

# Coal Vision 2030



**Stakeholders' consultation**

# Stakeholders' comments

- Stakeholders' are requested to provide their comments as per the format below,

S No	Section	Recommendation

- It is requested that comments are provided in MS-Excel (preferred) and/ or MS-Word format.
- The file be named as 'Coal Vision 2030\_Stakeholder consultation\_[Name of Entity].xlsx"
- The comments may be submitted preferably by 30 January 2018
- Comments can be sent to [gmcp@coalindia.in](mailto:gmcp@coalindia.in)

# Key highlights

The coal mining and coal-fired thermal power generation sectors are two of the core industries and together contribute approximately 10 per cent<sup>1</sup> to India's Index of Industrial Production (IIP), affirming their importance to the economy. Further, India's logistics industry, sponge iron industry, aluminium industry among several others, as on date, depend on India's domestic coal industry. Economic activities in three eastern states<sup>2</sup> are significantly dependent on coal. The sector employs about 500,000 people directly and, possibly, the same number indirectly. Hence, the importance of the coal sector in India, not just in terms of energy source for the country but also for the socio-economic role it plays, cannot be denied.

The journey of the coal industry, not just in India but also around the world has been replete with ups and downs. Coal got its lease of life due to the Industrial Revolution in the U.K., in the 1760s. Coal mining in India began soon after in the 1770s in Raniganj coalfield. The early coal mines were owned by the British mercantile firms, Indian private sector players and also state-owned entities like the Railways. Small scale mining operations continued until 1950s when the National Coal Development Corporation (NCDC) was formed with the task of exploring new coalfields and expediting development of new coal mines. The oil shock of the early 1970s and the imperative of growth, forced the then government to evaluate the importance of India's reliance on domestic sources of energy. Therefore in the early 1970s, the coal industry was nationalised to bring about an end to 'slaughter mining' — unsafe practices and lack of investment in suitable technology, which was threatening to lead to a large demand–supply gap. The creation of Coal India Limited (CIL) was crucial at this juncture. By 1991, there was no demand–supply gap for coal in India.<sup>3</sup> Soon after came the liberalisation of India with a clear impact on economic growth. To feed the increased demand for energy, the government decided to allocate coal mines from 1993 to various players for captive consumption. In the meantime, the power sector reforms took place in India including the Electricity Act of 2003 resulting in significant growth of the power sector. In parallel, during 1991–2011, multiple coal mines were re-rated to augment the production capacity. Despite these initiatives, by 2012, the demand–supply gap widened to nearly 137MTPA.<sup>4</sup> While CIL had played its role in modernising the coal industry in the 1970s, the demand–supply gap had again started to widen. The LARR Act, Forest Rights Act, delineation of Go and No-Go areas, etc., also created a situation where expansion of coal mines became challenging. Letters of Assurance were issued to the upcoming power plants that could not be converted into Fuel Supply Agreements (FSAs). Even where FSAs were issued, materialisation remained low. Presidential Directive was placed on CIL to honour its supply commitments through imports, if necessary. Then came the Comptroller and Auditor General of India (CAG) report followed by the Supreme Court verdict in 2014 that overturned the allocation of all coal mines (barring a few) allocated after 1993. Post haste, the government promulgated the Coal Mines (Special Provisions) Act, 2015, and also cleared the deck for the public sector coal companies to increase their production faster. The impact was immediately felt on the ground. Record production growth was witnessed in the PSU sector in FY15 and FY16. Over 70 coal mines were auctioned or allocated through the government dispensation route. As the Indian coal sector seemed to be coming out of the woods, it was seized by simultaneous developments around the world that seemed to indicate that the period of fossil fuels was probably coming to an end.

Technological change, change in environmental and regulatory regimes, global trade and economic ambiguity have jointly created uncertainty in the energy markets. Some of the numerous global and domestic events that have intensified the doubts on the future of coal, are enumerated below:

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<sup>1</sup> 2011–12 series; Weight of coal and lignite is 4.4% and that of electricity is 7.9943%; assuming 75% share of thermal power generation within overall electricity

<sup>2</sup> Chhattisgarh, Jharkhand, Odisha

<sup>3</sup> Annual Plan 1991–92 (refer page 149, paras 7.19 (coal demand) and 7.20 (coal production)) — [http://planningcommission.nic.in/reports/publications/anpl\\_9192e.pdf](http://planningcommission.nic.in/reports/publications/anpl_9192e.pdf)

<sup>4</sup> Working Group Report for Coal & Lignite, 12th Five-Year Plan

- Developments in solar PV and energy storage technologies
- COP21 commitments by India
- Apparent shrinkage in global coal consumption
- Apparent downward revision of the economic growth projections of India<sup>5</sup>
- Response to recent tranches of coal block auctions
- NPA crises, especially in the iron and steel, and power sectors, two major consumers of coal and important sectors linked to economic growth
- Changes in various policies pertaining to the domestic energy sector.

These developments are likely to have significant impact on the coal sector in India. Globally, some of these levers have already started unfolding and altering the business environment. Global coal prices peaked in 2008. Thereafter, the U.S., financial market crisis, combined with slowdown in global trade, has made energy and coal markets lose their sheen globally. In fact, in 2007, there were about 15 fossil fuel companies (oil and gas, and coal mining companies, excluding utilities) in Fortune Global 100, which came down to 10 by 2017, a reduction of 33 per cent. In terms of market capitalisation (one could say that this captures the future even better), the list of top-100 companies in the Forbes Global 2000 has seen the number of fossil fuel companies plummet from 16 to eight in the same period, a fall of 50 per cent. Clearly, if global equity markets are any indication to go by, it seems to be suggesting that fossil fuels have lost favour. The phenomenon is not limited to just top-100 companies. Coal mining companies beyond this list have also slipped in terms of performance and, in some cases, have had to file for bankruptcy.

In the Indian context, such decline may seem far-fetched. However, the world has seen multiple changes in its energy mix and so has India, at different levels. Globally, whale oil was virtually wiped out by rock oil in the mid-1800s. In India, use of charcoal and electric hotplates for cooking went out of fashion when LPG came in. Even in the case of coal industry in India, trends portend that in the long run the demand is likely to decrease substantially. However, the inflexion point is still unknown. With the increasing threat of climate change impacting humanity (irrespective of the U.S. position) and the global funding focus on renewables, it is a matter of time when alternate clean energy would displace coal. Standing in the midst of a change, it is very difficult for anyone to imagine its scale and often most people remain in a state of denial until the change is upon them. To complicate matters further, immediate events such as short-term price movements, out of line with the dominant trend since 2008, have given people the ammunition to argue against a wider and over-arching trend.

In view of above, Coal India Limited (CIL) has commissioned this study to assess the future demand scenarios for the coal sector in India (up to 2030) and identify other material developments. This study is an attempt to formulate vision statement for the coal sector detailing the future evolution and identify key actions.

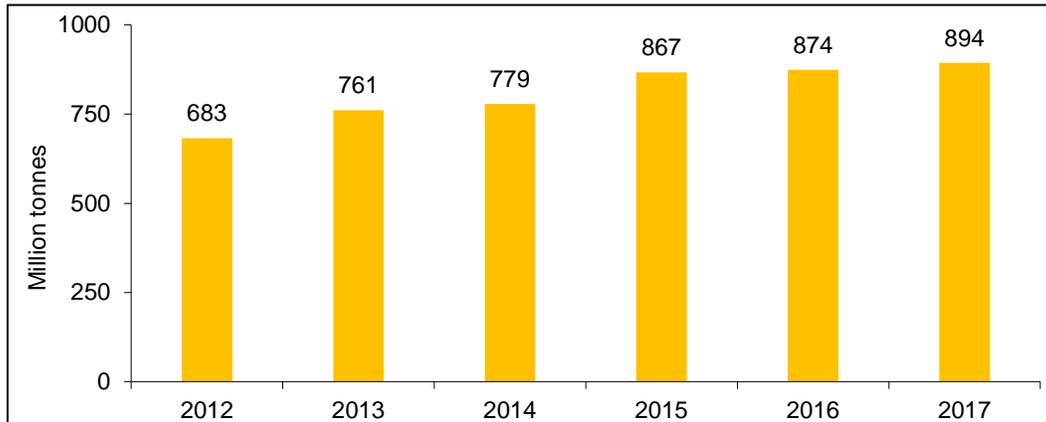
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<sup>5</sup> India still remains one of the fastest growing economy in the World

Captured below is a summary and key highlights of the vision document.

**1 Current status of the coal market in India — strong growth in demand backed by increase in production; evolving regulatory regime**

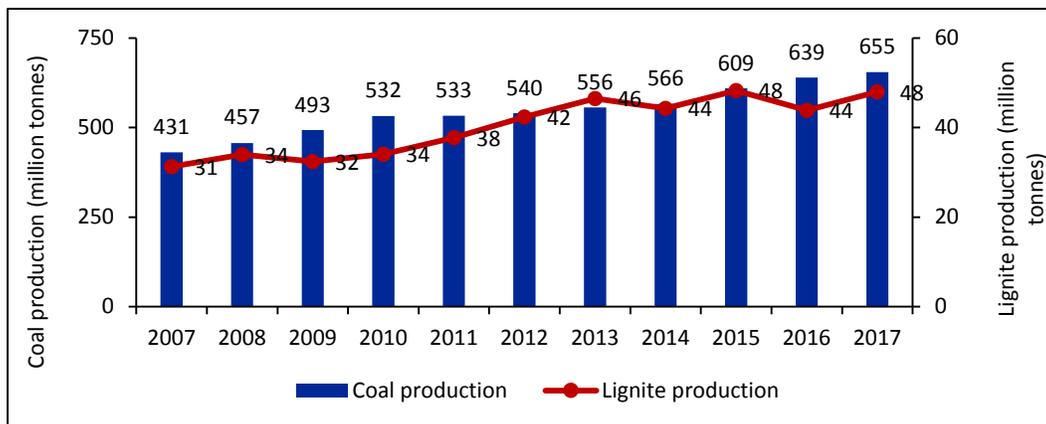
- **Strong growth in demand:** the demand for coal in India has increased nearly one-third in the last five years. The power sector and non-regulated sector, both, have driven the increase in demand.



Source: Ministry of Coal

The power sector remains the key consumer segment with nearly 70 per cent of the overall coal demand.

- **Strong growth in domestic coal production albeit lower than the demand growth:** The domestic coal production has witnessed a significant increase in the last five years. CIL’s production alone increased by more than 100MT, a 25 per cent increase from that of FY11–12. SCCL’s coal production also increased 10MT in the same period, approximately 20 per cent increase. The performance of the overall sector could have been better if not for the captive coal mining segment that underwent complete restructuring during this period.



Source: Ministry of Coal

As evident from the above, the dependence on the import of coal reduced during the period.

Another key aspect of coal supply in India is abundance of relatively lower grades of coal. In case of thermal coal, coal pertaining to GCV range of 3,400–4,600kcal/kg (G10–G13) forms about 69 per cent

of the overall supply. This has implication in terms of competitiveness against imported coal and alternate sources of energy (e.g., solar).

- **Evolving regulatory scenario changing resource allocation and market structure:** Since 2015, the Indian coal sector has seen extensive regulatory changes across the board. The changes were precipitated by a Supreme Court order, which de-allocated all captive coal blocks (except a select few). Subsequently, the government changed the captive coal allocation from 'First Come First Serve' basis to 'Auction' whereby eligible end consumers were required to bid for the coal blocks<sup>6</sup>. The government has also allocated coal blocks to state-owned EUPs for captive use and state mining corporations for commercial mining. Furthermore, the government is also working on the entry of private sector entities in the commercial coal mining space. This is a paradigm change in the policy since the nationalisation of the sector in 1970s. Although initial steps have been taken towards the creation of a competitive coal market in India, any material outcome is unlikely in the near future as CIL is likely to remain the dominant commercial coal supplier in India<sup>7</sup>.

Another key change has been in the coal allocation policy for the coal PSUs. Here, again, the linkages are now auctioned to end consumers as against allocation.

## 2 Exogenous forces impacting the coal sector — dynamic business environment; multiple opportunities, but also significant threat to the coal sector

- **Renewables and storage likely to emerge as key substitutes:** Solar has been rapidly growing for the last two years. The total capacity addition in solar over the last two years has been more than 8GW, an increase of approximately 200 per cent in the installed capacity. Wind has also seen similar capacity addition (about 7GW), albeit on a higher base. The policy push from the government and improving competitiveness are driving the strong capacity addition in the overall renewables sector.

Government has set the target for renewable sources to reach 175GW by FY22. This is more than threefold increase from the current base. Against it, industry stakeholders' perspective is that India is likely to reach about 125GW by 2022 and achieve the 175GW target two–three years hence. However, it is no mean feat and underlines the significant commitment of the government and developers towards renewables in India.

Efficient use of materials, improved manufacturing process, improvement in cell efficiency, and decrease in prices of solar inverters and other ancillary parts in the electrical system are expected to continue driving the competitiveness of solar. The prices are expected to reach about INR1.9–2.0 per kWh<sup>8</sup> by 2025, which is comparable to coal-based generation cost. A still lower range is entirely feasible. Such price levels could drive the substitution of coal-based power sources with renewables.

Another key determinant of the inflexion point would be emergence of storage solutions. Battery storage cost has reduced substantially from over USD1,000 per kWh to about USD250 per kWh over the last few years<sup>9</sup>. With increasing supply and advances in technology, battery cost is expected to go down further to approximately USD50 per kWh by 2030<sup>10</sup>. This may have significant implications on coal-fired power plants in terms of replacing the thermal capacity required to meet the peak demand.

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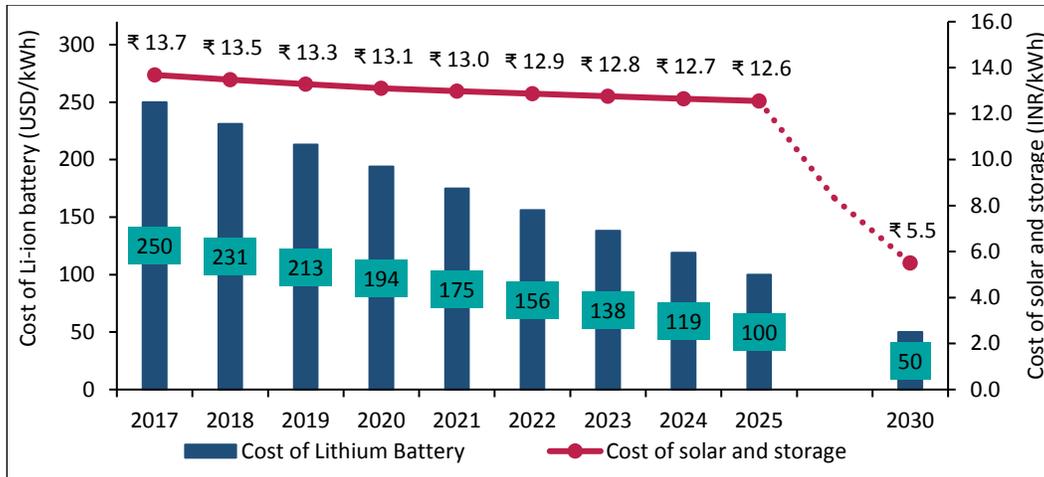
<sup>6</sup> Current regulatory framework allows allocation of coal blocks to government companies alone

<sup>7</sup> While, captive mining may emerge as a significant supply source, it will not impact the commercial supply and related market structure

<sup>8</sup> Note: Assuming a 7 per cent year-on-year decrease in solar prices till 2020 and slower decrease of 5 per cent thereafter till 2025

<sup>9</sup> Industry sources

<sup>10</sup> Source: US Department of Energy, and secondary reports



Source: US DoE, KPMG Analysis

The implication of the above is in terms of increasing shift of consumers to off-grid systems (based on RE generation and storage), pushing the cost of grid supply higher and thereby making coal still more uncompetitive.

- Energy efficiency to be another key substitute (of energy demand, and thereby coal demand):** Electricity demand is strongly correlated to economic growth, although the extent of the linkage depends on a country's level of economic development, the structure of its economy and the extent of access to electricity. Electricity intensity of GDP<sup>11</sup> has fallen for India from 1.8 to 1.2<sup>12</sup>, primarily because of the rise in energy efficiency due to technology advancement and various energy saving initiatives by the government. Similar trend has been seen in other countries as well. The Ministry of Power, through the Bureau of Energy Efficiency (BEE), has initiated a number of energy initiatives in the areas of household lighting, commercial buildings, standards and labelling of appliances, demand side management in agriculture/ municipalities, SMEs and large industries, including the initiation of the process for development of energy consumption norms for industrial sub sectors, capacity building of SDAs, etc. As a result, the intensity is estimated to continue to reduce and potentially reach 0.8 by 2030 reducing the energy demand growth for the same economic growth and thereby reducing the coal demand.
- E-mobility to be a key demand driver of electricity; likely to be positive for coal-based generation:** In India, e-mobility or electric vehicles (EVs) is at a nascent stage. Currently, there are just over 4 lakh electric two-wheelers and a few thousand electric cars on Indian roads. However, EVs have the potential to grow to more than 5 per cent (of annual vehicle sales) in a few years<sup>13</sup>. The Ministry of Heavy Industries and Public Enterprises, under the 'National Electric Mobility Mission Plan 2020', has formulated 'Faster Adoption and Manufacturing of Electric Vehicles' (FAME) scheme to push e-mobility adoption in the country. The scheme envisages a population of 15–16 million electric vehicles in India by the year 2020. It is estimated that EVs could emerge as a key segment in the overall automobile sector. Assuming a market share of 15 per cent by 2030, EVs can result in incremental power demand of nearly 160 Billion units (BUs<sup>14</sup>) by 2030.

<sup>11</sup> Defined as the ratio of total consumption of electricity to gross domestic product

<sup>12</sup> Source: CEA, KPMG Analysis

<sup>13</sup> Source: Society of Manufacturers of Electric Vehicles (SMEV) estimates

<sup>14</sup> Assuming a vehicle travels for 10,000km on an average in a year and requires 0.3kWh of energy per kilometre.

- **Regulatory environment to continue to get stricter, increasing the compliance cost:** Regulatory framework for access and extraction of resources is likely to continue to get stricter increasing the cost of compliance. In 2015, India migrated to auction as a mechanism for allocation of coal resources for extraction. In the Indian context, where supply is deficit and end consumers have made significant investment in the end use plants, auctions are likely to result in bidding beyond feasible limits.

The other aspects which are likely to continue to get stricter are land acquisition, resettlement and rehabilitation (R&R) and environment management. Focus on sustainable mining is greater than ever and, increasingly, mining companies would have to comply with stricter norms. Another aspect of stricter environment norms is the increase in operating cost of coal-based power plants. For instance, in 2015, MoEF&CC/ CPCB issued revised emission norms for thermal power plants in India, which mandated reduction in SO<sub>2</sub> and NO<sub>x</sub> emissions (in addition to suspended particulate matter). It is estimated that the compliance required to meet the revised norms would increase the generation cost by approximately INR0.20–0.30 per kWh. This would also adversely impact the competitiveness of coal-based sources and thereby the coal demand.

- **Extant coal to chemical technologies find limited fitment with Indian coal; focussed implementation and fiscal support required to drive the opportunity:** Established coal conversion processes by Exxon, UOP, Lurgi, etc., have been developed for coal having ash content less than 35 per cent. Comparatively, Indian coal is characterised by high ash content, low calorific value and high ash fusion temperature. This limits the applicability and/ or efficiency of conversion processes with Indian coal. It is therefore necessary to evaluate the sources and availability of coal with low ash content in India. In the case of Eastern Coalfields Limited (ECL), CIL's subsidiary with relatively greater proportion of high quality coal, the capacity of mines producing G1 to G6 grade coal (ash content less than 35 per cent) is about 48MTPA, although the current production is approximately 18MTPA. Higher production from these mines can potentially be utilised for coal to chemicals projects.

In terms of demand, coal to chemical technologies have the potential to grow in to 90–120MTPA of coal demand by 2030<sup>15</sup>. This is based on three end products, namely methanol, urea and dimethyl ether, and driven by import substitution of these products.

However, the actual market would be determined by the viability of the business particularly in the context of low quality coal and natural gas scenarios. The cost of production of methanol is expected to be USD450–540 per tonne, which is higher than the current spot market price of approximately USD290 per tonne<sup>16</sup>. Spot market price of methanol is expected to decline to about USD250 per tonne in 2018<sup>17</sup>. Similarly, in case of urea, the cost of production is expected to be about USD260 per tonne, which is higher than the current global spot market price of USD197 per tonne<sup>18</sup>. Global spot market price of urea is expected to reach nearly USD250 per tonne in 2018<sup>19</sup>. The coal-based urea production in the country may become viable in future as the global spot market price increases and suitable fiscal support is provided by the government to support the industry.

- **Change in power market structure could necessitate the change in coal market structure:** Power markets are likely to turn more dynamic and competitive with implementation of various reforms including Carriage and Content (separation of power supply and distribution networks), market-linked returns and increased competitiveness in the sector. In addition, the continued supply surplus scenario is likely to increase proportion of short-to-medium term power procurement. This would necessitate changes in coal markets including,
  - varying duration of FSAs (long-term versus short-term)

<sup>15</sup> Source: Ministry of Petroleum & Natural Gas, Working group for fertilizers 12th Five year plan, KPMG Analysis

<sup>16</sup> Source: CIBC Research- "Impact of Drought on Fertilizer Demand? - Field Notes - August 20, 2017"

<sup>17</sup> Source: JP Morgan- August 2017

<sup>18</sup> Source: CIBC Research- "Impact of Drought on Fertilizer Demand? - Field Notes - August 20, 2017"

<sup>19</sup> Source: JP Morgan- August 2017

- FSA for merchant generation capacity/ plants with no existing Power Purchase Agreement (PPA)
- evolution of spot market for coal and development of necessary infrastructure (logistics, coal hubs near demand centres to supply in a timely manner)
- pricing of coal (negotiated versus fixed).

### 3 Endogenous forces impacting the coal sector — development risk and technology adoption remain key constraints; favourable cost structure

- **Approvals / clearances continue to remain constrained:** Coal mining in the country is regulated at several levels with the central government, state governments and various local agencies involved in supervising the industry. Several approvals from multiple agencies are required for the commencement of mining operations. However, the process is not streamlined leading to delays and cost overruns. For example, in case of a Schedule II coal mine in Chhattisgarh, award of mining lease was delayed by four months from the planned date, ultimately leading to a delay of more than five months in commencement of production. Similar challenge was observed in another Schedule II coal mine in Jharkhand where the commencement of production was delayed by almost two years.  
CIL in its 1BT plan has also identified approvals to be a key bottleneck in increasing production sustainably.
- **Technology adoption by the coal sector in India is limited:** Indian coal mining sector is still beset with relatively small scale mining with limited mechanisation / scale of equipment. About 50 per cent of CIL's total production comes from 15 mines (all opencast) having a total production of 279MTPA. Remaining 452 mines produce only 274MTPA, approximately 0.60MTPA per mine. Similarly, in case of SCCL, 83 per cent of total production comes from only 14 mines; remaining 48 mines are able to produce only 11MTPA. The small scale mining constrained the extent of mechanisation. Technology adoption in underground mining is even more limited. Approximately 87 per cent of the underground coal mines of CIL are either semi-mechanised or non-mechanised (manual).
- **Operating performance is lower than global peers:** There is a significant gap in productivity norms of similar class of equipment in mines in India and those around the world. For instance, similar class of shovels in international mines are operated 40–50 per cent more hours annually than they are at CIL<sup>20</sup>. Equipment utilisation rates at mines operated contractually have been observed to be better than those operated departmentally by CIL. For example, in ECL, in 2016–17, the utilisation rate of hired excavators was 93 per cent as compared with 73 per cent utilisation rate of departmental excavators.  
This requires much greater focus on operational excellence and asset management practices in the Indian coal mining sector.
- **Favourable cost structure:** In spite of various constraints and challenges, the cost structure of Indian coal sector is favourable. It is estimated that the average cost of production (ROM coal, excluding crushing, sizing, transportation charges and all levies, duties, cess) is about INR1,000 per tonne. Majority of coal production is favourably placed with respect to cost of production except for about 10 per cent of overall coal production.  
However, the coal sector in India is constrained by tax structure and transportation cost. On landed basis, taxes, duties and levies account for up to 25 per cent and freight accounts for up to 34 per cent of the overall coal cost undermining its competitiveness<sup>21</sup>.

<sup>20</sup> Technology Development and Modernization of Mines of CIL, KPMG

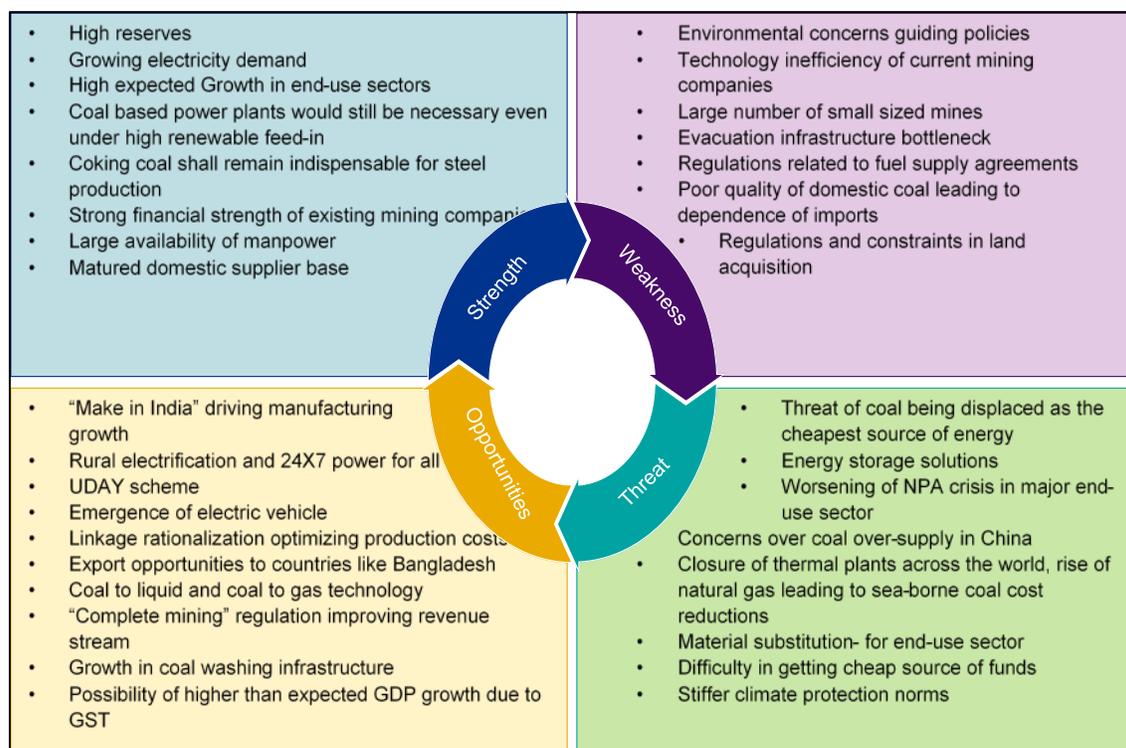
<sup>21</sup> For coal transported at a distance of 500km. This is on the basis of coal prices and railway freight at the time of submission of the draft report

Rail distance	CIL realisation <sup>22</sup>	Taxes, duties and levies <sup>23</sup>	Rail freight
<100km	56%	34%	10%
500km	41%	25%	34%
1,000km	32%	20%	48%

- Improving safety performance, although lower than global peers:** The Indian coal sector has seen improvement in safety performance over the last few years. However, there is a need for further improvement. This implies greater focus and investments is required in safety systems and in better implementation of safety norms. A dedicated effort has to be made to ensure achievement of the goal of zero fatalities and injuries.

#### 4 SWOT assessment

The SWOT analysis of coal would help visualise the relative strength and weakness of Indian coal sector along with the opportunities and challenges that lie ahead. Based on the analysis of exogenous and endogenous forces, following SWOT has been derived:



Strengths and weaknesses are endogenous whereas threats and opportunities are exogenous in nature.

<sup>22</sup> Include the notified ROM price, surface transportation charges and sizing charges at the time of submission of the draft report

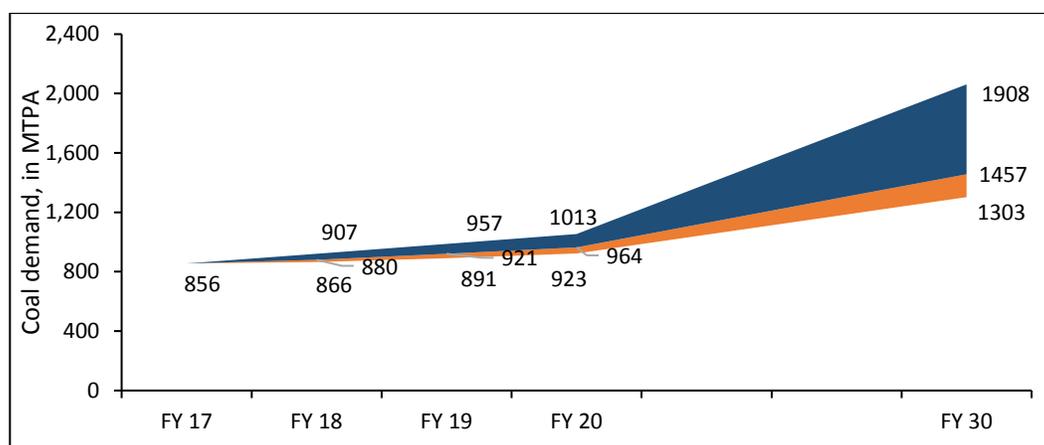
<sup>23</sup> Includes Royalty, DMF, NMET and state taxes assumed at 5 per cent, GST @ 5 per cent and GST compensation fund @ INR400/tonne

## 5 Coal<sup>24</sup> demand assessment

- **Coal to continue enjoying demand for some more time in India:** Even in the most adverse scenario, as of 2Q17, it appears that the demand for coal in India, as a source of primary energy, shall expand until 2030 and perhaps beyond. This would albeit be at a lower CAGR of 3 per cent, compared to 6 per cent in the last five years (in the low sentiment scenario).

Overall coal demand is estimated to be 900–1,000MTPA by 2020 and 1,300–1,900MTPA by 2030. The demand scenario is influenced by economic growth, energy efficiency and emergence of alternate coal uses. By 2030, of the overall coal demand, thermal coal demand is estimated to be 1,150–1,750MTPA and the balance is coking coal demand. While this appears to be a very wide range, the nature of uncertainties in the ecosystem are also quite wide.

The upper end of the spectrum of the coal demand corresponds to a GDP growth rate of 8 per cent. The lower end of the spectrum of the coal demand corresponds to an energy efficient scenario. While the recent quarterly estimates of the GDP are lower, it is believed that this is a result of the recent discontinuities like demonetisation and GST transition. As the positive impact of these changes start to pan out, it is expected that by next year, the GDP may improve to 7 per cent.



However, one potential discontinuity that may reduce the coal demand still lower is the shift of consumers *en masse* to off-grid systems driven by viability of solar and storage combine. In the current demand scenario, greater contribution from solar and larger RE has been assumed. However, it still does not cover the possibility of consumers increasingly shifting to off-grid system driven not just by cost considerations, but also climate and sustainability considerations. In such a scenario, the tipping point may occur prior to cost breakeven and irrespective of the existing grid-based capacity (fixed cost being sunk, the comparison would be with variable cost alone). Other drivers that could see sharper fall in storage cost, greater energy efficiencies, etc. On the other hand, greater than expected growth in the manufacturing sector, overall economic growth or delayed growth of renewables and/ or storage may lead to higher coal demand.

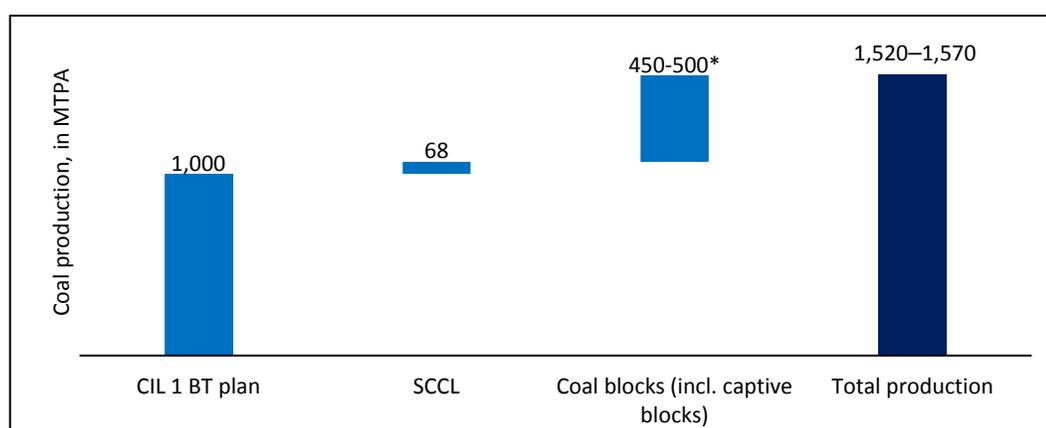
It is futile to project beyond this period in such a dynamic environment. Instead, it is recommended that every three years, the progress of key technologies that may alter the energy-mix dynamics need to be assessed and technological impact on coal demand be ascertained. A greater coordination between various end-use ministries and key consumer groups is recommended to closely track the demand evolution.

<sup>24</sup> Coal and lignite

- Coal demand growth in non-regulated sector to be higher than regulated sector (power):** the estimated growth in coal demand from non-regulated sector at ~6% CAGR up to 2030 is higher than the estimated demand growth in the regulated sector (~3% CAGR). However, the regulated sector will continue to be the largest coal consumer with two third contribution. This will require a reconsideration of priority (lack of) of coal dispatch and coal pricing to non-regulated sector.

Steel sector including CPP will be one of the key coal consuming sector in India<sup>25</sup>. The coking coal demand from the sector is estimated to increase to 140-160 MTPA by 2030 as against the current demand level of 60-70 MTPA. In absence of material growth in domestic coking coal supply, steel sector will be increasingly exposed to vagaries of international coal market. This would warrant increased focus on optimization of existing coking coal reserve in India, implementation of Jharia Action Plan and acquisition of international coking coal assets by coal PSUs.

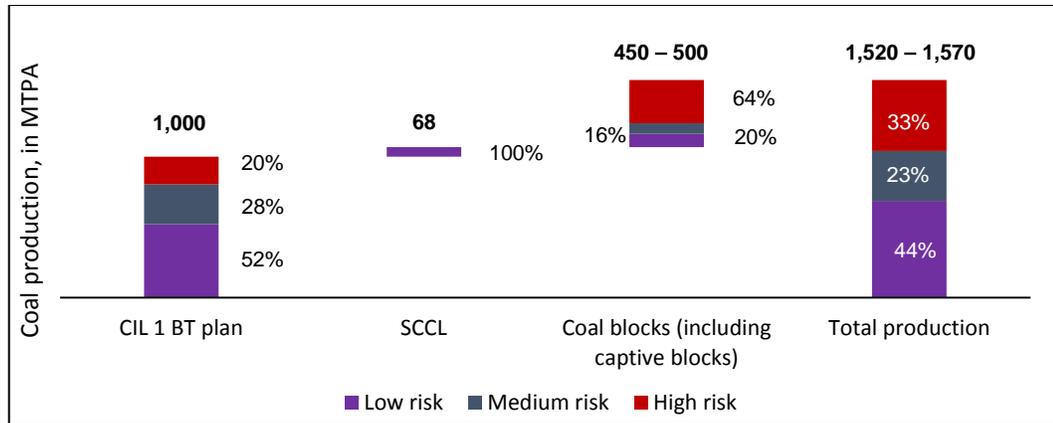
- No new coal mines need to be allocated/ auctioned beyond the current pipeline:** The total capacity of mines allocated/ auctioned (including to CIL, SCCL and NLCIL) as on date is about 1,500MTPA at the current rated capacity. In view of the likely demand (base case scenario), there is limited requirement of starting new coal mines except the ones already auctioned/ allocated.



In the scenario where actual demand is higher, focus could be laid on brownfield expansion of mines or re-rating of mines based on the R/P ratio of each mine. Although there is limited business case for new mines in the immediate future, say 2022–25 horizon, it may be advisable to monitor the growth in coal demand and decide on new mines accordingly.

- In short term, coal production is likely to be significantly lower than the potential, although demand may be met:** Majority of the mines currently auctioned / allocated (including CIL, SCCL) are scheduled to be completed by FY20. However, delayed clearances, land acquisition problems, R&R issues, evacuation constraints, etc., can delay materialisation of these plans. Based on the latest status updates, it is estimated that 33 per cent of the capacity is at risk of delay. Hence, the estimated coal production in short term, FY20–22, is 1,050MTPA which is comparable to the demand.

<sup>25</sup> Based on National Steel Vision 2030



Production from captive mines is particularly at risk. More than 100 blocks have been allocated (auctioned/ allotted) for captive and commercial mining till date. These blocks are estimated to have an overall capacity to 450–500MTPA. Based on the current status of these blocks, it is estimated that captive/ commercial coal blocks may contribute 90–170MTPA by FY20.

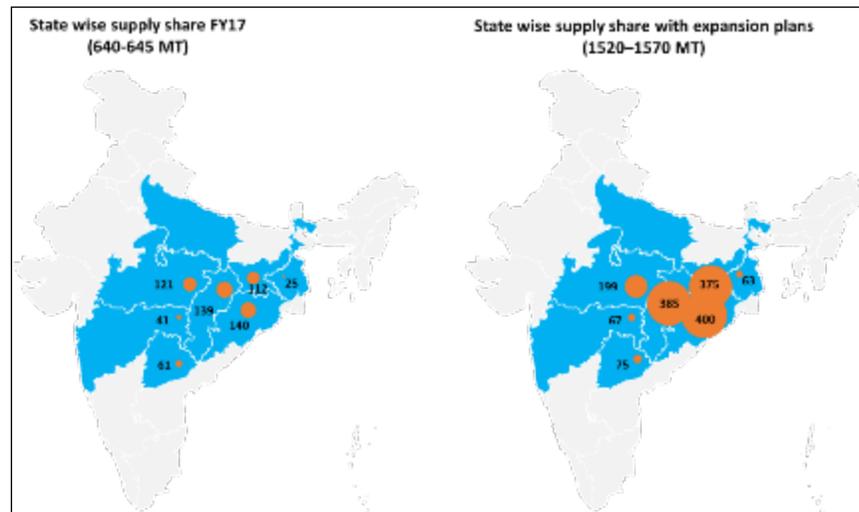
However, this does not exclude the possibility of coal deficit at consumers' end driven by evacuation constraints, marketing policies and mismatch between regions of production vis-à-vis consumptions. Coal mining companies need to ensure continuous monitoring and portfolio planning to avoid coal deficit.

- Adverse geology can constrain the competitiveness of future coal production:** stripping ratio in India is worsening leading to increased cost of production. It is estimated that weighted average strip ratio for MCL would increase from 0.9 to 1.4 under the 1 BT coal production plan. Similarly, the weighted average strip ratio for NCL is estimated to increase from 2.8 to 4.0, and for SECL, from 1.2 to 1.9. This would lead to increase in cost of production. On the other hand, the grade of coal is worsening. MCL typically has reserves and production in the G13 grade. With increasing share (27 per cent) of MCL in the overall CIL production, low grade coal is expected to increase in the overall production mix. Assuming similar grade mix for each subsidiary as in FY16, the share of G13 coal in the 1BT production plan is expected to go up from 23 per cent to 26 per cent. Therefore, with increasing cost of production and lowering of grade, the competitiveness of coal would get increasingly constrained.

This does not take into account the increase in capital cost due to revised land acquisition policy and overall inflation. Compared to alternative sources, particularly solar, coal could be increasingly disadvantaged.

- Captive coal blocks may be underutilised due to issues of end consumer sectors:** As cost competitiveness is expected to drive demand, coal blocks which may have landed costs higher than the alternate sources of coal available for the end user plant (EUP) may face constraints in production. An estimated capacity of 180–200MTPA is expected to face this challenge due to inherent challenges such as higher stripping ratio, higher cost of land acquisition, etc. Furthermore, an additional 20–25MTPA of capacity may face constraints due to the high premium quoted in the coal block auctions in spite of being inherently viable. Therefore, it is estimated that the production from this segment can be constrained to 270–325MTPA from the blocks allocated till date as against the total capacity of 500MTPA.

- Logistics infrastructure is likely to emerge as a key bottleneck:** Coal resources in India are available in only six–seven states in the country, of which 80 per cent is concentrated in four states. With the existing expansion plans in place, the supply concentration is estimated to get further concentrated in eastern states. For instance, coal production in Jharkhand is estimated to treble by 2030 from the present level of approximately 110MTPA today.



Source: CIL, MoC, KPMG Analysis

Map for illustrative purposes only; does not indicate actual boundaries. Not to scale

This rapid growth in production has to be supported by adequate infrastructure for loading, handling and transportation. Since the gestation period for railway projects are longer, it is recommended that long term planning is undertaken and key infrastructure facilities are implemented.

- Import is likely to emerge as the key substitute for domestic coal supply:** Most analysts expect Australian coal prices to reduce to USD60 per tonne by FY30, and the corresponding price for Indonesian Ecocoal to be USD30–40 per tonne (on the basis of the historical gap between high grade and medium grade coal). It is estimated that such price levels may drive as much as 200MTPA of coal demand towards imported coal, logistics permitting. This may happen due to cost pressure on domestic mining sector (due to worsening stripping ratio and manpower costs) and regulatory costs/ taxes, and the upward bias in railway freight. Unless costly mines are retired and price of coal accordingly corrected downwards, although the overall coal demand may grow in India, the domestic supply may remain stagnant or even fall. In the adverse demand scenario, assuming such level of import, the coal demand for domestic suppliers would be lower than the current levels. Therefore, it is imperative that much greater focus on cost competitiveness of domestic coal is ensured in order to retain competitiveness.

## 6 Focussed strategy to coal production is required to drive sustainable growth

- It would be important for India to ensure that this expansion from FY17 coal-production of 700MTPA to the minimum demand requirement of 1,300MTPA, be entirely low cost. That is by 2030, 1,300MTPA of production should come from large mechanized open cast and highly mechanised and large underground mines. Within this category of large, highly mechanised and low cost mines, brown-field expansion may be prioritised to minimise investment in supply chain and socio-environmental disruption. This number has to be seen in the context of CIL's clear path of expansion of up to 908–

925MTPA. Adding the other capacities and plans (SCCL, allocated coal blocks, etc.), India has a clear inventory of about 1,500MTPA ready to be mined before 2030.

Beyond 1,300MTPA, the aspiration towards 1,900MTPA has to be fulfilled in parts. This partial fulfilment is needed to absorb some of the existing higher cost capacity that may have to be continued for social reasons and geological considerations. This additional capacity would also allow India the luxury of limited scale-up to bridge the demand–supply gap should actual demand for coal tend towards the optimistic projections on account of slow technological developments or other constraints. The exact calibration of India's target capacity in coal by 2030 should be a function of its risk appetite to handle the trade-off between capital write-off risk of over-capacity and need for job creation on the one hand, and the risk of coal shortages on the other.

Assuming the target capacity is pegged nearly at 1,500MTPA by 2030 by the planners, the gap between 1,500MTPA and 1,900MTPA has to be managed by inventory of new low-cost resources. For the next three years, it is recommended that logistic evacuation projects be conceptualised with an eye towards moving 1,500MTPA with an interim target of at least 1,300MTPA, since the time period of railway and waterway infrastructure build-out is more than that of coal mine build-out. In addition, CMPDIL and CIL need to pursue project planning and clearances for the next three years with an eye towards achieving at least 1,500MTPA. Furthermore, persistent efforts have to be made to phase out costly capacities above 1,300MTPA continuously and replace them with less costly capacities. This would give longevity to this planned surplus capacity.

- It would also be imperative to look at 'low-cost production capacity' from the standpoint of 'low landed cost of power to end consumers'. If a low-cost coal mine has to transport coal to a distant and inefficient power station, then the benefit of the low-cost production capacity is lost. Hence, it is imperative to look at system costs going forward. Other than for strategic considerations, it can also be empirically stated that India should move towards pit-head thermal power capacities instead of load-centre power stations. This can have implications on environmental pollution of coal-belts and, hence, investment may have to be stepped-up in terms of R&D investment in carbon sequestration efforts. Historically, coal mining companies have invested lesser in R&D for carbon sequestration, and other clean coal technologies in comparison to power utility companies. The last few decades may prove to be the lost-decades in terms of global coal sector's efforts in this direction. However, it has become imperative for coal companies to give serious consideration to these efforts to address business continuity, while they still can. If the amount of R&D funds that are now being attracted into solar would have been invested in the last few decades into carbon sequestration globally, this exercise may not have been required.
- Another important area of action for the government is to create an enabling policy that accords flexibility to the coal sector to deal with the uncertainties that are looming in the future. These policy changes are needed in both the coal and power sectors. Some examples are given below —
  - Sectoral allocation of coal can be left to coal companies, including SMDCs
  - Flexibility in coal offtake for IPPs without linking it to medium-to-long term PPAs may be needed
  - Flexibility in production may be extended to captive mine holders as well
  - Captive mine holders may be provided option to exit the business as several mine holders have been struggling to bring the capacities online with questions over their viability. This has been due to several factors such as mines having inherently high cost structures, insufficient time and transparency by prior allottees for diligence before bidding or taking over the mines, inability to utilise the coal in their end-use plants due to business reasons and availability of cheaper coal in the market. However, this can be implemented only if supplies from the alternate sources including coal PSUs in the immediate term pick up.

## 7 Functional visions critical to achieve overall targets

The coal production strategy will have to be supported with vision for specific functional elements so that there is a comprehensive approach to the overall growth of coal sector in India. The key functions and the corresponding goals are presented herein below. Subsequently, some of the specific action items are presented. This is the broader framework for the evolution of coal sector to a sustainable future. It will be imperative for all stakeholders to closely monitor the change in business environment and determine priority/ additional actions items over the next few years.

- **Vision for core functional elements:** the key five core elements of the coal mining sectors and corresponding goals for 2030.

 <b>Policy</b>	 <b>Demand growth</b>	 <b>Coal supply</b>	 <b>Supply chain/ Logistics</b>	 <b>Sustainability</b>
<ul style="list-style-type: none"> <li>• <b>Less government – more governance:</b> simplification and rationalization</li> <li>• <b>Smart governance:</b> technology enabled processes</li> <li>• <b>Facilitating competitive markets:</b> greater transparency in coal access and pricing</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Promote sustainable coal consumption</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Reduce development risk:</b> simplify project development to reduce risk</li> <li>• <b>World class exploration:</b> focus on better understanding of resources</li> <li>• <b>Zero Import:</b> zero deficit based import</li> <li>• <b>Plan for least cost of supply:</b> enable low cost mines</li> </ul>	<ul style="list-style-type: none"> <li>• <b>No coal at stock:</b> adequate siding and rail infrastructure to move coal produced</li> <li>• <b>Closer to consumer:</b> shift from 'mine side' to 'delivered' mindset</li> <li>• <b>Lowest cost delivery:</b> find alternatives to reduce freight cost</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Go green:</b> minimize the carbon footprint and waste discharge from coal mining</li> <li>• <b>World leading practices:</b> leading practices and processes to enable sustainability</li> <li>• <b>Optimize operating footprint:</b> and thereby limit the social and environment impact</li> </ul>

- **Vision for ancillary functional elements:** the key additional five elements and the corresponding goals for 2030.

 <b>People and skills</b>	 <b>Technology, innovation and R&amp;D</b>	 <b>Customer experience</b>	 <b>Safety</b>	 <b>Coal PSUs</b>
<ul style="list-style-type: none"> <li>• <b>Focus on Learning &amp; Development:</b> coal sector is evolving and according new skills need to be created</li> <li>• <b>Technology enablement:</b> ensure technology to reduce fatigue and ensure safety</li> <li>• <b>Inclusive policies:</b> diversify the employment pool, particularly to women</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Mechanization and automation:</b> greater implementation of new age technologies; manual mining to be extinct</li> <li>• <b>Enabled ecosystem:</b> development of overall sector capabilities for successful implementation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Zero quality slippage:</b> zero tolerance to quality slippages</li> <li>• <b>Focus on coal washing:</b> viable coal washing industry</li> <li>• <b>Dynamic market:</b> greater flexibility in coal pricing and access</li> <li>• <b>Flexible Coal Distribution Policy:</b> enable access for all consumer groups</li> </ul>	<ul style="list-style-type: none"> <li>• <b>World leading practices:</b> simplification and rationalization; global collaboration</li> <li>• <b>Digital processes:</b> data enabled decision making</li> <li>• <b>Optimize operating footprint</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Production increase</b></li> <li>• <b>Increased efficiency</b></li> <li>• <b>Increased employee satisfaction</b></li> <li>• <b>Greater consumers satisfaction</b></li> <li>• <b>Diversification to new business areas</b></li> <li>• <b>Sustainable operations</b></li> <li>• <b>Greater exploration</b></li> </ul>

- **Action items:** some of the specific actions items are presented below:

- **Policy: enabling a simpler regulatory mechanism focused on leading processes, data driven decision making and increased use of technology**

Levers	Key activity	Measure	Timelines
<b>Regulator</b>	1. Establish Coal Regulator with clear mandate to enable competitive market structure in coal sector in India ( <i>potential overlap with CCO</i> ).Focus on proposed regulator to include, inter-alia, <ol style="list-style-type: none"> <li>Long term demand - supply planning</li> <li>Coordinate with MoC, MoR and other concerned ministries for related logistics planning and continual linkage rationalization</li> <li>Benchmark globally and prescribe efficiency parameters for coal mining in India</li> <li>Review and approve mining scheme for coal mines in India</li> <li>Review performance of coal mining companies in India including technical and cost performance</li> <li>Regulate pricing of coal as per the policy framework stated by MoCI</li> <li>Maintain the domestic coal price index</li> <li>Review and approve Coal Distribution Mechanisms for coal PSUs and commercial mining companies as per the extant policy framework stated by Gol</li> <li>Formulate and implement coal quality mechanism; preside on disputes between suppliers and consumers</li> <li>Collect, analyse, maintain and disseminate statistics related to coal mining sector in India</li> </ol>	1 Enactment of Coal Regulatory Authority Bill (amended as deemed necessary by MoC)	2018-19
<b>Single Window Clearance</b>	1. Establishment of a technical committee for rationalization, standardization of all approvals (Central, State level) for opening of coal mines in India	1 Establishment of the committee	December 2018

Levers	Key activity	Measure	Timelines
	<p>2. Creation of an empowered body with representation from all concerned central ministries and nodal office to act as, inter-alia</p> <p>a. Single nodal point for submission of all application for various clearance and approvals and related supporting document</p> <p>b. Interface between various central and state agencies and mine owners for requisite approvals</p> <p>c. Implementation agency for an IT Platform for submission and disposal of applications for various approvals, clearances, supporting documents, clarifications, monitoring of progress and roadblocks. The platform may be gradually expanded to include operational monitoring of mines including DGMS related activities</p>	<p>1 Establishment of the committee</p>	<p>2018-19</p>
<b>UG mines</b>	<p>1 Re-evaluate 'Resource Conservation' as the cornerstone of mining plan for UG mines. Greater focus may be accorded to rate of production and cost of mining</p>	<p>1 Policy notification</p>	<p>2018-19</p>
<b>Digital in governance</b>	<p>1 IT Platform for submission of applications for various approvals, clearances, supporting documents, clarifications, surveillance, monitoring of progress and roadblocks. The platform may be gradually expanded to include operational monitoring of mines including DGMS and coal regulator/ CCO related activities</p>	<p>1 Preparation of Detailed Functional Requirement</p> <p>2 Design, development and implementation of the platform</p> <p>3 Go-live</p>	<p>1. 2018-19 2. 2019-20 3. 2019-20</p>

- **Policy: enabling a competitive and dynamic market bringing in efficiencies in resource access and pricing**

Levers	Key activity	Measure	Timelines
<b>Commercial mining (non-PSU)</b>	1 Finalise the scheme for allocation of commercial mining blocks	1 Scheme and rules for allocation of commercial mining blocks	1. 2018-19
	2 Target 20-25% of commercial coal supply from non-PSUs by 2022	2 Auction of greater reserves to Commercial mining	2. 2018-19
	3 Enable greater flexibility in captive coal mines for disposal of coal (for non-captive uses)	3 Review amendment in Coal Mines (Special Provisions) Act, 2015	3. 2018-19
<b>Flexibility in captive coal block policy</b>	1 Include concerned state government in CMDPA with due responsibilities clearly delineated	1 Policy notifications	2018-19
	2 Enable greater flexibility in production and dispatch of coal from captive mines	1 Policy notifications	2018-19
	3 Re-evaluate auction methodology including options like Revenue Sharing	1 Policy notifications	2018-19
<b>Coal trading platform</b>	1 Establish an online platform for coal trading/transactions in India including spot/ forward auction of CIL, sale of coal by commercial mining companies (private and SMDCs). The platform may focus initially on mandatory reporting and gradually evolve into a trading platform	1 Preparation of Detailed Functional Requirement	1. 2018-19
		2 Design, development and implementation of the platform	2. 2019-20
		3 Go-live	3. 2019-20
<b>Domestic coal index</b>	1 Formulate a domestic coal price index	1 Concept Paper on Domestic Coal Index	1. December 2018
		2 Notify Domestic Coal Index	2. 2019-20

- **Demand generation: collaboration with coal consumers to enable sustainable growth of coal in India**

Levers	Key activity	Measure	Timelines
<b>Invest and Innovate</b>	1 Create a national mission to promote coal consumption from alternate usage (coal gasification, CBM, CMM, etc.)	1 Creation of the mission	June 2018
	2 Enable alternate usage of coal of up to 100 MTPA of coal by 2030 under PPP/ Private mode	1 Identification of mines and standard bidding document 2 International competitive bidding for award of mines	1 2018-19 2 2019-20
<b>Collaborate to minimize the impact of coal consumption (power sector)</b>	1 Increase ash utilization in coal mine filling; collaborate and develop necessary frameworks, infrastructure and cost sharing mechanisms	1 Establish a coordination committee involving MoC, MoP, MoEF and MoR	June 2018
	2 Create a joint forum of key power developers and coal mining companies to undertake investment in R&D for Carbon Capture and Sequestration (CCS) and coal washing technologies in India	1 Establishment of joint forum	2018-19

- **Coal supply:** reduce the development risk so as to enable faster mine development and lower cost; critical in the context of potential variability in the demand and hence, need for increased flexibility in capacity addition (closer to actual demand) to avoid stranded capacity or coal deficit

Levers	Key activity	Measure	Timelines
<b>Land Acquisition, R&amp;R</b>	1 Expand The Coal Bearings Areas (Acquisition and Development) Act to all coal blocks in India (irrespective of the coal mine owner)	1 Policy notification	2018-19
	2 Exempt surface right acquisition in case of UG mines based on land use, geology, mining scheme, mining technology etc.	1 Policy notification	2018-19
	3 Central and State Government to undertake comprehensive R&R Master Plan for all key coal producing areas (based on CIL projects and captive/ commercial mines). The study to include, inter-alia, SIA, identification of alternate land for R&R, business model for R&R and compensation mechanism	1 Completion of study	2018-20
	4 Formation of Centre/ State/ District level committees/ task force with representation of state government agencies, MoC, coal mining companies and other key agencies to coordinate, monitor and expedite land acquisition	1 Policy notification	2018-19
<b>Environmental Clearance/ Forest Clearance</b>	1 Government to offer coal blocks (auction/ allocation) with a time bound EC/FC clearance window	1 Policy notification	2018-19
	2 Allow cash deposit against land for compensatory afforestation for private sector coal mining companies	1 Policy notification	2018-19
	3 Integrate public consultation process for land acquisition and approvals. Exempt consultation in case of minor modifications in the plan	1 Policy notification	2018-19
	4 Undertaken EIA/ EMP Master Plan for key coal producing areas. Individual mine development to be integrated with the Master Plan	1 Completion of study	2018-20
	5 Define templates ToR for typical OC and UG mine types in India	1 Design templates	2018-19

- **Coal supply: leading exploration practices, adequate production to minimize coal imports and portfolio approach to minimize cost of supply**

Levers	Key activity	Measure	Timelines
<b>Standardize resource classification</b>	1 Implement UNFC classification (or equivalent international standard) for all coal inventory in India	1 Notify the requirement	June 2018
<b>Development exploration</b>	1 Mandate development exploration and revision of Geological models for all critical operating mines in India	1 Policy notification	2018-19
<b>Technology deployment in exploration</b>	1 Increase adoption of remote sensing, core open drilling and geophysical and geochemical logging (as against dominant core hole drilling), 2D and 3D seismic survey	<i>On rolling basis</i>	2018-22
<b>Increase short term supply</b>	2 Constitute Coordination Committee with concerned state government for critical coal projects (OC $\geq$ 5 MTPA; UG $\geq$ 1 MTPA) including CIL projects and captive coal blocks for expediting approvals, land acquisition and other activities  3 Alternate pricing mechanisms to be explored for coastal plants	1 Identification of projects  2 Formation of coordination Committee	1. June 2018 2. December 2018
<b>Long term capacity planning</b>	1 <b>Project planning:</b> Project planning in line with 1,900 MTPA of coal supply by 2030 including a. Identification of projects b. Exploration and preparation of geological model c. Preparation of Pre-feasibility Report d. Approvals  2 <b>Project development:</b> project development in line with minimum 1,300 MTPA of coal supply by 2030 including, a. Identification of projects b. Land acquisition and R&R c. Detailed Project Report d. Mine development	1 Formation of Planning Committee with representation from MoC, MoP, MoR, Niti Aayog, MoRTH, MoS&IW, Coal Consumers Association, Coal Producers Association, Coal PSUs	Progressively; 2019-20

Levers	Key activity	Measure	Timelines
<b>Logistics planning</b>	<ol style="list-style-type: none"> <li>1. <b>Logistics Master Plan:</b> Formulation of logistics plan in line with evacuation capacity of 1,500 MTPA by 2030 including               <ol style="list-style-type: none"> <li>a. O-D analysis Identification of arterial/ trunk capacity and related projects</li> <li>b. Identification of business model (IR, PPP, coal PSUs) for such projects</li> <li>c. Detailed Feasibility Report</li> <li>d. Award/ Implementation of projects</li> </ol> </li> </ol>		
<b>Coking coal</b>	<ol style="list-style-type: none"> <li>1 Jharia Action Plan: Expedite implementation of JAP</li> <li>2 Evaluate feasibility of a separate BU in CIL for coking coal operations with a dedicated D (Coking)/ ED (Coking) reporting to CMD, CIL. The BU may be spun off in to a separate subsidiary as and when operations achieve maturity</li> </ol>	<ol style="list-style-type: none"> <li>1 Review of JAP including R&amp;R and capital requirement</li> <li>2 Enable PPP in implementation</li> <li>1 Completion of study</li> </ol>	<p>2018-20</p> <p>2018-19</p>
<b>Portfolio planning</b>	<ol style="list-style-type: none"> <li>1. Prioritise projects (up to 1,300 MTPA coal supply by 2030) based on least cost of coal delivered (energy adjusted). Undertake integrated planning for coal mining sector in India (long term and short term planning based on coal mines capacity, cost of mining, grades, logistics constraint and cost, potential consumers) subject to,               <ol style="list-style-type: none"> <li>a. Necessary legislative/ regulatory changes to enable flexibility in coal production and supply from captive mines (<i>refer Policy Vision</i>)</li> <li>b. Supply chain flexibility</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1 Integrated Planning for coal sector in India</li> </ol>	<p>2018-19</p>

- **Supply chain and Logistics: focus on capacity creation and greater value addition (by coal mining companies); target to reduce the freight cost to improve the overall competitiveness of coal**

Levers	Key activity	Measure	Timelines
<b>Last mile logistics infrastructure</b>	1 Implement rapid loading system for mine clusters (CIL and captive/commercial mines) with annual capacity 5 MT and above	1 Project implementation	Progressively; 2019-20
	2 Coal mining companies may plan few centralized coal handling hubs for catering multiple sidings through conveyor. Coal handling plants would also help them supply of sized coal.	1 Feasibility Study for possible locations 2 Project implementation	1 2018-19 2 Progressively; 2019-20
<b>Siding infrastructure</b>	1 All siding to be equipped to handle bottom discharge and tippler discharge type of wagons	1. Feasibility Study for possible locations 2. Project implementation	1 2018-19 2 Progressively; 2019-20
<b>Flexibility in e-auction</b>	1 Allow coal companies for greater flexibility in e-auction in terms of maximum quantity, pricing, end-use etc.	1 Administrative order by MoC	2018-19
<b>Improved operational planning</b>	1 Mandate annual and rolling operational planning for all mines in India, particularly for coal PSUs, to enable stable production profile (adjusted for seasonal variation) and in line with demand	1 Implementation of Integrated Planning system ( <i>progressively across mines</i> )	1 10 MT and above: 2018-19 2 5 - 10 MT: 2019-20 3 All other mines: 2020-21
<b>Hub-Spoke supply model (15-20% coal supply in India)</b>	1 Evaluate techno-commercial feasibility of hub-spoke model for coal supply (focused at small and disaggregated demand, emergency procurement etc.) to ease the burden of planning for consumption, logistics and inventory in a dynamic end use/power market	1 Completion of study	2018-19
	1 Enable longer rake, higher axle load/ wagons with greater capacity	1 Completion of study	2018-19

Levers	Key activity	Measure	Timelines
<b>Mechanization of logistics</b>	2 Ensure close integration of coal logistics with DFC <sup>26</sup> in terms of first mile/ last mile connectivity and adequate siding infrastructure	1 Feasibility Study for possible locations 2 Project implementation	1 2019-20 2 2020-21
<b>Target ~15-20% coal transportation by alternate transportation models, particularly inland waterways</b>	1 Collaborate with IWAI to identify investment opportunities in terminal, first/ last mile connectivity and other infrastructure for increased share of inland waterways in coal logistics, particularly NW1 and NW5	1 Project identification	2018-19
<b>Conveyor belts, ropeway transportation</b>	1. Evaluate feasibility of conveyor belts/ overhead ropeways for coal being transported 10 - 50 km. Facilitate, a. do away with dedicated mine surcharge b. allow change of transportation mode for coal linkage auction (at the cost of consumer) c. greater flexibility in coal swaps (across companies, end-use sector etc.)	1 Completion of study	2018-19

<sup>26</sup> Expected to be commissioned by 2021

- **Sustainability: adherence to leading practices and optimizing the carbon and operating footprint**

Levers	Key activity	Measure	Timelines
<b>Renewable energy in mining</b>	1 Define RPO obligations for coal mines in India	1 Policy notification	2018-19
<b>Zero water discharge</b>	1 Enforce zero water discharge guidelines for all coal mines in India	1 Policy notification	2018-19
<b>Sustainable Development Framework</b>	1 Extend SDF to all coal mines in India	1 Policy notification	2018-19
<b>Star rating of mines</b>	1 Extend star rating system to all coal mines in India	1 Policy notification	2018-19
<b>Phase-out small, unviable mines</b>	1 Plan for progressively phasing out small and unviable mines in India	1 Policy notification	Progressively by FY2021-22
<b>Amalgamation of mines</b>	1 Techno-feasibility study for amalgamation of mines in CIL	1 Completion of study	2018-19

- **People & Skill: become a sector of choice for new talent with focus on training, diversity, adoption of technology; target to improve the productivity and average age of the workforce in the sector**

Levers	Key activity	Measure	Timelines
<b>Reduce total manpower</b>	<ol style="list-style-type: none"> <li>1 Reduction in manpower through natural attrition without losing key skills</li> <li>2 Move away from job for land policies and increase reliance on annuity or other financial commitments</li> </ol>	<ol style="list-style-type: none"> <li>1 Policy notification</li> </ol>	<ol style="list-style-type: none"> <li>1 2018-19</li> <li>2 2018-19</li> </ol>
<b>Skill upgradation</b>	<ol style="list-style-type: none"> <li>1 Develop skills upgradation roadmap in-line with technology developments and upgradations such as remote operations particularly for UG mines, higher degree of mechanization in all mines, continuous R&amp;D regarding automation and increased use of digital mining</li> <li>2 Increased focus on younger staff to be updated with newer technologies</li> <li>3 Building of technical skills amongst potential land losers for them to be able to participate meaningfully in the industry</li> </ol>	<ol style="list-style-type: none"> <li>1 Creation of technical skills upgradation roadmap</li> </ol>	<ol style="list-style-type: none"> <li>1 2018-19</li> </ol>
<b>Improve non-technical skills,</b>	<ol style="list-style-type: none"> <li>1 Strengthening and augmentation of skills in areas such as land &amp; revenue, environment &amp; forest, marketing &amp; sales, project management, etc. through training and integration with academic institutions</li> </ol>	<ol style="list-style-type: none"> <li>2 Creation of a roadmap as per the requirement</li> <li>3 Start of Implementation</li> </ol>	<ol style="list-style-type: none"> <li>2 2018-19</li> </ol>
<b>Increase diversity</b>	<ol style="list-style-type: none"> <li>1 DGMS may review any existing policies that stipulate certain conditions of participation of women in the coal sector in light of increased application of technology. This may be done basis international benchmarking</li> <li>2 Explore employment of other diverse groups like retired and experience coal mining personnel</li> </ol>	<ol style="list-style-type: none"> <li>1 Policy review by DGMS</li> </ol>	<ol style="list-style-type: none"> <li>1 2019-20</li> </ol>
<b>Training infrastructure</b>	<ol style="list-style-type: none"> <li>1 Expand the CoE network for mining education to additional institutes/ agencies in collaboration with foreign research/ academic/ training institutes and/ or OEMs               <ol style="list-style-type: none"> <li>a. technical education ambit to be increased beyond mining technologies to instrumentation, robotics, IT</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>2 Identification of potential entities in India</li> </ol>	<ol style="list-style-type: none"> <li>2 2018-19</li> </ol>

- **Technology, Innovation and R&D: developing ecosystem to enable increased technology adoption in the coal mining sector in India**

Levers	Key activity	Measure	Timelines
<b>Smart mines</b>	1 Identify critical mines (10 MT or above) for coal PSUs for integrated mechanization and automation across the value chain	1 Mine identification 2 Design requirement 3 Project implementation	1. June 2018 2. 2018-19 3. 2019-22
<b>Modernization of OC mines</b>	1 Formulate guidelines/ benchmarks for, a. Standardisation of HEMM for various pit capacities, b. Use of IT and digital technologies for fleet management, inventory, maintenance, safety, etc.	1 Formulate guidelines	2018-19
<b>Modernization of UG mines</b>	1 Plan for phasing out semi-mechanized operations across all UG mines in India ( <i>refer Sustainability Vision as well</i> )	1 Policy notification	Progressively by FY2021-22
	2 Target 10% of coal production by FY22 from large mechanized, UG mines. Conceptualize and implement mechanized UG projects of capacity 5 MT and above; target at least 20 such operational mines by FY22 <sup>27</sup>	1 Identify projects 2 Develop business model (PPP, coal PSU, Commercial mining) 3 Develop mine	1. December 2018 2. 2018-19 3. 2019-22
	3 Evaluate feasibility of a separate BU in CIL for UG operations with a dedicated D (UG)/ ED (UG) reporting to CMD, CIL. The BU may be spun off in to a separate subsidiary as and when operations achieve maturity	1 Completion of study	2018-19

<sup>27</sup> CIL has identified seven PSLW projects and twenty CM projects (Source: WG Report on Coal & Lignite, Twelfth Plan, CIL); same need to be reevaluated and scaled up as feasible

Levers	Key activity	Measure	Timelines
<b>Alternate coal technologies</b>	1 Increase R&D investment in alternate coal technologies (CBM, CMM, UCG, SCG) under public sector/ PPP/ foreign collaboration ( <i>refer Demand Growth vision</i> )	1 Pilots	1 2019-22
<b>Research and Innovation platforms</b>	1 Create a R&D platform, say "Coal Sector Technology and Research Mission of India", for coal mining companies in India and Government to strengthen R&D activities in the sector	1 Creation of the agency	2018-19
<b>Equipment manufacturing</b>	1 Under the aegis of 'Make in India' promote mining equipment manufacturing in India, taking advantage of downturn in coal mining in other countries	1 Define policy - implement modernization studies conducted by CIL before	2019-25; in phases
<b>Centre of Excellence</b>	1 Create CoE focussed at mechanization and automation and digital technologies in mining in collaboration with a leading global organization	1 Identification of the agency 2 Creation of CoE; initial grant from key coal mining companies in India and Gol	1 December 2018 2 2018-19
<b>Facilitating starts-up in coal mining in India</b>	1 Focused sub-program within 'Start-up India', 'Skill India', etc. targeted at coal mining sector in India in the areas of data and analytics, technical advisory, planning & scheduling, etc.	1 Identification of nodal agency for program implementation	1 2018-19

- **Customer experience: ensure strict adherence to quality and strive to deliver value added services to consumers**

Levers	Key activity	Measure	Timelines
<b>Stricter penalty for quality slippages</b>	1 Define guidelines for compensation for grade slippages (for instance, penalty may include reimbursement for cost of coal and punitive damages for proportion of handling and transportation cost)	1 Policy notification	2018-19
<b>Institutional mechanism for monitoring &amp; control, dispute resolution</b>	1 Constitute Coal Regulator Authority ( <i>refer Policy Vision herein above</i> )	1 Enactment of Coal Regulatory Authority Bill (amended as deemed necessary by MoC)	2018-19
<b>Sampling and testing</b>	1 Appoint independent agency for sampling and testing. The same may be empaneled and awarded work by the Coal Regulator Authority.	1 Appointment of agency	2019-20
	2 Augment lab infrastructure at key mining locations. Infrastructure to be owned and managed by the Coal Regulatory Authority. Coal consumers may be charged nominal fees (say, 10 Rs/t) for funding and managing of such infrastructure and appointment of sampling and testing agencies	1 Infrastructure creation	2019-20
<b>Quality management</b>	1 Coal crushing capacity to be enabled at all key mines. Target 80% of coal production to be despatched to be crushed and sized at mine site	1 Implementation of augmentation of crushing capacities to enable 80% crushing	2019-20
<b>Production planning</b>	1 Mandate computerized model based annual and rolling operational planning for all mines in India, particularly for coal PSUs, and declaration of grade on annual basis or more frequently, as required ( <i>refer Supply Chain Vision herein above</i> )	1 Implementation of Integrated Planning system ( <i>progressively across mines</i> )	1 10 MT and above: 2018-19 2 5 - 10 MT: 2019-20 3 All other mines: 2020-21

Levers	Key activity	Measure	Timelines
<b>Capacity creation</b>	1 Undertake coal washing capacity (along with reject based power generation) under PPP mode	1 Feasibility Study for possible locations 2 Project implementation	1. December 2018 2. 2018-20
<b>Dynamic market</b>	<i>Refer Policy Vision as above</i>		
<b>Linkage for Merchant Power Plants</b>	1 Notify Policy for award of coal linkages to power plants with no PPA under the Shakti Scheme	Policy notification	2018-19

- **Safety: zero tolerance to human injury/ fatality driven by leading processes, data enabled decision making, increased use of technology and institutional capacity building**

Levers	Key activity	Measure	Timelines
<b>Regulatory review</b>	1 Review of mine safety regulations/ guidelines particularly in the light of evolution in mining technology and business model (increased outsource). Shift from inspection to self-certification and technology based submission	1 Setting up of committee for review	2018-19
<b>Leading practices</b>	1 Facilitate knowledge management and collaboration platform for sharing of leading practices among mining companies	1 Setting up of KM platform	2018-19
	2 Stricter compliance with safety practices in operating mines. For instance, <ul style="list-style-type: none"> <li>a. use of Personal Protection Equipment (PPEs), for instance use of safety helmets, safety belts, etc.</li> <li>b. haul road safety including safety berms, width of haul roads, etc.</li> <li>c. in underground mines, sufficient lighting, use of safety boots, etc.</li> </ul>	<i>On rolling basis</i>	-
	3 Require coal mining companies to develop comprehensive safety management system based on four key elements, <ul style="list-style-type: none"> <li>a. Safety Management Plan – comprehensive plan based on risk management, training &amp; competence and incident investigation and emergency preparedness</li> <li>b. Strict adherence</li> <li>c. Increase use of technology – for instance, Real time monitoring systems in UG mines, Coal explosibility meters, Strata monitoring systems, Gas detection devices</li> <li>d. Closer monitoring</li> </ul>	1 Define guidelines	2018-19
<b>Global collaboration</b>	1 Facilitate Joint Study Group with other leading mining geographies for review of existing guidelines and development of future guidelines	1 Study tours	Progressively, 2018-20

Levers	Key activity	Measure	Timelines
<b>IT Platform</b>	1 Develop an integrated online safety system for, <ul style="list-style-type: none"> <li>- notifications</li> <li>- submissions</li> <li>- approvals</li> <li>- reporting</li> <li>- compliance</li> </ul>	1 Constitute taskforce 2 Design Functional Requirement 3 Develop and implement system 4 Go Live	1 December 2018 2 2018-19 3 2019-20 4 2019-20
<b>Optimize operating footprint</b>	<i>Refer Sustainability Vision as herein above</i>		

- **Coal PSUs: strong and competitive coal PSUs with capacity to match coal supply with national demand**

Levers	Key activity	Measure	Timelines
<b>Institutional capacity</b>	1 Design and implement self-reliant and independent department for project implementation	1 Detailed design	2018-19
<b>Land Acquisition, R&amp;R</b>	1 Greater flexibility to Subsidiaries for designing of R&R package on case-to-case basis	1 Policy notification	2018-19
	2 Strengthening of L&R department in terms of, - Staffing - Skill up-gradation - Defined career path - Computerization with specialized packages	1 Detailed design	2018-19
	3 Greater use of technology in the processes of “Data management (PAP data, land record etc.)”, “Claim Management”, “PAP tracking”, “CSR communication” etc.	1 Detailed Functional Requirement 2 Implementation	1 2018-19 2 2019-20
<b>Mine planning &amp; scheduling</b>	1 Implement integrated and detailed life of mine, medium-term and short-term planning and operational planning	1 Detailed Functional Requirement 2 Implementation	1 2018-19 2 2019-20
	2 Structured program for peer review of mining plans and geological model within the organization and in critical cases, with external technical experts	1 Policy formulation	2018-19
<b>Drill &amp; Blasting</b>	1 Increased use of ANFO (for coal and OB) <sup>1</sup> , replacing emulsion products in dry holes to reduce cost, increase hole loading rates and improve fragmentation due to use of high heave energy explosives	<i>Case to Case basis as per mine requirement</i>	<i>Rolling basis</i>
	2 Increased use of staggered patterns, increased blast size, use of pre-splitting and deck charge	<i>Case to Case basis as per mine requirement</i>	<i>Rolling basis</i>

Levers	Key activity	Measure	Timelines
	3 Introduction of angle drills and use of diesel-hydraulic systems to reduce toe burden, improve distribution of explosives along face and high penetration rates and will increase operating hours due to ease of relocation	Pilot	2018-19
	4 Use of blast analysis software and Drills with On-board monitoring system	Pilot	2018-19
<b>UG Operations</b>	1 Strengthening strata control practices - setting strata control monitoring cell at area / mine level	1 Setting up of SCM cell	1 Large 10 UG mines - 2018-19 2 Gradually to other viable/critical mines
	2 Installation of man riding system in UG mines to reduce the travel time to face, increase available working hours at face and reduce fatigue in workers	1 Project implementation	1 Large 10 UG mines - 2018-19 2 Gradually to other viable/critical mines
	3 Increased use of ventilation planning software	1 Pilot	2018-19
<b>Surveying</b>	1 Replacement of Theodolite with Total Station at all places, particularly in UG mines and gradual up gradation to adoption of advanced EDM based survey technologies like 3D Laser survey, digital/ electronic Theodolite in OC mines	1 100% Total Station 2 EDM based survey technology	1 2018-19 2 2019-20
	2 Increased use of ground penetration radar for mapping old and water logged working in UG mines	1 Pilot	2018-19

- **Coal PSUs: efficient operations and satisfied workforce**

Levers	Key activity	Measure	Timelines
<b>Institutional capacity</b>	1 Contractor market development	<i>On rolling basis</i>	
	2 Implement Continuous Improvement Program for sustained efficiency improvement in the organization	1 Pilot	2018-19
	3 Implement Procurement Shared Services to increased use of data and analytics, standardization, category centralization, creation of new skills and capabilities in the organization and vendor management program	1 Detailed design	2018-19
	4 Facilitate collaborative procurement platform within Coal PSUs and gradually, with mining PSUs in India to enable greater scale	1 Detailed Functional Requirement 2 Implementation	1 2018-19 2 2019-20
<b>Equipment productivity</b>	1 Enhancing Asset Management and use of EAMS (Enterprise Asset Management system)	1 Implementation at 10 large OC mines 2 Implementation at other mines	1. 2018-19 2. 2019-20
	2 Increased use of mobile crib huts, mobile equipment servicing and refuelling stations and mini-buses to transport personnel; overlapping of shifts, and flexible / additional deployment of people to work equipment through meal breaks	<i>On rolling basis</i>	
<b>Workshop &amp; Lab infrastructure</b>	1 Use of Laboratory Information Management System (LIMS) at laboratories	1 Pilot	2018-19
	2 Strengthening of workshop infrastructure including, <ul style="list-style-type: none"> <li>a. Standard infrastructure for workshops including facilities like wash bays, effluent treatment plant, etc.</li> <li>b. Important tools/ equipment like fork lift, tyre handler, crane, etc.</li> </ul>	<i>On rolling basis</i>	

Levers	Key activity	Measure	Timelines
<b>Competency mapping</b>	1 Map the organization wide competency framework to the key positions to create position specific competency frameworks.	1 Detailed design	2018-19
<b>HR Processes</b>	1 Re-engineer HR processes like performance management, L&D, reward management to enable HR development initiatives like Succession Planning, fast track career development	1 Detailed design	2018-19
	2 Automation of Transactional HR processes	1 Detailed design	2018-19
<b>Talent management</b>	1 Build job rotation, multi-skilling, flexibility in transfer etc. into the employment contracts across levels so that the mobility policies in the sector are in tune with the increasingly dynamic market scenario	1 Policy formulation	2018-19
	2 Institutionalize a fast track career progression program for executive cadre employees based on performance and potential assessment	2 Detailed design	2018-19
	3 Structured Succession Planning	1 Detailed design	2018-19

- **Coal PSUs: greater customer satisfaction, focus on diversification and sustainable operations**

Levers	Key activity	Measure	Timelines
<b>Investment in logistics infrastructure</b>	<i>Refer to Supply Chain Vision herein above</i>		
<b>Geographical expansion</b>	1 Evaluate international coal asset acquisition in the area of coking coal	1 Techno-commercial feasibility	2018-19
<b>Production expansion</b>	1 Evaluate and identify potential minerals for diversification in India and globally	1 Techno-commercial feasibility	2018-19
<b>Capacity building</b>	1 Create Directorate of Sustainability	1 Detailed design	2018-19
<b>Technology modernization</b>	1 Increased use of open-hole drilling and geo-physical logging for achieving higher exploration target with cost efficiency	On rolling basis	

To conclude, it seems that coal has a longer life in India than being apprehended in certain quarters. However, its life is by no means certain and the risk to growth, even sustenance, of the coal sector remains open. Environment impact of coal is also a reality and cannot be wished away. It is imperative for the sector to ensure that there is minimal disruption of environment across the value chain. From the perspective of policy makers, the challenge is to identify the route which maintains a fine balance between demand–supply scenario and capital investment, lest it may be stranded. It is strongly recommended that market developments be closely monitored to ensure that the supply is calibrated in line with the evolving demand. It is critical that the sector is guided through these trying times to avoid supply deficit in the short term and / or stranded capacities in the long term.