Water stress and coal-fired power plants in India

Summary

- In the last two years, commercial and state-owned lenders financed 16 coal-fired power projects. Five projects with a combined capacity of 3.8GW received a combined total of US$850 million in 2018. This was a 90% decline in financing compared to 2017, where 12 Indian coal plant projects were loaned a total of US$9.35 billion.[1]
- 11 of these projects are located in areas of extremely high water stress, and another five in areas of high water stress. Overall, about 40% of India's thermal power plants are situated in highly water-stressed areas.
- The average coal power station plant uses enough water to fill an Olympic-sized swimming pool every three and a half minutes. Power plants located in high water stress areas have a 21% lower energy output, on average, than those in low and medium water stress areas.

Water stress and coal power stations in India

Climate change is making India hotter and will make droughts in the region more frequent and severe[2]. Decreased rainfall[3], consecutive droughts, and the influence of El Niño are combining to increase India's water stress - when demand for water exceeds availability.

In recent years droughts caused by weak monsoons have resulted in water shortages and are causing power plants to close. Coal plants rely on predictable water supplies for extracting and washing, cooling, and generating electricity. A typical coal plant uses enough water to fill an Olympic-sized swimming pool every three and a half minutes. They frequently discharge contaminated water containing sludge or coal ash, and harmful heavy metals and toxic waste, and can pollute water sources used by local communities.

Between 2011 and 2016, Indian power companies increased their water consumption from 1.5 to 2.1 billion cubic meters annually, a 43% rise. This is likely due to increased electricity generation, and the use of different cooling systems that consume more water.[4] The Indian power sector used the equivalent of a fifth of the water consumed by the country's population in 2010.

There are numerous examples[5] of power plants not being able to operate at full capacity due to water stress. About 40% of India's thermal power plants (plants which generate electricity from fossil fuels, biomass, nuclear, or concentrated solar) are situated in highly water-stressed areas. Water shortages mean plants cannot operate at full capacity, and also pushes them into competition with other uses of water, including domestic and agricultural.

India's coal power plants are closing as a result of water stress

Water shortages are already causing problems for the Indian coal power sector, with many coal power stations in India already experiencing partial or full closures due to water scarcity. For example, in 2016 water shortages forced the Raichur, Ballari, and Kudgi power plants[6] in Karnataka into temporary closure. The Parli Thermal Power Station in Maharashtra has been closed since July 2015 due to water shortages, and the Chandrapur Thermal Power Station was partially shut down in 2010 due to drought.

[1] JSW received financing both in 2017 and 2018.
[2] Climate Change 2014: Impacts, Adaptation, and Vulnerability, Chapter 3, p.247.
[3] Irrigated Agriculture Development under Drought and Water Scarcity, p.13.
[4] Parched power: Water demands, risks, and opportunities for India's power sector, World Resources Institute, p.15.
[5] Parched power: Water demands, risks, and opportunities for India's power sector, World Resources Institute, p.6.
[6] Investor briefing: Water shortages threaten coal company revenues, Greenpeace India, p.16.

In 2016 18 coal plants closed as a result of water shortages, including the Farakka coal-fired power plant in West Bengal which was shut for 12 consecutive days. At the same time, drinking water within the plant and the surrounding towns went dry. More than 1,000 families of Farakka plant workers ran out of water during the crisis, and were forced to use water from the river for cooking and cleaning. The Raichur Thermal Power Station (RTPS) in Karnataka also closed due to water shortages. India missed out on being able to use about 14 terawatt-hours (TWh)[7] of electricity in 2016 due to lack of water - enough to power India's North-Eastern region[8] for a full year.

Between 2013 and 2016, 14 of India's largest thermal power plants[9] closed at least once from forced outages from a combination of issues including water shortages, equipment failure, and fuel shortages. Water scarcity contributed to these closures, and power plants lost US$1.4 billion in revenue over this period. India aims to double coal production by 2020, but water stress is a real issue for the country's coal sector, and more coal production would only make the situation worse.

The majority of coal projects now supported by the Indian government are in water-stressed areas

Despite the strong push for renewable energy in India, government-owned entities continue to be the primary financier of coal projects in the country. In the last two years, commercial and state-owned lenders financed 16[10] coal-fired power projects (21 coal plants) in India. Five coal-fired power projects with a combined capacity of 3.8GW received a combined total of US$850 million in 2018. This was a 90% decline in financing compared to 2017, where 12 Indian coal plant projects were loaned a total of US$9.35 billion.

The World Resources Institute (WRI) Aqueduct Water Risk Atlas shows which regions experienced chronic water stress,[11] where lack of water is constantly recurring, between 1950 and 2010[12]. **The Atlas shows that five coal plants are located in areas of high (>40%) water stress and another 11 are in areas of extremely high (40-80%) water stress.[13]** Historical data shows that power plants located in high water stress areas have a 21% lower average capacity[14] (energy output) than those situated in low and medium water stress areas.

Table: High level comparison of coal plants and water stress levels.

Level of water stress	Number of power plants	Name(s) of power plants
Extremely high (>80%)	11	JSW Barmer Power Station, Gatampur Tehsil Plants, Bajaj Energy (Barkhera, Maqsoodapur, Kundarkhi, Utraula), Doosan (Jawaharpur), Bander Power Station (Thermal Powertech Power Station), Lalitpur Coal Fired Power Station, Mundra thermal power station, Raikheda power station
High (40-80%)	5	Ratija Power project, Bajaj Energy (Khambarkhera), Doosan (Obra C project), Anuppur Thermal Power Project, Bhandhakbar Power Station

7 Parched power: Water demands, risks, and opportunities for India's power sector, World Resources Institute, p.3.
8 Water use in India's power generation: Impact of renewables and improved cooling technologies to 2030, International Renewable Energy Agency, p.2.
9 Parched power: Water demands, risks, and opportunities for India's power sector, World Resources Institute, p.3.
10 JSW received financing both in 2017 and 2018.
11 Aqueduct global maps 2.1: Constructing decision-relevant global water risk indicators, World Resources Institute, p.12.
12 "The most recent year for which withdrawal data were available was 2010; however, because of inconsistencies in reporting, not all countries had data for this year. As detailed in the following subsections, we first projected the water withdrawals to a common year (2010)" - Aqueduct global maps 2.1: Constructing decision-relevant global water risk indicators, World Resources Institute, p.4.
13 Baseline water stress measures the total amount of water used by a region against the total amount of water available. A higher percentage means there is more competition among users for water supplies.
14 Parched power: Water demands, risks, and opportunities for India's power sector, World Resources Institute, p.4.

Medium - High (20-40%)	1	Sarishatali Burdwan
Low - Medium (10-20%)	3	Dhariwal Power Station, Haldia Thermal Power Plant, Patratu Coal-Fired Power Project,
Low (<10%)	1	Pavalavasa Coal Power Plant (Parawada Coal Power Plant)

The following tables present a full breakdown of the 16 coal projects currently operating or being developed.

Table: Location and water stress assessment of the five coal projects financed in 2018.[15]

Power plant	Village(s)	Tehsil / Mandal / Taluk[16]	District	State	Coordinates	Baseline water stress
Sarishatali Burdwan	Asansol		Bardhaman	West Bengal	23.47,07,87.0310	Medium - High (20-40%)
Ratija Power project	Ratija		Korba	Chhattisgarh	22.3399938, 82.4927759	High (40-80%)
JSW Barmer Power Station[17]	Bhadresh		Barmer	Rajasthan	25.89494, 71.3256454	Extremely high (>80%)
Gatampur Tehsil Plants	Bagariya, Rampur, Bandh, Sidhaul, Lahurimau, Answer-Mau, Dharchhua and Sirsa	Ghatampur taluk	Kanpur Nagar	Uttar Pradesh	25.975,80.1889	Extremely high (>80%)
Haldia Thermal Power Plant	Baneshwar village		Haldia	West Bengal	22.060459, 88.109748	Low - Medium (10-20%)

Table: Location and water stress assessment of the 12 coal projects financed in 2017.[18]

Project: Bajaj Energy's five coal-fired power plants						
Power plant	**Village(s)**	**Tehsil / Mandal / Taluk[19]**	**District**	**State**	**Coordinates**	**Baseline water stress**
Barkhera	Berkhera	Bisalpur	Pilibhit	Uttar Pradesh	28.472353,79.807097	Extremely high (>80%)
Maqsoodapur	Maqsoodapur	Powayan	Shahjahanpur	Uttar Pradesh	28.244621,79.997759	Extremely high (>80%)
Khambarkhera	Khambarkhera	Lakhimpur Kheri	Kheri	Uttar Pradesh	28.016292,80.827654	High (40-80%)
Kundarkhi	Kundarkhi	Gonda	Gonda	Uttar Pradesh	27.078694,82.083794	Extremely high (>80%)
Utraula	Itaimaida	Utraula	Balrampur	Uttar Pradesh	27.345496,82.316618	Extremely high (>80%)
Project: Doosan Thermal Power Project						
Power plant	**Village(s)**	**Tehsil / Mandal / Taluk**	**District**	**State**	**Coordinates**	**Baseline water stress**
Obra C project			Sonebhadra	Uttar Pradesh	24.4445, 82.98	High (40-80%)
Jawaharpur project	Malawan	Etah tehsil	Etah	Uttar Pradesh	27.5, 78.83	Extremely high

[15] This table was created using information from SourceWatch, World Resources Institute Aqueduct Water Risk Atlas, and media stories.
[16] Tensil (mandal, taluk, taluq or taluka) is an administrative division.
[17] JSW received financing both in 2017 and 2018.
[18] This table was created using information from SourceWatch, World Resources Institute Aqueduct Water Risk Atlas, and media stories.
[19] Tensil (mandal, taluk, taluq or taluka) is an administrative division.

						(>80%)

Power plant	Village(s)	Tehsil / Mandal / Taluk	District	State	Coordinates	Baseline water stress
Anuppur Thermal Power Project	Laharpur Murra, Guwari, Belia, and Jethari	Jaithari and Anuppur tehsils	Anuppur	Madhya Pradesh	23.06633, 81.7859146	High (40-80%)
Bander power station (Thermal Powertech Power station)	Painampuram	Mutukur mandal	Nellore	Andhra Pradesh	14.351195, 80.143086	Extremely high (>80%)
Bhandhakbar Power Station	Bhandhakbar	Pali tehsil	Korba	Chhattisgarh	22.3409542, 82.4306029	High (40-80%)
Dhariwal Power Station	Tadali		Chandrapur	Maharashtra	20.0105878, 79.2034328	Low - Medium (10-20%)
JSW Barmer Power Station	Bhadresh		Barmer	Rajasthan	25.89494, 71.3256454	Extremely high (>80%)
Lalitpur Coal Fired Power Station	Mirchwara and Buraugaon	Mahroni taluk	Lalitpur	Uttar Pradesh	24.795833, 78.646944	Extremely high (>80%)
Mundra thermal power station	Tunda	Mundra taluk	Kutch	Gujarat	22.8235448, 69.5574957	Extremely high (>80%)
Patratu Coal-fired power project	Patratu		Ramgarh	Jharkhand	23.625, 85.273611	Low - Medium (10-20%)
Pavalavasa Coal Power Plant (Parawada Coal Power Plant)	Pavalavasa	Parawada mandal	Visakhapatnam	Andhra Pradesh	17.563911,83.138650	Low (<10%)
Raikheda power station	Raikheda, Gaitra, and Chicoli	Tilda tehsil	Raipur	Chhattisgarh	21.4499182, 81.8524736	Extremely high (>80%)

The overlap of government-supported coal power projects and regions of water stress highlights a challenge for the Indian coal industry. As well as an operational challenge, water scarcity creates financial risk[20] for the industry, threatening the profit margins of companies and their investors. The industry could be restricted physically by shutdowns from water shortages, be subject to limited or cancelled permits, or forced to install expensive technology that minimises water use. When coal plants are not in operation, they face becoming stranded or non-performing assets[21], like the Parli Thermal Power Station which started off with partial closures in 2013, and was fully shut down in 2015, costing taxpayers over ₹5,000 crores (US$741,950)[22]. Continued support of coal projects in water-scarce regions will exacerbate the environmental and social impacts to local communities, and intensify financial risk to Indian coal companies.

This briefing was compiled by researchers in Europe and the US. For more information or questions, please contact info@mission2020.global, or visit mission2020.global.

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[20] Parched power: Water demands, risks, and opportunities for India's power sector, World Resources Institute, p.7.
[21] Stranded Assets and Thermal Coal An analysis of environment-related risk exposure, Smith School of Enterprise and the Environment, p.9
[22] Investor briefing: Water shortages threaten coal company revenues, Greenpeace India, p.9.