Coal Dependence, Energy Security, and Human Security in India

SPRF.IN

06
22

| Mihir Vikrant Kaulgud

Discussion Paper

TABLE OF CONTENTS

If you have any suggestions, or would like to contribute, please write to us at contact@sprf.in

June 2022

Discussion Paper

Coal Dependence, Energy Security, and Human Security in India

| Mihir Vikrant Kaulgud

ABSTRACT

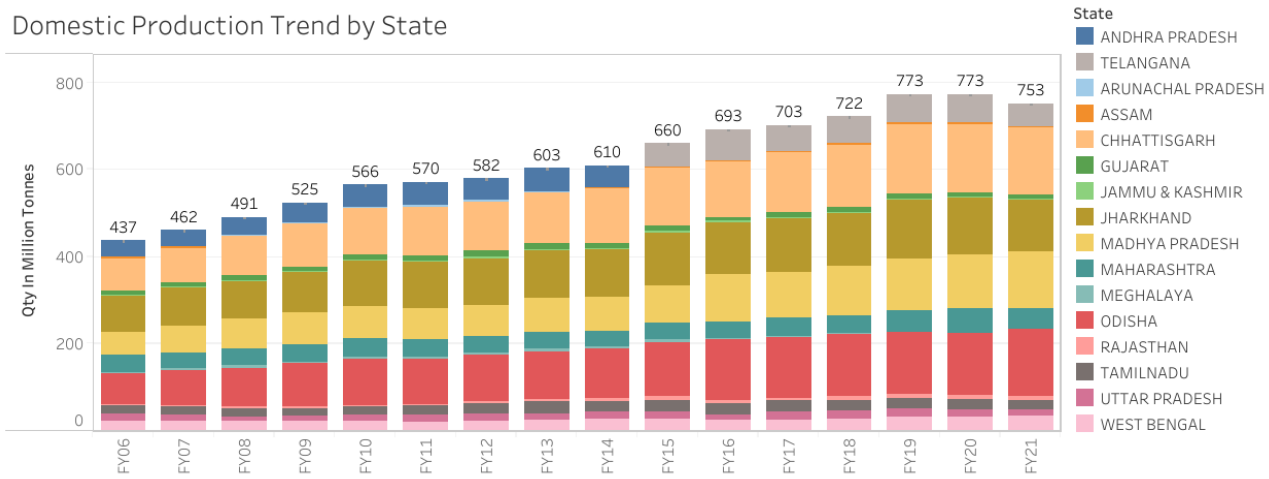
This paper investigates India's increasing dependence on coal to meet its rising energy consumption. This study examines the current justifications for this trend, considering how coal is intertwined with India's politics and economic aspirations. Rationales for using more coal remain rooted in an inadequate short-term, supply-centric notion of energy security. However, the paper suggests that delaying the renewable energy transition and increasing coal 'lock-in' harms India's energy security and human security in the long run. Given the entrenchment of coal within the Indian energy system, the paper highlights the need for a transition discourse where continuing legacies of coal dependence are re-evaluated in light of coal's adverse effects on climate change, energy security, and human security.

Keywords: Coal, Coal Dependence, Energy Security, Just Transition, Carbon Lock-In

INTRODUCTION

Despite commitments to phasing down coal in favour of renewable energy sources, India has steadily increased its coal production (see figure 1) and imports (see figure 2). The International Energy Agency [IEA] (2021a) notes that India has been increasing its thermal coal imports and forecasts that national coal consumption will grow at an average annual rate of 3.9% to reach 1.18 billion tonnes by 2024 (IEA, 2021b). Domestic production aims to reach 1 billion tonnes by 2024 (Press Information Bureau, 2019). These figures conform with the trend of an increase in coal plants and the privatisation of the coal industry (Oskarsson et al., 2021).

Figure 1: Domestic Production Trend by State



Source: (NITI Aayog, n.d.).

Figure 2: Coal Imports during the Last Ten Years

Year Wise Import of Coal and Coke to India during Last Ten Years
(Quantity in Million Tonnes & Value in Million Rs.)

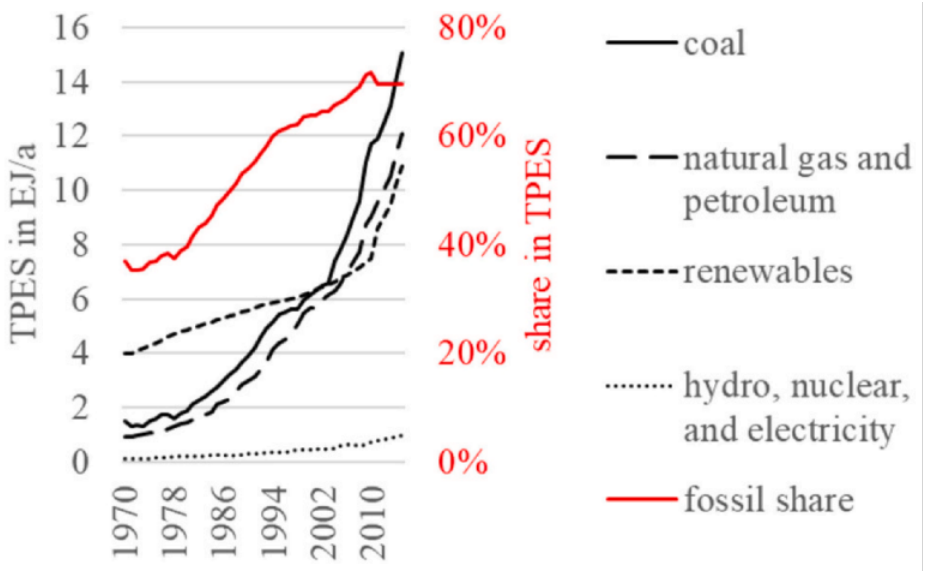
Year	Coking Coal		Non-Coking Coal		**Total Coal**		Coke & Others Coal Products		Lignite	
	Quantity	Value	Quantity	Value	**Quantity**	**Value**	Quantity	Value	Quantity	Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2011-12	31.80101	424692.34	71.05162	363683.49	**102.85263**	**788375.83**	2.36469	47584.54		
2012-13	35.55697	378398.09	110.22847	490056.94	**145.78545**	**868455.02**	3.08065	56918.82	0.00065	10.22
2013-14	36.87214	348318.65	129.98489	574973.16	**166.85702**	**923291.81**	4.17053	67994.89	0.00127	23.73
2014-15	43.71529	337655.59	174.06751	707410.50	**217.78280**	**1045066.09**	3.29388	43806.15		17.03
2015-16	44.56117	282519.09	159.38809	577818.53	**203.94926**	**860337.62**	3.07163	32683.54	0.00105	14.83
2016-17	41.64379	412300.61	149.30926	590013.33	**190.95305**	**1002313.94**	4.34648	54019.35	0.01912	433.29
2017-18	47.00325	595226.36	161.24542	789543.41	**208.24867**	**1384769.77**	4.58478	91524.74	0.01041	116.50
2018-19	51.83768	720497.64	183.51033	988707.26	**235.34801**	**1709204.90**	4.93094	120644.85	0.01937	403.43
2019-20	51.83275	612668.32	196.70383	914652.23	**248.53658**	**1527320.55**	2.87455	60256.67	0.05425	1074.46
2020-21	51.28828	454354.82	163.70662	706017.21	**214.99491**	**1160372.03**	2.45729	44688.59	0.01886	409.24

Source: DGCI&S, Kolkata
Some figures may not match with DGCI&S publication due to subsequent corrections and roundings.

Source: (Ministry of Coal, n.d.-a)

Increasing reliance on coal seems paradoxical given India's climate action goals and pledges. India is expanding its coal use parallel to its renewable sources, especially solar and wind (see figure 3). At the 26th Convention on Climate Change Conference of Parties [COP26], India, along with China, supported changing the language of "coal phase-out" to "coal phase down" (Perincherry, 2021)[1]. Despite increasing renewable energy capacity, coal is mainly responsible for meeting the rising energy demand and consumption (see figure 4). Therefore, coal is still India's dominant energy source (Roy and Schaffartzik, 2021).

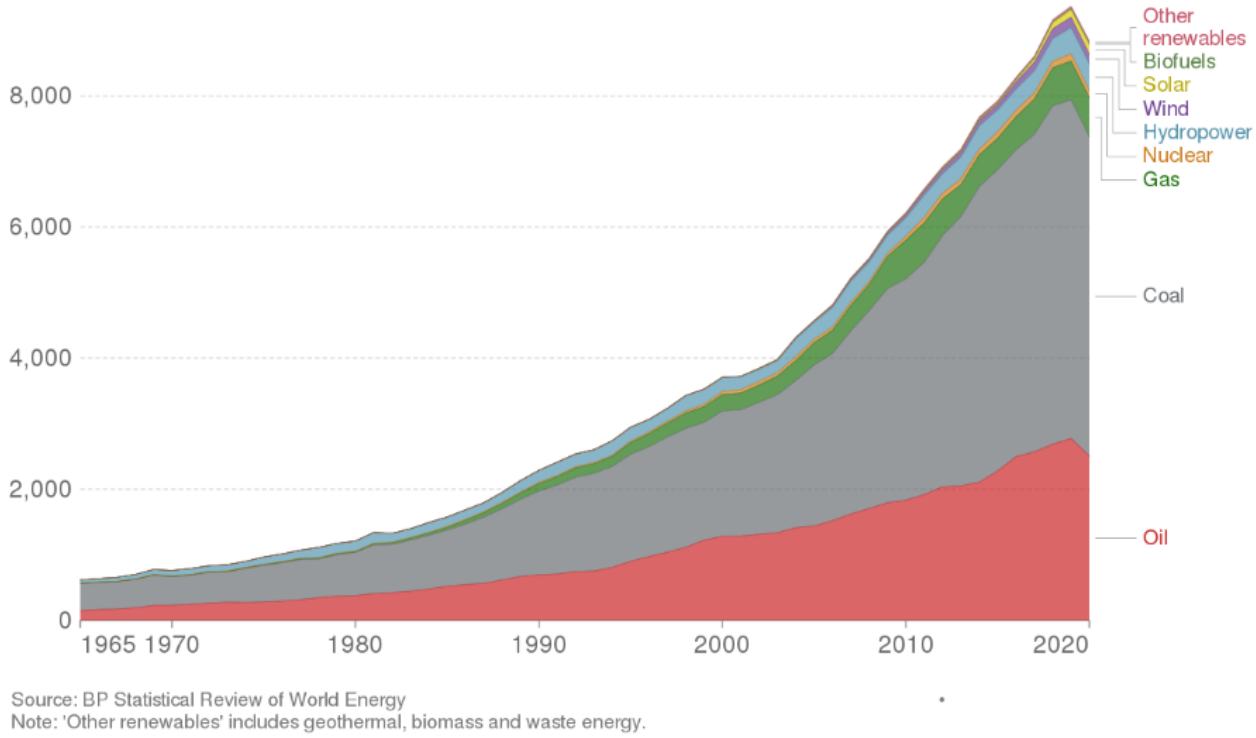
Figure 3: India's total primary energy supply (TPES) by sources in exajoules (1EJ = 1018J) per year (EJ/a), 1975–2015



Source: (Roy & Schaffartzik, 2021)

[1] Senior Indian officials aware of the negotiations at COP26 said that "India did not introduce the phrase 'phase down' in the Glasgow Climate Pact text" (Nandi, 2021). There are arguments that India has received disproportionate blame even though China and the US were also proponents of the 'phase down' language. See Shankleman and Rathi (2021).

Figure 4: Energy Consumption by Source, India



Source: (Ritchie & Roser, n.d.).

This paper discusses India's increasing reliance on coal in the context of a proposed transition away from coal and towards renewable energy. It outlines why increasing coal dependence is harmful to India's energy security in the long run. Moreover, delaying the renewable energy transition and 'locking in' future reliance on coal will adversely impact human security. Finally, the paper highlights the need for a conversation about energy transition and adopting an energy justice framework.

INDIA'S DEPENDENCE ON COAL: HISTORY AND POLITICS

Coal and India's economy and politics are historically intertwined. Lahiri-Dutt (2014, p. 1) writes that "coal mining was a pivotal modern industry shaping India's colonial trajectory but, unlike tea plantations or jute mills, the coal mining industry assumed iconic status as a national symbol after Independence". The first Prime Minister, Jawaharlal Nehru, considered coal central to India's self-reliance. Consequently, the five-year plans made coal mining the foundation of industrialisation and electrification. The nationalisation of coal mining and the creation of Coal India Limited [CIL] further confirmed India's reliance on coal. CIL is now the world's largest coal mining organisation and is considered a Maharatna or "fine gem" of the Indian state (Lahiri-Dutt, 2014, p. 18). The government has recently encouraged private investments in coal while the public sector maintains its dominance (see Figure 5). Under the Coal Mines (Special Provisions) Act, 2015, the government began allocating coal mines through auctions. In 2018, the government ended CIL's coal monopoly, and the private sector was allowed to mine coal commercially. In 2019, the Indian government approved 100% FDI for coal mining. Private actors are increasingly involved in logistics, coal power generation, and transmission (Oskarsson et al., 2021).

Figure 5: Company-wise production of raw coal during the last ten years

COMPANY WISE PRODUCTION OF RAW COAL DURING LAST TEN YEARS

[Quantity in Million Tonnes]

Company	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
CIL	431.32	435.84	452.20	462.41	494.23	538.75	554.14	567.37	606.89	602.13	596.22
SCCL	51.33	52.21	53.19	50.47	52.54	60.38	61.34	62.01	64.40	64.04	50.58
Others/Captive	50.04	51.90	51.01	52.88	62.41	40.09	42.39	46.03	57.43	64.70	69.29
Total	**532.69**	**539.95**	**556.40**	**565.77**	**609.18**	**639.23**	**657.87**	**675.40**	**728.72**	**730.87**	**716.08**

Note: Production of CIL is including Gare Palma IV/1 and IV 2&3 and production of captive is excluding these blocks.

Vishwanathan et al. (2018) note three reasons coal is seen as 'beneficial for the country'. Firstly, it is cheap and abundant. Secondly, over 10 million people work in the coal industry, making it an employment-generating sector. Finally, central and eastern states generate royalties from coal mining, and the central government receives dividends from CIL. Indian Railways, too, generates revenues by transporting coal, which helps offset the loss incurred in their passenger services. The Standing Committee on Energy, a parliamentary panel, presented a report in August 2021. The Committee recommended further utilising domestic coal reserves to reduce dependence on coal imports (Aggarwal, 2021). This suggestion was justified in terms of energy security, "providing affordable power for the common man," and bolstering the idea of a self-reliant India or 'Atmanirbhar Bharat' (ibid.). The Committee also noted that despite the proliferation of renewable energy sources, coal would "continue to be the mainstay of Indian power generation in this decade" (ibid.). The Home Minister, Amit Shah, recently said that the coal industry would be the "biggest contributor to the $5 trillion economy dream" (Asian News International, 2021). State revenues, industries, and people's livelihoods have become dependent on coal (D'Souza & Singhal, 2021; Vishwanathan et al., 2018). Various reports of "how politics around coal allocation helped select corporate houses, often owned and managed by politicians or their relatives and associates, to control and manage coal by paying a nominal fee" provide further evidence of coal's entrenchment in the political ecosystem. (Sahu, 2015, p. 29). In light of coal's history in India, these justifications reveal India's "coal is king" mentality (Gross, 2019).

Malakar, Herington, and Sharma (2019) highlight that the short-term, 'here-and-now' concerns of economic development and expanding access to electricity are prioritised over long-term adverse consequences of fossil fuels and transition to low carbon energy systems. Sandeep Pai, a senior researcher at the Centre for Strategic and International Studies, summarises this focus on short-term concerns: "[c]oal is a key domestic fuel for India and is important right now [emphasis added] from an energy security point of view. India will need to burn some coal now [emphasis added] because it needs to grow and industrialise to lift people out of poverty" (Perincherry, 2021). Writing more critically, Kohli and Menon (2020) argue that the commitment to the short-term benefits of coal is "to meet the expectations of a growing consumeristic society addicted to cheap power." Therefore, the crux of these arguments is that using more coal will improve India's energy security, lift people out of poverty, widen access to energy, and promote economic growth.

The following sections re-orient the focus of energy security from a short-term to a long-term view and introduce the need to consider citizens' livelihoods and health.

ENERGY SECURITY

The IEA (2019) defines energy security as "the uninterrupted availability of energy sources at an affordable price." Khatib (2000, Chapter 4), writing for the United Nations Development Programme, defines it as "the continuous availability of energy in varied forms, in sufficient quantities, and at affordable prices." These approximate the traditional energy security notion, which emphasises the security of 'supply' and affordability. The Standing Committee's statement that domestic coal could be used more to ensure energy security is based on the supply-centric definition of energy security. The Committee thus argues that if India depends less on external actors for coal, it will reduce political risks associated with relying on external actors for much-needed energy. Lahiri-Dutt (2014, p. 294) also notes that India's energy policy is based on a narrow definition of energy security as "increasing and protecting fuel supply". Moreover, this supply-centric definition is focused on the "continuous availability of commercial energy at competitive prices to support economic growth" (ibid., p. 19)

However, energy security—and arguably security itself—is a multidimensional concept with varying meanings (Jakstas, 2020, Chapter 5). Differing answers to the questions of "security for whom, from whom, by whom, of what values, from what threats and by what means", reveals the multidimensional aspect of security and energy security (Brauch, 2006, Chapter 3). These questions offer an expanded notion of security beyond the state-centric approach to security. Thus, it is not just national security that remains at stake, but human security as well, such as the security of those making a livelihood from coal mining. Moreover, the goal of an energy transition should be to move towards renewables and away from fossil fuels. The values that guide policymakers should thus be sustainability, energy efficiency, and mitigation of carbon emissions, rather than cheap energy supply and economic growth (ibid.). Rodríguez-Fernandez et al. (2022) define energy security regarding sovereignty, robustness and resilience during the energy transition. They define energy security as "the balance of national and international energy systems that will guarantee the functioning of the economy and the physical continuity of resources when faced with political and scarcity events, and that will be capable of adapting to and fulfilling the targets set to mitigate climate change" (ibid.). Hence, energy security must account for environmental and social security. Definitions of energy security must include providing safe, clean, and convenient forms of energy to households, especially the low-income ones (Lahiri-Dutt, 2014, p. 296). The three dimensions of energy security that Rodríguez-Fernandez et al. (2022) mention are elucidated below:

1. **Sovereignty -** Sovereignty is related to political risks associated with utilising a particular energy source and the leverage exerted by external players on domestic usage. As stated earlier, coal imports have been rising at a tremendous rate. Despite the stated ideal of Atmanirbhar Bharat, it is impossible to close the gap between domestic supply and demand. India needs to import coking and high-grade coal since they exist in lower reserves domestically. Therefore, increasing reliance on domestic energy can only go so far in ensuring energy security concerning 'security of supply'.

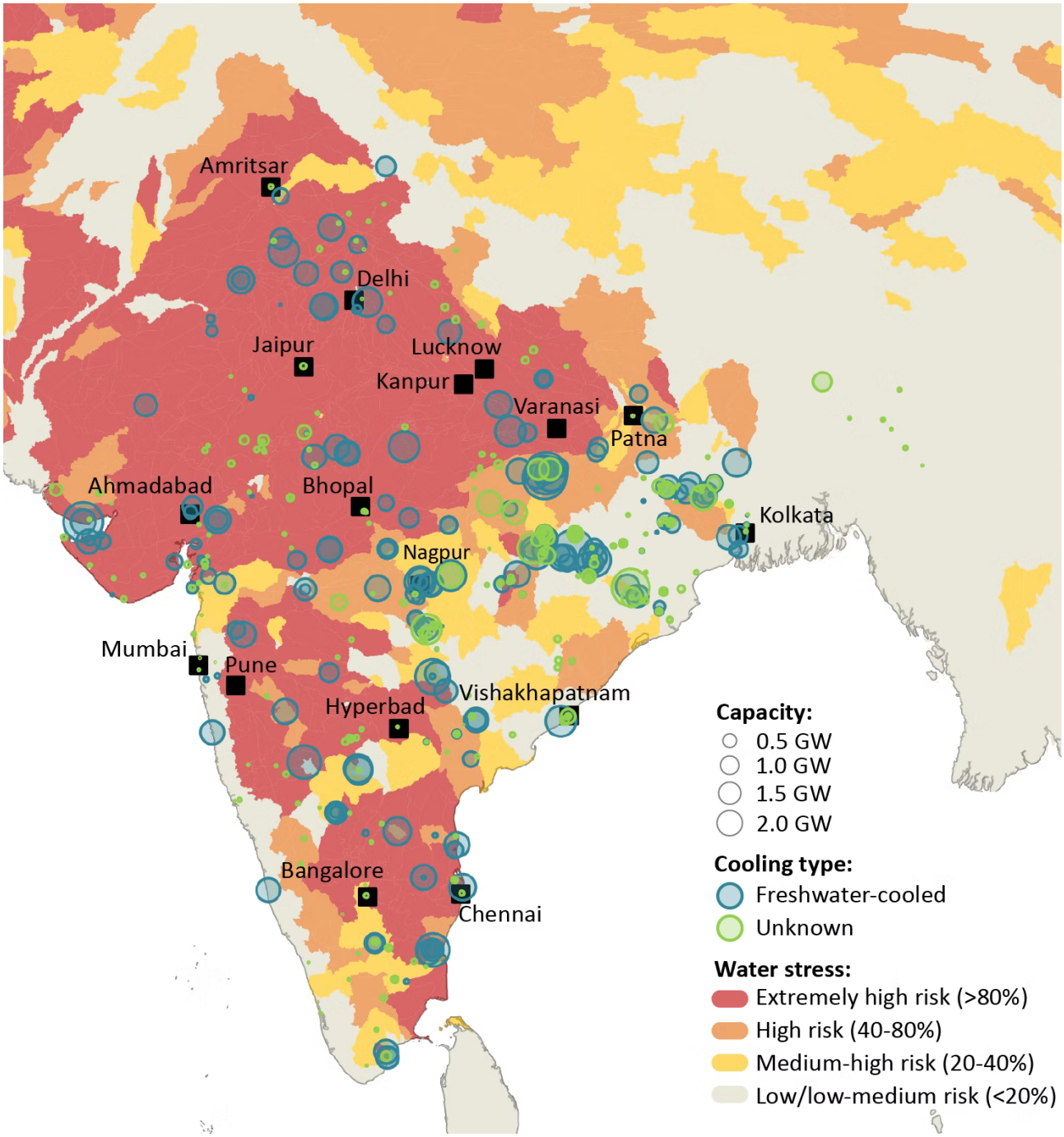
2. **Robustness-** Robustness is concerned with how well an energy system adapts to resource scarcity. While India's coal reserves are vast, policymakers must also consider other resources that are part of the coal energy production system. For instance, water is a critical resource used in thermal energy for cooling and washing impurities off of coal. Coal washing makes sure coal reserves are optimally used (Kohli & Menon, 2020). However, water scarcity due to extreme climate can adversely impact electricity generation by coal-powered plants (Vishwanathan et al., 2018). Water shortages and droughts endanger the ability of

the coal energy production system to deliver a constant supply of energy. According to the IEA (2021b), "more than 80% of coal plants today are cooled by freshwater sources, and over half of these are in areas experiencing high water stress" (see Figure 6). In 2020, the Government removed the requirement for coal washing, thereby making coal cheaper but "dirtier" (Kohli & Menon, 2020.) Lower-grade coal used without coal washing is less efficient and produces more ash, noxious gases, and particulate matter. These toxic byproducts also put other resources at risk; for instance, fly ash can pollute farmland and water sources with toxic chemicals if mismanaged (ibid.). In this case, it is a security threat in an era where resource-based conflicts will likely be more common. Therefore, planning for 'peak coal'—when the quantity of coal extracted decreases—is necessary not because the resource will run out but because the coal system is unsustainable (Guay, 2013; Powell et al., 2021).

3. **Resilience -** The resilience of an energy system is defined by its adaptability to transitions. Retrenchment of coal-based energy production delays a transition to renewables since retrenchment pushes energy transition further away. Moreover, expanding on coal means that infrastructural changes to the energy production and delivery architecture required by a renewable energy system are also not implemented. Moreover, increasing only coal production does not address the coal system's infrastructural issues. According to Tongia and Gross (2019), 'fixing' India's coal system is impossible without fixing distortions across coal mining, railways, power generators, and distribution companies. The IEA (2021a) also notes that "the rapidly rising requirement for flexibility in the operation of its power system is a potential hazard for electricity security in India." Therefore, increasing reliance on coal without systemic reform will leave India with a rigid energy production and distribution system incapable of a clean energy transition. Another significant task for achieving flexibility is to overcome political inertia, which can only be achieved by systemic change (Brown & Spiegel, 2019). Diversification is essential for resilience, as it spreads risks across multiple sources. In this case, "developing, demonstrating, and deploying clean energy technologies will boost the availability of innovative technologies as a hedge against technological uncertainty– this will enhance energy security" (IEA, 2021c). Thus, the Indian government must funnel research grants and private sector investment toward renewables, not coal. D'Souza and Singhal (2021, p. vii) write that investment and expansion of the coal sector alongside renewables will "impede investments needed to meet the net-zero target and continue the carbon lock-in with possibilities of stranded investments". India's coal history and increasing capacity are perfect for creating a 'carbon lock-in.' Carbon lock-in is a form of path dependency that prevents systemic transformations needed for the transition to renewable energy. It occurs when "the inertia of technologies, institutions, and behaviours individually and interactively limit the rate of such systemic transformations... whereby initial conditions, increasing economic returns to scale, and social and individual dynamics act to inhibit innovation and competitiveness of low-carbon alternatives" (Seto et al., 2016, p. 426). In other words, coal in India is change-resistant and will not transition without a concerted effort. In the long run, increasing coal dependency will severely reduce the ability of India's energy system to adapt.

Thus, considering these three dimensions of an expanded notion of energy security, it is apparent that the government's efforts to increase domestic extraction and utilisation of coal do not benefit India's energy security in the long run.

Figure 6: Location of existing coal plants and baseline level of water stress in India



Source: (IEA, 2021b).

HUMAN SECURITY

Coal is said to be cheap because of its abundance. However, Oskarsson et al. (2020, p. 3) write that coal's ability to produce electricity is based on "the sector's inability or unwillingness to deal appropriately with a range of social and environmental consequences. These consequences include compensation and resettlement of project affected populations, environmental mitigation, and proper mining closure and post-mining rehabilitation when operations stop". A non-state-centric approach to questions of security (Security for whom? Security for which values? Security from what threats?) brings the human security of people employed in and affected by the coal industry into focus. Human security is fundamentally concerned with people's survival, livelihood, and dignity. In this case, the dimensions of human security pertinent are economic security, impacts of environmental degradation, food and water scarcity, and assuredness of healthy lives.

Delayed energy transitions risk sudden and haphazard changes for those dependent on the coal industry for their livelihoods. Not aligning the trajectories of coal use and the announced climate mitigation goals "prevents the planning and investments for a post-coal world" (D'Souza & Singhal, 2021, p. vii). Therefore, the Indian government needs to account for workers across different sectors connected to coal, notably contractual and informal labour and their socio-economic profile. Without this, a significant chunk of the labour force may not be beneficiaries of the transition policies. The other dimension of economic security is indigenous tribal communities who lose their livelihoods after being displaced by coal mine creation "despite provisions for compensation and employment in the mines operated by Coal India Limited" (Roy & Schaffartzik, 2021, p. 7).

Coal mining is a hazardous occupation in terms of health, especially rat-hole mining. Furthermore, emissions from coal-based energy generation contribute to the climate crisis. These emissions contribute immensely to local pollution, a public health hazard on a regional level. According to Roy and Schaffartzik (2021, p. 3), "the coal complex in India has significant health impacts–mainly through local air pollution–including premature mortality, ranging from 80,000 to 115,000 premature deaths per year in the local population living around coal-fired power plants". Roy and Schaffartzik (2021) also provide the example of Andhra Pradesh, where the construction of thermal power plants damaged thousands of acres of wetlands crucial for the livelihood of local farmers and fisherfolk. Therefore, increasing coal reliance harms human security, given the loss of livelihoods, land degradation, and poor public health.

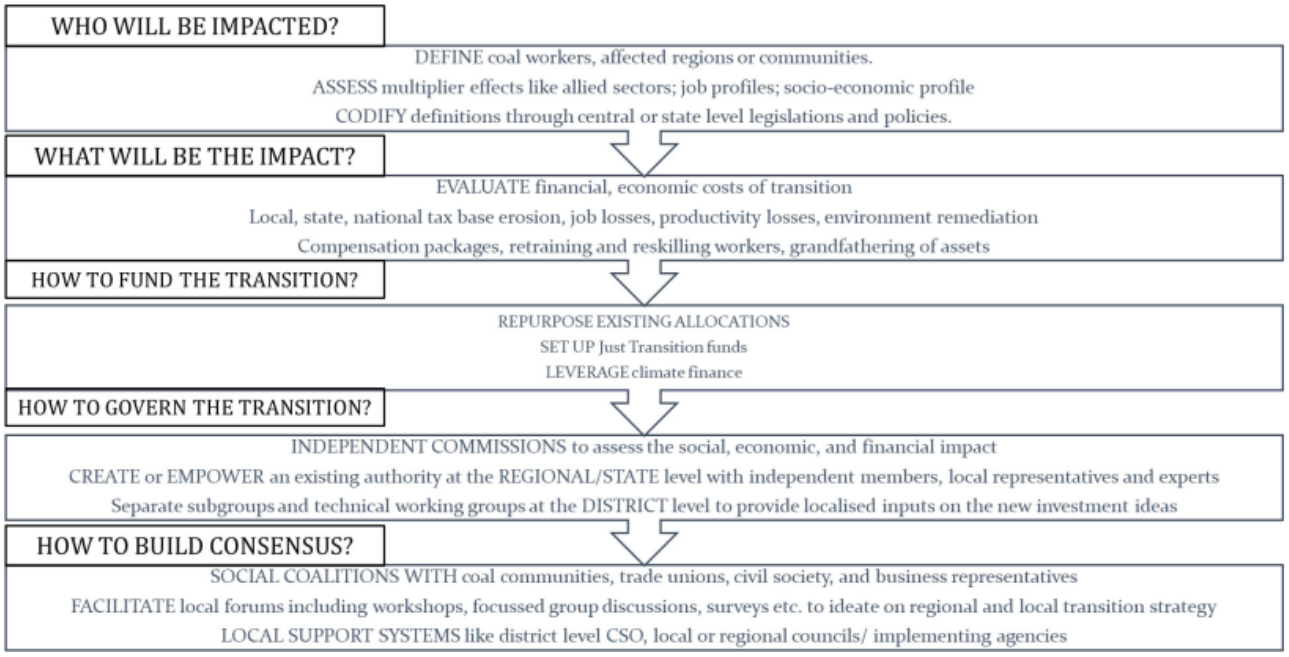
CONCLUSION: THE NEED FOR A TRANSITION DISCOURSE

However, given how deeply embedded coal is in India's economy and politics, it seems unlikely that policymakers will take up these perspectives in the form of concrete and comprehensive policies required to address the magnitude of a transition. According to the IEA (2022), coal made up 74% of India's power generation in 2021. The forecast for 2024 is that coal-fired generation will account for 70% of the electricity mix and renewables for 22%. Thus, coal may remain dominant and 'locked-in' in India. The country's transition discourse is currently optimistic about the share of renewables increasing in the power mix. However, it is unwilling to let go of coal. The country's intervention at COP26 to 'phase down' coal instead of phasing it out exemplifies this.

As India's demand for electricity continues to grow, the generation capacity expansion will accelerate from 2022 onwards. According to the Electricity Market Report 2021, the IEA expects "48% of new demand to be met by coal-fired generation… [and] low carbon sources provide about half of the additional supply" (IEA, 2022, p. 47). To truly leverage the increasing renewable capacity, it is necessary to transition away from fossil fuels, especially coal. This transition is also a chance to create a more just and secure energy system in terms of energy and human security.

The first step is a just transition discourse where continuing legacies of coal dependence are re-evaluated in light of coal's adverse effects on climate change, energy security, and human security. Such a transition discourse would thus be a first step in dismantling India's 'coal-lock in.' D'Souza and Singhal (2021) present a five-step just transition framework regarding coal transitions in India. The framework also reveals the different dimensions and stakeholders of such a transition. The framework's five questions can be considered a guide for transition discourse (see figure 7).

Figure 7: Just Transition Framework



Source: (D'Souza & Singhal, 2021)

The essential elements of this just transition discourse are as follows:

- A combined effort between local communities, the government, and businesses is needed to transition from fossil fuels to renewables. Hence, it should address all the stakeholders. Since coal/carbon lock-in involves interactions between multiple actors, eliminating the lock-in "will depend on coordinated efforts by people in the legislative and executive branches of government; in the research, development, and marketing departments of corporations; in international policy-making institutions; in financial institutions and capital markets; and in the non-governmental sectors" (Seto et al., 2016, p. 444);

- It should ultimately focus on decentralisation and localisation. Decentralisation reduces the risk of dependence on a centralised energy system, which is more vulnerable as a disruption to its central nodes has an adverse ripple effect on the entire system. Decentralisation also increases the chance of democratising energy systems.

- It must seek adequate finance for the transition, especially external funding, without which "it is unlikely that the scope of the transition only on livelihoods can be met solely by domestic funding" (D'Souza & Singhal, 2021, p. viii). An expanded notion of energy security, conscious of human security, will help India "communicate at the global level about the scale of these transitions and demand climate finance to manage and implement the strategy" (ibid.).

The presence of these elements in a transition discourse can help manage the demand for coal, especially in terms of power generation. Therefore, a transition discourse must include articulating policies that incentivise shifting investments away from coal and towards renewables. Moreover, as this paper has highlighted, a just transition discourse would help move beyond a short-term supply-centric conception of energy security. An expanded notion of energy security would account for the robustness and resilience of the energy system. As the preceding sections have highlighted, considering the broad spectrum of adverse consequences of increasing coal dependence questions the inertia of coal 'lock-in'. It also re-calibrates the state-centric focus of energy policy to a more people-centric focus. However, concrete actions must accompany this discourse in tandem; otherwise, the lock-in will be perpetuated and entrenched.

BIBLIOGRAPHY

Aggarwal, M. (2021, August 27). Underutilisation of Coal Reserves Could Put Energy Security at Stake: Parliamentary Panel. *The Wire.* https://thewire.in/energy/underutilisation-of-coal-reserves-could-put-energy-security-at-stake-parliamentary-panel.

Asian News International. (2021, January 11). Amit Shah: Coal industry will surely contribute in 5 trillion dollar economy dream. *The Economic Times.* https://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/coal-industry-will-surely-contribute-in-5-trillion-dollar-economy-dream-amit-shah/videoshow/80212132.cms?from=mdr.

Brauch, H. G. (2006). Security threats, challenges, vulnerability and risks. In U. O. Spring (Ed.), *International security, peace, development and environment* (pp. 102-140). Encyclopedia of Life Support Systems Publications.

Brown, B. & Spiegel, S. J. (2019). Coal, Climate Justice, and the Cultural Politics of Energy Transition. *Global Environmental Politics,* 19(2), 149–168. https://doi.org/10.1162/glep_a_00501.

D'Souza, S. & Singhal, K. (2021). *Socio-economic impacts of coal transitions in India: Bottom-up analysis of jobs in coal and coal-consuming industries.* National Foundation of India. https://nfi.org.in/sites/default/files/publication/cti.pdf.

Gross, S. (2019, March 8). *Coal is king in India—and will likely remain so.* Brookings. https://www.brookings.edu/blog/planetpolicy/2019/03/08/coal-is-king-in-india-and-will-likely-remain-so/.

Guay, J. (2013, August 5). *Why coal imports are adding to India's energy security problems.* Renew Economy. https://reneweconomy.com.au/india-coal-imports-and-energy-security-20733/.

International Energy Agency (2019, December 2). *Energy Security.* International Energy Agency. https://www.iea.org/areas-of-work/ensuring-energy-security.

International Energy Agency. (2021a). *India Energy Outlook 2021.* International Energy Agency. https://www.iea.org/reports/india-energy-outlook-2021.

International Energy Agency. (2021b). *Coal 2021.* International Energy Agency. https://www.iea.org/reports/coal-2021.

International Energy Agency. (2021c). *Security of Clean Energy Transitions.* International Energy Agency. https://www.iea.org/reports/security-of-clean-energy-transitions-2.

International Energy Agency. (2022). *Electricity Market Report - January 2022.* International Energy Agency. https://www.iea.org/reports/electricity-market-report-january-2022.

Jakstas, T. (2020). What does energy security mean? In M. Tvaronaciene & B. Slusarczyk (Eds.), *Energy Transformation Towards Sustainability* (pp. 99-112). Elsevier.

Khatib, H. (2000). Energy Security. *In World Energy Assessment Report* (pp. 111-134). United Nations Development Programme. https://www.undp.org/sites/g/files/zskgke326/files/publi-

cations/World%20Energy%20Assessment-2000.pdf.

Kohli, K. & Menon, M. (2020, June 16). India's U-Turn on 'Clean' Energy Is a Bad Move. *The Wire.* https://thewire.in/environment/coal-washing-environment-ministry-changing-rules.

Lahiri-Dutt, K. (2014). *The Coal Nation: Histories, Politics and Ecologies of Coal in India.* Routledge.

Malakar, Y., Herington, M., & Sharma, V. (2019). The temporalities of energy justice: Examining India's energy policy paradox using non-western philosophy. *Energy Research & Social Science*, 46, 16-25. https://doi.org/10.1016/j.erss.2018.11.002.

Ministry of Coal. (n.d.-a). *Import of Coal and Coke to India during last ten years.* Government of India. https://coal.gov.in/major-statistics/import-and-export?msclkid=857358d8cf5311ec8979aa3afe897297.

Ministry of Coal. (n.d.-b). *Coal Production and Offtake data (last 10 years).* Government of India. https://coal.gov.in/sites/default/files/2021-01/productiondata_tenyear.pdf.

Nandi, J. (2021, November 21). Didn't introduce 'phase down' in COP26 statement, clarifies India. *Hindustan Times.* https://www.hindustantimes.com/india-news/didnt-introduce-phase-down-in-cop-26-statement-clarifies-india-101637196023549.html.

NITI Aayog. (n.d.). *India Energy Dashboards - Coal Supply.* NITI Aayog. https://www.niti.gov.in/edm/#coalProduction.

Oskarsson, P., Nielsen, K. B., Lahiri-Dutt, K., & Roy, B. (2021). India's new coal geography: Coastal transformations, imported fuel and state-business collaboration in the transition to more fossil fuel energy. *Energy Research & Social Science,* 73, 101903. https://doi.org/10.1016/j.erss.2020.101903.

Perincherry, A. (2021, November 17). 'Phase Down' Over 'Phase Out': India's COP26 Coal Stand Necessary, Say Experts. *The Wire.* https://science.thewire.in/external-affairs/world/cop26-india-coal-phase-down-necessary-just-transition/.

Powell, L., Sati, A., & Tomar, V. K. (2021, October 15) China and India postpone peak coal. *Observer Research Foundation.* https://www.orfonline.org/expert-speak/china-and-india-postpone-peak-coal/.

Press Information Bureau. (2019, November 1). *Coal India to produce one billion tonnes of coal by 2024: Target announced by Shri Pralhad Joshi on 45th Coal India Foundation Day* [press release]. Government of India. https://pib.gov.in/Pressreleaseshare.aspx?PRID=1590009.

Ritchie, H. & Roser, M. (n.d.). India: Energy Country Profile. *Our World in Data.* https://ourworldindata.org/energy/country/india?msclkid=b728338bcf5411ecbb396d93be499655&country=~IND.

Rodríguez-Fernández, L., Carvajal, A. B. F., & de Tejada, V. F. (2022). Improving the concept of energy security in an energy transition environment: Application to the gas sector in the European Union. *The Extractive Industries and Society,* 9, 101045. https://doi.org/10.1016/j.exis.2022.101045.

Roy, B., & Schaffartzik, A. (2021). Talk renewables, walk coal: The paradox of India's energy transition. *Ecological Economics,* 180, 106871. https://doi.org/10.1016/j.ecolecon.2020.106871.

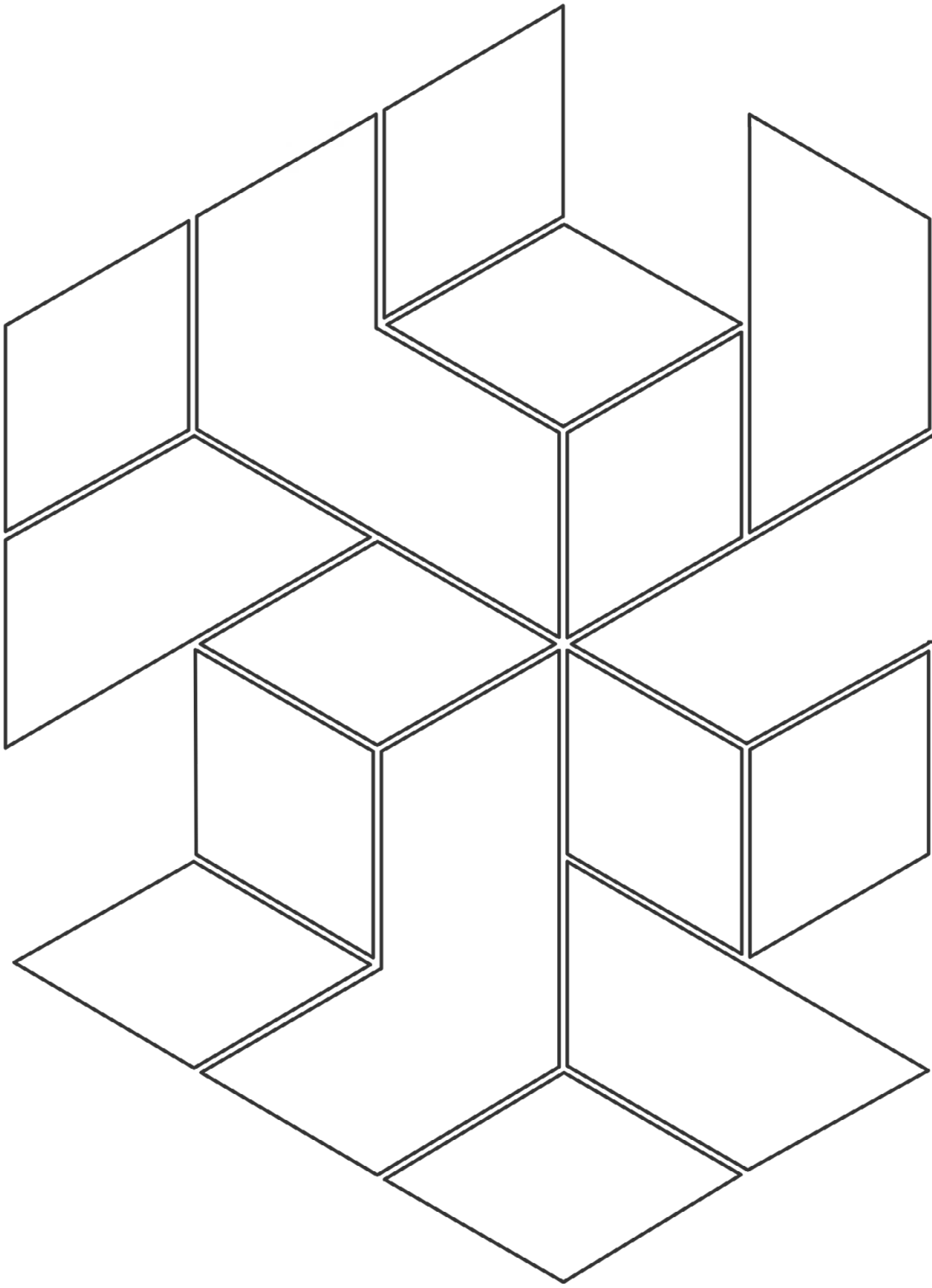
Sahu, G. (2015). *Review: The Coal of India [Reviewed Work: The Coal Nation: Histories, Ecologies and Politics of Coal in India,* by K. Lahiri-Dutt]. Economic and Political Weekly, 50(8), 29–31. http://www.jstor.org/stable/24481420.

Seto, K. C., Davis, S. J., Mitchell, R. B., Stokes, E. C., Unruh, G., & Ürge-Vorsatz, D. (2016). Carbon lock-in: types, causes, and policy implications. *Annual Review of Environment and Resources,* 41(1), 425-452. https://doi.org/10.1146/annurev-environ-110615-085934.

Shankleman, J. & Rathi, A. (2021, November 14). *Glasgow COP26 summit: India's coal defence hid China, US role.* Financial Review. https://www.afr.com/policy/energy-and-climate/india-s-last-minute-coal-defence-at-cop26-hid-role-of-china-us-20211114-p598rb?msclkid=75a736bacf4611ec81e42a8f8d7b2d3d.

Tongia, R. & Gross, S. (2019). *Coal in India: Adjusting to transition.* Brookings India. https://thinkasia.org/handle/11540/9782.

Vishwanathan, S., Garg, A. & Tiwari, V. (2018). *Coal transition in India. Assessing India's energy transition options.* IDDRI and Climate Strategies. https://climatestrategies.org/wp-content/uploads/2019/08/Coaltransitions_finalreport_India_2018.pdf.



SPRF.IN