PRIED
Policy Research Institute
for Equitable Development

Project Brief

THE COST OF THERMAL POWER GENERATION AT JAMSHORO

A Social and Environmental Disaster

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Disclaimer

The contents of this brief are based upon data collected from the field, a public opinion survey and anecdotes and case studies shared with the authors by the residents of some selected villages located in various coalfield blocks of Tharparkar district. No laboratory tests and/or collection, collation and analysis of medical records have been carried out as a part of the field work for this brief. Its contents, therefore, should be regarded only as a reflection of public perceptions, personal narratives and situation on the ground.

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List of Abbreviations

ADB	Asian Development Bank
ATSDR	Agency for Toxic Substance and Disease Registry
BoD	Board of Directors
CCRs	Coal Combustion Residuals
CFPP	Coal-fired Power Plant
COD	Commercial Operation Date
EU	European Union
GoS	Government of Sindh
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
FGD Gypsum	Flue Gas Desulfurized Gypsum
GoP	Government of Pakistan
GW	Gigawatt
HEI	Harbin Electric International
IDB	Islamic Development Bank
IEA	International Energy Agency (IEA)
IGCEP	Indicative Generation Capacity Enhancement Plan (IGCEP)
JPCL	Jamshoro Power Company Limited
JPGP	Jamshoro Power Generation Project
JTPS	Jamshoro Thermal Power Station
LARF	Land Acquisition and Resettlement Framework
LUMHS	Liaquat University of Medical and Health Sciences
MoE	Ministry of Energy
MoU	Memorandum of Understanding
MUET	Mehran University of Engineering and Technology
MW	Megawatt
NEPRA	National Electric Power Regulatory Authority
NOC	No Objection Certificate
PFF	Pakistan Fisherfolk Forum
PIC	Project Implementation Consultant
SECMC	Sindh Engro Coal Mining Company
SEPA	Sindh Environmental Protection Agency
TCB-I	Thar Coalfield Block-I
USA	United States of America
WAPDA	Water and Power Development Authority
WBG	World Bank Group
WHO	World Health Organization

BACKGROUND

Jamshoro coal-fired power plant is funded by the Asian Development Bank (ADB) and is officially known as Jamshoro Power Generation Project (JPGP). Located near Jamshoro city in southern Sindh, it includes two electricity generating units, Unit-1 and Unit-2, each with a capacity to produce 660 megawatts (MW) of electricity. The plant is designed to utilize supercritical technology — that is, it has efficiency levels of above 45 percent. It is also designed to run on blended fuel (80 percent sub-bituminous coal and 20 percent lignite coal). According to the official documents, the sub-bituminous coal is to be imported while the lignite coal is to be procured from Thar coalfields in Tharparkar district – around 270 kilometers to the east of the plant.

Unit-1 of JPGP is almost complete but it is yet to be commissioned. Its commercial operation date (COD) has been revised more than once. Had it become operational on 31st March 2019 as per its original COD, this unit would have pushed Pakistan's existing coal-based generation capacity of more than 7 gigawatts (GW) to above 8 GW. The delay in this unit's commissioning has been caused mainly because Pakistanis suffering from a serious shortage of foreign exchange required for the import of sub-bituminous coal. Another reason for the delay is that the construction of a railway track required for transporting lignite coal from Tharparkar to the site of Jamshoro Power Generation Project has not even started yet.

To address the problem of foreign exchange shortage, the government of Pakistan has come up with a proposal to run Unit-1 entirely on Thar's lignite coal. The proposed conversion, however, involves several structural changes in the plant's design, machinery and operations — each with serious policy, socio-economic and environmental implications.

This project brief — focused as it is on Unit-1 — aims at:

- identifying the existing as well as the future adverse social and environmental impacts associated with the Unit-1 of JPGP;
- generating a public discourse on these impacts; and
- influencing decision-making authorities to address the unit's present and potential social and environmental impacts.

The information and analysis provided in the brief are based on both primary and secondary data gathered respectively through field visits and desk research. A research team, comprising three people, conducted two field visits of the project site — first in December, 2023 and the second in April 2024. Secondary data being used for the brief includes the project's Environment Impact Assessment (EIA) report, its Social and Environmental Monitoring report, ADB's safeguard policies, news reports, news analysis and news articles.

During field visits, the research team conducted 25 interviews with women and men belonging to the directly affected communities of five villages -- Goth Ramzan Rajar, Goth Chakar Khan Rajar, Goth Lakha Dino Sheeno, Goth Usman Rajar and Goth Imam Bakhsh Shahno -- located near Jamshoro Thermal Power Station (JTPS) which includes JPGP. The team also held focused group discussions (FGDs) with five researchers associated with the Mehran University of Science and Technology (MUET) based in Jamshoro and 12 journalists living and working in the project area.

Structurally, the brief consists of three sections. Section one provides a brief introduction of JPGP, covering its history and its main features such as its location, cost, funding, fuel source, technology and ancillary structures etc. This section also discusses a recent government proposal to convert Unit-1 entirely to Thar's lignite coal

and highlights the implications of this conversion. Section two deals with the social and environmental problems emanating from Jamshoro Thermal Power Station (JTPS) on the whole and their potential intensification after the operationalization of Unit-1. The last section contains recommendations both for the government and ADB.

Power plant waste water

INTRODUCTION

1.1 A Brief History of Project Development

Jamshoro Power Generation Project (JPGP) is designed to comprise of one 660 MW supercritical power plant (Unit-1) with the provision to expand it and include another 660 MW supercritical power plant (Unit-2). In 2014, the Asian Development Bank (ADB) and the government of Pakistan signed an agreement for the construction of Unit-1. Subsequently, ADB's executive board approved a loan of 900 million US dollars for Pakistan to build and set up Unit-1. Per megawatt cost of the project was envisaged to be 40 percent less than per megawatt cost of a coal-fired power plant installed as part of the China-Pakistan Economic Corridor (CPEC).

Originally, the power plant in Unit-1 was supposed to run on blended coal (80 percent imported sub-bituminous and 20 percent local Thar lignite) but this provision was modified in 2015 and the idea of establishing Unit-1 was dropped altogether. In its place, the conversion of two existing power plants in Jamshoro from gas and oil to coal was envisioned. Soon afterwards, this proposal was dropped and the government decided to start construction work for Unit-1's coal-fired power plant in early 2016.

Given below are some basic but important facts about the project:

S. No	Fact	Detail
01	Project Name	Jamshoro Power Generation Project (JPGP)
02	Project Location	Jamshoro, province of Sindh, Pakistan
	Project Company	Jamshoro Power Company Limited (JPCL/GENCO-I)
03	Generation Capacity	660 megawatts
04	Project Cost	1.5 billion US dollars
05	Project Lender	Asian Development Bank (ADB
06	Project Funders	(i) Asian Development Bank (ADB): 900 million US dollar (ii) Islamic Development Bank (IDB): 220 million US dollar (iii) Government of Pakistan: 380 million US dollars
07	Project Implementation Consultant (PIC)	Joint venture of Mott MacDonald Limited (UK) and MM Pakistan (Pvt) Limited
08	Engineering, Procurement and Construction (EPC) Consultant	(i) M/s Siemens (Germany) (ii) Harbin Electric International (China)

Around the same time, ADB, however, complained that the government officials were delaying the process of inviting bids for the project's engineering, procurement and construction contracts. These bids, according to a news report, were invited by the Ministry of Water and Power in May 2016 – several months after the groundbreaking of the project.

ADB also complained that the disbursement of funds for the project was being delayed by the government's inability to secure financing to build a 105-kilometer railway line from Thar coalfields in Islamkot tehsil of Tharparkar district to Chhor, a town in the neighbouring district of Umerkot, where this line can join the existing

national railway network. The construction of the line is a necessary condition for transporting Thar's coal to JPGP (and to other parts of Pakistan). It was, indeed, only in April 2017 that Jamshoro Power Company Limited (JPCL) and Sindh Engro Coal Mining Company (SECMC) signed a memorandum of understanding (MoU) for the supply of local lignite from the Thar Coalfield Block-II to the site of Unit-1. As a result of all these delays, ADB disbursed only 10 million US dollars for the project by September 2017.

And even though the bids for engineering, procurement and construction (EPC) contract for Unit-1 were invited in 2016, the government took around two years to finalize them. In March 2018, it awarded the contract to a joint venture of a Chinese company, Harbin Electric International and a German company, M/s Siemens. The construction itself began in 2019. In September 2021, the National Electric Power Regulatory Authority (NEPRA) included this unit in the Indicative Generation Capacity Enhancement Plan (IGCEP) for 2021-2030.

News reports in early 2022, however, suggested that the plan to build Unit-2 was being shelved even though K-Electric, the company that provides electricity to Karachi, expressed keen interest in investing money for its construction.

Construction of Unit-1, on the other hand, was completed in June 2023. The only part of its associated civil works still under construction is a pipeline that will provide it water from the Indus river flowing only a couple of kilometers away. Once this line is completed, the unit is expected to produce electricity no later than September 2024 – provided it can cross another serious hurdle before or by then.

That hurdle pertains to the procurement of coal. Though Jamshoro Power Company Limited (JPCL) has signed an MoU with Sindh Engro Coal Mining Company for the supply of Thar coal for the power plant, this MoU has not been turned into a formal agreement so far. The railway line required to transport Thar coal to the plant is also still in the planning phase.

Similarly, JPCL has not entered into a formal agreement with any supplier of imported coal although it did invite bids for the purpose in April 2024.

Latest news reports suggest that ADB conducted a review of the project from 1st July 2024 to 3rd July 2024 to: (i) find out its overall implementation progress, (ii) examine in detail major activities/challenges and (iii) assess compliance with loan covenants and safeguards monitoring requirements. After the review, ABD has set the following deadlines for the operationalization of the project:

- Submission of cancelled loan proceeds and their reallocation – by 31st July 2024
- Submission of variations related to various civil contracts for ADB approval - by 31st July 2024
- Submission of Environment Impact Assessment (EIA) addendum for ash ponds - by 15th July 2024
- Submission of the addendum of EIA for ash and gypsum transportation – 30th July 30 2024
- Propose options (dates and locations) for ISO 14001 and ISO 45001 trainings.

ADB has also made it clear to the management of Jamshoro Power Company Limited that the latest loan extension being given is the last and final extension and will be valid till 31st December 2024. "It is imperative that the plant is commissioned within the loan period" so that ADB can disburse the 20 percent remaining amount due against the contractual milestones.

1.2. Project Location

Unit-1 is located on the right bank of the Indus river in Jamshoro district. It is located within the Jamshoro Thermal Power Station (JTPS) – a complex that also includes four other power plants running on oil and gas -- at Jabal Mohra village. This village is situated around six kilometers north of Jamshoro city and around 15 kilometers northwest of Hyderabad. JTPS is bounded by the Indus river in the east and Kirthar mountain range in the northwest.

Land degradation caused by power generation at Jamshoro

1.3. Project Cost, Funding and Stakeholders

The project's total cost is estimated to be 1.5 billion US dollars. The Asian Development Bank (ADB) and Islamic Development Bank (IDB) are lending Pakistan 900 million US dollars and 220 million US dollars respectively while the government's contribution to the project stands at 380 million US dollars. ADB loan, approved on 1st December 2013, is further divided into two components: a 870 million US dollars component which carries a high interest rate and a 30 million US dollars component which carries a concessional interest rate.

There have been many subsequent changes in the disbursement of these loans which are given in the table below :

Loan Number	Committed (US dollars in millions)	Cancelled/Date of cancellation	Actual	Reasons for cancellation
L3090	840	150/29th October 2018	658	cost savings
		32/11th May, 2020		Not available
L3091	30	26.7/24th March 2020	3.3	Reallocated to another project
L3092	30	17.54	12.46	Not available
Total	900	226.24	673.76	

The project is being developed and will be run by Jamshoro Power Company Limited (JPCL), also known as GENCO-I, incorporated in August 1998 under the Companies Ordinance 1984 as an enterprise owned by the Water and Power Development Authority (Wapda) which, in turn, is a part of the federal government's Power Division.

1.4. Plant's ancillary structures

(i) Coal-handling system:

Unit-1's power plant will require 6,800 tons of coal each day. Imported part of this coal will be unloaded at Karachi port before it is transported to the project site while local coal will be mined from Thar Coalfield Block-II and then moved to the project site. Though both types of coal will be delivered to the site primarily by rail, provisions have also been made to transport coal by trucks.

According to the original design of Unit-1, imported and local coal will be blended before delivery to the power plant's boiler. The project will also have the capacity to store 540,000 tons of coal – enough to keep the plant running for about 79.5 days.

(ii) Coal ash disposal system:

Coal ash includes fly ash, bottom ash, boiler slag and flue gas desulfurized gypsum. It, indeed, consists of all coal combustion residuals (CCRs), the materials left behind after coal is burned for electricity generation at a power plant. CCRs have concentrations of toxic substances such as arsenic, selenium, lead and mercury. At Unit-1, coal ash will be deposited in a designated pond. ADB estimates that this pond will be spread over 100 acres of land.

The land selected by Jamshoro Power Company Limited (JPCL) for the construction of the pond is owned by the provincial government of Sindh which is yet to hand it over to JPCL.

(iv) Wastewater channel:

A four-kilometer long open wastewater channel was constructed in 1989 to link Jamshoro Thermal Power Station (JTPS) to the Indus river. Being used for the disposal of wastewater released from the older thermal power plants at JTPS, it passes mainly through two villages, Goth Haji Ramzan Rajar and Goth Chakar Khan Rajar. It will be used for the disposal of wastewater to be released from Unit-1 as well.

(v) Water Supply Pipeline:

Coal-fired power plants require a lot of water to produce steam which turns the turbines to generate electricity. These plants also require a steady supply of water to keep their machinery cool. A 330-megawatt coal-fired power plant in Thar, for instance, requires 8.75 cusecs of clean water for steam generation and cooling. By the same measure, Unit-1 will require 17.5 cusecs of water. To procure this water, JPCL is constructing a 36-inch pipeline that will link Unit-1 with the Indus river. An electricity supply line is also being laid to run water pumping machines that will lift river water and pump it into the pipeline.

1.5. Proposal for the Plant's Conversion to Thar Coal

In September 2023, Asia Pak Investments, a Pakistani investment company that owns 54 percent shares in K-Electric and has shareholding stakes in Thar Coalfield Block-I as well, proposed to the government of Pakistan that it could invest 50 million US dollars to convert the Unit-1 fully so that it can run on Thar coal. It also proposed the government hand over the unit's operations, maintenance and coal procurement to K-Electric.

The same year, the government of Pakistan set up a technical committee – comprising representatives of Jamshoro Power Company Limited, federal government's Power Division and K-Electric -- to find out if it was feasible to change the plant's design, structure and machinery for its complete conversion to Thar coal. The committee carried out field visits and came up with a report that highlighted the following technical complexities:

- Since ADB is the main financier of the project, its consent is a prerequisite for any structural changes in the project;
- Engineering, procurement and construction consultants of Unit-1 lack experience to convert the plant to run on Thar coal;
- Higher quantities of coal will be need to produce electricity after the plant's conversion to Thar coal which has a lower calorific value and higher moisture content as compared to imported sub-bituminous coal. The conversion will, thus, lower the efficiency of the plant and increase its carbon emissions.
- Railway line required to transport Thar coal to Jamshoro through Chhor is still in the planning phase and may take a couple of years before it becomes operational.
- Jamshroro Power Company Limited (JPCL) has not yet signed any agreement with Sindh Engro Coal Mining Company to buy local coal from it.

SOCIAL, ECONOMIC AND ENVIRONMENTAL COSTS

2.1. Land Acquisition and Compensation

Official documents show that Jamshoro Power Company Limited acquired 700 acres of land in the late 1980s to build four power plants, running on oil and gas, as part of Jamshoro Thermal Power Station (JTPS). The social, economic and environmental costs of that acquisition still haunt the local residents – more than 30 years later. With the addition of Unit-1 to JTPS, more land has been acquired for its ancillary civil works, raising fears among the civil society that Sthis acquisition and the new plant's operations will only exacerbate the damage already done to their lives, livelihood and environment. Given below is a brief description of some of these costs:

(i) Land Acquisition for Ash Pond:

Since Unit-1 is located within JTPS, its construction did not involve any land acquisition but more than 100 acres of land are being acquired for the construction of some of its ancillary structures such as ash pond, slurry pipeline, water intake pump and water supply pipeline. That is where several new problems have arisen – as is explained in the succeeding paragraphs.

First of these questions pertains to the selection of site for the ash pond. The site originally chosen for it was owned by local communities so Jamshoro Power Company Limited (JPCL) developed a land acquisition and resettlement framework before acquiring this land. This framework included details of the land to be purchased from 18 local households that together had 106 family members. Later, however, the company decided not to acquire that land. Another site, also owned by the local community, was similarly chosen but was not acquired.

JPCL then thought that it should rather acquire on lease a piece of barren land owned by the Government of Sindh in Deh Morah Jabal in taluka Kotri of district Jamshoro. This land lies at an approximate distance of two kilometers in a northwesterly direction from JTPS. In July 2021, JPCL applied to the chief minister (CM) of Sindh, requesting him to allot the land to it under the Sindh Colonization and Disposal of Government Lands Rules 2005.

In September 2022, Sindh government directed JPCL to have a revised environment impact assessment (EIA) of the project approved from Sindh Environment Protection Agency (SEPA) since it had changed the original site of the ash pond. Though JPCL managed to get a no objection certificate (NOC) from SEPA in February 2023, the provincial government has not yet approved the allotment of land for the ash pond.

The other major problem concerning the ash pond is its capacity. Its Environment and Social Impact Assessment (ESIA) says it is being designed to store as much ash as the plant will produce in five years. The plant, on the other hand, is designed to operate for 30 years.

(ii) Land Acquisition for Water and Electricity Supply Line:

The land required for the water supply pipeline and electricity supply line was not mentioned in the land acquisition and resettlement framework prepared by Jamshoro Power Company Limited. It was also not mentioned in Unit-1's EIA.

People living in the villages along the route of these two lines are not happy with the land acquisition. For instance, land acquired for the water intake station has been built on the right bank of the Indus river on the land owned by a local farmer, Hazoor Bakhsh Khoso and his nephews who have several complaints about how JPCL has treated them. “The company promised to me that it will provide permanent jobs to two of my nephews. It did give them jobs but as the construction of the intake tank approached its end, they both were fired from their jobs allegedly for stealing something,” says Khoso. “The company is also using some of our land for storing construction material. “It used to pay us 50,000 every month as rent of that land but it stopped making those payments in January 2024,” he adds.

He has filed a petition in the district court of Hyderabad in order to make the company pay the outstanding land rent and restore the employment of his nephews.

Coal storage at Jamshoro power plant

A few other frictions have also been reported, with one involving a local land owner, Usman Rajar, making quite a stir.

On 26th January 2024, JPCL wrote a letter to the director general of Sindh Rangers and Inspector General Police (IGP) Sindh, stating that Usman Rajar was creating hurdles in the laying of water supply pipeline and installation of electricity poles. Seeking protection against him, the company alleged that he was demanding protection money or else he would damage the installations.

Usman Rajar, on the other hand, terms these allegations as baseless. “As a matter of fact, JPCL is not paying me the fair amount of compensation against the land it has acquired from me for the water pipeline and electricity supply line. To stop me from raising my voice against these injustices, the company wants to use brutal state force against me so as to infuse terror among the local communities,” he says.

In recent weeks, however, the two sides have agreed to end their conflict as the company has given jobs to two of Usman Rajar’s sons.

2.2. Water Contamination

Several mechanical processes in coal-fired power plants — including flue gas desulfurization, ash handling and cooling — produce wastewater containing toxins such as mercury, arsenic, lead, cobalt, manganese and other heavy metals. Disposal of untreated or inadequately treated wastewater produced by these plants can contaminate nearby water bodies.

First of all, it causes ‘thermal pollution’ because it is typically up to 20-25° degree Fahrenheit hotter than the freshwater a power plant receives. It can, thus lead to a decrease in the growth rate of fisheries.

Coal ash ponds also cause water contamination because ash stored in them carries many heavy metals such as arsenic, lead, mercury and selenium which can easily leach into subsoil water. Spills or leaks from ash ponds can also release contaminants into the surrounding environment, inducing water bodies. These accidents generally occur due to structural failures, human errors, extreme weather events or inadequate maintenance and monitoring.

Airborne emissions from coal-fired power plants are another source of water contamination as these emissions settle down on every surface that they find nearby – trees, land, houses and water bodies.

Jamshoro Thermal Power Station (JTPS) has been discharging its wastewater into the Indus river through an open channel -- about 4 kilometers long. It passes through Goth Imam Bux Shahno and Chakar Khan Rajar villages where it is causing water logging and salinity on a large scale. Local residents are equally concerned about its negative impacts on aquatic life. They say the river’s fish populations is dwindling due the release of contaminants in it. These contaminants, according to them, are also causing water-borne diseases among local villagers and their livestock.

These concerns are verified by water sample testing, commissioned by Harbin Electric International, an engineering partner in Unit-1 and conducted by Société Générale de Surveillance (SGS) Pakistan in November 2022. These tests showed that groundwater around JTPS had certain metals and hydrocarbons in middle to heavy ranges. In its addendum to the Environmental Impact Assessment (EIA), ADB has also acknowledged the presence of hydrocarbons in local groundwater, surmising these might have leached into the ground after some onsite or offsite spillage.

Similarly, the amount of arsenic in the groundwater of Jamshoro is much higher than the permissible limit of World Health Organization (WHO). A major reason for the heavy concentration of arsenic is contaminated wastewater of JTPS.

Local residents complain that these problems are having a negative impact of their quality of life. “We don’t drink groundwater anymore,” says Rizwan Shoro, a local journalist and a resident of village Haji Ramzan Rajar. Instead,

they have to fetch water from a nearby filtration plant set up by a pharmaceutical company. “The filtration plant was a great relief for us,” he says, “but then it broke down several weeks ago.”

ADB perhaps knows the problems that wastewater from JTPS could cause. In its 2013 environment impact assessment report about the station, the bank suggested that a pipeline rather than an open channel should be built to carry wastewater from Unit-1 to the river. In its latest assessment report, however, it has stated that the unit’s wastewater would be carried to the river through the open channel that already exists. This most recent report also claims that the channel has been rehabilitated so that the wastewater can flow through it without spreading over the nearby lands.

Situation on the ground suggests otherwise. The banks of the channel are still as untidy as they were in recent years. If and when effluents from Unit-1 will be released through it, local residents fear, the contamination of their groundwater will only increase.

Pakistan Fisherfolk Forum (PFF), a social movement that works to protect and promote the rights of fisherfolk and to preserve water bodies in Sindh, opposed the construction of Unit-1 on similar grounds and refused to be a part of the consultation process organized for creating its EIA report. “We knew the project will have harmful impacts on the ecosystem of river Indus and resultantly on the lives and livelihoods of the peasant and fisherfolk communities living along both sides of the river from the upstream of Kotri Barrage to the Indus Delta in the downstream,” says Mustafa Mirani, chairperson of PFF. The river contamination caused by this project will badly affect fish population, agriculture and mangrove forests in these areas. We, in fact, have raised these concerns with JPCL in a seminar,” he adds.

2.3. Land Degradation

Jamshoro Thermal Power Station (JTPS) has been releasing its wastewater into surrounding lands since it piloting and testing phases. The pond developed for the storage of this wastewater – before its release into the river – became dysfunctional soon afterwards and has never been rehabilitated since then. The channel that takes wastewater to the Indus is not lined and its banks are so untidy that they are quite prone to getting breached.

In recent past, according to local residents, such breaches have happened at least twice. In both instances, wastewater left the channel and spilled on to cultivated lands, destroying crops on a large area. Also, in both instances, distraught landowners held strong protests. In order to quieten them down, the company convinced some of them to receive financial compensation and accept jobs in lieu of their lost crops. This divided the protesters and undermined their struggle against the contamination of their lands.

Those who did not get money or jobs are fighting legal battles, seeking a fair compensation for their losses. While hearing the case lodged by one such landowner, Usman Rajar, Sindh High Court’s circuit bench in Hyderabad set up a six-member committee – headed by Civil Judge Jamshroro, Noor Ahmed Chandio and consisting of district administration and revenue officials -- on 10th June 2018 to find out how much of his farmland was waterlogged due to spillovers from the wastewater channel. The committee later informed the court that 187 acres of his land were damaged by wastewater.

One of the major reasons for farmland contamination is that heavy metals present in wastewater get deposited in the soil. These deposits have rendered barren thousands of acres of land belonging to 30 landowners in Goth

Haji Ramzan Rajar, Goth Chakar Khan Rajar and Goth Lakha Dino Shano villages located near JTPS. On farms where crops can still be cultivated, toxins enter the produce and pose severe health hazards to those who consume it.

This is how Rizwan Shoro sums up the overall degradation of land caused by JTPS: "Waterlogging and salinity have increased in our area, eating away houses and farmlands in several villages. These problems are likely to intensify after Unit-1 becomes operational."

2.4. Livelihood Losses

The JTPS-caused problems described in previous sections are also disrupting livelihood in local villages. Small landowners, pastoralists and fisherfolk, who depend mainly upon land and water resources for their livelihood, are suffering the most.

Crop failures due to land degradation have become a serious issue in the villagers around JTPS. Local landowners can no longer feed their families. Many of them, therefore, are selling their ancestral land to builders and migrating to nearby cities.

Families dependent on livestock herding are also being negatively impacted. "Our cattle fall sick after drinking wastewater released from thermal power plants. A large part of our income gets spent on their treatment and medication," says Rafiq Rajar, a shepherd of village Chakar Khan Rajar.

Abdul Sattar, a fisherman of Haji Ramzan Rajar village, has similar concerns. "Fish population has considerably decreased in the area where the wastewater channel discharges into the Indus river. A fisherman who used to catch more than 20 fish before is now catching only three or four fish in a whole day. The weight of fish has also decreased in recent years," he says.

The potential increase in water contamination after Unit-1 becomes operation is certain to intensify these livelihood losses.

2.5. Restricted Physical Mobility

Jamshoro Thermal Power Station (JTPS) is situated inside a 700-acre compound encircled by boundary walls. Its entrances are also heavily barricaded and its security team consists of one security manager, one assistant security manager, seven supervisors and about 114 guards. These guards are stationed at different entrances and installations within JTPS. No one is allowed to enter its premises without permission and without clearance from the security staff. An ADB report says that these strict security measures have been taken to ensure the security of foreigners working with Jamshoro Power Company Limited.

No matter what their rationale, these measures are creating many hurdles in the mobility of local residents, especially farmers and animal grazers. They are frequently harassed by JTPS security staff even when they pass by its boundary wall. This problem could get only worse with the operationalization of Unit-1.

2.6. Privacy and Safety Problems

Residents of Haji Ramzan Rajar village are seriously concerned about the violation of their privacy. A local shopkeeper says heavy vehicles passing through the village throughout the day and night to go the construction site of the water intake pump create a lot of noise, disturbing local peace. Since these vehicles are very tall, their driver seats are often so high that people sitting on them can easily look inside houses, causing distress especially for women.

The advent of power generation in the areas has created many conflicts in what was a very peaceful area before that, says Rizwan Shoro. These conflicts have led to round the clock police patrolling in the area, he says. "A number of police check posts have recently been constructed around the Jamshoro Thermal Power Station where local residents often face humiliation and harassment," he says.

2.7. Coal Transportation

With the operationalization of Unit-1, coal mining in Tharparkar will increases, intensifying the problems of access to clean water and clean air, displacement and livelihood losses that the residents of that district are already facing. Increased coal mining will also increase the medical risks that coal miners are often exposed to, particularly exposing them to coal workers pneumoconiosis, a dust-induced scarring lung disease commonly called black lung, chronic obstructive pulmonary disease and lung function impairment.

Also, whether Unit-1 runs on blended coal or entirely on Thar coal, its operationalization will require transportation of coal on a large scale. Swirling coal dust from trains and trucks engaged in this transportation will cause air pollution, respiratory ailments and contamination of soil and water resources along the routes they will take.

2.9. Air Pollution and Health Hazards

In 2018, the Asian Development Bank (ADB) conducted a study to measure the ground level concentrations of air pollutants at 20 locations near Jamshoro Thermal Power Station (JTPS). The results showed that short-term concentrations of sulfur dioxide (SO^2) at several locations were 1.5-3.6 times higher than those given in the guidelines of the Agency for Toxic Substance and Disease Registry (ATSDR), a public sector health agency in the United States. ADB also mentioned in its 2013 EIA report that emissions from the stacks of power plants located within JTPS have SO^2 concentration exceeding the limits set by Pakistan's National Environmental Quality Standards (NEQS) 2000. Residents of Goth Ramzan Rajar village confirm that respiratory diseases, breathing problems and lungs ailments have increased among those villagers who work at JTPS power plants.

Unit-1 will add coal ash to the pollutants being released by the existing plants. This ash has high amounts of toxic elements including arsenic, lead and mercury. It also contains particulate matter, oxides of nitrogen and heavy metals. The intensity of CO_2 emission from coal combustion is also higher than CO_2 emissions from other fossil fuels such as oil and natural gas. The unit, therefore, will pose serious health risks to the local population.

Around 24 villages (with a collective population of 59,000) located near Jamshoro Thermal Power Station (JTPS) are already experiencing serious issues related to air pollution. Their exposure to air pollution will increase after Unit-1 becomes operational.

Besides the villages around JTPS, nearby urban settlements will also suffer from the air pollution to be caused by coal combustion at Unit-1. These settlements include the campuses, hostels and residential colonies of Liaqat University of Medical and Health Sciences (LUMHS), Mehran University Engineering and Technology (MUET) and Petaro Cadet College. Thousands of students, teachers and administrators at these educational institutions will be all exposed to fly ash, particulate matter and other contaminants emitting from Unit-1. Coal dust emanating from coal transportation, coal crushing and coal storage will also create constant nuisance and airborne health risk to the people of villages and educational institutions located near the coal-fired power plant.

CONCLUSION AND RECOMMENDATIONS

3.1. Coal, Climate Change and ADB's Commitments

According to the International Energy Agency (IEA), coal produces one third of the globe's entire electricity. There are 2,400 coal fired power plants around the world producing 2000 gigawatts of electricity. Coal is also the single largest source of climate change because one fifth of the world's greenhouse gases are emitted when it is burnt to produce energy. Burning of coal for energy production, specifically low-quality lignite coal found in Tharparkar, produces a substantial number of hazardous particulates that pose serious medical risks.

ADB, therefore, faced strong criticism during its annual meeting in 2017 for financing Unit-1. Responding to this criticism in October 2018, the bank's energy director stated that Unit-1 would be the last fossil fuel power plant being funded by it. The bank also said that Unit-1 will follow the environmental safety guidelines of the International Finance Corporation (IFC), a part the World Bank Group (WBG), during the project's construction and operations. The bank similarly committed that it will ensure compliance with environment regulatory standards set by the government of Sindh while making the project operational.

Surveys on the ground, however, show that none of these standards are being followed and maintained at Unit-1.

3.2. Recommendations

(a) Recommendations for ADB

- The bank should conduct a formal study for the construction of a wastewater reutilization plant so that wastewater being generated at JTPS can be used again and again in power production processes; this reutilization will decrease demand of fresh water from the river and minimize the contamination of river waters being damaged by the discharge of JTPS wastewater in it;
- The bank should take serious environmental protection measures before the operationalization of Unit-1, particularly for the construction of ash pond and the wastewater pipeline, in line with its policies for integrating environmental considerations in its operations;
- The bank should ensure that the entire length of the wastewater channel is covered and lined by concrete to stop the seepage of wastewater into the underground aquifers and its spilling over into adjacent

farmlands;

- Following up on its commitments about renewable energy, the bank should withdraw its funding commitment for the construction of Unit-2;
- The bank should seek clarifications from the Jamshoro Power Company Limited about the environmental impacts of its plans to convert Unit-1 completely to local coal – that is, lignite coal being mined from Thar – since this coal is reported to emit more greenhouse gases than imported bituminous coal;
- The bank should also seek clarifications from the Jamshoro Power Company Limited about the environmental impacts of transporting Thar coal to Unit-1;

A village next to Jamshoro power plant

- Considering that the conversion of Unit-1 completely to Thar coal will expand and increase coal mining in Thar, the bank should consult the people of Thar regarding the environmental and social impacts of this expansion and increase;
- The bank should also coordinate between the people of Thar and the government of Pakistan so that they can sit down with each other to make an authentic assessment of these impacts of expanded and increased coal mining the transportation of coal from Thar to Jamshoro;
- The bank should similarly ensure that all the social and environmental concerns of the people of Thar are fully addressed before the government builds a railway line to link Thar coal mines with Jamshroro and also before it converts Unit-1 to local coal.

(b) Recommendations for the Government

- The government should abandon plans to build Unit-2;
- The government should ensure that all the global environmental and health safety standards are duly followed and always implemented at Unit-1;
- The government should ensure that Unit-1 does not add to water contamination, air pollution and land degradation already caused by JTPS;
- The government should ensure that all the households who have lost their sources of livelihood due to the construction of Unit-1 (as well as the construction and operations of other plants within JTPS) are duly and fairly compensated;
- The government should ensure that all the rights of people living around JTPS – such as their right to mobility and their right to privacy – are fully protected;
- The government should seek clarifications from the Jamshoro Power Company Limited about the environmental impacts of its plans to convert Unit-1 completely to local coal – that is, lignite coal being mined from Thar – since this coal is reported to emit more greenhouse gas than imported bituminous coal;
- The government should also seek clarifications from the Jamshoro Power Company Limited about the environmental impacts of transport Thar coal to Unit-1;
- Considering that the conversion of Unit-1 completely to Thar coal will expand and increase coal mining in Thar, the government should consult the people of Thar regarding the environmental and social impacts of this expansion and increase;
- The government should also consult the people of Thar to make an authentic assessment of these impacts of expanded and increased coal mining the transportation of coal from Thar to Jamshoro;
- The government should similarly ensure that all the social, economic and environmental concerns of the people of Thar are fully addressed before it builds a railway line to link Thar coal mines with Jamshroro and also before it converts Unit-1 to local coal.

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ANNEX-I: Coal-Fired Power Plants in Pakistan

S#	Name/Location	Company	Technology	Fuel/Source	Output
01	China Power Hub Plant (Lasbela/Balochistan)	China Power Hub Generation Company (Private Limited)	Supercritical	Imported Bituminous	1320 MW
02	Port Qasim Coal Power Plant (Karachi, Sindh)	Port Qasim Energy Holding	Supercritical	Imported Bituminous	1320 MW
03	Sahiwal Coal Power Plant (Sahiwal/Punjab)	Huaneng Shandong and Shandong Rui	Supercritical	Imported Bituminous	1320 MW
04	Thar Block I Power Plant (Tharparkar/Sindh)	Shanghai Electric Power Company	Subcritical	Local, Thar Lignite	1320 MW
05	Engro Thar Power Project (Tharparkar/Sindh)	Engro Power Gen Thar ltd	Subcritical	Local, Thar Lignite	660 MW
06	Lucky Electric Power Company (Bin Qasim, Karachi/Sindh)	Lucky Electric Power Company	Subcritical	Imported Bituminous/ Local, Thar Lignite	660 MW
07	Thal Nova Power Thar Limited (Tharparkar Sindh)	HUBCO	Subcritical	Local, Thar Lignite	330 MW
08	Thar Energy Limited (Tharparkar/Sindh)	HUBCO	Subcritical	Local, Thar Lignite	330 MW
09	Lakhra Coal Power Plant (Lakhra/Sindh)	WAPDA	Subcritical	Local, Lakhra Lignite	150 MW
					7410 MW

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