Delta Plan

- ***Picturesque landscapes, temperamental rivers, and a capricious climate***. These three small phrases rather tacitly, yet appropriately, capture the prospects and challenges of this beautiful piece of the world we call our motherland, Bangladesh. And yet there's an even more concise way to say all of this, that too in a single word. That word is "*delta*". Our country is part of a landform born out of the flow of rivers known as a riverine delta. And the BDP-2100 is the strategy that our government has chosen to grapple with the perils associated with being a delta that loom over us, to ***foster sustainable growth, development, and prosperity***.

- A delta is a piece of land that has been *formed over thousands of years* by the deposition of alluvium by *rivers flowing into more stagnant bodies of water*, such as a sea, a lake, or a slower-moving river. Nearly 80% of our land area forms two-thirds of what is the *biggest delta in the world*, the *Ganges delta* or the *Ganges-Brahmaputra delta*, spanning a total of some *100,000 square kilometres*.

  Ministers come and go, even dictators die, but mountain ranges stand unperturbed. – *Nicholas Spykman*, US Political Scientist.

- Geographical features happen to have formed over millions of years under mother nature's whims, and they rarely ever change within timescales proportionate to a human lifespan. As such, any reasonable development plan must keep them in the forefront, guiding the plans in every step of the way. Being a delta, however, is even more special, given the ***spate of hazards that it brings along***. The government has thus, prudently and aptly, channeled its efforts towards addressing this pressing issue.
  -

Climate change

- The industrial revolution was quite similar to the mythical *Golden Touch of King Midas*. We were brimming with rapture and excitement as we saw everything we touched turn into gold. But alas, a grim fate much like Midas would await, something that nobody could hardly ever anticipate. The industrial revolution, *the fabled and coveted golden goose* that we'd invented, had turned us into Victor *Frankenstein*, a genius whose own creation had been his undoing. The way forward chosen by Victor, as his last words articulated in a sombre overtone, was by *seeking happiness in tranquility and avoiding ambitions*.
- Yet we humans can't abandon ambition even in the face of impending doom. This spirit of strong convictions has many a times *pushed the limits of our abilities as a species*. These were times when we *acknowledged the obstacles and chose to grow*. At other times though, this has inspired *emboldened stupidity*, as charging towards mammoth

obstacles with no preparations as to how to tackle them would only end in smoke.
- Many *developed countries* who bear the *bulk of the responsibility* are relatively *nonchalant to execute policies* that they think gives others a share of the pie by taking a bit away from theirs, which certainly is the most terrible injustice, at least from their vantage point.

General info

- GHG:
  - Preindustrial: 278ppm
  - Current: 417ppm
  - GHGs in Kyoto: CO2, CH4, N2O (major) H2O(g), O3, PFC, CFC
- Extreme weather events => $157B lost in '20-'21 globally
- **Maplecroft** (Brit climate research institute) Climate Change Vulnerability Index: ***BD 1st***
- **Greenwatch** (German) Climate Risk Index '21: ***BD 7th*** in "Most affected by extreme weather in 2000-2019" category ($3.72B lost)

Causes of Climate Change

- **Natural**: net temperature change contribution around 0 if avg over decades
  - *Geological* heat source: volcanism
  - Variation in *solar irradiation*
  - Variation in the Earth's *orbit*
- **Human-induced**:
  - GHG (+++T)
  - Deforestation (+T)
  - Aerosols (-T)
  - Melting ice sheets (+T)

Emissions by Sector

Sector	Emission
Energy	33%
Industry	24%
AFOLU	22%
Transport	15%
Buildings	6%

Source: IPCC 6th Assessment Report (2022)

Emissions by Country

Country	Emission
China	30.9%
USA	13.5%

Country	Emission
India	7.3%
Russia	4.7%
Japan	2.9%

Power generation methods comparison

Emissions (lifecycle) by source of electricity (CO2e/kWh)

Fuel	CO2e/kWh	Relative to coal
Coal	1kg	1.
Gas	~500mg	½
Solar PV	~50mg	~1/20
Solar thermal	~22mg	~1/50
Nuclear	16mg	~1/60
Wind	12mg	1/80
Hydro	4mg	~1/250

Land usage (median, life-cycle) per unit of energy (m^2/MWh) generated by power plants

Method	m²/MWh
Hydro	33
Solar thermal	22
Solar PV	19
Coal	15
Rooftop solar	3
Gas	1
Wind*	0.4
Nuclear	0.3

Wind energy land usage is highly variable and the upper limit goes much higher, depending on the geographical features, season etc

Cost (average, life-cycle) per unit of energy (USD/MWh) generated by different power plants

Method	Cost
Solar	$100
Coal	$80
Gas	$70
Nuclear	$70
Hydro	$70
Wind	$50

Effects of Climate Change

Temperature

- **Global warming**: increase in global surface temp relative to baseline (usually taken to be 1850-1900, the earliest period of reliable observation with sufficient geographical coverage)
- Each of the **past 4 decades** have been **successively warmer than any decade that preceded** it since 1850
- **Global**:
  - **1.2°C warming so far** compared to preindustrial times
  - *Current state of policies* in different countries gives a projected warming of **2.7°C by 2100**
  - Full implementation of *pledges and commitments* so far would limit that to *2.1°C* at best.
- **Human impact**: ΔT (from 1850-1900 to 2011-2020) = 1.09°C. Human caused: 1.07°C.
- **BD**:
  - Last 50y, on avg: **0.4°C**
  - However locally this has been as high as 2°C in places
  - 4.8% working hours will be lost by 2030 due to heat stress, leading to a near-5% GDP loss ($30B)

SLR

- Causes:
  - Melting sea ice
  - Rising Temp => volume expansion of water
- Mean SLR (1901 to 2018) = 20cm (1.7mm/yr) (2000 to 2018) = 4.8cm (3.7mm/yr)
- Arctic ice melting won't contribute to SLR directly (as the ice is floating on the arctic sea) but rather indirectly by decreasing the Earth's albedo => ++T => melting. However, melting of land ice does cause SLR.
- Arctic sea ice area reduction ('80s vs 2010s):
  - September: 40%
  - March: 10%
- **BD**:
  - 2/3rds area <5m above SL
  - As per IPCC,
    - 30-45cm SLR => 35M coastal population displaced
    - By *2050, 25cm* SLR => *4%* land permanently inundated
    - By *2100, 100cm* SLR => *17.5%*
  - ↓*30% food production*
  - *1/3rd* population @risk of *displacement by 2100*
  - 30% area inundated in regular floods, 67% in major floods
  - *1.5% GDP loss/yr* by 2031

Lightning strikes

- ↑12% if ΔT=1°C

Climate-induced disasters

- More frequent extreme weather events
  - Heatwaves
  - Droughts
  - Wildfires
  - Heavy rainfall => flooding
  - Storms / cyclones
- **BD**:
  - *$3.7B lost/yr* from '00-'20 (Greenwatch)
  - *$4B loss/yr* by 2030

Human lives and economy

- **Health impacts**: Direct damage costs to health ~*$3B/yr* (WHO)
  - *Direct impacts*:
    - Extreme weather events such as heatwaves, storms, and floods can cause injury, illness, and death
    - WHO: *37% heat-related deaths* by human-induced climate change
  - *Indirect impacts*: Changes in temperature and rainfall can alter the survival, distribution, and behavior of insects and microbes, leading to *changes in infectious diseases.* Increases in precipitation, storm surge, and sea temperature can lead to more *water-related illnesses*
  - *Air quality*:
    - air pollution => ↓respiratory and cardiovascular health
    - air pollution causes 1 in 8 deaths worldwide
  - *Food safety*: ↓food production, ↑foodborne illnesses due to ↑temperature being suitable for microbial multiplication
  - *Mental health*
- **Economic impacts**:
  - GDP loss for ΔT = 2℃ :
    - World: ~11%
    - Asia, MENA: ~14-15%
  - The annual average economic losses from climate-related disasters are in the hundreds of billions of dollars. This is not to mention the human impact of geo-physical disasters, which are 91 percent climate-related, and which between 1998 and 2017 killed 1.3 million people, and left 4.4 billion injured.
- **BD**:
  - *~150k excess deaths/yr*
  - *6.8% GDP loss/yr*

Global Climate Diplomacy & Policymaking

- **Montreal protocol** '87
  - Ratified by all nations

    - Successfully brought down chemicals harming the O3 layer to zero
- **IPCC** '88
    - Established by WMO + UNEP
    - UN body responsible for compiling and assessing the latest literature on the state of affairs and guiding governments with their assessment and methodology reports
    - Nobel Peace prize '07
    - Latest: IPCC AR6 '21
        - "Starkest warning yet" - The Guardian
- **Earth summit** '92: adoption of 3 major Rio conventions, the most prominent one being UNFCCC. The others are UN convention on biological diversity, and the Convention to combat desertification.
    - *UNFCCC* '92:
        - Recognised the problem
        - Established COPs for regular review
        - Onus on the developed (annex I) countries
- **COP3** '97, Kyoto
    - **Kyoto protocol**:
        - Operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets
        - **Binding only to Annex-I countries**
        - 1st commitment period ('08-'12): 5% reduction from '90 levels
        - 2nd commitment period ('13-'20, Doha amendment): 18% reduction from '90 levels
        - Flexible "market-mechanisms" in case countries fail to meet targets:
            - **Emissions trading**: countries with allowed emissions to spare can sell them to countries that need to emit more than their allowance
            - **Clean development mechanism**: financing emission reduction in developed countries
- **COP16** '10, Cancun, Mexico: decision to make $100B/y **GCF**
- **COP21** '15, Paris:
    - **Paris agreement**:
        - set to replace Kyoto
        - non-binding unlike Kyoto, only "name-and-shame" system
        - limit warming to 2dC, preferrably 1.5dC
        - NDCs of the parties' choosing
- **COP23** '17, Bonn: Establishment of **Powering Past Coal Alliance (PPCA)**, a "non-proliferation treaty" for fossil fuels by UK and Canada (170 members)
- **COP26** '21, Glasgow:
    - Formally addressed **coal phase-out** for the first time
    - Net-zero by 2050
    - ***CVF meeting***:
        - Then CVF *chair Sheikh Hasina*
        - **4 points:**
            - Ambitious NDCs by major emitters

        - Developed countries 100B/y (50-50 for adaptation & mitigation)
        - Low-cost green tech by devd
        - Loss-and-damage; responsibility for climate migrants
- **COP27** '22, Sharm-Al-Sheikh:
    - Addressed **loss-and-damage**; transitional committee to operationalize the Loss and Damage Fund
    - Addressed the need to ***↓45% emissions by 2030 (base: 2010)*** levels AND ***net zero by 2050*** to keep global warming *≤1.5°C*
- **COP28** '23, Dubai:
    - "Fast-tracking a just, orderly, and equitable transition"
    - **Global Renewables and Energy Efficiency Pledge**: ≥ *triple* (≥ 11k GW) world's renewable generation capacity by 2030 (India, China didn't sign)
    - move away from carbon energy sources "in a just, orderly and equitable manner" to mitigate the worst effects of climate change, and reach net zero by 2050.

National policies and action

- **Adaptation** strategies
    - **Policies**
        - Plans: BDP-2100, MCPP (2022-2041), NAPA (2023-2050)
    - **Action / infrastructure**
        - *423 disaster shelters* in 247 upazillas in 42 districts (400-800 people each)
        - *550 Mujib killas*
        - *Hotline 1090* toll-free
        - Research on salinity and flooding-resistant crops
- **Mitigation** strategies
    - **Policies**:
        - Environment conservation act '95
        - National environment policy '18
        - Biodiversity act '17
        - Brick-making and brick-field establishment control (amendment) act '19
        - Air pollution control rules '22
    - **Action / infrastructure**:
        - **NDC** submitted to UNFCCC secretariat:
            - *Unconditionally* ***↓Emissions 6.7%*** (27.56Mt CO2e) *by '30*
            - *Conditional* upon foreign aid, *15.1%* (61.9Mt CO2e)
        - Pursuing **renewables** (*1158MW renewable* / 26700MW total (BER23)) *(SDG goal 7)*
            - ~1800 rooftop solars have been installed (60MW)
            - Hydro e.g. Kaptai (230MW)
        - **Phase-down of coal** for power generation (Coal source:11%, Gas:49%)
        - Air pollution:
            - Illegal, polluting brick kilns:
                - Mobile court => sued 2300+ people/companies

        - 86+ crore BDT fined
        - ~300 jailed
        - 761 illegal brick kilns have been demolished
    - *31 CAMS* (Continuous air-monitoring systems) installed in divisional and industrial cities including Dhaka
    - HCFC phase-out as party to *Montreal protocol* (67.5% reduction by '25)
    - Raids by mobile court against motor vehicles emitting black smoke

Further suggestions

- Reduce traffic
- Improve public transport infrastructure
- Levy taxes on motor vehicles
- Allow even number-plates to run on even days, odd number-plates on odd days
- Levy taxes on energy-intensive appliances e.g. AC
- Stop subsidising fossil fuels
- Subsidise clean energy solutions
- Promote awareness
- Include in curriculum more extensively
- Climate science department in all unis
- Stricter regulations of urbanisation, deforestation and ensuring implementation
- Diplomatic efforts to ensure green funding
- Stay below emissions quota => save money + carbon trade with saved quota

Environmental pollution

Intro

> "When the last tree is cut down, the last fish eaten, the last stream poisoned, you will realise that you cannot eat money" - Native American proverb
>
> "There is enough on this planet for everyone's need, but not for everyone's greed." - Gandhi

Man's quest for "development" defines the modern era of our civilisation. Although it has always been part of the human agenda, for the longest part of history, mankind has been subject to the whims of mother nature. Prosperity was mostly within the confines she had set for us.

But the mankind is a species of unfathomable potential. We not only persevered, but we invented. The invention of the steam engine by the illustrious inventor James Watt was the watershed moment that transformed man from the subdued to the subduer. And since then we never looked back. The days of worry were over. Even the poor of the industrial societies could consume a lot more, and hence were economically better off, compared to

the "middle-class" of the pre-industrial times. Mankind had hit its puberty, its growth spurt had begun.

Yet within all this shimmer, something was missing. We couldn't pinpoint exactly what, but many elderlies readily recognised it. What was missing was the connection to mother nature. Much like an unruly child who enters into a rebellious adolescence, we shrugged off the calls to restrain ourselves. We pushed our economies further and further chasing the dreams of prosperity, extracting every bit as we could from nature with no compunction, until she started to show the signs of illness.

And as she is our nurturer, we too suffer the consequences. *Pollution kills more people each year than AIDS, TB, and Malaria, three of the deadliest infectious diseases in existence, do combined*. Climate change, largely a product of air pollution, is disrupting weather patterns and delivering fatal blows to economies reducing over a tenth of the global GDP.

We find ourselves at a historical crossroads where we have to make a conscious choice between developing wisely ensuring the best of nature, or choosing to run amok until the entirety of our much-vaunted economy faces imminent implosion. As such, it is of paramount importance to address pollution much, much louder than ever before, now more than ever.

- BD loses **2.7%GDP/yr** due to EnvPol (WB)
- Introduction of **contaminants**, usually of **anthropogenic source** that **adversely change** the environment
    - Anthropogenic source: manufacturing, extraction, waste disposal, transport, agriculture
- Pollutant:
    - Substances: Solid, liquid, gas
    - Energy: radioactivity, heat, sound, light
- Over the *past two decades*, **deaths caused by the modern forms of pollution** have **increased by 66%**, driven by
    - industrialisation
    - uncontrolled urbanisation
    - population growth
    - fossil fuel combustion
    - an absence of adequate national or international chemical policy.
- **>9 million deaths/yr globally**. This number has not changed since 2015.
    - **More than AIDS, TB, Malaria killings combined**
- **>90% of pollution-related deaths** occur in *low and middle-income countries*

  "Environment is where we live, and development is what we all do in attempting to improve our lot within that abode. The two are inseparable... Ensure that it meets the needs of the present wihout compromising the ability of future generations to meet their own needs" - Brundtland report '87 (Our Common Future)

"The **triad of pollution, climate change, and biodiversity loss** are the **key global environmental issues** of our time." - *The Lancet Planetary Health*, Pollution and Health: A Progress Update.

- Men are more likely to die from air pollution, lead pollution, and occupational pollutants than women. Women and children are more likely to die from water pollution.

Air pollution

- According to the *WHO*, air pollution *accounts for 1 in 8 deaths* (6.67M/yr due to air pollution out of ~50M/yr total deaths) worldwide
- Research has demonstrated increased risk of developing asthma and chronic obstructive pulmonary disease (COPD) from increased exposure to traffic-related air pollution
- Air pollution has been associated with increased hospitalization and mortality from asthma and COPD
- Ambient levels of air pollution have been associated with preterm birth and low birth weight
- Data is accumulating that air pollution exposure also affects the central nervous system
- Air pollution increases the risk of dementia in people over 50 years old
- Childhood indoor air pollution may negatively affect cognitive function and neurodevelopment
- Air pollution is *entwined with climate change* because the emissions driving both come largely from the same sources (eg, fossil fuel or biofuel burning)
    - Burning fuels => fine and ultrafine particulates (eg, PM2·5 and others), long-lived greenhouse gases, and short-lived climate pollutants (SLCPs)
    - SLCPs:
        - Simultaneously warmer and polluter
        - CH4, black carbon (ie, soot), and hydrofluorocarbons
        - CH4 => 1/3rd of all GHG-related warming, 1/2 of all human-induced warming
        - ~15y lifepan in the atmosphere => cacn be leveraged to quickly impact climate change and pollution

Water pollution

Land pollution

Noise pollution

Chemical pollution

- Chemical poisoning (e.g. Pb) kills 1.8M/yr worldwide (lead alone kills 50% of them)
- More than 800 million children are estimated to have blood lead concentrations that exceed 5·0 µg/dL

- Children with blood lead concentrations higher than, or equal to, 5·0 µg/dL could score 3–5 points lower on intelligence tests
- Lead-related IQ losses are associated with increased rates of school failure, behavioural disorders, diminished economic productivity, and global economic losses of almost $1 trillion annually. In Africa, the economic losses from lead-related IQ loss are equivalent to about 4% of gross domestic product (GDP) and in Asia, these losses are equivalent to 2% of GDP.
- sources of lead exposure: unsound recycling of lead–acid batteries and e-waste without pollution controls; spices that are contaminated with lead; pottery glazed with lead salts, which leach out into acidic foods; and lead in paint and other consumer products.
- Toxicity:
    - Neuro
    - Fertility
    - Immuno: perfluoroalkyl acids => reduced antibody responses to vaccines

Radioactive pollution

Plastic pollution

Economic Impacts

- Measured by economic output lost due to premature death
- 2017 Lancet Commission on Pollution on Health:
    - 6.2% global GDP loss in '15
    - 80% of that due to air pollution
- A World Bank study on health effects of PM2.5
    - 6.1% GDP loss in '19
    - Most in South Asia: 10.1% GDP loss

Government measures

- **Policies**:
    - Environment conservation act '95
    - Noise pollution control rules '06
    - Environmental crisis management rules '16
    - National Biodiversity Strategy and Action Plan (NBSAP) '16-'21
    - Biodiversity act '17
    - National environment policy '18
    - Brick-making and brick-field establishment control (amendment) act '19
    - Air pollution control rules '22
    - Blue economy action plan
- **Air pollution**:
    - Illegal, polluting *brick kilns*:
        - *Mobile court* in Jan'19-Dec'22 => sued 2300+ people/ companies
        - *86+ crore BDT fined*
        - *290 jailed*

        - *761* illegal brick kilns have been *demolished*
    - *Complete replacement of bricks with blocks by 2025* in government building, repair, and renovation
    - *31 CAMS* (Continuous air-monitoring systems) installed in divisional and industrial cities including Dhaka
    - *HCFC phase-out* as party to *Montreal protocol* (67.5% reduction by '25)
    - Raids by mobile court against motor vehicles emitting black smoke
- **Industrial waste management**
    - Compulsory issuance & renewal of *environmental clearance* for industries
    - Establishment of *ETPs*: ~2400 out of ~2900 industrial units have an ETP so far
    - *IP cameras* for evaluation and monitoring of proper use of ETP
    - ~485 crore BDT fines imposed on ~12k river polluting industries
- **Sound pollution**: mobile court, raids, cases (~2400), fines (25 lacs)
- **Plastic pollution**:
    - Mobile court raids in *polythene* factories
    - *Mymensingh polythene-free division*
    - Awareness campaigning regularly in wet markets
    - ***Multisectoral action plan for sustainable plastic management in Bangladesh***
        - 50% plastic waste recycling by 2025
        - 80% by 2030
    - 3-year action plan for winding down single-use plastic usage
- **Water pollution**
    - **Blue economy action plan** to protect marine ecologies, prevent seawater pollution, utilise marine assets, preserve marine biodiversity
    - **Assessment of Coastal and Marine Biodiversity Resources and Ecosystems to Implement the BEAP**
    - Regular **monitoring of water quality** in 99 areas of *30 rivers*: pH, BOD, COD, DO, TDS, SS (suspended solid) => **Surface and Ground Water Quality Report**
- **13 ECAs (Ecologically Critical Areas)** where deforestation, hunting, fishing, damaging habitats etc are banned

Conclusion

The problems associated with pollution will likely plague us for decades to come, but we are at a tipping-point where we still can prevent a runaway collapse of the entire ecosystem. As we move forward, we must choose and invent ways to develop our economy without exploiting the nature. Each of us must ensure that we are doing our part in getting out of this mess that we ourselves have created. Although most statistics so far paint a bleak and sombre picture of what the future is to behold, maybe we should find solace in our ability to cooperate in times of crises. As the British Biologist *Sir David Attenborough* has eloquently articulated,

> "If working apart we're a force powerful enough to destabilize our planet, then surely working together we're powerful enough to save it."