

# COAL ISN'T EASY TO EXCLUDE FROM SUSTAINABLE DEVELOPMENT

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Heavy machines operate at an open cast coal mine in Khammam, Telangana, January 10, 2022. | Photo Credit: G.N. Rao/The Hindu

The world is [highly dependent on fossil fuels](#), which produce 80% of the total energy supplied. In 2022, oil, coal, and gas accounted for 30%, 27%, and 23% of the world's total energy, while solar and wind energy sources together contributed only 2.4%. Further, the per capita energy supplied in India during 2022 was 37% of the global average, and only 26% of that of China. Since per capita energy is directly related to the Human Development Index, we can expect that India's energy needs will continue to grow in the foreseeable future.

Electricity security is achieved only by having a reliable and stable supply of electricity that can always match the demand at an affordable price. Only 10.4% of the 36.44 exajoules of India's primary energy consumption in 2022 are from renewables (hydroelectric, solar, and wind); coal and oil gas account for 55.1% and 33.3%, respectively. [Coal-fired thermal power plants](#) (TPPs) generated 74.3% of India's electricity during FY 2022-2023; generation by TPPs continues to grow to meet demand. The country's coal sector plays a vital role in infrastructure development and in the power, steel, cement, and aluminium industries, which employ millions of people.

Further, India's cumulative emissions from fossil fuels and industry between the start of the industrial revolution in 1750 and the end of 2021 are only 3.3% of the global total, far behind those of Europe (31%), the U.S. (24.3%), and China (14.4%). Fulfilling the development needs of 17% of the world's population, which lives in India, is also a fundamental duty to which we must attend, failing which 'sustainable development' will simply be an empty catchphrase.

Most of the critical materials required for grid-scale battery storage are controlled by the top three producers – especially China – and batteries will become cost-effective only after 2030. Against this backdrop, India must focus on increasing the efficiency of its TPPs to reduce emissions while ramping up nuclear energy and enhancing pumped storage to integrate more solar and wind energy into the grid.

According to Central Electricity Authority (CEA) projections for FY 2031-2032, India's national grid can absorb 924 TWh of electricity from various renewable energy sources by progressively adding 47 GW of battery storage capacity and 27 GW of pumped storage projects by FY 32. The tariffs of pithead TPPs are only 40% of the current round-the-clock tariffs for solar plants backed

by battery storage in India today. Further, any major increase in battery storage capacity in India will require the import of critical minerals like lithium, cobalt, nickel, and graphite, which are controlled by other countries (mainly China), posing significant risks to India's energy security.

Ninety-six percent of the coal used by TPPs in India comes from domestic mines and is key to why electricity is so affordable in India. Therefore, the CEA's National Electricity Plan projects that TPP capacity in India will reach 259-262 GW by FY32, from 212 GW in FY23.

However, recent projections indicate that only 19 GW of pumped storage projects and 18 GW battery storage capacity additions are expected by FY32, which will require a further 23 GW of TPP capacity to be added to the grid by then – above the 40 GW of new TPP capacity projected by the CEA.

To balance this with India's long-term goal of reaching net-zero by 2070, the country must continue to implement clean coal technologies to reduce the power sector's emissions.

Coal deposits in India generally contain high levels of ash (35-50%) compared to those mined in other major coal-mining countries, like Australia, China, and the U.S. Burning coal with more ash leads to the erosion and eventual failure of boiler tubes and other components, affecting the plant's availability, efficiency, and performance.

The transport of unwashed raw coal to TPPs located more than 500 km from the mines also means transporting millions of tonnes of ash-producing non-coal material, congesting India's over-stretched road and rail transportation systems.

The practice in all major coal-producing countries is that the coal miner washes the run-of-mine coal (i.e. coal with impurities) at the pithead and dumps the rejects in the mine, before dispatching the washed coal of higher calorific value to consumers.

The government can mandate miners to supply only washed coal to all TPPs located more than 500 km from mines or ports to reduce carbon dioxide emissions and other environmental pollution. The coal-washing charges can be regulated as a part of the tariff determination process to protect consumers.

Indian coal – other than that from Assam and Meghalaya – has lower sulphur content than that mined in other coal-rich countries, and about one-sixth of that of coal used in Chinese power plants. However, TPPs in India also have some of the tallest stacks in the world, and most of them are in regions where the flue gas' exit velocity coupled with favourable weather conditions allow sulphur dioxide emissions to be dispersed far and wide.

According to the U.N. Intergovernmental Panel on Climate Change, historical sulphur dioxide emissions have created a cooling effect by producing sulphate aerosols that block some of the incoming solar radiation and enhance cloud formation, masking global temperature rise by 0.5 degrees Celsius.

However, the projected reduction in the gas's emission in China by the use of flue gas desulphurisers (FGDs) in their TPPs could result in an increase in the global average temperature between 2016 and 2050 by about 0.6 degrees Celsius.

Retrofitting existing TPPs with FGDs, to comply with current emission norms, could increase their specific coal consumption by 1.5-1.7%, leading to correspondingly lower energy efficiency and higher emission intensity. Such retrofitting also requires thousands of crores in capital investments and tariff hikes, not to mention temporary plant shutdowns.

Currently, retrofitting FGDs in operating TPPs has been delayed in India because TPPs are unable to shut down: coal-fired power generation has increased by 11% in the last seven months over the corresponding period in FY 2022-23.

In this milieu, the government can implement a 'graded priority' of power plant pollutants: particulate matter, carbon dioxide, sulphur dioxide, nitrogen oxides, and mercury, in that order. This way, India can reduce particulate emissions by 99.97% by installing the cost-effective, high-performance electrostatic precipitators and reserve FGDs for TPPs near urban areas.

Some 30% of the current TPP capacity in the country is from supercritical or ultra-supercritical technologies, which are also being installed in the 35 TPPs under construction. TPPs based on advanced ultra-supercritical technology (AUSC), with a proven efficiency of 46%, will also reduce carbon dioxide emissions by 15% compared to TPPs equipped with supercritical technology.

Integrated gasification combined cycle (IGCC) power plants also have efficiencies of 46-48% and can capture carbon dioxide.

Taken together, the Government of India can incentivise projects to prove IGCC or AUSC technologies at scale before 2030. To enhance round-the-clock zero-carbon electricity generation, the Indian government can encourage NTPC – India's largest power generator – to repurpose some TPP sites to install small modular nuclear reactors under the overall supervision of the Atomic Energy Regulator, while complying with international safeguards.

Global warming is the result of the combustion of fossil fuels, not just coal. Such a challenge can be tackled only according to the principle of 'common but differentiated responsibilities and respective capabilities' enshrined in the U.N. Framework Convention on Climate Change (UNFCCC) and in the Paris Agreement.

It's theoretically elegant to argue that switching to renewable energy will generate investments and jobs – but it may not work so smoothly in practice since the electricity grid must meet the peak demand at all times. The efficient operation of TPPs is critical for India since they ensure that peak and off-peak demands are met continuously, at affordable costs.

For India, low-carbon development is not a choice but a necessity, and the steps to achieve this are reflected in the 'Long-term Low-Emissions Development Strategy' it submitted to the UNFCCC.

The authors hope that developed countries will take the lead in combating climate change and provide new and additional climate-specific financial resources and technology transfer to developing countries as under the provisions existing under the UNFCCC and the Paris Agreement.

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