FUTURE OF COAL IN INDIA

Will coal be the secret of our energy?

INDIAN CHAMBER OF COMMERCE

CUTS International

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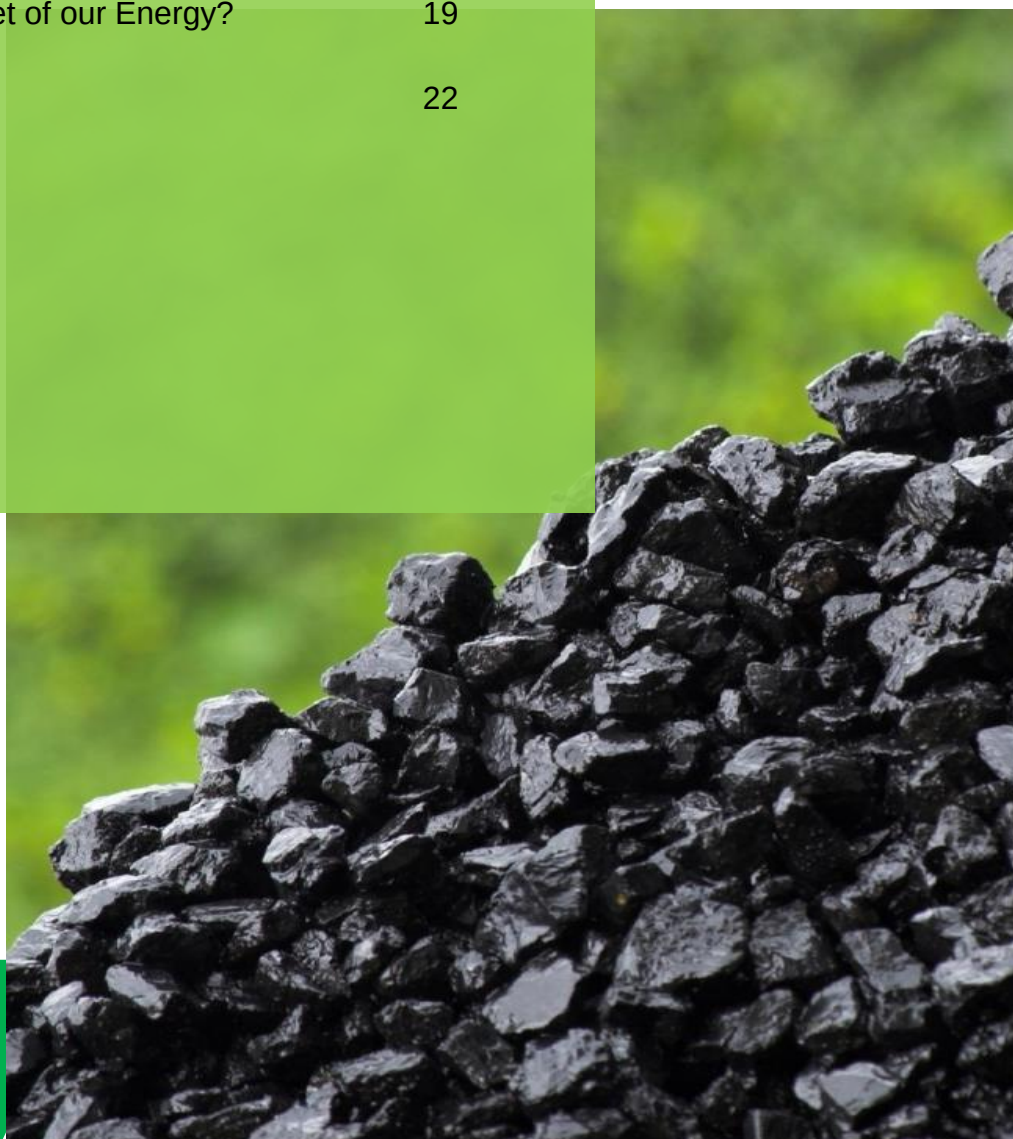


Foreword

The recent Cabinet decision to open up coal mining to commercial miners, who will now have the freedom to sell coal in the open market, is an interesting development.

For decades since its nationalisation, the public sector Coal India Limited (CIL) has dominated coal production in India, producing some 82 per cent of Indian domestic coal, and becoming the largest coal miner in the world by production.

With this latest development, decision-makers expect private players to bring in competition along with private investment, technology adoption and international best practices.

We are aware that when our government is battling the problem of low coal stocks in over 50 power plants in the country, there are other headwinds impacting the coal sector, including the emergence of renewable energy as a viable key substitute, increase in the cost of compliance due to the strict regulatory environment, delays in getting requisite clearances and the resultant cost overrun.

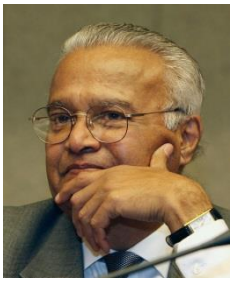
Alongside these, small-scale mining prevalent across the sector with limited mechanisation, low operating performance as compared to global peers and the likely emergence of imported coal as a viable substitute are among the other challenges.

Against this background, **Indian Chamber of Commerce** is organising **10th India Coal Summit at New Delhi on September 26, 2018.** CUTS International is the Knowledge Partner of this initiative.

I trust the conference would be able to generate new ideas and new thoughts among the various stakeholders to discuss, share and evolve suitable strategies and development models.

Dr Rajeev Singh
Director General
Indian Chamber of Commerce

Editor's Note



Coal, being an important source of energy generation, remains preferable to India for fueling its economic growth. Approximately, 70 percent of India's electricity generation is dependent on coal.

In addition, the Indian energy sector has been swiftly evolving and encountered several changes recently. India has envisioned an ambitious target of 227 GW of installed capacity of renewable power generation by 2022. Subsequently, renewable sources of energy have become an irreversible trend with energy tariff as lower as Rs 2.50 per unit.

Thus, it is evident that with technological advancement and rapid decrease in the cost of renewable source of energy, there will be a shift from coal-based power generation to other sources of energy. However, renewable sources have their own limitations and the peak load is expected to be dependent upon the coal-based generation in the near future.

Nevertheless, the coal sector has several structural issues and regulatory challenges. The sector is facing numerous issues, such as lukewarm demand, regulatory bottlenecks, technological disruptions and environmental risks.

In the light of the above, the paper focusses on the *'Future of Coal'* and delves deep to understand the structural issues, regulatory challenges, and technology disruptions in the sector.

Since 1983, Consumer Unity & Trust Society (CUTS International) has been working across sector for more inclusive policymaking processes that supports its vision of consumer sovereignty. This is our second report on the coal sector with ICC. The first report was on competition issues and regulatory architecture of the coal sector.

In the end, I would like to thank Udai S Mehta, Deputy Executive Director, and Arpit Tiwari, Assistant Policy Analyst, CUTS International for contributing in this paper under my overall guidance. We also appreciate the efforts of Madhuri Vasnani for editing, and Mukesh Tyagi and Rajkumar Trivedi for preparing the layout of the report.

Pradeep S Mehta
Secretary General
CUTS International

Executive Summary

In the era of renewable energy, coal will continue to remain the secret of our energy. This is primarily because the energy generation is highly dependent on coal. In addition, it has the multiplier effect on the economy, as it enhances the productivity of the manufacturing industries and leads to the creation of numerous jobs in mining and allied industries.

While both conventional and renewable sources of power generation have a crucial role to meet India's energy demand, but there will be a shift in energy supply mix in the future. Studies suggest that renewable energy is expected to have a share of approximately 35-40 percent by 2035 under business as usual scenario.

This is primarily because the renewable energy sources have increasingly become cheaper and with the innovations in the energy storage technology will ensure stable and reliable energy supply. However, renewable power generation when combined with energy storage systems (ESS) augments the cost of energy supply. However, renewable energy without ESS is an unreliable source of energy as there are fluctuations in supply due to changes in seasonal and weather condition.

On the contrary, coal is a cost effective and reliable source of energy. Most of the coal based power generation plants had attained break-even point and work on variable raw material cost only. In addition, with growing energy demand and increase in per capita consumption, there would be demand for coal-based energy sources.

However, the coal sector is facing numerous challenges, such as inconsistent trends in demand, anomalies in supply leading to inefficient network, among others. In addition, feeble regulatory and policy support for conventional power generation making it extremely difficult for the sector to remain competitive with other sources of energy.

Furthermore, poor financial health of DISCOMs and inadequate Power Purchase Agreements (PPAs) has created a situation of artificial demand scarcity. In absence of PPAs, coal suppliers do not issue Fuel Supply Agreements (FSAs); thus, power plants without PPAs are exposed to coal supply uncertainty. Further, the government policies directly and indirectly facilitate installation of renewable sources power plants.

In addition, the government is planning to covert one-third of automobiles on Indian road to Electric Vehicle (EV) by 2030. With the advent of EVs in the system, there would be the additional demand of electricity. It is expected that additional demand for coal-based generation would be met.

In the light of above, the paper attempts to answers two key questions:

a. *Is coal a source of power will be relevant in the next 5-10 years?*
b. *Given the push for renewables energy, can solar and wind energy co-exist with coal-based energy.*

While it is extremely difficult to forecast the future of coal with any certainty, the attempt has been made to understand the eminent threats and potential opportunities for the coal sector in India (see Table below).

Strengths	**Weaknesses**
High Coal Reserves	Environment Concerns
Ability to support peak demand	Absolute technology
Cost effective, reliable, and affordable energy provider	Sub-standard quality of domestic coal
	Sub-optimal regulations
	Sub-standard supply-chain infrastructure
Opportunities	**Threats**
Advent of Electric Vehicles in the market	Renewable Energy
Optimal Capacity Utilisation - with no additional investments - can boost power exchange markets	Technological advancement - Energy Storage systems
Cross border energy trade	Stricter environment norms
Export opportunities of coal	
Cheaper and reliable energy source	
Advance Clean coal technology	

Based on the above analysis it is reasonable to assume that while coal and renewable sources would be crucial to meet the energy demand. Coal will likely to remain the secret of energy.

However, in order to balance the interests of coal-based power plants against the imperative to increase installed capacity of renewable capacity, key stakeholder wise interventions are recommended:

Government	- Consistent policies to foster investment in the sector - Institutionalise Regulatory Impact Assessment to assess cost and benefits of rules and regulations
Industries	- Invest and setup plants near coal mines
Coal Suppliers	- Enhance labour productivity with use of latest technology - Ensure good quality coal - must adopt measures to check grading of coal periodically
Regulators	- Dire need for the establishment Regulator - Mandate of Central Electricity Regulatory Commission (CERC) could be expanded to govern coal sector

However, in order to stay competitive in the new paradigm, the government should re-evaluate and review the role of coal-based generation going ahead and accordingly adapt policy and operations periodically.

Introduction

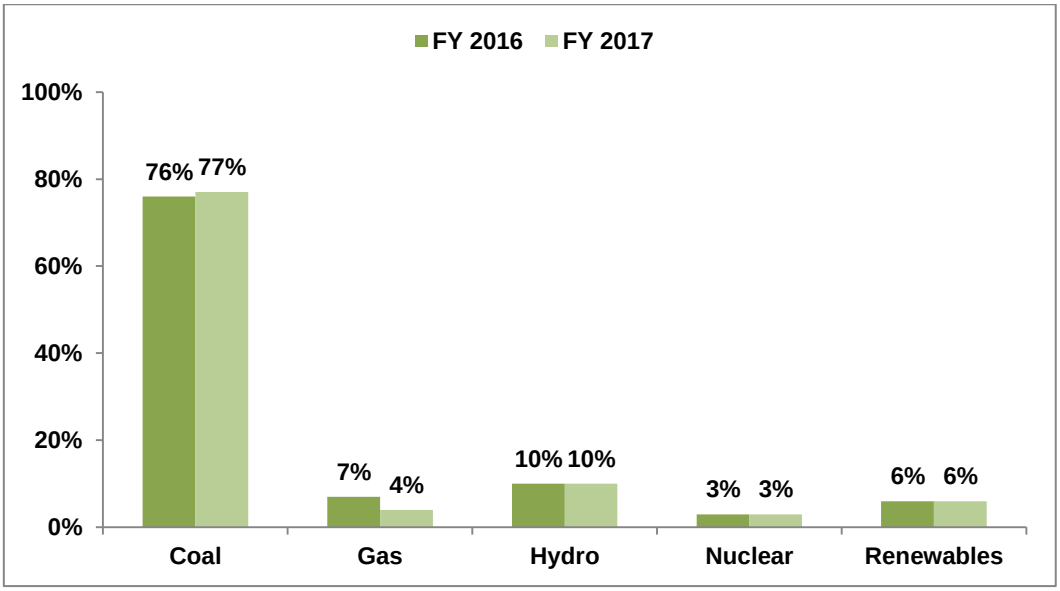
India is resolutely moving on a path of economic growth. The Economic Survey of India[1] has projected a growth rate of 7-7.5 percent in 2018-19. It is also expected that consumption expenditure is set to rise by a factor of three to reach USD 4 trillion by 2025.[2] It is imperative that such economic prosperity should be supported by significant transformations across multiple interdependent elements such as state of the art infrastructure, access to reliable, affordable, and low-cost energy to achieve sustainable growth.

At present, India's per capita energy consumption is 637.43 kg of oil equivalent (kgoe).[3] It is approximately one-third of the world average.[4] However, the per capita energy consumption is expected to increase 128 percent by 2035 with the rise in economic growth.[5] BP Energy Outlook (BPEO) 2035[6] also suggests that India is expected to encounter fastest growth in the energy consumption among various countries in the world. Furthermore, according to the BPEO, to meet such increased energy demand, twice the number of additional energy sources will be required, considering conservative growth scenarios.

The power generation in India is dependent on coal. At present, coal accounts for approximately 70 percent of the total electricity generation.[7] (Figure 1)

[1] https://timesofindia.indiatimes.com/realtime/Economic_Survey_2017_18.pdf
[2] https://www.bcg.com/en-in/publications/2017/marketing-sales-globalization-new-indian-changing-consumer.aspx
[3] https://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE
[4] Id
[5] http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Sustainable%20Energy/wea%202000/chapter11.pdf
[6] https://www.bp.com/en/global/corporate/energy-economics.html
[7] https://coal.nic.in/

Figure 1: Share of Electricity Generation by Type of Fuel



Source: Thomson one, https://www.reuters.com/article/column-russell-coal-india/column-indias-surging-coal-imports-driven-by-captive-power-users-russell-idUSL3N1VB28Z

Yet, the coal is facing the imminent threat from other sources of energy such as gas, nuclear, renewables etc. (Figure 2). To meet its environmental commitment and reduced average cost of supply via renewables sources of energy, India is moving ferociously on its ambitious journey to achieve the renewable power installed capacity of 175 Gigawatts (GW) by the year 2022.[8] In addition, the Ministry of Power is planning to increase its renewable target by 50 GW.

Table 1: Ministry of Power Tentative plan for Installation of Renewable Power source by 2022

Source of Energy	Commissioned Pipeline (GW)	FY 19 (GW)	FY 20 (GW)	Total (GW)
Solar	49.49	34	30	113.49
Wind	46.65	10	10	66.65
Small-Hydro	4.98	0.5	0.5	5.98
Biomass	9.5	0.5	0.5	10.50
Floating solar & offshore Wind	0	16	15	31
Total	110.62	61	56	227.62

Source: https://economictimes.indiatimes.com/industry/energy/power/india-will-add-225-gw-renewable-energy-project-capacity-by-2022-r-k-singh/articleshow/64461995.cms

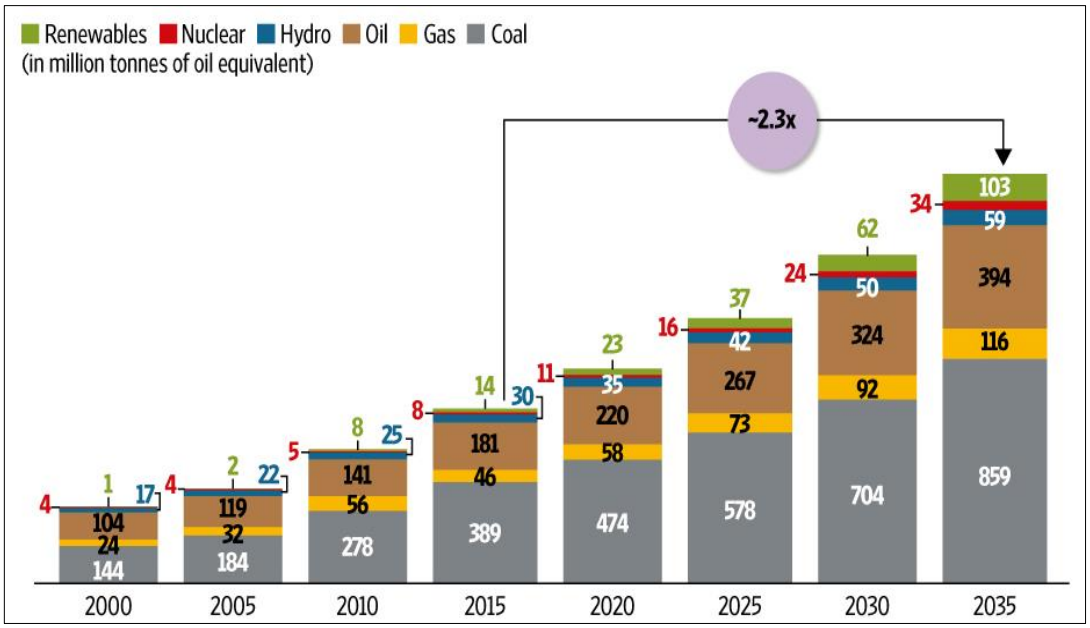
[8] http://pib.nic.in/newsite/PrintRelease.aspx?relid=180728

Therefore, this Paper, explores the *Future of Coal in India*. It is divided broadly into four sections. Section 1 briefly describes the reliance of Indian economy on coal scenario. Section 2 deals with current challenges and potential disruption in the energy sector in India. The emphasis is to assess the structural and regulatory challenges in the coal sector. In addition, technological disruptions in the energy sector are briefly assessed. Section 3 attempts to gauge – whether coal be the secret of our energy. The primary focus is to map out the potential opportunities and foreseeable threats to the sector. Section 4 summarises all issues raised in earlier sections and on that basis, draws policy recommendations about necessary measures, interventions, and actions required to strengthen the future of coal.

Coal – An Enabler of Economy

Coal based energy generation is predominantly cost-effective. Approximately three-fourth of global coal demand is from China and other developing countries such as India and Indonesia, etc. The energy production in these countries is increasingly dependent on coal.[9] With India's gross domestic product (GDP) expected to grow at seven percent, reliable and affordable access to electricity supply for industry and businesses is imperative. During this period, the coal-based power generation capacity has grown by approximately 29 GW.[10]

Figure 2: Dependence of Coal in Energy Generation



Source: Live Mint, BP Energy Outlook to 2035

Furthermore, it is expected that India will be the largest consumer of coal by 2035.[11] The Government plans to increase the capacity of coal-based power plants 50GW[12] by 2022. However, studies[13] suggest that there may be augmentation of capacity by addition of 65 GW coal-based power plants after 2030. In addition, BP Energy Outlook 2035 estimated that Coal would account for approximately 55 percent in total energy production.

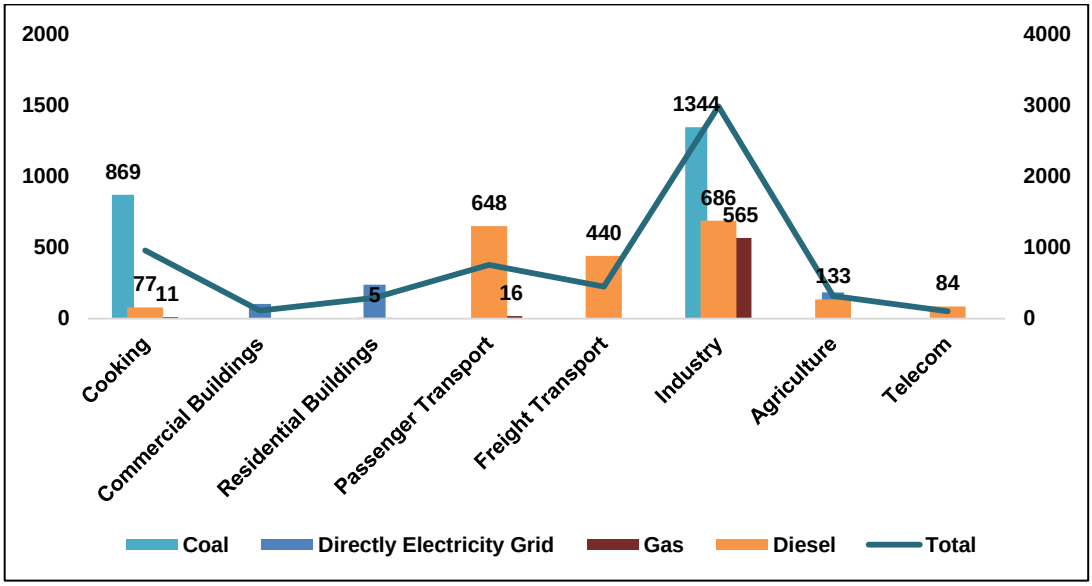
[9] https://about.bnef.com/blog/tumbling-costs-wind-solar-batteries-squeezing-fossil-fuels/
[10] http://www.businessworld.in/article/-Coal-Vision-2030-forecasts-demand-at-900-1-000-mtpa-by-2020/09-02-2018-140227/
[11] https://www.bp.com/en/global/corporate/media/press-releases/bp-energy-outlook-2035.html
[12] http://www.business-standard.com/article/economy-policy/india-does-not-need-more-coal-based-capacity-addition-till-2022-central-electricity-authority-116121300042_1.html
[13] https://energy.economictimes.indiatimes.com/news/renewable/india-will-get-75-per-cent-electricity-from-renewable-energy-in-2050-bnef/64885515

Such huge demand for coal augments the production of coal in India. It has increased from 540 million tonnes in 2011-12 to 663 million tonnes in 2015-16. It reflects the growth rate of 3.5 percent in production of coal when compounded annually whereas demand for coal has been increased by 4.5 percent compounded annually during the same period.[14]

Impact of Coal on Industries

Coal is an integral part of the economy. Heavy industries are extensively dependent on it. Coal accounts for approximately 51 percent of the total energy supply to Industries. (Figure 3)

Figure 3: Supply of Energy

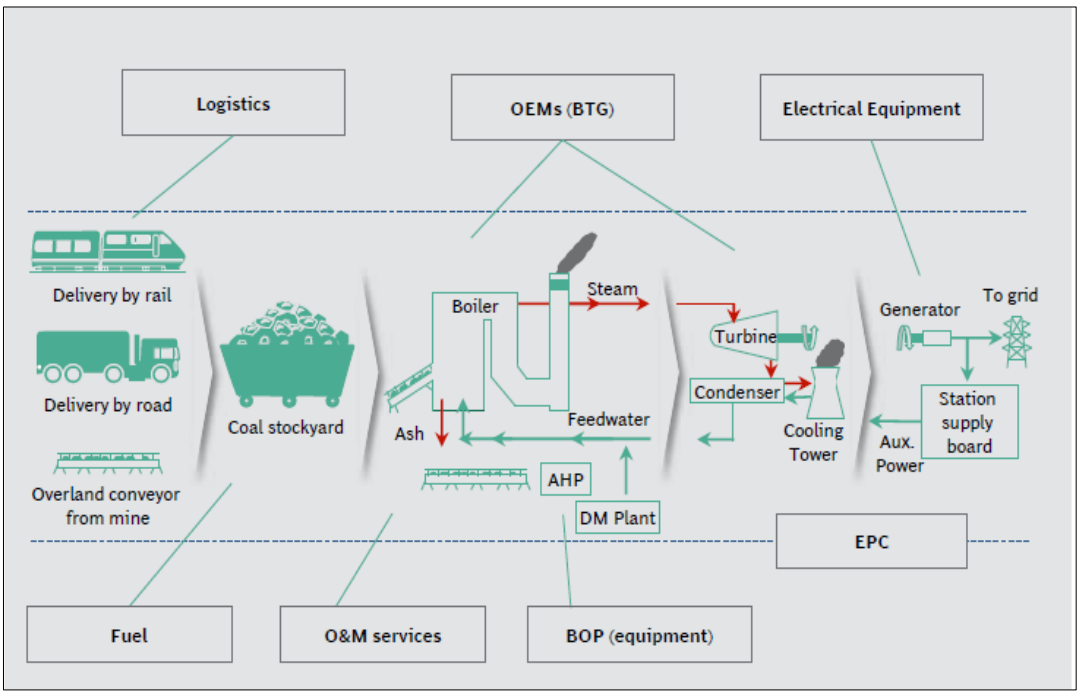


Source: http://iess2047.gov.in/pathways/

Coal has multifold effect on the economy. Direct effect is through job creation at the coal plants and various allied industries. The construction phase of a conventional project has an economic multiplier of 1.48x (i.e., economic benefit of INR 1.48 for every INR 1 of investment in the project phase), while operations phase of the plant has an employment multiplier of 2.8x (i.e., 2.8 jobs created for every job in the sector)[15]. The indirect effect is via enabling manufacturing sector and in the process creating jobs and opportunities in ancillary industries.[16] (Figure 4)

[14] http://www.coalcontroller.gov.in/writereaddata/files/download/provisionalcoalstat/ProvisionalCoalStat2016-17.pdf
[15] IHS, Cambridge Energy Research Associate
[16] http://www.ciienergyconclave.com/download/BCGCII_Report_2017.pdf

Figure 4: Dependence of Industries on Conventional Source of Power Generation



Source: http://www.ciienergyconclave.com/download/BCGCII_Report_2017.pdf

Thus, it is reasonable to assume that coal has significant impact on economy and act as growth drivers for a vast number of industries such as supply chain, fuel, original equipment manufacturers (OEMs), Engineering & Procurement Company, etc. (Figure 4)

However, Coal despite being the backbone of the industry, the coal sector is facing numerous challenges, which are discussed in the next section.

Current Challenges & Potential Disruptions in Coal Sector

As discussed, earlier, coal is essential in ensuring affordable and reliable access to electricity and thus enabling economy as a whole. However, the coal sector is facing numerous challenges such as inconsistent trends in demand, anomalies in supply leading to inefficient network, among others. In addition, feeble regulatory and policy support for conventional power generation making it extremely difficult for the sector to remain competitive with other sources of energy.

These challenges can be categorised along three key dimensions: structural challenges, regulatory challenges, and technological advancement in the sector.

a. Structural Challenges:

There are number of structural challenges within the coal sector. However, this paper, we are assesses challenges that are primarily linked to constraints in power procurement and supply of coal.

As discussed earlier that there has been an increase in domestic coal production however domestic coal production companies failed to match market demand. There are innumerable delays in the execution of projects from railways, such as track addition, rolling stock upgradation. Furthermore, low speed of freight trains augments the problem of the existing inadequately efficient rail network.[17] The average speed of domestic freight train is approximately 25 km/hour against the international benchmark speed of 60 km/hour of the trains. Consequently, private power generation companies struggle to procure raw material for their power generation due to delay in the supply of coal.

In addition, power generation sector is facing demand constraints from power distribution companies (discoms). Poor financial health of distribution companies has been a major bottleneck to increase in demand for electricity. Though, (Ujwal DISCOM Assurance Yojna) UDAY[18] has improved the financial situation of state owned discoms by reducing their interest burden but failed to drive investment in Power Purchasing Agreement (PPAs). Out

[17] https://www.livemint.com/Industry/mf6q1hQV6OlV6HIW5mQTiN/Indias-economic-growth-is-linked-to-the-fortunes-of-the-ene.html

[18] https://powermin.nic.in/pdf/Uday_Ujjawal_Scheme_for_Operational_and_financial_Turnaround_of_power_distribution_companies.pdf

of 66 privately commissioned plants in 2016, approximately 15 percent of these did not have PPAs. With limited number of PPAs, along issues of high Aggregate Technical and Commercial Losses (AT&C), insufficient tariff hikes and cross-subsidy from government hampers the profitability of discoms.

Thus, a combination of procurer demand constraints, lack of long term PPAs, policy inaction and developer aggression has led to a rise in stranded assets in the sector.[19] At present approximately 50 GW of the total installed power, capacity of India is stranded, majority number of such plants are owned by private companies. It comprises approximately INR 1.77 lakh crore of Non –performing Assets (NPA), which is approximately 12.6 percent of the total bad debts. [20]

In addition, the construction of approximately 17 coal-based power generation projects with a total capacity of 18420 MW is reported to be stalled due to financial problems of project developers.[21]

Approximately, eight projects with the capacity of 8000 MW[22] have been resolved by Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India (SHAKTI). However, 14 projects are pending in National Company Law Tribunal (NCLT).[23]

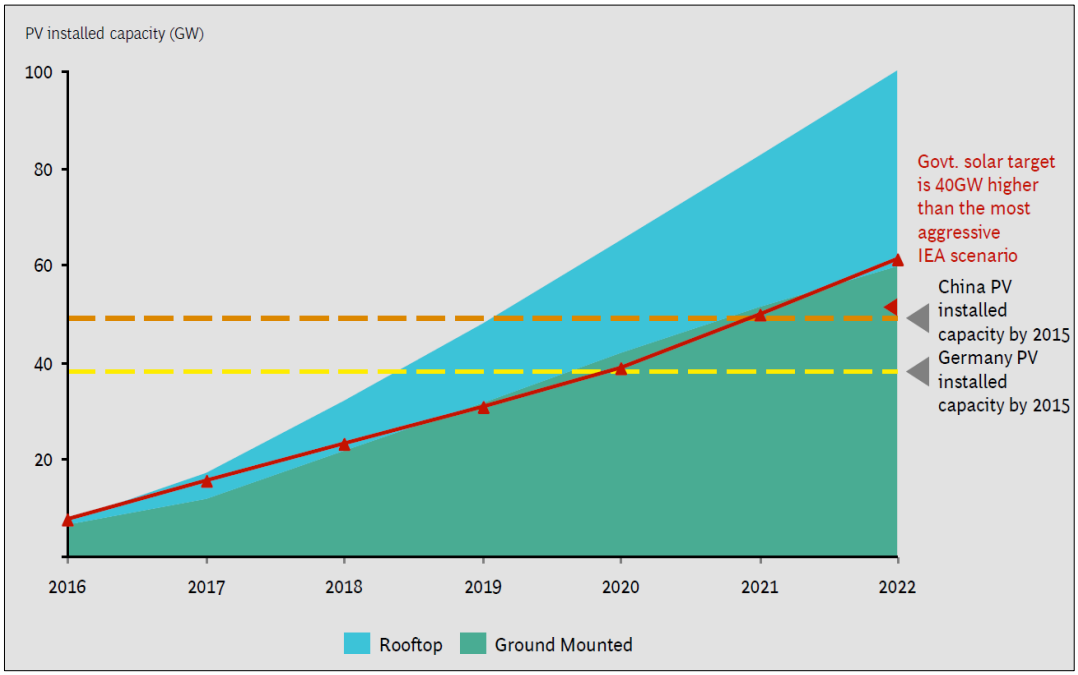
b. Regulatory Challenges

India's ambitious plan is to install 227 GW of renewable source of power generation plants by 2022. Therefore, the power sector is expected to encounter huge investment in the renewable energy. As discussed in previous section that Ministry of Power is planning to augment its renewable energy target by 50 GW. This increase in renewable energy target would require approximately INR 50 billion investment in the next five years.

Thus, in order to facilitate such huge investment and achieve its renewable energy target, the government formulated various policies and incorporated various schemes to foster investments in the renewable energy sector. Furthermore, studies[24] suggest that renewable energy sector is expected to grow up to a factor of 5. (See figure 5).

[19] https://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/urgent-need-to-revisit-1-billion-tonne-production-target-cil/articleshow/65355619.cms
[20] Id
[21] https://www.livemint.com/Industry/mf6g1hOV6OlV6HIW5mQTiN/Indias-economic-growth-is-linked-to-the-fortunes-of-the-ene.html
[22] https://economictimes.indiatimes.com/industry/energy/power/stressed-power-assets-will-fetch-more-if-fuel-and-regulatory-issues-are-resolved-power-secretary/articleshow/65316172.cms
[23] Id
[24] *http://www.ciienergyconclave.com/download/BCGCII_Report_2017.pdf*

Figure 5: Installed Capacity Projections for Solar



Source: http://www.ciienergyconclave.com/download/BCGCII_Report_2017.pdf

Table 2 Policy Interventions in Coal and Renewables

Parameters	Coal	Renewables
Ease of doing business - Regulatory barriers	a. Competition within the sector b. E-auction c. Rail-coal collaboration	a. Competition across the sector b. Cross subsidy of renewables c. Tripartite agreement among the Centre, State, Reserve Bank of India (RBI) - to facilitate Solar Energy Corporation of India (SECI)
Taxation	a. Goods and Service Tax (GST) - 18 percent b. Clean energy cess - INR 400/ MT	a. GST - five percent b. No import duty c. REC and or RPO d. Accelerated depreciation for taxation purposes e. No inter-state transmission of solar power

Parameters	Coal	Renewables
Transparency and accountability	a. SHAKTI b. Quality control - 100 percent crushed coal/ transfer of technology c. E-auction/ allocation of coal blocks	Competitive bidding

Source: Ministry of Coal, BCG Analysis, CUTS Analysis

However, there are other regulatory concerns looming over the sector such as illegalities in allocation of coal block and non-uniformity in the process to allocate them. Under the Mines & Minerals Development and Regulation Act (MMDRA), the central government is not authorised to allocate coal block, as the state government has the power to allocate coal mines. Many coal blocks were allotted to joint venture, which is not allowed under Coal Mines Nationalisation Act.

Furthermore, there had been serious lapses in governance in coal block allocations. Coal blocks were allotted without any public advertisement, thus, giving undue favour to certain companies. The Screening Committee neither listed out reasons for the allotment of the coal blocks nor provided equal opportunity to all applicants.

Such regulatory barriers restrict the investment in the sector and subsequently restrict the development of the sector.

c. Technological disruptions in the power generation sector

At present, the total installed capacity of coal-based power generation plants is 165 GW, of which only around 16.3 per cent (26.8 GW) is based on clean coal technologies such as super-critical technology. However, there are no ultra-supercritical technology-based coal based power generation plants in India. Such technologies improve the plant efficiency and reduce environmental impacts, both in terms of pollution and water requirements. Considering the above, the government[25] mandated that after 2017 only super-critical coal-based power generation plant would be installed. This is in line with the India's commitment under the Paris climate agreement to facilitate clean coal technologies for coal-based power generation plants.[26]

In addition, Coal India is undertaking various initiatives such as induction coal gasification and clean coal technology to ensure reduction in specific

[25] PIB 2015, *Initiatives to Improve the Efficiency of Coal Based Power Plants,* http://pib.nic.in/newsite/PrintRelease.aspx?relid=116893

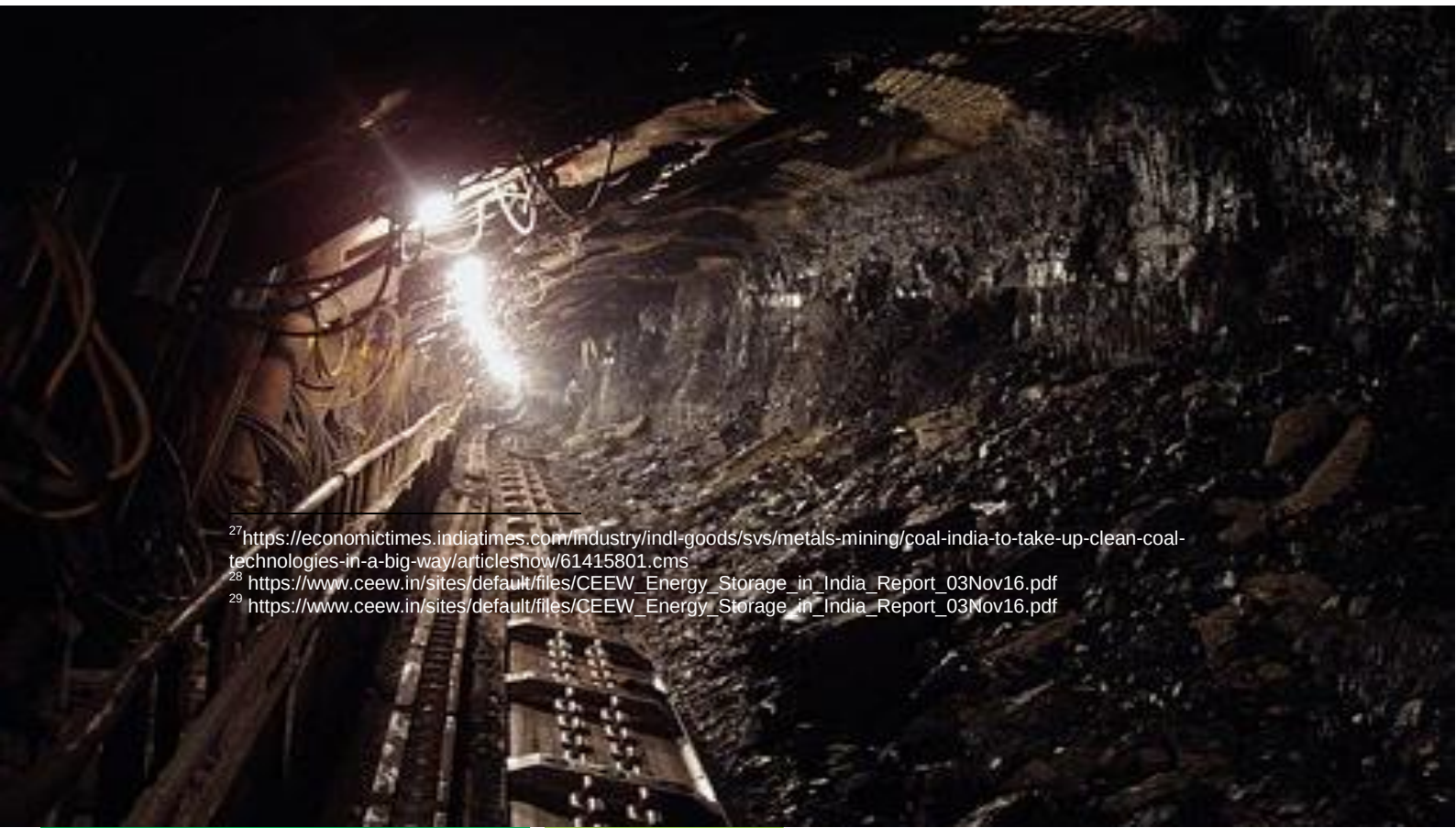
[26] https://www.livemint.com/Industry/xWRCQixbS6muKjFjesS4zM/Govt-in-fresh-push-for-power-from-clean-coal-technologies.html

coal consumption which would be able to generate high profits with greater efficiency.[27]

However, studies suggest that by 2030 solar power generation is expected to exceed coal-based power generation. This is primarily because installed capacity of renewable power is expected to increase many-folds from 2020s to 2030s, while there would be meagre addition in the installed capacity of coal-based power generation.

But fluctuations in the supply of solar and wind energy due to change in seasonal and weather patterns are quite evident. Therefore, it is reasonable to assume that deep penetration of renewables will facilitate adoption of battery technologies. However, at present the cost of renewable power generation combined with disruptive technologies such as Energy Storage Systems (ESS) is quite high.

However, studies also suggest that the shift from coal-based power generation to renewable energy coupled with ESS is expected to begin in as early as 2020.[28] It is further expected that industries and commercial consumers will be early adopters of batteries under this shift. Commercial enterprises such as petrol pumps, telecom towers, bank branches, healthcare centres, and government offices established in remote location where reliable grid is not available are also likely to adopt batteries along with solar PV system for a reliable access to power. It is estimated that petrol pumps and rural ATMs offer a market opportunity of approximately INR 5 bn.[29]



[27] https://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/coal-india-to-take-up-clean-coal-technologies-in-a-big-way/articleshow/61415801.cms
[28] https://www.ceew.in/sites/default/files/CEEW_Energy_Storage_in_India_Report_03Nov16.pdf
[29] https://www.ceew.in/sites/default/files/CEEW_Energy_Storage_in_India_Report_03Nov16.pdf

Will Coal be the Secret of our Energy?

As discussed above the current and future challenges to coal-based power generation raises two pertinent questions:

c. *Whether coal as a source of power would be relevant 5-10 years in the future?*
d. *Given the push for renewables energy, can solar and wind energy co-exist with coal-based energy.*

According to National Energy Policy 2017[30], even after ferocious growth of renewable energy, it would be extremely difficult for the solar and wind energy to go beyond 40 percent of total energy mix. Most of the existing coal-based power generation plants have achieved their break-even point and operate on variable cost only.

While the plant load factor (PLF) is declined from 79 percent in 2007-08 to 52 percent in 2017-18, but such plants are still equipped to operate on 85 percent PLF. Assuming the PLF scaled up from 52 to 85 percent, there would be increase of 50 percent in output from the same capacity. As the plant will operate, only on variable cost, this will be expected to be approximately INR 1.50. However, the price difference with renewable solar and wind energy is expected to be in the range of INR 0.70 to INR 1.00.[31] Based on the above assumption, the additional generation units required would be approximately 500 billion units. Considering the average cost saving is INR 0.80, it is expected to be a profit of INR 40,000 crore.

Furthermore, to meet aforementioned electricity generation, 350 million tonnes of coal would be required, i.e. demand of coal would be increased by approximately 7.5 percent. In addition, the additional demand for coal would also generate approximately INR 12000 crore under the Clean Energy Cess Fund at the rate of INR 400 per tonne.

Moreover, if the consumption of coal would be continued with the aforementioned assumptions, India would still be under the Climate Change COP 21 obligations. As per the obligations, India's renewable energy capacity should be 40 percent of the total capacity by 2030 and should consume less than 1500 million tonnes coal per year. Thus, it is reasonable to assume that coal is expected to be here for the at least next two decades.

[30] http://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf
[31] https://www.thehindu.com/business/Industry/coal-is-still-the-secret-of-our-energy/article19781521.ece

Table 3 SWOT Analysis of Coal

Strengths	Weaknesses
High Coal Reserves	Environmental Concerns
Ability to support peak demand	Absolute technology
Cost effective, reliable, and affordable energy provider	Substandard quality of domestic coal
	Suboptimal regulations
	Substandard supply-chain infrastructure

Opportunities	Threats
Advent of Electric Vehicles in the market	Renewable Energy
Optimal Capacity Utilisation - with no additional investments - can boost power exchange markets	Technological advancement - Energy Storage systems
Cross border energy trade	Stricter environmental norms
Export opportunities of coal	
Cheaper and reliable energy source	
Advance technology deployment - Clean coal technology	

In addition, there will tremendous increase in the renewable power generation, and have greater penetration in the energy mix. Nevertheless, the solar and wind energy have its own challenges. The primary concern is the issue of fluctuation in load. Fluctuations on seasonal and weather patterns are common to both solar and wind energy; however, day-night fluctuations are an issue specific to Solar PV. While fluctuations in solar energy are predictable in nature, fluctuations due to forecasting error and sudden change in weather are erratic in nature. This would pose a serious threat to grid load transition between renewable and coal based energy.

However, California State in US and Germany in Europe are able to achieve high grid stability by assessing the solar load profile across the day, the pattern so formed is popularly known as a '*Duck Curve*'. The solar load assessment revealed that solar load peaks in the morning and afternoon and gradually falls off in the evening. With greater penetration of solar energy in the grid, the greater the fluctuation in the energy supply. The inconsistency

in energy supply from solar necessitates the flexibility in the grid. Such flexibility to ramp up load half load to full load lies with the conventional sources of energy. Coal based power generation plants are not currently equipped to sustain such challenges. For instance, Germany has expanded its renewable energy generation to 40 percent and it co-exists with coal-based energy. Thus, it is reasonable to assume that coal and renewable energy not only co-exist together but also complement each other[32] given that India adopt such technology-based initiatives.

Change in Urban Mobility

The Government of India launched Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) under the National Electric Mobility Mission (NEMMP).[33] The Government aims to covert one-third of the automobiles on Indian road to Electric Vehicle (EV) by 2030.[34]

Studies have suggested that electric cars are more efficient and emit fewer amounts of greenhouse gases as compared to traditional gasoline based vehicles. For instance, for same number of kilometers (KM), an electric car powered by coal-based electricity would use only two-thirds amount of the energy as compared to of a car powered by petrol.[35] It for every 100 KM, Electric Vehicle approximately 3.8 Kg of coal is required while a petrol run vehicle would require approximately 5.7 litres of petrol.

Furthermore, Electric vehicles are expected to augment the households' power consumption by 50 percent.[36] Studies also suggested that power consumption of electric vehicle is equivalent the power consumption of two - three households.[37]

Therefore, with the advent of Electric Vehicles in the system, there would be additional demand of electricity. However, it is expected that additional demand would be met coal based generation. For instance, studies suggest that for every 10 times charging an electric vehicle, 6.5 times would be based on conventional sources of energy.

Therefore, based on the above discussion, it is reasonable to assume that **Coal is the secret of our energy.**

[32] https://about.bnef.com/new-energy-outlook/
[33] https://www.fame-india.gov.in/ViewNotification.aspx
[34] https://inc42.com/buzz/govt-will-provide-subsidies-for-all-electric-vehicles-under-fame-ii/
[35] https://www.theguardian.com/football/ng-interactive/2017/dec/25/how-green-are-electric-cars
[36] https://www.nytimes.com/2013/04/25/business/energy-environment/preparing-for-the-power-demands-of-an-electric-car-boom.html
[37] https://www.forbes.com/sites/judeclemente/2018/01/24/more-electric-vehicles-mean-more-coal-and-natural-gas/#583b0af12a37

Way Forward

It is evident from the discussion above that the sector is plagued with lukewarm demand, regulatory bottlenecks, technological disruptions, and environmental risks. However, this may adversely affect investments in the sector. In addition, the growth of the sector is slackened by the suboptimal transportation system, inaccessibility of land, exhaustive approval processes, poor productivity stemming from the use of outdated technology, and the unavailability of high quality coal in India.

Furthermore, with technological advancement and rapid decrease in the cost of renewable source of energy, there will be a shift from coal based power generation to other sources of energy. However, the peak load is likely to be dependent upon the coal-based generation in the near future. Therefore, it is imperative that coal sector should be developed to support power generation and allied industries dependent upon coal while not conceding the renewable power generation goals.

Thus, in order to strengthen the coal sector and ensure the sustainability of conventional source of power generation holistic mediations are needed. In light of above, following stakeholder wise interventions are recommended:

a. Government

A hands-on approach is needed from the government to ensure consistency in policies. While it is crucial that renewable energy must to incentivised to deepens its penetration in the system, but coal sector should also be technologically advanced. Therefore, it is imperative that the government should adopt consistent policies, which foster private investment in the sector. It should also ensure robust disputes settlement mechanism related to PPAs or land acquisition for stranded assets.

While commercialising the mining sector is a progressive steps in the development of the sector as a whole but government must ensure ease of doing business and red tapism and multiple clearances. This can be done by warranting convergence of multiple government agencies.

Thus, the government needs to initiate measures keeping in mind the costs and benefits (regulatory impact assessment[38]) of all possible

[38] Regulatory impact assessment (RIA) is an internationally recognised framework for determining the need for policies, and a scientific, logical guide to designing them, if required. It involves a step-by-step approach comprising problem definition, baseline scenario assessment, development and comparison of alternatives on the basis of their estimated costs and benefits on society, and selection of such alternative which has the potential to result in highest net benefits to society. RIA is an important element of an evidence-based approach to policy making, as it essentially comprises stakeholder engagement in policy making and review.

options of regulating the power sector. The decisions will certainly have an impact on the government's resources and manpower, though the results in the long term could lead to unprecedented positive outcomes.

b. Industries

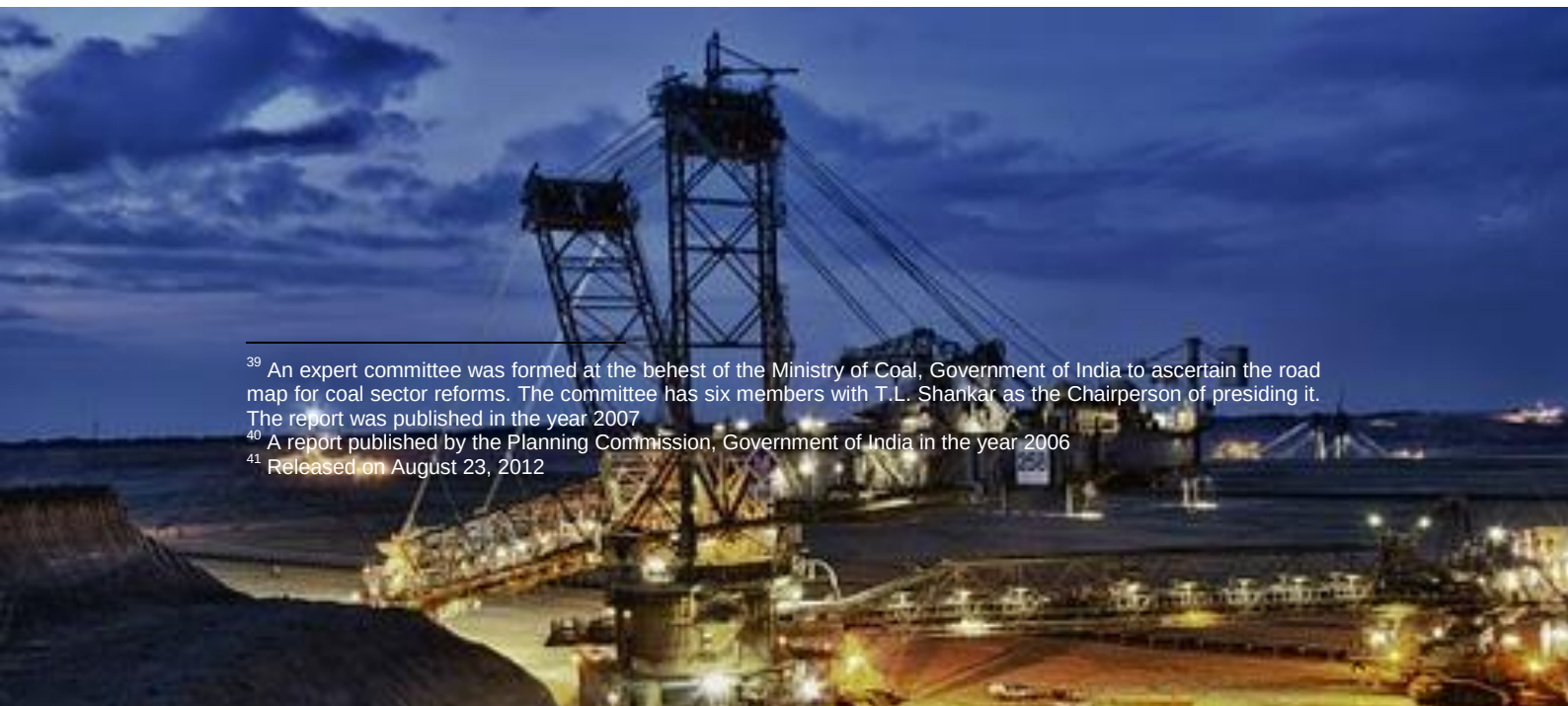
Suboptimal transport system is a key concern for both private and public industry players. Therefore, it may in the best interest of the industry to set up plants near coalmines. Studies suggest that eastern part of the country has immense potential for the energy intensive industries due to its strategic locational advantage within the close proximity to coal mines. This will likely to cut down significantly the operational cost of the power generation.

c. Coal Suppliers

Power generation is immensely dependent upon the grade of coal. Thus, it would be prudent that coal suppliers should adopt measures that warrant the grading of coal. For instance, Coal India may re-grade the mines in a timely interval by undertaking audits and inspection periodically. In addition, coal suppliers may augment labour productivity with the use of state of the art mining technologies.

d. Regulators

The sector is afflicted with many anomalies from both the coal suppliers' side and industries side. Therefore, there is a need for the establishment of a Regulator for the Coal Sector. Many committees set up by the government such as T L Shankar Committee,[39] the Integrated Energy Policy Report of Experts,[40] the Approach Paper to 12th Five Year Plan and the CAG Report[41] have advocated to set up an Independent Regulator for the Coal Sector. However, it is recommended that instead of establishing an independent regulatory body, the mandate of CERC can be expanded to govern the portion of coal sector, which is closely related to power generation.



[39] An expert committee was formed at the behest of the Ministry of Coal, Government of India to ascertain the road map for coal sector reforms. The committee has six members with T.L. Shankar as the Chairperson of presiding it. The report was published in the year 2007

[40] A report published by the Planning Commission, Government of India in the year 2006

[41] Released on August 23, 2012

Indian Chamber of Commerce (ICC) Profile

Founded in 1925, Indian Chamber of Commerce (ICC) is the leading and only National Chamber of Commerce operating from Kolkata, and one of the most pro-active and forward-looking Chambers in the country today. Its membership spans some of the most prominent and major industrial groups in India. ICC's forte is its ability to anticipate the needs of the future, respond to challenges, and prepare the stakeholders in the economy to benefit from these changes and opportunities.

Set up by a group of pioneering industrialists led by Mr G D Birla, the Indian Chamber of Commerce was closely associated with the Indian Freedom Movement, as the first organised voice of indigenous Indian Industry. Several of the distinguished industry leaders in India, such as Mr. B M Birla, Sir Ardeshir Dalal, Sir Badridas Goenka, Mr. S P Jain, Lala Karam Chand Thapar, Mr. Russi Mody, Mr. Ashok Jain, Mr. Sanjiv Goenka, have led the ICC as its President. Currently, Mr. Rudra Chatterjee is leading the Chamber as its President.

ICC is the only Chamber from India to win the first prize in World Chambers Competition in Quebec, Canada.

ICC's North-East Initiative has gained a new momentum and dynamism over the last few years. ICC has a special focus upon India's trade & commerce relations with South & South-East Asian nations, in sync with India's 'Look East' Policy, and has played a key role in building synergies between India and her Asian neighbours through Trade & Business Delegation Exchanges, and large Investment Summits.

ICC also has a very strong focus upon Economic Research & Policy issues - it regularly undertakes Macro-economic Surveys/Studies, prepares State Investment Climate Reports and Sector Reports, provides necessary Policy Inputs & Budget Recommendations to Governments at State & Central levels.

The Indian Chamber of Commerce headquartered in Kolkata, over the last few years has truly emerged as a national Chamber of repute, with full-fledged offices in New Delhi, Mumbai, Guwahati, Ranchi and Bhubaneshwar & Hyderabad functioning efficiently, and building meaningful synergies among Industry and Government by addressing strategic issues of national significance.

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CUTS International

CUTS International Profile

CUTS International (www.cuts-international.org) is a leading think-tank working on economic and public policy issues. It is a leading Southern voice and face of consumer empowerment through its rights-based approach and activities for influencing the process and content of inclusive growth and development. Presently, its work spans a multi-pronged agenda targeted to the realisation of CUTS' Vision of 'Consumer sovereignty' and it's Mission of 'consumer sovereignty in the framework of social justice, economic equality and environmental balance, within and across borders.'

Consumer interest is the *raison d'etre* of all economic transactions. In practice, that does not happen more often than not and particularly in the developing world because consumers are either less informed about their rights and responsibilities and/or on account of the fact that consumer movements in developing countries have weakened over time.

Over the last three decades, CUTS has experienced an organic and evolutionary growth – marked by a refreshing spontaneity in responding to the need of the hour, particularly those of the developing world, by addressing contemporary and emerging issues of economic governance at national, regional and international-level through cross-fertilisation of ideas and experiences of state and non-state actors.

What started as a consumer protection organisation in its traditional sense, CUTS has attained uniqueness through the realisation that the consumer needs to be economically, politically and socially empowered via diverse channels such as 'Good Governance', 'Effective Regulation' and 'Rules-based Trade', so that consumer rights (from basic needs to safety, choice, information, consumer education, redressal, representation and healthy environment including sustainable consumption) are embedded in the quest of achieving sustainable development and to make economic growth more inclusive.

Three core areas: ‘Good Governance’, ‘Effective Regulation’ and ‘Rules-based Trade’ – constitute the areas of specialisation of CUTS. All of them are aligned with the following activities:

- Research (for policy as well as practice changes) involves the evaluation and analysis of primary data and secondary evidence to arrive at recommendations for furthering progress towards consumer protection and sovereignty, which are articulated in the organisation’s ‘Vision’ and ‘Mission’.

- Advocacy refers to the generation of awareness about these recommendations and dissemination of other knowledge/information relevant for the mentioned progress as well as capacity building of CUTS and its partners which are needed for understanding and pushing the implementation of those recommendations.

- Networking and Capacity Building involves the creation of frameworks through which such advocacy can be effectively conducted with inputs from Research, Advocacy, Networking, Capacity Building of state and non-state actors on our core areas and their linkages, so that consumers are better empowered to access their rights and execute their responsibilities for bettering their lives.

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