

Mitigating pollution from coal based power plants

K.M. MAHBUBUR RAHMAN

AFTER Rampal, Bangladesh is going to set up more thermal power plants of 1,320 MW capacity each at Moheshkhali, Patuakhali and Matarbari under foreign collaboration based on imported coal. All these plants will emit pollution into atmosphere. The Rampal power plant is a potential threat to the Sundarbans nearby, and all of them will affect the people, livestock, crops, groves and plantations in the neighbouring areas. This article will discuss the aspects of pollution and ways and means of mitigation for safety of people.

Emission of pollutants and their impact

The flue gas with the products of combustion of coal will spread in the surrounding areas. The emission will consist mainly of carbon dioxide (CO₂), sulphur dioxide (SO₂), nitrogen oxide (NO_x) and miniature particles. All of them are injurious to health, and will have the following effects:

Carbon dioxide will be discharged into the atmosphere at the rate of 30,000 ton/day. It will add to global warming, which is a cause of climate change.

Sulphur dioxide with moisture creates acid mist which enters the lungs, gets mixed with blood and affects blood chemistry. In extreme cases sulphur dioxide will combine with water in the atmosphere in the presence of nitrogen oxide as promoter and make sulphuric acid, which will come down as acid rain and damage the crops, vegetation and pisciculture. Further, the atmosphere will generally be acidic and will enhance corrosion rate of metallic structures and sheet metal roofing of rural homes.

Nitrogen oxide creates ozone or smog at ground level. Inhalation can burn lung tissue, and cause asthma and chronic respiratory diseases.

The particulates (fly ash) can cause severe asthma, bronchitis and premature death. Fly ash also carries uranium, a radioactive matter. With rain, fly ash will leach into the soil, and radiation will contaminate agricultural produce. Ingesting even a small amount of radiation may have fatal consequences.

These effects of pollution will be felt after prolonged exposure in the form of health problems and premature deaths in the community.

Emission control and effluent treatment

Emission will have to be strictly controlled to minimise pollution. The following equipments are compulsory requirements and should be specified in the contract document:

(1) Electrostatic Precipitators/Bag filter houses are very important as they can capture 99.9% fly ash particulates. The separated fly ash can be pneumatically handled and stored in silos as a by-product for beneficial use. Output of fly ash in each plant will be 4,200 ton/day.

(2) Flue-gas Desulphurisation (FGD) is a technology that utilises chemical scrubbers to remove sulphur dioxide from exhaust flue gas. It reacts chemically with lime to form calcium sulphate (gypsum), which is a useful by-product. If the product is wet slurry, it should be dehydrated by centrifuge. Output of gypsum in each power plant will be 620 ton/day. Application of this technology cannot be avoided as imported coals may contain high percentage of sulphur.



(3) Selective catalytic Reduction (SCR) system has to be applied to remove nitrogen oxide from boiler exhaust. The system uses ammonia to reduce nitrogen oxide with the help of a catalyst to simple nitrogen, a harmless inert gas. It is a necessary application as imported coal may have high nitrogen content.

The effluents from the water treatment plant, desalination plant and other auxiliaries should not be released into the rivers before clarification by standard effluent treatment system.

Beneficial use of residual by-products

All avenues need to be explored for "beneficial use" and recycling of the waste products.

Fly ash: It is a very light weight and fine particle like talcum powder with cement-like properties.

Fly ash can be used in: (a) the production of cement;

(b) manufacture of fly ash bricks; (c) as a component in road bases, sub bases and pavements; (d) blending with Portland cement in masonry work.

Bottom ash: It is heavier, coarse and granular combustion product which collects at the bottom of the boiler. The fields of application are (a) in structural fills and land reclamation; (b) as aggregate in RCC road bases and pavements; (c) as feedstock in production of cement clinker.

Output of ash in each plant will be 1,800 ton/day

Gypsum: FGD gypsum is widely used in the production of gypsum wallboards and in cement production. Gypsum from all the power plants will suffice as raw material to make a gypsum board factory viable.

Need for more efficient boiler

Selection of highly efficient boiler is very important, because higher efficiency leads to fuel economy and less pollution. Bangladesh Power Development Board (BPDB), the joint owner of the Rampal power plant, is going for Supercritical (SC) boiler, which is two generations behind the latest development.

Ultra Supercritical (USC) and Advanced Ultra Supercritical (AUSC) boilers with improved pulverised coal combustion system and higher thermal efficiency have come in the market. BPDB may seriously consider selection of at least the next higher version USC boiler of efficiency 45% in place of SC boiler of efficiency 40%.

The efficiency improvement of 5% will be a great advantage. The coal requirement will be reduced by 235,000 ton/year, which will save Tk.125 cr. per year. The initial fixed cost may be high but will be compensated in the long run by fuel economy. Also, the emission of CO₂ will be reduced by 1,600 ton/day.

Conclusion

A coal-fired power plant produces clean electrical energy but pollutes the atmosphere and environment. The pollution has to be minimised by using state-of-the-art technologies for the sake of the health of the people.

There is no denying that Bangladesh needs electricity for development and progress. The proposed power plants and those in the pipeline are going to provide the much needed electricity for rapid economic growth to reach the level of middle income country by 2040. The country has to balance eco-friendly need and nature for better economy and better life of people – the spirit should be progress to the maximum and pollution at the minimum.

The writer is a Senior Mechanical Engineer.
Email: mahbub_r_407@yahoo.com

Black holes DO exist

QUAMRUL HAIDER

A piece in *The Daily Mail* reports the conclusion of Laura Mersini-Houghton, a cosmologist and a theoretical physicist at the University of North Carolina, that black holes do not exist.

In order to understand what led Mersini-Houghton to make such an earth-shattering claim, it is necessary to have a brief understanding of the history of black holes. A black hole – one of Einstein's general relativity's predictions – is an unfathomable hole drilled in the superstructure of the Universe. Inside a black hole, the immense strength of gravity distorts the structure of space and time so severely that light rays can no longer travel in a straight line, but rather follow a trajectory curving back towards the black hole. Consequently, light rays remain trapped, resulting in a total information blackout.

But according to the uncertainty principle of quantum mechanics, information from the Universe can never disappear. Thus we see that when it comes to black holes, quantum theory and Einstein's general relativity fail to agree. This is known as the "information loss paradox."

In 1974, Stephen Hawking proposed that a black hole temporarily (which could be aeons!) entraps matter and energy that can eventually reemerge as radiation. This outgoing radiation, known as Hawking Radiation, possesses all the original information about what fell into the black hole. The radiation is yet to be detected from a "real" black hole.

Mersini-Houghton agrees that as a star collapses under its own gravity, it produces Hawking Radiation, but before it becomes a black hole and not after, as predicted by Hawking. She claims that by giving off this radiation, a star's mass also decreases. Eventually, the star won't have enough mass to become a black hole. Her calculations indicate that the collapse of a star will stop at a finite radius before the event horizon of a black hole, which is an imaginary boundary beyond which everything is forever hidden.

It should be noted that current cosmological models predict that a star becomes a black hole if its mass is greater than three solar masses. In that case, there is no force in the Universe that can prevent gravity from crushing it into zero volume and infinite density, known as a singularity. Indeed, numerous black holes, including super-massive ones at the centre of galaxies as far as 2.7 billion light years away from Earth, have been detected by the space-based Hubble telescope and the Chandra Observatory.

Through her claim of the nonexistence of black holes, Mersini-Houghton is questioning the validity of the fundamental concept of "singularity" out of which the Universe was born. If she is correct, then the Big Bang Theory is wrong. If Big Bang Theory is correct, then she is wrong.

A scientist's work will gain acceptance if it is published in a high-impact refereed journal. The paper by Laura Mersini-Houghton on the nonexistence of black holes was rejected by the referees of the prestigious journal *Physics Letters*. The article can be found on arXiv, an online repository of physics papers that is not peer-reviewed.

The physics community, particularly cosmologists and astrophysicists, consider Laura Mersini-Houghton's claim about nonexistence of black holes as nonsense or an outcome of her lack of understanding of Hawking Radiation. I see it as a reenactment of Ponsch and Fleischmann's infamous claim in 1989 that they observed cold fusion in the laboratory.

According to mainstream cosmologists, a black hole doesn't emit enough Hawking Radiation to shrink its mass down to where Mersini-Houghton claims. Hence, there is no evidence to support her hypothesis that there are no black holes.

The writer is Professor of Physics at Fordham University, New York.

The case for a climate change envoy

POLITICS OF CLIMATE CHANGE



SALEEMUL HUQ

IT is now clear to all concerned that not only Bangladesh but the rest of the world too will have to deal with climate change for decades to come. Hence it will require permanent national and international institutions to deal with adaptation as well as mitigation and green development over not just the next five-year plan but for the next few five-year plans.

At the global level, the main institution to discuss and agree actions is the United Nations Framework Convention on Climate Change (UNFCCC). There are also other fora where climate change discussions are held and decisions taken, such as the recent Climate Summit in New York called by the Secretary General of the United Nations Mr. Ban Ki Moon.

It is for this reason that a number of developed countries, such as the United Kingdom, France, Sweden and others, have appointed special climate change envoys to be able to attend all relevant meetings (not just the UNFCCC negotiations). Recently, several developing countries, such as Indonesia, have also appointed climate change envoys.

Most recently, the Gambia was the first Least Developed Country (LDC) to appoint a Special Climate

Change Envoy, Mr. Pa Ousman Jarju. He was previously a highly effective chair of the LDC Group in the UNFCCC negotiations and just a few weeks ago he was also appointed minister for environment of the Gambia (while also remaining the climate change envoy). He represented the Gambia at the Climate Summit as well as several high-level meetings in New York.

The case for a climate change envoy

I would like to make the case for other LDCs, including Bangladesh, to consider appointing climate change envoys, giving some reasons in support of my argument and also mentioning some obstacles that would need to be addressed.

Firstly, climate change related meetings at regional and global level are taking place almost continuously and not just at the annual UNFCCC meetings. Hence, keeping up with such meetings seriously will be a full-time job.

Secondly, the current negotiators tend to be technical people or general bureaucrats from the ministry of environment in the LDCs, including Bangladesh. The topic of tackling climate change has become one that is no longer just technical or environmental, so it requires a higher level of political engagement on a more regular basis than just once year negotiations at the Conference of Parties (COP) under the UNFCCC.

Finally, the skills required for being a successful climate change envoy are not technical or environmental but diplomatic, and require specific knowledge of UN procedures. Hence, the most suitable candidate for selec-

tion as a climate change envoy will be a senior diplomat who has spent time posted in the UN in New York or Geneva. Technical aspects could be handled by the experts from other ministries who would advise the envoy.

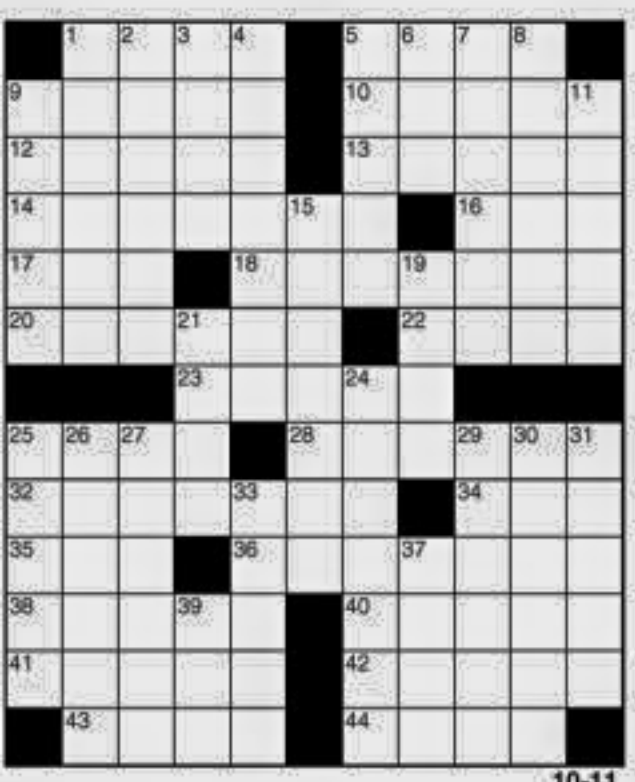
Barrier

One obstacle in selecting a diplomat as climate change envoy from the foreign ministry is possible resistance from the ministry of environment (which has traditionally handled international meetings). These turf issues cannot be resolved at ministerial level, and need resolution by the head of government whose decision will be accepted by all the ministries. It would also help if the appointee is known to have a close relationship with the head of government as this will enhance his/her credibility in dealing with other countries.

Conclusion:

As adaptation to adverse impacts of climate change as well as mitigation and green development pathways are developed at both national as well as global levels it is especially important for LDCs, including Bangladesh, to remain actively engaged in connecting the national with the global. Therefore, all heads of government of LDCs, including Bangladesh, should consider appointing a skilled current, or retired, diplomat as the climate envoy to represent the country's interests at all global climate change fora and meetings.

The writer is Director, International Centre for Climate Change and Development, Independent University, Bangladesh.
E-mail: Saleemul.huq@iied.org



Yesterday's answer

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