Breaking the Myth Behind Coastal Thermal Power Plants

Shripad Dharmadhikary

It is often believed that coal-based power plants near the coast, by virtue of their proximity to the sea, do not create any pressure on water resources. Shripad Dharmadhikary's visit to Krishnapattanam in Andhra Pradesh and parts of Tamil Nadu exposes the fallacy in that.

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Krishnapattanam is a small coastal village in Nellore district of Andhra Pradesh. Though figuratively it is a stone's throw from the coast, the village was blessed with copious amounts of good quality ground water. But Krishnapattanam's claim to fame lies elsewhere today. It has become the location of one of India's largest ports, the Krishnapattanam Port, dedicated to the nation on 17 July, 2008.

The port is expected to handle huge volumes of coal, imported as well from other parts of India. The destination for these would be the large number of coal-based thermal power plants coming up around the port.

Coastal Thermal Power Plants

Coal-based thermal power plants require two things in massive quantities – coal of course, and water. Inland coal power plants use vast quantities of water and create pressure on scarce freshwater resources. Thus, there has been a big interest in locating these plants in coastal areas, where they can use sea water. The argument is that since sea water is available in virtually unlimited quantities, the water problem related to coal-based thermal power plants is essentially taken care of.

In more recent years, coal availability has also become a big issue. Coal India Limited, which produces about 80 per cent of the country's coal has not been able to keep up with the demand. The Coalgate scam has also had a big impact. Given all this, India's coal imports have been going up. The expectation that a significant part of India's proposed coal thermal capacity addition will depend on imported coal has also made coastal locations very attractive for thermal power plants.

It is no surprise then, that coastal districts such as Nellore boast thousands of megawatts (MWs) of proposed capacity addition. An analysis of data by the Ministry of Environment and Forests (MoEF) showed that coal based capacity in the environmental clearance pipeline (environment clearance granted or under process) for Nellore district was 22,700 MW, for Kutch (Gujarat) 17,980 MW, for Tuticorin (T.N) 14,000 MW, and for Cuddalore (T.N.) 10,140 MW, to give a few examples. This does not include major projects like the proposed 4000 MW Ultra Mega Power Plant (UMPP) at Cheyyur in Kanchipuram district in Tamil Nadu.

However, as several of these plants come up, the assumption that locating such plants on the coast will take care of the water problems related to coal-based power has proved quite unrealistic, and exposed it as being based on a lack of understanding and assessments of the coastal hydrology and ecology.

A recent visit to some of these areas by the author has shown that the coastal thermal power plants and their related infrastructure is playing havoc with local hydrological systems and the lives and livelihoods of communities which are closely associated with water.

Krishnapattanam

As the construction of the port and several thermal power plants around it started, Krishnapattanam found its groundwater turning increasingly saline. In a few years, it had been rendered completely useless. Now the village is being supplied with tanker water by the port company. But this is not very good for drinking and many families now buy bottled water for drinking and domestic use.

Krishnapattanam Village; in front of each house plastic drums await delivery of water by tankers. Pic: Shripad Dharmadhikary

Krishnapattanam has gone from self-reliance in water to complete dependence on tankers and the market. Local people offer two reasons: One, that the dredging activities for the port have created pathways for intrusion of the saline (sea) water into coastal groundwater systems. Second, excessive withdrawals of groundwater for the construction of the port and thermal power plants have led to depletion of groundwater, with falling levels facilitating sea water ingress.

Meanwhile, the nearby village of Gummal Dibba is facing, apart from similar salinisation of its groundwater, a total loss of its main livelihood – fisheries, a fate shared by Krishnapattanam too. The families in this village fish in the nearby Kandeleru creek. The Krishnapattanam port is located at the mouth of this creek.

Several thermal power plants are discharging their waste water, including hot water into this creek. People report that the power plant discharges on one side, particularly hot water, kill the fries (young ones of the fish). On the other hand, the increasing turbidity due to dredging operations, along with other pollutants kill the mature fish. Together, these two have almost totally destroyed the fisheries.

Local residents do not get fish now even for their own domestic use, let alone for the market. Apart from this, fishing in the sea has also suffered as the ships coming in and going out have severely restricted the movements of the fishing boats.

Not being educated, these local people do not get any other jobs. The huge capital investments in the port and power plants that promised development for the local communities have at best offered them jobs of sweepers and security guards, and that too on contract basis, say the people of the region.

To add to this, they complain about the all-pervasive coal dust that settles everywhere in the village and contaminates their water sources.

These two villages are just representative of the larger scenario in the region, and this is the case when only a few of the power plants have started operating and that too, still below their full capacity. The impact would be multiplied many times when all the plants come online. Particularly important will be the problem of ash disposal, which right now is being dumped by the plants in their own premises given that the volumes are now low.

Complex coastal ecosystems under threat

The problems seen at and around Krishnapattanam are a result of an underlying fundamental disruption of coastal hydrology and ecosystems due to thermal power plants, which is likely to manifest in the form of many other impacts.

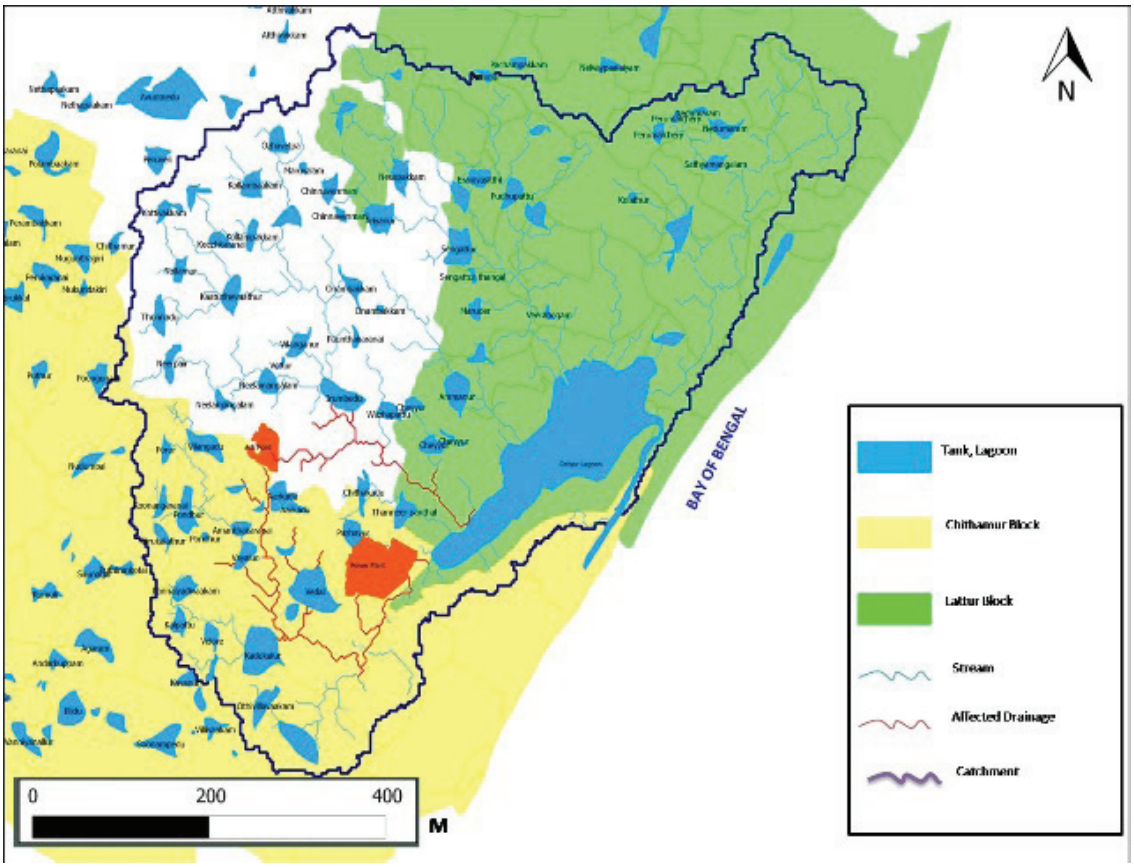
Coastal hydrology is far more complex than inland hydrology. It has three kinds of waters – saline (sea water), brackish (mix of saline and fresh water) and freshwater. All three co-exist in close vicinity, and all three support different kinds of flora and fauna, and in turn, provide diversified bases for livelihoods. They exist in a delicate balance and interactions, providing very vibrant ecosystems. An example is the creeks, the backwaters, the rivers and estuaries that provide some of the richest and most productive fisheries. Coal-based power plants intrude on this ecosystem and disrupt their balance.

It should be noted that coastal thermal power plants cannot work by themselves. They require the development of large scale supporting infrastructure. This includes the port for getting the coal, and often the very rationale for location of the plant on the coast, as well as a transport system for getting the coal from the port to the plant, which can either be truck transport that in turn requires development of roads, or conveyor belt systems miles long. Then, there is the need for water intake structures including channels, pipes and pumping stations; the waste water discharge structures, the ash disposal areas and desalinisation facilities.

Together, just the construction of all these can cause serious disruptions of drainage patterns, and of ground and surface water systems. Added to this are the impacts of the operation of the power plant – the waste water and hot water discharges, ash disposal, coal dust and other effluents.

One of the most serious threats from coastal thermal power plants is created as they bring in vast quantities of sea water into freshwater and brackish water areas. Unfortunately, these impacts are neither properly assessed – through the environment impact assessments or other modes of assessment – nor are they properly mitigated or compensated. All these are hidden behind the notion that because coastal power plants use sea water, water is really not an issue.

An independent report released very recently (on 14 July 2014) for the first time provides a comprehensive picture of what the impacts of such coastal power plants are likely to be. The report titled “Hydrological Implications of the 4000 MW coal-fired Ultra Mega Power Project in Cheyyur, Tamil Nadu“, brought out by Community Environmental Monitoring (a program of The Other Media), with inputs from S. Janakarajan, Siddharth Hande & Nityanand Jayaraman, uses GIS to present a detailed map of all the numerous water bodies in the project area, and shows how the project will cause enormous impact.



Cheyyur Water Bodies Map; Red line shows water flow paths below ash pond, and water bodies it will pass through.

This report shows that the waste water drain will cut existing drainage, and divert the monsoon water that normally reaches the Cheyyur / Odiyur lagoon away from it. This will badly affect the lagoon, a resting and feeding place for migratory birds and a biologically highly productive system that is crucial for local fisheries.

The report, through the map, highlights that the area has a rich system of eris – tanks that are built in a cascade with the overflow of one feeding the other. These tanks serve as source of irrigation for agriculture, for fisheries and meet many other needs.

The ash pond of the project is located at a higher elevation and the overflow (not to mention any accidental releases or breach) from the ash pond will follow the contours and run through several of these water bodies, contaminating them. It may be noted that the plant is likely to generate close to a million tons of ash per year, and that coal ash contains toxic heavy metals and possibly even radioactive material.

Ash dumped in the Buckingham Canal in front of the North Chennai Power Plant. Pic: Shripad Dharmadhikary

The report further points out that the coastal area has very old sand dunes, which house a rich ecosystem of a large variety of plants, including economically important ones like cashew. Moreover, these sand dunes provide protection that makes agriculture possible in large areas close to the coast. Part of the reason for the rich biodiversity of the sand dunes is their capacity to hold rainwater like a sponge and release it slowly for the needs of vegetation. The project will destroy several such sand dunes – some flattened to build project components like the coal yard, others cut through for the conveyer belt, and so on.

The report brings out the serious consequences on the entire water system of the area due to the Cheyyur power project, reaching the conclusion that the electricity from the power plant will come at the greatest of costs – water. It urges that while there are may be several other sources for electricity, there are no alternatives to preserving our water resources.

In conclusion

The Cheyyur hydrological impact report is especially important, for similar impacts are likely to be seen in the case of most coastal power plants. It brings out starkly the fact that water remains a very serious issue for coastal thermal power plants too. Thus, the time has come to jettison the false sense of security and comfort, often bordering on complacency, that arises out of the myth that water is not at all a concern for coastal power plants.

In fact, there is increasing evidence to show that water and water systems – and related livelihoods – could be one of the most important factors to consider for coastal coal-based thermal power plants, particularly where such development is taking place as large clusters. Given this, there is a need to re-assess all such plants from the perspective of impacts on water.

Limitations of World Bank's Thirsty Energy Reflections

There are serious limitations in the way the World Bank is looking at the Water Energy nexus. This is evident from a reading of its own working paper released in June 2013, of the same title, Thirsty Energy.

This document does highlight the large amounts of water needed to produce electricity, particularly coal-fired electricity, but it falls far short of understanding or revealing the full range of impacts of energy production on water. Let us look only at the example of coal fired electricity and water.

Coal and Water

The entire chain of coal based electricity production – from coal mining, transport, power plant and ash disposal – has huge impacts on water. These can be broadly categorised as follows.

(1) Direct consumption of water for coal mining, thermal plants, ash disposal etc.

(2) Disruption of both surface and ground water resources (e.g. coal mines will dewater groundwater aquifers around them, impacting local communities)

(3) Pollution

Unfortunately, Thirsty Energy looks only at item (1) above, and completely ignores impacts of (2) and (3), which can be as big as or even worse than those of (1).

Direct Use Underestimated

Even in the direct use of water, Thirsty Energy grossly underestimates the use of water by coal plants. It assumes that the biggest use of water in coal power plants is for cooling purposes. It says, In a coal plant with cooling towers, it is estimated that 90 percent of the water is used in the cooling system and the other 10 percent is used in other processes (DOE, 2009) . However, this is not true at all in the case of India. In India, in addition to water used for cooling which is huge, massive quantities of water are used for ash disposal.

Ash pond of 2340 MW Chandrapur Thermal Power plant. The pond is spread over 2600 hectares. It is supposed to be lined with impermeable material, as are all ash ponds, but is not.

Ash Dump of HINDALCO Alumina Company at Hirakud, Sambalpur in Odisha. Note Location Close to water body.

Burning of coal leaves behind ash, which is particularly high in India as domestic coal is high in ash content. While ash is supposed to be reused (the various reuses are fraught with risks, an issue we are not dealing with here), vast quantities still are being disposed in the form of dry ash dumps (see photo), or in ash ponds in the form of slurry (see photo). The latter requires massive quantities of water. For example, data obtained by us (Manthan Adhyayan Kendra) under the Right to Information Act showed that in many thermal power plants, water used for ash disposal ranged from 25% to 40% of total water use, and on a per unit basis was between 0.7 to 2 litres per unit (KWh) of electricity generated. But water for this need, for ash disposal, does not figure anywhere in the estimations of Thirsty Energy.

It's claimed that newer plants will use much lesser water for ash disposal, and any such development will be welcome. But there are serious questions about these claims which still need to be proved on the ground. Till then, ash disposal remains a huge water guzzler in India.

Disruption of surface and ground water resources

Coal mines, both open cast and underground, can severely disrupt the groundwater flows, aquifers and also impact surface water. When one digs a coal mine, in essence one is digging a big pit, which cuts across ground water flows. These can lead to drying up of wells and even surface water bodies in the vicinity.

Our visits to various mines in different states show that the impact of groundwater dewatering is felt up to distances of 4-5 km. A study by Central Ground Water Board (CGWB) of the Padampur-Durgapur coal mines in Chandrapur district of Maharashtra noted that effect of mine dewatering was seen upto distances of 3 km. (See Photo , dry well in Sinala village).

Dry well at village Sinala, near Padampur-Durgapur mine. Local people talked about how earlier this and other wells used to supply water well past the monsoon, but now dry up soon after.

Dried surface pond near coal mines in Angul district in Odisha. Local people told us that this pond used to supply water to irrigated fields of people till February, but now does not retain any water post monsoon. They link this to the mining activities. Coal mine EIAs mostly do not look at the impacts on surface water resources.

In quantitative terms, the above mentioned CGWB studies note a dewatering of 10.89 million cubic meters (MCM) per year for Kamthi-Inder-Gondegaon mine, and 7.76 MCM per year for Padampur-Durgapur mine. By rough estimates, this amount of water can irrigate 2200 ha and 1500 ha of land respectively. This is the water that is lost to the local communities. Some of this – mine drainage - could potentially be supplied back to the local communities – but this has the risk of being contaminated and would need treatment before returning back. The experience so far of pollution control and proper treatment of water is not at all encouraging in this matter.

It is not only groundwater, but also surface water bodies that are affected. (See photo). This entire aspect, which affects thousands of people from communities in vicinity of coal mines, is overlooked by Thirsty Energy.

Coal and Pollution

There are many sources of pollution in the coal – electricity chain. For water, some of the important issues are the mine drainage, water pollution due to oil and grease and coal dust, contamination of ground and surface waters with ash, which has presence of heavy metals, overburden draining into water sources etc.

One of the serious pollutants is acid mine drainage which occurs when mine drainage interacts with sulphides, if any, present in the ore or rock.

The mine drainage, even if not acidic, has other pollutants, mainly in the form of suspended solids, and settling in a settling tank is projected as an adequate method of treating it. We are still studying this aspect. However, our field visits have shown that often mine drainage


Lahiri Nallah in Lahiri Opencast mine area of Mahanadi Coalfield in Jharsuguda, Odisha, contaminated with grease and coal dust.

is discharged onto local water bodies without even this basic treatment.

Another serious source of pollution is the ash. The un-utilised ash is being dumped in fly-ash dumps or fly ash ponds from where risk of contaminating water is very high, through leaching, through spilling and through ash dyke breaches (not to mention illegal discharge of ash into nallahs and rivers). It may be mentioned that it is only in recent years that the authorities are taking some cognisance of the pollution from ash, and are calling for monitoring of heavy metal in ash and also presence of radio-active elements. However, ash continues to be dumped into, and contaminate land and water.

Thirsty Energy ignores entirely this aspect of pollution of water, which is a significant part of the (coal) energy – water nexus, and on occasions could be even more of a threat than the large quantities of water which are consumptively used.

Limited Understanding Limits Solutions

Thus Thirsty Energy reveals a very limited understanding of the impacts of (coal based) energy production on water. This in turn affects the solutions it offers. It is no surprise then that the solutions presented by Thirsty Energy are mainly technical and managerial in nature – more efficient water use, air cooling, integrated energy-water modelling etc. While all these are important, one critical element that is missing is the participation of local communities – who are the most impacted by the water-energy nexus – in planning, monitoring and regulating the impacts of energy on water.

The above mentioned article is a combined piece of two originally separate articles the first titled 'Breaking the myth behind Coastal Thermal Power Plants' first published in India Together, with the support of Oorvani Foundation - community-funded media for the new India and the second titled 'Limitations of World Bank's Thirsty Energy', both by the same author Shripad Dharmadhikary.

The author has given IPPAI the necessary permission to publish his articles

About the author:

Mr. Shripad Dharmadhikary completed his B.Tech in mechanical engineering from IIT Bombay (now Mumbai) in 1985, and after working for few years with industry, become a full-time activist in the Narmada Bachao Andolan (NBA), a mass movement of the people affected by large dams on the Narmada river. In 2001, he relinquished full time work of the NBA to set up Manthan Adhyayan Kendra. Shripad's work interests include dams, rivers, irrigation, hydropower, privatisation and commodification of water, analysis of water and energy policies, energy-water nexus and environmental flows. He has also completed an online course in environmental flows from UNESCO-IHE.

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