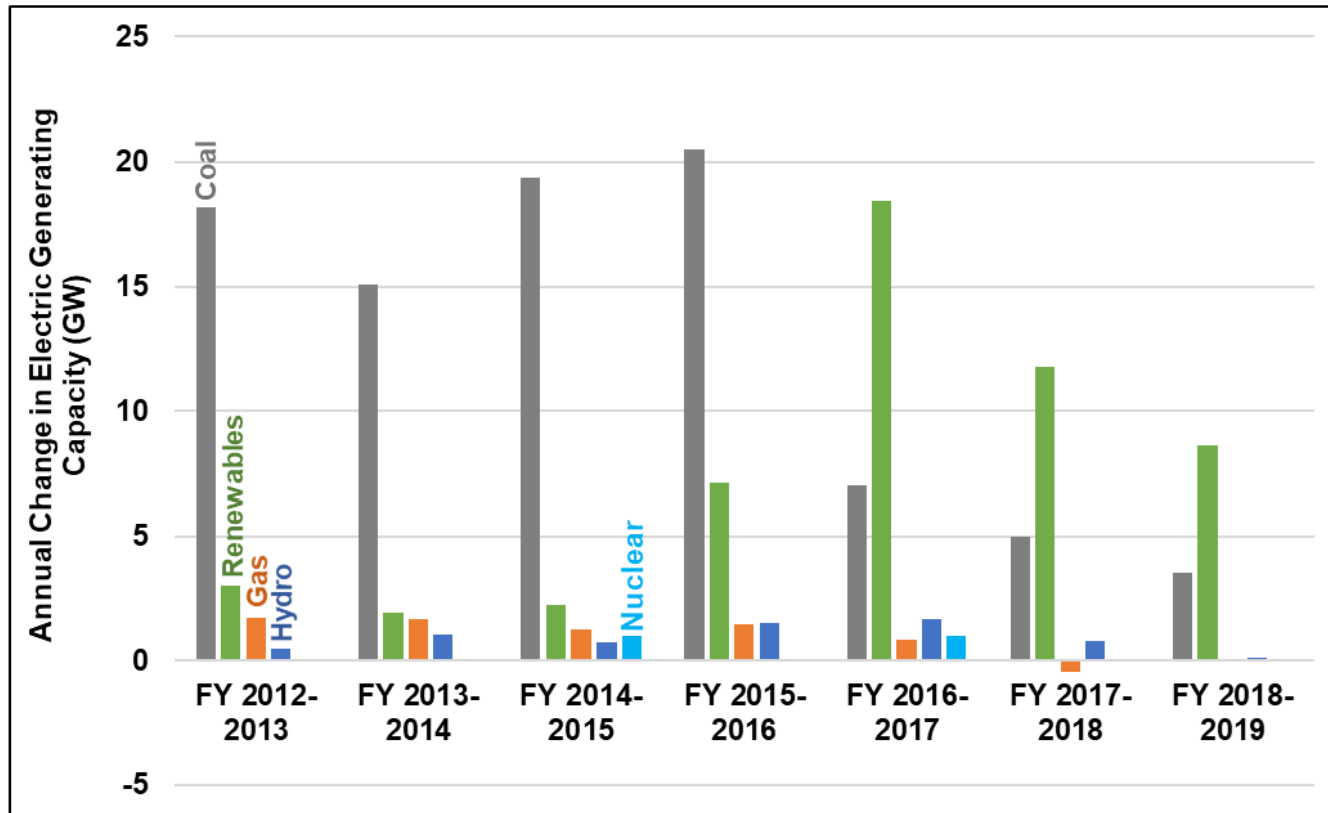
From 2025 PV + Storage cheaper than coal?





India: Path to 175 GW RE?

Figure 2. Indian Annual Capacity Change by Resource, FY 2012-13 to FY 2018-19



Note: Excludes diesel. Lignite is included in coal, which started being reported as a separate category in FY 2018-19.

Source: Applied Economics Clinic (AEC) calculations using data from India CEA⁸



Where do we stand in Germany?

Annual renewable shares of electricity in Germany





- Germany will phase out nuclear by 2022
- Germany will phase out coal by 2038
- Within 10 years almost all coal fired power plants in Germany had to become flexible!
- Flexibility became more important than Efficiency in power plants!
- Can India do alike?



- Increase RE significantly, ensure 175 GW by 2022, 450 GW by 2030
- Push Energy Efficiency even stronger, regulation, enforcement, incentives, financing
- Create/Allow flexibility markets (ancillary, incentivise Demand Shift, allow Time of Use Tariff, pass carriage & content bill)
- Just Transition (find solutions for existing assets and districts)
- Develop Storage (R&D, manufacturing)



Thank You



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