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Abstract

India is the world's third-largest emitter of CO2 and coal-fired power plants contribute approximately half of India's CO_2 emissions. Indian government policies assume a significant expansion of coal-fired power in India over the next two decades. This paper compares the costs of coal and renewable power, including quantifiable *domestic* external costs, in 2018 as well as projections for 2025. Our estimate for the environmental cost of coal is 2.4 US ¢/KWh (1.64 ₹/KWh) in the financial year 2018-19. The average cost of electricity from nearly all coal plants in India is greater than the cost of new solar and wind generators in 2018-19 when environmental costs are taken into account. More than 50% of the coal capacity has a social *operating* cost that is higher than the average social cost of power from renewables. By 2025, the cost of electricity from renewables with storage will be comparable to the domestic social costs of the cheapest new coal plants. We emphasize that this analysis holds without any accounting of climate change impacts in the form of a cost of carbon. There is, therefore, no economic case for new coal plants in India.

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1 Introduction

India's CO_2 emissions are the third-highest in the world after China and the US, and coal-fired electricity accounts for about one-half of them. Coal provided 74.3% of Indian electricity generation in the financial year 2018-19 (1st April to 31 March) [MoP, 2019], and the electricity sector accounted for two-thirds of India's coal use. Renewables have made significant inroads recently with capacity addition between 2017 and 2019 being nearly 2.5 times coal capacity addition.[1] Solar PV and wind contributed 7.4% of electricity generation in 2018-19. In 2014, the Prime Minister announced a target to install 100 GW of solar PV and 60 GW of wind capacity by 2022 of which about 64 GW had been installed by March 2019. If the 2022 target is met, then the share of wind and PV in electricity generation is projected to increase to about 20% [Palchak *et al.*, 2017]. Electricity generation from coal in India temporarily peaked in 2018-19, as a result of two consecutive years of slow or negative growth (including the COVID-19 induced recession) and rapidly rising renewables contribution. In 2020-21, electricity generation from coal was 4% lower than the 2018-19 peak, and share of coal in electricity has reduced to 71% [MoP, 2019].

Nonetheless, Indian policymakers still seem committed to a significant expansion of coal in the coming decades. Indeed, the Economic Survey (2016-17), the most important policy document of the Ministry of Finance, claimed that the social cost of electricity from renewables was three times that of coal [MoF, 2017]. A recent review of seven energy and emissions modeling studies published after 2013 found that all of them project an increase in coal use by a factor of 2 to 3 in their reference scenarios for 2030, even those that incorporated emission-reduction policies announced in 2015 or later [Dubash *et al.*, 2018]. The draft energy policy of the Government of India [Aayog, 2017] projects an increase in coal power capacity of 70 to 130 percent by 2040 and calls for large increases in investment in coal mining infrastructure. The International Energy Agency's World Energy Outlook 2020 [IEA, 2020] projects coal based electricity generation to grow by approximately 20% in business as usual scenarios

[1] Data and code used in this paper are in an Excel workbook called Data-and-Code-book.xlsx. Data on generation capacity is in Sheet 2.

while declining by as much as 85% in sustainable development scenarios.[2] A draft National Electricity Policy dated February 2021 continues to recommend expansion of the coal power fleet emphasizing that it is the cheapest source of electricity [Varadhan, 2021]. Policies regulating coal in the Indian power sector might have a significant impact on the difficulty in meeting the stringent carbon budget of the IPCC Special Report on Global Warming of 1.5 °C [IPCC, 2018].

Here we do an accounting of the private and external costs of electricity from coal, solar and wind using the most recent data and literature. We take the perspective of an Indian policy-maker, and, therefore, account only for costs incurred within India.[3] We first show that the cost of electricity from the cheapest wind and solar PV in 2018-19 is, in fact, lower than just the *operating* cost of more than half of existing coal capacity, once domestic costs of pollution are accounted for. In fact, even when externalities are not accounted for, we find that about a third of coal capacity has operating costs higher than the average cost of new renewables. It is only pre-existing contracts that are keeping many coal plants in operation. It would be economical to start replacing the highest-cost coal generation with renewables. Modelling of the Indian electricity grid shows that such replacement would be feasible with only some regulatory changes and modest improvements to the transmission system until the share of wind and solar PV reaches three times its 2018 level [Palchak *et al.*, 2017].

Next, we compare the likely domestic social costs of renewables with storage and coal-fired power in 2025. We find that they fall within the same range. Thus, the energy economics literature that predicts a massive expansion of coal, as well as current government plans, are both inconsistent with least-cost development of India's power supply system. In fact, least-cost development will entail a large decline in CO2 emissions from electricity.

[2] As recently as 2019, the International Energy Agency was predicting a doubling of coal production in India by 2040 with an even larger increase in coal consumption in its Stated Policies Scenario [IEA, 2019].

[3] Since particulate pollution and climate costs of coal combustion extend outside India, our conclusions would be strengthened, if we were to include them.

2 Costs of Electricity from Coal

2.1 Private Costs of Coal

Coal (including lignite) power plants generate 71% of India's electricity. There has been a significant expansion of coal power in India since 1980, and especially since 2007. Coal plant capacity grew from approximately 16 GW in 1980 to 71 GW in 2007, and was 200 GW in 2019. Figure 2 shows the variable and total costs of electricity from coal for all generating plants on 25 May 2018.[4] The data come from the Government of India's Merit Order Dispatch of Electricity for Rejuvenation of Income and Transparency (MERIT) website (http://meritindia.in/) which provides a real-time snapshot of generating power plants in the country. The wide range in variable costs represent the range in the cost of coal (graded by calorific value) and the cost of rail transportation of coal from mine to power plant. While the typical cost (including taxes) of the average grade of thermal coal is $ 22/ton (₹1541), the cost doubles for a plant at a distance of 1000 km. Capital costs vary significantly as well. These could be zero for very old plants and could be as high as 8-12 ¢/kWh for new units with low capacity utilization factors.

2.2 External Costs of Coal

The largest contributor to the external costs of coal-fired electricity is the impact on mortality from air pollution. Coal combustion in power plants is a significant source of microscopic particulate matter like PM2.5, both primary PM2.5 emissions (ash, black carbon and organic carbon) as well as secondary PM2.5 (sulphates and nitrates), formed in the atmosphere from SO_x and NO_x emissions. The population-weighted average concentration of PM2.5 is 74 $\mu g/m^3$, significantly higher than the World Health Organization (WHO) Air Quality Guideline of 10 $\mu g/m^3$ [GBD-MAPS, 2018].

Our estimate of the mortality cost of coal is based on the latest and most comprehensive

[4] We chose a day in May when demand typically peaks in India and most coal plants are likely to be running.

study of mortality from ambient air pollution [GBD-MAPS, 2018] that estimated 30,000 deaths from primary coal ash PM2.5 emissions [Venkataraman, 2018] and 82,900 deaths from secondary PM2.5 emissions in 2015.[5] To estimate the deaths that can be attributed to individual coal power plants we assume that the deaths are proportional to total pollution exposure per plant. We assume that the exposure is proportional to a product of annual coal consumption and exposed population. The exposed population is estimated as the sum of the monthly average number of people in a 90°sector of radius 700 km in the direction of the monthly average wind direction. We use a database of power-station-level coal consumption and annual power generation from [MoP, 2019] to estimate the number of deaths per KWh of electricity from an individual coal power plant. Accounting for emissions and population growth since 2015, we arrive at a linear extrapolation of 135,000 deaths attributable to coal plants in 2018. [6]

We multiply the deaths per power plant by the value of a statistical life (VSL). VSL is the product of the willingness to pay to avoid a given increase in the probability of death and the reciprocal of the probability. That is, it is a measure of the monetary value that people place on a reduction in the risk of dying, where the units are scaled to express the value of reducing a certainty of death to zero. The product of annual deaths with VSL is thus an estimate of the annual monetary loss from the deaths due to air pollution.

There are three published studies estimating the VSL in India. Two of them use data on wages and occupational risks in Indian cities to estimate the risk-income trade-off chosen by workers [Shanmugam, 2001], [Madheswaran, 2007]. We exclude these estimates because they are very high compared to developed-country estimates estimated from much more comprehensive data.

[5] The Burden of Disease attributable to Major Air Pollution Sources (GBD MAPS) project developed current and future pollution emissions inventories, simulated the contribution of each emissions source to ambient pollution, and estimated the exposure of the population in 2015 to each source, and the associated mortality and morbidity burden.

[6] A recent paper [Cropper *et al.*, 2021], using somewhat different assumptions and modelling, arrives at an estimate of between 78,000 and 113,000 deaths in India in 2018 that are attributable to coal-fired power plants. As discussed below, using these estimates would not lead to a qualitative change in our conclusions.

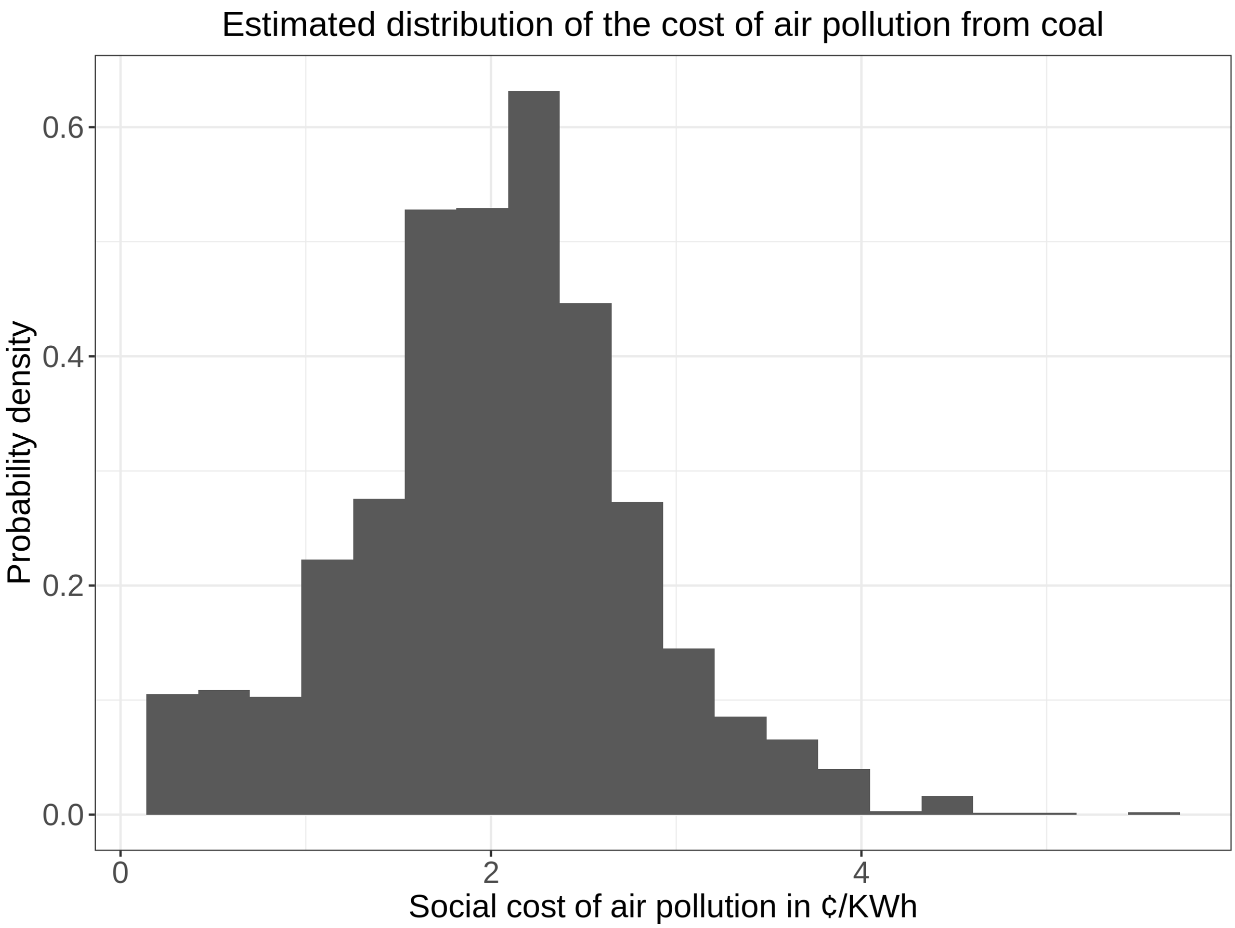

Figure 1: Distribution of the social cost of mortality from air pollution from coal plants. Sources: [MoP, 2019] and this study. The mean cost is 2.03 ¢/KWh with an inter-quartile range of (1.60-2.45).

Instead we use a conservative VSL estimate from a stated preference study in a context of mortality risk from traffic [Bhattacharya *et al.*, 2007] that finds a VSL of 1.3 million Indian rupees (₹) in 2005. Since the VSL depends on income, we update this estimate to 2018. The extent of the adjustment needed depends on the elasticity of VSL with respect to nominal income at Indian income levels. A recent study [Hammitt & Robinson, 2011] suggests that the income-elasticity of the VSL is greater than one at low income levels.

Using a central official value of the VSL for the US, we calculate the elasticity that is implied by comparing it to the Indian VSL from [Bhattacharya *et al.*, 2007]. Applying this value of

1.46, we update the Indian VSL to 10.3 million rupees (149,000 USD in 2018-19). This is considerably lower than the value of 275,000 USD (18 million rupees) in 2016 arrived at by [Viscusi & Masterman, 2017] who use benefit transfer from a VSL for the US. We estimate that the average air pollution related mortality cost in 2018-19 of 2.03 ¢/KWh (1.40 ₹/KWh using an exchange rate of 69 rupees to a dollar). Coal plants on the coast and near the Indian border have low pollution costs as a significant part of the pollution is away from the Indian landmass. Coal plants in densely populated areas have a higher pollution cost. Figure 1 shows the estimated distribution of the social cost of air pollution per KWh from coal plants.

Table 1: Quantifiable External Costs of Coal in 2018.

Coal Externalities	**Cost (¢/KWh)**
Environmental cost of mining	0.29
Mortality cost of air pollution	2.03
Agriculture impact due to reduced insolation	0.06
Total	2.38

Sources: Mining–[TERI, 2013], Mortality–This study, Agriculture–[Auffhammer *et al.*, 2006], [Gupta *et al.*, 2017]. The following costs were not quantifiable: morbidity from pollution, labor productivity losses, pollution-induced emigration, transport delays and accidents due to reduced visibility from smog, loss of tourism revenue due to pollution, utility losses from haze, and the costs of water depletion and pollution by coal power plants.

Other external costs taken from the literature are added to this mortality cost to arrive at a total external cost of 2.38 ¢/KWh (1.64 ₹/KWh). See Table 1. The quantified external cost of coal-fired power is, therefore, over 0.9% of Gross National Income. This is an under-estimate of the domestic external cost because we are unable to quantify several related externalities like the cost of morbidity from pollution, labor productivity losses, pollution-induced emigration, transport delays and accidents due to reduced visibility from smog, loss of tourism revenue due to pollution, utility losses from haze, and the costs of water depletion and pollution by coal power plants.[7]

Adding the external costs of coal to the private costs of generation on May 25, 2018 taken from the Ministry of Power [MoP, 2019], we arrive at the coal cost curves in Figure 2 below (Note that we plot the cumulative available coal generating capacity on the x-axis, ranked by increasing cost of generation). The plots show that the mean cost of power from new renewables is less than the *operating cost* of more than half of the available coal capacity even after accounting for all social and external costs (not including costs of climate change).

3 Renewables are Cheaper than Coal

The price of solar PV, and recently, wind, have declined steeply in part due to the reverse-auction-based price discovery mechanism [IRENA, 2017]. The average prices of solar PV and wind discovered in auctions held in 2017-18 for plants to be commissioned in 2018-19 were 3.97 ¢/KWh (2.74 ₹/KWh) and 4.00 ¢/KWh (2.76 ₹/KWh) respectively.

To find the domestic social costs of the renewables we need to add domestic pollution externalities and the costs of integrating intermittent renewables into the system. The former are negligible since in any case most manufacturing does not occur in India. Integration costs consist of grid costs, balancing costs, and profile costs [Ueckerdt *et al.*, 2013]. We can neglect the costs of connecting to the grid since there is no reason to believe that these are any different for renewables than for fossil plants in India.

Balancing costs arise from the need to ramp fossil plants up and down to match the electricity demand that remains after the portion of demand that is served by variable renewables. The best estimates from studies in OECD countries [Samadi, 2017], are that balancing costs are 0.35 ¢/KWh. The cost of balancing depends significantly on the size of the balancing area and the reliability of the grid. As all of India operates as one grid, the potential balancing area

[7] The mortality estimates of [Cropper *et al.*, 2021] reduce the external costs to a range of 1.55 ¢/KWh to 2.04 ¢/KWh. Using the lower end of this cost range instead of basing it on the mortality estimate from the GBD-MAPS study would still leave just the variable cost of 30% of coal capacity greater than the average total cost of new wind and solar PV. This can be seen by examining Figure 2 below.

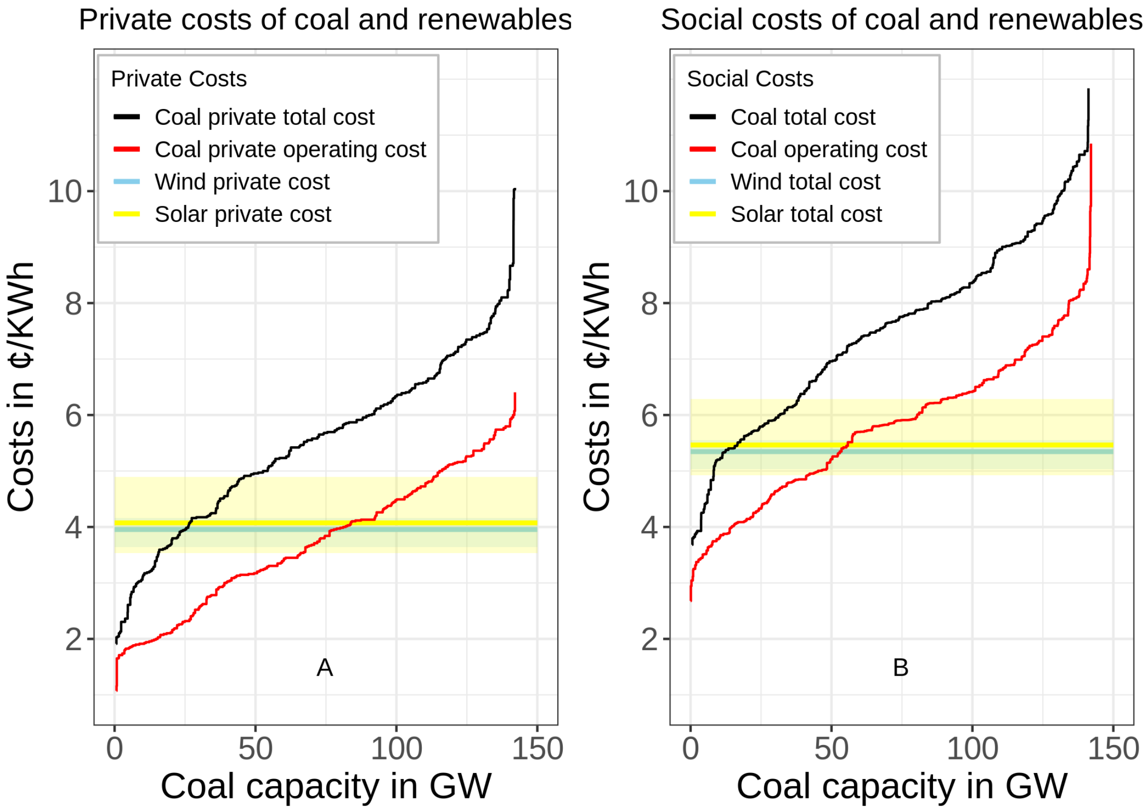

Figure 2: A: Domestic private operating and total costs of electricity from coal plants with available (cumulative) coal generating capacity on the x-axis ranked by increasing cost. Straight lines are average domestic private costs of renewables in 2018-19 while shaded areas show the ranges of renewable costs (blue for wind). B: Same as A with social cost of coal added while accounting for a tax of ₹400/ton ($5.8/ton). All costs in US ¢/KWh converted from 2018-19 Indian rupees (₹). Sources: [MoP, 2019] and this study.

is large. At the same time, the reliability of the Indian grid is far below the norms in more developed countries. The median distribution transformer in India has 207 outages and 88.8 hours of outage per year [CEA, 2017] while the corresponding figure for the USA is a median of 1.5 outages and 2.88 outage hours per year [Larsen *et al.*, 2016]. Since the requirement for reliability is less stringent in India, this means the balancing cost will be lower than in the OECD. Balancing costs can be further reduced if the timing of electricity demand can be shifted to match supply. This is true of agricultural demand from groundwater pumping (18% of total demand in 2017-18 [CEA, 2018a]) since in most states, farmers do not pay for electricity per KWh and receive a supply that is rationed by the distribution companies during off-peak hours. While we use the estimate of 0.35 ¢/KWh for balancing costs in this study it should be considered an upper limit of the possible range of values.

Profile costs result from the need to maintain fossil-fuel capacity even as fossil generation is partly replaced by renewables, so that the fixed cost of fossil plants is spread over a smaller volume of electricity produced. We estimate profile costs using the method of [Ueckerdt *et al.*, 2013]. Coal costs in 2018-19 are for new pithead plants without any pollution control equipment in the reference scenario for 2018-19. While the coal capacity in 2018-19 is approximately 200 GW about 40 GW of coal power plants were not running in May 2018 either due to lack of demand and power purchase agreements or due to lack of coal supply agreements [PSCE, 2018]. These plants should not have been built at all. Therefore, we calculate the profile costs using 160 GW instead of 197.17 GW. Capital costs of the power plants already built are sunk costs. We argue below that it is not optimal to build new coal plants. Therefore, we can neglect the profile costs arising from the capital costs of new coal plants. Consequently, we estimate only the change in fixed operating costs due to change in capacity factors. Profile costs thus calculated are 1.04 ¢/KWh (0.72 ₹/KWh) in 2018. The discussion above on reliability is applicable to profile costs as well. Therefore, these costs are likely to be significantly lower for less reliable grids such as India's than our estimate here.

Incorporating integration costs, we get average domestic social costs of solar PV and wind to be 5.20 ¢/KWh (3.59 ₹/KWh) and 5.47 ¢/KWh (3.77 ₹/KWh) respectively in 2018-19. The straight lines in Figure 2 show the resulting average social costs of solar PV and wind, and the shaded areas the ranges. Renewables are cheaper than almost all electricity generated from coal in India when the external cost of coal is accounted for. Moreover, even the social *operating cost* of coal-fired electricity is greater than that of renewables for over half of coal plant capacity. Indeed, even from the narrower perspective of the distribution companies, it is cheaper to build new renewables than to continue to buy power under pre-existing contracts from a significant fraction of existing coal plants (see Figure 2). This explains why the National Thermal Power Corporation, India's largest generating company, has applied, and received approval from regulators, to substitute solar PV for coal-fired electricity in some of its existing power purchase agreements [Jai, 2018].

4 Dispatchable Renewables Could Soon Replace New Coal

Solar PV and wind electricity have achieved these low costs in India in part due to initial subsidies that were explicitly meant to drive down costs [MNRE, 2010]. However, variable renewables cannot be relied upon to meet demand peaks.

India's thermal, hydro, and nuclear power capacity was 304 GW in 2018, far more than what is needed to meet the annual peak demand of about 180 GW. Demand growth may put an end to this excess capacity by the mid-2020's unless new thermal or dispatchable renewable capacity is built.

Figure 3 shows the likely social costs, including only domestic non-climate externalities, of various technologies, including storage, in 2025. We use the Levelized Cost of Energy (LCOE) framework to make these cost projections. Data, assumptions and calculations can be found in Sheets 6-8 of Data-and-Code-book.xlsx.

Based on Central Electricity Regulatory Commission (CERC) recommendations, we use a benchmark capital cost of 1058 $/KW in 2018, fixed operating cost of 47.83 $/KW and a variable operating cost of 2.2¢/KWh for new coal plants in 2018 (See Sheet 7 of Data-and-Code-book.xlsx, [CERC, 2014], [CERC, 2017], [Srinivasan *et al.*, 2018] and [Bhati & Ramanathan, 2016]). Sheet 7 provides other important parameters such as fuel and transport costs. We assume a range of capacity utilization factors (50%-60%), inflation and discount rates to estimate a range for the LCOE of coal (Sheets 7 and 8). Social costs of coal assume complete implementation of new regulations on SOx and NOx emissions (that will reduce external costs) and increases in the VSL with income growth (that will increase external costs). Our estimate of the costs of new coal plants is likely to be an underestimate as we do not account for the likely increase in the cost of capital occasioned by a higher stranded asset risk. In the case of coal with storage, only the social operating cost of coal generation is considered.

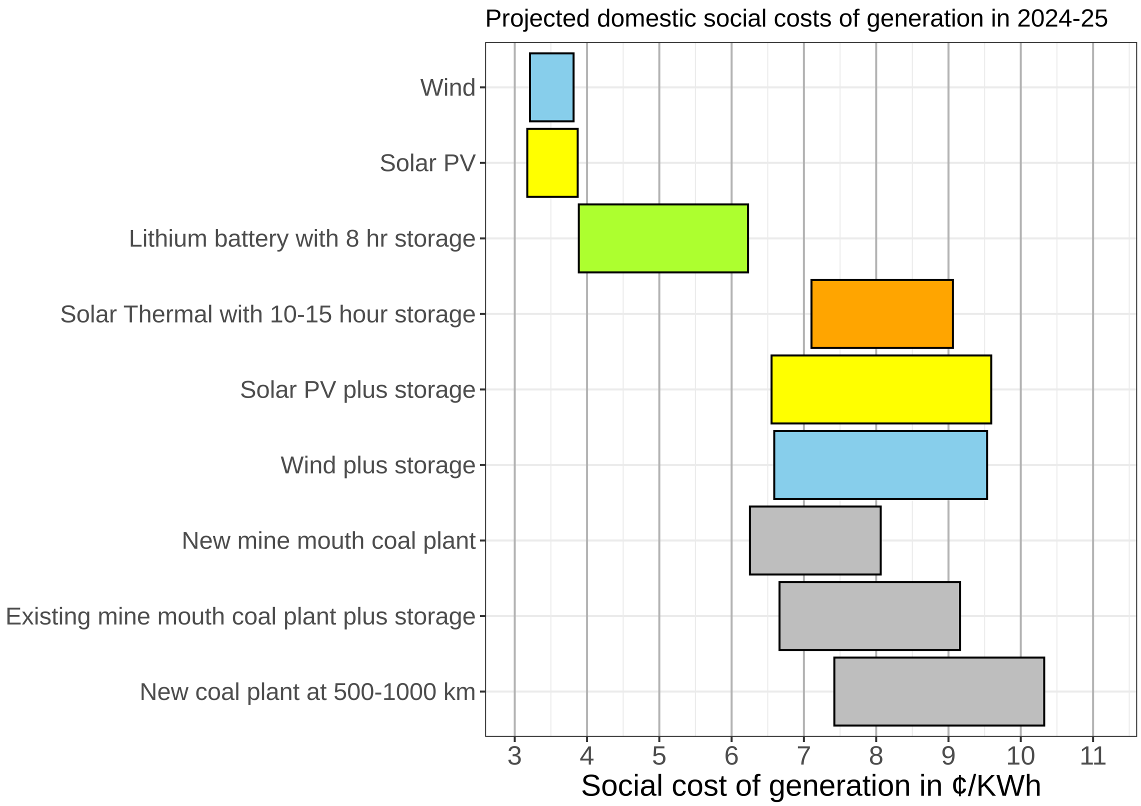

Figure 3: Projected social costs of electricity from different generation technologies in 2025. These social costs assume the installation of air pollution control by all coal power plants by 2025, and include external costs from the health impacts of residual air pollution, and estimated external costs for renewables at an expected penetration level of 20% in 2025. All costs in US ¢/KWh converted from 2018-19 Indian rupees (₹).

CERC doesn't provide benchmark costs for renewables as these have been declining fast. For solar PV and wind, we obtain mean capital cost estimates of 507 \$/KW and 833 \$/KW respectively in 2018, from the Electricity Regulatory Commissions of the states of Maharashtra, Karnataka and Tamil Nadu (See Sheet 6 of Data-and-Code-book.xlsx, and the Appendix). These states are responsible for the highest deployment of renewables in India, and these can be used as reference costs. Our cost projections for renewables in 2025 assume a modest 15% reduction in capital costs. These projections are in line with reference or high cost projects in the projections of the International Renewable Energy Agency (IRENA) [IRENA, 2016] and the National Renewable Energy Laboratory (NREL) [NREL, 2018]. We use a lithium battery with eight hours of storage as the reference storage technology with wind, solar PV, and coal. We estimate this battery to cost 1780 $/KW for 8 hours of storage (Sheet 10 of Data-and-Code-book.xlsx). We assume a learning rate of 17%-18% for Lithium batteries [Kittner *et al.*, 2017]. For solar thermal plants, we use a reference plant with 50-200 MW capacity and approximately 10-15 hours of storage with cost and performance parameters of projects currently under construction in China. The solar thermal plants cost an estimated 4500 $/KWh currently but we can expect cost to decline rapidly at a learning rate of 35% [Lilliestam *et al.*, 2017] (Sheet 10).

By 2025, we expect that renewables with storage will be in the same cost range as new mine-mouth coal plants. In January 2020, 1.2 GW of renewables with storage to supply peak power were auctioned for 8.6-9.6 ¢/KWh, a price range that intersects with our projections for 2025 [Parikh, 2020]. Coal plants further from mines are more expensive. Running existing coal plants more intensively during off-peak hours, storing the electricity in batteries, and supplying it during peak hours, is another option that has roughly the same range of costs as renewables with storage. For this reason, we neglect profile costs of coal plants in our calculations, since storage will allow their capacity utilization to be high. By 2025, renewables are likely to account for about 20-25% of electricity generation. If this is accompanied by some curtailment, then by far the cheapest option to meet peak demand will be to store this otherwise un-utilized electricity in batteries and supply it during peak hours. The International Energy Agency also projects that, as a result of competition from renewables and storage, coal power plants capacity and generation will likely peak and plateau around 2025 in its Business As Usual Scenario (See [IEA, 2020], Box 6.2). More sustainable scenarios show strong declines by 2050. We also note that the National Electricity Plan [CEA, 2018b] recommends the retirement of 25 GW of coal by 2027 as these would be uneconomical to run after the installation of pollution control equipment.

5 Discussion

Our analysis of the social costs of electricity in India in 2018-19 shows that generation costs from almost all coal plants were higher than from renewables. Even when externalities are not priced, a large fraction of the coal fleet has higher operating costs than new renewables. The fact that there is a significant fraction of coal plant capacity that has higher social variable costs than new renewables further implies that replacement of coal power by renewable power should begin without delay. This is true even though climate externalities are not accounted for in our estimates.

Here we must digress for a moment to address some informal arguments that have been made in favor of delaying a transition out of coal. It has been suggested that coal power has benefits to the Indian economy that are not accounted for here, for example, that the transport of coal to power plants provides a significant fraction of the revenue of the government-owned railway [Tongia & Gross, 2019]. This argument ignores the fact that transport capacity on the railways is a scarce resource and reducing coal transport will open up capacity for the transport of other goods. The government could always make up revenue losses by raising fares or other taxes, if it chooses to do so. Arguments suggesting that uneconomical coal plants should not be closed since that would result in job loss or other macroeconomic negative spillovers are also shaky [Kalkuhl *et al.*, 2019]. In any standard cost-benefit analysis such as ours, all resources, including labor going into the production of coal or renewable electricity, are valued at their observed prices that are assumed to represent their opportunity costs, unless it is clear that such prices deviate from social shadow prices. Our implicit assumption (which is standard in the literature) is that the labor released from employment in coal would find employment elsewhere – its social opportunity cost is its wage. Such assumptions are never strictly true, but for a long-run perspective such as ours, they are entirely appropriate – since labor does turn over in the long run. It is conceivable that the coal sector is large enough to contribute to a macroeconomic crisis if it is shut down too quickly. But this is much more likely to happen if the transition is delayed and the cost of keeping uneconomic plants open mounts to the point that it triggers a disorderly collapse. Finally, it may be argued that the value chain in coal creates more demand within the country than value chains in renewables. It is not clear whether such an argument has a basis in fact. At least one study suggests that more jobs would be created in India by renewables than would be lost in coal [Pai *et al.*, 2021]. But in any case, there is no economic basis for the argument that domestic production is somehow more valuable than imports in any given sector. In fact, there is evidence to show that restricting imports of machinery hurts economic growth in less developed countries [Mazumdar, 2001]. This is to be expected, since such restrictions raise the cost of domestic manufactures.

In addition to comparing costs in 2018, the most recent year for which we have data, we also estimate that the levelized social costs of electricity in 2025 for renewables with storage and the cheapest coal plants will be in the same range. Since the external costs of coal given here are a significant underestimate of the domestic social cost of coal and do not account for climate externalities, there is no economic case for new coal plants in 2025. This finding undermines most of the energy economics literature and official national and international agencies that project large increases in coal capacity in India with associated growth in CO_2 emissions.[8] For such an expansion to take place, the government would have to heavily subsidize investment in coal. Such investment would almost certainly prove highly unprofitable and would require continuing subsidies to keep plants in operation.

In fact, there is a strong, purely domestic, economic case for doing just the opposite, by ramping up policies to encourage the deployment of renewables with storage *today*, in order to drive down costs, just as has been done with variable renewables. It is also important to install pollution control devices on coal plants that are expected to continue to operate for some years, and to introduce technology and policy measures that facilitate renewable integration.

Coal has played the lead role in the growth of the Indian electricity sector, though this has come at a great cost to public health and the environment. Today, the environmental and

[8]The most recent IEA report [IEA, 2020] differs from past projections by predicting a much more modest increase in coal-based generation in a business-as-usual scenario.

other costs of coal make it a more expensive of source of electricity than most renewable sources of power. Electricity from coal also contributes about half of India's CO_2 emissions. While coal will continue to play an important but declining role for years to come, renewables are the future of the Indian electricity sector. It now seems most likely that when all social costs, including climate costs, are properly accounted for, renewables with storage will be cheaper than electricity from new coal plants in 2025 and beyond. Indian policymakers should start preparing now for this eventuality, especially with policies to re-employ and compensate workers in coal and related sectors who will have to find new employment.

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