PRIED
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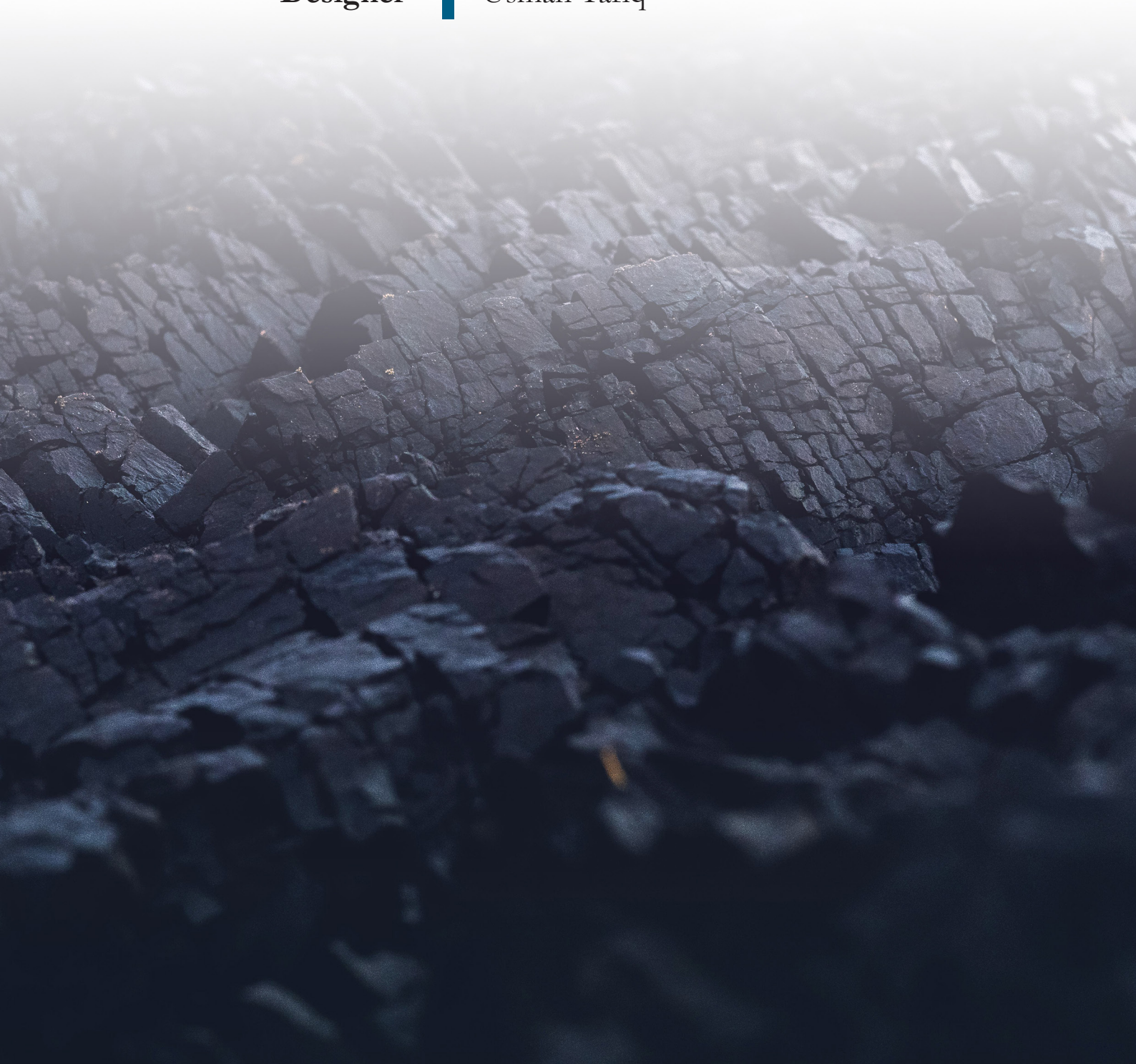
PROJECT BRIEF

THAR RAILWAY

THE REAL COST OF COAL TRANSPORTATION

Authors	Hussain Assad and Zahra Naeem
Reviewer	Azhar Lashari
Editor	Muhammad Badar Alam
Designer	Usman Tariq



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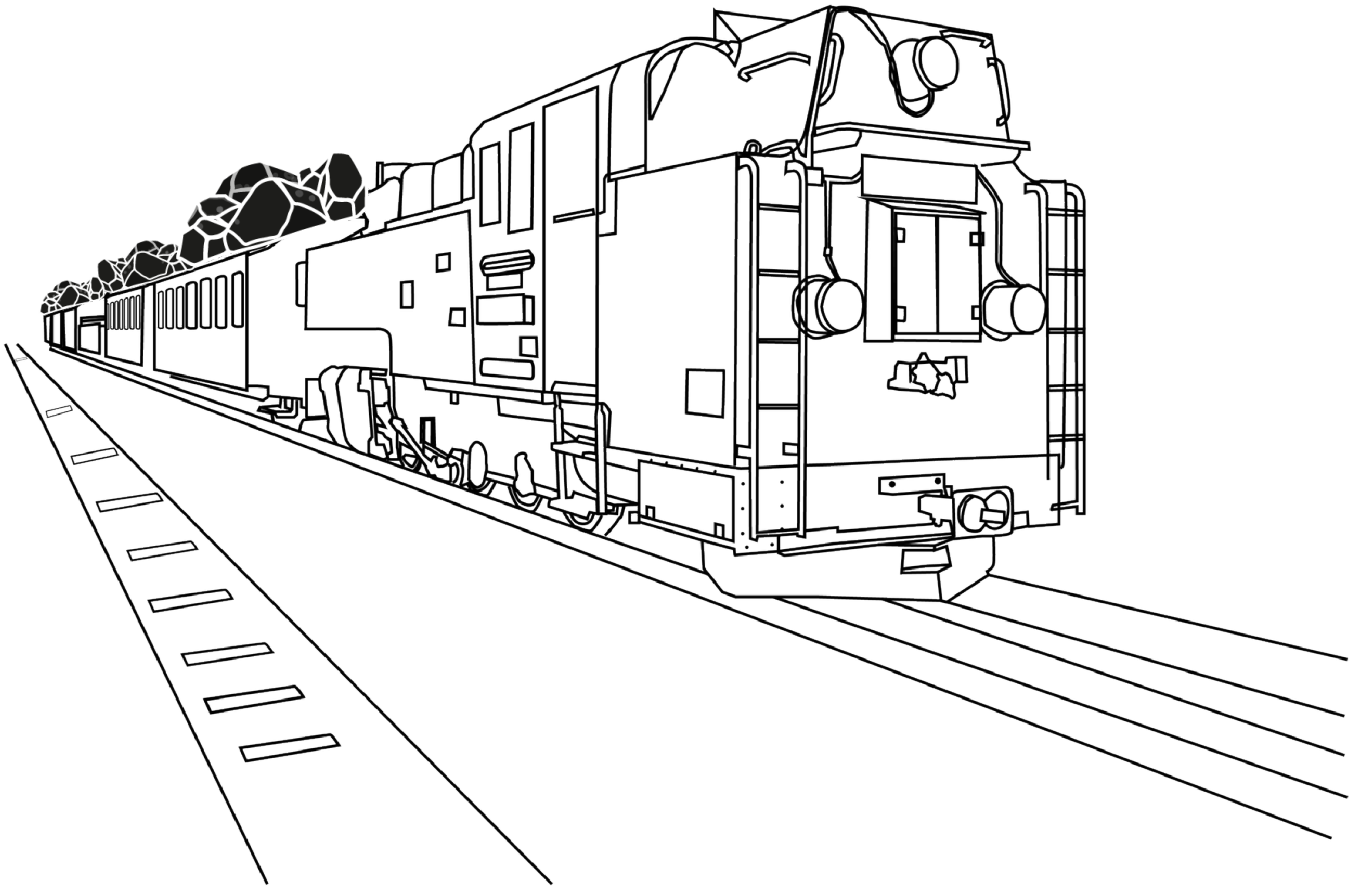

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The rationale

Pakistan is highly dependent on imported fuel. In 2023, Its energy import bill was approximately 17.5 billion US dollars. This figure is projected to rise significantly, potentially reaching 31 billion US dollars by 2031[1]. This is mainly because the country's indigenous gas reserves have almost run out but its gas-guzzling domestic and industrial consumers are finding it hard to make a transition to other sources of energy.

Pakistan, however, found it very hard to pay for the import of fossil fuels after the economic crisis of 2022. The problem was further intensified by the government's diminished ability to finance even its own running. This poses a significant threat to the country's foreign trade balance and energy security.

To avoid these ballooning import bills, the government has decided to exploit locally available energy resources, especially the coal reserves of Thar[2] desert, which spans a large part of Tharparkar district in eastern Sindh, as a means to ease its financial burden. Many politicians, government officials, policymakers and even private sector representatives believe that exploiting Thar's coal reserves to their fullest potential is the best way for Pakistan to break out of its energy and financial crises simultaneously. The development of these reserves – including their mining and transportation – is, therefore, considered to be the only viable means for a sustained energy supply to the industry[3].Thar rail line project, thus, forms a vital link in the coal supply chain to three key industries: electricity, cement and fertilizers. It is, indeed, seen as a necessary step to create a country-wide market for Thar coal.

Pakistan already generates 3,300 megawatts (MWs) of electricity from the coal deposits of Thar[4] -- sixth largest in the world – with power plants which are set up close to coal mines. Apart from Thar coal's usage in power production, it is also being transported by road to several industries, especially cement manufacturing plants. Now the government is also planning to convert coal power plants based on imported coal to Thar coal. Similarly, another upcoming coal-based power plant, Lucky Power, plans to use Thar coal and will need rail connectivity with Thar coal.

The government approved planning document, called PC-1, for the Thar coal rail project argues that transporting coal to the power plants mentioned above by trucks will damage the road infrastructure and harm the environment. The current transportation infrastructure in the Thar coal mine area is inadequate for handling bulk transportation of coal, reads the PC-1. So, it is "essential to establish an efficient and robust transportation system to overcome Thar coal's geographical limitations and ensure its nationwide distribution." Internationally too, adds the PC-1, railway infrastructure is commonly used for bulk transportation of goods, including coal. "This is particularly evident in Europe, especially in Germany, where lignite coal is transported across the country via railways." Similarly, in India, Coal India Limited, a company that produces more than 80 percent[5] of that country's coal, "relies on railway infrastructure to distribute coal to power and cement industries nationwide."

1 https://oilprice.com/Energy/Energy-General/Why-No-Major-Oil-Company-Is-Rushing-To-Drill-Pakistans-Huge-Oil-Reserves.html

2 https://www.dawn.com/news/1714366

3 https://tribune.com.pk/story/2433921/long-awaited-rail-track-to-ferry-thar-coal-okayed

4 https://www.dawn.com/news/1797677

5 https://asia.nikkei.com/Companies/Coal-India-Ltd

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The PC-1 also states that any additional/future electricity generation plant will also require Thar coal. One such plant is Jamshoro Power Company's Unit-2 which "will create an additional Thar coal demand of 3.6 [Million Ton Per Annum] MTPA[6]".

According to the Energy Yearbook 2019, Pakistan imported 15 million tons of coal in the financial year 2018-19, largely for the power and cement industries. The government believes that a portion of this imported coal can be replaced by Thar coal. If 20 percent of this imported coal has to be replaced by Thar coal, the demand for Thar coal will increase by 9.7 MTPA.

ANNUAL OPERATING AND MAINTENANCE COST AFTER COMPLETION OF THE PROJECT

Item-wise annual operating / maintenance cost based on proposed capacity utilization to be worked out for 5 years and sources of its financing.

O&M cost of the project has been assumed as PKR 2,000 million for the first operational year with an annual increment of 10% each year.

Year	O&M Cost	Local Component (Million PKR)	Foreign Component (Million PKR)	Total (Million PKR)
1	2,000.00	2,000.00	-	2,000.00
2	2,200.00	2,200.00	-	2,200.00
3	2,420.00	2,420.00	-	2,420.00
4	2,662.00	2,662.00	-	2,662.00
5	2,928.00	2,928.00	-	2,928.00
Total (A)		**12,210.20**	**0.00**	**12,210.20**

Source: Planning Commission PC-1 PROFORMA (Infrastructure sectors)

The government is now laying down a rail line that will link Thar's coalfield blocks with the existing national railway network so that coal being extracted from mines in Thar is conveyed to coal-based power plants based outside Thar and some other industries. This is being done even when studies show that generating electricity from local coal is at least 37 percent more expensive than that produced through renewables such as solar[7].

This policy brief seeks to explore how this new rail network will impact the socially unique, environmentally fragile and economically marginalized region of Thar. It, thereby, questions some aspects of the reliability

argument usually put forward to support the expansion of Thar coal development projects.

6 The information provided is sourced from official documents, including PC-1, the Feasibility Study conducted by Pakistan Railway, the Sindh Government's official project brief, and information available on the Ministry of Railways website.

7 https://renewablesfirst.org/wp-content/uploads/2023/11/BTM-CHAPTER-4-Website-Version.pdf

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GOVERNMENT OF PAKISTAN PLANNING COMMISSION PC-I PROFORMA	
Name of the project	Thar Coal Rail Connectivity with existing Railway Network including last mile connectivity with Port Qasim.
Location	Islamakot (Tharparkar) - New Chhor (Umerkot), Bin Qasim (Province of Sindh). (Site Plan) at Annexure-A & A1)
Authorities Responsible for:	
Sponsoring:	50% Cost will be borne by Federal Government and 50% by Provincial Government of Sindh. The MoU has been signed and placed at Appendix-2
Execution:	Pakistan Railways/Pakistan Railways Freight Transporation Company.
Operation and Maintenance:	Pakistan Railways/Pakistan Railways Freight Transporation Company.
Concerned Federal Ministry	Ministry of Railways

Source: Planning Commission PC-1 PROFORMA (Infrastructure sectors)

The first phase of this project involves a 105-kilometer long single-line rail track that will start from Thar Coalfield Block II in Tharparkar, going north to the town of Chhore located in Umerkot district. In Chhore, it will be linked to an existing rail line going to Mirpur Khas which, in turn, is linked to the national infrastructure of Pakistan Railway. The proposed track will pass through Bitra, Jaman Smao, Saleh Janjhi, Meghay jo Tar, Donbarro, Tigthio, Hanjtal, Paburvero, Arbab Sameja Dhani, Ak Wadho, Panchando Par, Fangario, Odani, Nabisar and New Chhore villages of Thar. Seven railway stations will be constructed along this route, with two main stations to be built in Thar Coalfield Block II and new Chhore.

The second phase of this project involves a 9-kilometer long double-line track from Karachi's Bin Qasim area to two power plants located near Port Qasim.

Together, these tracks will have the capacity to transport 10 million tons of coal annually[8].

Year-wise/component-wise physical activities		
Items	**July-2023 To June, 2024**	**July-2024 To June-2025**
Thar Coal Rail Connectivity with existing Railway Network including last mile connectivity with Port Qasim	50%	50%

Source: PC 1 -Year-wise/component-wise physical activities

8 https://tribune.com.pk/story/2449713/despite-no-allocation-ecnec-okays-big-scheme

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As the earliest stage of the coal rail line project, Pakistan Railways' Freight Transport Company conducted a study to see if it was feasible to connect Thar's coalfields with the national rail network. The study was carried out between July 2019 and March 2020[9] and its goal was to "examine the overall potential for extending rail links strategically and to make suggestions for project implementation of the most acceptable development

option in terms of track alignment, technical standards, financials, and organization". Its final version was submitted to the federal government in May 2020.

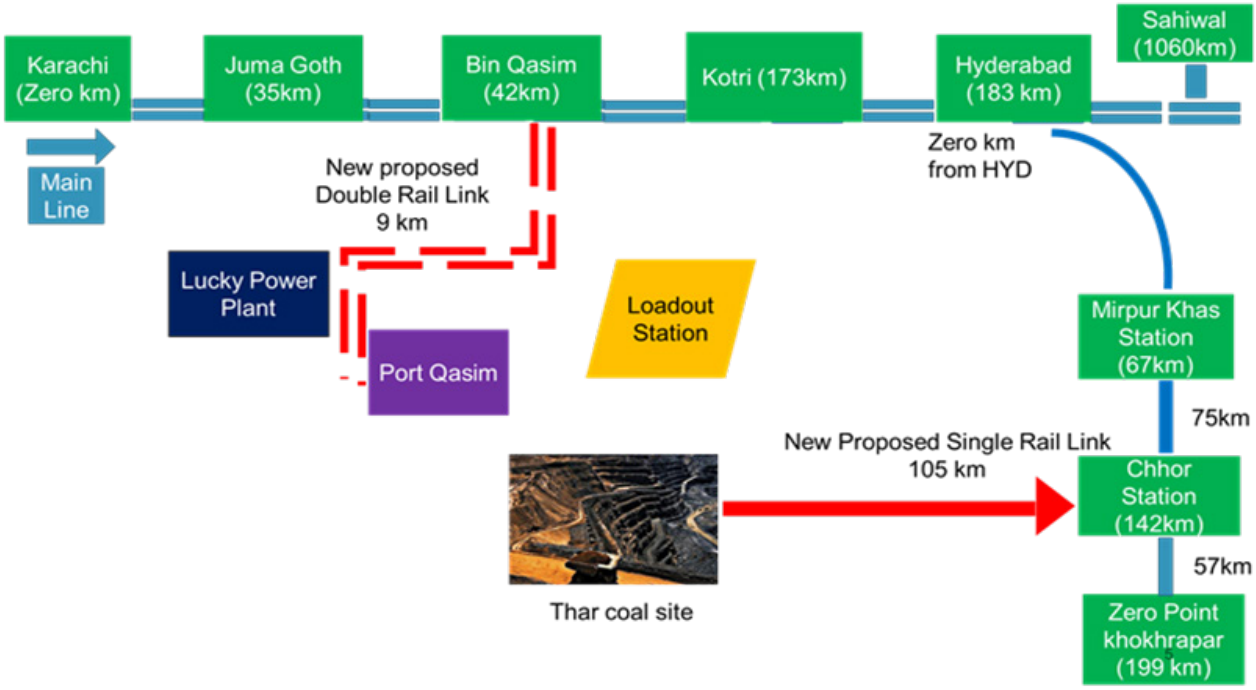

Fig 1: The government proposed railway lines spanning 105 kilometers

The PC-I submitted by the Ministry of Railways on October 20, 2022, was discussed during the Central Development Working Party (CDWP) meeting on December 22, 2022. During the meeting, it was instructed to update the project by aligning the revenue assumptions with the provisions related to Thar Coal demand and supply (Power Division) of the Energy Department, Government of Sindh, as shared by the Planning Commission.

The Sindh government subsequently prepared a PC-I for the project, estimating its cost to be 55,973,489 million rupees but this was revised upwards to 86 billion rupees in 2022 mainly because of decrease in the price of rupee versus US dollar. Under the provincial PC-I, Engro Energy Limited, a private company based in Karachi, was supposed to spend 49 million rupees on the rail line while the remaining amount of money was to be provided by the Sindh government.

A revised and updated PC-1 was made in 2022. This new PC-1, already approved by the Executive Committee of the National Economic Council (ECNE), states that the provincial and the federal governments will now

9 Energy Update - News, Updates related to Power, Nuclear, Solar, Renewable Energy in Pakistan

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bear its costs jointly and equally. It notes that the estimated cost of the project will be 58,240.651 million rupees. It states that 50 percent of the project's cost will be borne by the federal government through Public Sector Development Programs (PSDP), while the remaining 50 percent will be covered by the Sindh Province Annual Development Plan (ADP).

The land required for the project has been earmarked even when the world is increasingly acknowledging that coal is the dirtiest fossil fuel – one that degrades the environment at every stage of its life cycle. Unsurprisingly, its extraction and usage account for 44 percent[10] of all global carbon emissions. These negative effects explain why coal phase out and retirement of coal-fired power plants tops the agenda of climate action groups globally. Since the signing of the Paris Agreement by 196 countries in 2015, the world, in fact, has seen a drop in the establishment of new coal-fired power plants by 76 percent[11].

Even in Pakistan -- where China invested extensively in coal mining and coal-based power generation between 2013 and 2017 – the avenues of financing new projects in this sector are diminishing. The most important reason for the shrinking of these avenues is that Chinese President Xi Jinping announced in 2023[12] that China will no longer fund any new coal projects anywhere in the world. The irony is that Pakistan, too, announced a similar moratorium on coal power plants in 2021 and, yet, it is expanding its coal-enabling infrastructure.

On track, off track

The arguments being put forward in favor of the project include:

1. Transporting 1000 tons of coal on a train for a kilometer requires 3.5 liters of fuel while transporting the same amount of coal for the same distance by road requires 10 liters of fuel. The rail lines will, therefore, reduce the cost of coal transportation.

2. Transportation of coal by rail will also have a smaller climatic and environmental impact than its transportation by road because the former uses less fuel than the latter. The plantation of trees along the railway line would also help clean the air and reduce pollution in the project area. Transporting coal via specially designed railway wagons is expected to minimize the flight of coal dust, thereby reducing air pollution.

3. Shifting various industries across Pakistan to local coal will help Pakistan cut its annual fuel import costs possibly by 1.5 billion US dollars.

4. The usage of Thar coal for industrial production will help power producers, cement manufacturers and fertilizers producers to reduce operational and manufacturing costs which will bring down input prices in agriculture and construction sectors – ultimately benefiting consumers across the country.

10 https://www.imf.org/en/Blogs/Articles/2020/12/08/blog-a-greener-future-begins-with-a-shift-to-coal-alternatives

11 https://www.e3g.org/publications/no-new-coal/

12 https://www.climatechangenews.com/2021/09/21/president-xi-declares-end-chinese-support-new-coal-power-abroad/

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5. The expansion of Thar Coal will bring prosperity to the local populace of the Thar Coal mine area by unlocking the royalty and creating sustainable job opportunities for them. It is also expected to increase land value, regional income and economic activity in Thar.

6. It is expected to increase freight and passenger traffic for Pakistan Railways, enhancing revenue generation.

7. The railway line can potentially be used for future public transport which could connect Tharparkar with nearby business centers.

Counter-points to each of these arguments, however, can be easily and effectively made. For instance, the cost-effectiveness of transporting coal by rail does not consider the fact that coal dust will fly in large quantities during this transportation, causing irreparable air pollution along the way. The medical and environmental price of this pollution is certainly too high to be overlooked. And, it will also offset the supposed climatic and environmental advantages that coal rail may have over road transport.

Secondly, coal mining and coal-based power generation in Tharparkar are already known to have caused many medical and environmental hazards for the residents of that district. The economic costs of these hazards could easily outweigh the financial benefits that Pakistan may reap from replacing imported fuels with local coal.

Thirdly, production of electricity from Thar coal has failed to reduce electricity's consumer prices. In fact, Pakistan experienced large-scale protests even in late 2023 against exorbitant electricity bills[13]. So, the argument that the prices of cement and fertilizers will come down due to the usage of local coal may not turn out to be valid after all.

Interestingly, the arguments listed above in support of new coal rails also could not convince the federal government to finance the project – not at least initially. The Sindh government, however, still insisted that it will build the lines by mobilizing financial resources through Public Private Partnership (PPP) mode. Later, the then Prime Minister Shahbaz Sharif intervened personally and approved the execution of the project under the Public Sector Development Program (PSDP). This approval finally paved the way for the signing of a Memorandum of Understanding on October 5, 2022[14] by the federal Ministry of Railways and the provincial government of Sindh for carrying out the project.

⚠ Risks and hazards

Studies abound about the negative impacts of mining coal and burning it for power generation and for other industrial and commercial purposes. One of these studies states that the concentration of Particulate Matter 2.5 (PM 2.5) in the atmosphere as a result of fossil-fuel combustion caused between 740,000 and 1360,000 avoidable deaths globally in 2018. The same study reveals that over half of these concentrations can be attributed to

13 https://shorturl.at/tuSX3

14 https://www.app.com.pk/national/mou-signed-to-construct-105km-rail-track-in-thar-coal/

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usage of coal alone[15]. These fatalities explain why developed nations like the United States of America passed laws – such as Clean Air Act – several decades ago to rid the air of the negative impacts of fossil fuels including coal. These laws are rightly considered to have saved innumerable lives[16].

Having said that, a working paper published in 2017 by the United States' National Bureau of Economic Research suggests that the impacts of transporting coal on environment, communities and other life forms rarely come under discussion or robust scrutiny[17]. A 1987 research paper, titled "Environmental Impacts of Coal Mining & Utilization" available online on ScienceDirect website, carries out one such scrutiny. It shows that coal transportation in all its forms "exhibit certain common environmental impact features" because it "necessarily involves fugitive dusts, even though precautionary measures are increasingly taken"[18].

Almost all of the environmental impacts of coal transport occur during loading, en route, or during unloading. The impacts are likely to affect "natural" systems, including agriculture, forestry, horticulture, and aquaculture, buildings and installations, and involve death or injury to humans in an occupational capacity, or to the public[19].

A series of studies, commissioned by the United States Department of Energy, similarly stresses upon the environmental impacts of coal transportation on human beings. A panel of public health experts in Oakland, United States, for example, concluded after public hearings in 2015 that coal trains significantly contribute to the diffusion of PM 2.5 in atmosphere which is definitely linked to premature deaths, increased lung cancer, increased incidence of other lung diseases and heart related hospitalization[20].

The panel particularly emphasized: "Coal dust typically contains toxins such as mercury, lead, arsenic, cadmium, and crystalline silica. These substances are of high health concern if inhaled or ingested and are known to cause cancer, fetal defects and neurological damage, even at very low doses. There are no known safe levels of exposure to these toxics." [21]

In Australia, a key coal-exporting nation, activists have been protesting for several years against the development of a coal mine for transportation of coal to India. Their worst fears were, in fact, realized when a coal spill during a cyclone caused wetlands near the Abbot Point port in Queensland to turn black[22].

Parallels from India, the second largest coal user in the world after China, suggest that PM 2.5 concentrations there are recorded to be 53.3 micrograms per cubic meter of atmosphere whereas the World Health Organization (WHO) recommends that these concentrations should not exceed 5 micrograms per cubic meter[23]. Studies also suggest that the use of fossil fuels, including coal, in India and China is contributing to roughly 10 percent

15 Source sector and fuel contributions to ambient PM2.5 and attributable mortality across multiple spatial scales | Nature Communications

16 https://journalistsresource.org/environment/local-health-effects-transporting-coal/

17 Handle with Care: The Local Air Pollution Costs of Coal Storage. | NBER

18 Environmental Impacts of Coal Transportation - ScienceDirect

19 Environmental Impacts of Coal Transportation - ScienceDirect

20 An Assessment of the Health and Safety Implications of Coal Transport through Oakland - Human Impact Partners

21 www.mdpi.com/1420-3049/26/19/6060

22 Environmental and other effects of mining and transport ccc281.pdf (usea.org)

23 India Had Eighth-Worst Air Pollution in 2022: Report (thewire.in)

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of the global ambient PM 2.5 disease burden[24].

The combustion of coal also releases other pollutants such as sulfur dioxide (SO2) and nitrogen oxide (NO) into the air[25]. Both of these gasses are linked to such medical conditions as increased respiratory illnesses, alterations in the lungs' defenses, higher incidence of cardiovascular diseases[26], increased inflammation of the airways, worsened cough and wheezing, reduced lung function, increased asthma attacks and greater likelihood of admissions in emergency departments and hospitals[27].

Pakistan is already the fifth most polluted country in the world. It is also among the ten countries which are most vulnerable to climate change. Transporting Thar coal through rail to various industries in Punjab, Sindh and Khyber Pakhtunkhwa will only exacerbate these problems[28]. Here is how:

Several studies suggest that Thar's lignite coal has a lower heating capacity (1300-kilowatt hour/ ton) as compared to imported(sub-bituminous) coal which has a heating capacity of (1927 kilowatt hour /ton). This means that power producers and industrial units shifting from imported coal to Thar coal will have to burn almost 33 percent more fuel than they already do to meet their energy needs. The transportation of this extra fuel will certainly lead to the addition of more fly ash and PM 2.5 in the atmosphere than is already happening during the transport of imported coal.

Transportation of additional coal will also increase PM 2.5 concentrations in the atmosphere which – as studies mentioned above suggest – is directly responsible for catastrophic medical effects and is likely to exacerbate the problems of smog and polluted air[29] in the central and northern regions of Pakistan.

This is also likely to cause numerous problems outside of Thar. For one, it will increase health hazards in all those areas where the coal will be transported to and stored. That coal storage and transportation cause serious public health risks and environmental problems is evident from the numerous letters that the Sindh Environmental Protection Agency (SEPA) has written to the chairman of the Port Qasim Authority about these very risks and problems.

It is also important to highlight here that an increase in the mining, transportation, and usage of coal in Pakistan is happening at a time when many other countries are moving away from it. If nothing else, this global shift away from coal will become a major hurdle in the way of Pakistan's efforts to secure financing for its projects[30] to shift its power generation and industrial activities to Thar coal.

Pakistan is also likely to disqualify itself from accessing climate-specific financing tools such as Green Climate

24 Source sector and fuel contributions to ambient PM2.5 and attributable mortality across multiple spatial scales | Nature Communications

25 https://www.iea.org/

26 Sulphur dioxide (iqair.com)

27 Nitrogen Dioxide | American Lung Association

28 https://www.iqair.com/world-air-quality-ranking

29 https://m.thewire.in/article/environment/india-had-eight-worst-air-pollution-in-2022-report#:~:text=Weighted%20by%20population%2C%20India's%20average,PM2

30 https://www.dawn.com/news/1794418

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Fund (GCF) if it continues to expand its mining, transportation, and usage of coal and thereby increase its hazardous emissions profile.

Home truths

The transporting of Thar coal across Pakistan will also create a market for low quality lignite coal. This market will inevitably require expansion in mining activities in Tharparkar which will then lead to the acquisition of more land from the local residents and the devastation of their soil, air and water. That the ongoing coal mining activities have already had the same effects has, indeed, been documented by several studies including those done by the Policy Research Institute for Equitable Development (PRIED)[31].

One of these reports, Coal rush: The impacts of coal power generation on Tharis' land rights, reveals the detrimental impacts of coal mining and power generation on the land rights of Tharparkar's residents and describes in detail the social and environmental chaos that coal projects have wrought upon a previously well-adapted and resilient livelihood system that has sustained the district's populations for centuries[32]. Another PRIED study document increased respiratory diseases and other illnesses among humans and animals in Tharparkar[33] as a result of coal mining and coal-based power generation.

The long-distance rail transport of coal will also result in substantial greenhouse gas emissions which is a major contributor to climate change and global warming. The operation of coal trains will similarly generate noise pollution, adversely affecting local ecosystems, wildlife, and human health. Also, the large-scale construction activity needed for laying down the proposed rail lines will disrupt local natural ecosystems and habitats, leading to the displacement of wildlife and loss of biodiversity.

A stone marking the route of the proposed railway line. Photo by PRIED

Construction and operations of rail tracks for coal transportation are feared to destroy the ecology of many parts of Tharparkar which is home to many rare species of birds, animals, plants, and trees. For instance, the

31 priedpk.org/wp-content/uploads/2023/01/Coal-Power-and-Livelihood-Disruptions-in-Thar.pdf

32 https://www.priedpk.org/wp-content/uploads/2023/01/Research-Study-Coal-rush-The-impacts-of-coal-power-generation-on-Tharis-land-rights-1.pdf

33 https://www.priedpk.org/wp-content/uploads/2023/11/project-brief-01-Health-Hazards.pdf

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construction of the track might cause large scale deforestation and, as local knowledge suggests, it might also

adversely impact the local drainage system. Since Thar has experienced floods in the past, there are serious concerns that the proposed railway track will be vulnerable to such natural disasters. This explains why the bankable feasibility study conducted by Pakistan Railways recommends that an adequate drainage system be provided along and across the track. It is obvious that the construction of this railway system and the protection of the proposed track from the floods will require significant amount of money which will raise its overall cost.

The proposed track will also deprive several hundred families of their only source of income: land. Some residents of Parchando Par village, with approximately 500 households, say they will be affected by the upcoming railway track construction. One of them, Manjo Manth, says he will lose 10 acres of his ancestral land to the project. "No government official has contacted us so far but there are speculations that they will give us 400,000-500,000 rupees per acre as compensation," he says and adds: This money is too little to compensate for our loss of livelihood.

The project's own Environment Impact Assessment (EIA) itself acknowledges the problem of livelihood loss, albeit indirectly. It says that "most households in the project area do not own land, with land ownership being particularly rare among women-headed households". It also states that "low agricultural productivity in the area often leads to insufficient cereal production for household consumption, especially in female-headed households". While recognizing these "key socio-economic challenges", the EIA acknowledges that it "lacks depth in addressing how the railway project might exacerbate or mitigate these issues, particularly the vulnerabilities of landless and women-headed households".

Recommendations

The facts and details stated above clearly show that the federal and provincial governments must address environmental and climatic concerns related to the transportation of Thar coal before laying down the railway line. The Federal Ministry of Planning and Development, therefore, must prepare comprehensive mechanisms to assess the social and environmental costs of the project and recommend – as well as implement – suitable, sustainable, effective and immediate remedies for those costs.

Also, as has been established in PRIED's earlier studies, coal development has seriously hurt the fragile ecological balance that sustains local communities living in Tharparkar. In the absence of any effective and suitable mitigation strategies by the state, they have already been left to themselves to deal with the negative environmental, economic and medical fallout of coal extraction and usage right next to their homes and hearths. Laying down of the railway line will only exacerbate these fallouts.

As suggested by the EIA report, it is important to carry out detailed studies on the potential effects of the railway line on agricultural practices and food security in the project area. These studies should take into account socio-cultural, economic, medical and biodiversity aspects of the project and also provide detailed mitigation measures to address the problems related to agriculture and food security.

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Moreover, since the expansion of coal mining in Thar and transportation of coal through rail are both certain to increase the level of greenhouse gas emissions and other environmentally hazardous substances, they must be allowed to go ahead only after all the necessary environmental, social, and economic safeguards have been put in place – and that too according to internationally acceptable standards.

Coal transportation also generates PM 2.5 which has proven to be a serious health and environmental hazard globally. Any development project that increases the generation of this particulate matter must, therefore, be subjected to serious and detailed scrutiny involving independent experts, civil society, and local communities.