

Figure 2: India has a booming and vibrant economy, but potential for high emissions remains

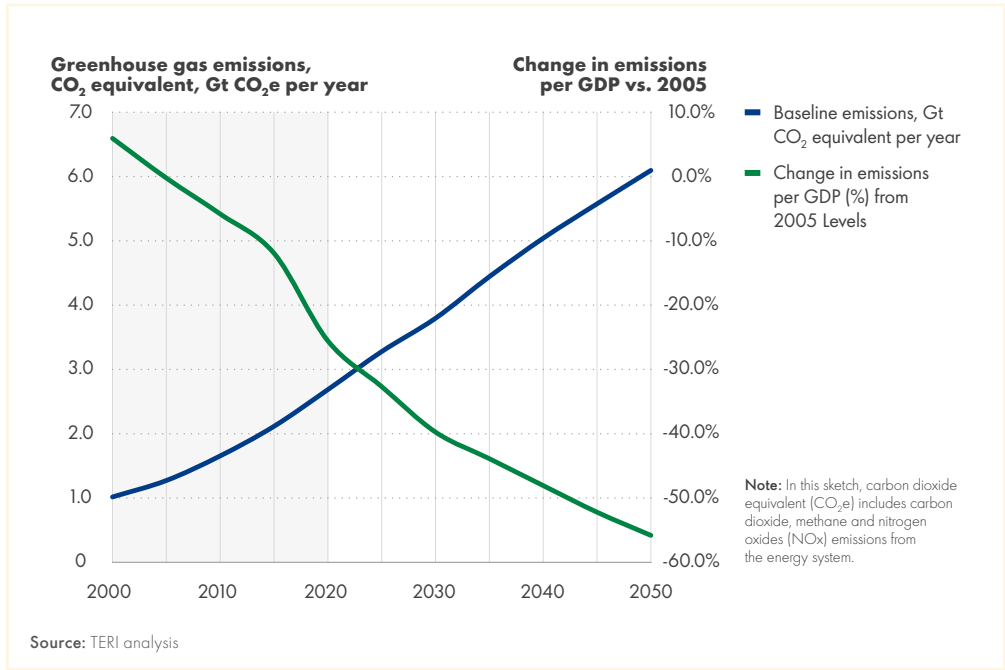
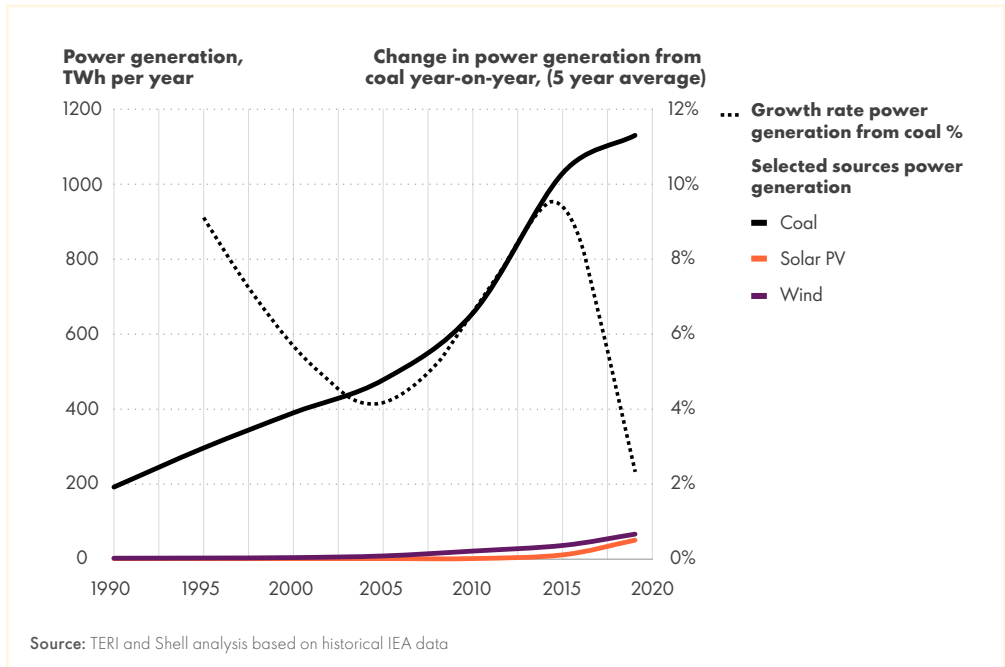


Figure 3: The transition of power generation is making progress





SECTION ONE
ENERGY SYSTEM
CHANGE





SEIZING THE OPPORTUNITY

The transition challenge that India faces is quite different to most other countries in that a substantial portion of the potential future emitting infrastructure has yet to be built or deployed, but it almost certainly will if current investment trends do not shift. For example, motor vehicle numbers in India are around a tenth that of many European countries on a per capita basis and will certainly increase. The pathway for India is to rapidly adopt a range of new energy and mobility technologies before it has committed to a high-emitting energy system.

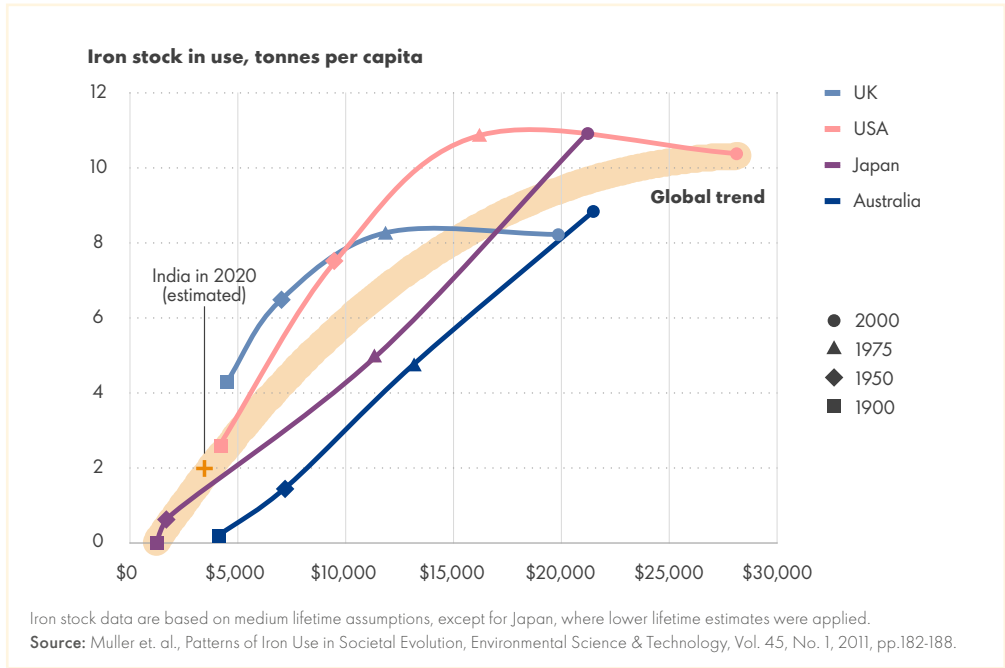
There is a further central opportunity to mitigate future emissions. India's development trajectory will likely feature a broader balance between industrial and service sectors earlier in its development compared with other countries. Taking advantage of the efficiencies offered through electrification, renewable energy and digitalisation, the country could reach a given level of GDP per capita with a much lower energy consumption than developed economies. This will be crucial if India is to succeed in managing its emissions. There are also potential wide-ranging economic benefits on offer. New sources of growth and competitive advantage that India could derive from cleaner technologies and renewable resources also offer commercial opportunities for businesses across the country, while weening India off its demand for oil, 80% of which is imported.

THE CHALLENGES AHEAD

India is at a pivotal point in its development. Energy use remains low and the use of materials such as iron is still modest compared to developed economies. There is clear evidence that India is adopting recent technologies as it develops. For example, the LED lighting market has grown in tandem with access to electricity in India. There is a trend towards first-time LED use in low-income households as electricity becomes available, which helps to manage both access to electricity and emissions. However, there are challenges ahead.

Today there are about 3 billion tonnes of steel in use within the country, in buildings, cars, appliances, pipelines and industrial plants (Figure 4). But as India aspires to be a developed economy, that number will likely rise to around 15 billion tonnes.¹⁰ Every other country has built its steel infrastructure with coal as the energy source, but if India does the same that could add another 24 billion tonnes of CO₂ to the atmosphere globally, based on production emissions of about 2 tonnes of CO₂ per tonne of iron. This is 6% of the IPCC 1.5°C carbon budget globally¹¹ and would create a significant emissions spike, even considering efficiency improvements in smelting and optimised recycling. It will also add to the local environmental stresses that people in India feel each and every day. And that is just one aspect of India's national development pathway.

Figure 4: Demand for materials puts pressure on emissions; steel use in India could quintuple over time



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The challenges related to development in India need to be recognised to reach the goal of net-zero emissions. India is a country that is rapidly developing and industrialising, a process that is inherently emissions-intensive if it follows the path previously taken by all leading economies. The **NZE** scenario addresses these issues through the technologies, practices and behaviours it analyses. Below we look in more detail at actions required to:

- accelerate the mass deployment of clean technologies and energies;
- support energy-efficient and low-carbon choices; and
- remove unavoidable emissions.

PART 1: ACCELERATE CLEAN TECHNOLOGIES

To reach a net-zero emissions energy system by 2050, India needs to deploy cleaner energy technologies on a mass scale.

It requires more widespread and faster deployment and adoption of large-scale solar, wind and hydro power – replacing coal – to power greater electrification across the country, both in rural and urban areas. In tandem, it requires the development of new fuels, such as liquid biofuels and biogas, to help drive the decarbonisation of the agricultural and transport sectors. And, over time, India requires hydrogen produced from electrolysis to manage carbon emissions from hard-to-abate sectors such as heavy industry and heavy commercial vehicles.

The role of electricity

The electrification of energy services is a major lever for the transformation of the energy system and reduction of emissions, particularly as the electricity system shifts to zero-carbon generation through solar and wind power.

Opportunities for electrification exist in every sector of the economy, with most making use of available or near-term technologies.

Figure 5: Power generation grows, dominated by wind and solar mid-century

