



The black hole of coal

HAZARIBAGH, JHARKHAND STATE

India shows how hard it is to move beyond fossil fuels towards a renewable future

DARKNESS is falling as coal starts its long, lawless journey from the pit. The first signs are the cycle-pushing foot-soldiers, such as Ravi Kumar, a 26-year-old whose yellow shirt and grey turban are as coal-smudged as his face and hands. Using his bike like a wheelbarrow, he strains uphill with his back bent, then coasts down with one sandalled foot on the pedal, the other scuffing the tarmac as a brake. The bike is laden with half-a-dozen sacks of coal, pilfered from a nearby mine.

There are hundreds of other small-time thieves like him, he says nervously, supplementing their income on a Sunday evening by fanning out to sell bike-loads of coal to owners of iron works and brick kilns, and tea brewers. Coal-fed braziers and stoves flicker by the side of the road, black smoke pouring out. An Indian Dickens would be scribbling furiously.

Then there are the coal lorries—the heavy artillery. They gather at the edge of a nearby village, 140 of them squeezed along the roadside, ready to trundle off for the nightlong journey to Hazaribagh, the biggest city in this part of Jharkhand state.

Across eastern India, which sits on the country's largest coal reserves, this ragtag army sets out at dusk to feed the furnaces, fill the railway wagons, and fuel the power stations that get India's economy moving.

It is the same across much of Asia, where coal consumption grew by 3.1% a year from 2006 to 2016, accounting for almost three-quarters of the world's demand for the most polluting fossil fuel.

Last year, just as Western banks and global development agencies were shunning coal projects on environmental grounds, India, the world's second-biggest burner after China, consumed an additional 27m tonnes, a rise of 4.8%. That led to the first increase in global coal consumption in four years, says BP, an oil company. Demand in China also picked up slightly, and there were big increases from Bangladesh and

Pakistan to the Philippines and South Korea. Such is the supply and demand that prices for thermal coal, the type used for generating electricity, are at their highest since 2012, and have more than doubled in the past two years.

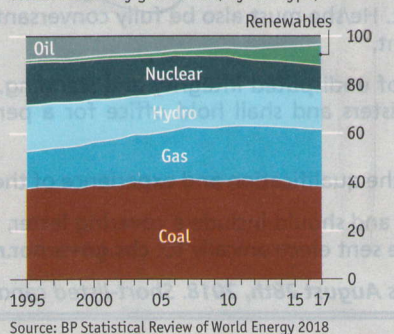
The environmental implications of this resurgence are deeply troubling. Asia accounts for more than half of the 9m pollution-related fatalities recorded in 2015, according to a recent study for the *Lancet*, a medical journal. India's 2.5m deaths is by far the biggest share. Coal is the main culprit. It is also a wrecker of the climate. Coal's comeback helps explain why 2017 was the first year in four that global emissions of carbon dioxide have risen, thwarting the planet-wide effort, accelerated by the Paris summit in 2015, to control climate change. BP notes that coal's share of global electricity generation—by far the largest source at 38%—has not shrunk in over 20 years, despite the rise of gas and renewable energy (see chart 1).

No country is likely to contribute more to the growth in energy demand over the next two decades than India, says the International Energy Agency (IEA), a global forecaster. When India submitted plans for climate-change actions at the Paris summit, it predicted that its electricity demand would triple between 2012 and 2030. If coal meets much of the growing appetite for power, as the IEA expects it will, no country will contribute more to the rise in carbon emissions.

India has plans for alternative means of generating electricity. Even before the Paris summit, Narendra Modi, the prime minister, aimed to install 175 gigawatts (GW) of renewable-energy capacity by 2022, a vast

Coal is still king

Global electricity generation, by fuel type, %



► increase from today. That has now risen to 227GW. In the meantime, prices of wind and solar power have tumbled. Recent auctions have led to a 50% drop in the cost of solar power in the past two years, to about three rupees (\$0.05) per kilowatt hour, about the same as wind. This can make both sources cheaper than building new coal-fired capacity. An excise tax on production and imports makes coal ever less attractive. After a massive spree of building coal-fired power plants in recent years, investment slumped last year, while that in alternatives surged (see chart 2).

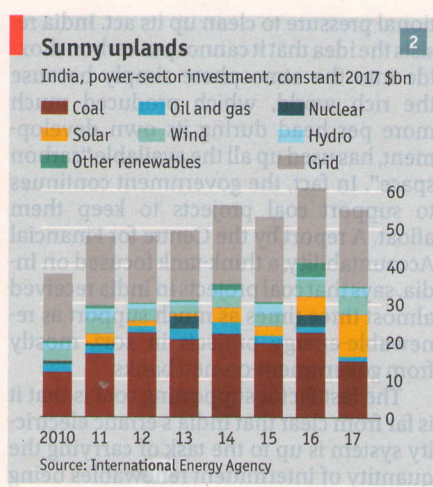
It is one thing to recognise the imperative for reducing coal in a country's energy mix. It is another to consider the ramifications of shifting from a cheap source of fuel native to India. A swing through coal country provides a sobering illustration of how hard it is to wean a country off fossil fuels. The first thing you notice, however obvious, is that coal is grimy. It cakes roadsides and blackens rivers and lungs with soot.

Although coal is horribly filthy, India is utterly dependent on it. It generates more than three-quarters of the country's electricity. Mining it and turning it into power accounts for a tenth of India's industrial production. It provides jobs as well as power. Coal India, a state-owned coal miner that is the world's largest, employs, at last count, 370,000 people, and there are up to 500,000 working in the coal industry at large. Far from reining in production, Coal India plans to increase it, from 560m tonnes in 2017 to 1bn tonnes by 2020. The government's target for national production is 1.3bn-1.9bn tonnes by 2030.

Rohit Chandra, a political scientist who is writing a book on India's coal industry, estimates that 10m-15m people benefit indirectly from coal, through social programmes near mines. He notes that, in eastern states, Coal India and its subsidiaries have provided roads, homes and water when local governments have been negligent. It is also a big source of revenue for state governments in poor areas.

The mighty railways, which employ over 1.5m, also depend on coal. Because the producing states are in the east, far from the biggest cities, coal accounts for half the freight carried on the network.

To illustrate coal's stubborn resilience, consider the Patratu power station in Jharkhand. The building feels all but abandoned. Sunflowers grow amid the rusted struts of its substation. Buffalo sometimes



wander into the vast turbine hall, littered with boilers and other equipment. Some boilers are broken open so that you can peer inside. The centrepiece is its control room, built by Soviet engineers in 1962, still furnished with its original knobs and dials. Clambering through the mess gives a perverse thrill.

The plant chugged on for more than half a century, producing its final trickles of power last year. But instead of facing extinction, as many environmentalists would hope, Patratu is about to be resurrected by NTPC, the state-owned power producer, and the Jharkhand government. In May Mr Modi staged a televised event in which he unveiled a new foundation stone. The first phase of renewal will be a 2.4GW power station, costing 186bn rupees. A second will add 1.6GW.

Back from the brink

It is not a one-off. For all Mr Modi's ambitions for renewable energy, Patratu is part of a projected 48GW of coal-fired capacity under construction or planned between 2017 and 2022. Although it is a sharp slowdown compared with recent years, it goes far beyond replacing 22.7GW that is due to be retired and is not far short of the 69GW of renewable energy so far installed in India. For comparison it is almost as much as the total thermal-power capacity of South Africa, a coal-burning country.

Patratu, and the coal fields that supply it, provide a glimpse of the interdependence between coal, power and the state that took root with the birth of modern India. After independence in 1947, the Indian government wrote an electricity law to of-

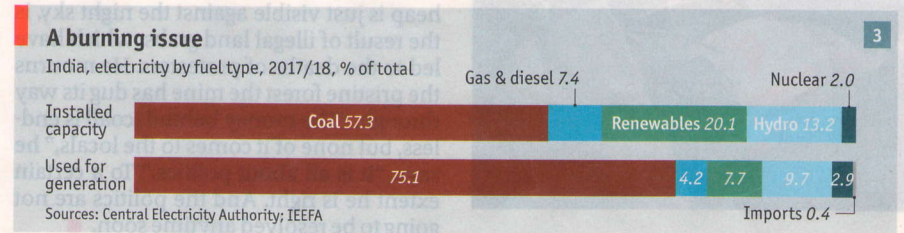
fer power to its newly free citizens. At first it put the formerly British-owned mines into private Indian hands but, after it became known as "slaughter mining" because of an atrocious safety record, the industry was nationalised in 1973. Power generation was kept mainly in state hands. During the cold war, the Soviet Union backed the development of energy infrastructure, which helped entrench the state-owned model and produced power stations like Patratu.

Three factors help explain why coal is likely to remain ingrained under the fingernails of the nation—politics, economics, and the complications of generating electricity. First politics. Coal chokes India politically, especially in states where it is mined. Though Jharkhand sits on 40% of India's mineral resources, it is among the five poorest states. A Maoist insurrection simmers on the edge of coal country, partly because the benefits have been so unevenly shared between those who exploit coal and those living on the land.

The "resource curse" is an argument for weaning the economy off coal, yet it works both ways. Coal-related graft infects politics, making change harder. "Gangs of Wasseypur", a Bollywood blockbuster of 2012, is a dramatisation of the mafia that for decades has hijacked Jharkhand's coal industry, for personal and political gain. Ramesh Sharan, vice-chancellor of the Vinoba Bhave University of Hazaribagh, says that about a third of coal output in Jharkhand is mined illegally, lining the pockets of businessmen, politicians and bureaucrats, especially at election time. "Everybody's a shareholder in the coal mafia," he says.

Mr Chandra describes coal as "deeply embedded and enmeshed" with the state. Efforts to reduce the government's role in the industry have had perverse results. For instance, in the 1990s the steel industry and other consumers were permitted to mine coal for their own use, which led to an infamous scandal, called "Coalgate". In 2014 the Supreme Court annulled mining contracts awarded between 1993 and 2010, after it became clear that they had been allocated in an arbitrary way at throwaway prices, mostly as a result of crony capitalism involving politically aligned firms, state-owned banks and local bureaucrats. It cost the government the equivalent of \$33bn. So embedded are such interests, which have largely gone unchallenged, that a swift transition from coal would meet "serious political opposition" in parts of India, says Mr Chandra.

The second factor behind coal's persistence is economics. The coal-fired power industry is too big to fail. It is a huge source of financial vulnerability because it has grown too quickly in recent years, on a river of money borrowed from state-owned banks. During the past decade, private firms built a massive 84GW of coal-fired generating capacity, more than a third of



► India's total, on expectations of a surge in electricity demand.

That increase has so far failed to live up to expectations, in part because of problems with the national grid that continues to leave large swathes of the population without power for much of the day. As a result, coal-fired plants have suddenly found themselves awash with unwanted capacity. Revenues have plummeted. The average load factor—the proportion of its nominal capacity a plant generates—was 60% in 2016-17, down from 70% in 2012-13.

Unplugged

This has left parts of the industry, as well as many of the banks that lent to it, in dire straits. Arvind Subramanian, the government's (outgoing) chief economic adviser, points to estimates that some 40 to 50GW-worth of coal-fired plants are behind on debt repayments. He says this represents about 15% of "stressed assets" in India's banking system. Many of the banks are state-owned, posing a risk for the economy.

Mr Subramanian, Mr Chandra and others fear that if coal-fired plants go belly up, the banking system would be badly strained. But bankruptcies are unlikely to be forced by banks that want to avoid write downs on loans that will pay off when the expected surge in demand finally comes.

Coal's life will be made harder by increased competition from cheap solar and wind. Because of that, Mr Subramanian suggests that Mr Modi, his solar-evangelist boss, should slow down his roll out of renewable energy. "In my ideal world India should do a bit less renewable and a bit more coal for the next 10-15 years," Mr Subramanian said in May. Some dismiss his comments as deliberately provocative. Yet he has rubbed salt into the wounds of environmentalists by describing efforts to wean energy-poor countries such as India off fossil fuels as "carbon imperialism".

Coal's staying power may be reinforced by India's sense of immunity from interna-

tional pressure to clean up its act. India resists the idea that it cannot put carbon dioxide into the atmosphere simply because the rich world, which produced much more per head during its own development, has used up all the available "carbon space". In fact, the government continues to support coal projects to keep them afloat. A report by the Centre for Financial Accountability, a think-tank focused on India, says that coal projects in India received almost three times as much support as renewable-energy projects in 2017, mostly from government-owned banks.

The last factor supporting coal is that it is far from clear that India's erratic electricity system is up to the task of carrying the quantity of intermittent renewables being planned, or that low renewables prices are sustainable. As everywhere, intermittency is a problem because the sun does not always shine or the wind blow. This means that solar and wind generate less than their installed capacity would suggest. They account for 20% of capacity, compared with 57% for coal. But they generate a meagre 7.7% of output because of intermittency, compared with 75% for coal (see chart 3 on previous page).

Old-fashioned grids, which carry electricity from power stations to homes and businesses, need expensive upgrades to integrate widely distributed solar and wind farms, so that power from states where the sun is shining, for instance, goes to places where it is not. The 158GW of renewable capacity that is supposed to be built over the next four years could put an enormous strain on the system, despite copious recent investment in grids.

There may also be a "renewables bubble" in India, pushing down prices below a sustainable level. Solar firms offering very low bids in power auctions (where the lowest-cost provider wins) may not be able to supply what they promise. States may try to renegotiate prices agreed when renewables were more expensive, which

could put off developers. There are persistent risks related to land acquisition, rights of way and availability of local infrastructure, as well as uncertainty over funding costs. Banks and businesses were misguidedly bullish about coal in the past decade. Why trust them more on renewables? "I don't know why anyone would invest in renewables," says Sajal Ghosh, an energy economist. "But I also don't know why anyone would invest in coal."

Some still live in hope. Ajay Mathur of The Energy and Resources Institute, a research body, points out that if the price of renewables continues to fall to below two rupees per kilowatt-hour, roughly the variable cost of coal-fired power (ie, excluding the cost of building the plant), solar will become the preferred choice for distribution companies. "I'm not sure where the electricity generated by these new power plants will be sold because coal-based power is becoming economically obsolete," he says. Navroz Dubash, of the Centre for Policy Research, a think-tank, agrees. He says it is "kind of crazy" to think that there will still be investment in coal-fired power plants, which last for decades but could be redundant in years. He also describes the idea of supporting coal to bail out the banks as "throwing good money after bad."

Grid pro quo

More likely coal and renewables will live side by side for many years. A lot of Indians still go without power. The average Indian uses a bit less electricity than a citizen of Gabon, a bit more than a Guyanese. Mr Modi may have thrown his weight behind solar and wind but, until other forms of backup power, such as storage, become cheaper, the system will still need coal to keep the lights on. If demand for electricity picks up, with growth in the number of electric vehicles, for example, coal may become yet more important in the energy mix—and the gains from burning less petrol will be offset.

In the long run, the strategy is to put new coal-fired power plants in places like Jharkhand, close to sources of coal and far from big cities. But even there, locals are unhappy. Sitting beside a coal-fired brazier during a blackout near Hazaribagh, a former consular employee from Kolkata, who asks not to be named, picks up and inspects a lump of coal: "Black diamond", they call it," he snorts. He complains that a new NTPC coal mine, whose giant slag heap is just visible against the night sky, is the result of illegal land grabs, which have led to the deaths of protesters. He mourns the pristine forest the mine has dug its way through. "The money behind [coal] is endless, but none of it comes to the locals," he says. "It is all about politics." To a certain extent he is right. And the politics are not going to be resolved anytime soon. ■



◀ Riding India's business cycle