Come September: Can coal-based power plants sing a happier tune?

Ashok Sreenivas, Shiv Vembadi
Prayas (Energy Group)
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Abstract

This paper analyses the seasonal shortage of coal experienced at power plants in the post-monsoon months, in an attempt to understand the reasons behind such shortage and to suggest possible ways of minimising or managing such shortages. Its major findings are as follows:

1. Current coal production is not sufficient to meet the required coal-based power generation. This leads to increased cost of electricity for the end consumer as costlier coal is procured through imports or e-auctions. Ironically, this is in spite of many states in the country having 'excess' contracted capacity.
2. Notwithstanding insufficient coal production, better evacuation management can significantly help to mitigate the seasonal coal shortages at power plants.
3. The analysis suggests that the country's electricity generation needs and power plants' coal stock requirement can be met by enhancing coal production in the summer months (April to June). Moreover, such increased production appears to be technically feasible.
4. Another possible way to augment linkage coal supply to power plants is to use some or all of the coal sold under the special forward e-auction for power. This will help CIL to adhere to its linkage contracts without affecting CIL's profitability significantly.

It appears that better planning, coordination and proactive steps by the concerned agencies such as the Ministries of Coal, Power and Railways, along with coal companies, power generators and transporters, can address the problem of chronic seasonal coal shortages while also reducing coal imports for power generation. This is in addition to measures such as increasing production from allocated captive mines. Such augmentation of coal supply is necessary to meaningful and productive utilisation of the current 'excess' coal-based generation capacity and to facilitate market operations such as open-access. In short, a combination of such measures has the potential to address many problems that affect the coal and power sectors today.

1 Introduction

Coal-based power plants in India generally have reasonably good coal stock at the beginning of April.[1] However, this relatively happy situation does not last long and coal stock at power plants becomes critically low in the months immediately after the monsoon – typically from September to November – when electricity demand picks up sharply.[2] As a result, power generators cannot fulfil their long-term contracts to supply power to distribution companies, which leads to two undesirable outcomes. Firstly, distribution companies may 'shed load', i.e. not supply power to consumers resulting in reduced quality of life and economic activity. Secondly, power gets more expensive because it is either procured from the short-term market, or the shortage of domestic coal is compensated for by getting it from other, more expensive sources such as imports and e-auctions. For example, in spite of having excess contracted capacity, because of coal shortage, the Maharashtra state distribution company was allowed[3] to procure high-cost short-term power from the market many times over the past two financial years by the Maharashtra Electricity Regulatory Commission.[4] Interestingly, the shortage of coal and resultant increase in cost of power do not financially affect either the power generators or power distribution companies because these costs are simply 'passed through' to consumers.[5] Thus, the coal shortage issue is really a public policy issue as it directly affects the electricity price for all consumers.

In spite of its predictable seasonal cycle, the issue of these seasonal shortages has not been adequately addressed. Curiously, even as power plants report coal shortages, the Ministry of Coal (MoC) and coal companies publish statistics to indicate robust growth in coal production and supply, often refuting claims of coal shortages[6]. This study aims to understand this issue of coal shortages at power plants, and investigate if there are any solutions to avoid it or manage it better.

There could be many avenues to increase coal supply to power plants. For example, many public and private power generators have been allocated captive coal mines, but production from these mines is well below expectation. Addressing this may bridge some of the gap in coal supply to power plants and reduce pressure on other coal sources. While acknowledging this, this study focuses on Coal India Ltd. (CIL), which is India's dominant coal supplier producing nearly 85% of India's coal. It also focuses on coal

[1] https://energy.economictimes.indiatimes.com/news/power/power-plants-go-slow-on-unloading-coal-stock/68572031

[2] https://www.business-standard.com/article/economy-policy/coal-supply-shortage-how-the-crisis-suddenly-began-and-why-117102400294_1.html; https://www.thehindubusinessline.com/economy/policy/looming-coal-shortage-set-to-unplug-power-plants/article22661776.ece; http://indianexpress.com/article/cities/mumbai/coal-stock-running-low-maharashtra-set-to-face-a-powerless-summer-5131046/

[3] http://mercindia.org.in/pdf/Order%2058%2042/Order-135%20of%202017-06102017.pdf, http://mercindia.org.in/pdf/Order%2058%2042/Order-181%20of%202017-05012018.pdf, http://mercindia.org.in/pdf/Order%2058%2042/Order-176%20of%202018-04072018.pdf and http://mercindia.org.in/pdf/Order%2058%2042/Notice-85%20of%202019-09042019.pdf

[4] The Maharashtra state generator has coal allocation for the full 10 GW of coal-based capacity it owns. But due to excess contracted capacity, 4 GW out of this 10 GW of capacity is backed down for a long term due to economic reasons. This makes the coal shortage in Maharashtra (and other similar states) particularly curious.

[5] This is even more so, with recent judicial and regulatory orders permitting pass-through of imported coal costs (e.g. https://economictimes.indiatimes.com/industry/energy/power/cerc-allows-compensation-to-power-plants-for-coal-imports-in-times-of-domestic-coal-shortage/articleshow/69364841.cms)

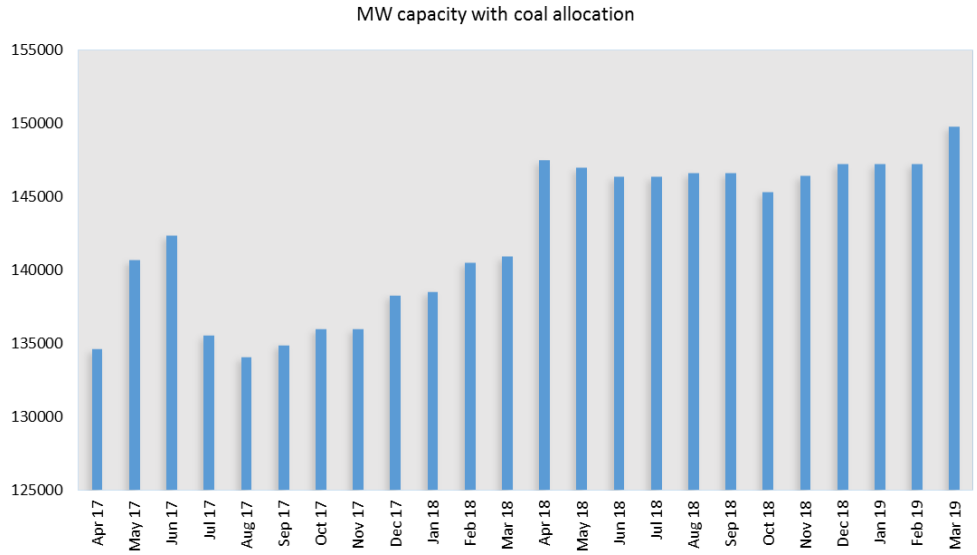
[6] http://pib.gov.in/PressReleseDetail.aspx?PRID=1556666; https://energy.economictimes.indiatimes.com/news/coal/coal-minister-piyush-goyal-trashes-reports-of-fuel-shortage-for-plants/67115232

supply through the linkage route, i.e. coal supply based on long-term coal supply agreements or arrangements, about 90% of which was supplied to power generators over the past two years by CIL.

2 Data sources and methodology

This study is based on a detailed analysis of monthly data regarding coal production, coal supply, coal stock and power generation by domestic coal-based plants over the last two financial years, namely 2017-18 and 2018-19. Since the objective of the study is to understand domestic coal shortage, for each month, the study only considers plants which are based on domestic coal and which have some coal allocation from CIL or Singareni Collieries Company Ltd. (SCCL) in that month. This information is present in the monthly 'Coal Statement' published by the Central Electricity Authority (CEA)[7]. In other words, for each month, coal-based plants that are either based on imported coal or have no domestic coal allocation are not considered[8]. Over the analysis period, the monthly capacity considered ranges between 135 GW and 150 GW (Figure 1), as against an installed domestic coal-based capacity of about 174 GW. Thus, the capacity analysed is representative of the installed capacity in the country.

Figure 1: Domestic coal-based capacity with domestic coal allocation in each month



The data sources used in this study are summarised in Table 1. It should be noted that there were some discrepancies in using data from multiple sources, which has necessitated some workarounds and assumptions. Consider the Sabarmati power plant in Gujarat. The CEA's coal statement only reports coal allocation, receipt and consumption for Sabarmati C, which is one of the units of the plant. However, the quantity of coal allocation, receipt etc. seem too high for the 60 MW unit and instead seem to correspond to the entire 422 MW plant. Power generation data (also published by CEA) shows that Sabarmati C unit has not generated any power for the last two years. However, the Sabarmati plant has

[7] The source or methodology for the coal allocation figure given in the coal statement is not known. In particular, the relationship of this allocation to the plant's linkage or Fuel Supply Agreement is not clear.

[8] Two specific plants, Patratu in Jharkhand and Ennore in Tamil Nadu (around 450 MW each), are left out as they have not generated any electricity in the last two years and had a negligible coal allocation only for a few months of the analysis.

been generating electricity in this period. Hence, in this study, we consider coal allocation, receipt, consumption etc. as reported for the Sabarmati C unit, but consider generation reported for the entire Sabarmati plant. Other data issues are discussed in Section 5.

Table 1: Data sources used in the analysis[9]

Data	Source	Granularity	Frequency
Coal receipt, consumption and stock at power plants	CEA: Coal Statement[a]	Plant wise	Monthly
CIL production[b]	CIL: Provisional Production and Offtake Performance of CIL	National	Monthly
CIL offtake[c]			
CIL pit-head coal stock	Derived from CIL data[d]	National	Monthly
Thermal power generation	CEA: Monthly Generation Report[e]	Plant wise	Monthly
E-auction quantity	MoC – Monthly Summary for Cabinet	National	Monthly

a. The CEA Coal Statement has also been used as the primary source to identify power plants.
b. CIL also publishes data about quantity of coal despatched to thermal power plants on a daily basis. This was used to validate and reconcile some of the other coal despatch numbers, though it was not directly used in this analysis.
c. Offtake includes despatch plus any consumption by the collieries. This is only of raw coal.
d. Monthly CIL opening/closing stock has been calculated from CIL production and offtake data, beginning with closing stock at the end of 2016-17 taken from Coal Directory 2016-17. The calculated closing stock for 2017-18 matches with the closing stock available from the Provisional Coal Statistics 2017-18.
e. CEA reports monthly generation for the plants it is monitoring. This includes most plants whose coal stock is monitored.

This data is analysed at an aggregate national level on a monthly basis to answer questions such as:

- Was the monthly coal allocation to power plants sufficient? How was the actual coal supply to power plants compared to the coal allocation?
- Could better evacuation management have met the demand without increasing production?
- Would an increase in CIL's production have met the coal demand?
- Could the demand have been met through other sources?

Some normative values have been assumed to aid the analysis. According to the CEA, power stations should have coal stock for 20-30 days at a PLF of 85%. However, coal-based plants have been running at lower PLFs in recent years and this is likely to continue. Hence, a normative PLF of 70% is assumed. It is also assumed, based on recent data, that 0.66 kg of Indian coal is required to generate 1 kWh of electricity.

3 Coal availability at power plants

In this section, we analyse the coal availability situation at power plants at the national level.

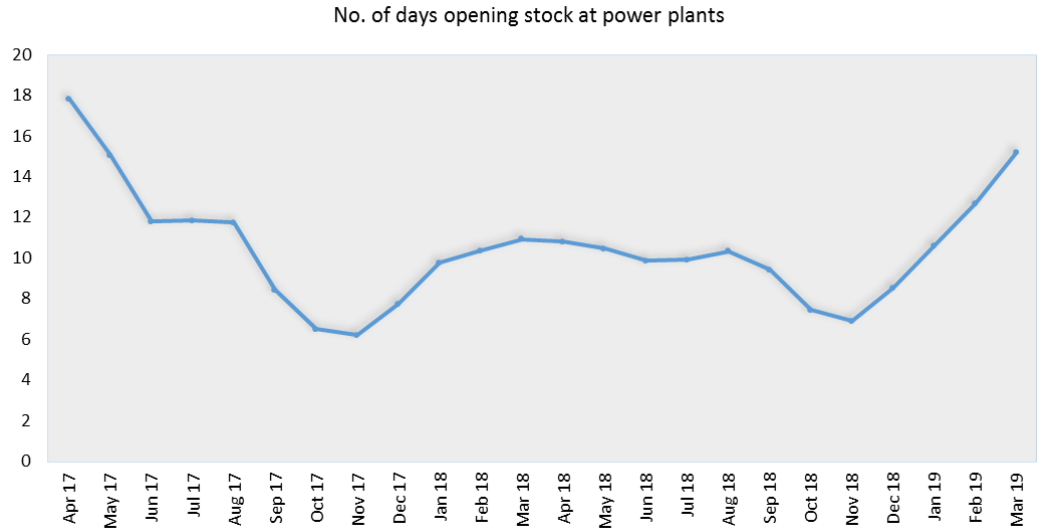
1. **Coal stock at power plants:** For each month of the analysis period, using normative assumptions of PLF and specific coal consumption, Figure 2 shows the number of days of opening coal stock on an

[9] Most of the sources listed report data for only raw coal (i.e. not including coal products such as washed coal). However, since most of the supply is of raw coal, the distinction is not significant for the purpose of this analysis.

aggregate basis[10] at power plants that had coal allocation. As can be seen, coal stock was always below the minimum requirement of 20 days and was below even 10 days in 11 of the 24 months. A clear pattern is also visible. In a financial year, opening stock is highest in April. It falls from April through June, and then stays nearly flat through to August. Then it dips from September through November, before gradually climbing back in the December to March period.

During the monsoon months, electricity demand, particularly from coal, is typically at the lowest. Coal-based electricity demand begins to pick up around September because overall power demand begins to increase after monsoon and generation from some power sources such as hydro and wind drop. In spite of such a predictable increase in coal demand from September, it is surprising that there is a coal shortage every year in the months following the monsoon.

Figure 2: Number of days of opening coal stock at power plants



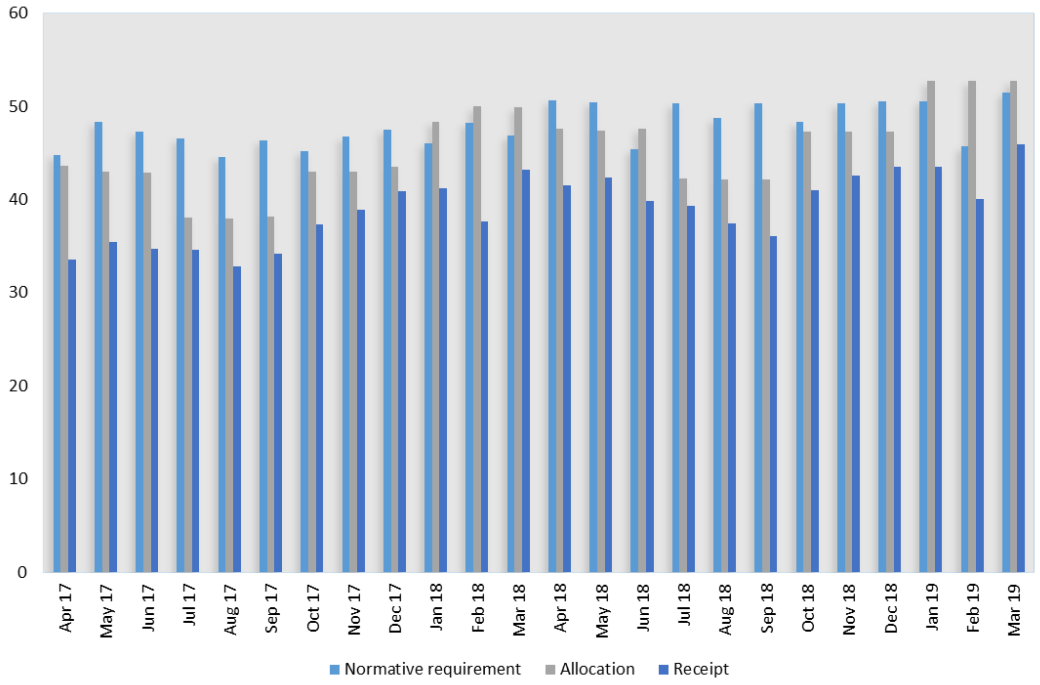
2. **Coal allocation and supply:** Adequate coal allocation and actual coal supply are the two key parameters to ensure sufficient coal availability at power plants. Figure 3 shows the monthly coal allocation and actual coal receipt at power plants, along with their normative coal requirement at 70% PLF. It can be seen that coal allocation was insufficient in all months except January, February and March (which are also high production months). On aggregate, coal allocation was about 5% short of the normative requirement though, in some months it was as much as 18% short of requirement. Actual coal receipt was much lower than even coal allocation in every month. On aggregate, coal receipts were only 86% of what was allocated and 81% of what was required, with the situation being much worse in some months. This perhaps led plants to use up their stock and reach a situation of critically low stock, particularly in the post monsoon months.

3. **Impact on power generation:** What was the impact of the limited coal supply from CIL (and SCCL) on power generation in the country? The Load Generation Balance Report (LGBR) published annually by

[10] That is, the number of days for which the total stock would have served the total capacity with allocation

CEA tracks electricity shortages in the country and lists the causes for the shortages. According to the 2017-18 LGBR, there was hardly any electricity shortage in the country as a whole, and none of the shortages were attributed to coal unavailability. The situation appears to be similar for 2018-19[11]. So, there was adequate coal-based generation in the country. This was because generators made up for shortage of domestic linkage coal by procuring it from other sources, leading to increased cost of power generation. Over the two years analysed, more than 38 MT of coal was imported to blend with domestic coal in domestic coal-based plants[12] and about 56 MT of coal was procured through the special forward e-auction for power at an average price premium of about 45% over CIL notified prices. In addition, distribution companies also procured expensive power from short-term markets[13] in spite of many of them having surplus contracted capacity.

Figure 3: Coal requirement, allocation and receipt (MT)



While coal-based power generation itself was sufficient, there was a seasonal shortage of coal stock at power plants because of a significant shortfall of domestic coal supply through the linkage route. This was compensated by generators through costlier alternatives such as imports and e-auctions, and by distribution utilities through short-term market based power purchase leading to increased electricity cost for consumers.

[11] Though the 2018-19 LGBR has not yet been published, news reports (https://www.deccanherald.com/national/india-still-not-a-power-surplus-nation-729490.html) indicate that coal shortage was not a reason for the small power deficit in 2018-19.
[12] This is in addition to coal imported by purely imported coal-based plants.
[13] For example, see http://mercindia.org.in/pdf/Order%2058%2042/Order-176%20of%202018-04072018.pdf

4 Increasing linkage coal supply

In this section, we examine whether sufficient domestic coal could have been supplied over the last two financial years through the linkage route to

- generate the requisite amount of coal-based electricity each month, i.e. the amount of electricity actually generated by domestic coal-based plants with linkage in that month, and
- to maintain a minimum desirable level of stock at power plants

We use the terms *demanded electricity* for the electricity to be generated in a month, and *coal demand* for the total coal required to generate the demanded electricity and maintain minimum desirable stock in that month. There are three possible ways the coal demand could have been met:

1. Optimal coal evacuation (without changing coal production)
2. Increased coal production (accompanied by optimal coal evacuation)
3. Other sources of domestic coal (accompanied by optimal coal evacuation)

Each of these three possibilities is examined below for two possible scenarios of opening coal stock at power plants as described in Table 2. For each scenario, the desired opening stock at power plants for a month is calculated based on assumptions of normative PLF and specific coal consumption.

Table 2: Opening stock scenarios

Description	Scenario name	Scenario description
Desirable # of days of opening stock at power plants	OS1	15 days stock at 70% PLF
	OS2	20 days stock at 70% PLF

The coal demand for a month is the sum of the amount of coal required to generate the demanded electricity in that month and the desired opening stock at power plants in the next month. It is assumed that CIL has to meet 90% of this coal demand, with SCCL meeting the remaining 10%. This is explained in greater detail below.

4.1 Better evacuation

Could the coal demand have been satisfied with the current CIL production but with better evacuation? We use the following methodology to answer this question. Beginning with the opening coal stock at power plants and CIL in April 2017, we estimate the coal stock at CIL's pit-head for the subsequent months if evacuation had been optimal and it had supplied sufficient coal to meet the coal demand. This is done as shown below (where month m+1 is the month following month m).[14]

PitHeadOpeningStock (m+1) = PitHeadOpeningStock (m) + *CILProduction* (m) – *ActualCILOfftake* (m) – AdditionalCILSupply (m)

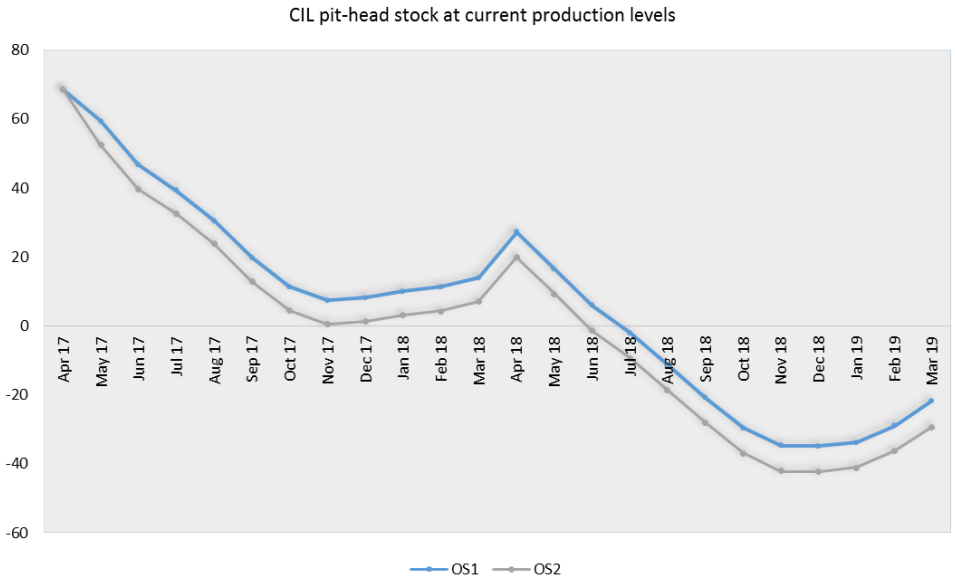
[14] Values in italics represent data that is available in data sources or computable from them. *CILProduction* and *ActualCILOfftake* are available from CIL. *ActualCoalReceipt* is available in the CEA coal statement and represents receipt from CIL and SCCL. *PowerPlantOpeningStock* for the first month (April 2017) is available from data and is calculated for the subsequent months based on the desirable opening stock. *CoalRequiredForGeneration* is calculated from the demanded electricity.

AdditionalCILSupply (m) = (CoalDemand (m) – *PowerPlantOpeningStock* (m) – *ActualCoalReceipt* (m)) * 90%

CoalDemand (m) = *PowerPlantOpeningStock* (m+1) + *CoalRequiredForGeneration* (m)

If this analysis shows that CIL's pit-head stock remains healthy, assumed to be above 10 MT for this analysis, while meeting the coal demand, then it indicates that better evacuation could have met the coal demand without any change in production. If the pit-head opening stock falls below the 10 MT level but stays above zero, then it indicates a not-very-comfortable, but physically possible, situation. If the pit-head coal stock becomes negative, it indicates that it was physically impossible to meet the coal demand with current production even with efficient evacuation. Figure 4 shows CIL's monthly opening pit-head stock if it had supplied enough coal (without changing its monthly coal production) to meet the coal demand as per scenarios OS1 and OS2.

Figure 4: CIL opening pit-head stock at current production levels under power plant stock scenarios OS1 and OS2



Some interesting insights emerge from this. First, consider the OS1 scenario. In the 'crisis' months of 2017-18, i.e. September to November 2017, better evacuation could have maintained 15 days stock at power plants even with current production levels, though CIL opening pit-head stock would have fallen to a little below 10 MT in November and December 2017. But current production would not have been sufficient to maintain 15 days of opening stock at power plants in the crisis months of 2018-19, since CIL's opening pit-head stock falls into the negative territory from July 2018. In case of the OS2 scenario, the CIL opening pit-head stock comes perilously close to becoming negative in the 'crisis' months of 2017-18 for it to be considered practical. In 2018-19, it becomes negative from June 2018 indicating that current production levels are unable to maintain 20 days opening stock at power plants.

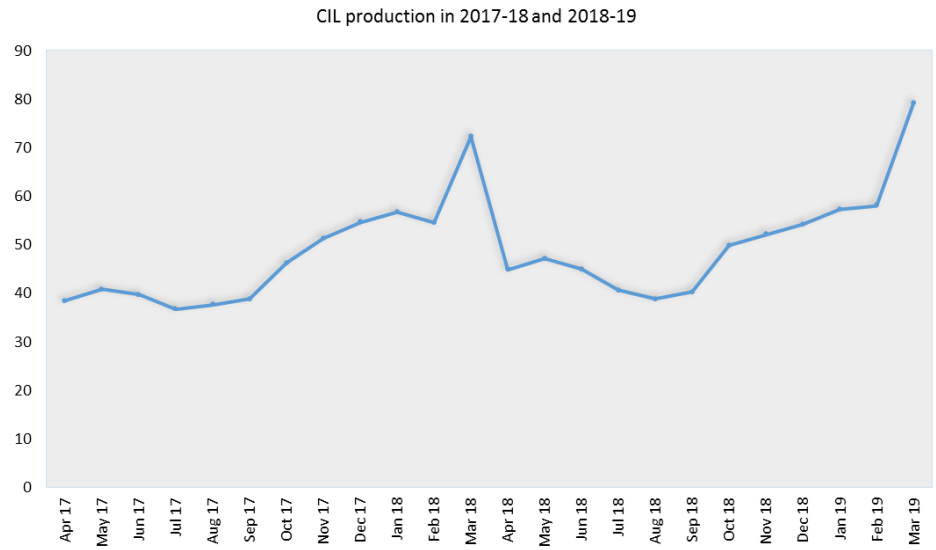
Even with efficient evacuation, current CIL production could not have met the coal requirement for power generation and desired power plant opening stock requirement in either scenario. However, with better evacuation, the shortage in the post monsoon crisis months of 2017 could have been mitigated significantly as power plants could have maintained almost 15 days of stock.

4.2 Increasing CIL production

The previous section showed that only improving evacuation would not have met all the coal demand for power generation and opening stock at power plants. Was it feasible for CIL to have produced more coal to meet the demand? We examine this question in this section using an analysis similar to the previous section but with different assumptions for CIL production (i.e. the variable *CILProduction*).

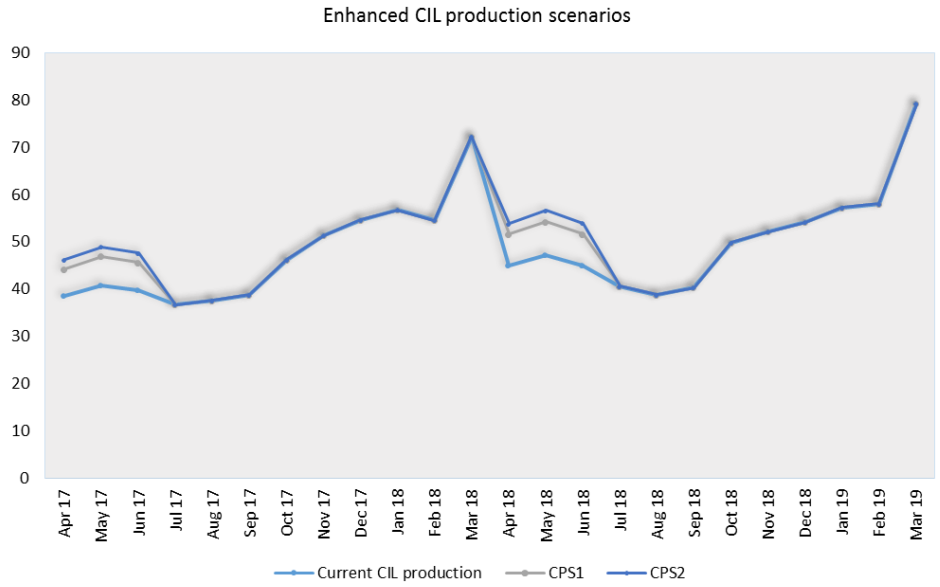
CIL's current production pattern is shown in Figure 5. In any financial year, it stays flat at a moderate level in April, May and June, before dipping somewhat during the monsoon months of July and August. It then gradually increases through the remaining months and typically ends with a major spike in March (which leads to a high pit-head opening stock for April). Given this pattern, one avenue to increase CIL's coal production becomes evident, namely the summer months of April, May and June when its production remains subdued. Indeed during these months, CIL's pit-head stock depletes.

Figure 5: Actual CIL production over the last two financial years



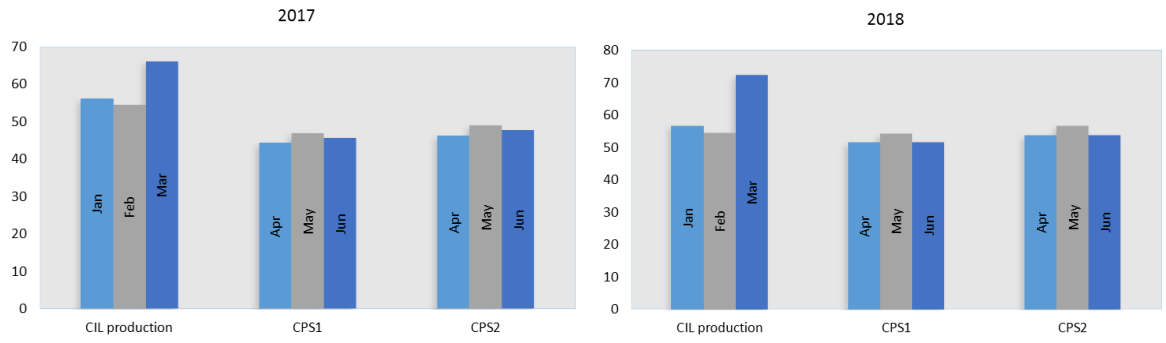
This forms the basis for the proposed alternative production scenarios CPS1 and CPS2. In CPS1, we assume that CIL increased its coal production in the months of April, May and June of the two years by 15% compared to current production, while production in the other months remains unchanged. CPS2 is similar, except that the production is assumed to have increased by 20% in these three months over the two years. The alternative production scenarios are depicted in Figure 6 along with current CIL production. These scenarios represent an overall increase in CIL's production of only 3.3% and 4.4% for the scenarios CPS1 and CPS2 respectively over the analysis period of two years.

Figure 6: Enhanced CIL production scenarios



Two questions arise regarding these scenarios. Would such an increase in production have been feasible? Would such an increase in production have met the coal demand in scenarios OS1 and OS2? We consider the feasibility question first. Figure 7 shows CIL's production in January, February and March of 2017 and 2018, against CIL's expected production in April, May and June of the same year under the CPS1 and CPS2 scenarios. It is evident that even in the CPS2 scenario with 20% increase in production in these months, the expected production in April, May and June is lower than the actual production in January, February and March of the same year. Thus, the increased production considered under CPS1 and CPS2 in April, May and June would have been technically feasible.

Figure 7: CIL actual production in Jan-Feb-Mar and required production in Apr-May-Jun under CPS1 and CPS2 (MT)



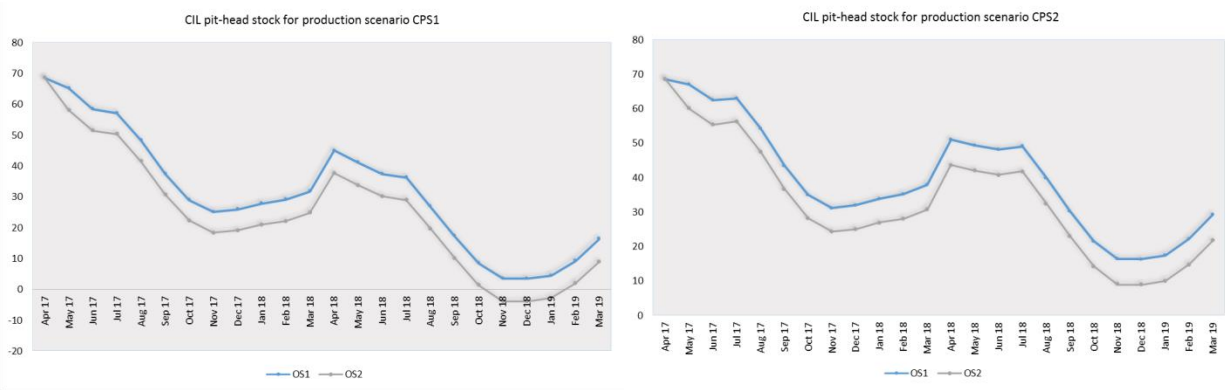
But would such increased production in the summer months have led to pit-head stock build up to a level where it could be hazardous? It would not have, since the purpose of the suggested scenarios CPS1 and CPS2 is to supply coal to power plants for them to generate the required electricity and maintain a stock for 15-20 days. CEA's norms stipulate that 20-30 days of stock at 85% PLF is desirable at power stations. Moreover, regulations provide cost-plus (or Section 62) power generators, who form the bulk

of coal-based power generators, with working capital to procure 30 days of coal stock in advance and this is included as part of the tariff. Therefore, power plants should have had both space and money to purchase and stock at least 20 days of coal at 70% PLF. Since power plants had an average opening stock of only around 10-15 days in the summer months of 2017 and 2018, they definitely had room to absorb more stock. As shown in Figure 8, with suitable coal evacuation to shift coal stock to power plants, CIL's opening pit-head stock in May, June and July (which are relevant to higher production in the months of April, May and June) under the CPS1 and CPS2 scenarios would have been less than the opening pit-head stock in April of the same year. Therefore, such increased production accompanied by suitable evacuation would have been safe.

We now examine whether scenarios CPS1 and CPS2 were sufficient to supply the coal required for generation and maintenance of power plant opening stock under scenarios OS1 and OS2. That is, would CIL's opening pit-head stock in any month have become critically low or negative if it supplied coal under these scenarios? Figure 8 shows CIL's monthly pit-head opening stock under the two production scenarios CPS1 and CPS2 and the two desirable coal stock scenarios OS1 and OS2.

CPS1 would not have been able to meet the power plant stock requirement of OS2 (20 days), as the pit-head opening stock would have become negative in November, December and January of 2018-19, and would have been very close to zero in October and February. However, CPS1 would have met the requirement of OS1, though the opening pit-head stock would have fallen below 10 MT in five of the 24 months. CPS2, on the other hand, would have comfortably met the requirements of OS1 with pit-head stock never falling below 16 MT. It would also have met the requirements of OS2, though its opening pit-head stock would have fallen marginally below 10 MT in three months (November, December and January of 2018-19).

Figure 8: CIL pit-head stock (MT) for scenarios CPS1 and CPS2, and opening stock scenarios OS1 and OS2



This analysis of the past two financial years suggests that if CIL increases its production in the summer months, it could potentially supply sufficient linkage coal to plants to meet all their electricity generation needs and to maintain sufficient coal stock for up to 20 days[15]. Moreover, such enhanced production is both technically feasible and safe. It is possible that such a pattern of production in summer as

[15] It is reiterated that this analysis is at a national aggregate level. There may be specific issues to be resolved regarding specific coal plants but that is beyond the scope of this study.

suggested here would require revisiting CIL's utilization of its heavy earth moving machinery, but this is beyond the scope of this study.

Of course, it is not enough merely for CIL to increase its production as indicated in scenarios CPS1 and CPS2. Power plants should be willing to offtake and stock sufficient coal, and coal transporters should provide for timely coal evacuation. Doing so will help reduce the cost of electricity and reduce the country's import dependence for coal. Moreover, this is a feasible proposition with current levels of technology. All that is required is better coordinated planning between the agencies managing the coal, power and railway sectors, and the corresponding companies in these sectors.

> If a) coal production can increase production by up to 20% in the summer months compared to current levels, b) power plants requisition and stock sufficient coal through the year, and c) railways and other transport agencies provide the necessary evacuation services, it should be possible to ensure that power plants with coal linkage can generate the required electricity and also maintain up to 20 days coal stock.

4.3 Other sources of domestic coal: e-auctions

The power sector does not procure domestic coal only through linkages. It also acquires them through a variety of e-auctions conducted by CIL. As per the monthly summary submitted by MoC to the Cabinet, there are at least four types of e-auctions: spot e-auction (for all sectors), special forward e-auction for power, exclusive e-auction for non-power and special spot e-auction (for all sectors). Since this analysis is focused on the power sector, it only considers the e-auction targeted at the power sector, i.e. the special forward e-auction for power, and not the other forms of e-auction[16].

Over the two years analysed, about 56 MT of coal was sold under the special forward e-auction for power at an average price premium of about 45% over CIL notified prices. In contrast, the extra production expected from CIL over the two years under the CPS1 and CPS2 scenarios was only 38 MT and 51 MT respectively. This suggests that, if the coal sold under special forward e-auction for power is used instead to meet linkage commitments, accompanied by suitable requisitioning and evacuation, then it can significantly reduce or eliminate the shortages at power plants and need for coal imports.

Two concerns may arise regarding this suggestion. The first is regarding coal availability for non-power sectors, since some of them depend exclusively on channels such as e-auctions to access coal. However, since the only e-auction considered here is the special forward e-auction for power, the coal available to other sectors through e-auction is not affected, and hence this should not be a concern. The second concern would be regarding CIL's profitability and revenue stream. We believe that this also should not be a major concern for the following reasons:

- Coal supply to consumers with linkages is well below allocation levels and such consumers are buying coal through e-auction to make up for the shortfall. Given this, it seems fair to first try to

[16] Power generators with coal linkage do purchase e-auction coal to make up for their shortages. However, no disaggregated data is available publicly to assess whether the special forward e-auction for power caters mainly to plants with linkage or to those without linkage.

meet the demand of linkage consumers, and offer lesser coal on special forward e-auction for power, perhaps restricting it to those without (sufficient) linkage.

- Guidelines indicate that about 10% of CIL's production should be sold through e-auctions[17]. But, over the past two years, the total quantity of coal sold under e-auction (about 172 MT) was actually around 15% of CIL's production. Using the coal sold under forward e-auction for power to satisfy linkages will bring the e-auction quantity closer to the 10% suggested under the guidelines.
- Of the 172 MT of coal sold under e-auction over the last two financial years, nearly 116 MT, or about two-thirds, was auctioned through channels other than special forward e-auction for power. Hence, the suggestion made here applies only to one-third of the total quantity auctioned by CIL. So, it should not affect CIL's profitability by much.

Some or all the coal being sold under the special forward e-auction for power could be considered to fulfil coal linkage requirements. This, along with suitable requisitioning and evacuation, can go a long way to eliminate coal shortages at power plants and coal imports by domestic coal-based plants.

5 Conclusions

Before we summarise the conclusions from the study, we describe some of the data related challenges encountered. Reconciling data from multiple sources is always a challenge as inconsistencies are likely to exist. We provide a few illustrative examples below to underscore the need for better data collection and reconciliation.

The SEVA data portal[18] is expected to provide detailed information about coal supply to power plants from CIL and could have been a good source for granular data. However, the data on this portal suffers from internal inconsistencies and differs from other sources. For example, for the year 2017-18, SEVA reports different figures for total coal despatched by CIL depending on how the data is viewed. It reports 431.3 MT as the figure if the data is viewed subsidiary-wise, but only 400.3 MT if it is viewed by mode or contract. For the period October to March, SEVA reports a fall in coal despatch by CIL in 2018-19 as compared to 2017-18 (224.7 MT and 227.1 MT respectively). This is inconsistent with coal receipt figures and coal-based power generation reported by CEA, and coal production and overall coal despatch figures reported by CIL, all of which indicate an increase in the October-March period of 2018-19 as compared to 2017-18. For this reason, SEVA was not used for this analysis.

There are also challenges with CEA's data. According to CEA's coal statement, the Kudgi power plant in Karnataka does not have any coal allocation but receives coal supply. CEA's generation data suggests that it also generates electricity. However, because it has no coal allocation, it was not considered in our analysis. For more than 20% of the plants for which CEA reports data in its coal statement, the monthly closing coal stock does not match the expected value obtained from the opening coal stock, coal receipt from various sources and coal consumed for power generation. The problem with coal receipt and generation data for the Sabarmati power station was described Section 2.

[17] See, for example question 10 on https://www.coalindia.in/home/faq.aspx, accessed June 3, 2019

[18] https://elib.cmpdi.co.in/SEVA/, accessed May 18, 2019. We have observed that data on this portal gets updated with significant lag.

Notwithstanding the data challenges, there are some clear findings from this study.

1. **Insufficient coal production:** Current coal production is not sufficient to meet the required coal-based power generation in the country, despite assurances to the contrary by the coal sector. This leads to increased cost of electricity for the end consumer and possible load shedding, in spite of many states in the country having 'excess' contracted capacity.
2. **Better evacuation management:** In spite of the coal production being insufficient, better evacuation management, which includes better planning, requisitioning and transporting of coal, can help to significantly mitigate the seasonal coal shortages at power plants, as demonstrated for 2017.
3. **Increasing coal production:** A seasonal analysis of coal production and despatch suggests that it should be technically feasible to enhance coal production in the summer months (April to June) sufficiently to meet the country's electricity generation needs and power plants' coal stock requirement. This needs to be accompanied by suitable coal requisitioning and evacuation so that the coal is available at the point of use.
4. **Using e-auction coal:** Over the last two years, the quantity of coal sold through the special forward e-auction for power is more than the linkage supply shortfall to meet domestic coal-based power generation and to maintain sufficient stock at power plants. Using some or all of the coal sold under the special forward e-auction for power to instead supply to linkage consumers can not only help overcome the shortages but also help CIL to adhere to its linkage contracts. Moreover, this is possible without affecting CIL's profitability significantly.

This study did not touch upon issues of fairness of distribution of coal across consumers, though it is also important. Until the issue of shortages is resolved, there is a need for clear and transparent protocols and mechanism by which coal shortages are distributed across consumers. This is currently lacking, and hence could lead to inequitable distribution of coal across consumers.

This analysis suggests that better planning, coordination and proactive steps by the concerned agencies such as the Ministries of Coal, Power and Railways, along with coal companies, power generators and transporters, can potentially address the problem of chronic seasonal coal shortages in the country while also reducing coal imports for power generation. In the coal sector, some feasible measures include increased production by CIL, using the coal sold under the special forward e-auction for power to fulfil linkages, and increased production from captive mines.

Addressing this challenge is very important for the future of the coal and power sectors. Without reliable and affordable coal supply, the current 'excess' coal-based generation capacity cannot be meaningfully and productively used, and it will restrict the ability of financially strapped distribution companies to utilise their excess contracted capacity effectively by selling it to willing consumers. Moreover, uncertainty about coal supply will hamper future investments in the sector and market operations such as open-access transactions.

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About Prayas

Prayas (Initiatives in Health, Energy, Learning and Parenthood) is a non-governmental, non-profit organization based in Pune, India. Members of Prayas are professionals working to protect and promote the public interest in general, and interests of the disadvantaged sections of society, in particular. Prayas (Energy Group) works on theoretical, conceptual, regulatory and policy issues in the energy and electricity sectors. Our activities cover research and intervention in policy and regulatory areas, as well as training, awareness, and support to civil society groups. Prayas (Energy Group) has contributed in the energy sector policy development as part of several official committees constituted by ministries, erstwhile Planning Commission and NITI Ayog. Prayas is registered as SIRO (Scientific and Industrial Research Organization) with Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India.

Prayas (Energy Group)
Unit IIIA, Devgiri, Kothrud Industrial Area,
Pune 411 038, Maharashtra, India
E-mail: energy@prayaspune.org
Website: http://www.prayaspune.org/peg

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