PROJECT BRIEF

Coal Power Projects: Poisoning Water in Thar

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1. INTRODUCTION

Coal, which presently contributes 13 percent power in Pakistan's energy mix, is the dirtiest of all fuels, posing serious threats to our health and ecosystem. Coal's lifecycle—from mining to processing, from transportation to burning—releases numerous toxic pollutants into our air, our waters and onto our land. Coal mining adds harmful pollutants like methane and particulate matter (PM) to the air. Methane contributes to global warming while PM causes premature deaths; chronic bronchitis and heart attacks; aggravation of respiratory and cardiovascular illness; changes to lung structure and natural defense mechanisms.

Coal combustion at thermal power plants emits five major conventional air pollutants—PM, oxides of nitrogen, sulfur dioxide, mercury and carbon dioxide. Oxides of nitrogen produce smog, which significantly contributes to the formation of harmful ground-level ozone. The heat trapping carbon dioxide—a greenhouse gas—is the largest driver of global warming and contributor to the climate change. Surface mining involves removal of soil and rock above the deposits of coal, causing deforestation, changing landscape and eroding natural habitat. Besides causing air pollution and land degradation, coal mining operations and power generation at thermal plants also induce adverse impacts on local water resources.

Coal mining operations affect both the surface waters and groundwater. Acid mine drainage (AMD), a waste from mining sites, causes heavy metals and toxins to be carried into streams and groundwater, and can make the water undrinkable. Open-pit mining—a technique of surface mining used in Thar region—involves dewatering which depletes groundwater table. Highly acidic water, containing heavy metals like arsenic, copper and lead, usually comes out of mining operations. The water discharged from coal mines contaminates the nearby water bodies like rivers, streams, lakes and aquifer, posing serious threat to public health and the sustenance of local flora and fauna. After coal is mined it is washed with water and chemicals to remove impurities and make it fit for burning. Coal slurry produced in coal-washing process is stored in improvised ponds, which can leak, spill or fail.

Coal combustion at thermal power plants leaves behind a grey powder like substance known as coal ash, containing concentrated amounts of toxic elements, mostly including (apart from other pollutants) arsenic, lead and mercury. Exposure to coal ash heightens the risk for cancer, cardiovascular diseases, neurological disorders, reproductive problems and other serious issues of public health. Sulfur dioxide causes acid rain, which, in turn, acidifies lakes and streams, destroying aquatic habitat, damaging forest trees and plants. Mercury released from coal power plants is deposited on soil and in water, where it transforms chemically into a highly toxic form (methylmercury) that accumulates in fish tissue.

Coal-fired power plants generally require huge supplies of water. They function by heating water to create steam, which then turns turbines and generates electricity. The enormous quantities of water required by coal power plants usually come from nearby water sources like rivers, lakes, canals, etc. Apportionment of water for coal power plants ultimately affect the local communities, who depend upon these water sources for drinking, domestic-use, irrigation, fishing and other livelihood purposes.

For the protection of the people and environment from these water woes, world over the governments make legal and policy frameworks and develop the effective monitoring mechanisms to regulate the operations of the companies and departments involved in coal mining and power generation. Under these regulatory frameworks, the companies are bound to maintain some standards for the disposal of effluents and wastewater. Compliance of these standards involves significant economic cost. In the countries like Pakistan, where these laws and policies either do not exist or are inappropriate and monitoring mechanisms are not efficient, the coal companies and departments damn care about the environmental standards to be maintained in the disposal of effluents and wastewater.

This project brief focuses on the reckless ways the coal power companies have been discharging wastewater and toxic impacts of coal power projects on the precarious water resources of Thar region in Sindh province of Pakistan. It covers the drinking water crisis, biodiversity losses and livelihood disruptions caused by dewatering of coal mines and dumping of effluent water discharged in mining and power generation processes. Most of the information provided in this project brief is based on the interviews and meetings held with the representatives of the communities, civil society organizations (CSOs) and local media persons during field visit to Thar in December 2021. Apart from these primary sources, some secondary sources like news clippings, web-links and the reports available online have also been used in its development.

2. COAL POWER POTENTIAL AND WATER RESOURCES IN THAR

Thar Desert, where Pakistan's enormous lignite coal reserves are located, is one of the most arid, regions of the country. Though rich in terms of coal and other mineral resources, Thar is largely a water scarce region, which is prone to frequent mild to harsh droughts. There is no perennial surface water available in the region. The major source of the available water is underground, the quality of which generally ranges from saline to brackish. For drinking, domestic use and animal-rearing, an overwhelming majority of local population depend upon dug-wells, the depth of which varies from 10 to 100 meters[1]. Water from dug-wells is pulled out by the donkeys, camels and several human hands.

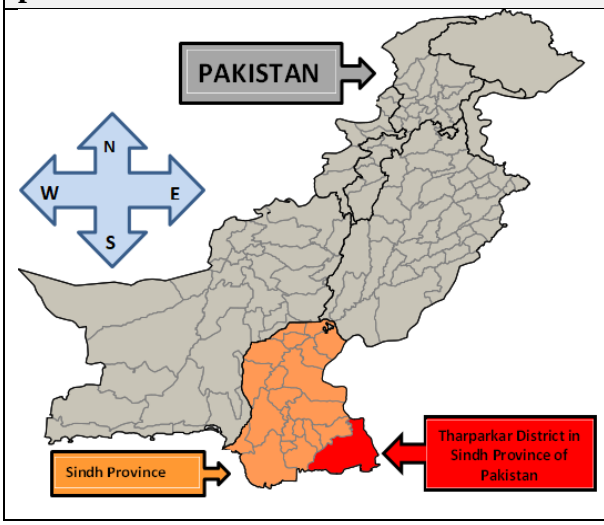
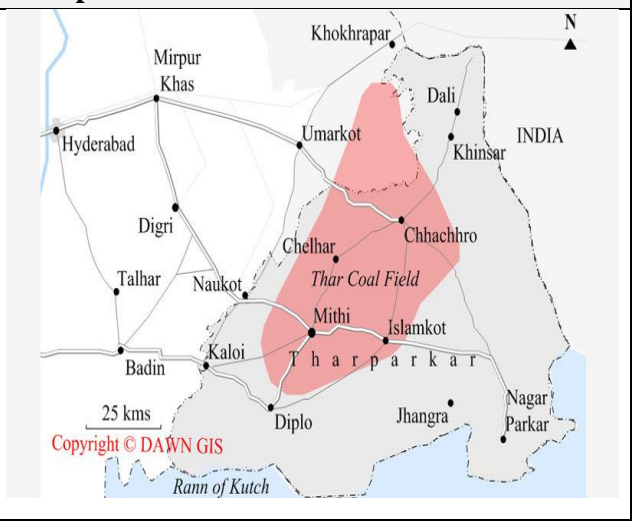
Water is the most precious asset in the region. In many areas, people have to spend three to four hours daily to fetch few liters of water in clay pitchers or plastic cans on their heads, donkeys, camels or motorcycles. The average rainfall in the region is 250-300 millimeters (mm), most of which occurs in monsoon from mid-June to mid-August. This rainwater replenishes groundwater and recharges wells. Livelihoods, primarily agriculture and livestock rearing, are heavily reliant on annual rainfall and for groundwater supplies. During extreme droughts, the families belonging to the most affected areas along with their herds of livestock migrate to the neighboring canal command areas, work as farm labor and live there until the rains break the dry spell in Thar.

This water scarce region of Pakistan hosts its sixth largest coal reserves in the world. Out of its total coal reserves of 186 billion ton (bt), 176 bt reserves are located in a single contiguous area of 9,000 square kilometers in Tharparakr district of Sindh province in Pakistan. Mithi, the district headquarter of Tharparkar, is situated some 380 km east of Karachi—the provincial capital of Sindh province. 'Thar coal reserves' are 50 mt more than the joint oil reserves of Saudi Arabia and Iran, having a potential to generate 100,000 megawatt (MW) of electricity for over 200 years[2].

[1] https://www.scitechnol.com/peer-review/assessment-of-water-quality-of-groundwater-of-thar-desert-sindh-pakistan-Rr1A.php?article_id=8364

[2] A power point presentation of Engro Powergen by Kahlid Mansoor on 6th April 2012

Figure-1: Map of Thar coalfield

Map of Tharparkar district in Sindh province of Pakistan[3]	Map of Thar coalfield in district Tharparkar[4]
	

Thar lignite coal deposits were discovered in early 1990s. In terms of quality, Thar coal is ranked as lignite 'B'[5]. Lignite coal is considered the lowest rank of coal due to its low heat and high carbon, Sulphur and ash contents. In 2002, the government of Pakistan introduced "Policy for Power Generation Projects", which underlined the significance of indigenous resources, especially coal, for power generation[6]. In 2008, the then federal and provincial (Sindh) governments decided to exploit Thar coal reserves for power generation on a 'fast track basis.' In this regard, Thar Coal and Energy Board (TCEB) was established to facilitate investment and development of coal based power projects[7].

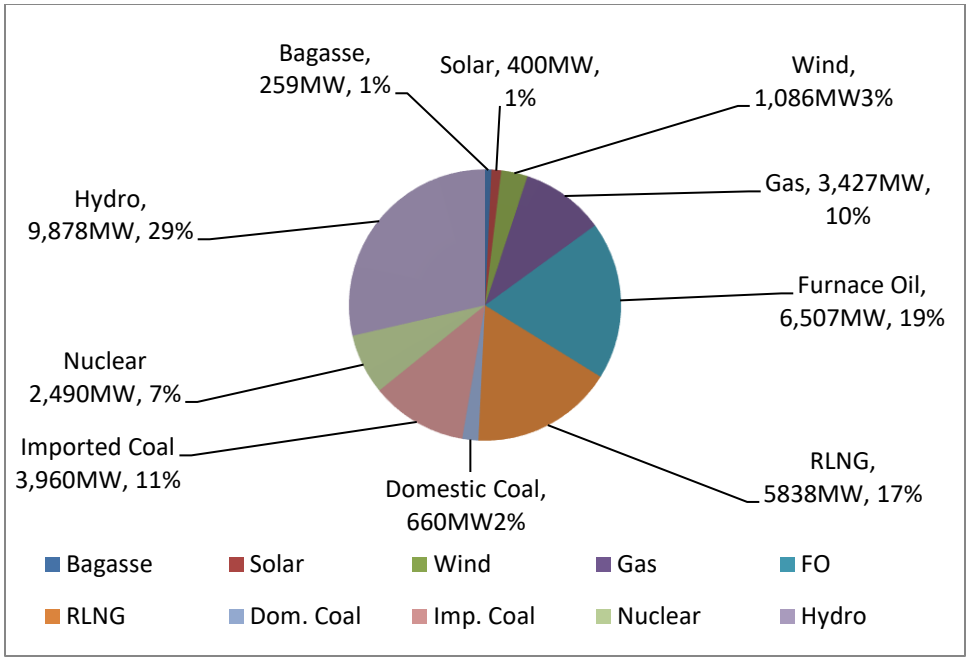
In the years to come, there came Chinese investment under China Pakistan Economic Corridor (CPEC)—a project of Belt and Road Initiative (BRI)—to develop coal mining and thermal power plants in Thar. Thar Coalfield Block-II (TCB-II) was the first out of 13 blocks, where Sindh Engro Coal Mining Company (SECMC) started its coal mining and installation of a 660MW power plant. After TCB-II, Sino Sindh Resource Limited (SSRL) started to develop coal mine and install a 1.320 MW thermal power plant in TCB-I. The next coalfield block to be

[3] https://commons.wikimedia.org/wiki/File:Pakistan_-_Sindh_-_Tharparkar_district.svg
[4] https://www.dawn.com/news/1145855
[5] 'Thar coal mining: potential, concerns and mining', a joint publication of Thardeep Rural Development Program (TRDP) and Novib http://thardeep.org/thardeep/Publication/PubFiles/eptkriact8vqCoal%20Mining%20In%20Tharparkar%20Potential,%20Concerns%20and%20Remedies.pdf
[6] Policy For Power Generation Projects Year 2002 https://nepra.org.pk/Policies/Power%20Policy%202002.pdf
[7] Pakistan's Thar Coal Power Generation Potential, a report by Pakistan Power and Infrastructure Board (PPIB) published in July 2008 http://embassyofpakistanusa.org/wp-content/uploads/2017/05/Thar-Coal-Power-Generation.pdf

developed under CPEC was TCB-VI, spread over an area of 66.1 square kilometers. A UK-based company, Oracle Power PLC, was supposed to develop coal mine, install a 1,320 MW coal-fired power plant, and produce gas, urea and diesel in TCB-VI[8]. Practically, however, no civil work has yet started in TCB-VI.

Two out of total 13 Thar coalfield blocks—namely TCB-II and TCB-I—have seen considerable growth in terms of coal-mining operations, development of coal-fired thermal power plants and coal based power generation in last several years (less than one decade). A 660 MW coal-fired thermal plant in TCB-II being operated by the SECMC has already started to feed into national grid, contributing 2% power in Pakistan's total installed generation capacity in 2021[9].

Figure-2: Pakistan's installed generation capacity as of May 2021



Source: Indicative Generation Capacity Enhancement Plan 2021-2030 by NEPRA

In 2022, extraction of lignite coal deposits began in TCB-I[10]. A 1,320 MW coal power plant being installed by Sino Sindh Resources Limited (SSRL) is nearing its completion. Moreover, five out of total seven committed coal power projects in Pakistan's Indicative Generation Capacity Enhancement Plan (IGCEP) 2021-2030, which are likely to be operational in next couple of years, will be fueled by local (Thar) coal. Presently at different stages of completion,

[8] Sindh plans to launch Thar Coal Block-VI under CPEC https://www.dawn.com/news/1521780
[9] *Indicative Generation Capacity Enhancement Plan 2021-2030 by NEPRA* https://nepra.org.pk/Admission%20Notices/2021/06%20June/IGCEP%202021.pdf
[10] https://www.dawn.com/news/1672580/extraction-of-lignite-coal-deposits-begins-in-thars-block-1

the five committed local coal power projects in Thar—including the 1,320 MW SSRL project—will be adding 2,970 MW to national installed generation capacity.

Figure-3: List of committed coal-based power generation projects considered in IGCEP 2021-2030

#	Name of committed Project	Fuel Type	Agency	Installed Capacity (MW)	Status	Expected Date of Commissioning
1	Lucky	Local Coal	PPIB	660	LOS (Issued)	May 21
2	Thar (TEL)	Local Coal	PPIB	330	Under Construction	Mar 22
3	Thar-I (SSRL)	Local Coal	PPIB	1,320	LOS (Issued)	May 22
4	Thal Nova	Local Coal	PPIB	330	LOS (Issued)	Jun 22
5	Jamshoro (Unit-1)	Imported Coal	GENCO	660	PC-1 approved & financing secured	Oct 22
6	Gawadar	Imported Coal	PPIB	300	LOS (Issued)	Jun 23
7	Siddiqsons	Local Coal	PPIB	330	LOS (Issued)	Jul 23
	Total Installed Capacity (MW) of Committed Coal Projects			**3,930**		

Source: IGCEP 2021-2030 by NEPRA

3. EFFLUENT AFFLICTIONS OF THAR COAL

The coal rush in Tharparakr district, whilst uprooting thousands of families from their ancestral homes and native lands, has also been complicating the water difficulties of Thari's. Amongst the activities around coal mining and power production i) the disposal of saline water extracted from coal mines, ii) the discharge of wastewater from coal mines and thermal power plants and iii) the construction of the infrastructure for diverting water from Nara Canal[11] to Thar coalfield have had significant impacts upon communities across Thar. The consequences have ranged from water depletion, toxicity, significant increased incidence of malaria, and poisoned and dying livestock. We examine the causes and details of each of these outcomes in the following sections.

The sweet water of dug-wells in the close vicinity of wastewater reservoirs is becoming toxic. Incidents of malarial fever are increasing in the villages around the wastewater reservoirs. Water level of the dug-wells is depleting in the villages neighboring coal mining sites. The number of animals dying after drinking wastewater released from coal mines and power plant is rising. The following section gives details about the sufferings of local communities due to effluent water being released from coal mines and coal-fired power plants in Tharparker.

3.1. Reservoirs for Disposal of Mine Water:

Thar coal is buried under layers of groundwater or aquifers—(i) dune sand aquifer (located at a depth of 50m to 60m), (ii) coal seam roof aquifer (depth 120m), and (iii) coal seam floor aquifer (depth 180m to 190m)[12]. These aquifers have to be drained for extracting coal. In other words, dewatering of open pits is an essential component of coal mining projects as depressurization is necessary to reach coal depth, which is 150 meters. It helps keep the mine dry and safe. The coal companies have installed submersible sumps at the bottom of pit to drain the groundwater.

Dewatering is meant to lower the water table, particularly in the areas neighboring mining sites. This water depletion is being felt in the villages neighboring mining sites, a claim denied by the proponents of coal power projects. The SECMC authorities claim that the Thar Coalfield Block-II mining project will pump out only 0.02 percent of groundwater and that it will not affect the drinking water sources in the area. According to them, the water being drained comes out from second and third aquifers, which are at 120 meters and 180 meters deep under the surface and has nothing to do with the top aquifer at 55 meters being used by the local population for drinking water purpose[13]. With contested claims it remains to be seen if a scientific study can bring clarity.

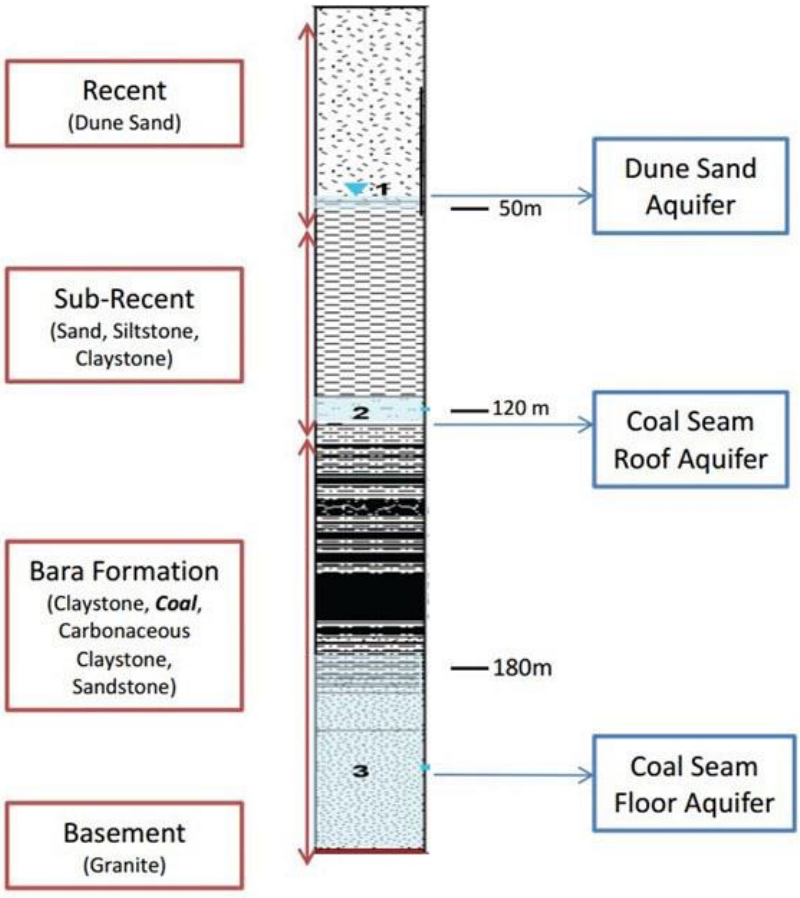
[11] Nara Canal, branching out from Sukkur Barrage on Indus River, is the longest (364km) canal of Pakistan, irrigating two million acres of land in Khairpur, Sanghar, Mirpurkhas and Umerkot districts in Sindh

[12] Development and Catastrophe https://www.thenews.com.pk/tns/detail/568851-development-catastrophe

[13] https://profit.pakistantoday.com.pk/2018/03/09/pumping-out-water-for-thar-coal-mining-not-to-affect-drinking-water-sources-secmc/

For the disposal of effluent water drained from the coal mines, the companies operating in two Thar coalfield blocks need to build reservoirs. For this purpose, the SECMC built the first reservoir at Gorano. The expansion in mining operations requires more reservoirs to be built in Thar coalfield since the capacity of Gorano reservoir is not enough to contain the increasing volume of water. Different sites—including Saringwari, Dabri, Dhinkaro and Dhukar Chau—for disposal of effluent water pumped out from coal mines have come under consideration. Eventually, a reservoir at Dukar Chaou was built. The increasing volume of wastewater has had significant consequences for groundwater quality and quantity in Thar, whilst impacting land and posing threats to animals/livestock.

Figure-4: Three aquifers of Thar coalfield



Source: The Friday Times, 30th December 2016[14]

[14] The water this desert doesn't want https://www.thefridaytimes.com/the-water-this-desert-doesnt-want/

3.1.1. Gorano Reservoir:

Gorano is a natural depression, which is 37 kilometers south of mining site in the TCB-II. The reservoir spanned over 1,500 acres has a capacity to hold 30 million cubic meters of water. The reservoir has been built on the on the survey (privately owned), *yaksala* (leased out) and *gauchar* (grazing) land of the local communities. As the civil work on the construction of the reservoir started in 2016, the initial concerns raised by the local communities were mainly related to land acquisition. They organized protest demonstrations and filed a writ petition against the forced land acquisition, injustices in compensation and livelihood losses.

With the completion of the Gorano reservoir, the SECMC begun disposal of subsoil brine water as well as using it for dumping other effluents produced while treating mined water and producing coal-based electricity. Since the SECMC has not lined the Gorrano reservoir with a geo-membrane or a soil sealant, percolation of saline water has already started making an impact on 12 villages around the reservoir, including Gorrano, Burd, Gawaran, Shivay Jo Tar, Gopay Ji Dhani, Bhopay Ji Dhani, Khokhar Jo Tar, Mutu Jo Tar, Nibbay Ji Dhani, Suleman Hajjam, Kattan, Chothay Ji Dhani and Esan Shah Jo Tar.

Like other parts of Thar, these 12 villages near the site of the reservoir are highly dependent on their dug wells. Due to seepage of saline and effluent water from Gorrano reservoir, water level of wells in some villages has started to rise whilst causing contamination of these wells. The contamination has generated a serious water crisis in Gorrano and Suleman Hajjam villages.

Similar concerns of toxicity are threatening lands, plant-life and livestock. Community members testify to the drying up of local trees , which serve as the only fodder for their livestock in winter, have dried. Secondly, since there is no fencing around the reservoir, the local communities have to be extra alert and vigilant lest their animals drink the wastewater or drown in it. The incidents of animals drowning in the reservoir are a serious concern of the local communities. Moreover, they apprehend that the seepage from the reservoir will degrade their agriculture land and turn the entire area into marshlands. They presented the failure of saline water fishing and agriculture—an experiment started by SECMC at Gorano—as evidence to substantiate their concerns of water toxicity.

3.1.2. Dukar Chau Reservoir:

Around 10 kilometer south of Gorano, there is another natural depression near Dukar Chau, where an additional reservoir has been recently built. The story of Gorano is now being repeated in Dukar Chau. With the beginning of year 2022, the residents of Dukar Chau and some other villages, including Meehari, Ganjri, Harimar, Gawaran, started to hold protest demonstrations in front of Press Club, Islamkot. They have been protesting against the coal companies for dumping

wastewater into their villages and forcibly acquiring their land[15]. They echoed the same concerns—contamination of well water, drying up of trees, threats to livestock and degradation of agricultural land—which have already been raised by the residents of 12 villages around Gorano reservoir.

Protesters from Dukar Chau have i) complained that by wastewater gushing from the broken pipeline was playing havoc in the area, ruining the land used for grazing animals and agriculture, ii) the companies didn't take the local population into confidence iii) land acquisition has been inadequate and procedurally flawed, with only four landlords having been paid compensation iv) the actual extent of the reservoir is double that which was originally allocated (from 500 to a 1000 acres).[16]

3.2. Reinjection of Wastewater:

Not all the wastewater discharged from mines and power plants in Thar is not being dumped on the surface. Apart from dumping wastewater in two reservoirs, namely Gorrano and Dukar Chau, the SECMC has been reinjecting surplus mine water into the aquifer. The company has laid a pipeline from the mining site in Block-II to Meghay Jo Tar village. A water reinjection plant has been installed in the village. The surplus mine water is being reinjected into the aquifer through this plant.

Mine water reinjection plant at Meghay Jo Tar village

World over mining companies reinject 'treated' water into underground aquifer but it requires rigorous environmental analysis, stringent regulatory framework and monitoring mechanism

[15] https://www.thefridaytimes.com/like-a-suicide-bomb-thar-villagers-concerned-over-pipeline-carrying-wastewater-from-coal-mines/

[16] Daily Nijat/Sindhi newspaper, 18th January 2022

because reinjection involves serious environmental impacts like potential seismic activity arising out of aquifer reinjection; increase or decrease in groundwater pressure; changing the flow paths between the aquifers; mixing of different groundwater chemistries; and groundwater contamination[17].

In the case of reinjection at plant Meghay Jo Tar, no information regarding the volume and quality of mine water being injected into aquifer is available. Wider communities have serious apprehensions and questions regarding the volume and quality of the mine water being injected into groundwater aquifer. Their apprehensions range from injection of untreated mine water into aquifer to absence of any effective regulatory and monitoring mechanism around the reinjection process. Their apprehensions are validated by the 'silence' assumed by the residents of Meghay Jo Tar regarding the reinjection plant. The locals tend to avoid responding any questions about the reinjection plant. Within everyday conversation the popular perception is that the company has bribed some powerful, influential local people, who in turn, have pressured the residents of Meghay Jo Tar from sharing the information about the reinjection plant with outsiders.

Mine water injection pump at Meghay Jo Tar

3.3. Wastewater Disposal beyond Designated Sites:

Disposal of wastewater involves certain costs i.e. installing treatment plants, laying pipelines, building reservoirs, lining reservoirs with geo-membrane or soil sealant, installing reinjection plants to operate and control the pollution induced by the coal mines and coal power plants. To save these costs, the coal companies often shift the costs onto local communities, forcing them to

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aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/WaterUseGovernance/Report/c04

deal with heavily-polluted water that endangers their health and safety. The water woes of Tharis caused by coal mining and thermal power generation are not limited to the designated wastewater disposal sites i.e. reservoirs in Gorano and Dukar Chau and mine water reinjection plant at Meghay Jo Tar.

With the increasing volume of effluent water in Thar coalfield, the companies have been dumping wastewater in an arbitrary, irresponsible and dangerous manner. Tilwaiyo, Warwai (TCB-I), Jaman Samoon and Bitra (TCB-II) are the most affected villages. For last several months a number of livestock herds - camels, cows, sheep and goats - have died after drinking wastewater released in these villages. The water released by coal mines and power plant has also been providing breeding ground for mosquitos. Before the advent of wastewater ponds, mosquito infestation was unknown in the locality. With this infestation, malaria has now become endemic in the area.

In October 2021, the Sino Sindh Resource Limited (SSRL) began dumping wastewater into the grazing land of two neighboring villages of Thar Coal Block-I, namely Tilwaiyo and Warwai. Due to inundation of wastewater released by the nearby coal mine, a dug-well of sweet water has become toxic in Tilwaiyo village.

Dumping of wastewater in the grazing land of Tilwaiyo and Warwai

Around 250 families and 500 animal heads were dependent on the well. It took the local community four to five months to dig the well and they spent Rs. 700,000 on its construction. Over the past three months the well is no longer useable. Besides, at least fifty camel and a significant number of sheep and goat have died after drinking the toxic water in Tilwaio and Warvai villages.

A camel died after drinking toxic water in TCB-I

In Thar Coalfield Block-II, the Sindh Engro Coal Mining Company (SECMC) has been discharging wastewater of coal power plant into Jaman Samoon[18] and Bitra villages for more than one year. In last one year, around 300 sheep and goat and 50 cows have died after drinking the toxic water in these villages.

Facing the threats the wastewater posed to their health, safety, agriculture and animals, the local villagers held a number of protest demonstrations in front of Press Club, Islamkot. They brought the matter into the notice of deputy commissioner. Instead of resolving their issue, the district administration threatened the local activists of 'dire consequences' if they did not stop their protest.

[18] The locals of Jaman Samoon village also complained about the increasing number of stray dogs attracted by the waste food being dumped by the company outside the plant area. These stray dogs roam around the ponds of waste water and attack the animals and children belonging to the two villages.

Wastewater from SECMC coal power plant being dumped in Jaman Samoon village

4. CONCLUSION

Prime Minster Imran Khan announced coal moratorium while addressing the Climate Ambition Summit on 12th December 2020. Besides, the incumbent government has made commitment on Pakistan's transition away from fossil fuels to renewable sources of energy. Despite the coal moratorium and official commitments to renewable energy transition, the authorities responsible for planning and decision-making in energy sector still believe that exploitation of its local coal can go a long way to rid the country of its financial woes. In its bid to indigenize its energy mix as foreseen in the IGCEP 2021-2030, Pakistan is aiming to expand exploitation of its local coal reserves.

According to the IGCEP 2021-2030, the existing installed generation capacity of coal-based power will almost double by 2030. Across this period imported coal based power will form 19% of this increase, Thar coal will provide the remaining 81% of this increase. The share of Thar coal in Pakistan's generation mix will increase more than fivefold from 2021 to 2030.

Figure-5: Coal-based installed generation capacity (MW) of Pakistan

Year	Local Coal	Imported Coal	Total
2021	660	3,960	4,620
2030	3,630	4,920	8,550

Source: IGCEP 2021-2030 by NEPRA

The expanding volume of coal mining and thermal power generation in the years to come is destined to come along with the severe depletion and contamination of water resources, apart from serious biodiversity losses and other harmful environmental impacts, in Thar region. The government and the private companies will have to be mindful of the serious threats the coal power projects have been posing to the precarious water resources of the desert region. If the existing mining and power generation projects cannot be retired, or proposed plans are to be continued, oversight of the industry needs to be seriously enhanced, understanding the range of problems that have been highlighted in Thar coal need to be analysed and addressed.

While dealing with the water woes and other adverse environmental impacts induced by coal power projects, the government must adopt a robust regulatory framework, adopt international best practices and bring the conduct of executing agencies and private companies under public oversight. The monitoring mechanisms to ensure certain standards and practices in water and environmental management of Thar coal power projects will have to be made inclusive, participatory, accountable and transparent.

The local communities will have to be put first in decision-making processes. Their immediate problems will have to be addressed on a priority basis. Their concerns need to be given the weightage in policy-making, planning and implementation processes. To move in this direction, the government should establish a people's commission—involving the local communities, civil society, experts and media—to monitor the compliance laws, policies, standards and best practices in environmental governance of Thar coal, evaluate the existing water-related and other harmful environmental impacts of the coal power projects, redress the grievances of local communities and make policy recommendations.