



Coal-Sourcing Options for Captive Power Plants of Aluminum Smelters in India: Issues and Challenges

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INTRODUCTION

The domestic aluminum industry is struggling to remain globally competitive due to increasing production costs. India has among the highest cost of production of aluminum. This can be attributed to high power cost in India. Non-coking coal is crucial input for aluminum producers with power cost constituting almost 40% of the aluminum production cost (Saraswat & Ghosh, 2018). One ton of aluminum production requires about 14,500 units of electricity generated from almost 11 tons of coal (Saraswat & Ghosh, 2018). All the plants have set up their captive power plants of about 9500 MW for cheaper and uninterrupted power supply. Presently, the captive power plants of aluminum smelters in India are going through coal shortage, majorly due to less supply of domestic linkage coal against annual contracted quantity as per Fuel Supply Agreement (FSA) with Coal India Limited (CIL).

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The objective of the study is to suggest most viable coal source mix for uninterrupted coal supply to the captive power plants of the aluminum industries in India.

INDUSTRY SCENARIO

To carry out the research, we have studied overview of global and domestic energy-mix, power and coal scenario, demand and supply of coal, and typical coal sourcing in aluminum sector. In addition, geological and geographical coal reserve, installed and generation capacity of domestic power sector, coal production and offtake at CIL and subsidiaries and domestic coal supply trend to power and non-power sector have been reviewed. The study encompasses discussions on coal block allocation/auction, linkage auction, e-auction-related regulatory framework and import of coal scenarios within the industry and Indian economy as well.

Indian Aluminum Industry

The Indian primary aluminum industry consists of three major players which are NALCO (PSU), Hindalco and Vedanta with a production of about 3.4 MT and capacity of 4.1 MT. The aluminum industry has set up about 9500 MW of captive power capacity for cheaper and uninterrupted power supply.

Coal-Sourcing Options

There are five key sourcing options of coal, varying significantly on cost, quality and availability for the CPPs of aluminum smelter in India.

1. Linkage/Linkage Auction: Linkage coal is of lowest cost, characterized by relatively regular and stable supply. Materialization is low and variable (affected with change in demand supply scenario of domestic power and coal sector).
2. e-Auction: Cost and volumes of e-auction coal are subject to market dynamics at monthly level.
3. Import: Imported coal characterized by highest cost and one to two months of lead time for supply can be used for blending with other

cheaper coals. There is also technical limitation on the portion and quality of import coal blending.

4. Traders: Coal procurement from traders is characterized by highly unreliable supply, subject to volumes available with traders, transportation availability and competition among buyers.
5. Captive Coal Mines: Significant capital investment is needed upfront to bid and develop captive coal mines to achieve volume and price security.

Imperatives for Efficient Coal Sourcing for Aluminum Smelters in India

Coal-sourcing mix should be dynamically optimized every month, in light of changing prices, quality and quantity available across all sources. Marginal cost of coal should be used as the measure for each sourcing basket. Long-term and medium-term security need to be emphasized for reliable uninterrupted coal supply. Risk of cost of coal shortage should be valued at equivalent GRID power prices/opportunity loss in production. Sourcing team needs to be in constant touch with multiple importers, traders and transporters in order to ensure that all sources are tapped effectively. Sourcing team needs to capitalize on cyclicity in international coal market-benefit from phases of low prices. They need to have logistics capacity to handle varying modal mix and coal quality.

Issues and Challenges in Sourcing Coal for Aluminum Smelters in India

There is a significant gap in demand and supply of coal in domestic market of India. Domestic coal supply to CPPs of aluminum smelters has been worsening due to following major issues:

- Cancellation of coal block allocation by Supreme Court in 2014 and aggressive bidding (high premium) in subsequent coal block e-auction from 2015 (“Supreme Court Scraps 214 coal blocks”, 2014).
- Underutilization of captive coal block due to cost competitiveness, inherent challenges such as higher stripping ratio and higher cost of land acquisition.

- Auction of linkage coal on the basis of source-specific competitive bidding.
- Stress in power sector affecting CIL's coal supply to non-regulated sector.
- Higher dependency on CIL for supply of domestic power grade coal.
- Incremental production of coal being used to cater the increased demand of power utilities.
- Disturbances in coal production of CIL due to major issues such as delay in getting Environment Clearance (EC), Forest Clearance (FC), Rehabilitation & Resettlement (R&R) issues and local disturbances.
- Quantity of coal offered in spot and exclusive e-auction schemes by CIL's subsidiaries reduced.
- CIL's vendible pi-head coal stock continuously depleting due to increased supply to the power sector.
- Higher dependency on imported coal due to wider gap in domestic coal demand and supply.
- Government directive to power utilities to run on domestic coal supply. Power utilities thus reduced the import of coal for blending with domestic coal. Some of the PSU utilities recently ended up importing coal to tide over the shortage.
- Capacity constraints leading to coal infrastructure and logistics bottlenecks in coal- evacuations from mines/sidings.
- Frequent interruptions in linkage coal supply to the non-regulated sector by CIL and priority in rake supply to the power sector. Captive power plants (including aluminum smelters, steel, cement and other industries), which use about 33 gigawatts of coal-fired generation capacity, are last in line for domestic coal supply by CIL (Russell, 2018). Aluminum industry is not in priority in coal supply as it is classified as non-core industry ("Aluminium makers face coal shortage", 2018).
- Coal quality non-conformance in the supply of coal by CIL's subsidiaries. Deficiency in quality assessment by third party (improper sample collection and unavailability of sample preparation equipment). There is enormous delay in getting the analysis reports, credit/debit notes. Subsidiaries supplied unsized and uncrushed coal at various instances.
- Grade of coal produced has been worsening.
- Competitive and dynamic power market. High spot power price in importing power from grid by aluminum smelters.

- Hiccups in growth of renewable energy sources.
- Coal block auction for commercial mining have been moving at a slow pace.
- High taxes, duties and levies, excessive carbon tax, Renewable Power Obligation (RPO) burden, higher electricity duty.
- Low Research & Development (R&D) in coal sector and limited use of coal-washing technologies in India.
- Huge reserve lying untouched due to the non-application of advanced technologies specific to the particular type of deposit.
- Adverse geology and increase in stripping ratio resulted in increase in mining cost.
- Operating performance of CIL is lower than global peers. Technology adoption by the coal sector in India is limited.

Global Coal Scenario

R/P (Reserves-to-Production) ratio for coal is around 134 years. Around 85% of the coal production globally is consumed domestically. China continues to be the largest coal producer globally and accounts for 45% of the world's coal production. The United States, India, Australia and Indonesia together account for 32% of the world coal production. Generation from coal has started to decline due to continuously increasing mix of renewables. Globally, coal production has been declining. Developed economies namely the United States, China and Europe continued to report fall in demand for coal and have reported growth in gas-based and renewable energy generation. Australia and Indonesia continued to be the largest coal-exporting nations in the world and accounted for 56% of the total coal export volume. The top four destinations of exported coal were China, India, Japan and South Korea and accounted for 59% of the total global coal import volume.

POWER SECTOR SCENARIO IN INDIA

India is the third largest producer and third largest consumer of electricity in the world. Over financial year (FY) 2010–2018, electricity production in India grew at a compound annual growth rate (CAGR) of 6%. India has the fifth largest installed capacity in the world. The installed power capacity reached 346 GW as of September 2018. Installed capacity increased steadily over the years, posting a compound annual growth rate (CAGR) of 9.08% in FY 2009–2018 (Government of India, India Brand Equity Foundation, 2019).

Coal provides 56% of Indian energy needs, and 73% of the entire power generated in the country is coal based. Coal-based power generation grew at a CAGR of 9% in FY 2013–2016 period; however, this growth has been slowed down to 5% in last three years. Coal-based power plant installed capacity has grown at a CAGR of 12% in FY 2013–2016 period, as a result the Plant Load Factor (PLF) of coal-based power plants dropped significantly in FY 2013–2016 period (72% to 62%). However, the PLF has again increased due to slowdown in capacity addition in FY 2016–2019 period. The increase in capacity has outpaced the growth in demand, resulting in a declining trend of all-India Plant Load Factor (PLF). This indicates underutilization of thermal capacity.

Coal demand by power sector has been growing at 5–6% per annum in line with GDP growth. Some of the shortfall/steadiness in nuclear/hydro and gas-based power plant had to be taken by coal-based power plant. As a result, PLF of coal-based power plants is consistently higher than last year. Coal demand by power plants has increased from 46 Million Tonnes per month in FY 2015–2016 to 53 Million Tonnes per month in FY 2018–2019. Currently, coal consumption is at its highest level; however, import by power sector has not picked up, putting huge pressure on domestic coal supply to power sector.

Coal Sector Scenario in India

India has the fifth largest geological coal reserve of 319 billion tons (149 BT measured, 139 BT indicated and 31 BT inferred), of which 89% of the existing coal reserves in India belong to the non-coking category, which is consumed mainly for power, cement and fertilizer production. India is the third largest coal producer in the world after China and the United States. The total coal production in India was around 676 million tons (MT) in FY 2018. More than 93% of the domestic production comes from public sector coal producers. 93% of coal production is from open-cast mines. Domestic coal shortage has been widely reported, especially for thermal power plants. The state-run miners (CIL and SCCL) on their part have been trying to address the issue of coal shortage at power plants. Demand for non-coking coal in India has been rising at 3.7% from FY 2012–2018. Non-coking coal consumption is forecasted to grow at a CAGR of 5.4% to reach 1076 MT in FY 2023 from 826 MT in FY 2018 and domestic supply is forecasted to reach 931 MT in FY 2023 from 664 MT in FY 2019, at a CAGR of 7% (Government of India, India Brand Equity Foundation,

Table 4.1 Growth of Indian non-coking coal sector at a glance

<i>Particulars (MT)</i>	<i>2013–2014</i>	<i>2016–2017</i>	<i>2017–2018</i>
1. Reserve of non-coking coal (measured)	107,509	124,423	129,112
2. Demand of non-coking coal	716	828	845
3. Supply of non-coking coal	514	591	664
4. Non-coking coal production in India	509	596	608
5. Non-coking coal production by CIL	414	499	534
6. Import of non-coking coal	130	149	145

Source: CEA, MOC, CIL Reports

2019). Correspondingly, supply for non-coking coal has only been rising at 2.8% from FY 2012–2018. This has led to consistent increase in demand–supply gap for non-coking coal. The growth of non-coking coal sector in India is exhibited in Table 4.1.

Geological Coal Reserve in India

As per GSI compilation of resources as on 1 April 2018, in situ geological resources of coal in India up to a depth of 1200 meters is 319 BT, which includes proved, indicated and inferred resources. Jharkhand, Odisha and Chhattisgarh constitute 69% of the total coal reserve of India having 83, 79 and 57 BT of coal respectively (Geological Survey of India, 2018). Out of the total coal reserve of 319 BT, non-coking coal is 283 BT (89%). Geographical mismatch between demand and supply of coal is explained, as 87% of coal is concentrated in the eastern states of Odisha, West Bengal, Jharkhand and central states of Madhya Pradesh and Chhattisgarh. Around 45% of the thermal power plants (TPPs) are on the northern and western regions.

Key Trends on e-Auction of Captive Coal Blocks

Hon'ble Supreme Court of India vide its judgments in August and September 2014 had declared 204 coal mines/blocks allocated to the various government and private companies since 1993 as illegal on the grounds that the procedure followed was arbitrary and no objective criterion was used to determine the selection of companies. Pursuant to this judgment, e-auction of Schedule II and Schedule III Coal Mines was conducted (Government of India, Ministry of Coal, 2015).

Post SC judgment on deallocation of 204 coal blocks in September 2014, the Ministry of Coal has so far awarded 84 coal blocks through auction and allocation route to various end users out of which around 18 mines have started production of coal (Government of India, Ministry of Coal, Coal Controller Organization, 2018). Captive coal blocks are underutilized due to reasons such as:

- Coal blocks which may have landed costs higher than the alternate sources of coal available for the end-user plant (EUP).
- Inherent challenges such as higher stripping ratio and higher cost of land acquisition.
- High premium quoted in the coal block auctions in spite of being inherently viable.

e-Auction of Coal Blocks for Non-regulated Sector

Attractiveness of each coal blocks to be mapped is based on capacity and quality of coal; evacuation infra and distance from the plant; type of deposit: underground and open-cast; readiness of blocks: status of clearances; land acquisition; R&R issues. A bidder can sell up to 25% of actual mine production in open market without being charged any additional premiums on such sale (Government of India, Ministry of Coal, 2019). Washery rejects from these mines can only be sold after taking approval from Coal Controller of India (CCO). A successful bidder or allottee proposing to utilize the coal mined from a particular mine for any other plants owned by the bidder or its subsidiary company for common specified end use shall provide prior intimation to the Central Government in writing.

An end user can bid for uncovered portion of their requirement met by captive coal mine and linkage. However, a linkage can be surrendered once a coal mine is secured under auction. The entitlement to receive coal pursuant to such coal linkage shall stand proportionately reduced on the basis of the requirement of coal being met from the mine.

Coal India Limited (CIL): Overview of Coal Production and Dispatch

The producing Indian subsidiary companies of Coal India Limited are:

1. Eastern Coalfields Limited (ECL)
2. Bharat Coking Coal Limited (BCCL)

3. Central Coalfields Limited (CCL)
4. Western Coalfields Limited (WCL)
5. South Eastern Coalfields Limited (SECL)
6. Northern Coalfields Limited (NCL)
7. Mahanadi Coalfields Limited (MCL)
8. North Eastern Coalfields (NEC)

Coal India Limited (CIL) is the biggest coal company in the world. CIL had 369 mines at the beginning of 2017–2018, of which 174 are underground, 177 open-cast and 18 mixed mines. While production from open-cast mining was 536.83 MT during 2017–2018, production from underground mining was only 30.54 MT. Incremental increase in coal production by CIL in the last five years (FY 2013–FY 2018) was 115 MTs, compared to incremental increase of 73 MTs during previous five years, from FY 2008 to FY 2013. Coal Production Growth of CIL stood at CAGR: 4.5% during FY 2012–2018. Production from open-cast mines during 2017–2018 was 94% of total coal production. Non-coking and coking coal comprises 94% and 6% of CIL's coal production. About 50% of CIL's total production comes from 15 mega open-cast mines. There are 26 operational mega mines, which are contributing around 60% of total production. CIL is developing 11 new mines to maintain the current production momentum.

Production of coal at CIL's subsidiaries was affected due to issues related to land acquisition/possession, Rehabilitation & Resettlement (R&R) and related law and order issues, Forest Clearance (FC) and Environment Clearance (EC). Around 60% of the world's coal production is from underground mines while 40% from surface mines. The largest coal-producing countries like China, South Africa, the United States and Australia are producing coal from underground mining at 95%, 50%, 33% and 20% respectively. India stands at about 6%. The growth of coal production from mines of CIL is linked to growth of coal production from surface mines. After nationalization in 1970s, CIL had more than 700 underground mines. About 60 small and old (underground and mixed) mines were closed in 2017–2018.

Policies Driving Linkage e-Auctions

Coal India Limited (CIL) has been supplying indigenous coal to regulated, strategic and non-regulated sectors. Regulated sector covers non-captive coal-based power generation units. Strategic sectors are rail and defense. Non-regulated sectors cover cement, steel, captive power and

others. Proportion of coal allocation between power and non-power sectors may be continued at the same level as average proportion of the last five years, that is, 75% for power and 25% for non-power (Government of India, Ministry of Coal, 2016). About 90% of the supplies are made through long-term Fuel Supply Agreements (FSAs) with end users and the rest through electronic auctions (e-auctions) (Government of India, Ministry of Coal, 2015).

The coal linkages were earlier granted to various entities on the basis of decisions of a Standing Linkage Committee. In the non-regulated sector, there is no justification of providing coal at a price less than the market price because the market is not regulated and the market forces determine the price of the final product. Post the Supreme Court judgment on deallocation of 204 coal blocks in September 2014 (Government of India, Ministry of Coal, 2015), it is logical to interpret that the same philosophy of non-discretionary allocation could be extended for the CIL's linkages as well. This development has made CIL to allocate linkages through a market-based mechanism. In pursuance to the new policy, CIL has been conducting linkage auctions for different sub-sectors under non-regulated sector since June 2016 (Coal India Limited, 2016).

RoM (Run-of-Mines) prices of CIL are different for regulated and non-regulated sectors. This is a fair principle, and especially in the non-regulated sectors, the various end-use sub-sectors have their own distinctive economics and methodology. If the sectors are pitted against each other, it would lead to some sectors losing out on linkages.

Therefore, separate quantities have to be earmarked for regulated and non-regulated sectors on the one hand, and furthermore, within the non-regulated sub-sectors, cement, sponge iron, all captive power plants (CPPs), steel (coking coal) and others would have separate quanta in the auction process. The attributes of linkage auction of coal is detailed as below:

- The methodology for auction of linkages that achieves this balance is Supplier Controlled Ascending Market Clearing Auction where the prices are increased till demand–supply equilibrium is established. The initial floor price is set at the relevant CIL ROM price and for a particular link quantity. If bids are received for quantity greater than link quantity, then the floor price is increased in steps. Auction stops when bids are received for the exact quantity, that is, link quantity offered. Maximum bid quantity by a particular bidder shall not exceed the normative requirement of the end-user plant.

- For auction of linkages, CIL/SCCL shall chalk out annual or six-monthly auction calendar.
- There may not be premature termination of FSAs of non-regulated sector. However, there will be no renewal of existing FSAs of non-regulated sector (except FSAs of Central Public Sector Enterprises (CPSEs) of Fertilizer [Urea]), which are maturing in 2015–2016 onward. Extant coal supply arrangements may continue till commencement of coal supply under auction process (Government of India, Ministry of Coal, 2016).
- Source of supply shall be individual mines/railway sidings. Auction will be conducted in “Lots”. Each lot will majorly have grade, quantity, size, point of delivery (road-sale point/railway siding), sub-sector for which that lot is earmarked.
- The tenure of the FSA shall be five years, which can be extended by another five years on mutually agreed terms upon the request of the bidder. FSA shall have a lock-in period of two years. Post the expiry of lock-in period, the successful bidder may seek an exit after serving a prior written notice of three months (Coal India Limited, 2016).
- Eligible quantities are calculated by a predetermined formula. Consumption is considered at 85% PLF and Heat rate as prescribed by Central Electricity Authority. All existing linkages are subtracted at G-10 irrespective of FSA grade. All existing captive mine secured are taken out from consumption requirement. Auctions are conducted on Rs/ton premium over notified price (Coal India Limited, 2016).
- Linkage auction FSA requires 100% supply by CIL against 75% supply in existing linkage FSA (Coal India Limited, 2016).
- Quality assurance through third-party sampling facility.
- Linkage Auction FSA is mine-specific and hence there shall be predictability of tentative logistics cost
- Regional players that are nearing expiry of existing linkages will be the foremost competitors. A list of all regional players needs to be prepared with existing linkage expiry, location and willingness to pay.
- However, non-regional players that have high unsecured demand can be surprise entries.

KEY TRENDS ON INDIA’S IMPORT OF COAL

The coal production in the country had not been keeping pace with the increasing demand. The major reason being delay in development of coal mines in the country. Moreover, the supply of high-quality coal (low-ash coal) in the country has been more limited. This compelled power plants

to import coal to bridge the demand–supply gap. Power utilities were advised to import coal for blending due to inadequate availability of domestic coal and to maintain the stipulations of Ministry of Environment and Forest regarding use of coal with less than 34% ash content and to occasionally supplement the coal from indigenous sources. Further, with the commissioning of power plants designed for use of imported coal as fuel, power utilities imported coal to meet the requirement of fuel for these power plants. Present import policy allows coal to be freely imported under Open General License by the consumers themselves considering their needs.

Coal accounted for 4.9% of total imported goods by value (approx. \$22 billion) in India and is the fourth most imported commodity behind petroleum, precious stones and gold. Steam coal or non-coking coal accounts for 70% of total coal imports volume. India’s non-coking coal imports were at 164.21 MT in FY 2018–2019, about 13.25% increase over 144.99 MT recorded in FY 2017–2018 (“Coal Import Rises”, 2019). Indonesia is the most dominant source with about 48% share in total import.

GLOBAL COAL DEMAND AND SUPPLY

The global seaborne trade amounts to around 1 billion tons and with prices averaging \$80 per ton, the market size would be near \$80 billion. Only 15% of global production is traded for more than 50% for oil. During the last 12 months, global coal prices have been in the range of \$70–106. Global coal demand is expected to go up to 1000 MT in 2018 from 923 MT in 2017, which means that there will be a likely 77 MT growth in demand in 2018. Attributes of demand and supply forces are discussed in the section below:

- Demand: China and India are the biggest drivers, account for around 65% of the global thermal coal demand. Growth rates are driven by GDP growth combined with power generation mix changes. China’s coal consumption is a major uncertainty with 80 million tons gap between high and low scenario. India’s domestic coal demand is set to increase at the rate of 6% per annum owing to growth and import-substitution.
- Supply: Indonesia is expected to continue their dominance in supply of non-coking coal. Indonesia’s regulations and South Africa’s rail-

ways coal export capacity are likely to be the major factors on supply side. Chinese and Indian policy-making and domestic industry dynamics are pivotal factors.

- Pricing: There would be continued price volatility driven by demand–supply gap, logistics bottlenecks, policy decisions and mine disruptions. USD movement, oil price, geological inflation, inflation in labor and other mining costs will affect the prices.

IMPLICATIONS FOR CAPTIVE POWER PLANTS

Captive power plants (CPPs) typically have 70% of their import requirements on long-term contracts (LTCs) and the rest is opportunistic buying on spot. Best-in-class companies have a mix of traders and miners in their supplier portfolio. LTCs are signed with one or two suppliers per geographies and two geographies overall at most (typically Indonesia and South Africa). Mozambique and the United States are typically used for opportunistic buying (especially high sulfur off-spec coal). Best-in-class prices for importers in India are in the range of 20–27% discount to Newcastle (NEWC) index. This is driven by a strong value proposition of large volumes and excellent reputation on payment. Within Indonesia, it is economical to target supplier with lower gross calorific value (GCV) off-specifications (off-spec) coal (<5500 NAR) as lower GCV off-spec coal trades at a discount. Long-term contracts are generally linked to index (Newcastle, API4, etc.) while spot prices are fix for delivery within 90 days. Selection of right index for target quality of coal is important, as GCV discount has been available for lower GCV coal. The index should be closer to the actual GCV. If linked to Newcastle, the most prominent index, sufficient discount should be applied. Industry players are working on various combinations of short term, long term, FOB/CIF, trader/miner, fix/index and get varying discount from index. A comprehensive supplier-management program is executed across three categories

- A class supplier: Candidates for LTCs, CEO to CEO discussion every six months, potential for long-term strategic partnerships
- B class supplier: Predominantly spot purchase, meetings through roadshows every year
- C class supplier: Low priority, to engage in case of positive disruptions in their system

PRICING AND CONTRACTING STRATEGY

Optimal strategies across major elements depend on volumes and overall prevailing market conditions as mentioned below:

1. **High-volume, long-term index-linked contracts (volume: >5 MT):**
 - (a) Description: Typically done by Japanese and South Korean players for high GCV coal (>5500 NAR)
 - (b) Long-term contracts directly with coal producers up to three years
 - (c) Buyer rationale: Long-term supply security at competitive price
2. **Medium-term volume variable price contract with coal producers/traders (Volume: 1–5 MT):**
 - (a) Description: Typically done for low and medium GCV coal
 - (b) Buyer rationale: Supply security in the short term
 - (c) Typically get in to this when market is not at its lowest
3. **Small-volume spot/short-term contract (volume <1 MT):**
 - (a) Description: three to six months' contracts with producers/traders (1–3 vessels)
 - (b) Typically driven by opportunistic buying or distress sale
 - (c) Buyer rationale: Market intelligence on price for negotiation on LTCs
 - (d) Large portion of volumes on variable demand
4. **Short-term vs. long-term contract: long-term contracts (>6 months) applicable when**
 - (a) Quantity to be procured is >3 MTPA and it is certain
 - (b) Supply security is critical
 - (c) Outlook on domestic e-auction prices is high
 - (d) Index discount with chosen supplier is substantial
5. **Producers vs. traders: traders offer certain advantages over producers**
 - (a) Supply security, flexibility to lift laycans, quick fulfillment
 - (b) Offer multi-origin, opportunity to buy low volumes
 - (c) Optimize specifications and price across locations
 - (d) Large traders get up to 15% discount from relevant index while buying from producers

6. **Index-linked vs. fixed price contracts:**
 - (a) Index-linked contracts reduce risk for both supplier and buyer—most commonly used for LT contracts
 - (b) Big traders are able to keep part of their requirement fixed at lower cost due to volume and long-term relationships
7. **Free on board/cost, insurance and freight (FOB/CIF):**
 - (a) Miners prefer FOB deals: Marine-logistics arrangement to be arranged by customers
 - (b) CIF with traders is more prevalent norm due to the following:
 - (i) Traders have better charter deals
 - (ii) As an aggregator, traders also provide flexibility of choosing discharge port
8. **Off-specs coal:** Off-specifications coal trades with a discount. Operational feasibility should be worked out.
9. **Implications of quality parameters:** Plants should examine cost benefit analysis for the quality parameters viz. GCV, moisture, ash, VM, sulfur, AFT, HGI and size. A rejection limit is set after a certain range.

RECOMMENDATIONS

1. **Sourcing Strategy:** Around 70% of the overall coal requirement should be secured on long-term basis through captive coal blocks, linkage auction based on cost economics for uninterrupted reliable coal supply. Only ~30% of the coal should be secured through open-markets sources such as domestic e-auction, traders, imported coal for blending. Sufficient coal to be made available at the plants (15 days' stock). Integrated margin management to be used while formulating the coal-sourcing strategy.
2. **Linkage Coal Materialization with Quality Conformance:** Continuous pursuance at Ministry of Coal (MOC)/Coal India Limited (CIL) to be in place for stable coal supply to non-power sector as per monthly contracted quantity. Robust transportation and supervision services contracts should be in place. Quality conformance to be ensured through third-party sampling provision
3. **E-auction Coal Procurement:** A comprehensive e-auction strategy should be implemented based on marginal cost analysis, intelligence gathering, mines-wise attractiveness, competitive intensity, dynamic decision-making model, monthly decision on mine-level quantity

and price targets. Quality conformance should be safeguarded through third-party sampling provision

4. **Import Coal Procurement:** 70% of import quantity should be procured on long-term contracts (LTCs) with 30% on opportunistic buying with one or two suppliers for LTCs per geography and two geographies at most for LTCs. Mix of miners and traders should be considered in the import coal supply portfolio.

LIMITATIONS OF THE STUDY

- This study is limited to the coal-sourcing options for CPP sub-sector of aluminum industry under non-regulated customers of CIL.
- The basis of sample selection is purely judgmental in view of the time available
- The issues identified and proposed action plans in this report are based on the discussions with the people engaged in the industry, review of relevant documents/reports and physical observation of the activities in the process.
- Subsequent test work, study of issues in detail and developing action plans are directed toward the issues identified.
- The work carried out and the analysis thereof are based on the primary and secondary data gathered from various websites, study of various published reports, interviews with the industry experts.
- An effort has been made in specific to verify the accuracy and authenticity of the information gathered only in those cases where it was felt necessary.
- The outcome of the analysis may not be exhaustive and representing all possibilities.

REFERENCES

- Aluminium industry demands resumption of coal supply. (2018, August 30). *Financial Express*. Retrieved from <https://www.financialexpress.com/industry/aluminium-industry-demands-resumption-of-coal-supply/1296858/>
- Aluminium makers face coal shortage: FIMI. (2018, August 15). *The Times of India*. Retrieved from <https://timesofindia.indiatimes.com/business/india-business/aluminium-makers-face-coal-shortage-fimi/articleshow/65414671.cms>
- Coal Import rises 9% to 234 MT in FY19. (2019, April 22). *The Hindu Business Line*. Retrieved from <https://www.thehindubusinessline.com/economy/coal-import-rises-9-to-234-mt-in-fy19/article26911197.ece>

- Coal India Limited. (2016, September 14). *Pre bid presentation, auction of coal linkages*. Retrieved from <https://www.mstcecommerce.com/auctionhome/coallinkage/RenderFileLinkage.jsp?file=Prebid-Presentation-Others-20-09-16.pdf>
- Geological Survey of India. (2018). *Indian coal and lignite resources-2018*. Retrieved from <https://employee.gsi.gov.in/cs/groups/public/documents/document/b3zp/mjkl/~edisp/dcportlgsigovi295293.pdf>
- Government of India, India Brand Equity Foundation. (2019). *Indian power industry report*. Retrieved from <https://www.ibef.org/download/power-mar-2019.pdf>
- Government of India, Ministry of Coal. (2015, June 24). Minutes of the fifth meeting of the Inter-Ministerial Committee for proposed auction of coal linkages/LoAs through competitive bidding held on 04.06.2015. Retrieved from https://coal.nic.in/sites/upload_files/coal/files/curentnotices/250615_0.pdf
- Government of India, Ministry of Coal. (2016, February 15). *Auction of linkage of non-regulated*. Retrieved from https://coal.nic.in/sites/upload_files/coal/files/curentnotices/28-06-2018-d.pdf
- Government of India, Ministry of Coal. (2019, April 16). *Monthly summary for the cabinet for the month of March, 2019*. Retrieved from https://coal.nic.in/sites/upload_files/coal/files/coalupload/16042019march.pdf
- Government of India, Ministry of Coal, Coal Controller Organization. (2018). *Provisional coal statistics 2017-18*. Retrieved from <http://www.coalcontroller.gov.in/writereaddata/files/download/provisionalcoalstat/ProvisionalCoalStat2017-18.pdf>
- Russell, C. (2018, August 20). India's surging coal imports driven by captive power users, *Reuters*. Retrieved from <https://in.reuters.com/article/column-russell-coal-india/column-indias-surging-coal-imports-driven-by-captive-power-users-idINKCN1L50CZ>
- Saraswat, & Ghosh. (2018). *Need for an aluminium policy in India*. Retrieved from http://www.niti.gov.in/writereaddata/files/document_publication/niti_aluminum_upload.pdf
- Supreme Court scraps 214 coal blocks gives companies 6 months to wind up. (2014, September 24). *India Today*. Retrieved from <https://www.indiatoday.in/india/story/coal-scam-coalgate-supreme-court-coal-blocks-300653-2014-09-24>