IMC Report on Augmentation and Consumption of Domestic Coking Coal by Steel Sector

(Report by IMC Constituted by Ministry of Coal)

Inter-Ministerial Committee
7-16-2021

Foreword

Coking coal is very critical input in steel production which is very important for industrial development of the country. Since coking coal supplies are insufficient to meet the domestic demand, India has been importing coking coal on regular basis. The mandate of this committee was to consider the estimated demand of coking coal by 2030 and prepare an action plan to reduce import of coking coal which includes exploration, enhanced production, adoption of new technologies, allocation of coking coal blocks for private sector development, setting up of new coking coal washeries, enhanced R&D activities and improvement of quality parameters.

I would like to thank all the members of the committee for their valuable time and sincere efforts to make the report comprehensive and implementable. I would like to make special mention of officials from CIL, CMPDIL, Mr. Pankaj Satija, Mr. Kapil Dhagat, Mr. Arvind Rajagopalan and Mr. Ravinder Bhan for their earnest contributions to enrich the deliberations and preparation of the report. I also take this opportunity to thank Ms. Poonam Singhal (CIL), Ms. Tuktuk Bansal and Mr. Gaurav Aggarwal (SBI Capital Markets Limited), whose services are invaluable in finalizing the report. I hope this report will set the roadmap for the country on reducing the import of coking coal.

M. Nagaraju, IAS

Chairman, Inter-Ministerial Committee & Additional Secretary,

Ministry of Coal

Table of Contents

List of Figures

List of Tables

Chapter 1: Coking Coal Scenario in India

I. Overview

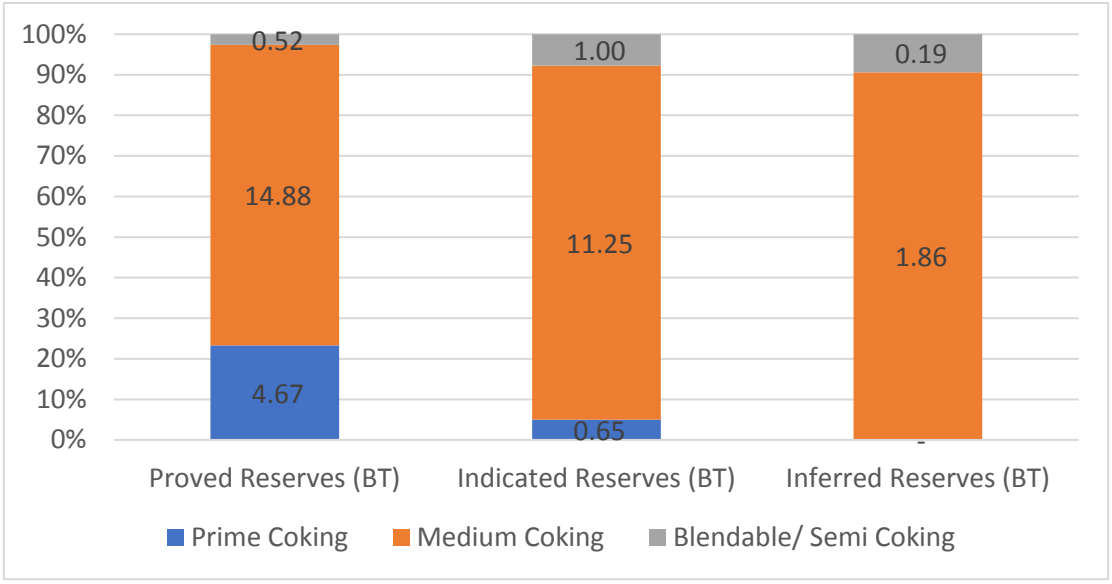
Iron ore and coking coal are two most critical raw materials for steel production. India has surplus reserves of iron ore for long term requirement. However, the supply of coking coal needs to be enhanced on account of the following:

1. **Huge Demand Supply Gap of Coking Coal:** India's domestic reserves are inadequate to meet the demand. Domestic raw and washed coking coal production during last few years has been around ~50 MTPA and ~5 MTPA respectively, whereas import of coking coal stood at ~50 MTPA.
2. **Increase in Domestic Steel Demand:** According to National Steel Policy 2017, to achieve steel making capacity of 300 MTPA (including 181 MTPA through blast furnace route) by FY 2030, huge volumes of coking coal (~170 MT of domestic raw coking coal) would be required.
3. **Import Dependent:** Indian steel industry fulfils ~70% of its coking coal requirements through imports. Growth in steel production is expected to push up demand for metallurgical coking coal to 75 MT in FY 2023. Consequently, the share of imports is expected to remain over 76-77% in FY 2022 and FY 2023. In absolute terms, coking coal imports are expected to increase to 58 MT in FY 2023 from 47 MT in FY 2018.

II. Coking Coal Reserves

As on April 1, 2020, India has ~35 BT of coking coal reserves. Of these 35 BT reserves, ~20 BT are Proved Reserves and remaining 15 BT are Indicated and Inferred coking coal reserves. Category-wise coking coal reserves of the country is provided below:

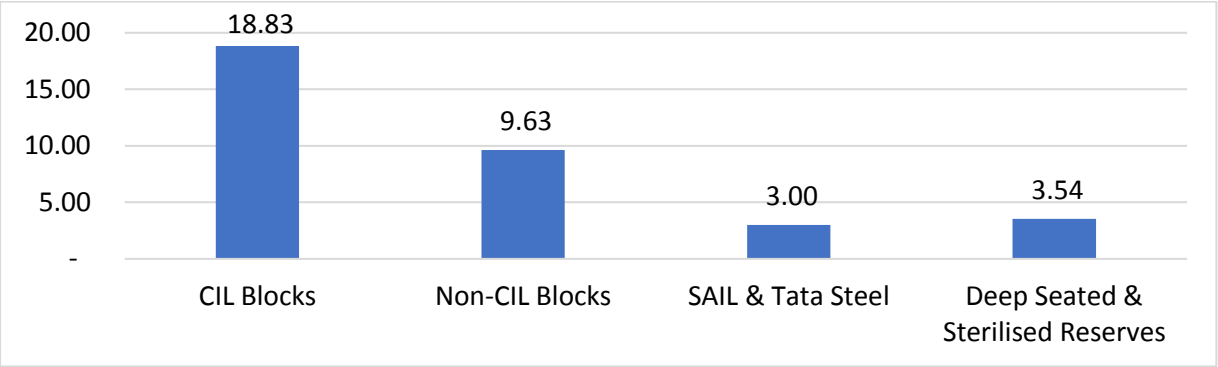
Figure 1: Coking Coal Reserves of India as on April 1, 2020



Source: Provisional Coal Statistics FY 2020 by CCO

As per the information provided by CMPDIL, out of the 35 BT coking coal reserves, ~18.83 BT coking coal reserves are in the coal blocks which are with Coal India Limited (CIL) and the remaining reserves are in non-CIL blocks or with TATA Steel and Steel Authority of India Limited (SAIL). Company-wise break-up of coking coal reserves is provided below:

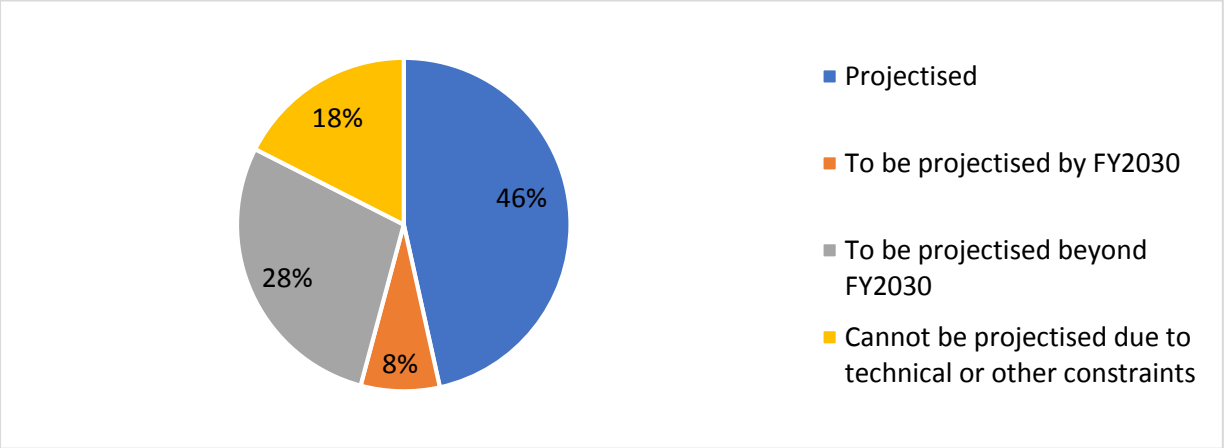
Figure 2: Company-wise Break-up of Coking Coal Reserves (BT)



Source: CMPDIL

Further, as per the information provided by CMPDIL, out of 18.83 BT of coking coal reserves of CIL, 8.76 BT have been projectized till date, 1.44 BT is expected to be projectized by FY2030, 5.33 BT is expected to be projectized beyond FY2030 and 3.3 BT cannot be projectized because of technical or other constraints. Break-up of CIL's coking coal reserves is provided below:

Figure 3: Break-up of CIL's Coking Coal Reserves (BT)



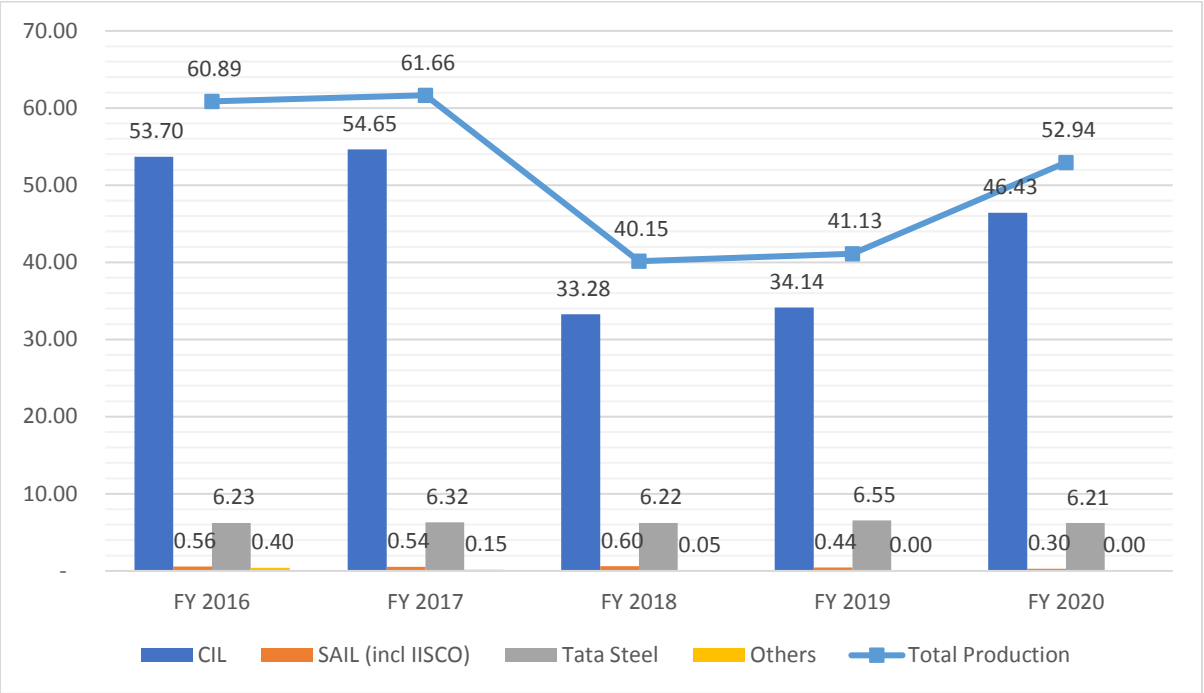
Source: CMPDIL

For SAIL and Tata Steel, the total coal reserves are 3.138 BT, i.e. total coal up to bottom most seam. Out of this, coal resources excluding intrusive effected seams & blocked coal are 1.391 BT and total reserve as per approved mine plan is 345 MT as per approved plan on year 2017-18 with total 42 MT reserves extracted till March 21. Therefore, balance mineable reserves approximately 300 MT.

III. Production of Coking Coal (Raw & Washed Coking Coal)

Majority of the country's coking coal is being produced in Jharkhand. While the raw coking coal production in the country has registered a negative CAGR of 3% during FY 2016- FY 2020, the production increased from 41 MT in FY 2019 to 53 MT in FY 2020. Production data for FY 2021 is not yet available. Year-on-year raw coking coal production in the country over the last 5 years is provided below:

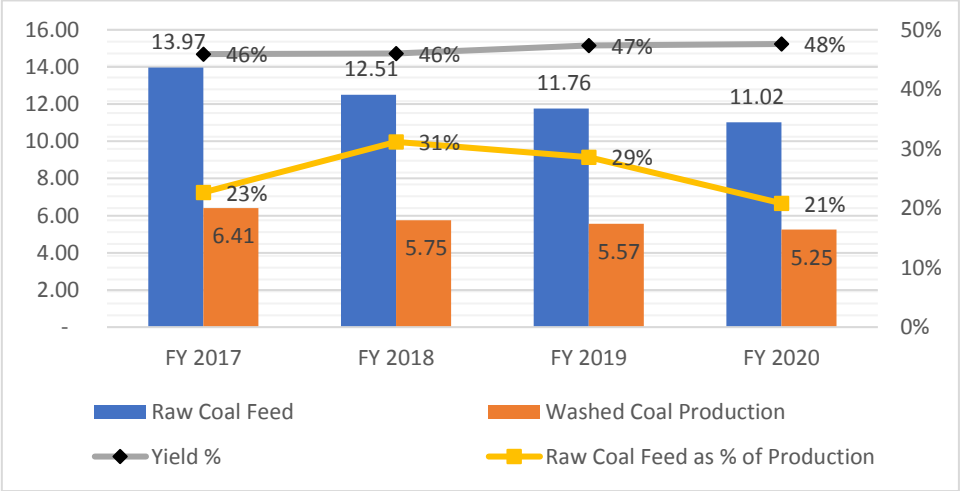
Figure 4: Annual Raw Coking Coal Production in India



Source: Provisional Coal Statistics FY 2018, FY 2019 and FY 2020 by CCO

Over the last 4 years, only about 20-30% of coking coal produced was washed before utilisation with average yield of ~47%. It may be noted here that Washery I-VI grade coking coal is required to be washed before utilisation by steel sector. Details of coking coal washed in the last 4 years is provided below:

Figure 5: Annual Washed Coking Coal Production in India



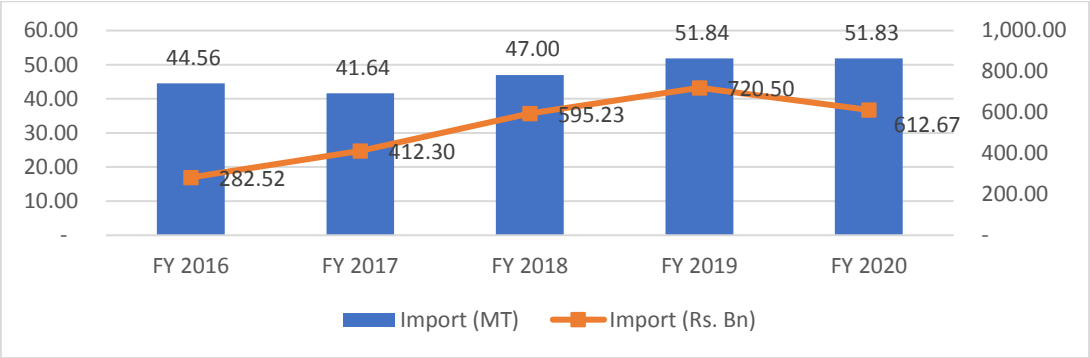
Source: MoC's Website

IV. Import of Coking Coal

Since domestic coking coal is of high ash variety and the demand of coking coal in India is much higher than domestic production, about 50 MT coking coal is imported by the country on an annual basis. During FY 2021, 51. 29 MT coking coal was imported in the country, registering a CAGR of 5% during

the period FY 2017 to FY 2021. Coking coal imports in the country during FY 2016 to FY 2020 is provided below:

Figure 6: Annual Imports of Coking Coal in India



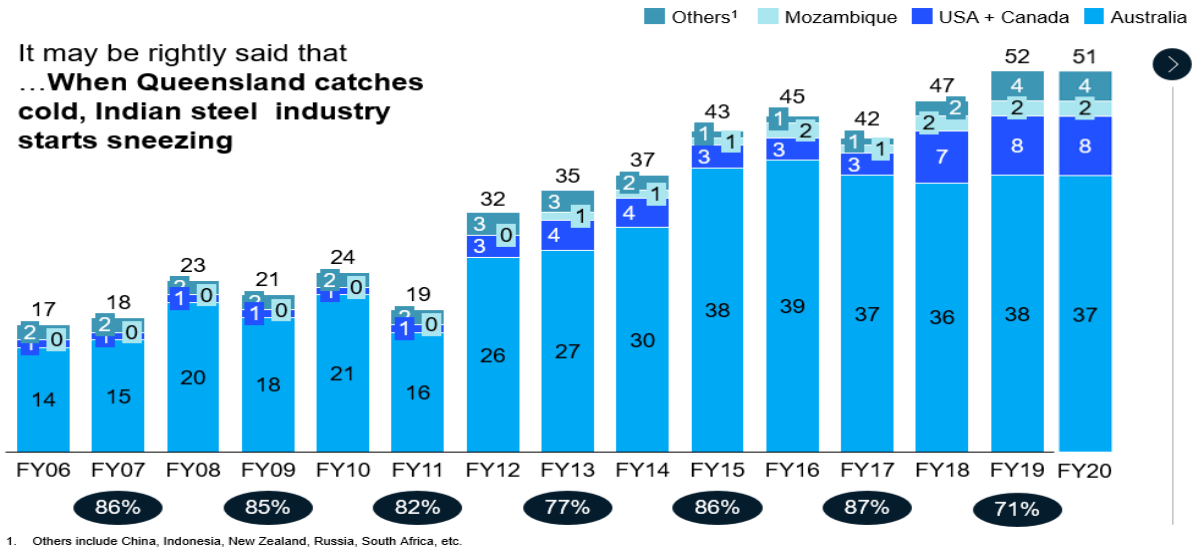
Source: MoC's Website

Almost 70% of the coking coal in the country is imported from Australia, leaving India highly dependent on Australia for supply of a critical raw material to the steel industry and exposing the industry to price volatility vulnerability.

- Seaborne coking coal demand from India has always relied heavily on Australian exports
- Driven by a push from the Indian government, steel mills diversified their raw material sourcing, for instance, Canada, US and Mozambique in recent years. The latter through upstream investments into new mines.

Country-wise import of coking coal during FY 2006-2020 is provided below:

Figure 7: Country-wise Coking Coal Imports in FY 2006-2020 (MT)



Australia is prone to weather disruptions during January - March. With current buy of ~37 MTPA, a 1-month stock disruption can have a huge financial impact on the domestic steel manufacturers. However, Australia remains the best source for sustainable supply of good quality coals; hence backbone coals still need to be sourced.

Figure 8: Global and India Coking Coal Imports in FY 2019 (MT)

Global Coking Coal seaborne exports

	FY 19 Global Country Wise Coking Coal Exports (MT)		% of Total
1	Australia	179	59.3%
2	US	56	18.5%
3	Canada	32	10.6%
4	Russia	19	6.3%
5	Mozambique	9	3.0%
	Others	8	2.6%
	Total	302	

Source: Mc Kinsey Report

vs

India Coking Coal imports

	FY19 Country Wise Coking Coal Imports (MT)		% of Total
1	Australia	36.93	71.24%
2	Canada	4.29	8.28%
3	USA	4.13	7.97%
4	Indonesia	1.17	2.25%
5	Mozambique	2.23	4.32%
6	Singapore	1.50	2.91%
7	Russia	0.547	1.05%
8	UAE	0.437	0.84%
	Total	51.88	

Australia's share has seen a decreasing trend over the past 3 years with increase seen from US & Canada

V. Mission Coking Coal

Coking coal is mainly used in manufacturing of steel through blast furnace route. Domestic coking coal is high ash coal (mostly between 18% - 49%) and is not suitable for direct use in the blast furnace. Therefore, coking coal is washed to reduce the ash percentage and Indian Prime Coking Coal and Medium Coking Coal (<18% ash) is blended with imported coking coal (~9% ash) before utilisation in the Coke Ovens to make Coke for feeding into the Blast Furnace.

Limited supply of raw coking coal and washery capacity is a challenge in increasing the blending percentage of domestic coking coal. With increase in supply of domestic coking coal (18% ash), the blending percentage may be increased up to 25% without usage of stamp charging technology by steel sector and over 35% with usage of stamp charging technology.

Estimated capacity of steel production in FY2020-21 is 131 MT of which 65 MT is through blast furnace route. As per National Steel Policy 2017, the targeted steel production by FY2029-30 is 300 MT of which 181 MT would be through blast furnace route i.e. nearly 3-fold increase is targeted in the blast furnace route steel-making capacity. Together with increased steel production and higher blending percentage, multi-fold increase is required in the supply of domestic coking coal. Hence, Ministry of Coal (MoC) has set up a Mission Coking Coal to suggest a road map to augment the production and utilisation of domestic coking coal in India.

Demand Supply Gap Analysis of Domestic Coking Coal by FY 2030

For undertaking the demand supply gap analysis by FY 2030, following scenarios have been considered:

a. **Demand:** Demand for domestic coking coal has been estimated considering production of steel through blast furnace route as per National Steel Policy 2017.
b. **Supply:** Increased focus by CIL to enhance coking coal production to reach 105 MT by FY 2030

Detailed demand supply gap analysis is presented below.

1. **Demand FY2030:** For producing 181 MT steel through blast furnace route by FY 2030 as per National Steel Policy 2017, about 161 MT coking coal (10 -11 % ash) would be required. The demand for domestic coking coal would depend on whether stamp charging technology is being used before feeding coal into coke oven or not. Under Scenario 1 (i.e. without stamp charging), demand for raw coking coal and washed coking coal (assuming 33% yield) has been estimated as 121 MT and 40 MT respectively. Under Scenario 2 (i.e. with stamp charging), demand for raw coking coal and washed coking coal (assuming 33% yield) has been estimated as 170 MT and 56 MT respectively. Therefore, coking coal washery capacity would be required to wash ~121 MT and ~170 MT raw coking coal under Scenario 1 and Scenario 2 respectively.

Table 1: Demand of Coking Coal in India – FY 2030

Particulars (figures in MTPA)	**Scenario 1: Without usage of Stamp Charging Technology**	**Scenario 2: With usage of Stamp Charging Technology**
Blending % of domestic coking coal at 18% ash	25%	35%
Imported coking coal requirement	121	105
Requirement of washed domestic coking coal	40	56
Requirement of raw domestic coking coal for meeting remaining washed coal	121	170

2. **Supply FY2030:** Key producers of coking coal would be Coal India Limited (CIL) (production from BCCL & CCL), Tata Steel, SAIL and non-CIL blocks allocated under CM(SP) Act and MMDR Act. Supply side estimates are as provided below:

Figure 9: Coking Coal Production Projections (MT)

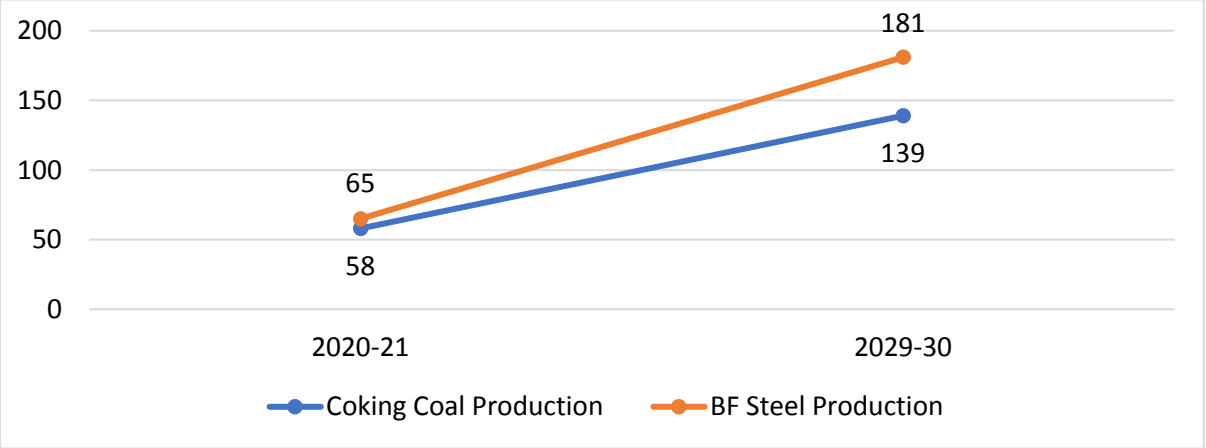
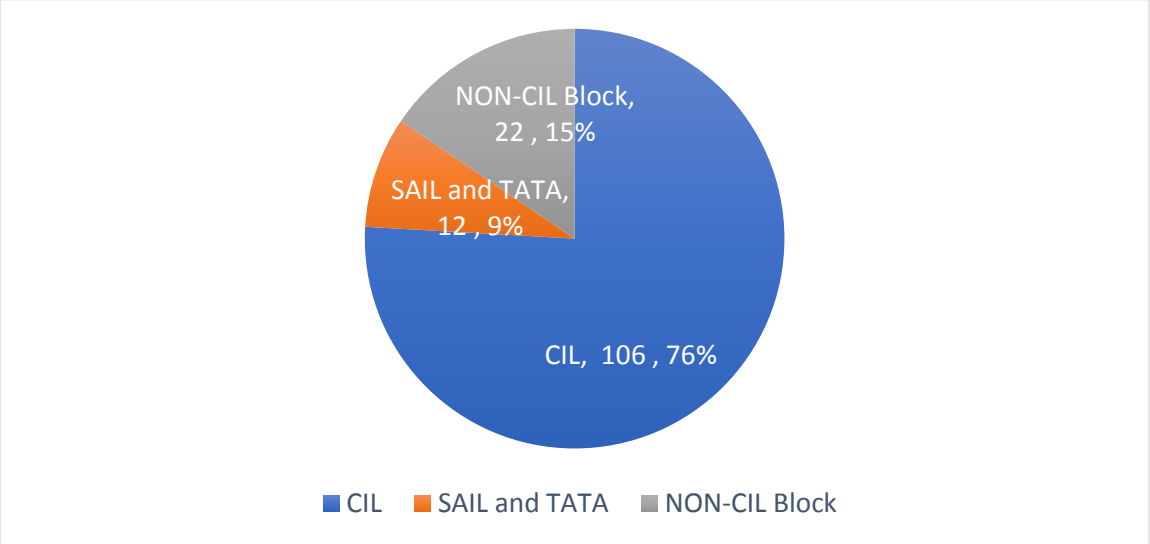
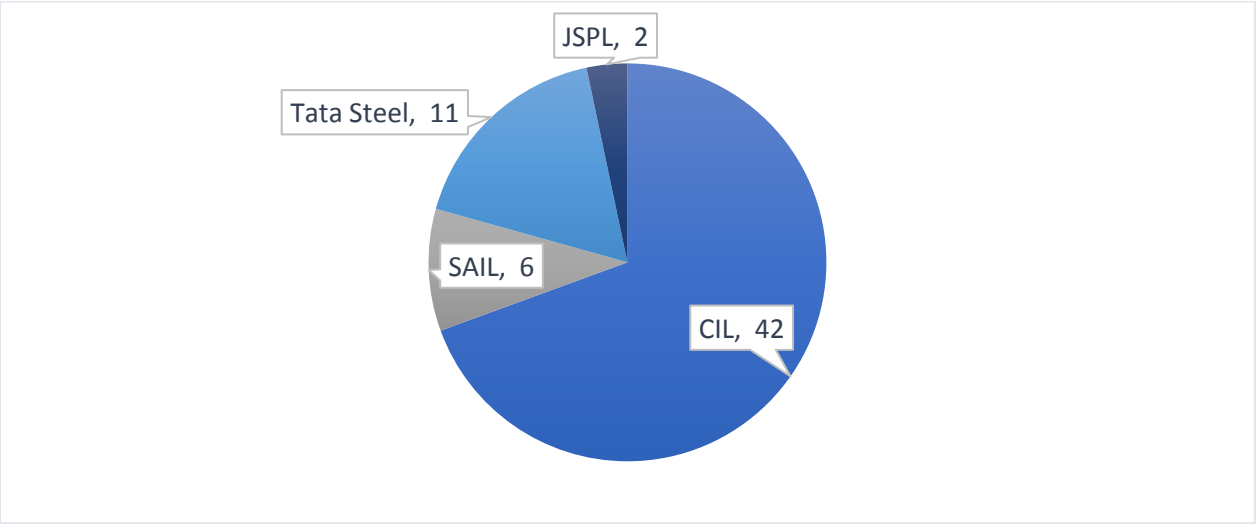


Figure 10: Company-wise Coking Coal Production Projection (140 MT)



****In addition to the above, Tasra coal mine has been allocated to SAIL under MMDR Act, however, production from Tasra block is considered under the production by SAIL & Tata Steel*

Figure 11: Coking Coal Washery Capacity (61 MT – Input Feed)

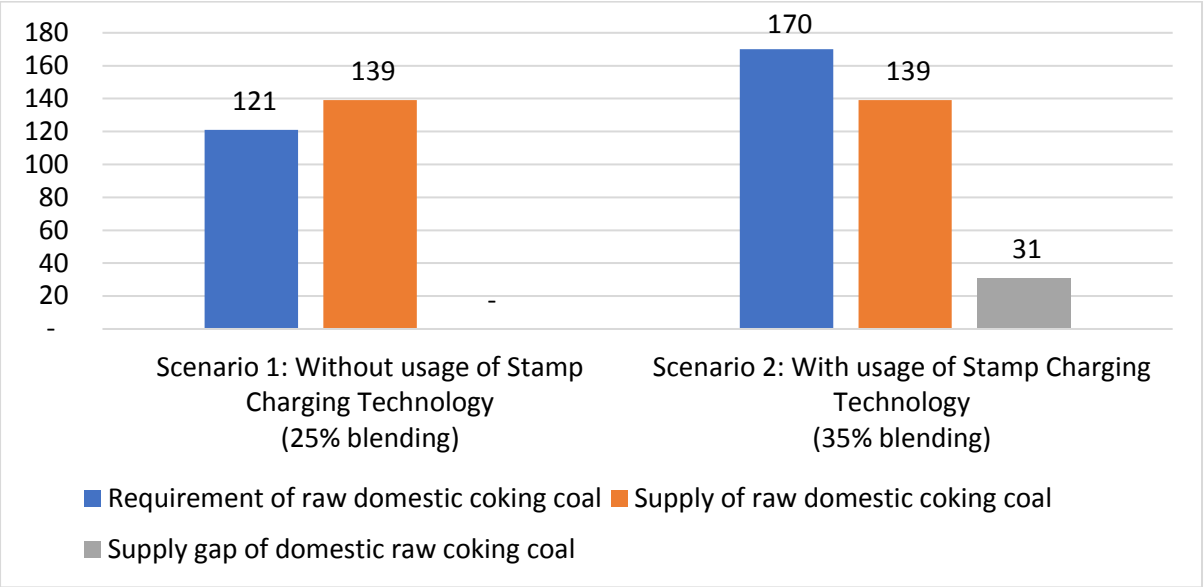


**Raw coal is being supplied by CIL to Tata for washing in its own washeries*

Details of planned production by FY 2030 and washery capacity is provided in Annexure 1.

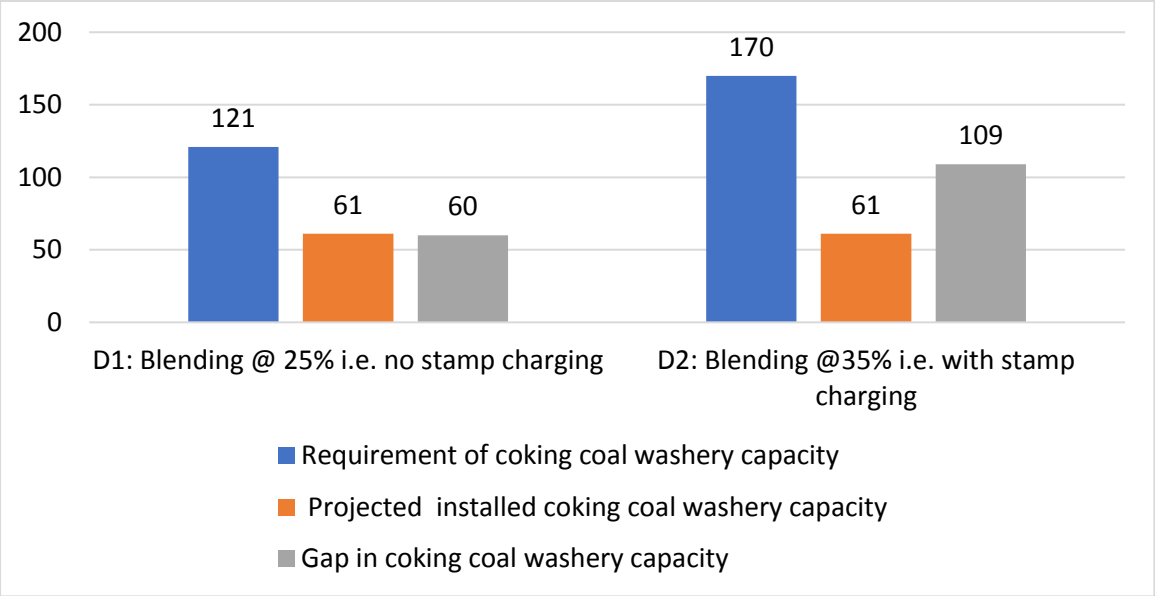
3. Demand-Supply Gap FY2030: Based on the above Scenario, the demand supply gap under the two demand scenarios is as presented below. It may be noted that as per the analysis, while there would not be any supply gap of domestic raw coking coal under Scenario 1, there would be a supply gap of 30 MT of domestic raw coking coal under Scenario 2. Further, the gap in the washery capacity is estimated at 60 MT and 109 MT under Scenario 1 & Scenario 2 respectively.

Figure 12: Demand Supply Gap of Domestic Raw Coking Coal (MT)



Source: MoC's Estimates

Figure 13: Demand Supply Gap of Coking Coal Washery Capacity (MT)



Source: MoC's Estimates

**Numbers assuming entire raw coking coal produced would be washed. However, higher grade coking coal such as Steel Grade I, Steel Grade II is not required to be washed before blending, therefore, the actual required washery capacity would be less than abovementioned capacity and will depend on the grade of coal produced*

Chapter 2: Inter-Ministerial Committee and Terms of Reference

I. Constitution of the Inter-Ministerial Committee

An Inter-Ministerial Committee (IMC) has been set up by the Ministry of Coal, Government of India for suggesting a road map for the country on augmenting the domestic coking coal production and increasing the consumption of the domestic coking coal by steel sector, vide its order dated March 19, 2021. Copy of the Order is provided as Annexure 2. The IMC is chaired by M Nagaraju, Additional Secretary, Ministry of Coal. The members of the IMC are provided below:

Table 2: List of Members of the IMC

S. No.	Name	Designation
1	M Nagaraju, Additional Secretary, Ministry of Coal	Chairman
2	Adviser (Projects), Ministry of Coal	Member
3	Representative of Ministry of Steel (not below the rank of Joint Secretary)	Member
4	CMD, CMPDI	Member
5	DT, CIL	Member
6	DT, BCCL	Member
7	Mr. Ravinder Bhan, Director (Regulatory & Policy), ISA	Member
8	Mr. Deepak Sindkar, Head (Procurement), Arcelor Mittal Nippon Steel India Ltd.	Member
9	Mr. Arvind Rajgopalan, AVP, JSW Steel	Member
10	Mr. L.K.S. Rao, Executive Director, SAIL	Member
11	Mr. Pankaj Satija, Chief, Regulatory Affairs, Tata Steel Ltd.	Member
12	Mr. Kapil Dhagat, Executive Vice President/ Business Unit Coal – Jindal Steel and Power Limited	Member

II. Terms of Reference of the IMC

The Terms of Reference (TOR) of the Inter-Ministerial Committee are:

1. To suggest national strategy to enhance coking coal and suggest road map to projectise and explore more coking coal block.
2. To suggest R&D to beneficiate coking coal to reduce ash% with upgraded technology.
3. Methodology to encourage the private sector to set up coking coal washery.
4. Examine domestic coking coal and suggest competitive pricing strategy.
5. Suggest incentive to steel sector to redesign blast furnace.
6. Address coking coal quality issues and suggest measures to improve coking coal quality.
7. To incentivise the coking coal production from Underground (UG) mines considering better quality of coal from UG mines – TOR added by IMC members.

III. Proceedings of the IMC

1. First Meeting of the IMC

The IMC held its first meeting on March 26, 2021 wherein a brief presentation was made to the members of the IMC regarding the present coking coal scenario in the country, demand supply gap of coking coal for the FY 2029-30 and the terms of reference of the IMC. Discussions were held on steps

to augment the coking coal production, increase the washery capacity for washing the coking coal and the coking coal quality parameters. The minutes of the meeting has been placed at Annexure 3.

2. Second Meeting of the IMC

The second meeting of the IMC was held on May 07, 2021 wherein a brief presentation was made by CMPDI on the augmentation of coking coal, followed by a presentation by Mr. Pankaj Satija, Tata Steel on the coking coal scenario and way forward. The terms of reference were discussed in detail along with the recommendations for meeting the future coking coal demand and addressing the demand supply gap of coking coal. The minutes of the meeting has been placed at Annexure 4.

3. Third Meeting of the IMC

The third meeting of the IMC was held on May 31, 2021 wherein a brief presentation was made by Mr. Pankaj Satija, Tata Steel on the R&D initiatives and skill development of employees. A detailed discussion was held on the R&D initiatives along with the recommendations for meeting the skill development gap of coking coal. The minutes of the meeting has been placed at Annexure 5.

4. Review Meeting of the IMC

A review meeting of the IMC was held on June 07, 2021 under the Chairmanship of Secretary (Coal). During the meeting, a brief presentation was made on the draft recommendations of the IMC and discussions were held on those recommendations. The minutes of the meeting has been placed at Annexure 6.

Recommendations of the IMC on the TOR is provided in the subsequent chapters of this report. The data presented in the report has been provided by members of the IMC.

Chapter 3: TOR 1 – Enhancing Exploration and Production of Coking Coal

TOR 1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks

I. Overview

Current Status of Exploration: In India, as on April 2020, ~20 BT of coking coal reserves are in the proven category while another ~15 BT coking coal reserves are in inferred or indicated reserves category. Coking coal is used in the steel industry as a fuel for the blast furnace, either for production of metallurgical coke. Coking coal is much different from coal used in other processes such as non-coking or power grade coal used for power generation. Only a certain class of coals possessing very specific properties and composition are suitable for the making of a quality coke for blast furnace use. Some of the important features of coking coal available in India are discussed below:

1. The 'Prime Coking Coal' resources are restricted to Jharia CF only. The 'Medium Coking Coals' are available in Jharia, Raniganj, Bokaro, Ramgarh, Karanpura, Sohagpur & Pench-Kanhan coalfields and the semi-coking coals are available in Raniganj, Ramgarh & Sonhat coalfields.

2. Almost 85% of the Prime coking coal resources of the nation, which are confined to Jharia coalfield, stand 'Proved' catering to the needs of country's steel industry.

The study and exploration of coal in India is carried out in four stages viz. (i) Preliminary Exploration to bring out the overall approximate resource potential (ii) Regional Exploration for broad assessment of the resource and utilisation potential more definitively, (iii) Detailed Exploration with high density exploratory drilling to provide resource parameters with high confidence to enable project formulation and (iv) Developmental Exploration to provide support to working mines as and when required.

The exploration technologies followed in both Regional/Promotional and Detailed Exploration remain basically the same, except that in the former larger areas are tackled with wider sampling interval for regional evaluation of the deposit, whereas in the latter smaller areas are covered with closer sampling interval for more detailed evaluation of the deposit. The basic and supplementary technologies that are employed in detailed coal exploration in the country are given below:

Table 3: Regional/ Detailed Exploration Technology for Coal

Technology	Objective
Geological mapping and surface geophysical survey e.g. electrical resistivity, gravity and magnetic	For delineation of incrops, faults and formational boundaries, basins configuration, intrusive bodies, etc.
Coring Drilling by Wire Line methods	For expediting slim hole drilling programme and improving core recovery.
Geological / geotechnical and hydrogeological core logging and sampling	For collection of basic borehole data and preparation and packing of samples for various chemical and physical tests
Geophysical well logging.	For cross verification of core recovery, lithology identification, porosity and permeability of rocks, geo-engineering properties etc.

Technology	Objective
Hydrogeological Investigations	For evaluating the hydrogeological condition in opencast and underground mining projects
Chemical analysis and coal quality profiling	For characterising coal quality to assess utilisation potential
Computerisation of data	Processing, interpretation, and Geological modelling through minex software and documentation in the form of GR (Geological Report).
Time period of completion of Exploration	1 and half year of exploration and 6 months in GR preparation of a block of 10 sq.km area.

Coking Coal Demand Supply Gap: Presently, majority of the coking coal produced in the country is being supplied to the power sector because the inferior coking coal is not being washed and is being supplied directly to the thermal power plants. In FY 2020, out of ~53 MT coking coal produced, only ~11 MT was washed with a yield of ~5.25 MT. The installed coking coal washery capacity of CIL, SAIL & Tata Steel is expected to be ~61 MT by FY2024-25 and hence, at least 61 MT domestic coking coal should be washed and supplied to steel sector and diversion of coking coal to power sector should be avoided.

As per the coking coal production projection, the coking coal production is expected to be ~139 MT by 2029-30. With the usage of stamp charging technology, the requirement of washed coking coal would be ~56 MT and for getting ~56 MT washed coking coal, the requirement of raw coking coal would be ~170 MT at 33% yield and there is a demand supply gap of coking coal to the tune of ~31 MT. To meet this shortfall, following measures have been suggested by CMPDIL:

1. CIL had identified few projects with the cumulative capacity of ~40 MT of which PRs of 6 projects with cumulative PRC of ~9.63MT are yet to be approved. List of these blocks is provided in Annexure 7.
2. 36 non-CIL coking coal blocks have been identified with total PRC of ~17 MT which are yet to be allotted. List of these blocks is provided in Annexure 8.
3. ~13.66 MT of coking coal is expected from the 8 unprojectised coking coal blocks of CIL. List of these blocks is provided in Annexure 9.

CBM Overlap Blocks: Presently, in the active 8 CBM blocks i.e. 51 coal blocks, 8.3 BT of coking coal reserve is available and additionally there are few more non-active CBM blocks as well having coking coal reserves. It is understood that it has been decided by MoPNG and MoC that active CBM overlap blocks shall not be relinquished. However, allocation of non-active CBM overlap blocks may be considered upon relinquishment by MoPNG.

Development of 12 Jharia Fire Sites: It has been informed that out of 27 fire sights, there are 12 fire sites which have been found economically unviable as per CIL's assessment. However, since the fire is an environmental threat, it needs to be doused by extracting coal from these sites. It was discussed by the IMC that development of these blocks may be undertaken either on PPP basis wherein CIL handles the R&R obligations and the private sector player will undertake block development and operations. Alternatively, the blocks may be awarded to private sector on Viability Gap Funding basis. However, it has been prima facie expressed by steel industry members of the IMC that complex R&R

issues are involved in development of Jharia and hence public sector support would be crucial for the private sector to undertake these projects.

II. IMC's Recommendations

The committee discussed the current situation and ways to enhance the exploration and production of coking coal to meet the demand supply gap which is envisaged for the FY 2030. Below are the recommendation of the committee:

1. **Exploration of Coking Coal by Government** – It has been expressed by the private sector that exploration is a risky business wherein rewards are not commensurate with the risk as demonstrated in the following table. Accordingly, it is recommended that Government should undertake exploration of coking coal blocks and thereafter, development can be undertaken by public and private sector players. Further, adequate funds should be allocated by the Government for exploration of deep-seated coal reserves. Allocated fund under central sector scheme for exploration for FY 2021-22 was Rs. 200 crore for detailed exploration and Rs. 130 crore for regional exploration.
   As per the current methodology, in case of a partially explored mine, the successful bidder after completing the prospecting operations has the choice to relinquish the coal mine or carry out the mining operations.

Figure 14: Data on Exploration Spend

Region	Exploration Spend (2020 $b)		No of Discoveries #		Tier 1+2 Discoveries		Estimated Value (2020 $b)		Value / Spend
Australia	$23	12%	84	15%	12	18%	$17	17%	0.72
Canada	$25	13%	74	13%	12	18%	$14	14%	0.55
USA	$13	7%	19	3%	3	5%	$6	6%	0.48
Latin America	$39	20%	133	24%	9	14%	$10	11%	0.27
Pacific/SE Asia	$8	4%	23	4%	1	2%	$3	3%	0.35
Africa	$20	10%	124	22%	14	22%	$21	22%	1.02
W Europe	$4	2%	24	4%	0	0%	$1	1%	0.19
China + FSU + EE	$55	28%	170	20%	13	20%	$23	24%	0.41
Rest of World	$6	3%	24	3%	1	2%	$2	2%	0.26
	---	-----	----	------	---	------	----	------	----
TOTAL	$194	100%	852	100%	65	100%	$95	100%	0.49

Note: Analysis includes Bulk Minerals, but excludes satellite deposits found within existing camps
Discoveries refer to Moderate-, Major- and Giant-sized deposits.

Source: MinEx Consulting © Oct 2020

Caution: The Estimated Values are approximate only, and ignores the value of unreported discoveries

2. **Exploration of Coking Coal by Private Sector** – In addition to the exploration activities undertaken by the Government, exploration activities may be outsourced to private sector by CMPDIL/ MECL etc. Further, Ministry of Coal is undertaking auction of Partially Explored Mines wherein the Successful Bidder is responsible for exploration of these mines. In the ongoing second round of commercial coal mines auction, 30 partially explored blocks (both coking & non-coking) have been put up for auction. Depending on the outcome of the present round of auction, Ministry of Coal may undertake a policy level review of auction methodology for partially explored blocks.

3. **Exploration of 15BT Indicated and Inferred category blocks** should be taken up on priority basis so that production can be started from these blocks at the earliest.
4. **Adoption of new technology/ updation of technology for exploration work:** Increased adoption of modern exploration techniques including remote sensing, core open drilling and geophysical and geochemical logging (as against dominant core hole drilling), 2D and 3D seismic survey for bridging geological data gap to be considered. Public sector exploration agencies like CMPDIL, MECL etc should be mandated to deploy latest exploration techniques.

   To projectise the balance proved category reserves of about 5.33 Bt targeted beyond 2030, more drilling & scientific studies are required so as to establish the mineability of the deposit. It is suggested that to accomplish this task, a detailed plan for exploration involving a combination of drilling (Coring & NC) and high resolution seismic survey (2D/3D) & hi-tech processing, geophysical logging, geo-tech studies, Gas studies, hydrogeological studies (preferably with Packer testing), Chemical analysis, Lidar Surveys & use of GIS/GPS, etc should be prepared and implemented through expert agencies. Even for 1.44 Bt which can be projectized before 2030, a more scientific approach involving the latest technology & planning skills may be tried so as to maximize the exploitation with utmost safety.
5. **Development exploration** and revision of Geological models for all critical operating mines in India should be mandated.
6. **Resource classification** to be standardized by implementing CRIRSCO (or equivalent international standard) classification.
7. CCL and BCCL are major producers of Coal in India including Coking Coal. Augmentation of production levels from the mines under them can enhance the exploitation of this unused black resource of the country particularly the coking Coal. Some of the recommendations of the study titled 'Study on UG Coal Mining in CIL-Problems, Potential, Technology, Modernisation, Production and Safety', which has been mentioned in the **"Parliamentary Standing Committee Report on Coal and Steel (2020-21)"** and presented in the seventeenth Lok Sabha includes:
   a) **Strategy for exploitation of coal resources and business plan:** CIL needs to formulate a strategy for exploitation of coal resources within its leasehold for sustainable coal production in the long term through 2040. The strategy should basically highlight the following aspects:
      i. Coal resources amenable to OC mining and UG mining within CIL leasehold. Phase-wise demand of coal on CIL through 2040.
      ii. Phase-wise coal production possible from OC and UG mining through 2040 in CIL.
      iii. Phase-wise requirement of land and other major infrastructures (rail/road/power) through 2040.
      iv. The above strategy for exploitation of coal should be integrated with the business plan of CIL through 2040.

   b) Upgradation of technology
      i. Introduction of mass production technology, particularly longwall mining, would require detailed geological information. The study reveals that out of 90 mines studied 44 number of mines (mostly in ECL, BCCL and CCL) require further exploration, particularly for lower coal horizons, to establish reserves, quality and structure of the coal seams. It is therefore, recommended that thrust need to be put on application of modern exploration techniques including high

resolution seismic survey for bridging the geological data gap within next couple of years.

ii. The study has recommended introduction of mining systems like Wongawilli and Longwall Top Coal Caving (LTCC) systems in CIL mines wherever such systems are found suitable. These systems have been successfully applied in other countries but are new to India. In addition, in certain steep seams, pilot scale studies for application of hydraulic mining system has also been recommended.

iii. The study recommends widening/deepening of existing shafts, sinking of new shafts and drivage of new inclines to cater to the increased demand of vertical coal transport. For in-seam coal transportation, conventional rope haulage system has been proposed to be replaced by conveyors in the mines where mass production technologies have been suggested.

iv. To reduce the time spent in travelling and to reduce the fatigue of workers, the study recommends introduction of man riding system in almost all the mines studied.

v. In addition, air cooling system has been recommended in all the mines with high depth. Also, the study recommends introduction of inseam methane drainage for highly gassy mines and installation of inertisation plants in a number of mines to mitigate the risk of fire.

c) **Skilled manpower and training:** The study has projected a shortage of skilled manpower to the tune of 22,871 numbers by 2026-27 for the UG mines operating in 2026-27. The key features of the suggested revamped training system are:

i. Large workforce (including land losers) to be converted to useful manpower resource through need- based structured training.

ii. Training Need Analysis (TNA) to be introduced and training programme to be developed accordingly to suit different job categories. Equipment manufacturers are also to be associated for TNA.

iii. Introduction of competency assessment system after completion of training and issuance of certificate of competency by competent assessors.

iv. Employment of training partners — overseas and in-country, for training in new technologies.

v. Employment of qualified/competent trainer for imparting training in CIL training centers.

vi. Local ITIs may be made training partners of the respective subsidiaries. Similar arrangement may be made with the OEMs on PPP model.

vii. Managerial skill upgradation based on national and international standards, best practices, SOPs etc.

viii. Revamping of training organization and infrastructure and introduction of State of the Art training aids like equipment simulator, virtual reality mine simulator etc. in regional training centers of the subsidiaries.

8. Co-ordinated action may be undertaken with Skill Council for Mining Sector (NSDC) to train workforce with required skillset.
9. Most of the coal mines in Jharia coalfield, East & West Bokaro coalfields, North & south Karanpura coalfields are very old and in some of the areas, systematic mining couldn't be carried out possibly due to limited exploratory data and infrastructure difficulties in the past. With the advancement of technology for maximizing extraction of Coal by open cut / underground method, studies need to be carried out to find out the feasibility of extracting these coals based on the cost economics.
    a. CMPDIL, is recognized Exploration agency for coal under Ministry of Coal and repository of past exploration data, who also have access to all the collieries mining data. Hence they should re-build comprehensive integrated geological models of these coalfields using latest state of art software's like Minex etc. using the past exploration and mine data.
    b. The above studies should lead to delineation of newer resource bearing area being converted to extractable reserves with the updated coking characteristics and clean coal. These data would be very useful for assessing application of new technologies in extraction of coal and to assess the techno economic feasibility.
10. Ministry of Coal may frame guidelines to allow extraction of coal in the barrier between two opencast mines. While this is permitted with permission from DGMS and modification of mine plan, there needs to be some policy on minimizing the loss of coal in the barrier pillars.
11. **Supply of coking coal being produced to steel sector**: Presently, majority of coking coal produced in the country is supplied to power sector. In FY 2020, out of ~53 MT coking coal produced, only ~11 MT was washed with a yield of ~5.25 MT. The installed coking coal washery capacity of CIL, SAIL & Tata Steel is expected to be ~61 MT by FY2024-25. Therefore, by FY2024-25 atleast 61 MT domestic coking coal should be washed and supplied to steel sector and diversion of coking coal to power sector should be avoided. CIL to undertake discussions with steel sector and endeavour to supply maximum quantity of coking coal produced (after testing for coking propensity) to steel sector. This initiative can be taken immediately, and supplies may be made in accordance with the installed washery capacity.
12. **Low ash non coking coal is used as PCI coal** in the blast furnace which reduces the requirement of coking coal. CIL may engage with steel sector to earmark deposits of such suitable non-coking coal for awarding linkage to steel sector. Steel companies should also be asked to ensure utilisation of domestic low ash non coking coal as PCI coal.
13. **Identification of additional blocks for production:** Tentative potential of 40 MT additional production (as presented by CMPDIL)
    a. 9.63 MT by CIL where PR is yet to be approved
    b. 13.66 MT capacity of unprojectised CIL blocks
    c. 17.05 MT PRC of 36 blocks which may be allocated through auction - 7 currently under auction

    It may be noted that all projects of CIL may not be viable/ approved. Similarly, 36 blocks to be allocated through auction are understood to be difficult to mine and have CBM overlap issues. Further, Steel industry's response to coking coal block auctions has been lukewarm in the past; blocks like Choritand Tiliaya, Jogeshwar & Khas Jogeshwar have been offered for auction multiple times, however, there were no takers from the steel industry. Steel industry has suggested that more data should be made available so that they can undertake proper due diligence before bidding. Accordingly, it is recommended that:
    a. CIL to undertake necessary action for operationalising its blocks

b. CMPDI to provide details of seam-wise ash %, coking properties and other such details for the 36 blocks to the industry for further analysis.
c. Consultations to be held with Steel industry to understand the reasons for limited participation in the auction of blocks and policy action can be taken accordingly.
d. Additional blocks to be identified for allocation to private sector with favorable mining characteristics.
e. Since block development takes 51-66 months post allocation, the allocation activity should be undertaken immediately.

14. **Allocation of coking coal blocks having CBM overlap issues:** In 8 active CBM blocks (51 coal blocks), 8.3 BT of coking coal reserve is available. In addition, there are non-active CBM blocks. A joint working group of MoC and MoPNG has been formed for relinquishment of these blocks by MoPNG. Decision has been taken to relinquish non-active CBM blocks and blocks can be awarded through auction post relinquishment by MoPNG. However, active CBM blocks cannot be relinquished. Accordingly, it is recommended that
    - CBM Overlap Blocks relinquished by MoPNG to be auctioned immediately.
    - A dossier with key details of such projects may be prepared and shared with industry for conducting broad due diligence. Consultations may be held with the industry thereafter to seek their interest in participating in CBM overlap projects.
15. **Extinguish fire at Jharia sites and extract coking coal:** Out of 27 existing fire sites, 15 fire sights were found to be economically viable and 12 fire sites have been found to be unviable by CIL for extinguishing fires and extracting coal. Government should allocate adequate funds with the aim to extinguishing fire at Jharia within next 5 years.

    Participation of private sector may be considered for these sites through a transparent mechanism: Either through a service contract like MDO or through a modified contract where in the winning party extinguishes fire and sell or utilise the extracted coal. IMC members from the steel industry have prima facie expressed their reservations regarding participation in Jharia coal blocks. Accordingly, it is recommended that consultations be held with private sector (not just steel sector) to seek their interest in participating in Jharia coalfield projects and a policy framework may be prepared accordingly for participation of private sector either on Viability Gap Funding basis or PPP basis and if required, CIL's support may be sought for R&R activities. Government of Jharkhand has an important role to play in tackling the fires, rehabilitation of people and building of a smart city for them.
16. **Development of Non-coal Bearing Land or De-coal Land:** As CIL is vested with CBA land, Government should invest in non-coal bearing land or de-coaled land for development of infrastructure including washeries.
17. **Joint Annual Review Meeting by Ministry of Coal & Ministry of Steel:** Since the coking coal would be utilised by the steel sector, it needs to be ensured that installation of blast furnace capacity and development of new coking coal blocks are in sync. Further, there may be other factors such as technological advancements which may impact the demand for coking coal. Accordingly, to ensure that coking coal production is in sync with the demand from steel sector, annual joint planning/ review meeting should be conducted by Ministry of Coal and Ministry of Steel.

Chapter 4: TOR 2 – Suggesting R&D Initiatives for Beneficiation of Coking Coal

TOR 2: To suggest R&D initiatives to beneficiate coking coal to reduce ash% with upgraded technology

I. Overview

Indian coking coal is characterized by high ash% with difficult washability characteristics. Therefore, in general Indian coking coal requires beneficiation at lower particle size (<15mm) and beneficiation technologies should have higher sharpness of separation.

Low Volatile Coking Coal:

Jharia and Bokaro coalfields constitute the major resources of coking coal in India and the coalfields are presently being operated by Bharat Coking Coal Limited (BCCL) and Central Coalfields Limited (CCL). Presently, out of 32 billion tonnes of coking coal reserve in the country, approximately 8.5 billion tonnes fall into Low Volatile High Rank (LVHR) category that cannot be used directly in the steel industry. The present resource of LVHR coals is estimated to be about 7953 million tonnes in Jharia Coalfield and 496 million tonnes in East Bokaro Coalfield. These are mainly confined to seam VIII and below in Jharia Coalfield and Karo Group of seams in East Bokaro Coalfield. The LVC coals by the term itself indicates that the coal contains low volatile content, which directly cannot be used for metallurgical purpose. These coals are characterized as follows:

a. Thick seams, with number of bands, spreading over to some 30 km stretch along the strike direction.
b. Low volatile matter content (mean vitrinite reflectance varies between 1.25 and 1.45 percent) showing desirable maturity of coal.
c. High inertinite content (60-70%, sometimes even more) which are intimately mixed up with inorganic micro components as well as with vitrinite. As a result microlithotypes are mostly of vitrinertite and carbargillite, which gives a high percentage of near gravity material (50-60%) at the desired specific gravity of cut.
d. High raw coal ash (30-35%, sometimes even more).
e. Due to intimate mixing of micro components these coals have extremely poor liberation characteristics; when the raw coal is progressively crushed from 75, to say, 13 or 6 or even 3 mm (considered as the limit for existing coke oven technologies throughout the world), the yield of cleans at 17.5 +/- 0.5% ash varies between 30 and 35%
f. Difficult washability characteristics and high near gravity material (NGM) at the desired specific gravity of cut.

The coking coal washeries in India were established for treating the upper seam coals of Jharia and Bokaro Coalfields, which are good quality coking coals. However, with passage of time the upper seam coals exhausted leaving behind lower seam coals, which are low volatile in nature. Unfortunately, the washability potential of the LVC coals are so poor that the existing washeries having conventional washing technologies are unable to supply coals of ash 17-18% as desired by indigenous metallurgical industries and cannot stand in competition with foreign coals because of poor yield of clean coal. As such, these coals are being supplied to the thermal power plants, against augmenting the demand of metallurgical coal for coke making thus, wasting the scarce coking coal resources.

During previous studies, it has been found that a considerable quantity of high ash (>35%) Low Volatile Medium Coking (LVMC) coal, used as power coal, exhibits improvement in coking properties on

washing and may therefore, be utilized in Steel making through Blast Furnace route. Washability studies have also proved that washed LVMC Coal have coking propensity and may be blended for steel making in metallurgical industry.

A Committee was constituted by Ministry of Coal, Government of India on 09.03.17 under the Chairmanship of CMD, CMPDI to undertake a project on "To assess the technical feasibility of washing coking coals to the level of 13% ash content". The major conclusions drawn from this project were as follows:

a. The various washability test of raw coal reveals that the ash% varies widely and is as high as 52%, with majority of the coal falling under W-IV and ungraded/ LVMC.
b. There is considerable decrease in yield of clean coal at 13%, ash level when raw coal ash deteriorates from W-IV to ungraded. Simultaneously, yield also decreases adequately when clean coal ash is kept at 13% in comparison to 18%. It has been observed that in general the desired selling price of clean coal produced on washing W-IV coal is less than the desired selling price of clean coal produced on washing ungraded coal.
c. In case of washing coal to obtain clean coal at 13% ash, there is huge generation of middlings when compared to that at 18% ash clean coal.
d. In case of clean coal at 13% ash, it is obvious that significant quantity of coal having coking properties is reporting to the middlings which could otherwise be used for metallurgical purpose.
e. The study has revealed that the yield of clean coal at 13% ash varies from about 13% to 28%. The quality of raw coal feed varies widely depending on the seams being mined. Hence, the yield of clean coal will also vary widely from time to time.
f. The tentative capital investment for setting up of a 2.5 Mty capacity washery has been broadly estimated as Rs. 390 Crores considering the tentative process flowsheet and infrastructure facilities.
g. The washing cost per tonne of raw coal input has been estimated as Rs. 478.45 at 80% capacity utilization which may vary based on the technology and actual financial parameters at the time of implementation.

The extensive studies carried out on different LVC coals proved beyond doubt that if the feed ash content is more than 35% the theoretical recovery of clean coal varies from 20 to 30% at 18% clean coal ash content. The major knowledge gap lies at how to increase the recovery keeping the ash content at 18% and reduce the operating cost.

Major R&D Projects: The R&D initiatives in coal sector are administered through Standing Scientific Research Committee chaired by Secretary (Coal). List of R&D projects being carried out/ already carried out by CMPDIL in recent past is presented below:

a. **Project Title 1:** Demonstration of coal dry beneficiation system using Radiometric techniques (ArdeeSort) at old Madhuban washery (2.5 Mty), BCCL – Under Closure
    - Agencies: CMPDI (Principal implementing agency), AHPL (Technology provider-cum implementing agency), BCCL (sub-implementing agency)
    - Technology: X-ray based radiometric detection and pneumatic removal technology
    - Capacity: Demonstration Scale (400 tph), -50+25mm, -25+13mm size fraction
    - Results: Technological instability for deshaling of coking coal leads to inconsistent results, it needs modification/adjustment in the technology for better performance

b. **Project Title 2:** Design of cost-effective process flow sheet for Improved washing efficiency of Indian coking and non-coking coals – Under Progress
    - Agencies: (ISM, Principal implementing agency), BCCL & CMPDI (sub-implementing agencies)
    - Technology: Jigging, Froth flotation, Oil agglomeration, Water only cyclones, Cross flow or
    - Floatex density separator, Allflux or Reflux classifier
    - Capacity: Laboratory/Bench scale, W-IV, V & VI, -4mm size fraction
    - Results: Under progress
c. **Project Title 3:** Upgradation of Low-grade Indian coals through Dry and Chemical beneficiation -- UPCOMING
    - Agencies: IIT-Kharagpur (Principal implementing agency), MCL, BCCL & CMPDI (sub-implementing agencies)
    - Technology: Air Dense Medium Fluidized Bed Separator, Froth Flotation and Chemical leaching
    - Capacity: Laboratory/Bench scale, -50mm size fraction
d. **Project Title 4:** Effective Utilization of Middling and Fines of Coking Coal washery for recovery of Carbon values -- UPCOMING
    - Agencies: NML (Principal implementing agency), BCCL & CMPDI (sub-implementing
    - agencies)
    - Technology: Jig, Cyclone, Spiral, Flotation etc.
    - Capacity: Laboratory/Bench scale
e. **Project Title 5:** Study on performance improvement of coking coal washery in Coal India Limited through Modelling and Simulation analysis --UPCOMING
    - Agencies: NML, CMPDI (Principal implementing agencies), BCCL (sub-implementing
    - agencies)
    - Technology: Modelling & Simulation using USIMPAC software
    - Capacity: Plant scale onsite study/Lab study

List of major R&D projects being carried out by other laboratories is presented below:

Title	Sponsor	Nodal Lab	Participating Lab
Quality Enhancement Of Coal For Its Efficient Use	10th Five Year Plan	CIMFR – Dhanbad	*RRL – Bhubneswar* *NML – Jamshedpur* *RRL - Bhopal*
Resource Quality Assessment of Coal for Specific End uses	10th Five Year Plan	CIMFR – Dhanbad	*NML – Jamshedpur* *NEIST – Jorhat* *NCL - Pune*
Clean Coal Technology Tap Coal	11th Five Year Plan	CIMFR – Dhanbad	*NCL – Pune* *CMERI - Durgapur*
Alternative Complimentary Route Of Direct Steel Making	Ministry of Steel	NML – Jamshedpur	CIMFR, Dhanbad

Title	Sponsor	Nodal Lab	Participating Lab
With Reference To Indian Raw Materials			IMMT – Bhubneswar AMPRI – Bhopal
Development of technology to produce clean coal from high ash and high sulphur Indian coal	Ministry of Steel	IMMT - Bhubneswar	CIMFR, Dhanbad NML-Jamshedpur NEIST – Jorhat RDCIS – Ranchi CMPDI-Ranchi
Development of Zero Waste Technology for Processing and Utilization of Thermal Coal	12th Five year Plan	NML – Jamshedpur	CIMFR, Dhanbad IMMT – Bhubneswar AMPRI – Bhopal
Value Addition from Coking Coal Slimes Lying in Waste Settling Ponds of Washery	Coal Controller	CIMFR – Dhanbad	Nil
Development of an On-line Coal Washability Analyzer	Ministry of Coal	CIMFR – Dhanbad	M/s Ardee Hi-Tech Pvt Ltd.

II. IMC's Recommendations

Since the Indian coking coal is of poor quality, R&D initiatives need to be taken up to:

i. beneficiate coal with high ash% with upgraded technology; and
ii. explore alternative technology for utilization of high grade non-coking coal for steel making.

Below are the recommendations of the IMC:

1. Some of the beneficiation technologies which may be adopted by Indian miners to reduce ash % while maintaining similar/ higher yield are:
   a. **Intermediate Size Beneficiation (ISB):** This plant design incorporates intermediate circuit (3rd circuit) against the conventional two-circuit design (coarse and fines circuit). ISB generally beneficiates fine coal of size range (1/0.5mm – 0.25/0.15 mm). ISB is capable to increase 3-4% clean coal yield without compromising ash levels. ISB generally employs technologies like Small diameter DMCs (Dense Medium Cyclones), Spirals, teetered bed separator Reflux Classifier for intermediate circuit.

   b. **Superior flotation technologies for fine coal beneficiation (>0.5/0.25 mm):** Advanced flotation technologies (Jameson cell, Column flotation etc.) are very efficient in achieving lower clean coal ash and reducing misplacement of coal values in tailings compared to conventional mechanical flotation cell.

   c. **Plant automation and advanced instrumentation for process monitoring:** Online ash analyser, Real time measurement of Ep and coal washability etc. can help to efficiently monitor the beneficiation plant. This helps to reduce the misplacement of coal in by-product stream and thus increases overall clean coal yield and simultaneously maintains desired product quality.

d. Technologies like Dense Media Cyclones, Froth Flotation Cells with advanced chemicals, reflux classifiers and spirals can be used as well for beneficiating coking coal.

2. Further, R&D initiatives may be undertaken in the following areas:
   a. Technologies like dry beneficiation, hydrophobic & hydrophilic separation, ash leaching which are not yet commercially deployed, may be explored further for suitability to Indian coal;

   b. R&D initiatives may be undertaken to improve flotation efficiency and assess effect of partially/fully oxidized coal surface and bubble characteristics;

   c. The studies so far conducted concentrated on washing the coals at coarser size and not much data is available on the improvement of recovery by crushing/grinding to finer sizes as it is understood that by crushing/grinding to finer sizes the liberation of mineral matter with that of coal matrix will improve. Future studies may be carried out as follows:
      i. Detailed characterization studies to understand the exact mineral assemblage of the coal matrix, liberation size, petrographic properties etc.

      ii. Crushing/Grinding the raw/deshaled LVC coals to finer sizes viz., 6mm, 3mm and 0.5mm.

      iii. Innovative beneficiation techniques for better yield along with dewatering of the clean coal.

      iv. Utilization for metallurgical coke making through stamp charging process.

   d. Utilisation of non-coking coal for coke making

      v. Hydrogenation of coal

      vi. Blending with high grade prime coking coal

      vii. Blending with carbonaceous material

      viii. Using inorganic/ organic binder for agglomeration

   3. **Technology:** The washability characteristic of any ROM coal plays a vital role to decide the quality and productivity. Also, systematic approach after studying the washability characteristic curves can lead to the most suitable technology to wash specific ROM feeds. It is very important to wash & recover the precious coking coal fines with the application of suitable technologies like reflux classifiers, spirals, teetered bed separators, etc. It is very vital for the investor/owner to select the most suitable type of technology in Coal Washing before an investment decision is taken. Hence, availability of ROM coal quality parameters (preferably seam-wise) & size fractions are of utmost importance.

      Syngenetic minerals occur either as finely disseminated mineral particles or in the form of larger species intimately intergrown with coal macerals. Coals with fine syngenetic minerals will produce relatively equal amounts of light density clean coal, middling, and high-density rejects when subjected to gravity separation, mainly used for coal washing in India. About 80% of raw coal is treated in dense media cyclone (a gravity separation process) to produce coarse clean coal. The rest, 20%, is treated in a fine coal flotation process, which utilizes inherent hydrophobic characteristics of organics present in coal.

It is well known that the flotation process could help in concentrate vitrinite macerals in the froth fraction, which in turn improve the coking potential of clean composite coal consisting of coarse and fine clean coal. The mechanical flotation cell with advanced automation facilities captures low ash coal particles with high recovery from high ash feed materials with optimized doses of reagents and airflow rate. Hence, the adoption of comprehensive beneficiation processes (dense media cyclone and froth floatation), having new age crushing facilities & fines recovery technologies could yield more clean coal for coke-making application. In this way, more indigenous coal may be utilized by increasing the clean coal fines percentage in the clean composite coal, which will enhance the coking potential. This will also prevent wastage/loss of precious coking coal fines into rejects/middlings or into drains, etc.

Policy framework for the disposal of washery rejects and middlings may be reviewed and made more elaborate to include the mechanism of selling of rejects/middling into the market using either E-Auction Platforms or through open trades by Washery Operators/Aggregator Model.

4. Government of India should make a strategic plan for time bound stoppage of supply of Low Volatile coking coals to the power generating companies. This should be linked up with the construction and commissioning of new coking coal washeries and monitoring their implementation. Precious coking coals should not be burnt in Boilers for generating steam for power production:
   a. Considering washing technology by far established, the conventional washeries are to be supplemented by construction of new washeries with required technologies, which is the need of hour. CSIR – CIMFR had carried out extensive laboratory and pilot plant tests on all the major sources of LVC coals and developed new flow sheets, which may be utilized for construction of new washeries or for retrofitting/modernization of the existing washeries.

   b. For high ash LVC coals (>40% ash content), deshaling plants may be installed and the deshaled coal may be sent to the existing coal washeries for immediate recovery of clean coal from LVC coals.

   c. An efficient road map for blending of beneficiated LVC coals, heat affected coals, coking coal fines, low ash non coking coals, low sulfur coals of NE etc., with imported coals may also be considered, only after proper characterization for reducing the percentage of imported coal in the overall blend for coke making.

   d. Coal producers, research institutes, universities and the end users of coking coals should form a Joint Action Group for efficient use of LVC coals.

5. R& D is very important for the industry and for continuous improvement of productivity and efficiency requires investment in technical expertise and resources. The private sector may not be able to invest resources. Therefore,R&D initiatives may be funded by Ministry of Coal either alone or jointly with Ministry of Steel or Coal India Limited.

Chapter 5: TOR 3 – Incentivising Setting up of Coking Coal Washery

TOR 3: Methodology to encourage the private sector to set up coking coal washery

I. Overview

India has ~35 Billion Tonnes of Coking Coal reserves out of which more than 50% is of the high ash variety (35-50% ash content) and possesses difficult to very difficult washability characteristics due to typical geological formation and origin. Presently around 95% of coking coal produced in India is of this grade and most of this is sold to power plants without deshaling due to the non-availability of adequate and appropriate washing capacities and should be deshaled before being sold to the power plants.

Washery Capacity: While the present installed capacity of coking coal washeries in India is 35.73 MTPA (input feed), the operable capacity is much less at 23.25 MTPA as the washeries have outlived their lives.

Table 4: Present Capacity of Coking Coal Washeries

S. No.	Company	Washery	Location	Year of Commissioning	Installed Capacity (MTPA)	Operable Capacity (MTPA)
1	CIL (BCCL)	Bhojudih	West Bengal	1962	1.70	0.28
2	CIL (BCCL)	Moonidih	Jharkhand	1983	1.60	0.70
3	CIL (BCCL)	Mohuda	Jharkhand	1989	0.63	0.10
4	CIL (BCCL)	Dugda-II	Jharkhand	1969	2.00	0.14
5	CIL (BCCL)	Madhuban	Jharkhand	1998	2.50	0.08
6	CIL (BCCL)	Dahibari	Jharkhand	2018	1.60	1.60
7	CIL (BCCL)	Patherdih I	Jharkhand	2020	5.00	5.00
8	CIL (CCL)	Kathara	Jharkhand	1969	3.00	0.80
9	CIL (CCL)	Sawang	Jharkhand	1970	0.75	0.20
10	CIL (CCL)	Rajrappa	Jharkhand	1987	3.00	1.70
11	CIL (CCL)	Kedla	Jharkhand	1997	2.60	1.30
	Sub-Total				**24.38**	**11.90**
12	SAIL	Chasnala	Jharkhand	1969	2.00	2.00
13	Tata Steel	W Bokaro II	Jharkhand	1984	2.50	2.50
14	Tata Steel	W Bokaro III	Jharkhand	1994	3.85	3.85
15	Tata Steel	Jamadoba	Jharkhand	1957	2.00	2.00
16	Tata Steel	Bhelatand	Jharkhand	1995	1.00	1.00
	Sub-Total				**11.35**	**11.35**
	Total				**35.73**	**20.25**

CIL, SAIL and Tata Steel are setting up new washeries and renovating their existing washeries. Apart from the existing capacity of 23.25 MTPA, additional planned washery capacity by FY 2025 is ~38 MTPA, resulting in total washery capacity of ~61 MTPA by FY 2025, as presented in the following table:

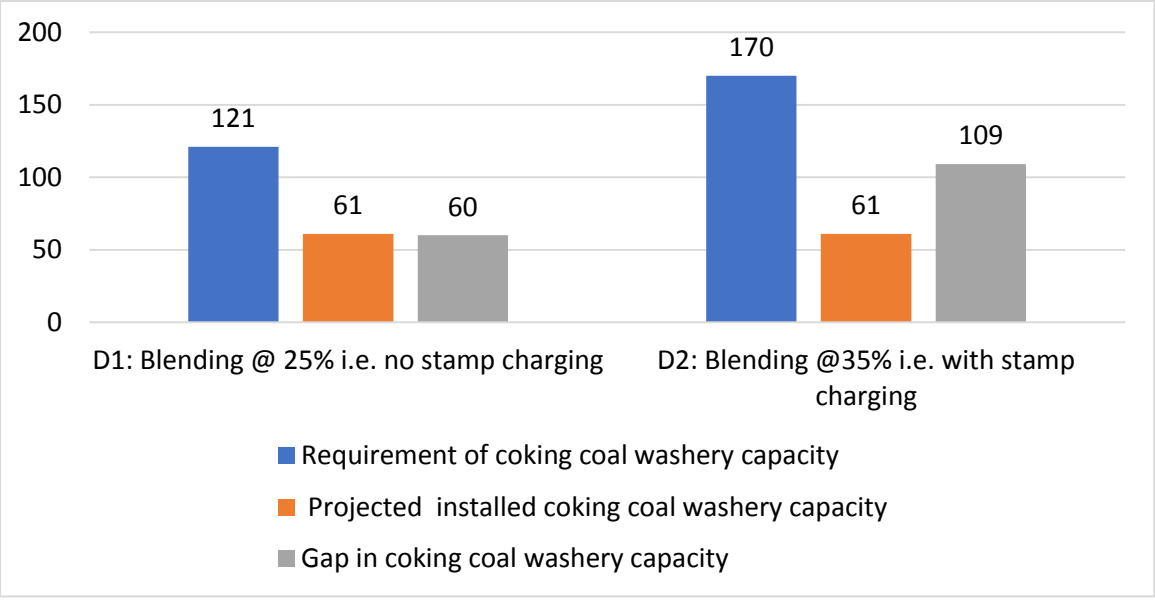
Table 5: Planned Capacity of Coking Coal Washeries – FY 2025

Washery	Location	Capacity (MTPA)	Expected COD
CIL & its Subsidiaries			
Madhuban (BCCL)	Block-II Area, Dhanbad, Jharia Coalfield	5.0	Jul 2021

Washery	Location	Capacity (MTPA)	Expected COD
Patherdih II (BCCL)	Patherdih, Jharia Coalfield, Dhanbad	2.5	Jun 2022
Bhojudih (BCCL)	Purulia District, West Bengal	2.0	Mar 2022
Moonidih (BCCL)	Moonidih Project, Jharia Coalfield, Dhanbad, Jharkhand	2.5	Jan 2023
New Kathara (CCL)	Kathara Area, East Bokaro Coalfield, Jharkhand	3.0	Nov 2022
Basantpur-Tapin (CCL)	Hazaribagh Area, West Bokaro Coalfield, Jharkhand	4.0	Nov 2022
New Rajrappa (CCL)	Rajrappa Area, Ramgarh Coalfield, Jharkhand	3.0	May 2024
Karo (CCL)	B&K Area, East Bokaro Coalfield, Jharkhand	5.0	Nov 2024
Topa (CCL)	Kuju Area, West Bokaro Coalfield, Jharkhand	3.0	Nov 2024
Sub-Total (CIL)		**30.00**	
SAIL	Tasra	4.00	
Tata Steel	Washery III, West Bokaro	0.65	
Tata Steel	Bhelatand Washery, Jharia	0.50	
JSPL	Angul, Odisha	2.00	
Total		**37.15**	

However, with an ambitious steel production target of 300 MTPA by 2030, India needs to ensure utilisation of the coking coal in the most efficient manner for metallurgical purposes only. Over 100 MT of additional coking coal washery capacity requirement has been estimated assuming a 35% blending ratio.

Figure 15: Demand Supply Gap of Coking Coal Washery Capacity (MT)



**Numbers assuming entire raw coking coal produced would be washed. However, higher grade coking coal such as Steel Grade I, Steel Grade II is not required to be washed before blending, therefore, the actual required washery capacity would be less than abovementioned capacity and will depend on the grade of coal produced*

Washery Technology: Indian coals consist of high near gravity material and has difficult washing characteristics. Hence, wet washing of coals is therefore unavoidable to achieve the desired separation. Amongst various washing processes available, jigs are considered adequate for a standard two product beneficiation. Jigs also offer cost effective technology with a clean coal yield of 75–85 percent at about 34 percent ash content. Main coal washing technologies currently in use or envisaged in new/upcoming coking coal washeries in India for coking coal are: Jigs for deshaling; Jigs, HM Bath and Heavy media (HM) cyclones for coarse coal; Spirals, Reflux Classifier and Teetered Bed Separator for intermediate size beneficiation; Froth flotation and Water Only Cyclone for fines beneficiation.

Coking Coal Washery Aggregator Model (Centralised Washing/ Beneficiation): India has huge resources of inferior grade coking coal which needs comprehensive beneficiation/ washing to produce a useful fraction of clean coking coal which can be gainfully utilised by the Steel Sector. As investments for such beneficiation/ washing facility at every mine being operated by CIL subsidiaries may not be feasible, a model can be developed to facilitate a Coking Coal Aggregator to set up a large centralised state of the art Coking Coal Beneficiation Facility which enjoys 'economy of scale' and beneficiates the produce from a large number of collieries, thereby supplying desired grade of clean coking coal to the steel sector and the washery by-products to the thermal power sector in place of the present practise of the entire inferior coking coal being burnt by the thermal power plants.

II. IMC's Recommendations

The committee discussed the current situation and ways to increase the coking coal washery capacity in the country to meet the required coking coal washery capacity by FY 2030 for washing the coking coal. Below are the recommendations of the committee:

1. **Setting up of washeries by CIL:**
    a. CIL should plan washery projects in such a manner that coal feed is available to the washery for the life of the project and the washery is viable; CMPDIL may be assigned the task of identifying coking coal production centres and planning of washeries on centralised basis for each such production centre.
    b. Requirement of washed coking coal (domestic) should be projected by Ministry of Steel till 2030 and long-term contract between coal companies and steel manufacturers needed for taking investment decisions on setting up of washeries.
    c. Consultations may be held with MDOs to understand if they would be interested in integrated MDO contracts i.e. mine development & operation and BOO washery
2. **Setting up of washeries by private sector:** Private sector may be encouraged to set up washery on aggregator model basis i.e. several small mine owners or coking coal linkage holders (ROM coal) may either tie up with a washery player or set up a consortium/ JV for setting up the coal washery. However, under present policy framework, CIL linkages can be awarded for end use purpose only. Therefore, a washery owner cannot participate in the auction of coking coal linkage. It is recommended that policy framework may be devised for awarding coking coal linkage to washeries who can beneficiate coal and sell to steel sector.
3. Possibility of setting up small (1 MT) Mobile washeries to be explored.
4. Feasibility of washing Washery Grade V & VI coal to 18% ash level may be explored on aggregator model basis. Also, investments into R&D for washing Washery Grade V & VI coal may be considered.

Chapter 6: TOR 4 – Addressing Coking Coal Pricing Issue

TOR 4: Examine the domestic coking coal pricing and suggest competitive pricing strategy

I. Overview

Globally, coking coal prices are affected by various factors such as price of steel, coking coal demand and supply and market sentiments. Indian coking coal does not seem to be competitive with respect to imported hard coking coal at current price because the prices of Indian coking coal do not reflect the current international market.

Presently, SAIL and RINL are sourcing directly from the established coking coal producer/ supplier through global open tenders and finalizes basis lowest CIF at a designated port and places long term contracts for uninterrupted supply at a negotiated price. SAIL and RINL are also sourcing coal from CIL through MoU route. Tata Steel and JSW procure coal through their own procuring arm and they source it through both the long-term contracts or spot trades whereas, the small and medium sized players source coal through the commodity traders. JSPL imports almost 50% of its coking coal requirement through Long-term supply contracts and rest through its own coking coal mines abroad & through spot purchases.

CIL is currently using prices agreed with key customers for sale of coking coal through MoU. Although, CCL introduced the import parity-based pricing mechanism in 2017 for its WMCC, the same was discontinued as purchasers raised concerns over high prices and coal quality differences.

CIL Notified Price of Coking Coal:

- **BCCL's Price Notification:** BCCL has notified the price of ROM Coal on September 06, 2019 for grades ST I, ST II and W I – WIV while the price for W V and W VI grade coking coal was notified on March 07, 2019. The price ranges from Rs. 6153/ tonne for ST I grade of Prime Coking Coal to Rs. 2464/ tonne for W VI grade of Prime Coking Coal. BCCL's notified prices for coking coal has been provided at Annexure 10.
- **CCL's Price Notification:** CCL had notified the price of ROM coal for non-regulated sector on January 12, 2017 for ST I, ST II, W I – WIII grades, on December 29, 2018 for W IV grade and on April 6, 2019 for W V, W VI grade of coking coal. The price ranges from Rs. 4880/ tonne for ST I grade to Rs. 1988/ tonne for WVI grade of coking coal. Details regarding the CCL's notified price for different grades of coking coal has been provided at Annexure 10.

National Coal Index (NCI) & Representative Price for Coking Coal:

National Coal Index is published monthly by Ministry of Coal. Coking coal is categorised as Coking Top Grade (ST – I, ST-II or Imported) and Coking Bottom Grade (WI – WIV). As per the latest available data of April'21, the NCI for Coking Top Grade is 81.67 while for Coking Bottom Grade is 116.50 while the representative prices vary from Rs. 10,678/ tonne for ST I grade to Rs. 3087/ tonne for W IV grade of coking coal for April'21. The representative prices and NCI for coking coal for April'21 have been placed at Annexure 10.

FOB Price of Australian Coking Coal:

It may be noted that the prices are highly volatile with annual average price ranging between 124 – 207 USD/ tonne during 2016 to 2020. It may be noted that all FOB prices include logistic & handling cost upto the Load Port whereas in India, pricing is done on Ex-Mine basis. This aspect should be taken

into consideration while formulating the pricing mechanism for Indian Coking Coal. FOB Prices of Australian coking coal over the last 5 years have been provided at Annexure 10.

Railway Freight for Coking Coal and Coke

One of the secondary aspect driving up domestic coking coal costs for the steel sector is the idle freight for coking coal and coke that is being mandated by Indian Railways. Low and variable density of coking coal/ coke means that actual physical loadability is much lower than the chargeable weights of wagons. Against 68 Tons chargeable weight, loadability is only 42-45 ton for coke and 56-62 ton for coking coal. This results in abrupt price rise due to the mandate of the idle freight in spite of lower loading by tonnage. Hence, there is need to review chargeable weights for such commodities and Indian Railways needs to lay down permissible carrying capacity depending upon the volume of commodities instead to mandating idle freight.

II. IMC's Recommendations

The committee understands that CIL is undertaking the pricing reforms and has already appointed a consultant to prepare import parity-based pricing mechanism for coking coal.

The committee suggested that the import parity-based pricing mechanism should be adopted for pricing the washed coking coal. It would ensure that the washed coking coal is following the pricing trend at international rates and being sold at parity domestically. The price should be adjusted based on the difference in the quality of the imported coking coal vis-à-vis domestic coking coal.

The Committee understood the issue of idle freight for domestic coking coal and coke and suggested that it may be suitably taken up with Indian Railways to adopt a commodity wise carrying capacity based freight structure so that such practices of charging idle freight for commodities like coking coal and coke can be done away with.

Chapter 7: TOR 5 – Incentivising Redesigning of Blast Furnace

TOR 5: Suggest incentives to steel sector to redesign blast furnace

I. Overview

Estimated capacity of steel production in FY2020-21 is 131 MT of which 65 MT is through blast furnace route. As per National Steel Policy 2017, the targeted steel production by FY2029-30 is 300 MT of which 181 MT would be through blast furnace route i.e. nearly 3-fold increase is targeted in the blast furnace route steel-making capacity. Further, it was noted by the IMC that with utilisation of stamp charging technology, the blending % of domestic coking coal can be increased and thus, adoption of stamp charging technology should be encouraged.

Enablers to reduce coke rate in BF: Coke rate in blast furnace (BF) is a key parameter which affects the coking coal requirements. Coke rate can be reduced by tweaking the design aspects, BF feed or using alternative fuels. Various methods through which the coke rate can be reduced in the Blast Furnace has been provided at Annexure 11.

II. IMC's Recommendations

To meet the projected target of 181 MT steel production through blast furnace, incentives need to be given to the steel sector to redesign the blast furnace. The Ministry of Steel has been asked by the Committee to submit steel industry's action plan for setting up the BF capacity and use of stamp charging battery technology till FY 2030.

The committee also suggested that the Ministry of Steel should also undertake R&D initiatives to increase utilization of domestic coking coal by steel sector and should design an incentive framework for re-designing blast furnaces for utilisation of stamp charging technology by the Steel Industry.

Chapter 8: TOR 6 – Addressing Coking Coal Quality Parameters

TOR 6: Address coking coal quality issues and suggest measures to improve coking coal quality

I. Overview

Coking coal quality is pertinent for production of desired coke for consumption in blast furnace (BF) operation. Quality of coke is inter-linked with BF productivity and ultimately affects coking coal consumption. The quality of coking coal depends on combination of different quality parameters like Ash, VM, CSN, Dilation, Fluidity, plastic range, Rank, HGI etc. Issues related to coking coal quality can be addressed through coal blending, technological interventions and real-time monitoring.

Addressing issues related to coking coal quality:

- **Preparation of optimum coal blend:** It should consider the equivalent domestic sources of coking coal which can replace the imported coal. As per the following table, it can be observed that our domestic coals are quite comparable to imported hard coking coals in terms of rheological properties but relatively inferior in terms of Ash, CSN, S and alkali content of the coal. In terms of coke CSR, it is very close to Tier 2 hard coking coal and it can replace Tier 2 hard coking coal and can be used up to 50% in the blend without affecting coke quality. The main bottleneck for domestic coal usage is its higher ash% which affects BF productivity. Higher ash% of domestic coking coal can be addressed through coal beneficiation technologies as mentioned in TOR 2.

Table 6: Coking Coal Property for Different Category of Imported Coking Coal

Particulars	Unit	Hard Coking Coal	Soft Coking Coal
Ash	% max	8	8
Moisture	% max	8	8
Volatile Matter	%	20-32	20-34
Sulphur	% max	0.6	0.5
CSN	Min	5	3
MMR	%	1.15-1.35	0.90-1.35
Vitrinite	% min	55	45
Max Fluidity	min ddpm	300	150
GCV	Kcal/Kg	NA	NA
Phosphorous	%	NA	NA

Source: CIL

- **Coke Making Technologies** to handle wide range of different qualities of coal or inferior coal. We should go for Stamp charging instead of Top charging coke making technology, this will reduce the percentage of Hard Coking Coal in the blend and will facilitate usage of medium and semi-soft coal without impacting the coke quality.

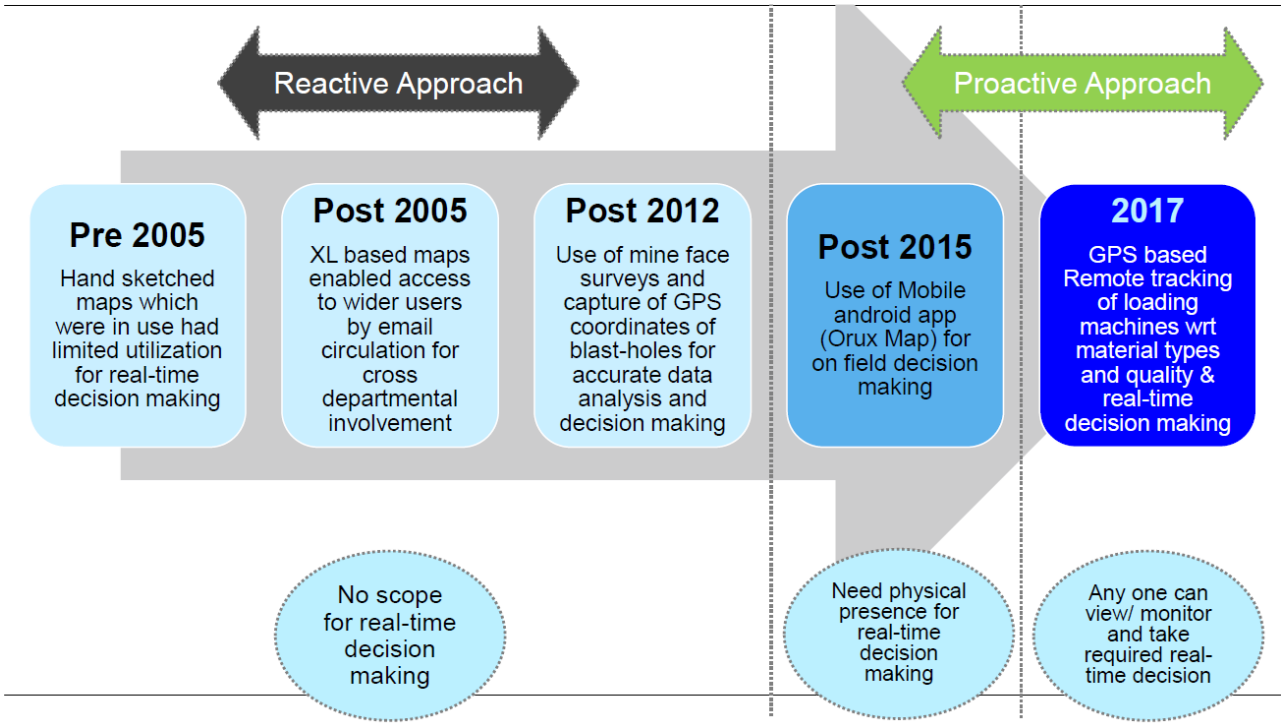
A change in the coking coal quality parameters makes it unfit to be used in the blast furnaces for steel production. The industry has demanded that quality specifications of coal being sold should be clearly stated as it will aid in analysing whether coal is suitable for the BF and accordingly, help in making a purchase decision.

The industry has requested that the key quality parameters such as Vitrinite content, Mean Maximum reflectance of Vitrinite (MMR% or RVmax) Vitrinite Distribution or V-Type distribution (V9-V14), Free Swelling Index (FSI) or Crucible Swelling Number (CSN), Gray King (LTGK) Coke type and Maximum fluidity, Total Moisture (as received), Ash (air dried), Volatile Matter (air dried) which are essential for ascertaining coking propensities needs to be mentioned. Data on Total Sulfur (air dried), Phosphorus (air dried), Alkalis (Na_2O, K_2O), Ash Fusion Temperature (AFT), CSR (Coke strength after reactivity) etc. which play vital role in coke – making should also be made available. These data to be published on the CIL website and these should be updated periodically. Also, the purchaser should also be allowed to choose supplies from a specific coal mine.

Real Time ROM Quality Monitoring System: A detailed explanation of real time ROM quality monitoring system is provided below:

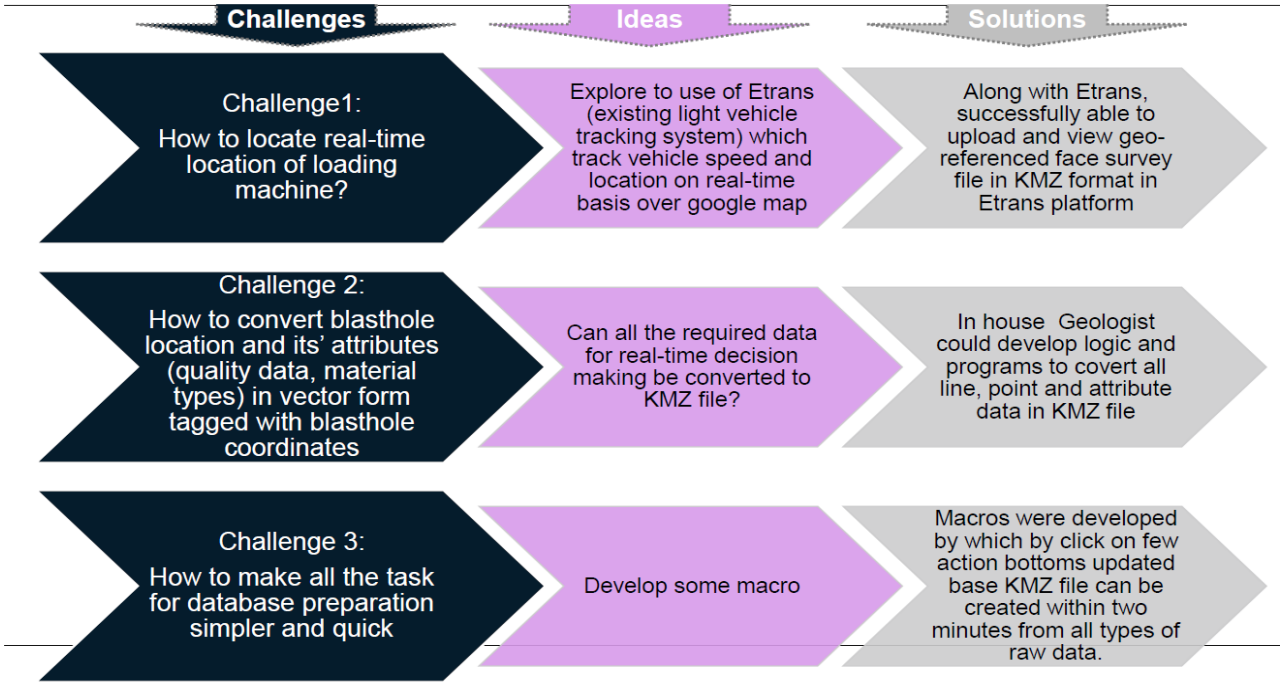
1. **Problem Statement:**
    i. Due to lack of any on- line tracking system and with complex material association at times with progressive feeding of ROM from any blasted muck-pile, the associated subgrades and wastes also gets fed to processing plants
    ii. Limited options are available to control such mixing. Currently actions are taken at the dump slots of plants from control rooms via physical inspection of ROM which is very subjective, person dependent and showdown production at times
    iii. The definite process is the sampling & analysis of plant products from which ROM grade is derived from mass balances. But by the time analysis report is received, non-conformable products already got generated and correction is not possible.
    iv. The other option is that, sampler/ geologist stays at loading site throughout the shift where the person constantly monitor position of shovel with coordinated blast-hole assay quality for real- time ROM quality monitoring. But this is not feasible.
2. **Why real time quality tracking is a must:**
    i. At present mining in Noamundi and Katamati leaseholds within the available pits limits, with time has reached to the deeper parts of the ore zones where variation of ROM quality along with frequent association of ore and wastes is providing greater challenge in maintaining desired ROM feed quality to plant.
    ii. Maintaining consistency in product quality is the biggest challenge now a days with increasing variability and wider range of quality of ores in any single blast
    iii. Dilution of subgrades and waste at present is the leading concern where almost in all the blasts there exist repeated materials of ore, subgrade and waste.
    iv. Therefore, it is required to devise a real-time monitoring mechanism to avoid misinterpretations and dilution of ore with wastes and subgrade that impact quality of ROM and results in poor product quality.
3. **Evolution of ROM Quality Tracking:**

Figure 16: Evolution of ROM Quality Tracking



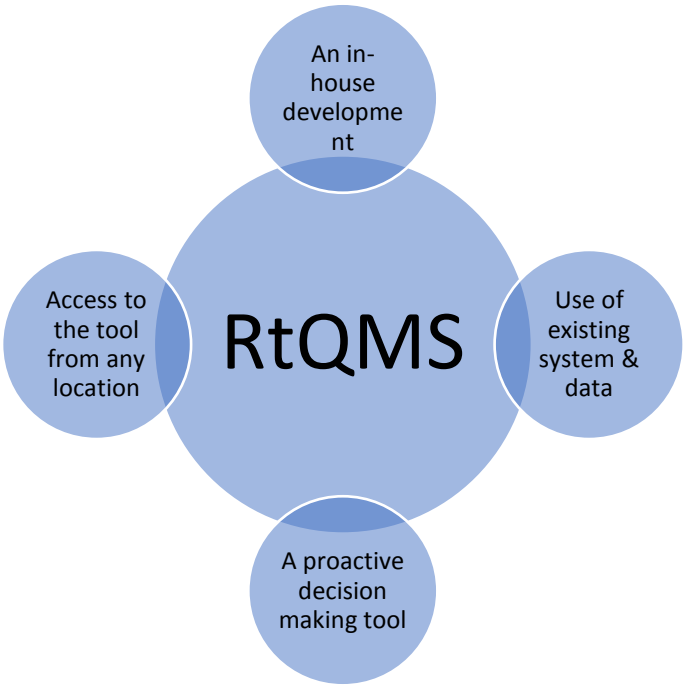
4. **Challenges & Solutions:** Some of the challenges and solutions are provided below:

Figure 17: Challenges & Solutions for ROM Quality Tracking



5. **RtQMS: Real Time Quality Monitoring System**

Figure 18: RtQM System



II. IMC's Recommendations

For address coking coal quality issues, IMC recommends:

1. Key quality parameters (mine-wise & seam-wise) to be published by CIL on its website and updated periodically - Vitrinite Reflectance (RVmax), Mean Maximum Reflectance (MMR), Crucible Swelling Number (CSN), Coke Strength after reaction (CSR), Vitrinite Content, Vitrinite Distribution(V9-V14), Free Swelling Index (FSI), Maximum fluidity, Total Moisture (as received), Ash (air dried), Volatile Matter (air dried), Total Sulfur (air dried), Phosphorus (air dried), Maximum Dilation, Hardgrove Grindability Index (HGI), Alkalis (Na2O, K2O), Ash Fusion Temperature (AFT), Gray King (GK) Coke type
2. Purchaser should be allowed to choose supplies from a specific source (mine).
3. One of the important practices to reduce the ROM Ash% in coking coals, is to restrict the mining heights in underground thereby avoiding the stone/shale bands while cutting the coal by mechanised means. There are examples where drum diameter of Shearer machine (important component of Longwall Set) was reduced so as to avoid cutting of stone band near to the roof in underground coking coal mine in Australia. In Continuous Miner panels, extraction heights can be adjusted before the extraction & monitored strictly to maintain ROM Ash levels to the minimum. Similarly, in opencast mines, prior to mining, decision can be taken to adjust the mining horizons and discard the rest of inferior horizons into the waste. Effective use of Surface Miners wherever these can be deployed, can result into Ash reduction in ROM coal. Hence, the mining contracts should be designed in such a way that such conditions are in-built in the system to ensure best of the practices.

Further, IMC recommends that steel sector may consider deployment of the following to address coking coal quality concerns:

1. Beneficiation of coal should be done prior to coke making to get desired level of ash% and moisture%.
2. **Preparation of optimum coal blend** (using a basket of coals, domestic as well as imported) to obtain required rheological properties (CSN, fluidity, plastic range etc). Provision for advanced blending facility should also be available.
3. **Plant Automation and real-time quality measurement instruments** – Ash analysers, moisture analysers should be used including the use of statistical models to predict the optimum coal blend.
4. Standardization of coal sampling and testing procedure

Chapter 9: TOR 7 – Incentivising Coking Coal Production from Underground Mines

TOR 7: To incentivise the coking coal production from Underground (UG) mines considering better quality of coal from UG mines

I. Overview & IMC's Recommendations

As per the *Parliamentary Standing Committee Report on Coal and Steel (2020-21)*, it has been recommended that some incentives for UG mining should be provided as there is need for achieving balanced production from OC and UG mining in CIL for long term sustainability of coal supply. In accordance with the Standing Committee Report, it is recommended that

1. Financial Internal Rate of Return of 8% at 85% level of production (instead of 12% at 85% level of production at present) to be considered for UG mining projects.
2. **Availability of Low Ash-High Grade Thermal Coal for PCI, DRI and Coal Gasification**: There is a serious concern about the increasing trend of high-grade thermal coal imports which is also a major contributor for foreign exchange outflow. India has added huge resources through exploration during the past years under power grade category (G10-G17) mostly mined by large capacity opencast mines yielding attractive returns. The higher-grade coals (G3-G7 grades) are available scarcely in India mainly due to its exploitation through underground methods. The age-old underground mines were targeting higher grade coals due to economic reasons and due to un-scientific mining historically, substantial reserves were sterilised which are good source of high grades. Still, there are very good opportunities to exploit higher grade resources with the application of scientific exploration & exploitation techniques. There are lucrative deposits in India in pockets which have almost similar properties like RB1 & RB2 branded coals from South Africa which are in high demand in Cement & Sponge Iron industries. The major bottleneck is the economics of operation as in India, a project proponent is required to acquire almost entire tract of land even for underground mining if depillaring as the final operation is planned. This additional investment on land & related Rehabilitation & Resettlement of affected population & also their demand for jobs, drags the economics back and these projects become unviable with very low IRRs%. In other countries like Australia where large tracts of land is available without much of habitation, such underground projects have smooth sailing despite stringent environmental norms & levies. In India, a project is considered viable when it yields at least 12% IRR at 85% Capacity Utilisation. Alternatively, to make the project viable, a desired selling price of coal to achieve 12% IRR at 85% Capacity Utilisation may become a basis for long-term Off-take Agreements. It is a welcome idea to reduce the target IRR% to 8% but simultaneously we must strive to overcome other constraints like availability of land, R&R, compensation, etc.

   It has been identified that few attractive deposits like Churcha in SECL which produces G-3 grade coal competes well with RB1 Coal of South Africa that even with E-Auction premiums, the landed price of Churcha coal at End-Use Plants are much below the landed price of imported coal which is hovering around US $115 per tonne. Hence, it is suggested such potential deposits are developed with Mass Production Technologies like Longwall, Continuous Miners-Shuttle Car combination or Continuous Haulage Systems with CMs & production is augmented in existing mines. The need to acquire entire tract of land for underground deposits may be reviewed & such conditions are eased out to attract investment. Policy on Loss making CIL mines having balance extractable reserves of better

grades of coal to sustain production for at least 15-20 years may be made for investment & re-organisation.

3. Part of GST collection by Central Government may be allocated to continue the subsidies allowed under CODA and rules made thereunder and also to consider the following additional subsidies:
    - Cost of relocating CIL quarters/buildings, private settlements and public facilities required for UG mining projects with caving.
    - Increasing stowing subsidy to 100% of normative stowing cost from the present level of 75%.
4. CIL may set aside some fund from its gross profits towards creating an 'UG mine development reserve' which may be utilized for supporting UG mine development.
5. Indigenous manufacture of UG mining machineries
    - Disinvestment of present (Joint Venture) JVs and inviting global bid from reputed mining machinery manufacturing companies for establishing a mining machinery manufacturing facility registered in India. Such company may be permitted to export surplus production only after fulfilling the domestic need.
    - Establishing a company in Public-Private Partnership (PPP) mode involving coal PSUs and reputed mining machinery manufacturers in private sector.
    - Establishing a JV company with partnership of different Indian PSUs presently engaged in manufacture of mining machineries.

    New investors or JVs for the mining machinery manufacturing shall be encouraged only when they see potential in the underground mining and possibility of deployment of number of Longwall Sets, Road headers, Continuous Miner-Shuttle Car combination, Continuous haulage systems, underground man-riding systems, other electronic devices for gas monitoring, ventilation, etc. For this purpose, it is advisable to generate a Matrix of available coal blocks to define the mining potentiality and such deployments. The matrix so generated would give an idea about the Mine Capacities in India using these technologies and would in turn facilitate decision making for the investors/JVs in the field of Mining Machinery Manufacturing based on volume to be handled.

6. Providing Tax incentive to entities engaged in Underground Mining
    - Relief under GST –
        a) Rationalizing the GST rate on mining licenses and mining related input services: As of now, mining licenses are charged to GST at 18%. Also, mining related services such as handling and distribution services are charged at 18%. It is to be noted that coking coal is taxable at 5%. This is creating huge working capital blockage for mining industry. Reducing GST rate on input services to 5% can provide huge relief to coking coal miners.
        b) Input tax credit of steel and cement used immovable property other than plant & machinery: As of now, input tax credit on steel and cement used is confined to those used in plant and machinery. For underground mining, steel and cement is used in installation of many immovable properties. Blockage of credit is leading to cost to business. Allowing the credit on cement and steel used in immovable property used for business will be a good relief to coking coal industry.

c) The GST Compensation Cess charged for Domestic Coal produced through Underground Mining should be reduced

- Relief under Income Tax Act
  a) Chapter VI A deductions: Coking coal industry requires a good technological push. It requires to use new advanced machineries which promotes automation, cost saving, safety and environment protection. Industries should be promoted to use such assets. Allowing certain percentage of investment in such machineries as a deduction under chapter VI A of income deduction will promote industries to go for capital investment.
  b) Such chapter VIA deduction can also be extended to expenses incurred by entities in Research and Development for more efficient underground mining.
- The Royalty chargeable for Domestic Coal mined through Underground Mining should be at a concessional rate.

Chapter 10: Summary of IMC's Recommendations & Implementation Roadmap

I. Summary of IMC's Recommendations

A summary of IMC's recommendations for each of the TOR is provided below:

1. **Recommendations TOR 1:** To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks
    a. Exploration of coking coal by Government should be enhanced and outsourcing of exploration activity to private sector
    b. Allocation of adequate funds by the Government for exploration of deep-seated coal reserves
    c. Adoption of new technology for exploration
    d. Resource classification to be standardized
    e. Adoption of new technology for increase in production
    f. CIL to discuss with steel sector for supply of coking coal being produced to steel sector
    g. Supply of low ash non-coking coal to steel sector for use as PCI coal
    h. Identification of additional coking coal blocks for production by CIL and private sector
    i. Government should allocate adequate funds with the aim to extinguishing fire at Jharia within next 5 years.
    j. Consultation with private sector for Jharia coking coal blocks
    k. Development of Non-coal Bearing Land or De-coal Land by Government.
    l. Auction of CBM overlap coking coal blocks
    m. Joint annual review by Ministry of Coal and Ministry of Steel
2. **Recommendations TOR 2**: To suggest R&D initiatives to beneficiate coking coal to reduce ash% with upgraded technology
    a. Adoption of existing advanced technology for beneficiation of coking coal
    b. R&D initiatives to improve flotation efficiency and other technologies for beneficiation
    c. Policy framework to be reviewed and elaborated for incorporating the mechanism of selling of rejects/ middlings into the market using e-auction platforms or through open trades by washery operators/ aggregator model
    d. R&D initiatives for utilisation of non-coking coal for coke making
    e. Strategic plan to be devised by Government for time bound stoppage of supply of Low Volatile coking coals to the power generating companies
3. **Recommendations TOR 3:** Methodology to encourage the private sector to set up coking coal washery
    a. Allocation of coking coal linkages by CIL to private washeries
    b. Setting up of coking coal washeries on aggregator model basis to be explored
    c. Possibility of setting up small (1 MT) Mobile washeries to be explored.
    d. CIL should conduct consultations with MDOs to gauge their interest for participating in integrated MDO contracts and a framework should be prepared for award of contracts
    e. Requirement of washed coking coal (domestic) should be projected by Ministry of Steel till 2030 and long-term contract between coal companies and steel manufacturers needed for taking investment decisions on setting up of washeries
    f. Feasibility of washing Washery Grade V & VI coal to 18% ash level may be explored on aggregator model basis. Also, investments into R&D for washing Washery Grade V & VI coal may be considered.

4. **Recommendations TOR 4:** Examine the domestic coking coal pricing and suggest competitive pricing strategy
    a. CIL has already appointed a consultant for suggesting import parity-based pricing mechanism for domestic coking coal factoring the quality parameters
    b. Commodity wise carrying capacity based freight structure should be adopted by Indian Railways instead of charging idle freight for commodities like coking coal and coke
5. **Recommendations TOR 5:** Suggest incentives to steel sector to redesign blast furnace
    a. Ministry of Steel to prepare a plan for setting up of 300 MT steel making capacity by steel sector; incentive framework to encourage steel sector for utilisation of stamp charging technology and invest into R&D initiatives for redesigning blast furnaces for utilisation of domestic coking coal
6. **Recommendations TOR 6:** Address coking coal quality issues and suggest measures to improve coking coal quality
    a. CIL to publish mine-wise/ seam-wise details of coking properties of coal on its website and purchaser may be allowed to choose from specific source
    b. Beneficiation of coal should be done prior to coke making to get desired level of ash% and moisture%.
    c. **Preparation of optimum coal blend** (using a basket of coals, domestic as well as imported) to obtain required rheological properties (CSN, fluidity, plastic range etc). Provision for advanced blending facility should also be available.
    d. **Plant Automation and real-time quality measurement instruments** – Ash analysers, moisture analysers should be used including the use of statistical models to predict the optimum coal blend.
    e. Standardization of coal sampling and testing procedure
7. **Recommendations TOR 7:** To incentivise the coking coal production from Underground (UG) mines considering better quality of coal from UG mines
    a. Tax incentives may be provided to the entities engaged in UG mining and for manufacturing of underground mining machinery

II. Roadmap for Implementation of IMC's Recommendations

IMC has also suggested a roadmap for implementation of its recommendations along with timelines:

Table 7: Roadmap for Implementation of IMC's Recommendations

S. No.	TOR	IMC's Recommendations	Action Item
	TOR 1: Production & Exploration		
1.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Adoption of new technology for exploration	A. Ministry of Coal to mandate exploration agencies to use latest exploration technology B. CIL along with CMPDIL to undertake a study to assess the feasibility of building geological models for Jharia, East & West Bokaro, North & South Karanpura Coalfields with latest technology.
2.	TOR1: To suggest National Strategy to	Resource classification may be standardized by	A. Ministry of Coal to prepare framework for resource classification by implementing

S. No.	TOR	IMC's Recommendations	Action Item
	enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	implementing CRIRSCO (or equivalent international standard) classification	CRIRSCO (or equivalent international standard) classification
3.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Exploration of 15BT Indicated and Inferred category blocks should be taken up on priority basis so that production can be started from these blocks at the earliest.	A. Ministry of Coal to undertake exploration either through Government agencies or by outsourcing contract to private sector and allocation of partially explored blocks. B. Government to allocate adequate funds for exploration of deep-seated coal reserves
4.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	CIL to discuss with steel sector for supply of coking coal being produced to steel sector	A. CIL to undertake discussions with steel sector to supply washed coking coal to steel sector based on its production plan
5.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Supply of low ash non-coking coal to steel sector for use as PCI coal	A. CIL to offer low ash non-coking coal to steel sector for use as PCI coal through linkage auction
6.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Identification of additional coking coal blocks for production by CIL and private sector	A. CMPDIL to identify additional coking coal blocks for production by CIL and private sector B. Ministry of Coal to undertake action for allocation of these blocks
7.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Allocation of adequate funds by the Government with the aim to extinguishing fire at Jharia within next 5 years. Consultation with private sector for Jharia coking coal blocks	A. Government should allocate adequate funds with the aim to extinguishing fire at Jharia within next 5 years. B. Ministry of Coal to undertake consultations with private sector for allocation of Jharia coal blocks on PPP basis or VGF basis

S. No.	TOR	IMC's Recommendations	Action Item
			C. A framework for allocation to be prepared by Ministry of Coal upon consultations with the industry players
8.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Auction of CBM overlap coking coal blocks	A. Ministry of Coal to undertake discussions with MoPNG for relinquishment of non-active CBM blocks B. Upon relinquishment, Ministry of Coal to auction CBM overlap coking coal blocks
9.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Adoption of new technology for increase in production	A. CIL to undertake cost benefit analysis of adoption of new production technologies and identify pilot projects for deployment of the same. B. In second phase, the deployment may be undertaken for other projects C. Ministry of Coal to undertake discussions with other blocks allocatees to encourage adoption of stated production technologies
10.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	**Development of Non-coal Bearing Land or De-coal Land:** As CIL is vested with CBA land, Government should invest in non-coal bearing land or de-coal land for coal development of infrastructure including washeries.	Ministry of Coal to prepare framework for investments in non-coal bearing land or de-coal land for coal development of infrastructure including washeries.
11.	TOR1: To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks	Joint annual review by Ministry of Coal and Ministry of Steel to sync up coking coal production with demand	A. Ministry of Coal and Steel to set up a mechanism for joint annual planning meet
	TOR 2: R&D Initiatives		
12.	TOR 2: To suggest R&D initiatives to beneficiate coking coal to reduce ash% with upgraded technology	Adoption of existing advance technology for beneficiation of coking coal	A. CIL to undertake the analysis to determine whether existing beneficiation technology may be adopted by CIL or not and identify pilot projects where such technology may be implemented. Upon successful implementation of pilot project, these technologies may be deployed for other projects.

S. No.	TOR	IMC's Recommendations	Action Item
			B. MoC to engage with SAIL & Tata Steel regarding adoption of advanced beneficiation technology in their washeries
13.	TOR 2: To suggest R&D initiatives to beneficiate coking coal to reduce ash% with upgraded technology	R&D initiatives to improve flotation efficiency and other technologies for beneficiation. R&D initiatives for utilisation of non-coking coal for coke making	A. Ministry of Coal, Ministry of Steel and CIL to set up a task force to identify R&D projects in the stated areas and prepare an implementation plan
14.	TOR 2: To suggest R&D initiatives to beneficiate coking coal to reduce ash% with upgraded technology	Policy framework for the disposal of washery rejects and middlings may be reviewed and made more elaborate	A. The policy framework needs to be reviewed and elaborated by Ministry of Coal for incorporating the mechanism selling of rejects/middling into the market using either E-Auction Platforms or through open trades by Washery Operators/Aggregator Model.
	TOR 3: Setting up Washery		
15.	TOR 3: Methodology to encourage the private sector to set up coking coal washery	Allocation of coking coal linkages by CIL to private washeries	A. Ministry of Coal to prepare policy framework through which CIL can award coking coal linkage to washeries who can beneficiate coal and sell to steel sector. B. Award of linkages by CIL upon finalisation of policy framework
16.	TOR 3: Methodology to encourage the private sector to set up coking coal washery	Setting up of coking coal washeries on aggregator model basis	A. CIL to undertake analysis and identify projects for which washery may be set up on aggregator model basis B. CIL to set up the washery upon establishing project viability C. Ministry of Coal to take action and encourage private sector to set up washeries on aggregator model basis.
17.	TOR 3: Methodology to encourage the private sector to set up coking coal washery	Requirement of washed coking coal(domestic) should be projected by Ministry of Steel till 2030 and long term contract between coal companies and steel manufacturers needed for taking investment decisions on setting up of washeries	A. Ministry of Steel to provide requirement of washed coking coal(domestic) by steel industry till 2030 B. Ministry of Steel to facilitate execution of long term contracts between CIL and steel manufacturers for supply of washed coking coal by CIL
18.	TOR 3: Methodology to encourage the private sector to set	Possibility of setting up small (1 MT) Mobile washeries to be examined	A. To examine the possibility of setting up Mobile Washeries

S. No.	TOR	IMC's Recommendations	Action Item
	up coking coal washery		B. Setting up of mobile washeries, if found viable
19.	TOR 3: Methodology to encourage the private sector to set up coking coal washery	Consultations may be held with MDOs to understand if they would be interested in integrated MDO contracts i.e. mine development & operation and BOO washery	A. CIL to hold consultations with MDOs to gauge their interest for participating in integrated MDO contracts (MDO + Washery) B. CIL to prepare a framework for award of integrated MDO contracts
20.	TOR 3: Methodology to encourage the private sector to set up coking coal washery	Feasibility of washing Washery Grade V & VI coal to 18% ash level may be explored on aggregator model basis. Also, investments into R&D for washing Washery Grade V & VI coal may be considered.	A. CIL and other players to explore feasibility of washing Washery Grade V & VI coal to 18% ash level on aggregator model basis. Also, investments into R&D for washing Washery Grade V & VI coal to be considered.
	TOR 4: Pricing		
21.	TOR 4: Examine the domestic coking coal pricing and suggest competitive pricing strategy	CIL has already appointed a consultant for suggesting import parity based pricing mechanism for domestic coking coal factoring the quality parameters	A. CIL to finalise import parity based pricing mechanism for coking coal
22.	TOR 4: Examine the domestic coking coal pricing and suggest competitive pricing strategy	Commodity wise carrying capacity based freight structure should be adopted by Indian Railways instead of charging idle freight for commodities like coking coal and coke	A. Ministry of Coal to take up with Indian Railways to adopt a ccommodity wise carrying capacity based freight structure instead of charging idle freight for commodities like coking coal and coke
	TOR 5: Redesigning BF		
23.	TOR 5: Suggest incentives to steel sector to redesign blast furnace	Ministry of Steel to prepare a plan for setting up of 300 MT steel making capacity and use of stamp charging battery technology by steel sector; incentive framework to encourage steel sector for utilisation of stamp charging technology and invest into R&D initiatives for redesigning blast furnaces for utilisation of domestic coking coal	A. Ministry of Steel to prepare a plan for setting up of 300 MT steel making capacity and use of stamp charging battery technology by steel sector B. Ministry of Steel to prepare an incentive framework to incentivise steel industry for redesigning blast furnaces for utilisation of domestic coking coal C. Ministry of Steel to prepare an incentive framework to encourage steel sector for utilisation of stamp charging technology

S. No.	TOR	IMC's Recommendations	Action Item
	TOR 6: Quality		
24.	TOR 6: Address coking coal quality issues and suggest measures to improve coking coal quality	CIL to publish mine-wise/ seam-wise details of coking properties of coal on its website and purchaser may be allowed to choose from specific source	A. CIL to publish mine-wise/ seam-wise details of coking properties of coal on its website B. CIL to offer source specific (mine-wise) supplies in the auction
	TOR 7: Incentivising production from underground mines		
25.	To incentivise the coking coal production from Underground (UG) mines considering better quality of coal from UG mines	Tax incentives may be provided to the entities for manufacturing of underground mining machinery and entities engaged in UG mining.	A. Ministry of Coal to take up with Ministry of Finance for providing tax incentives for manufacturing of underground mining machinery and entities engaged in UG mining.

Annexure 1 – Details of Planned Coking Coal Production and Washery Capacity Till FY 2030

I. Planned Production by CIL

Particulars	CIL	CCL	BCCL	ECL	SECL	WCL
Balance Coking Coal Resource for Production Projection (Bt)	12.41	6.03	4.95	0.29	0.90	0.24
Projectised Coking Coal Resource (Bt)	5.65	2.94	2.37	0.29	0.02	0.02
Mineable Coking Coal Reserve (Bt)	2.79	1.68	1.01	0.08	0.02	0.01
Total Capacity (Mtpa)	**151.68**	**81.15**	**68.56**	**0.37**	**0.36**	**1.24**
Capacity - Approved	**110.04**	**41.34**	**66.73**	**0.37**	**0.36**	**1.24**
Capacity - to be Approved (PR already formulated)	**41.64**	**39.81**	**1.83**	**0.00**	**0.00**	**0.00**
Production in 2019-20 (Actual)	46.71	20.02	25.95	0.31	0.25	0.18
Production Projection 23-24 (Mtpa)	79.34	31.84	46.70	0.00	0.25	0.55
W-IV and better	59.24	18.47	40.22	0.00	0.00	0.55
W-V, VI	19.85	13.38	6.47	0.00	0.00	0.00
(Semi Coking) SC-I and II	0.25	0.00	0.00	0.00	0.25	0.00
Production Projection 29-30 (Mtpa)	**105.57**	**57.93**	**47.09**	**0.00**	**0.25**	**0.30**
W-IV and better	76.43	38.92	37.20	0.00	0.00	0.30
W-V, VI	28.90	19.01	9.89	0.00	0.00	0.00
SC-I and II	0.25	0.00	0.00	0.00	0.25	0.00
Total Washing Capacity in 29-30	**44.63**	**19.30**	**25.33**			
Tentative clean coal in 29-30	**17.33**	**8.30**	**9.03**			

II. Planned Production by SAIL & Tata Steel

Information was sought from Ministry of Steel, however the same has not been received.

III. PRC of Non-CIL Blocks Allocated

S. No	Block	Status of Exploration	Grades	Estimated PRC for Coking Coal (MTY)
1	Brahmadiha	Partly Explored	WI-WVI	0.15
2	Urtan North	Explored	WIII-WIV	0.60
3	Urtan	Explored	WIII	0.62
4	Rohne	Partly Explored	WI-WVI	8.0
5	Moitra	Explored	WIII-WVI	9.72
6	Rabodih OCP	Explored	WIII-WVI	2.5
	TOTAL			**21.59**

IV. Planned Washery Capacity – CIL, SAIL, Tata Steel & JSPL

Washery	Location	Capacity (MTPA)	Expected COD
CIL & its Subsidiaries			
Madhuban (BCCL)	Block-II Area, Dhanbad, Jharia Coalfield	5.0	Jul 2021
Patherdih II (BCCL)	Patherdih, Jharia Coalfield, Dhanbad	2.5	Jun 2022
Bhojudih (BCCL)	Purulia District, West Bengal	2.0	Mar 2022
Moonidih (BCCL)	Moonidih Project, Jharia Coalfield, Dhanbad, Jharkhand	2.5	Jan 2023
New Kathara (CCL)	Kathara Area, East Bokaro Coalfield, Jharkhand	3.0	Nov 2022
Basantpur-Tapin (CCL)	Hazaribagh Area, West Bokaro Coalfield, Jharkhand	4.0	Nov 2022
New Rajrappa (CCL)	Rajrappa Area, Ramgarh Coalfield, Jharkhand	3.0	May 2024
Karo (CCL)	B&K Area, East Bokaro Coalfield, Jharkhand	5.0	Nov 2024
Topa (CCL)	Kuju Area, West Bokaro Coalfield, Jharkhand	3.0	Nov 2024
Sub-Total (CIL)		**30.00**	
SAIL	Tasra	4.00	
Tata Steel	Washery III, West Bokaro	0.65	
Tata Steel	Bhelatand Washery, Jharia	0.50	
JSPL	Angul, Odisha	2.00	
Total		**37.15**	

Annexure 2 – Ministry of Coal's Order for Constitution of IMC

No. CPIAM- 43016/9/2015-CRC-I (1)
भारत सरकार/ Government of India
कोयला मंत्रालय/ Ministry of Coal
****

Room no. 622A, Shastri Bhawan,
New Delhi, Dated: 19th March, 2021

OFFICE ORDER

Subject: Constitution of Inter-Ministerial Committee for making suggestions on augmentation and consumption of domestic coking coal by steel sector.

The Competent Authority has approved to constitute an Inter-Ministerial Committee (IMC) for making suggestions on augmentation and consumption of domestic coking coal by steel sector.

2. Composition and Terms of Reference of the IMC is as under:

Composition-

Sl. No.	Name	Designation
1	Additional Secretary (MN), Ministry of Coal	**Chairman**
2	Adviser(Projects), Ministry of Coal	Member
3	Representative of Ministry of Steel (not below the rank of Joint Secretary)	Member
4	CMD, CMPDI	Member
5	DT, CIL	Member
6	DT, BCCL	Member
7	Mr. Ravinder Bhan, Director(Regulatory & Policy), ISA	Member
8	Mr. Deepak Sindkar, Head (Procurement), Arcelor Mittal Nippon Steel India Ltd	Member
9	Mr. Arvind Rajgopalan, AVP, JSW Steel	Member
10	Mr. L.K.S. Rao, Executive Director, SAIL	Member
11	Mr. Pankaj Satija, Chief, Regulatory Affairs, Tata Steel Ltd.	Member

Terms of Reference-

1. To Suggest National Strategy to enhance coking coal and suggest road map to projectise and explore more coking coal bock.
2. To suggest R&D to beneficiate coking coal to reduce ash% with upgraded technology.
3. Methodology to encourage the private sector to set up coking coal washery.
4. Examine the domestic coking coal and suggest competitive pricing strategy.
5. Suggest incentive to steel sector to redesign blast furnace .
6. Address Coking Coal Quality issue and suggest measures to improve coking coal quality.

3. The IMC will submit its report within 03 months.

(Hitlar Singh)
Under Secretary to the Government of India
Email: hitlar.singh85@nic.in

To,
Members of the IMC

Copy to:

1. Secretary, Coal
2. Secretary, Steel
3. Chairman, CIL

No. CPIAM- 43016/9/2015-CRC-I (1)
भारत सरकार/ Government of India
कोयला मंत्रालय/ Ministry of Coal
****

Room no. 622A, Shastri Bhawan,
New Delhi, Dated: 31 March, 2021

OFFICE ORDER

Subject: Constitution of Inter-Ministerial Committee for making suggestions on augmentation and consumption of domestic coking coal by steel sector.

The Competent Authority has approved to include the following person in the Inter-Ministerial Committee, constituted vide this Ministry's Office Order of even number dated 19.03.2021 -

Sl. No.	Name	Designation
1	Mr Kapil Dhagat, Executive Vice President/Business Unit Coal-Jindal Steel and Power Limited	Member

2. All other terms and conditions will remain the same.

(Hitlar Singh)
Under Secretary to the Government of India
Email: hitlar.singh85@nic.in

To,

Members of the Inter-Ministerial Committee

Copy to:

1. Secretary, Coal
2. Secretary, Steel
3. Chairman, CIL

Annexure 3 – Minutes of IMC Meeting – March 26, 2021

(Provided separately)

Annexure 4 – Minutes of IMC Meeting – May 7, 2021

(Provided separately)

Annexure 5 – Minutes of IMC Meeting – May 23, 2021

(Provided separately)

Annexure 6 – Minutes of IMC Review Meeting – June 7, 2021

(Provided separately)

Annexure 7 – List of CIL's Coking Coal Blocks where PR is to be Approved

S. No	Name of Mine	Company	Capacity (Mtpa)	Status of PR
1	Kuju OC	CCL	1.30	Available
2	Swang Pipradih OC	CCL	2.00	Available
3	Jaridih OC	CCL	1.00	Available
4	Ramgarh-II West OC	CCL	1.50	Available
5	Chano Rikba OC	CCL	2.00	Available
6	Kapuria	BCCL	1.83	Final PR submitted
	Total		**9.63**	

Annexure 8 – List of 36 Non-CIL Coking Coal Blocks To be Allocated

S N	BLOCK NAME	COALFIELD	CATEGORY	Status of Exploration	Area (Sq.km)	Total Resource (MT)	Tentative Grade	CBM Overlap Approx. (%)	Estimated PRC (MTY)
1.	Aluara	Jharia	MMDR	Regionally Explored	25.44	720.00	W II - W III		DIFFICULT TO ASSESS MINEABILITY
2.	Babupara	North Karanpura	MMDR	Regionally Explored	8.15	115.00	WIII-WVI	46	2.00
3.	Badam Dipside	North Karanpura	MMDR	Under Exploration	11.97	1040.00	WIII-WVI	74	1.00
4.	Basantpur	West Bokaro	MMDR	Regionally Explored	4.55	200.00	WIII-WVI	Nil	1.00
5.	Beheraband North Extn	Sohagpur	MMDR	Explored	14.84	86.71	W III/G6-G8	Nil	1.00
6.	Dipside of Rohne Rautpara	North Karanpura	MMDR	Regionally Explored	15.69	470.00	WIII-WVI	75	1.00
7.	Duni	West Bokaro	MMDR	Regionally Explored	2.17	140.00	W II - W III	79	DIFFICULT TO ASSESS MINEABILITY
8.	GOURIGRAM	Jharia	MMDR	Regionally Explored	4.62	229.00	W II - W III	87	DIFFICULT TO ASSESS MINEABILITY
9.	Jhirki & Jhirki West	East Bokaro	MMDR	Explored	2.84	301.46	W-II to W-IV	1	1.50
10.	Lalgarh South South of Lalgarh South (2 blocks)	West Bokaro	MMDR	Regionally Explored	6.37	300.00	WIII-WVI	76	DIFFICULT TO ASSESS MINEABILITY
11.	Muditoli	East Bokaro	MMDR	Regionally Explored	1.55	40.00	W III - W IV	100	0.30
12.	North Kathara Phase-I	East Bokaro	MMDR	Explored	0.91	42.87	W II - W III	5	0.34
13.	North Kathara Phase-II & III	East Bokaro	MMDR	Explored	3.55	295.98	W II - W III	9	0.27
14.	Parbatpur North	Jharia	MMDR	Regionally Explored	5.72	425.00	W II - W III	87	0.50
15.	Phusro	East Bokaro	MMDR	Regionally Explored	8.2	350.00	WIII	84	DIFFICULT TO ASSESS MINEABILITY
16.	Saria East	East Bokaro	MMDR	Regionally Explored	3.52	260.00	WIII-WVI	84	0.30
17.	Saria West	East Bokaro	MMDR	Regionally Explored	6.19	180.00	WIII-WVI	94	0.30

S N	BLOCK NAME	COALFIELD	CATEGORY	Status of Exploration	Area (Sq.km)	Total Resource (MT)	Tentative Grade	CBM Overlap Approx. (%)	Estimated PRC (MTY)
18.	Tambia	Pench-Kanhan	MMDR	Regionally Explored	17.02	103.29	W II- W III/ G4-G8	Nil	0.51
19.	Tenughat North	East Bokaro	MMDR	Regionally Explored	3.35	360.00	WIII-WVI	100	0.30
20.	Tenughat West	East Bokaro	MMDR	Regionally Explored	8.81	1000.00	WIII-WVI	97	0.30
21.	Burakhap Small Patch	Ramgarh	CMSP	Explored	0.58	9.68	C-E/Weakly Coking	Nil	0.40
22.	Choritand Tiliaya	West Bokaro	CMSP	Explored	2.49	97.04	W-V	Nil	0.72
23.	Gomia	East Bokaro	CMSP	Explored	3.5	251.18	SII-WIV	100	0.50
24.	Jogeshwar & Khas Jogeshwar	West Bokaro	CMSP	Partly Explored	2.66	84.03	WIII-WVI	Nil	0.31
25.	Kulti	Raniganj	CMSP	Explored	7.68	210.63	SI-WIV	99	Not Assessed
26.	Lalgarh (North)	West Bokaro	CMSP	Explored	2.91	27.04	WIII-WVI	82	1.00
27.	Mahal	Jharia	CMSP	Explored	5.52	258.35	WI-WVI	91	0.30
28.	Pindra-Debipur-Khaowatand	East Bokaro	CMSP	Regionally Explored	15.62	110.00	WI-WVI	88	0.50
29.	Rauta Closed Mine	Ramgarh	CMSP	Regionally Explored	1.75	7.00	WIV-WVI	Nil	0.40
30.	Saria Koiyatand	East Bokaro	CMSP	Regionally Explored	4.21	202.00	WI-WVI	99	0.50
31.	Sitanala	Jharia	CMSP	Explored	3.17	108.85	WI-WVI	18	DIFFICULT TO ASSESS MINEABILITY
32.	Sitarampur	Raniganj	CMSP	Explored	8.37	133.01	SI-WIV	81	Not Assessed
33.	Tandsi-III & Tandsi -III (Extn.)	Pench-Kanhan	CMSP	Explored	3.68	17.39	WIV-WVI	Nil	0.30
34.	Tenughat-Jhirki	East Bokaro	CMSP	Explored	2.76	215.76	WI-WVI	91	0.50
35.	Parbatpur-Central	Jharia	CMSP (CUSTODIAN)	Explored	8.95	231.00	WI-WVI	96	1.00

Annexure 9 – Tentative Capacity in FY 2030 of Unprojectised CIL Coking Coal Blocks

Sl No	Block	Sub-Blocks	Coalfield	Unprojectised Coking Coal Resource (Mt)							
				Total	Can be Projectised					Cannot be Projectised	
					Resource (Mt)	GR Timeline	PR Timeline	Tentative Capacity	Reason (projectised beyond 29-30)	Resource (Mt)	Reason
1	Chalkari Extn. & Angwali		EAST BOKARO	361.42	361.42	Feb, 2021	Dec, 2021	2.00			
2	West Mohuda (Addl. CIL)		Jharia	138.46	138.46	2024-25	2025-26	0.50	Exploration for lower seams going on, likely to complete by 2023-24. After that the block will be be projectised in 2024-25.		
3	New Laikdih (Revised)		Raniganj	50.37	20.00	2021-22	2022-23	1.00		30.37	Reserve below 200m depth.
4	BEHRABANDH	BEHERABANDH WEST	SOHAGPUR	114.85	114.85	2022-23	2023-24	1.00			
		KEWAI	SOHAGPUR			2020-21	2021-22	0.50			
5	KANCHANPUR PAKARIA	PAKARIA EAST	SOHAGPUR	186.46	186.46	2024-25*	25-26	1.50			
		PAKARIA WEST	SOHAGPUR	146.53	146.53	2024-25*	25-26	1.00			
		KANCHANPUR	SOHAGPUR	76.32	76.32	2022-23*	23-24	1.36			
6	JARWAHI	JARWAHI	SOHAGPUR	201.68	201.68	2023-24*	24-25	1.50			
7	CHULAHA BULIA	CHULAHA BULIA EAST	SOHAGPUR	155.73	155.73	2020-21	21-22	1.00			
		CHULAHA BULIA CENTRAL	SOHAGPUR			2022-23	23-24	1.00			
		CHULAHA BULIA WEST	SOHAGPUR			2024-25	25-26	1.00			
8	Begunia		Raniganj	34.14	34.14	Available	2022-23	0.30			
	TOTAL			**1465.96**	**1435.59**			**13.66**		**30.37**	

Annexure 10 – Coking Coal Prices

CIL Notified Price of Coking Coal:

1. **BCCL's Price Notification:** Price of ROM coal as per BCCL's price notification dated September 6, 2019 (for ST I, ST II, W I – WIV) and March 7, 2019 (for W V, W VI) is provided below:

BCCL's Notified Price of Coking Coal

Grade	Prime Coking Coal (ROM) Rs./ tonne	HVMC Coal (ROM) for Non-regulated Sector Rs./ tonne
ST I	6153	-
ST II	5917	-
Direct feed at 20-21% ash (with existing bonus/ penalty @Rs. 170/ tonne per percent decrease/ increase in ash percent)	6101	-
W I	5280	4436
W II	4416	4182
W III	3519	3312
W IV	3326	3147
W V	2678	2553
W VI	2464	2370

2. **CCL's Price Notification:** Price of ROM coal for non-regulated sector as per CCL's price notification dated January 12, 2017 (for ST I, ST II, W I – WIII), December 29, 2018 (W IV) and April 6, 2019 (for W V, W VI) is provided below:

CCL's Notified Price of Coking Coal

Grade	ROM Coal (Non-regulated sector) Rs./ tonne
ST I	4880
ST II	4080
W I	3450
W II	3210
W III	2750
W IV	2535
W V	2261
W VI	1988

National Coal Index (NCI) & Representative Price for Coking Coal: National Coal Index is published monthly by Ministry of Coal. Coking coal is categorised as Coking Top Grade (ST – I, ST-II or Imported) and Coking Bottom Grade (WI – WIV). Historical NCI data and representative price for coking coal is provided below:

National Coal Index for Coking Coal

Grade	Mar'20	Apr'20	May'20	Jun'20	Jul'20	Aug'20	Sep'20	Oct'20	Nov'20	Dec'20	Jan'21	Feb'21	Mar'21	Apr'21
Top	83.69	91.88	88.40	75.80	64.20	64.59	65.72	67.11	69.65	69.12	66.12	69.75	78.82	81.67
Bottom	125.17	116.08	117.02	110.66	113.60	109.95	111.33	115.71	119.39	115.46	115.32	117.94	115.27	116.50

Note: Data from Apr'20 to Apr'21 is provisional

Representative Price for Coking Coal

Grade	Mar'20	Apr'20	May'20	Jun'20	Jul'20	Aug'20	Sep'20	Oct'20	Nov'20	Dec'20	Jan'21	Feb'21	Mar'21	Apr'21
ST I	10949	12046	11579	9893	8340	8393	8543	8730	9069	8998	8598	9084	10297	10678
ST II	9942	10937	10513	8983	7573	7621	7757	7927	8235	8171	7807	8248	9349	9696
W I	5790	5790	5790	5790	5790	5790	5790	5790	5790	5790	5790	5790	5790	5790
W II	5156	5156	4839	4930	4427	4427	4427	4427	4763	4555	4555	4555	4555	4574
W III	4413	3873	3708	3604	4110	4247	4154	4012	4143	4155	4404	4186	3816	3758
W IV	3180	3066	3074	2999	3023	304	2973	3072	3134	3067	3073	3089	3070	3087

Note: Data from Apr'20 to Apr'21 is provisional

FOB Price of Australian Coking Coal: FOB Prices of Australian coking coal over the last 5 years is provided below. It may be noted that the prices are highly volatile with annual average price ranging between 124 – 207 USD/ tonne during 2016 to 2020.

Australian Coking Coal Monthly Price (FOB Basis)

International Coking Coal Monthly Price (Australia FOB basis) — USD/ tonne

Month	2016	2017	2018	2019	2020	2021
	Spot	Spot	Spot	Spot	Spot	Spot
January	77	185	240	199	150	126
February	76	161	229	207	156	144
March	83	157	219	213	158	116
April	92	263	188	204	128	110
May	91	173	184	208	114	
June	90	147	198	197	111	
July	96	166	182	181	113	
August	114	197	180	156	107	
September	189	205	201	145	124	
October	232	181	217	149	121	
November	300	190	221	134	102	
December	267	239	227	136	101	
Average	**142**	**189**	**207**	**177**	**124**	**124**

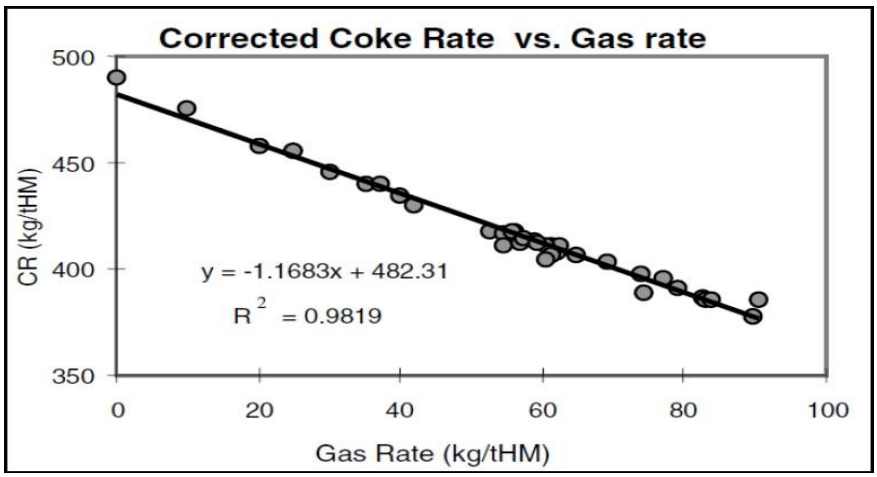
Source: CRISIL Research

Annexure 11 – Methods to Reduce the Coke Rate in Blast Furnace

Coke rate can be reduced by tweaking the design aspects, BF feed or using alternative fuels. Methods to reduce the coke rate is mentioned below:

a. Natural gas (NG) injection into blast furnace: NG has high calorific value. It is affordable, abundantly available source of energy. Evidence suggests that 1 kg natural gas can replace 1.2 kg of coke. It is practically achieved in Siderar BF#2 as provided in following figure:

Replacement Rate



Design modifications in existing system for NG injection: NG input given through Tuyere Injection System. Following changes are required:

- Modification in Lance design to inject NG through tuyeres
- NG injection requires high pressure ~8 bar to inject through tuyeres. So, design modification requires to increase its pressure or high pressure natural gas supply is required.
- Similarly, Cove Oven Gas injection can be achieved with similar design modifications to reduce coking coal consumption.

b. **Hydrogen injection into BF:** Availability of H2 is an issue due to its high cost. Safety risk is also involved in its storage.

c. **High agglomerate in BF feed:** Agglomerates (pellet, sinter etc) can go up to 100% in BF feed to reduce the overall coke rate and to improve BF productivity. 1% agglomerate reduces coke rate by ~1.7 kg/thm

d. **Achieving high hot blast temperature to reduce coke rate:** An increase in hot blast temperature by 100°C (through LD/Coke oven gas heating/installation of additional heater) will reduce Coke Rate by 12 kg/thm

e. **Reduction in slag rate by decreasing Alumina content in BF feed:** Reduction in Alumina % in Raw materials (mainly in iron ore) will help to reduce coke rate through reducing slag rate due to low Al2O3 input. Around 100 kg reduction in slag rate will reduce coke rate by 15 kg/thm.

Minutes of the 1st meeting of Inter-Ministerial Committee held on March 26, 2021

The Ministry of Coal has formed an Inter-Ministerial Committee on 19th March, 2021 under the Chairmanship of Additional Secretary (MN), MoC, for making suggestions on augmentation and consumption of domestic coking coal by steel sector. Committee comprises Members from Ministry of Coal, Ministry of Steel, Coal India Limited and its subsidiaries (BCCL & CMPDIL), industry players (ISA, SAIL, Tata Steel, AMNS, JSW Steel, and JSPL). Terms of reference of IMC are as under-

- To suggest National Strategy to enhance production of coking coal and suggest road map to projectise and explore more coking coal blocks;
- To suggest R&D initiatives to beneficiate coking coal to reduce ash% with upgraded technology;
- Methodology to encourage the private sector to set up coking coal washery;
- Examine the domestic coking coal pricing and suggest competitive pricing strategy;
- Suggest incentives to steel sector to redesign blast furnace; and
- Address coking coal quality issues and suggest measures to improve coking coal quality.

2. 1st meeting of the said Inter-Ministerial Committee was held on 26.3.2021 under the Chairmanship of Shri M. Nagaraju, Additional Secretary (Coal) for making suggestions on augmentation of production and consumption of domestic coking coal by steel sector. List of the participants is enclosed at Annexure I.

3. A presentation was made by SBI Capital Markets Ltd. on the Terms of Reference of the Inter-Ministerial Committee and the coking coal scenario in the country. A brief of the discussions held during the meeting is provided below:

3.1 Additional Secretary (Coal) asked the participants to suggest measures that can be taken up to enhance production of coking coal, suggest R&D initiatives to reduce ash %, methodology to encourage private sector in setting up coking coal washery, suggest competitive price strategy, suggest incentives to steel sector to redesign blast furnace and suggest measures to improve coking coal quality.

3.2 Mr.Pankaj Satija, Chief, Regulatory Affairs, Tata Steel Ltd. suggested that the current trend of abandoning underground mines which become cost ineffective needs to be viewed by providing incentives like lower royalty rates to effectively balance and counter the higher cost. He has been asked to submit a note on the type of incentives i.e. royalty incentives, incentives on UG mining that can be given to the players for providing impetus to underground mining of coking coal production in the country. Quality of underground coal is generally better as it does not get diluted like that of OC mines.

3.3 Mr. Satija suggested that an industry focussed approach needs to be adopted for R&D in coking coal sector to facilitate increased utilisation of domestic coking coal by the steel sector through effective beneficiation. Also, the incentives for R&D need to be made more lucrative to attract private sector investment. He

suggested that coking coal bearing areas needs to be developed in conjunction to CIL's efforts to complement the investments in coal washeries which have already been conceived by the respective CIL subsidiaries. He also suggested that policies need to be adopted to fast track utilisation of domestic coking coal.

3.4 Mr. Satija informed that while the PSUs have the facility of acquiring land under the provisions of the Coal Bearing Areas Act, the same facilitation is not extended to the Private Sector. He suggested that the provisions for land acquisition under the Coal Bearing Areas Act should be extended to the Private Sector as well.

3.5 Mr. Satija told that beneficiation/ washing facility at every mine being operated by CIL subsidiaries may not be feasible, and suggested a model may be developed to facilitate a Coking Coal Agglomerator to set up a large centralised state of the art Coking Coal Beneficiation Facility which enjoys 'economy of scale' and beneficiates the produce from a large number of collieries, thereby supplying desired grade of clean coking coal to the steel sector and the washery by-products to the thermal power sector in place of the present practise of the entire inferior coking coal being burnt by the thermal power plants.

3.6 Mr. Satija also suggested that in order to promote utilisation of domestic coking coal by the steel sector, comprehensive quality parameters need to be developed i.e. apart from the ash %, parameters like CSR, CSN etc. shall also be provided.

3.7 Mr. Arvind Rajgopalan, AVP, JSW Steel informed that the private players from the steel sector are not participating in the auctions because the Indian coking coal is of very high ash content and coal beneficiation is required to bring down the ash content. Also, the coal quality is not consistent throughout the block and there are grade slippages which eventually leads to changing the economics of the block and making it unviable. He suggested to explore the coking coal blocks which are commercially viable. Mr. Arvind also suggested that the domestic coking coal prices are different from the prices of imported coking coal and if both these gets linked, it will lead to a problem in pricing coking coal.

3.8 Mr. Dhagat, EVP, JSPL informed that not only the ash content but a lot of other factors like MMR, total moisture, Crucible Swelling Number (CSN), Coke Strength after Reaction (CSR), vitrinite content etc. are also important for determining the quality of coal. List of Parameters enclosed in Annexure-2. He suggested that CIL should provide the petrographic study for all the coking coal blocks put up in auction for encouraging the private players to participate in the auction of coking coal blocks.

3.9 Mr. Dhagat informed that setting up of a washery where there are low reserves is unviable and there should be at least 4-5 MT PRC of coking coal blocks for setting up a washery.

3.10 Mr. Dhagat informed that the theoretical yield of clean coal varies from 13% to 28% at 13% ash coal and the theoretical yield of 34% ash middlings varies from 51% to 62% which is more than double the quantity of middlings generated at 18% ash clean coal.

3.11 Mr. Dhagat also suggested that for implementing the Jharia Action Plan, three options may be considered i.e. BCCL to mine the UG deposits using MDO and

may sell the coal on cost plus basis to end-users; awarding delineated coal blocks of Jharia coalfield to private sector players through auction or PPP and entrust entire activities including R&R; or end user steel companies to finance R&R in turn of firm supply commitments.

3.12 Mr. Rao, ED, SAIL mentioned that for increasing the coking coal production in the country, the coal blocks offered by BCCL and CCL should be of good quality, but instead they are of high ash content. He informed that SAIL is planning to go for the stamp charging technology for blending washed domestic coking coal. He suggested that the coking coal blocks may be given to SAIL will develop these blocks.

3.13 Director (Technical), CIL informed that major bulk of the W-V and W-VI grade coal is going to the power sector and if the coal beneficiation is available, the same may be provided to the steel companies.

3.14 CMD, CMPDI informed that there are some coking coal blocks in the SECL command area and there is requirement from the steel sector, CMPDI can explore and share the data.

3.15 Director (Technical), BCCL informed that for transporting coal even for a range of ~25km, the freight charges for the lowest category i.e. 100km is being levied which eventually leads to the increased cost of the coal. He suggested that if a category of 0-25km for railway freight may be added, it will benefit the coal sector. BCCL has been asked to share a note on this. Director (Technical) also suggested that for an UG mine with washers, the IRR is very low and the same can be given through MDO mode for making it viable.

3.16 The participants were asked about their plans to increase the blast furnace capacity. Mr. Satija informed that they currently have a capacity of ~20 MTPA which will be increased to ~35 MTPA in 5 years. Mr. Dhagat informed that currently they have ~5.5 MTPA of blast furnace capacity which will be increased to ~35 MTPA. Mr. Arvind informed that JSW Steel is targeting a blast furnace capacity of ~40 MTPA by 2025 which will be increased to ~60 MTPA by 2030.

3.17 Additional Secretary (Coal) asked where the R&D can be done. Mr. Dhagat suggested that the R&D can be done at the washeries and also, the lab capacities can be enhanced for conducting coking coal petrography studies.

3.18 Mr. Satija suggested to add one more point to the Terms of Reference i.e. to enhance the coking coal production from UG mines considering better quality of coal from UG.

3.19 BCCL and CCL have been asked to prepare a note on how to ensure the quality of washed coking coal at the delivery end and have been asked to bring a report for the next meeting.

Meeting ended with a vote of thanks to the chair.

Annexure-I

List of Participants

1. Shri M. Nagaraju, Additional Secretary, Ministry of Coal.
2. Advisor (Projects), Ministry of Coal.
3. Shri Shekhar Saran, CMD, CMPDI
4. Shri Chanchal Goswami, DT, BCCL
5. Shri Ravinder Bhan, Director (regulatory and Policy), ISA
6. Shri Deepak Sindkar, Head (Procurement), Arceor Mittal Nippon Steel India Ltd.
7. Shri Arvind Rajgopalan, AVP, JSW Steel
8. Shri L.K.S. Rao , ED, SAIL
9. Shri Pankal Satija, Chief Regulatory Affairs, Tata Steel Ltd.
10. Shri Kapil Dhagat, EVP/BU Coal- JSPL
11. Shri Ram Shiromani Saroj, Deputy Secretary, Ministry of Coal.
12. Shri Hitlar Singh, US, Ministry of Coal.
13. Shri Arvind Kumar, CM, Ministry of Coal.
14. Mrs. Poonam Singhal, DM, Ministry of Coal.
15. Mrs. Tuktuk Bansal, AVP, SBICAPs
16. Shri Gaurav Agarwal, SBICAPs

Annexure-2

Internationally accepted Quality specifications used in export/imports of coking coal

1. **Vitrinite Reflectance (RVmax):** The study of vitrinite reflectance (or VR) is a key method for identifying the maximum temperature history of sediments in sedimentary basins.
2. **Mean Maximum Reflectance (MMR):** The value of MMR in coking coal varies in the range of 0.85%-1.35%. Soft coking coal has lower MMR while hard coking coal has higher MMR.
3. **Crucible Swelling Number (CSN):** The range of CSN in coking coal is minimum 3 to maximum 9. Prime coking coal has higher CSN values while soft coking coal have low CSN values.
4. **Coke Strength after reaction (CSR):** CSR refers to coke "hot" strength, generally a quality reference in a simulated reaction condition in an industrial blast furnace. It is one of the major considerations when blending coking coal for export sale. The Prime hard Coking coals have CSR around 65 to 68, 67 is considered to be very good number.
5. **Vitrinite Content:** The value of vitrinite in coking coals is 50% minimum. For soft coking coal the limit is minimum 45%.
6. **Vitrinite Distribution(V9-V14):** The value of vitrinite distribution in coking coal is 70% minimum.
7. **Free Swelling Index (FSI):** Coking coal is best if it has a very narrow range of volatility and plasticity. This is measured by the Free Swelling Index which is a measure of the tendency of a coal to swell when heated under controlled conditions. FSI must be minimum 4 for coking coal.
8. **Maximum fluidity:** The value of maximum fluidity in coking coal is on average is 600 ddpm. Higher fluidity gives better flowing ability in the coke ovens. Very high fluidity coals are normally blended with lower fluidity coals to get optimum fluidity in the blend.
9. **Total Moisture (as received):** It is limited to 10% maximum in as received condition. High moisture creates handling problem and lowers available carbon.
10. **Ash (air dried):** It is limited to 10% maximum in air dried condition. High Ash content reduces BF productivity and increases coke rate in the furnace.
11. **Volatile Matter (air dried):** The volatile matter in coking coal ranges from 20% to 35% in air dried sample. High volatile matter reduces the yield of metallurgical coke in the coke oven battery but improves the coke oven gas generation. The recovery type coke oven mostly use high volatile coking coal and non-recovery types coke ovens use low vol coking coal.
12. **Total Sulfur (air dried):** In coking coal Sulphur is to be limited to 0.6%

maximum in air dried condition. Higher Sulphur in coking coal increases the Sulphur content of hot metal in blast furnace.

13. **Phosphorus (air dried):** Phosphorus content of coking coal is to be limited to 0.1% maximum in air dried condition. Phosphorus goes to hot metal in blast furnace creating difficulties in dephosphorization during steel making.

14. **Maximum Dilation:** The value of maximum dilation is 55% minimum. It depends on the value of maximum dilation of the coal blend components.

15. **Hardgrove Grindability Index (HGI):** HGI is a measure for the grindability of acoal. The smaller the HGI, the harder is coal texture and less grindable is the coal. Grindability is an important factor for the design a coal mill.

16. **Alkalis (Na2O, K2O):** The Alkalis in coking coal is to be controlled at 2% maximum in coal ash. High alkali content is not desirable in BF and also affects the BF lining adversely.

17. **Ash Fusion Temperature (AFT):** In coking coal higher AFT is needed and it should be 1450 degree celcius minimum. AFT in coking coal is to be higher than coking temperature.

18. **Gray King (GK) Coke type:** The value of the gray king is to be G 5 minimum in coking coal. For soft coking coal the limit of Gray king value is G min.

Minutes of the 2nd meeting of IMC held on May 07.05.2021 under the Chairmanship of Additional Secretary (Coal) on augmentation and consumption of domestic coking coal by steel sector.

2nd Meeting of the Inter-Ministerial Committee was held on 07.05.2021 under the Chairmanship of Additional Secretary (Coal) on augmentation and consumption of domestic coking coal by steel sector. List of the participants is enclosed at Annexure.

2. At the outset, Chairman of IMC welcomed all the participants and briefed about the objectives of the meeting. Subsequently, Presentations were made by CMPDI on augmentation of coking coal and Mr. Pankaj Satija, Chief (Regulatory Affairs), Tata Steel Ltd. on the coking coal scenario in the country and way forward.

3. Brief of the discussions held during the meeting are as under-

3.1 Additional Secretary (Coal) enquired from CMPDI that the 6 projects where PRs are yet to be approved, whether all of them are viable or not. It was informed by CMPDI that 5 CCL projects are viable and for the 6th Project i.e. Kapuria of BCCL, IRR is expected to be around 9.7% by MDO mode.

3.2 Additional Secretary (Coal) further enquired from CMPDI whether the 9.63 MT of coking coal capacity where the PRs are yet to be approved and 13.66 MT of tentative capacity in 2029-30 of un-projectised CIL coking coal blocks are part of the projected coking coal production of 105.57 MT of CIL by 2029-30 or not. It was informed by CMPDI that the above mentioned capacities of 9.63 MT and 13.66 MT have not been considered in the 105.57 MT projectized coking coal production of CIL.

3.3 Additional Secretary (Coal) again enquired from CMPDI that whether the 36 non-CIL coking coal blocks to be allocated can be easily explored without any difficulties or not. CMPDI informed that there are CBM overlap issues in theses blocks and the mining conditions are not favourable.

3.4 Mr. Dhagat, EVP, JSPL asked CMPDI to provide the ash%, coking properties and other mine specific details for these 36 blocks for further analysis. CMPDI told that they will categorise the blocks in to opencast and underground and share the GRs of the blocks wherever it is available.

3.5 Mr. Satija informed that Australia contributes more than 70% to India's coking coal imports and therefore there is a risk due to over dependence on Australia for coking coal. Mr. Satija told that to enhance the production of coking coal, private participation in coal block exploration should be considered. Also, the resource classification should be standardised by implementing CRIRSCO (or equivalent international standard) classification for coal inventory in India along with deployment of technology like remote sensing, core open drilling, geophysical and geochemical logging, 2D & 3D seismic surveys etc.

3.6 Mr. Satija presented that as per the Parliamentary Standing Committee Report on Coal and Steel (2020-21), wherever applicable, mining systems like Wongawilli and Longwall Top Coal Caving (LTCC) should be adopted. Also, it is suggested to introduce man riding system to reduce the time spent in travelling and to reduce the fatigue of the workers. Also, the report has projected a shortage of skilled manpower by 2026-27 and suggested a revamped training system.

3.7 He mentioned that as per the Parliamentary Standing Committee Report on Coal and Steel (2020-21), there is no R&D wing in any coal producing subsidiary of CIL and it recommends creation of a R&D wing in each subsidiary and suggested few R&D studies for different subsidiaries of CIL.

3.8 He further mentioned that the report also recommended indigenous manufacturing of UG mining machineries through different modes like PPP or forming a JV etc. and suggested incentivising the UG mining for long term sustainability of coal supply. Mr. Satija also suggested that incentives should be provided to the entities engaged in UG mining by providing relief under GST and providing relief under Income Tax Act.

3.9 Mr. Satija suggested developing a Coking coal aggregator model to setup a large centralised coking coal beneficiation facility which beneficiates coal from a large number of collieries thereby supplying desired grade of clean coking coal to the steel sector and washery by-products to thermal power sector instead of the current practice of entire inferior coking coal being burnt by thermal power plants.

3.10 Mr. Satija suggested that for reducing the ash% while maintaining the similar/higher yield, Intermediate Size Beneficiation (ISB), superior floatation technologies for fine coal beneficiation etc can be used.

3.11 Mr. Satija also recommended that if the coking coal being sold to power plants is washed, then there is a potential to cut approx. 40% of import at current level of production thereby saving close to USD 3 Bn. Therefore, for ensuring maximum utilisation of coking coal, the coking coal currently being sold to power plants may be allocated as long term linkages to washeries established by steel plants interested in washing coal for their exclusive use. Also, suitable augmentation plan should be designed for all existing washeries to enable them to handle all qualities of coal.

3.12 Mr. Satija informed that the supplies of raw coal is at much higher than declared ash% of various grades of coal thereby impacting the clean coal yield %. Therefore, for correct grading, a one-time sample test analysis should be carried out for detailed physiological and rheological properties. Then the average values of this analysis may be compared with reputed publications for segregating each grade. Once segregated as per Platts methodology, index price of that specific coal may be taken as reference for respective grades of CIL coking coal thereby standardising the coal grades and bringing the transparency to the pricing model.

3.13 Mr. Satija suggested that the coke rate in Blast Furnace (BF) can be reduced by tweaking design aspects, BF feed or using alternative fuels. To reduce the coke rate, Natural Gas can be injected into the BF and 1KG of natural gas can replace 1.2KG of coke. Also, agglomerates (pellet, sinter etc.) can go up to 100% in the BF feed to reduce the overall coke rate. 1% agglomerate reduces coke rate by ~1.7 kg/thm. Also, achieving the high hot blast temperature by 100^{o} C will reduce the coke rate by 12 kg/thm and reduction in alumina % in raw materials (mainly iron ore) will also help reducing the coke rate by reducing the slag rate due to low Al2O3 input. Around 100kg reduction in slag rate will reduce coke rate by 15 kg/thm.

3.14 To improve the coking coal quality, Mr. Satija suggested that beneficiation of coal should be done prior to coke making to get the desired level of ash% and moisture%. Preparation of optimum coal blend should be done to obtain the required rheological properties like CSN, fluidity, plastic range etc. For predicting the optimum coal blend, ash analysers, moisture analysers and use of statistical models should

be done. Also, standardisation of coal sampling and testing procedure will also help in improving the coking coal quality.

3.15 Additional Secretary (Coal) asked DS (Steel) to share the detailed action plan of 300 MT by 2030 with Ministry of Coal. It was informed by DS (Steel) that the same has been shared with DS (Coal).

3.16 CCL had sought assurance from SAIL regarding the offtake of washed coking coal from CCL. Additional Secretary (Coal) asked SAIL to give some assurance to CCL mentioning the ash content and other parameters for offtake of atleast some amount of washed coal from CCL.

3.17 Additional Secretary (Coal) also asked whether the 18% ash washed coking coal would be suitable for blending with the imported coking coal or not. Mr. Satija informed that 18% ash washed coking coal is suitable to be used for blending with the imported coking coal.

3.18 Additional Secretary (Coal) informed that steps to improve the quality of coking coal, JV for indigenous manufacturing of UG machineries, R&D plans, future plan for installing washeries etc. will be discussed at length in the next meeting.

Meeting ended with a vote of thanks to the chair.

Annexure:

List of Participants

1. Shri M. Nagaraju, Additional Secretary, Ministry of Coal.
2. Advisor (Projects), Ministry of Coal.
3. Shri A.K. Rana, GM, CMPDI
4. Shri Chanchal Goswami, DT, BCCL
5. Shri Ravinder Bhan, Director (regulatory and Policy), ISA
6. Shri Deepak Sindkar, Head (Procurement), Arceor Mittal Nippon Steel India Ltd.
7. Shri Arvind Rajgopalan, AVP, JSW Steel
8. Shri L.K.S. Rao, ED, SAIL
9. Shri Pankal Satija, Chief Regulatory Affairs, Tata Steel Ltd.
10. Shri Kapil Dhagat, EVP/BU Coal- JSPL
11. Shri Ram Shiromani Saroj, Deputy Secretary, Ministry of Coal.
12. Shri Gopalakrishnan Ganesan, Deputy Secretary, Ministry of Steel
13. Shri Hitlar Singh, Under Secretary, Ministry of Coal.
14. Shri Arvind Kumar, CM, Ministry of Coal.
15. Mrs. Poonam Singhal, DM, Ministry of Coal.
16. Mrs. Tuktuk Bansal, AVP, SBICAPs
17. Shri Gaurav Agarwal, SBICAPs

Minutes of the 3rd meeting of IMC held on May 31.05.2021 under the Chairmanship of Additional Secretary (Coal) on augmentation and consumption of domestic coking coal by steel sector

3rd Meeting of the Inter-Ministerial Committee was held on 31.05.2021 under the Chairmanship of Additional Secretary (Coal) on augmentation and consumption of domestic coking coal by steel sector. List of the participants is enclosed at Annexure.

2. At the outset, Chairman of IMC welcomed all the participants and briefed about the objectives of the meeting. Subsequently, presentations were made by CMPDI on augmentation of coking coal and Mr. Pankaj Satija, Chief (Regulatory Affairs), Tata Steel Ltd. on the coking coal scenario in the country and way forward.

3. Brief of the discussions held during the meeting are as under-

3.1 Mr. Pankaj Satija , Tata Steel informed that to enhance the efficiency and environmental acceptability of coal extraction, International Energy Agency (IEA) has identified groups of Clean Coal Technologies (CCT) during various stages of coal life cycle and these are coal upgrading (mining), efficiency improvements of existing washeries, application of advanced technologies and near zero emission with potential to dramatically reduce GHG emissions.

3.2 Mr. Satija further emphsized that the dilution of coal quality can be reduced by using surface miners which can do selective mining .Surface miners are useful in wining thin inter-bedded coal seams with less dilution of coal and increase ROM quality, especially in areas sensitive to blasting. For preventing the dilution of coal quality due to blasting, drilling and blasting of the overburden and inter-burdens will increase the productivity significantly. But it requires certain geological condition to deploy.

3.3 Mr. Satija informed that the real time quality tracking is important to avoid misinterpretations and dilution of ore with wastes and subgrade that impact quality of ROM and results in poor product quality. It was informed that post 2015, a proactive approach has been adopted for ROM quality tracking by using the mobile app for on field decision making and GPS based remote tracking for loading machines is being done.

3.4 Mr. Satija informed that reduction in floatation efficiency with the Indian coking coal has been observed due to various factors like oxidation of coal surface, insufficient availability of bubbles in the cell etc. and suggested that the R&D should be undertaken to ensure that there is no alteration in coal properties. Also, the R&D may also focus on utilising non-coking coal for coke making by following the process of hydrogenation of coal, blending it with high grade prime coking coal, blending with carbonaceous materials and using inorganic/ organic binders for agglomeration.

3.5 Mr. Satija further suggested that the research can be focused on designing the washing equipment to treat the Indian coal with difficult washing conditions. Also, the research can focus on resolving the issue of misplacement of coal in cyclone washing which is the most widely used separator in Indian washeries, with the help of improved automation and control techniques. He also suggested that R&D efforts should focus on simplifying the washing mechanism with maximum 2-3 stages of washing thereby simplifying the operation and maintenance of the washeries. Also,

usage of different equipment for improving the washability of Indian coal like BATAC Jigs, Variwave Jigs etc. can be researched as well.

3.6 Mr. Satija informed that OECD has initiated a programme called 'OECD Mining Regions and Cities Project' to develop a framework around policies, governance structures and implementation mechanisms related to sustainable raw materials supply, diversification opportunities, and regulatory framework. OECD recommends place based policies with use of region specific assets, creation of complementarities among sector policies at regional level and using multi-level governance mechanisms for aligning objectives and implementation. As part of the diversification efforts, it is also recommended to organise programmes that address information asymmetries and transfer of the business knowledge and skills to entrepreneurs and SMEs. It can be seen that the global value chains in 2000s is following a deepening "smile-curve" for OECD mining regions as the pre and post production intangible activities are adding more value in comparison to the value chain of 1970s and the value added due to the actual production has decreased over time.

3.7 Shri Ravindra Bhan , ISA stated that washed coking coal at 18 % ash is not very suitable for blending. Coking coal with 13-14 % ash will be more useful. This should be looked into.

3.8 Mr. Aravind Rajgopalan, JSW suggested that the companies should focus on exploring a lot more virgin coking coal blocks and not focus on the Jharia coal field only. Additional Secretary (Coal) asked whether the industry is interested in Jharia through MDO mode to which it was responded that there are a lot of challenges in extracting coal out of the Jharia coalfield.

3.9 Additional Secretary (Coal) asked whether the industry is interested in prospecting the coking coal blocks if the terms and conditions are liberalised. Mr. Satija informed that as per the study, for every $1 invested for prospecting operations of a coal mine, $0.55 was generated and hence it is not feasible. Mr. Satija was asked to share the presentation on this study. Also, there are no incentives for doing the exploration of a coal mine and to improve this, policy need to be formulated.

3.10 Ministry of Steel suggested that the exploration for UG mines is important. Also, the prospecting operations needs to be enhanced for better quality and increased quantity of coking coal. Regarding the Jharia coalfield, they suggested that the PPP model may be looked at for extracting the coal out of the coalfield.

3.11 Additional Secretary (Coal) asked whether the industry is interested in washing the coal, if the coal is provided to them for washing. Mr. Satija informed that the some of the players are already washing the coal provided to them. He also suggested that if the large volume of coal is given to the players for some period of time and the per tonne cost of washing is lowered, then the players would be interesting in washing the coal. He also suggested to use the aggregator model for a group of mines where it is not feasible to set up the washeries.

3.12 DT, CIL asked Ministry of Steel to share the action plan for production of 300 MT of steel by 2030. Ministry of Steel informed that they are working on it and will be sharing the action plan by June 06, 2021.

Meeting ended with a vote of thanks by the chair.

Annexure:

List of Participants:

1. Shri M. Nagaraju, Additional Secretary, Ministry of Coal.
2. Advisor (Projects), Ministry of Coal.
3. Shri A.K. Rana, GM, CMPDI
4. Shri Chanchal Goswami, DT, BCCL
5. Shri Ravinder Bhan, Director (regulatory and Policy), ISA
6. Shri Deepak Sindkar, Head (Procurement), Arceor Mittal Nippon Steel India Ltd.
7. Shri Arvind Rajgopalan, AVP, JSW Steel
8. Shri L.K.S. Rao, ED, SAIL
9. Shri Pankal Satija, Chief Regulatory Affairs, Tata Steel Ltd.
10. Shri Kapil Dhagat, EVP/BU Coal- JSPL
11. Shri Ram Shiromani Saroj, Deputy Secretary, Ministry of Coal.
12. Shri Gopalakrishnan Ganesan, Deputy Secretary, Ministry of Steel
13. Shri Hitlar Singh, Under Secretary, Ministry of Coal.
14. Shri Arvind Kumar, CM, Ministry of Coal.
15. Mrs. Poonam Singhal, DM, Ministry of Coal.
16. Mrs. Tuktuk Bansal, AVP, SBICAPs
17. Shri Gaurav Agarwal, SBICAPs

Minutes of the meeting of IMC held on 07.06.2021 under the Chairmanship of Secretary, Coal to review the progress of Coking Coal Mission.

A meeting was held on 07.06.2021 under the Chairmanship of Secretary, Coal to review the progress of Coking Coal Mission. List of the participants is enclosed at Annexure.

2. At the outset, Additional Secretary, Coal welcomed all the participants and briefed about the objectives of the meeting. Subsequently, a presentation was made by SBI Capital Markets on the recommendations of the IMC.

3. Brief of the discussions held during the meeting are as under-

3.1 Mr. Bhaskar Chatterjee, ISA suggested that an action paper should be prepared, and each action point should be mentioned along with the timeline for completion of that action point. It is important to conduct the consultations with the steel sector and the concerned states and stated that Indian Steel Association (ISA) would be interested in facilitating these consultations. He also suggested to examine new technologies for bringing down the ash%.

3.2 Secretary, Coal asked the forum to deliberate on ways to enhance the coking coal production in the country, reasons for lukewarm participation in coking coal blocks in the earlier auction tranches, ways to make commercial auction of coking coal blocks more attractive. He also asked the forum to suggest the ways to enhance the exploration of coal blocks and whether the steel industry players are interested in exploring the coal blocks and whether any relaxation in auction terms is required for making exploration more attractive. He sought suggestions from the industry for extracting coal and extinguishing fire at Jharia i.e. whether the steel industry would be interested in Jharia sites or it should be done in MDO mode etc. He also desired the forum to discuss ways to not only enhance the coking coal production but also other high GCV grade non-coking coal as well which is being imported by the country for utilisation in DRI sector and ways to encourage the players to participate in the commercial auctions for coking and other high GCV grade blocks as well as the washing of the coal. He desired that some way has to be found out to encourage Private industries to wash and sell coal.

3.3 Shri Pankaj Satija, Tata Steel mentioned that R&R is the biggest issue for private sector for undertaking Jharia sites. Further, the blocks offered for auction under MMDR & CMSP Act have huge R&R issues. Industry would be interested in blocks where such R&R issues are not there/ resolved and mineability is not difficult. More information can be shared by Tata Steel on possible R&D initiatives.

3.4 Shri Arvind Rajagopalan, JSW Steel mentioned that the quality of coal available at present does not have the properties suitable for steel making; washing only reduces the ash percent. Increased availability of high GCV non-coking coal for DRI can also help in reducing the coking coal requirement and thus the import. He further mentioned that Investment by Private Sector for exploration in unexplored coking coal blocks would not be not economical. He suggested that the seam-wise

quality of the coal should be made available to the prospective bidders and unless it is known, the viability of the coal blocks could not be determined. Regarding the Jharia sites, he stated that the players are not sure of the exact quality of the coking coal that will come out from the Jharia fire sites and if the coal is not fit for coking, then it will be a major issue.

3.5 Sri L K S Rao, ED, SAIL mentioned that the quality of raw coal and washed coal from CIL is not suitable. Quality is important.

3.6 Director (T), CIL stated that the focus should also be on providing good non-coking coal for Sponge Iron through DRI. He suggested that a platform should be created for regular consultations between the Ministry of Steel, Ministry of Coal, ISA and other players for resolving the issues, if any in a timely manner.

3.7 Director (T), BCCL stated that exploration should concentrate on resources that are at depths that are mineable. As a example he cited the in case of Kapuria, where reserves were shown to be about 190 Million tonnes, but actual mineable was found to be only 20 Million tonnes.

Regarding the Jharia sites issue, he mentioned that the private players / MDO will not be interested in small patches of mine and instead considerable reseve with at least 12-15 years of life should be provided to make it viable.

3.8 CMD, CMPDI mentioned Washery V and Washery VI are not viable/suitable for washing. Even a part of WIV is not washable.He further stated that the integrated mine-cum-washery projects should be planned for increased washing of coal. He also mentioned that the coal quality parameters will be identified for the ongoing exploration works as well. Regarding exploring Mines with washeries, he mentioned that high input cost may jeopardise the viability of washeries. Regarding the Jharia sites, he stated that a policy needs to be prepared for transferring of CBA land to private players. He further mentioned whether the steel sector players are working on redesigning the blast furnace for stamp charging technology and blending upto 35% and requested to give a clear roadmap upto 2030.

3.9 JS (BPP) stated that most of the good quality coking coal blocks are in dense forest zones and discussions need to be done with MoEFCC for the terms and conditions to allow mining of these blocks.

3.10 Additional Secretary (Coal) mentioned that for the unviable sites of Jharia coalfield, viability gap funding (VGF) option can be explored for extinguishing the fires in Jharia. He also suggested that as per a study, the return on the amount invested in exploration is not at all viable and hence the Government of India needs to spend more on exploration through PSUs or other parties. Also, for ensuring maximum extraction of coal from the coal mine, advanced technologies should be imported from other countries.

3.11 Mr. Bhaskar Chatterjee suggested that ISA (in consultation with steel industry) will submit a note on the modifications required in the terms and conditions of the

auctions, additional information which may be provided in the mine dossier and mineablility of blocks. For exploring the partially explored blocks, he mentioned that the players needs to be incentivised by allotting the coal blocks to the player who has done the exploration, if they find it attractive for mining. For enhancing the washing capacity, he suggested that the private players will be encouraged to set up the washeries if they can sell the washed coal as well, rather than just washing the coal. He suggested for Incentivising the setting up of washeries by Private Sector and new technologies to keep the quality of washed coal at 18%.

3.12 Secretary (Coal) suggested that Secretary (Steel) should write to Secretary (Expenditure) for allowing Ministry of Coal to carry on the exploration activities of coking coal blocks and high GCV non-coking coal blocks. Secretary (Coal) also informed that the objective of the Government is to incentivise the exploration and mining activities of coal so that more and more good quality coal can be produced and for ensuring this, a world class exploration regime needs to be prepared by CMPDI with whatever best technology available anywhere in the world.

3.13 Secretary (Coal) also suggested that Jharia sites may be undertaken on PPP basis wherein CIL may use its internal funds created under Jharia Mater Plan @ Rs. 350 Crore per annum to undertake R&R activities and the private sector would undertake coal extraction and fire extinguishment activities. It was further stated that incentives for coal gasification/ liquefaction would be discussed in future meetings to encourage coal gasification / liquefaction which will help in reducing carbon foot print.

Meeting ended with a vote of thanks by the chair.

Annexure

List of Participants:

Ministry of Coal-

1. Dr. Anil Kumar Jain, Secretary
2. Shri V.K. Tiwari, Addl. Secretary
3. Shri M. Nagaraju, Addl. Secretary
4. Shri B.P. Pati, JS
5. Mrs. Vismita Tej, JS
6. Shri S.B. Negi, JS
7. Mrs. Santosh, DDG
8. Shri Animesh Bharti, EA
9. Shri Peeyush Kumar, CM
10. Shri Arvind Kumar, CM
11. Shri Hitlar Singh, US
12. Mrs Poonam Singhal, DM
13. PMC/MoC

Ministry of Steel-

1. Shri Gopalakrishnan Ganesan, Deputy Secretary

Members of IMC-

1. CMD, CMPDI
2. DT, CIL
3. DT, BCCL
4. Shri Ravinder Bhan, Director (regulatory and Policy), ISA
5. Shri Deepak Sindkar, Head (Procurement), Arceor Mittal Nippon Steel India Ltd.
6. Shri Arvind Rajgopalan, AVP, JSW Steel
7. Shri L.K.S. Rao, ED, SAIL
8. Shri Pankal Satija, Chief Regulatory Affairs, Tata Steel Ltd.
9. Shri Kapil Dhagat, EVP/BU Coal-JSPL