Evaluation of the EIA for the 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4) at Matarbari, Moheshkhali Upazila, Cox's Bazar District by **Mark Chernaik**, Staff Scientist of ELAW

1. The EIA Provides an Inadequate Justification for the Project in Light of Available Information about Power Overcapacity in Bangladesh

Proposed projects with the potential to cause serious environmental harm should not move forward if they are unnecessary. With respect to the need for the project, page 12 of the EIA states:

> "Need of the project
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> "The Government of Bangladesh has planned to expand its electricity generating capacity, in line with the government's vision 2021, SDGs 2030 and vision 2041and accordingly has taken up development program in different sectors to achieve industrialization in an accelerated manner, to improve the lifestyle of the people and the socio-economic condition in general. To meet the present and future demand, the government has given top priority to the development of the power sector, has formulated a Power System Master Plan (PSMP 2016), and has undertaken a massive power generation expansion plan by installing a medium size new Power Plant and upgrading the old ones.
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> "Considering the targets, the government has adopted fuel diversification as a strategy to reduce dependency on natural gas-fired electricity production and adopting energy security. As per PSMP-2016-Revisit, the Government also expected to generate 32 per cent of electricity from coal-fired power plants as an alternative to natural gas by 2041. However, the cancelation of ten coal-based power plants which happened recently, may change the power generation strategy of the government from coal-fired power plants. It is mentioned here that, the "Matarbari Ultra Super Critical Coal-Fired Power Plant Development Project Phase 2 Units 3/4" (hereinafter referred as to "Project") is an expansion phase-1 of the Units 1/2 Project which is excluded from the ten-cancelation power plant. Furthermore, in the context of the implementation of power plant technologies, the ultra-super critical coal-fired power plant is reliable, cost-effective, durable and sustainable.
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> "To ensure the financial sustainability of the whole project (Unit 1-4), the implementation of phase-2 is necessary because it will share the common supporting facilities like; port, road and others associated infrastructures which is already under construction in Phase-1. Moreover, in the perspective of pollution control, the Phase- 2 (Units 3/4) will introduce more efficient and state-of-the-art technology like Limestone based Flue Gas Desulfurization (FGD), Electrostatic Precipitator (ESP), low NOx burner (multi-phase burning) and denitrification system (Selective catalytic reduction (SCR). Therefore, the cumulative impacts of Unit (1-4) in the flue gas treatment will fulfill the Bangladesh standards and IFC / EHS guideline efficiently."

This information about the need for the project is firmly contradicted by recent financial analysis of electrical energy systems in Bangladesh showing that there is an overcapacity and under-utilisation of power supply which the proposed project would worsen. According to the Institute for Energy Economics and Financial Analysis (IEEFA):

> "The Bangladesh Power Development Board's (BPDB) latest annual report for the year 2019-201 reveals that the nation's overall power system utilisation has fallen again in FY2019-20 to just

40%, down from 43% in the prior year (Figure 1). A figure of 40% utilisation indicates significant surplus capacity within the power system.

"With 2,000MW expected to have been added to the system by the end of 2020, this overcapacity will have worsened before the end of the year. Furthermore, in its new annual report, the BPDB discloses that 15,294MW of new power capacity is under construction and around 21,000MW will be added by the end of 2025. Over the same period, only 5,501MW of old capacity is to be retired.

"As a result, under-utilisation – and hence, overcapacity – will worsen out to 2025 unless power generation growth recovers quickly and remains at a very high level throughout the period. Power generation growth was just 1.26% in 2019-20 according to the BPDB, barely keeping pace with population growth, as the economic impacts of COVID-19 were felt in Bangladesh.

"IEEFA has estimated future capacity utilisation based on power generation growth assumptions and BPDB's disclosed capacity additions and retirements out to 2025. Even if generation growth immediately recovers to 10% per annum in 2020-21 and remains at that level, overall capacity utilisation will drop below 40% during the early 2020s before recovering back to just 40% in 2025-26 (Figure 2).

"If annual generation growth is 8% then utilisation will keep dropping down to 36% by 2025-26. In the event that generation growth is 7%, utilisation worsens even further to 34%, meaning two-thirds of the nation's power capacity will sit idle across a full year (Figure 2).

"With the global economic recovery from COVID-19 uncertain, Bangladesh risks seeing an already significant overcapacity situation worsen over the next five years if power generation growth does not recover to, and stay at, very high levels.

"Worsening overcapacity has significant implications for the BPDB's finances as well as power tariffs. Under power purchase agreements, thermal power generators receive capacity payments regardless of whether they are utilised or not. Capacity payments to power plants that increasingly sit idle raise the per unit cost of generation, which could result in the need for higher government subsidies to bail out BPDB's losses and/or the need to increase power tariffs for consumers."[1]

A recent presentation on "Abandoning Coal in Power Generation: Government Initiatives & Way Forward" by the Centre for Policy Dialogue (CPD) emphasizes the following facts:

"The webinar organised by CPD on 24 June, 2020 has made a number of recommendations which are pertinent to government's recent initiative

"COVID 19 has provided an opportunity to revisit existing approaches, operations, management, cost and return of the ongoing power generation including redirecting the power sector towards clean energy by 2030 and 2041

"Growing overcapacity and inefficiency in the power sector have been creating fiscal financial pressure on the Power Division particularly to the BPDB which need reprioritization of investment projects

[1] IEEFA (January 2021) "Power Overcapacity Worsening in Bangladesh: Switch in Focus From Coal and LNG To Renewables and Grid Can Address the Problem"

> "The Power Division needs to follow 'go slow' policy in power generation related projects both under public and private sector given the huge amount of overcapacity currently exists
>
> "The power division needs to shifts its focus from generating electricity based on fossil fuel to more by renewable energy both under public and private sector
>
> "Government should negotiate with development partners and private sector about possible deferment/cancellation of the projects including those of coal fired projects
>
> "A well planned renewable energy led electricity generation through solar, wind, roof top and other means could be a better option for the future."[2]

Not only is the 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4) at Matarbari unnecessary, its addition to the power system of Bangladesh would be unwelcome from a fiscal standpoint.

2. The EIA provides an argument for why renewable energy systems are not the preferred alternative to the project that is contradicted by the Sustainable and Renewable Energy Development Authority of the Ministry of Power, Energy and Mineral Resources

Pages 297-298 of the EIA makes the following argument that generating electrical power by using solar photovoltaic panels is not a realistic alternative to a coal-fired power plant.

> "The annual power generation of 600 MW x 2 = 1,200 MW for this project is 1,200 MW x 24 hours x 365 days x 80% = 8,410 GWh/year, assuming the capacity factor of 80%. With reference to the above-mentioned power generation amount of 1,332 kWh/m2 per unit area, the site area required to generate the annual power generation (8,935 GWh/year) of this project by photovoltaic power generation is 8,410 GWh/year / 1,332 kWh/m2 = 631ha (in case the capacity factor is 1kW/m2), which is equivalent to the total site area of 700ha required for the Units 1/2 project and this project.
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> "However, in fact, it is said that 10 to 15m2/kW is required to install a solar panel (1kW). According to "NEDO PV Challenges 2020", the capacity factor of photovoltaic power generation for business use is 18%3, and with reference to these values, the required site area is calculated as 700ha x 8,410 GWh/year / [7,000,000m2 / 10m2//kW / 1,000,000 x 8,760 x 18%] = 5,333 ha (Green part in Figure 8.2).
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> "When considering photovoltaic power generation, it is necessary to select the site in consideration of topography, weather, diurnal fluctuations, etc. It is not realistic because project owner has to secure the vast land."

This argument is directly contradicted by information presented by the Sustainable and Renewable Energy Development Authority (SREDA), Power Division, Ministry of Power, Energy and Mineral Resources:

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[2] Moazzem, K. G., Ahmed, T., & Shibly, S. A. (2020). Abandoning Coal in Power Generation Government Initiatives & Way Forward.

“It is crucial for Bangladesh to prepare for a future when the reserves of fossil fuels will be on the verge of depletion all over the world and climate change will pose an extreme threat to lives and livelihoods. This future is also likely to see the cost of renewable energy decreasing and technological efficiency increasing. As one of the most susceptible countries to the ravages of climate change, Bangladesh should invest in a future which is environmentally and economically sustainable. Despite limited land availability for the deployment of solar energy, the government through appropriate policies can still use the available land effectively to meet the energy needs. Land use efficiency can be increased by the use of agrivoltaics or creating multilayer use of solar installations, like raising the height of the solar panels, and using the land below for agriculture which needs less solar radiation, or grazing pasture for livestock, or planting the land with flowering plants for apiaries or developing pisciculture.

“The global scenario is rapidly changing, and the share of renewables in the energy mix across the world is increasing. Renewables are securing more annual investment when compared to fossil fuel capacity. The reasons are obvious—the pressing need for energy security and the risk posed by climate change. Already, renewable energy sources specially the solar photovoltaic, have become financially competitive with fossil fuels in many jurisdictions, and in the future, will become cheaper than any fossil fuel-based energy. Cheaper power from renewables will be the chief driving force in the energy industry. Therefore, like many other countries, Bangladesh should also adopt ambitious renewable energy targets. Among all renewable sources, solar energy is continuously proving itself to be the most suitable solution for Bangladesh. Since the country has a rationed amount of land, the decisions about land allocation should be prudent. Accordingly, special emphasis should be put on the solar rooftops and the solar irrigation sector.

“In this study, three scenarios are presented for the future of solar energy in Bangladesh, i.e. the BAU case, the medium, and the high deployment scenario. In the BAU case, future solar capacity is estimated to be 8 GW; for the mid and high deployment cases, the estimations are 25 GW and 40 GW respectively till 2041. The scenarios are developed based on existing and developing technologies which are known today and do not consider the possibility of entirely new or unknown technologies emerging.

“It is recommended that Bangladesh should aim for the high deployment scenario. In this case, the installed capacity of the solar PV systems will be almost half (50%) of the projected generation capacity of the country under the condition of high economic growth and without any EE&C measures. With EE&C measures, the share would be around 60%. The capacity utilization factor of the solar PV power plants in Bangladesh is approximately 18% and by the year 2041 the energy generation demand of the country will be 360,000 GWh (Approximating with EE&C measures). In the high deployment scenario, the energy generation from the solar PV systems will be around 63,000 GWh per year, which means that the solar PV systems will provide nearly 17.5% of the total electric energy demand of the country by the year 2041.

“In order to execute the high deployment scenario, the government should undertake several important and timely steps. According to the Delta Plan of Bangladesh, there will be more than 3,300 square kilometers of new reclaimed land in the near future. If around 5% of this reclaimed new land is used for solar power projects, and the government undertakes the necessary land and transmission infrastructure development, these projects can be built and operated by either the government utilities or the private sector through competitive bidding of IPP projects or by both.”[3]

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[3] SREDA (10 October 2020) “National Solar Energy Action Plan, 2021 - 2041” at page 126.

3. The EIA Does Not Assess the Substantial Impacts on the Climate of the Project's Greenhouse Gas Emissions

Page 303 of the EIA provides the following information of the project's greenhouse gas emissions:

> "In addition, CO_2 emission of the project is estimated 7,319,280 t-CO_2/y.."

The Matarbari 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4) is expected to have a 30-year operational life. This implies that over the 30-year operational life of the project it would emit nearly *220 million metric tons of CO_2.*

In July of 2021, the number of expected deaths caused by the emission of one additional metric ton of CO_2 was estimated by research conducted at the Columbia University School of International and Public Affairs: The study states the following:

> "In this study, we create an extension to DICE-2016 called DICE-EMR (Dynamic Integrated Climate-Economy Model with an Endogenous Mortality Response). We construct an additional reduced-form mortality damage function that projects the effect of climate change on the mortality rate using estimates from studies chosen from an interdisciplinary systematic research synthesis of the scholarly literature (see "Methods" section for details). We use DICE-EMR to produce a new metric that avoids some of the limitations of the SCC: the mortality cost of carbon (MCC). *The 2020 MCC is the number of expected temperature related excess deaths globally from 2020 to 2100 caused by the emission of one additional metric ton of carbon-dioxide equivalent emissions in 2020*. We find that in the DICE baseline scenario that results in 4.1°C warming above preindustrial temperatures by 2100, the 2020 MCC is 2.26×10^{-4} lives per metric ton in the central estimate, which implies that adding 4,434 metric tons of carbon dioxide in 2020 … causes one excess death globally in expectation between 2020 and 2100."[4]
>
> "We find that optimal climate policy in DICE-EMR, however, involves large immediate emissions reductions and full decarbonization by 2050. This results in 2.4 °C warming by 2100.
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> "If the world undertakes the optimal emissions path in DICEEMR and restrains global average temperatures to 2.4 °C, we largely avoid the temperatures where marginal increases in temperature resulting from a marginal emission today are most damaging. Therefore, the SCC and the MCC are highly sensitive to future climate policy. On the optimal emissions path the 2020 MCC drops by 53% from 2.26×10^{-4} lives per metric ton in the baseline emissions scenario to 1.07×10^{-4} lives per metric ton (see Table 1). *This implies that under DICE-EMR's optimal climate policy, adding (reducing) 9,318 tons of carbon dioxide— equivalent to the lifetime emissions of 7.3 average Americans—causes (reduces) one excess death globally between 2020 and 2100*. It also implies that adding (reducing) 1,276 metric tons of carbon dioxide in 2020 … causes (reduces) 0.14 excess deaths between 2020 and 2100 in expectation on the optimal emissions path …."[5]

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[4] Bressler, R. D. (2021). The mortality cost of carbon. Nature communications, 12(1), 1-12, at page 2.

[5] Ibid., at page 4.

Table 1 2020 mortality cost of carbon (MCC).			
	Low mortality estimate (<10th percentile)	**Central mortality estimate**	**High mortality estimate (>90th percentile)**
Baseline emissions scenario (4.1 °C warming by 2100)	-1.71×10^{-4}	2.26×10^{-4}	6.78×10^{-4}
Optimal emissions scenario (2.4 °C warming by 2100)	-2.16×10^{-4}	1.07×10^{-4}	5.22×10^{-4}

DICE-EMR projects that an additional metric ton of carbon dioxide emitted in 2020 causes 2.26×10^{-4} excess deaths from 2020 to 2100 in the central estimate in the baseline emissions scenario and 1.07×10^{-4} excess deaths in the central estimate in the optimal emissions scenario.

This analysis allows us to calculate the mortality costs associated with the Matarbari 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4). For example, if the world undertakes the optimal emissions path and restrains global average temperatures to 2.4 °C by 2100, then for the eighty-year period that encompasses the operational life of the project, expected CO_2 emissions from the project would cause 23,600 excess deaths.[6]

4. The EIA Does Not Assess How the Project is Compatible with Recent International Agreements for Meeting the Temperature Targets of the United Nations Framework Convention on Climate Change

In November of 2021 at the 26th Conference of the Parties (COP26) to the United Nations Convention on Climate Change (UNFCC), countries around the world agreed to the following to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. Specifically, at COP26, the Conference of the Parties in the Glasgow Climate Pact:

> "15. Reaffirms the long-term global goal to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
>
> "16. Recognizes that the impacts of climate change will be much lower at the temperature increase of 1.5 °C compared with 2 °C, and resolves to pursue efforts to limit the temperature increase to 1.5 °C;
>
> "17. Also recognizes that limiting global warming to 1.5 °C *requires rapid, deep and sustained reductions in global greenhouse gas emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century*, as well as deep reductions in other greenhouse gases;
>
> 18. Further recognizes that this requires accelerated action in this critical decade, on the basis of the best available scientific knowledge and equity, reflecting common but differentiated responsibilities and respective capabilities and in the context of sustainable development and efforts to eradicate poverty;
>
> 19. Invites Parties to consider further actions to reduce by 2030 non-carbon dioxide greenhouse gas emissions, including methane;

[6] 220 million metric tons CO_2eq x 1 excess death/9318 tons CO_2eq = 23,600 excess deaths.

> 20. Calls upon Parties to accelerate the development, deployment and dissemination of technologies, and the adoption of policies, *to transition towards low-emission energy systems*, including by rapidly scaling up the deployment of clean power generation and energy efficiency measures, *including accelerating efforts towards the phasedown of unabated coal power* and phase-out of inefficient fossil fuel subsidies, while providing targeted support to the poorest and most vulnerable in line with national circumstances and recognizing the need for support towards a just transition ….”[7]

The proposed Matarbari 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4**)** is fundamentally inconsistent with the Glasgow Climate Pact. According to Section 11.3 (Expected Project Implementation Schedule) on page 348 of the EIA, commissioning of the the Matarbari 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4) is not expected until 2029. The expected 30-year life of the project (See EIA at page 53) means that the project is expected to be operational from 2029 to 2059. An unabated coal power project plant emitting more than 7.3 million metric tons of CO_2 per year for the years 2029-2059 is not consistent with the following elements of the Glasgow Climate Pact:

- “reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century”
- a “transition towards low-emission energy systems”
- “accelerating efforts towards the phasedown of unabated coal power.”

5. The EIA Does Not Disclose that the Proposed Power Plant’s Emissions of Air Pollutants Would Violate Japanese Ambient Air Quality Standards and Result in Excess Premature Mortality

The proposed Matarbari 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4**)** project has been financed by the Japan International Cooperation Agency (JICA) with five separate overseas development assistance loans. Tokyo Electric Power Services Co. Ltd (TEPSCO) has drafted the EIA for the project. On the principle that government-backed lending institutions should not finance projects that would fail to comply with environmental standards of the lender country, the impact of the proposed Matarbari 2X600 MW Ultra Super Critical Coal Fired Power Project, Phase-2, (Unit 3/4**)** must be measured against Japanese standards.

Table 4.13: Ambient air at different locations around the project site (Dry season) on pages 109-110 of the EIA provides the following information about baseline air quality.

[7] Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (13 November 2021) “Glasgow Climate Pact”

Table 4.13: Ambient air at different locations around the project site (Dry season)

Sample Location	Coordinates	Measured Concentrations of Ambient Air Quality Parameters					
		PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	CO_2
AQ-4, Sampling: 1 Date:07-08.01.2021	21°42'47.4"N, 91°52'40.56"E	67.13	23.15	<2.5	<5.0	2.0	351.0
AQ-4, Sampling: 2 Date: 04-05.03.2021	21°42'47.4"N, 91°52'40.56"E	75.92	30.19	<2.5	<5.0	3.0	473.0
AQ-4, Sampling: 3 Date: 05-06.03.2021	21°42'47.4"N, 91°52'40.56"E	52.78	27.88	<2.5	<5.0	3.3	373.0
AQ-5, Sampling: 1 Date:07-08.01.2021	21°41'09.70"N, 91°52'15.60"E	27.29	32.41	<2.5	<5.0	6.0	373.0
AQ-5, Sampling: 2 Date: 04-05.03.2021	21°41'09.70"N, 91°52'15.60"E	57.94	27.22	<2.5	<5.0	6.3	373.0
AQ-5, Sampling: 3 Date: 05-06.03.2021	21°41'09.70"N, 91°52'15.60"E	47.17	24.03	<2.5	<5.0	5.6	350.6
Units		µg/m3	µg/m3	µg/m3	µg/m3	ppm	ppm
Test Duration (Hours)		24				1	

Table 4.14: Ambient air at different locations around the project site (Wet season)

Table 4.14: Ambient air at different locations around the project site (Wet season)

ID of Sample Location	Measured Concentrations of Ambient Air Quality					
	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	CO_2
POINT-1: AQ-4, Sampling: 1 GPS: 21°42'47.4"N, 91°52'40.56"E Date: 04 - 05.06.2021	13.89	9.67	<2.5	<5.0	3.0	367.0
POINT-1: AQ-4, Sampling: 2 GPS: 21°42'47.4"N, 91°52'40.56"E Date: 05 - 06.03.2021	8.80	18.16	<2.5	<5.0	2.4	351.0
POINT-1: AQ-4, Sampling: 3 GPS: 21°42'47.4"N, 91°52'40.56"E Date: 06 - 07.06.2021	12.54	10.61	<2.5	<5.0	2.7	362.0
POINT-2: AQ-5, Sampling: 1 GPS: 21°41'09.70"N, 91°52'15.60"E Date: 01 - 02.06.2021 Time: 09:00 AM – 08:00 AM	9.26	12.23	<2.5	<5.0	5.1	353.0
POINT-2: AQ-5, Sampling: 2 GPS: 21°41'09.70"N, 91°52'15.60"E Date: 02 - 03.06.2021 Time: 09:00 AM – 08:00 AM	13.43	5.66	<2.5	<5.0	5.4	364.0
POINT-2: AQ-5, Sampling: 3 GPS: 21°41'09.70"N, 91°52'15.60"E Date: 03 - 04.06.2021 Time: 09:00 AM – 08:00 AM	11.32	7.12	<2.5	<5.0	6.0	347.0

$PM_{2.5}$ levels in the six samples collected at AQ-4 (Matarbari) average 19.9 µg/m^3. $PM_{2.5}$ levels in the six samples collected at AQ-5 (Dhalghata) average 17.9 µg/m^3.

The Japanese ambient air quality standard for $PM_{2.5}$ is a follows.

“The annual standard for PM2.5 is less than or equal to 15.0 μg/m3. The 24 hour standard, which means the annual 98th percentile values at designated monitoring sites in an area, is less than or equal to 35μg/m3. (Notification on September 9, 2009).”[8]

Because $PM_{2.5}$ levels in Matarbari and Dhalghata exceed the Japanese ambient air quality standard for $PM_{2.5}$ of 15 μg/m^3, JICA and TEPSCO should have concluded that baseline air quality in Matarbari and Dhalghata do not comply with exceed the Japanese ambient air quality standard for $PM_{2.5}$ and therefore no proposed major source of pollution may be located therein as the area lacks further assimilative capacity. Table 5.13: The impacts of air pollutants from exhaust gas on starting on Page 247 of the EIA predicts that Units 1-4 of project would cause an incremental increase in PM levels of 0.5 μg/m^3 on an annual basis. Such increase would further exacerbate non-compliance at Matarbari and Dhalghata with the long-term (annual) Japanese ambient air quality standard for $PM_{2.5}$.

The Japanese ambient air quality standard for SO_2 is a follows:

“The daily average for hourly values shall not exceed 0.04 ppm, and hourly values shall not exceed 0.1 ppm (Notification on May 16, 1973).”[9]

An hourly standard for SO_2 of 0.1 parts per million (ppm) is numerically equivalent to a standard of 262 μg/m^3. Table 5.13: The impacts of air pollutants from exhaust gas on starting on Page 247 of the EIA predicts that Units 1-4 of project would cause a maximum incremental increase in NO_2 levels of 322 μg/m^3 on an hourly basis. As a result, air quality would violate the Japanese ambient air quality standard for SO_2 by a substantial margin.

The Japanese ambient air quality standard for NO_2 is a follows:

“The daily average for hourly values shall be within the 0.04-0.06 ppm zone or below that zone (Notification on July 11, 1978).”[10]

An hourly standard for NO_2 of 0.04-0.06 parts per million (ppm) is numerically equivalent to a standard of 75.2 to 113 μg/$m^{3.}$ Table 5.13: The impacts of air pollutants from exhaust gas on starting on Page 247 of the EIA predicts that Units 1-4 of project would cause a maximum incremental increase in NO_2 levels of 207 μg/m^3 on an hourly basis. As a result, air quality would violate the Japanese ambient air quality standard for NO_2 by a substantial margin.

In 2019, a Master of Science graduate from the Institute of Energy, University of Dhaka, and Research Assistant at the Nanoscale Research Laboratory, Department of Biomedical Engineering, The University of Texas, published a study using air pollutant disperion modelling to predict the health effects of expected air pollutant emissions of the proposed Matarbari coal-fired power plant (Units 1-4). This study concluded the following:

[8] Ministry of Japan - Environmental Quality Standards in Japan - Air Quality. http://www.env.go.jp/en/air/aq/aq.html
[9] Ibid.
[10] Ibid.

> "This study reports the probability of increased mortality of people within the political border of Bangladesh due to the emission of fine particulate matter with diameters of 2.5 microns or less (PM2.5) from the Matarbari coal power plant (MCPP). A Gaussian plume dispersion model has been used for this estimation. The PM2.5 emission rate data are unavailable as the construction of MCPP is still in its initial stage; therefore, the anticipated PM2.5 emission rate has been estimated based on data from a number of coal-fired power plants in India and China. To make this study more meaningful, two different emission rates have been considered representing the best case and worst-case scenarios. In both cases, the intake fraction has been found to be 0.12×10^{-2}, and the value of relative risk varies between 1.134 and 1.374, respectively. Finally, it is estimated that approximately 11.5 million people inside Bangladesh will be exposed to the PM2.5 emission from MCPP, and between 7,667 and 17,675 people will experience premature death every year."[11]

The EIA failed to disclose the existence of this study, and the extent of annual premature deaths this study predicts that the proposed Matarbari coal-fired power plant (Units 1-4) would cause.

6. The EIA proposes a coal ash disposal facility that is contrary to international best practice

Page 54 of the EIA describes an ash pond that would be constructed for the final disposal of more than 240,000 tons per year of coal combustion residues that would be generated by the project:

> "Ash pond
>
> "Ash will be disposed at 1st Ash Pond area the first after the commencement of Operation for Units 1/2. This 1st Ash Pond is designed/planned to be satisfied with the necessity capacity at least 5 years operation for Units 1/2. (Area of this 1st Ash Pond is 429,000m2 (Ave.)). After fulfill of ash in 1st Ash Pond, ash will be disposed in the remaining Ash Pond area continuously. In this regard, the Partition Wall will be constructed between the 1st Ash Pond and remaining Ash Pond. The design of Partition Wall had been completed under the Units 1/2 Project, and the volume of the Partition Wall will be 248,000m3.
> ✓ The area of overall Ash Pond is 2,554,000 m2 (Ave),
> ✓ The average bottom elevation is MSL +1.0m.
> ✓ The top of Dyke in circumference of ash pond is MSL +14.0m."

However, the proposed coal ash pond would likely violate international best practice with respect to its proposed location and design.

<u>The proposed coal ash pond may lack adequate separation between the base of the ash pond and the upper limit of the upper most aquifer</u>

Because of toxic constituents in coal ash, coal ash disposal facilities may not be located where such toxic constituents would be in close contact with important natural resources, such as aquifers and wetlands.

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[11] Ahmed, S. I. U. (2019). Qualitative assessment on premature human mortality due to the emission of fine particulate matter from the Matarbari coal power plant. Environmental Quality Management, 29(2), 51-55.

For the protection of aquifers, the United States Environmental Protection Agency imposes the following standard:

> "40 CFR § 257.60 Placement above the uppermost aquifer.
>
> "(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table)."

It is known that groundwater exists in the project area and is used by the local community. Page 118 of the EIA states:

> "The quality of groundwater has been tested two locations Matarbari and Dhalghata union during pre-monsoon and monsoon period. The locations for water samples has been selected in such a way that it would represents the situation of groundwater status in study area."

Note that according to page 54 of the EIA, the average bottom elevation of the proposed coal ash pond is only 1 meter above mean sea level (MSL). Therefore, unless the upper limit of the uppermost aquifer that provides groundwater to the community at Matarbari and Dhalgata is at least one-half meter <u>**below**</u> MSL, then there is no possibility for the proposed coal ash pond to maintain an adequate separation between the base of the coal ash pond and the upper limit of the uppermost aquifer requiring protection. Bore log data in the Appendices of this EIA or the 2013 EIA should provide information about the depth of the water table at locations where groundwater samples were taken.

<u>The proposed coal ash pond would likely be located in wetlands</u>

For the protection of wetlands, the United States Environmental Protection Agency imposes the following standard:

> "40 CFR § 257.61 Wetlands.
>
> "(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in § 232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.
>
>> "(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.
>>
>> "(2) The construction and operation of the CCR unit will not cause or contribute to any of the following: (i) A violation of any applicable state or federal water quality standard; (ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act; (iii) Jeopardize the continued existence of endangered or threatened

> species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and (iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.
>
> "(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors: (i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit; (ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit; (iii) The volume and chemical nature of the CCR; (iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR; (v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment; and (vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.
>
> "(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and
>
> "(5) Sufficient information is available to make a reasoned determination with respect to the demonstrations in paragraphs (a)(1) through (4) of this section."

In its description of the baseline environment, page 136 of the EIA attests to the prevalence of wetlands in the project area:

> "Due to salinity the amount of cultivated land in the study area is low. The huge amounts of wetland are used for salt cultivation during dry season. Apart from these some wetlands are used for fish cultivation. Aquatic vegetation in salt cultivation area is rare. Some aquatic vegetation is found in the fish firm [sic] area. a total 42 plant species recorded from this site. The most common species are Shapla, Kachuripana, Mulsi, Nukha, Hydrolea, Kolmi, Dholkolmi, Kachu, Helencha, and Heicha shak. A rare occurrence of Hogla also recorded in the wetland."

There is no information in the EIA that would support: 1) a clear and objective rebuttal of the presumption that an alternative to the proposed ash pond is reasonably available that does not involve wetlands; and 2) a finding that the proposed ash pond would not cause or contribute to significant degradation of wetlands.

<u>The design of the proposed coal ash pond lacks a required leachate collection and removal system</u>

Because toxic constituents in coal ash seep and accumulate in the bottom of a coal ash disposal facility, a leachate collection and removal system is required to prevent such accumulation. With respect to coal ash disposal facilities, the United States Environmental Protection Agency imposes the following standard:

“§ 257.70 Design criteria for new CCR landfills and any lateral expansion of a CCR landfill.

“(a) (1) New CCR landfills and any lateral expansion of a CCR landfill must be designed, constructed, operated, and maintained with either a composite liner that meets the requirements of paragraph (b) of this section or an alternative composite liner that meets the requirements in paragraph (c) of this section, and a leachate collection and removal system that meets the requirements of paragraph (d) of this section. ….

“(d) The leachate collection and removal system must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and post-closure care period. The leachate collection and removal system must be:

“(1) Designed and operated to maintain less than a 30-centimeter depth of leachate over the composite liner or alternative composite liner;

“(2) Constructed of materials that are chemically resistant to the CCR and any non-CCR waste managed in the CCR unit and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the CCR unit; and

“(3) Designed and operated to minimize clogging during the active life and post-closure care period.”

There is no information in the EIA indicating that the proposed coal ash pond would include a leachate collection and removal system.

<u>The design of the proposed coal ash pond lacks a required groundwater monitoring system</u>

Because toxic constituents in coal ash often breach liners beneath coal ash disposal facilities, it is necessary to monitor groundwater quality to detect any breach early enough to allow effective remedial actions in response to a breach. With respect to groundwater monitoring systems, the United States Environmental Protection Agency imposes the following standard:

“40 CF § 257.91 Groundwater monitoring systems.

“(a) Performance standard. The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

“(1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where: (i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or (ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells; and

> "(2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

"(b) The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include thorough characterization of:

> (1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and
>
> (2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

"(c) The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a) of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain:

> "(1) A minimum of one upgradient and three downgradient monitoring wells; and
>
> "(2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit."

It is clear that the proposed coal ash disposal facility does not include a groundwater monitoring system that meets these requirements. Table 7.1: Mitigation of Impacts of the EIA starting on page 276 lists only the following Management Effort with respect to groundwater monitoring: "2) Ground water - Monitoring of water levels and water quality at wells in residential areas." The proposed monitoring of water levels and water quality at wells in residential areas is not a groundwater monitoring system consisting of a sufficient number of wells, installed at appropriate locations and depths, to accurately represent the quality of background groundwater that has not been affected by leakage from the proposed coal ash pond and accurately represent the quality of groundwater passing the waste boundary of the proposed coal ash bond (such wells must be located at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer).