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India's energy and emissions in 2022

Selected highlights

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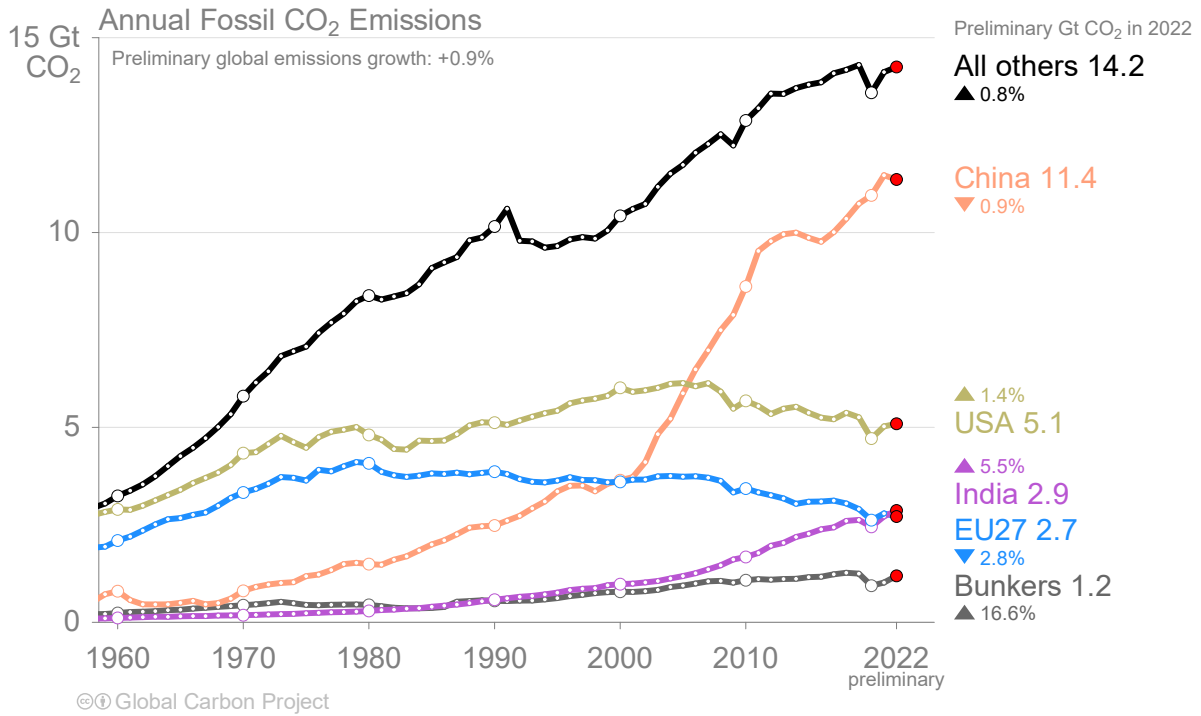
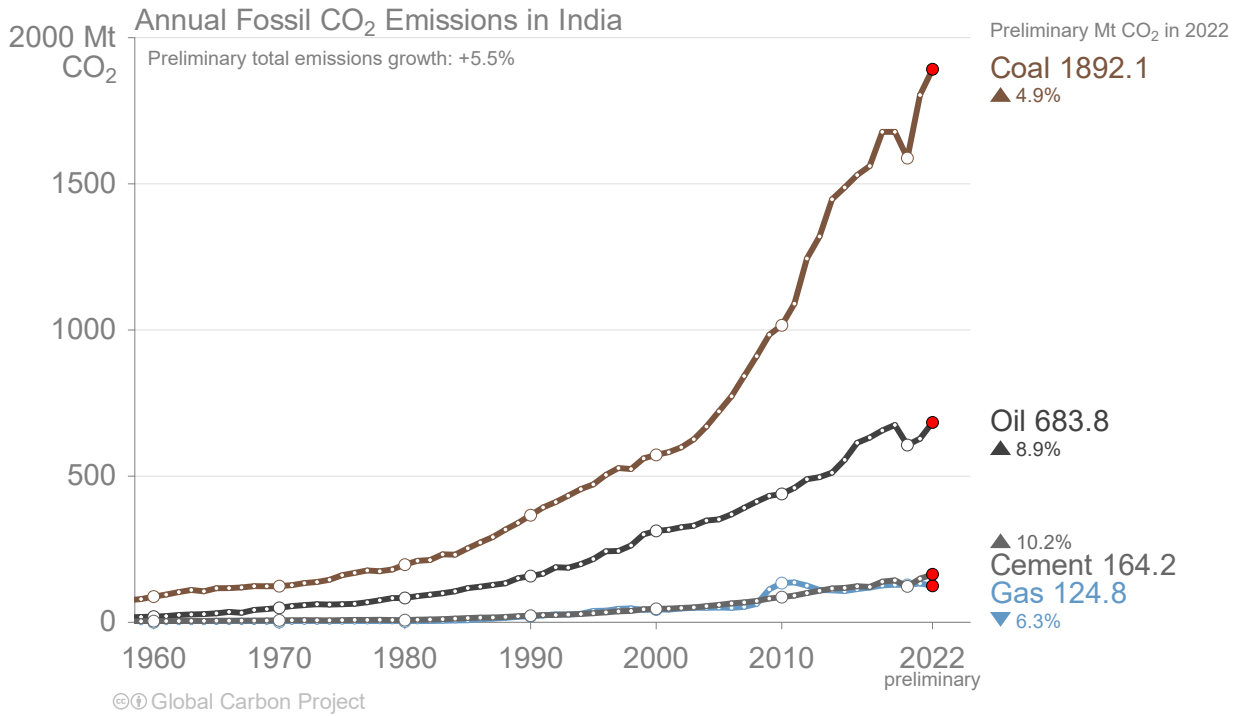
India's CO_2 emissions grew strongly in 2022

- India's fossil CO_2 emissions exceeded those of the European Union in 2022 for the first time ever
- India's strong emissions growth in 2022 stands in contrast to other key regions
- But India's emissions were 2.0 tonnes per person
  - EU average: 6.1 tonnes
  - World excluding India: 5.3 tonnes



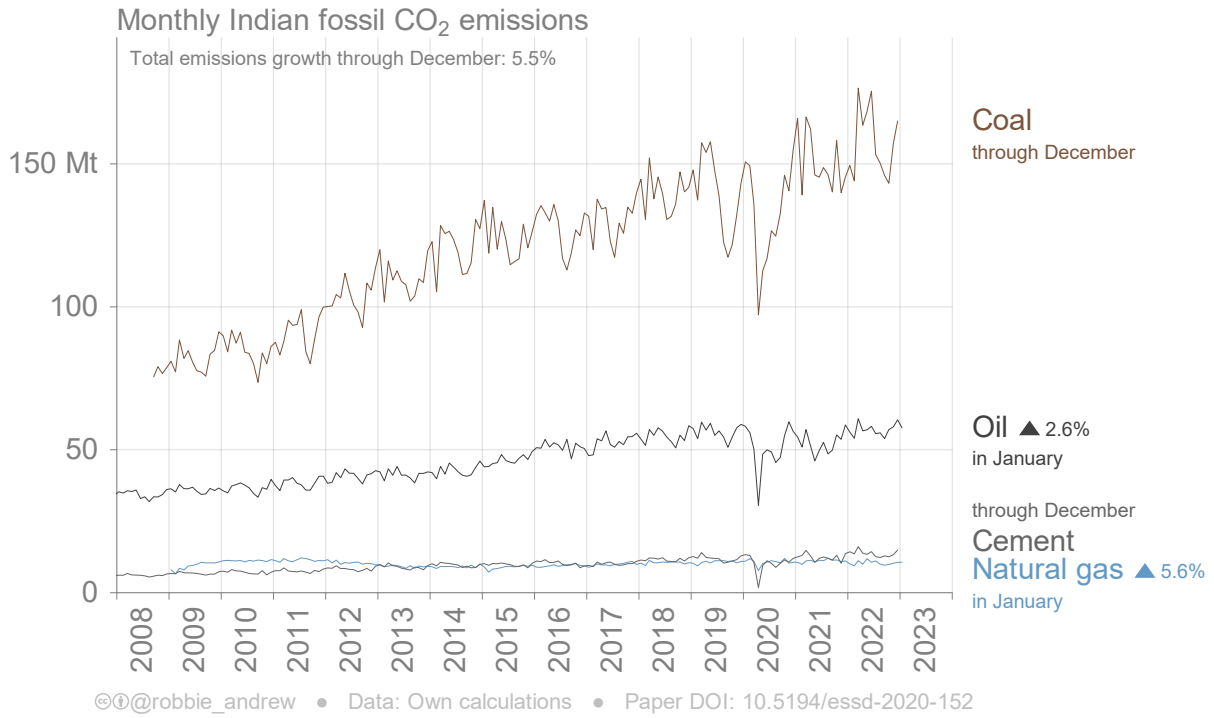
Long-term view of emissions

- India's emissions have been growing steadily, interrupted only by the pandemic
- India's economy has been growing strongly in recent years
- Particularly energy supply was and still is very low per capita and energy access is an important part of development



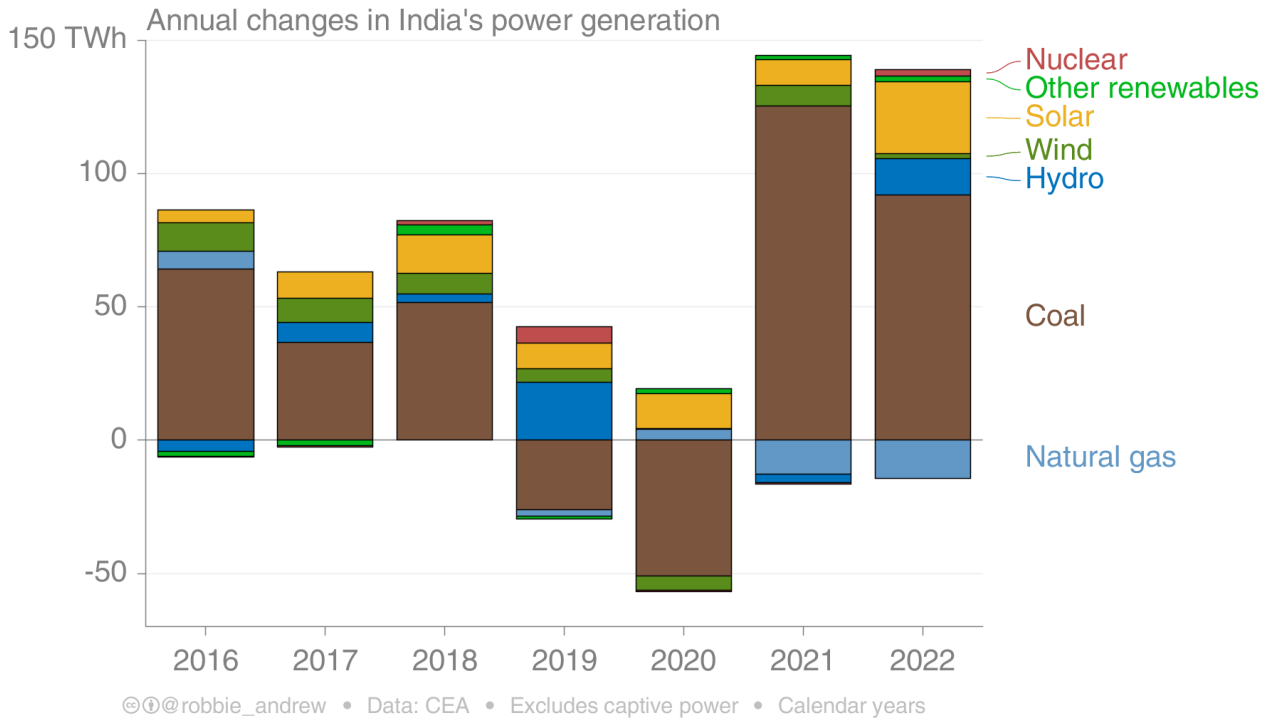
Recent years, monthly estimates

- Large dips across all four categories in 2020
  - Some of the strictest lockdowns in the world at the time (4 hours' notice)
- Natural gas is a small share of energy
  - Contrast with Pakistan and Bangladesh, which have both struggled with 2022's high LNG import prices



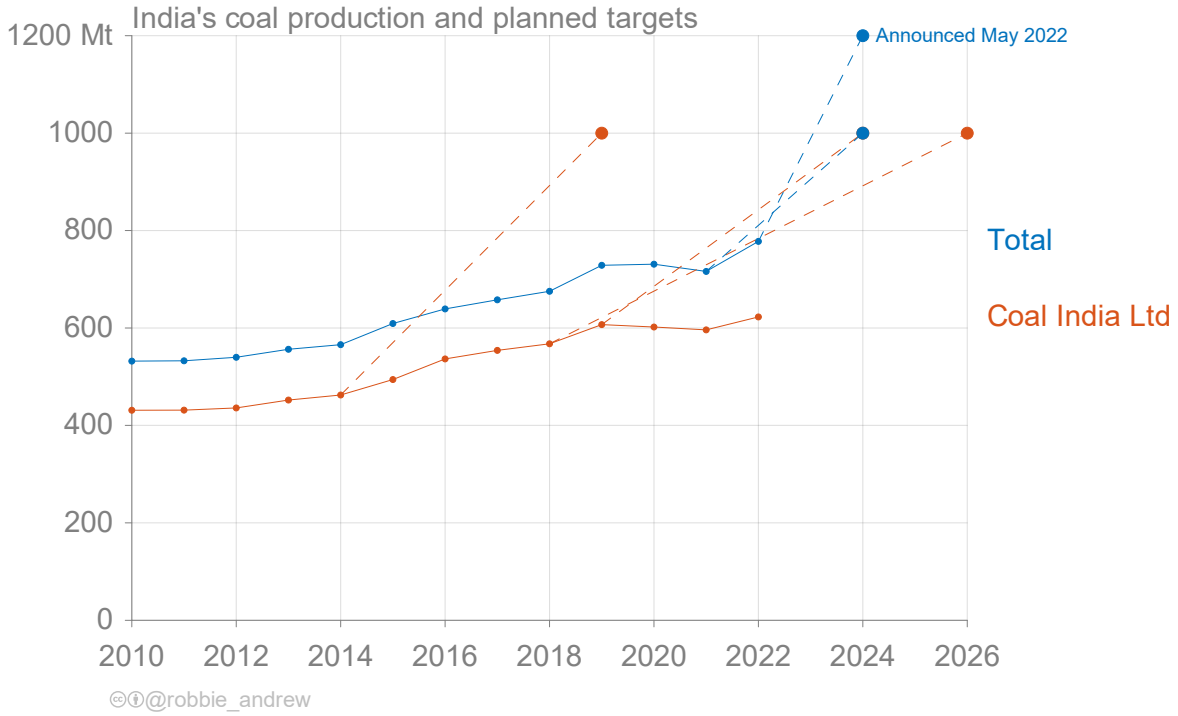
Power generation

- Power demand grew strongly in both 2021 and 2022
- The contribution of solar to the increase was a record 26.8 TWh
  - Capacity increased by 25% over the course of the year
  - Still only 6% of total generation in 2022
- Hydro also grew, with a wetter-than-average monsoon
- But most of the growth was in coal
  - Up 92 TWh (8.6%) in 2022



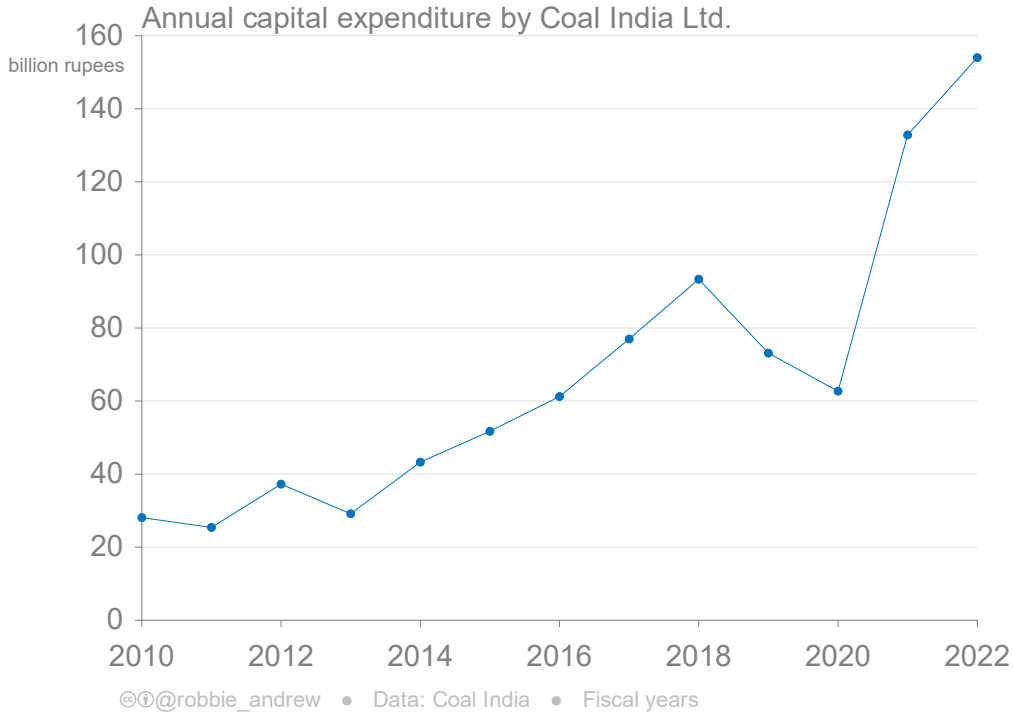
Coal production

- India hopes to increase coal production sharply
- Such hopes are always ambitious, and have previously always been dashed
- India insisted at COP26 in 2021 that the wording "phase out" of coal be replaced with "phase down"
  - India's interpretation of "phase down" is that it relates to the *share* of energy, not *absolute* coal consumption



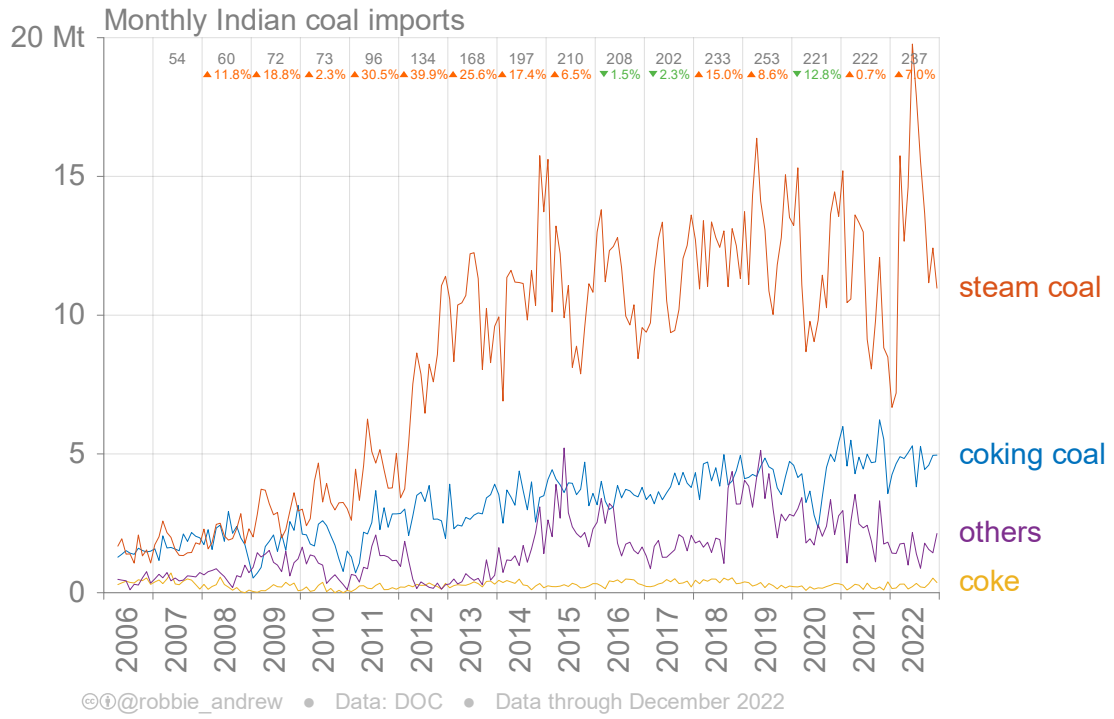
Coal production

- Coal India's annual capex has been increasing steeply, although with a break in 2019 and 2020
- Efforts to keep up with demand
- Mechanization of "first-mile connectivity"
  - Covered conveyor belts replace trucks between pithead and dispatch point
- Increased rail tracks and sidings
- Heavy machinery



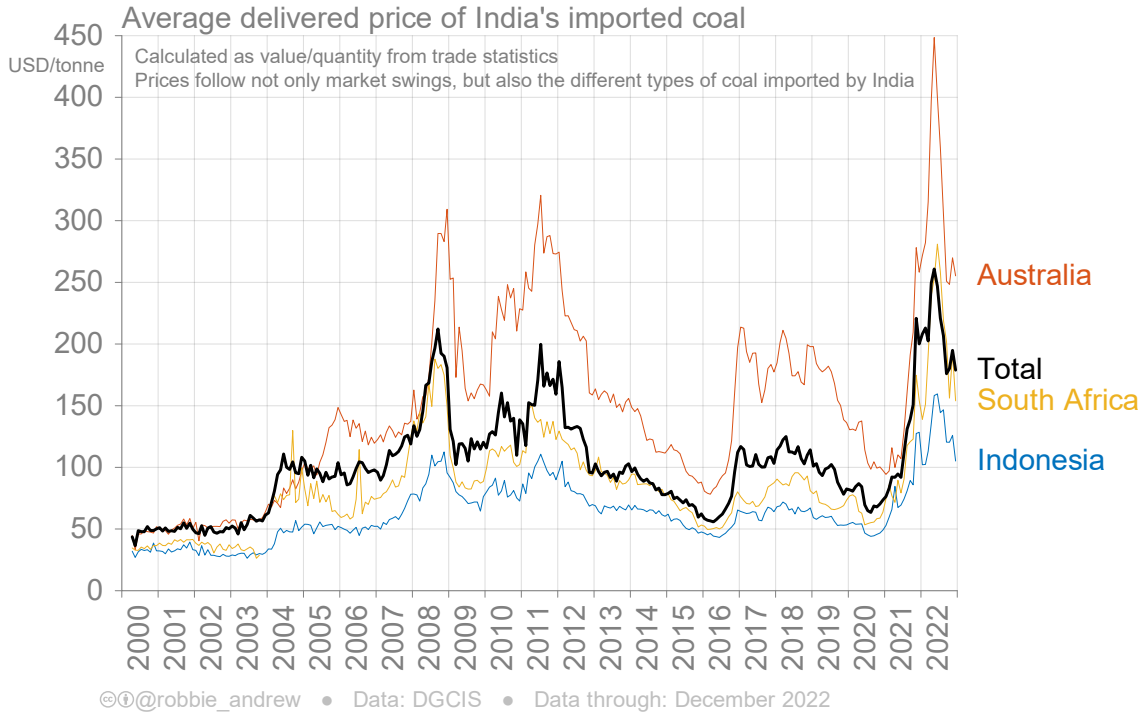
Coal imports

- Imports of steam (thermal) coal reached a record monthly peak of 19.8 Mt in June 2022
- Annual total coal imports approached the record set in 2019, but held back by very low levels in January and February



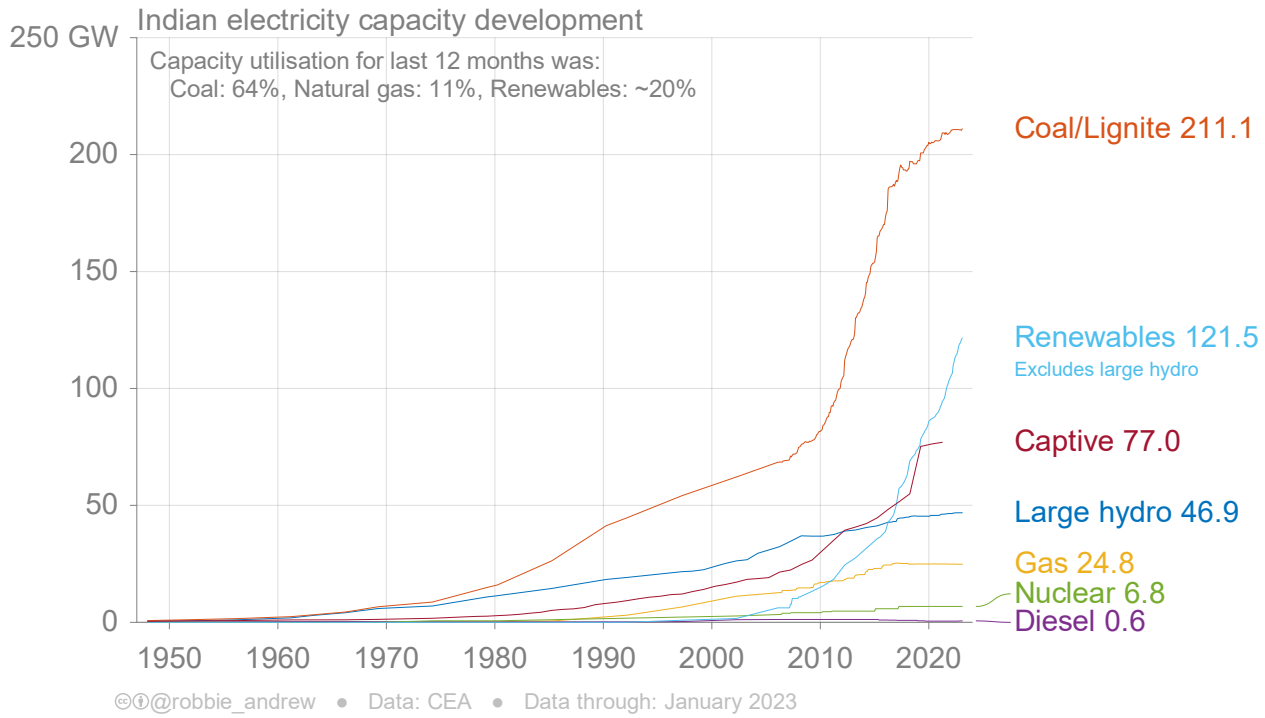
Coal imports

- High international coal prices in 2022 drove up India's import bill
- In early 2023 the government (Centre) has ordered coastal power stations that operate on imported coal to produce more output in expectation of record power demand



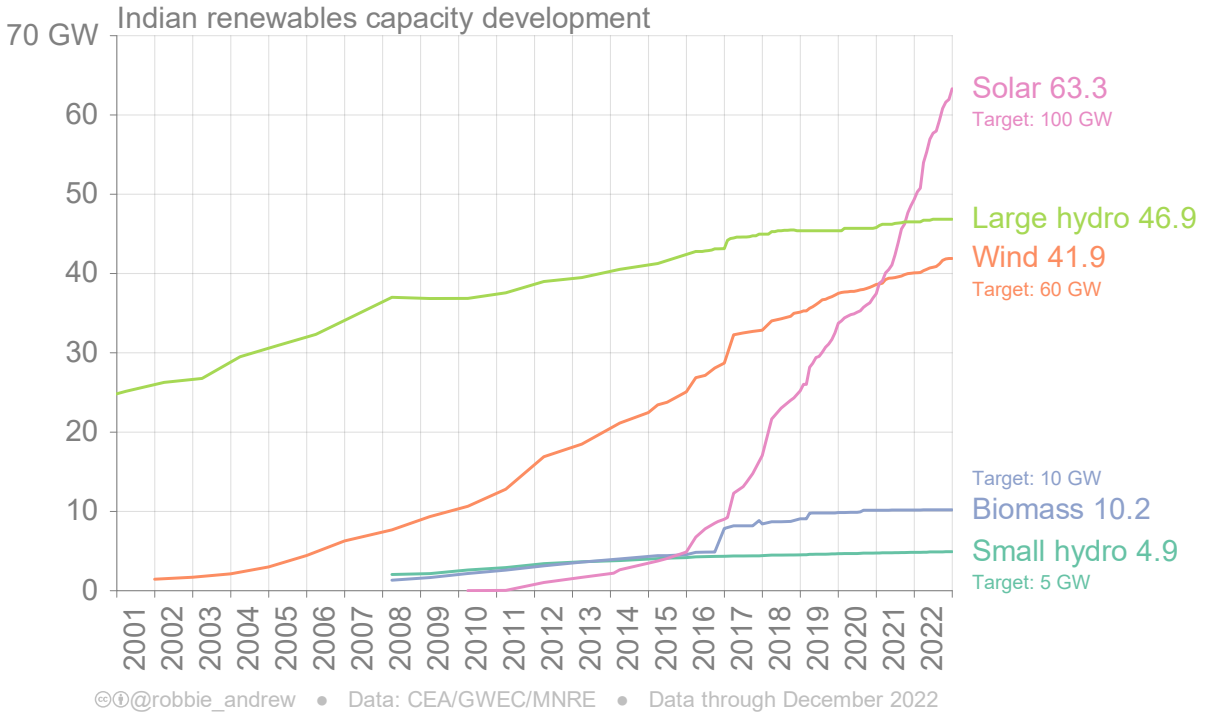
Power generation capacity

- India constructed a large fleet of coal-fired power stations in the 2010s in response to
  - An enormous blackout in 2012 affecting hundreds of millions of people
  - Government forecasts of substantial power demand increases



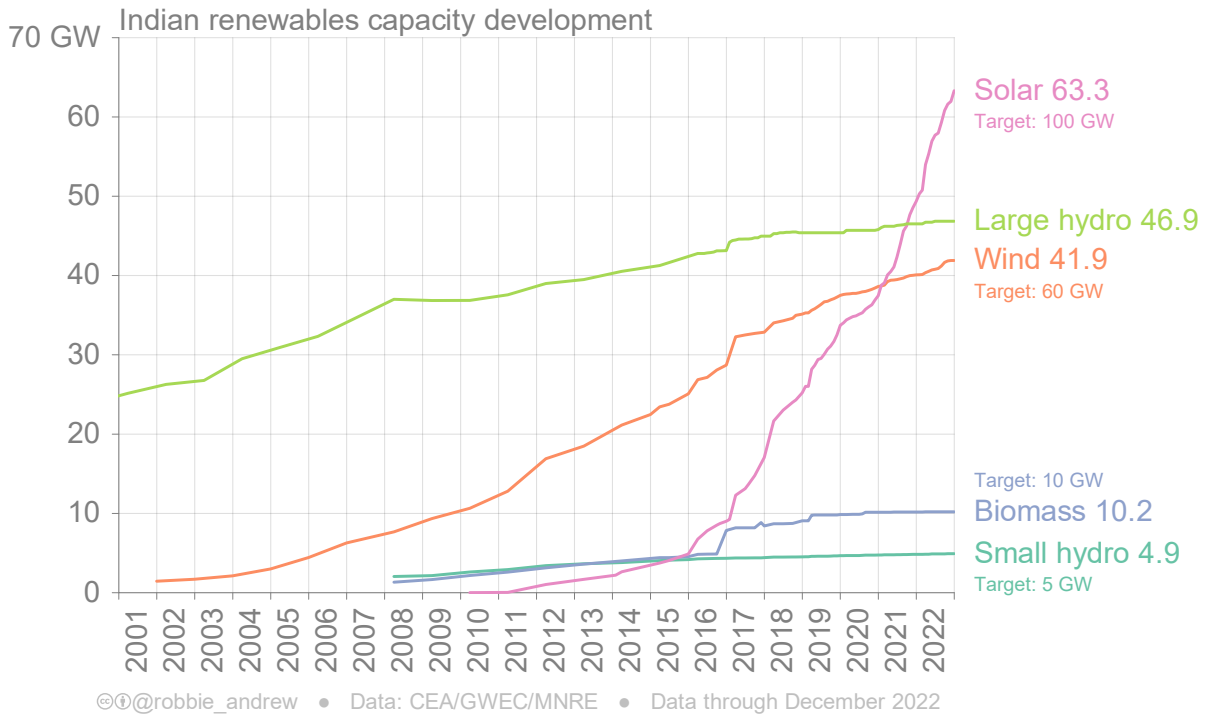
Renewables capacity

- Solar capacity continued to grow strongly in 2022, gaining 14 GW (28%)
  - But fell well short of India's ambitious 100 GW target
- Wind has been growing more slowly
  - Added only 1.8 GW (4.5%)
  - And also fell short of India's 2022 target of 60 GW



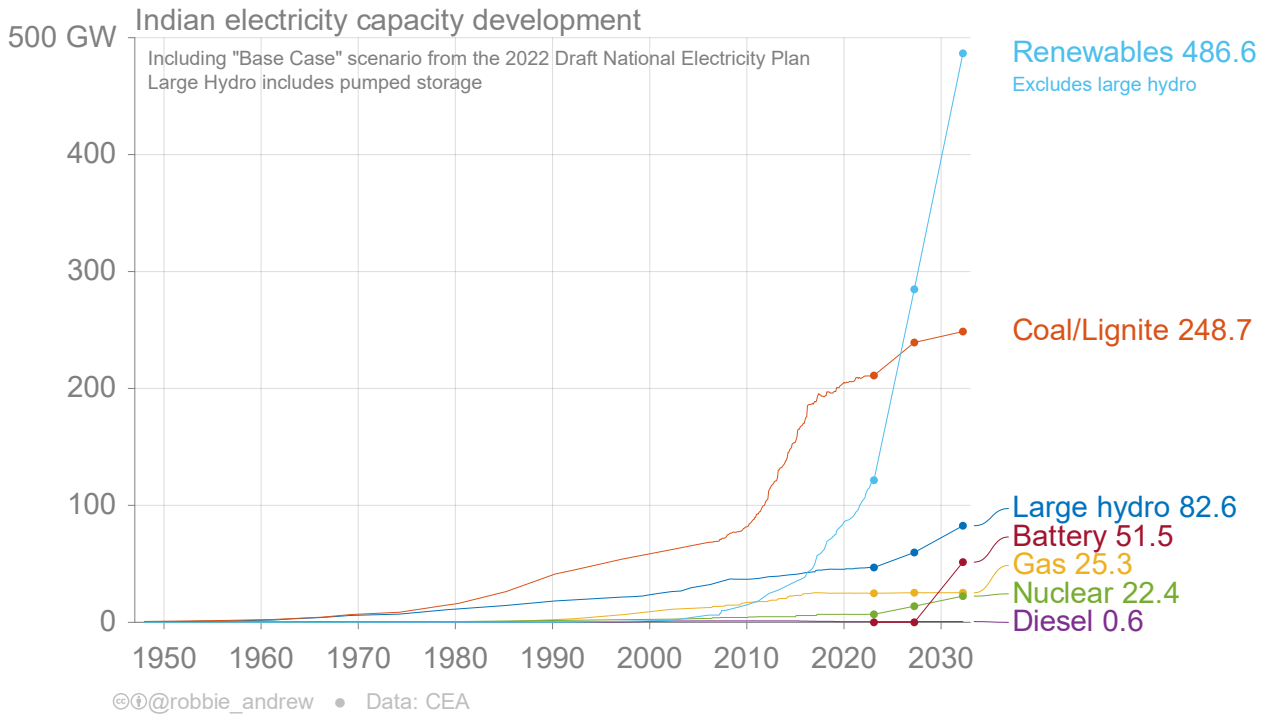
Solar short of 100 GW target

- Ambitious target set by politicians, not derived from modelling
- Policy conflict with goal of domestic manufacturing: high import tariffs raising cost of solar panels
- Uncertain business environment: states reneging on contracts
- Insufficient facilitation for rooftop solar, 40 GW of the target
- Existing long-term power contracts
- Long-term industry deficits



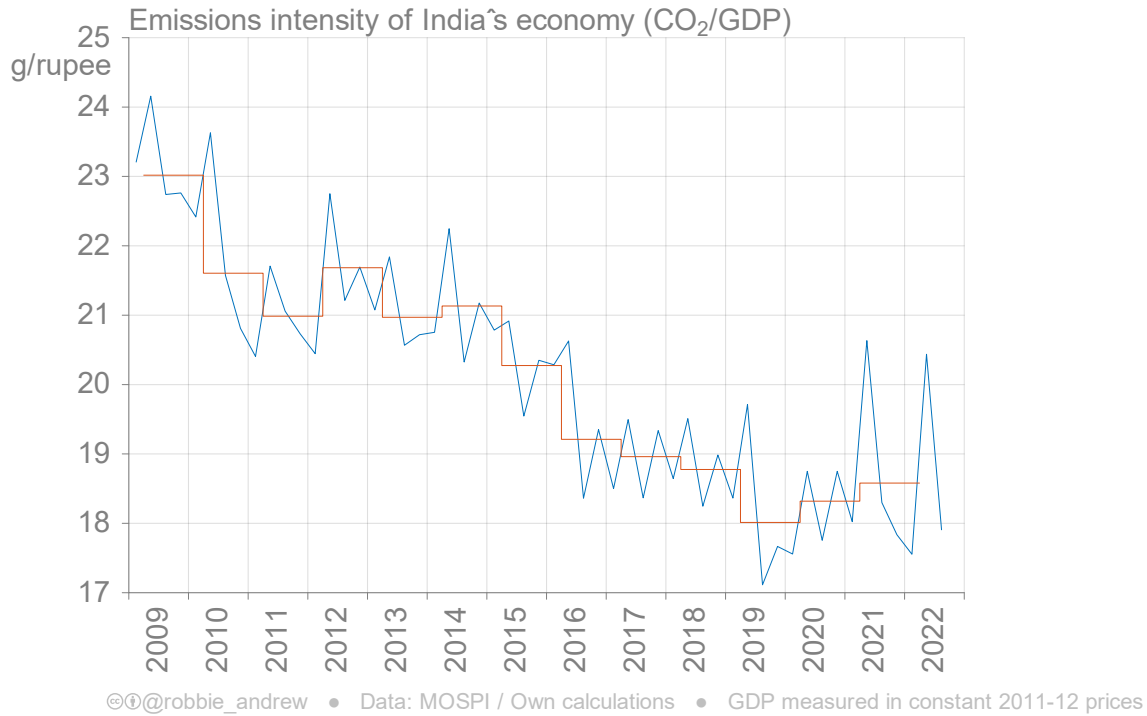
Power capacity expectations

- The draft National Electricity Plan released in September 2022 expects more coal power capacity to be added
- Renewables growth is expected to be very high
- Large batteries are expected to be commissioned in the second period of the projection



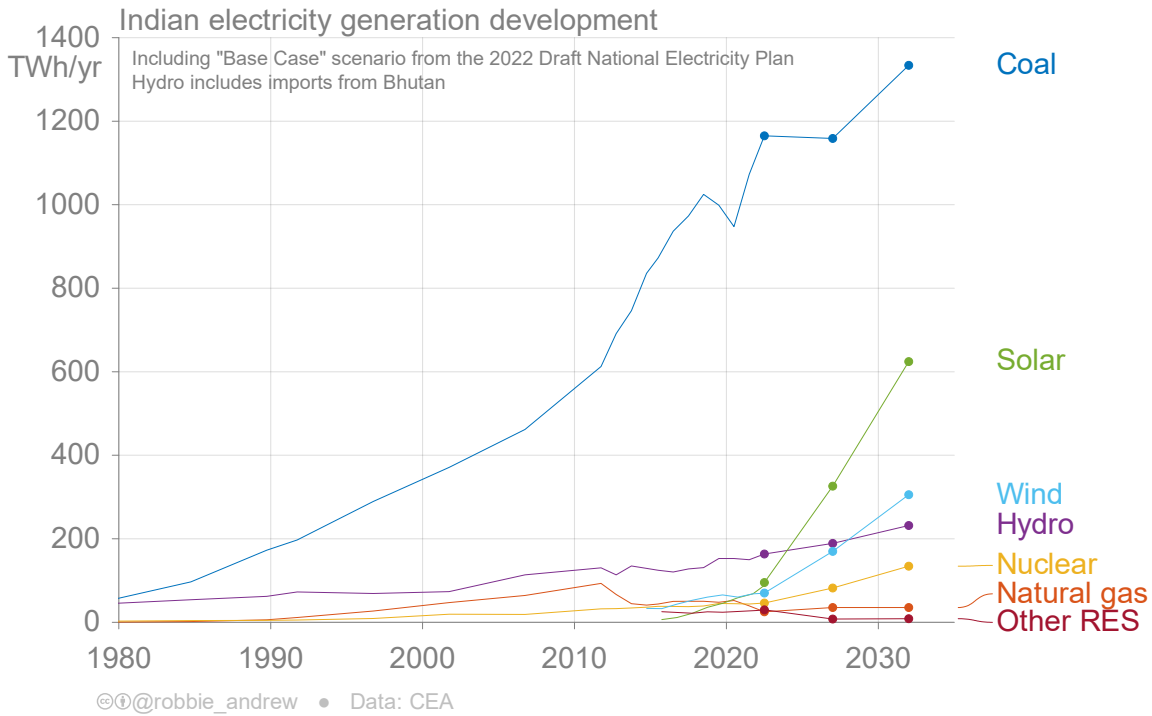
NDC: Nationally Determined Contributions

- "To reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level"
  - Considered by some to be effectively just business as usual: not ambitious
- "To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030"



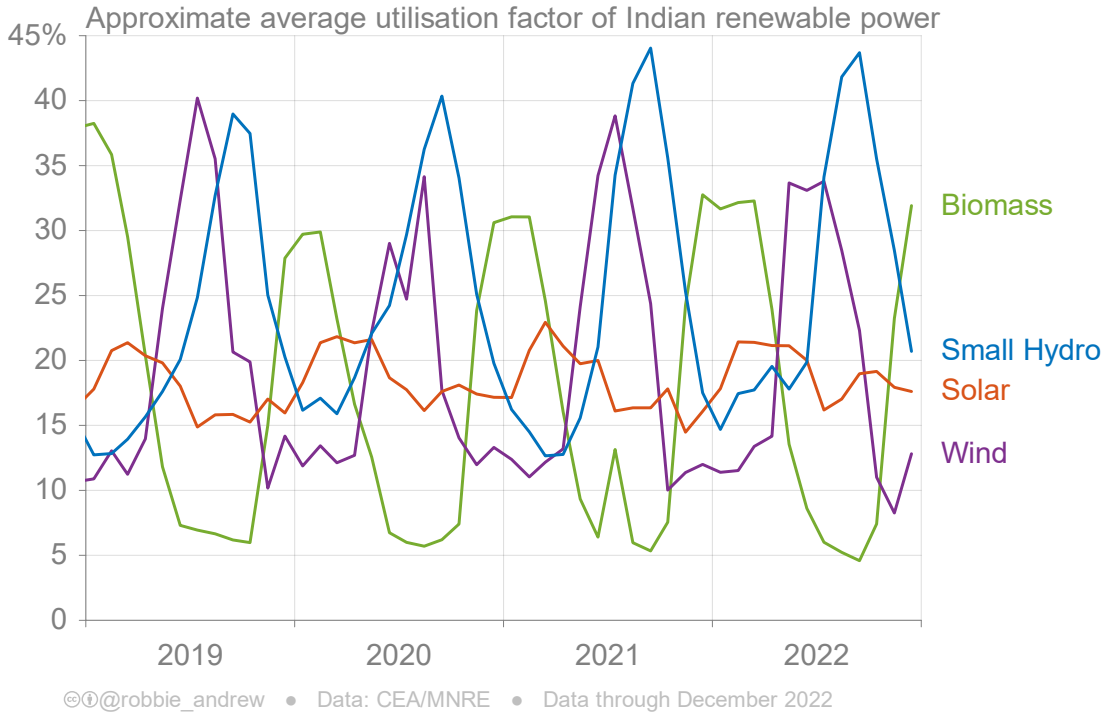
Power generation expectations

- Renewables have variable and relatively low capacity-utilization factors
  - This is largely a function of the variability of insolation and wind
- This means that the numbers for generation look quite different to those of capacity
- Non-fossil is expected to be about 49% of generation in 2031/32
  - NDC goal “about 50 percent” by 2030



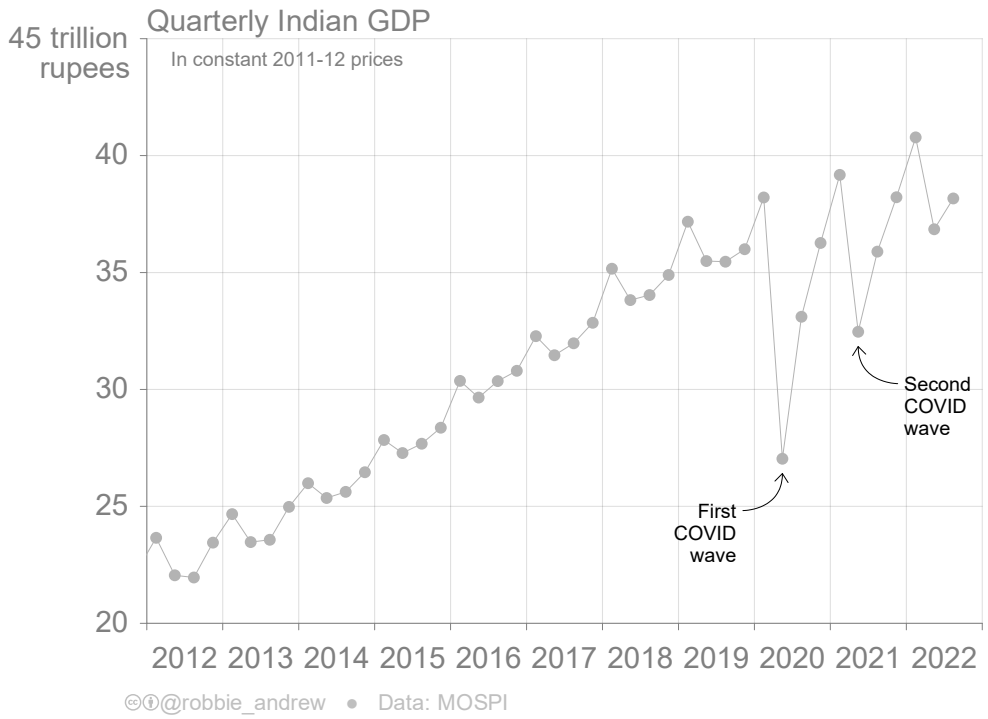
Capacity vs generation of renewables

- The ratio of generation to rated capacity of renewables varies widely
- Biomass limited by availability of agricultural residues
- Small hydro without reservoirs, driven by monsoon rains
- Wind driven by monsoon winds
- Solar the most invariable by season, but obviously highly variable within a day



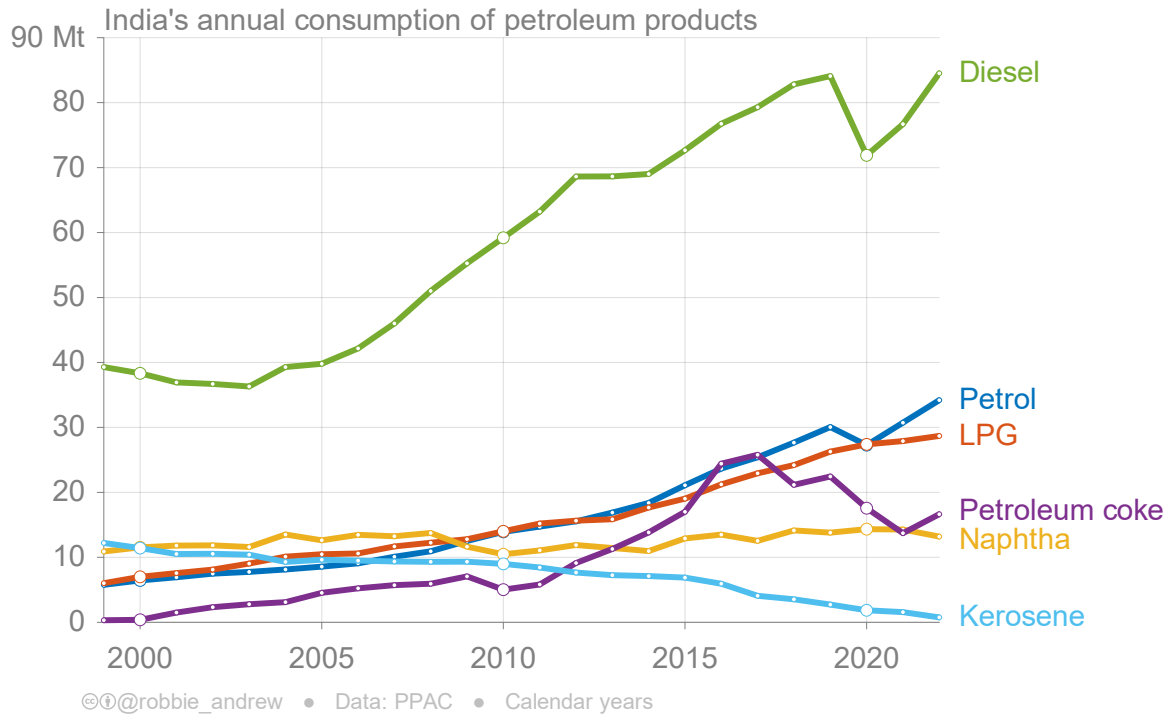
Economy

- India's economy took the greatest hit among the G20 group of countries during the pandemic
  - Cumulative growth over the two calendar years 2020–21 was only 1%
- Lockdowns in June quarters of both 2020 (first wave) and 2021 (second wave) led to substantial reductions in economic activity



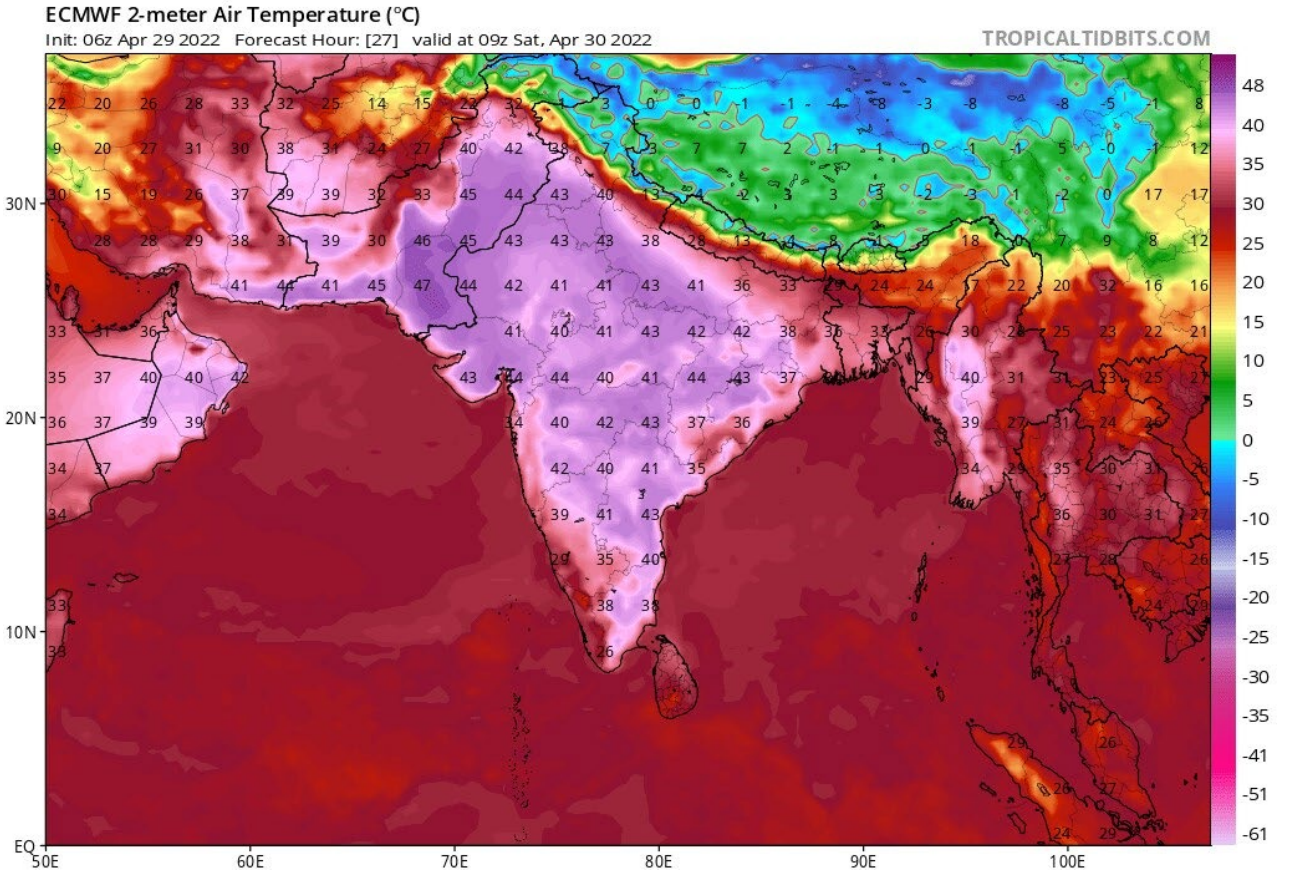
Annual consumption of petroleum products

- Diesel barely back to 2019 level
- Strong growth of petrol
- Petcoke bounce
  - Imported coal prices are high, so cement manufacturers have imported petcoke in preference
- Kerosene almost entirely phased out
  - Efforts to shift Indian households' lighting from kerosene to electric
- Strong growth in LPG as replacement for biomass in households



India’s weather in 2022

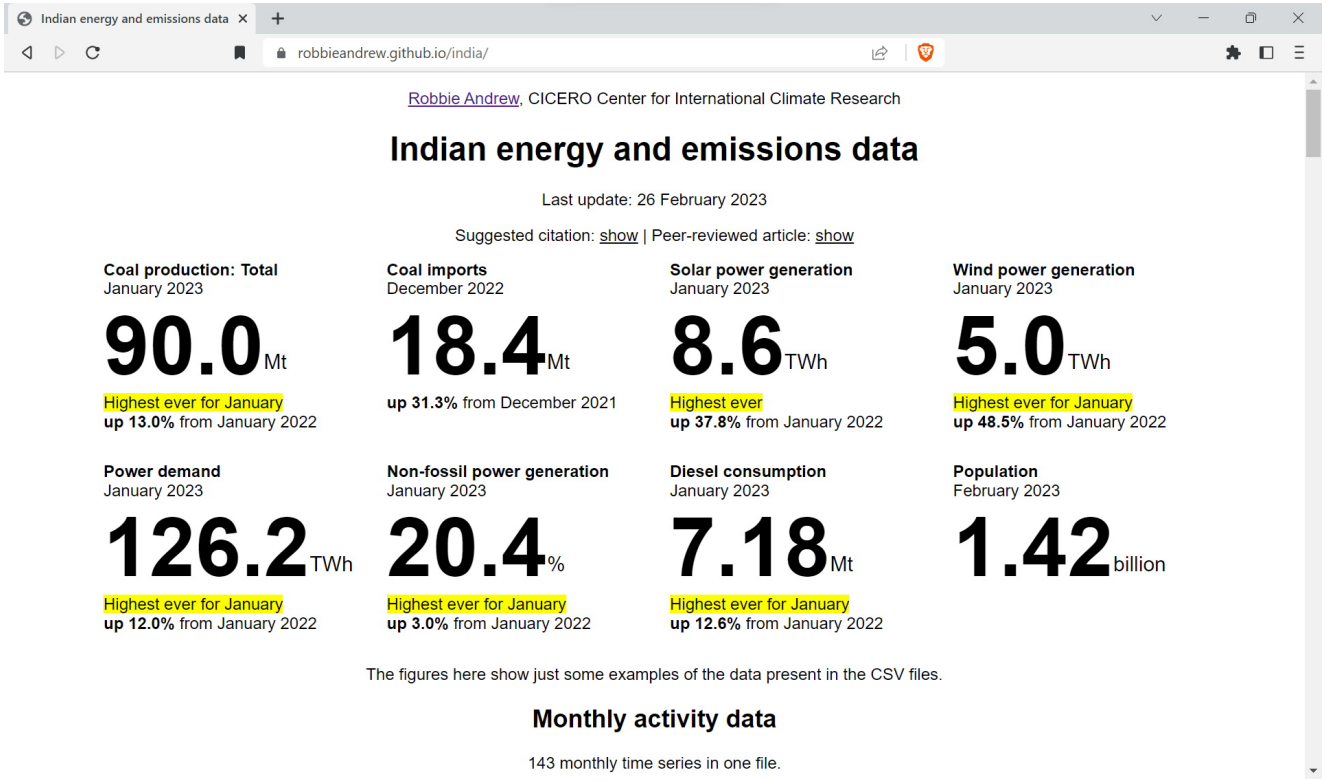
- In March and April India and Pakistan faced early and extended heatwaves
  - India’s hottest March since records began
- Surge in power demand led to India’s passenger trains being cancelled so more coal could be moved from mines to power stations
- Half of Indians work outside and only 8% of houses have air conditioning, leading to high exposure rates, but sales of cooling units are growing quickly



tropicaltidbits.com via Washington Post

Get the data behind this presentation

- Data are collated from many government and company websites
- Data are extracted from PDF documents where necessary, cleaned, and metadata attached
- Some data updated daily
  - electricity generation from two sources
- Dashboard with recent highlights
- https://robbieandrew.github.io/india



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Thank you

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