BRIEFING PAPER

BANGLADEH'S NATIONALLY DETERMINED COTRIBUTIONS (NDCs)

SCOPES OF ENHANCED EMISSION REDUCTION

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1. GLOBAL PERSPECTIVE OF NDC ACCOMPLISHMENT

1.1 Background

Paris Agreement (PA), a landmark accord and remarkable achievement in human civilization history on the climate change process, was adopted in 2015 by 196 parties to the United Framework's convention on Climate Change Convention (UNFCCC). PA revealed the last ray of hope for global unity to hold the global average temperature well below 2 °C above pre-industrial levels after the repetitive failure of UFCCC treaties (UNEP, 2019). The collective target for combating global warming encompasses a common platform for individual states to determine the share of their contribution towards global commitment. Paris Agreement- the flexible, softer legal mechanism offers voluntary contributions from the states while it brought both north and south political disputes on the table to prevent precarious anthropogenic interference with the climate system.

Nevertheless, strong global responses towards long-term temperature goals, enhancement of climate resilience and adaptive capacity, and consistent finance allocation for GHGs emission reduction are the imperative measures to tackle global warming. An alliance of vulnerable countries like Least Developed Countries (LCDs), Small Islands (SIDs), the Independent Association of Latin America, and the Caribbean proposed an aspiration to limit the temperature increase to 1.5°C.

In 2013, at COP 19 in Warsaw, Poland, the parties were asked to publish their Intended Nationally Determined Contributors (INDC) without any prejudice to the legal nature of the contributions to achieve long-term goals of PA and various legal obligations for both developed and developing counties were set in accordance to Nationally Appropriate Mitigation Action (NAMA) pledge. The climate actions reflected in INDC create a constructive feedback loop between national and global decision-making processes to attain such goals in the climate change world.

COP 24 is an earmark in the climate negotiation history because, for the first time, the Parties reached a consensus to promote greenhouse gas (GHGs) emission curtail, net-zero emissions in the second half of this century, and accelerate climate change adaptation strategies under the flagship of Paris Rule Book (WRI, n.d.). The adoption of the Paris Rule Book at COP 24 (2018) in Katowice, Poland, set PA in motion by providing the states' guidelines - how to effectively implement national climate plans, strengthen them under PA, and eventually establish an institutional structure for mobilizing concrete climate actions. This is known by United Nations as nationally determined contributions or NDCs. The countries will update their NDC every five years to reflect the highest possible ambition under PA provisions.

The time has begun to keep the PA viable and undertakes ambitious climate actions with full accountability by the states irrespective of their economic status and political supremacy. Paris Rulebook crafted a careful balance framework to delineate how every

country can make own climate action plans, targets, contributions, and strengthen their ambitions over time based on country's circumstances, recourses and abilities (UNEP, 2019). The enunciation of a country's progress towards combating climate change and limiting future climate risks can be achievable through an INDC that is ambitious, transparent, and equitable (WRI, n.d.).

1.2 A Global Challenge to Achieve Current NDC Ambition Level

A decade lost, there is no remarkable change in the global emissions reduction trend, and the emission gap is more extensive than ever before (UNEP, 2019). The reality of ten years after the Copenhagen Accord (COP 13, 2009), the expectations of abating GHGs emissions seem nugatory to the hopes despite a decade of growing political and societal attention on climate change and the breakthrough PA (ibid). Global GHGs emissions grew at an incessant rate with no sign of peaking, and the global emissions escalate at an average rate of 1.6 percent per annum from the period of 2008 to 2017. According to UNEP's study, global emission touched a record of 53.32 $GtCO_2e$ in 2017 (Ibid).

Over the periods, GHGs emissions by both per capita and annual rate are amplifying. The report of the World Resource Institute (2020) estimated the emission pathways of individual GHG for 2016 and illustrated that CO_2 was the highest contributor (74.4%) following Methane (CH_4 17.3%), Nitrous Oxide (6.2%), and other emissions like Hydrofluorocarbons (HFCs), Cholofulrocarbons (CHCs), Sulphur hexafluoride (SF_6) account 2.1% in global emissions trajectory. A gradual increase in global carbon dioxide (CO_2) emissions from fossil fuel combustion and industrial activities over the last twenty years. Global emissions from the energy (electricity, heat, and transport) sector comprise 73.2% while 18.4% from agriculture, forestry, land use, 5.2% from an industrial process, and the rest 3.2% from waste (Ritchie & Roser, n.d.). Furthermore, more attention should be given to short-lived climate pollutants (SLCP), i.e., black carbon, tropospheric ozone, methane, and some hydrofluorocarbons (HFCs), because they tend to short-term global warming influence. It is noteworthy that removing such SLCP from the atmosphere will ultimately reduce carbon concentration through combining with CO_2 (UNEP, 2019).

Although global emissions were approximately 23 billion metric tons at the end of the century, the emission in 2019 had reached a record of 36.44 billion metric tons. However, the emission dropped only in 2009 due to economic recession, and in 2020 a reduction of 2 billion metric tons GHGs because of the COVID-19 pandemic (Tiseo, 2021). The projection of global CO_2 emission based on the business-as-usual (BAU) trend shows an increase to some 43.08 billion metric tons in 2050 compared to 35.3 billion metric tons in 2018 (Tiseo, 2020).

A sharp change in temperature and rapid rise in global CO_2 concentration is observed after the Industrial Revolution. Anthropogenic emissions; for instance, over the long period, CO_2 atmospheric concentration did not exceed over 300 parts per million (ppm), but now it is over 400 ppm for the first time in more than 800,000 decades with an average temperature rise of 1.1 ^0C (Ritchie & Roser, 2020). Nonetheless, it is evident that to keep on track towards limiting global warming; countries must triple their ambition levels in their NDCs

to keep the temperature below 2 ^{0}C, while they must increase the ambition level at least fivefold to align the global temperature limit with1.5 ^{0}C (UNEP, 2019). This is a real global challenge for the nations to bring up the giant leap ambitions and accelerate climate action in the coming years (ibid).

1.3 Bleak Fact of High Ambition Goals for Deep Carbon Cut

The world has failed to bridge or even to narrow the 2020 emissions gap and cannot afford to lose another decade; hence, urgent robust transformable climate actions with new climate policies are indispensable to implement (UNEP, 2019). Although acknowledging the significance of Cancun pledges, the world is far behind to reach its targets due to inadequate ambitions and actions. According to the UNEP report (2019), the emission gap will be 13 $GtCO_2e$ in 2030 between the emission levels (with full implementation of conditional NDCs), and level consistent towards 2 ^{0}C pathways it will be 15 $GtCO_2e$ if only unconditional NDC will be executed. For the target of 1.5 ^{0}C with the same scenario, the emission gap will be 29 $GtCO_2e$ and 32 $GtCO_2e$, respectively that accounts for 50 percent larger than the 2020 emission gap (ibid).

The projection of GHGs emissions for the year 2020 is on the right track (Figure 1) because of the very insignificant climate policies to offset emissions' critical drivers, i.e., population growth and economic progress. Considering the emission gap in 2020 will irrefutably widen the emission gap of 2030 while the high ambition of 1.5 ^{0}C target become more stringent and strenuous (ibid).

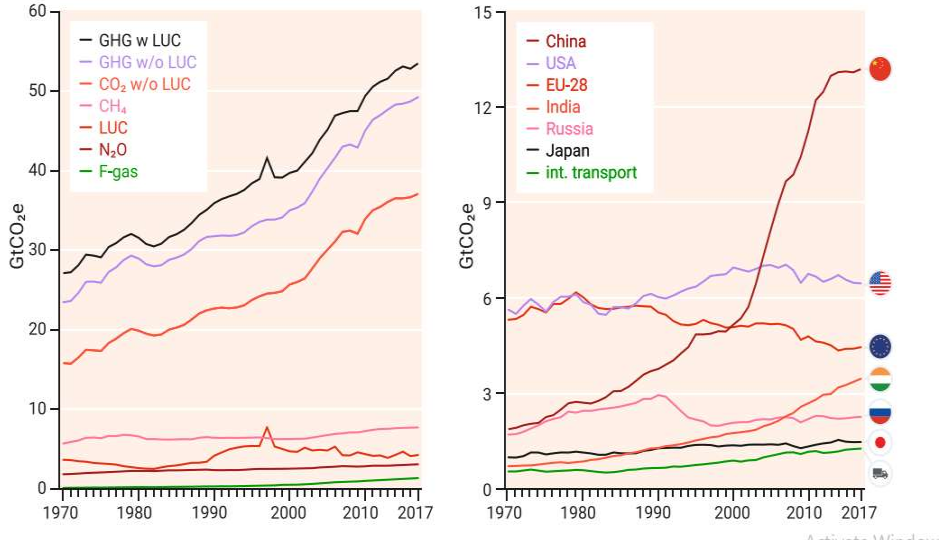


Figure 1: Global GHG emissions by type each (left) and top GHG emitters (right)

(Source: UNEP, 2018)

Also, high ambition to deep carbon cut seems a bleak fact as the global average temperature will rise between 3.4 °C and 3.7 °C with the continuation of existing policy;

and 2.9 °C and 3.4 °C with the implementation of unconditional NDC by 2100 comparing to pre-industrial levels and continuing after that (UNEP, 2019). According to the United Nations report, the countries submitted their national climate plans by the end of 2020 to limit global temperature rise to 1.5°C is yet far off track and is only expected to cut emissions by an additional 2.8% by 2030. While to reach this goal, emissions cut by 55% is necessary within 2030, below the initial pledges placed ahead in 2015. Despite putting forward bold climate targets last year by some countries like Columbia, Argentina, the United Kingdom, and the European Union become overshadowed because of placing ahead of weaker targets by a few countries, i.e., Brazil, Mexico even their prior one in five years. Therefore, unprecedented and immediate actions are essential to bridge the existing emission gap. New or updated NDC with extensive mitigation actions can collectively ramp up long-term goals onto a pathway to limit global temperature rise to 1.5 °C (ibid).

Given the context, a set of strategies, i.e., concerted climate actions with nature-based solutions, alteration, and scale-up of current best practices, overarching intergovernmental policy approaches, shifting of investments in innovation and technology for carbon neutrality, balance transformation in carbon-intensive sectors can nudge the world stepping towards zero-carbon and climate-resilient future. The next decade will define future endeavors towards PA goals for making national plans to keep the earth habitable and save perilous future.

2. WAY FOREWARD TO CONCERTED CARBON NEUTRALITY

A high and urgent ambition for deep emissions reduction needs immediate transformative decisions and actions. All countries should have clear planning actions to fulfill their long-term commitments while early transformative decisions are required to be taken for emissions reduction to 45% by 2030 to embark on the road towards carbon-neutrality around this mid- century (UNFCCC, 2021).

According to the synthesis NDC report from UN Climate Change, 48 new or updated NDCs submitted by 75 parties by 31 December 2020, which represent about 30% of total global GHG emissions. However, the climate commitments from the countries are not on track to meet PA goals as the ambition level communicated through these NDCs indicates a very small change (less than 1%) in the countries' total emission in 2030 comparing to 2010. The report also illustrates that per capita GHG emission will be 6.52 t CO2 eq in 2025 and 6.52 t CO2 eq in 2030, which is 4.7% lower in 2025 and 9.6% lower in 2030 comparing to the emission level in 2017. So, IPCC stresses on reduction up to nearly - 45% in 2030 compared to 2010 to achieve the 1.5 ^{0}C temperature goal.

In new or updated NDC, many nations proposed long-term mitigation visions, strategies and targets towards and beyond 2050 for achieving carbon neutrality, climate neutrality or net zero emissions. Most parties basically emphasis on mitigation co-benefits of adaptation actions and economic diversification plans in their updated NDC whereas many developing countries yet remain in urgent need of support to carry out climate efforts through

financial and technical assistances. It is worth mentioning that climate actions must be enabled and facilitated through need based adequate resource supports and accessibility of greener technologies for the deep transformation. Ultimately, irrespective of economic and political stances, the nations must redouble their climate actions to meet the PA goal of limiting global temperature rise by 2 ^{0}C or ideally 1.5 ^{0}C by the end of this century.

3. BANGLADESH: THE COUNTRY WITH ASPIRATION AND CURRENT TARGETS OF NDC

Bangladesh, a South Asian country with over 164 million people, marks as a role-model in the climate-induced disaster adaptation context in the world. The country aspires to become a middle-income country by 2024 despite of its current position (7th) in Global Climate Index, and stay below per capita emissions of developing countries (Figure 2) to meet climate goals by 2030 (CDKN, 2016) & (MoEFCC, 2018). Though Bangladesh release very scanty portion of global GHG emissions, i.e., less than 0.35% but it is highly susceptible to climate vulnerability. According to Asian Development Bank report, climate-induced disasters result in an annual loss of 2% of GDP by 2050 and 9.4% of GDP by 2100 (Ibid).

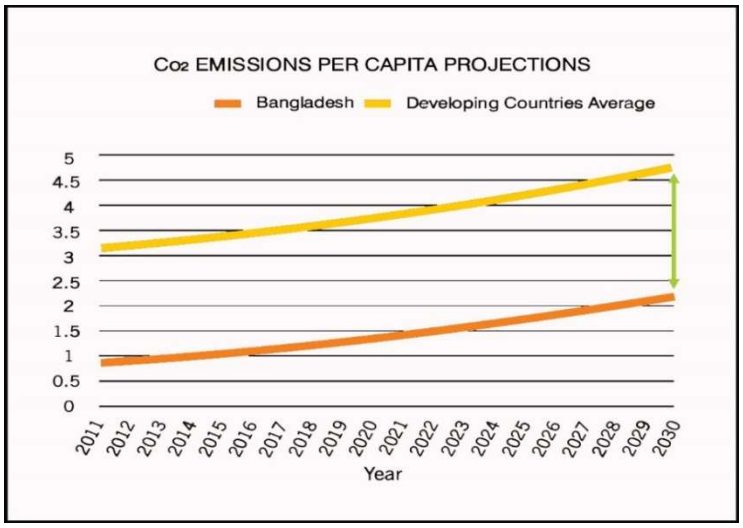


Figure 2: Projection of CO_2 emission per capita in Bangladesh compared to developing nations *[Source: (CDKN, 2016)]*

Given the context, the country is adopting global collective actions for GHG emissions reduction and emphasis more on adaptation for enhancing resilience to climate change. Bangladesh propose both unconditional and conditional contributions targets for reduction emissions in global GHG trajectory and the targets reflect in its Internal Nationally Determined Contributions (INDC) road-map. A number of mitigation actions are set in INDC to limit national GHG emissions so that the country can stepped towards a low-carbon, climate resilient prosperous economy. Bangladesh encounters three major sectors: the power, industry and transport for curbing internal emissions by both conditional and

unconditional business-as-usual (BAU) contributions. Further, mitigation actions in other sectors will carry out parallel to current INDC.

The mitigation targets of current INDC at sector-wise are aligned with the country's existing national plans and strategies. The INDC delineates that Bangladesh will provide an unconditional contribution to curtail GHG emission by 5% from BAU depend on its domestic resources and supports, while a conditional contribution by 15% reduction based on international financial and technical supports in power, transport and industry sectors (Figure 3 and Table 1) by 2030. Acknowledging the Paris Agreement (PA), the country's INDC has become Nationally Determined Contributions (NDC) after the first submission of its climate actions targets and goals to UNFCCC in 2015. The NDC is expected to be a foundation of future climate change actions under UNFCCC process.

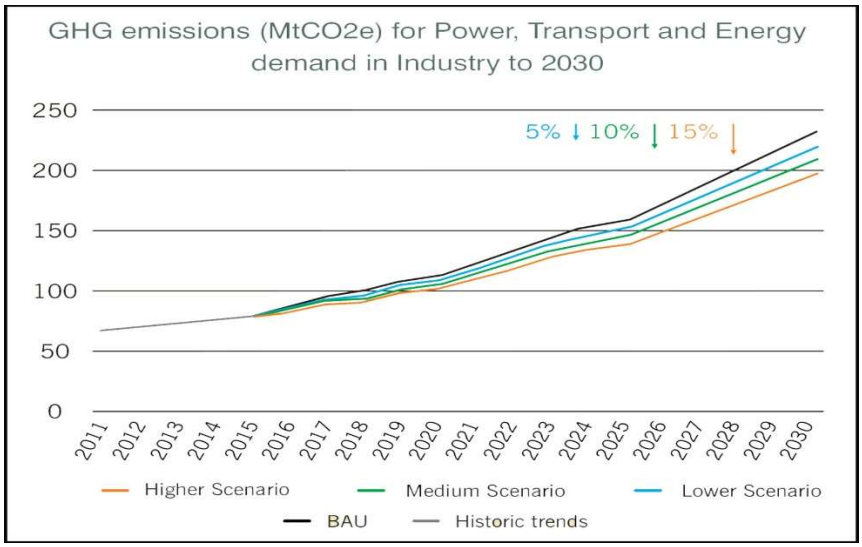


Figure 3: Ambitions for GHG reduction in power, transport and industry sectors by 2030
[Source: (CDKN, 2016)]

Table 1: GHG emissions in 2030 and % of reduction from BAU for power, transport and industry as mitigation scenarios

Sector	% change from BAU in 2030				GHG emission in 2030 (MtCO2e)		
	BAU	Low ambition	Medium ambition	High ambition	Low ambition	Medium ambition	High ambition
Power	91.42	86.41	80.91	74.83	-5.48	-11.50	-18.15
Transport	36.61	33.23	30.04	27.90	-9.23	-17.95	-23.79
Industry	105.73	101.93	99.52	95.10	-3.59	-5.87	-10.05
Total	233.76	221.57	210.47	197.83	-5.21	-9.96	-15.37

[Source: (CDKN, 2016)]

Time series data analysis shows that three major sectors- power, industry and transport are primarily responsible for major CO_2 emissions including potential sectors of residential and agriculture (Figure 4) and there is an upward trend over the years. Bangladesh anticipates 69% of total emissions from its power, industry and transport sector (excluding LULUCF) by 2030, which accounts an increase of 264% from 64 MtCO2e in 2011 to 234 MtCO2e in 2030. According to NDC targets, the country will reduce its GHG emissions by unconditional 12 MtCO2e (5% below BAU) and conditional 36 MtCO2e (15% below BAU) from the power, industry and transport sectors by 2030. The country is developing its NDC implementation plans for execution of the adaptation activities worth about 40 billion USD. Figure 5 represents estimated investment in power, transport and industry sectors to meet NDC targets by both conditional and unconditional contributions by 2030.

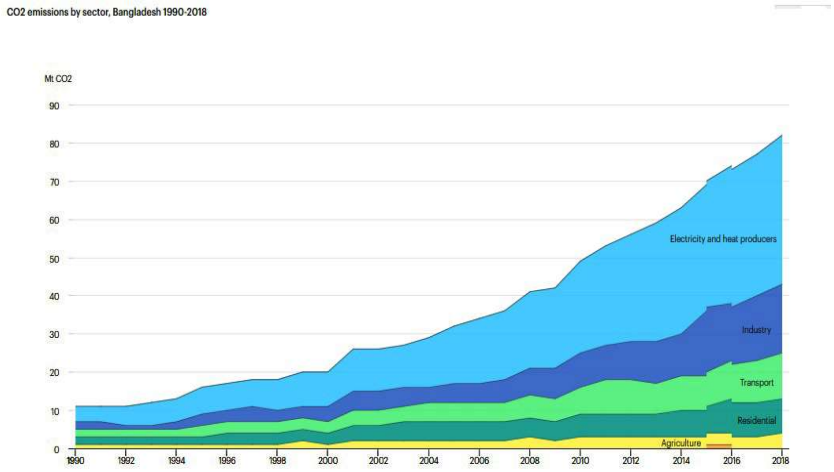


Figure 4: CO_2 emissions pathway from major sectors in Bangladesh from 1990 to 2018

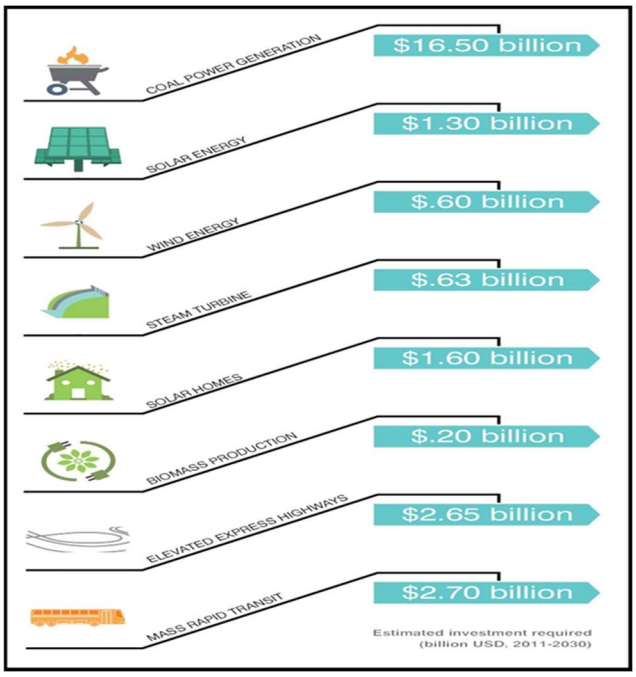


Figure 5: Estimated cost in power, transport and industry sectors for NDC by 2030

[Source: (*CDKN, 2016*)*]*

3.1 Initiatives to Tackle Climate Change Impacts at National Level

Climate change issues have not been fully address and highlighted in national policies, except in the Coastal Zone Policy (CZP) 2005, and the National Agriculture Extension Policy (NAEP) 2012 (MoEFCC, 2018). The CZP accentuates the vulnerabilities of coastal people, adaptive measures, continuous management of sea dykes, institutional framework for protection of coastline, detection and monitoring sea level rise, and contingency plans are also formulated to tackle its impacts. While the NAEP stresses strategic approaches for natural resource conservation and long-term sustainable use of resources with mitigation actions to tackle climate induced vulnerabilities. For instance, introducing different cropping patterns like short duration, salt and drought tolerant varieties as climate resilient crops, effective water management, early warning and weather forecasting are sustainable solutions for desirable crop productions (ibid).

Given the context, the GoB basically spends about 6-7% of its annual budget on climate-induced vulnerabilities aligned to national strategic actions so that the country scale-up its resilience to the effects of climate change (Ibid). The first ever national climate fund: the Bangladesh Climate Change Trust Fund (BCCTF) was established in 2010 for assisting the vulnerable communities to recover and become more resilient against climate-induced impacts (ICCAD, 2015). BCCTF allocated USD 340 million for climate activities from the national budget whereas 66% of this fund primarily assigned to adaptation capacity enhancement, and the rest amount (34%) is kept as fixed deposit for emergencies responses (Ibid). A large number of small-scale projects under BCCTF aimed to bring benefits to climate vulnerable people while more than 400 projects have been sanctioned for adaptation, mitigation, technology transfer, research activities, and capacity build-up through the participations of both public and private organizations including research institutes (MoEFCC, 2018). Also, another innovative fund, the Bangladesh Climate Change Resilient Fund (BCCRF) has been adopted to perform the same activities as BCCTF with the support of development partners (Ibid).

Owing to the priorities to GHG emissions mitigation, there are institutional arrangements for mitigation actions at national level, the country has adopted few national instruments like the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), National Adaptation Programme Action (NAPA), ongoing National Adaptation Plan (NAP), National Sustainable Development Strategy, the Perspective Plan (Vision 2021), the Seventh Five Year Plan, The Delta Plan 2100, the National Disaster Management Plan, the Disaster Management Act and the Country Investment Plan of Bangladesh on Environment, Forestry and Climate Change all are dedicated to climate change adaptation actions (Ibid). Climate Change Cells (CCC) has been established in many ministries whereas the Ministry of Forest, Environment, Climate Change (MoEFCC) has set-up Climate Change Unit (CCU) that is renamed Climate Change Trust (CCT) to buildup capacity of the government to

mainstreaming climate change in development, co-ordinate CCC, and integrates climate change risk management at both the local and national levels.

In 2005, NAPA was adopted in the light of climate change context to stress on community based adaptations and livelihood diversification; for instance, afforestation, climate resilient mangrove and non-mangrove plantations, agriculture, livestock and fishery based livelihood etc. While the existing BCCSAP, a ten year plan (2009-2018) of actions to cope with the climate challenges, emphasis on climate induced hazards; and BCCSAP is implemented by MoEFCC, line ministries, and Civil Society Organization (CSO)/Non-Government Organizations (NGOs) with BCCTF under MoEFCC. The BCCSAP emphasis on the improvement of energy efficiency in both domestic and commercial sectors, emission reduction in the agricultural sectors through effective water and fertilizer management, collection of methane (CH_4) gas from landfill sites, enhanced fuel efficiency of vehicles, promote public transportation, boost up afforestation and reforestation etc. are the strategies of GHG emissions curtail.

However, other institutional instruments: National Energy Policy (2004) for energy efficiency (EE) focused on clean development mechanism (CDM) projects. In accordance to EE and CDM different renewable energy sources such as solar, wind energy, biomass, biogas, hydro-power, bio-fuels, geothermal, river current, wave and tidal energy are identified under the Renewable Energy Policy (2008) to expedite global emissions limit
for mitigating climate change by 80% reduction by 2050 (MoEFCC, 2018). While combating the adverse impact of climate change, National Industrial Policy formulated in 2016 to make guidelines for the establishment of industries with full consideration of disaster risks reduction and environmental issues. In addition, gender perspective got momentum and the government adopted Bangladesh Climate Change and Gender Action Plan in 2013 so that gender inclusion in development initiatives are attainable to increase resilience (MoEFCC, 2018).

The major priorities areas are climate change, environment, disaster risk reduction and response in the Prospective Plan, Vision 2021 while the framework comprises the development of resilience of the vulnerable populations to climate induced natural disasters and advantages from natural resource management (NRM), environmental governance and low-emission green development. Other milestone of national policies are National Information and Communication Technology (ICT) Policy, 2015 for pre and post-disasters management, and National Biotechnology Policy, 2012 to develop climate resilient crops. Besides, GoB undertook two major development projects: Investment Project (DPP) and Technical Assistance Projects (TPP) to mainstreaming climate change, disaster, and environmental issues, so that climate change and disaster issues can make as integral part and further strengthen environmental issues that mandate every implementing entity. The country projected the requirement of a potential budget of USD 42 billion for the implementation of the adaptation measures identified in the NDC, and

Bangladesh can look options for funding sources from the Green Climate Fund, the Adaptation Fund and the Least Developed Countries Fund (Ibid).

2.2 Coordination and Governance

The Ministry of Environment and Forests (MoEFCC) is the apex entity for coordinating actions on NDC implementation and MoEFCC will closely work with the Planning Commission to smoothly execute seventh five year plan (7th FYP) so that integration of climate consideration will be guaranteed. Each NDC sectoral action plans entail coordination and governance among different stakeholders, and government and civil society at each sectoral level. The proposed governance arrangement offered the implementation of NDC with integration of National Action Plan (NAP) side by side (Figure 6) under a single framework (MoEFCC, 2018). A single NDC-NAP Advisory Committee will be headed by MoEFCC Secretary while NDC-NAP coordination committee will be headed by Additional Secretary from MoEFCC. The role of Advisory Committee is to provide strategic advices on cross-cutting issues for NDC implementation and often assess the progress on overall NDC implementation (Ibid).

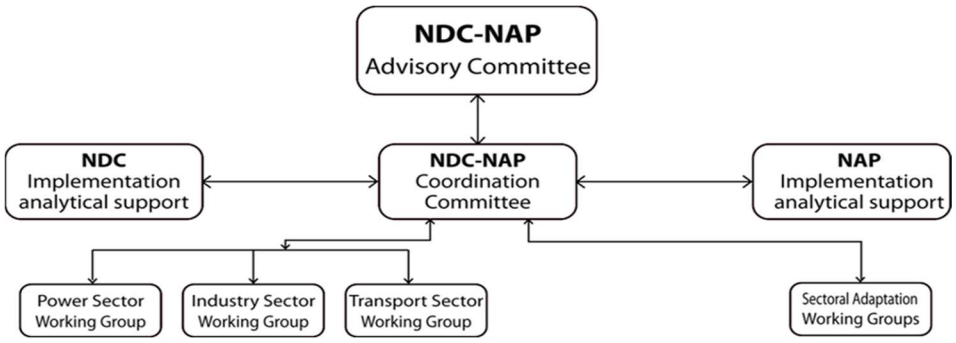


Figure 6: Governance arrangements for NDC-NAP implementation framework

The NDC-NAP Coordination Committee will have lead role on climate change and coordinate with the UNFCCC (Ibid). The committee will act as the secretariat to the NDC Advisory Committee and will be responsible for report presentation to the Advisory Committee while the Department of Environment (DoE) will liaise with different ministries to have analytical support for NDC and NAP implementation with good quality and effective MRV. A pool of analytical resource is drawn up across many Ministries, which will provide regular and ad-hoc support both to the NDC-NAP Coordination Committee and to Sectoral Working Groups for data presentation and analysis. DoE will coordinate with the NDC-NAP Coordination Committee in MoEFCC and supervise the analysis for further resource development and allocation, capacity build-up for implementation of NDC-NAP tasks (Ibid).

Three sectoral working groups in power/energy, industry and transport sectors are responsible for the functions of quantified GHG reduction commitments in the NDC and will interact closely with any institutional structures or processes aligned with their respective sectors. The NDC Implementation Sectoral Focal Points will ensure the engagement of stakeholders in sectoral issues and also their involvement in NDC implementation (Ibid).

4. 4. SECTORAL IMPACTS, VULNERABILITY AND BUDGET ALLOCATION TO CLIMATE CHANGE

Climate change impacts undeniably impose serious threats and effects on the entire economy of Bangladesh, and the country will experience continue large downturn in real GDP by 0.62% within 2030. The Third National Communication report illustrates that the country needs an investment of USD 44 billion to address and handle the climate-related disasters and diseases (MoEFCC, 2018). The country has adopted an overarching two-fold strategy against climate change impacts, primarily focused to increase resilience as adaptation measures, and reduce GHG emissions for more resilient development.

The country encounter 3.1% loss (overall USD 2.9 billion) in agricultural GDP each year due to climate change impacts, and such annual loss may escalate to USD 5.1 billion with the worst climate scenarios. Even though, agriculture, the largest employer sector comprises direct employment of 43% labor force, 41% of the population rely on agriculture for their subsistence, and contributes 14.73% to the GDP but this sector remained less priority sector where merely 4% of the total budget allocated from 2010 to 2016 (Ibid). In fiscal year 2020-21, agricultural sector got the highest allocation, BDT 16,437 crore (2.89% of the total budget) due to ongoing COVID-19 pandemic and aiming to ensure better food security (Daily Sun, 2020). The coastal area of Bangladesh encompasses about 20% of the total land area, and over 30% of the country's net cultivable area but 0.95 million hectares of coastal land out of 2.83 million hectares suffered from various levels of salinity.

Over the periods, a lion share of government budget (BCCTF) allocated to infrastructures (70% in 2010-2014) while knowledge management, and capacity building and institutional strengthening received minimal allocation (Dhaka Tribune, 2018). Estimation shows that the number of projects allocation increased with pace of time (2009-10 to 2015-16) but the overall budget allocation decreased. Furthermore, a shift in sector wise project allocation is evident, i.e., a total of 32 projects, 31% of total projects implementation allocated to the Ministry of Environment and Forests (MoEF) while just 6% of the total fund distributed to the Ministry of Local Government, Rural Development, and Cooperatives (LGED) (Ibid). But the budget allocation has changed drastically from the period 2010 to 2016; for instance, LGED received 63% of total budget and MoEF got 15% share that is almost half the funding comparing to its very initial funding. The Ministry of Disaster Management and Relief received 1% from BCCTF for implementation of the projects.

5. ROADMAP FOR SECTOR- WISE NDC IMPLEMENTATION

In the context of NDCs, Bangladesh owing to its LDC status, exempted from the general rules of PA to each party of the convention: periodic submission of GHGs inventory, climate change impacts and adaptation information, and regular track and report on the progress towards its NDC's targets (MoEFCC, 2018). Only LDCs and SIDs are allowed to submit their

progress report on NDC's target according to their will while all other parties should submit their progress report no less than every 2 years. As a result, Bangladesh has no specific deadline or requirement at present in accordance to measurable, reportable and verifiable (MRV) criteria of its NDC implementation at international level (Ibid).

It is point worthy that Bangladesh considers NDC implementation not just for international reporting but to assist its domestic audience through the involvement and transparent NDC implementation. Under the current UNFCCC reporting requirement, Bangladesh is not bound to produce its regular GHG projections but the country can update its GHG inventory with the technical assistance from the external institutions (e.g. academics or consultants).

The country's NDC aligns closely to its Seventh Five Year Plan (7FYP) that promote climate change mitigation and adaptation actions, low carbon development, a whole-government approach to climate-readiness, capacity buildup of stakeholders, coordination and communication amongst key institutions, and innovation and research work.

5.1 Mitigation Actions in Power Sector

Bangladesh entirely relies on fossil fuel (99.1%) combustion to meet its energy demand (Figure 7), whereas natural gas has always been the major source of energy in different sectors. The country meets its energy demand from natural gas (67%), and oil (22.7%) while oil is solely imported to run the oil-fired power plants due to no existence of internal resource of oil. Furthermore, the coal consumption per annum is growing by 33% since 1990, and the government has a plan to start coal-based power plants with the capacity of 7.5 GW electricity production by 2021 (Salam, et al., 2020). It is estimated that the country has spent approximately 2.4% of its GDP on fuel imports that comprises about USD 4.6 billion in 2015 and a gradual rise in the reliance on importing electricity from India is continuously mounting (Climate Analytics, 2019).

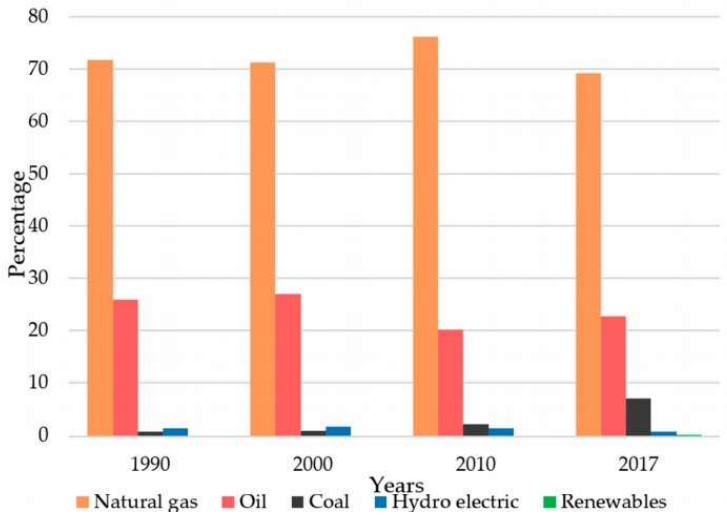


Figure 7: Energy mix of Bangladesh

[Source: (Salam, et al., 2020)]

Energy consumption in building sector of the country comprises 55% of the total energy which is followed by the industry sector (30%), transport sector (12%) and agricultural sector (4%) respectively. The country is experiencing an upsurge of about 30% energy consumption in building sector due to incessant growth of population and economic development (Salam, et al., 2020). Since 2006, energy consumption is rising annually at 3% while a sharp increase of energy usage in residential buildings to about 28.1% and 2.8% in non-residential building sector from 2006 to 2016 (Ibid). At present, 38% of total population live in urban areas and the rate of urban population growth is expecting to rise 50% by 2050. Eventually, the energy demand will up over the years, so the GoB taking a plan to curb energy consumption to 20% through the implementation of building codes. An energy audit study report on commercial buildings in Dhaka city represents that energy efficient equipment can reduce nearly 8 to 15% of electricity while energy consumption through lightening can be shorten 28% to 45% through efficient components usage (Ibid). Besides, the country desires to attain 15% and 21% reduction in primary energy consumption per GDP for all sectors by 2021 and 2030 According to the Energy Efficiency and Conservation Master Plan (EECMP) (MoEFCC, 2018).

While, the existing dependency on oil and gas with a recent plan of extensive expansion of coal power plants push Bangladesh to play a paradox role (Climate Analytics, 2019). As the country has already signed PA agreement and legally bound to follow its rules but the existing reliance on oil and gas and a recent plan of extensive expansion of coal power plants make the country in a dubious position because it is completely inconsistent with PA (Ibid). Bangladesh has plans to make progress in domestic coal production, import Liquefied Natural Gas (LNG) to meet national gas demand, and development of coal-fired power with a projection of 35% total energy share by 2041. All these strategic plans are not in right track towards decarbonization pathway and not compatible with PA (Ibid).

Though the country's CO_2 emissions per capita have been more than doubled from 0.2 to 0.46 MT between 2000 and 2016 but remaining very low comparing to the global average - 4.8 MT CO_2 per capita. Energy consumption has been increased at more than 8% while electricity consumption increased even faster at 10% due to the economic activities. In 2015, the country's coal share was 1.7% in power generation but GoB has high aspiration to enlarge the share of coal in its total power generation sector (Salam, et al., 2020).

The revised Power System Master Plan (2016) conceives 70% of power generation through two fossil fuels, i.e. coal and natural gas, each comprises 35% share while GoB has committed to 10% renewable energy by 2021 (MPEMR, 2016). Bangladesh's existing power plants are predominantly gas and oil based, and the country is completely depend on oil import while its present energy demand surpasses the supply that require for searching alternatives energy resources so that the dependency on oil and gas can be minimized. Since Bangladesh is leading the chair of Climate Vulnerable Forum (CVF) at present, so the country has significant scope to scale up its ambitious long-term strategy to strengthen energy independence, foster progress in energy accessibility and energy

poverty eradication through the expansion of renewable resources that align with the goals of PA and CVF (Climate Analytics, 2019).

Bangladesh under its current NDC, plans to reduce GHG emissions in power sector below 5% as unconditional, and 18% as conditional from BAU by 2030. The GoB has taken a number of initiatives to establish a low carbon power generation system. For instance, a target to lessen energy intensity per GDP by 20% from the baseline 2013 energy levels within 2030, promotion of sales of high efficiency products in the market through an energy efficiency labelling program, establishment of Energy Management System/Program, and Energy Audits for industries etc. (Sarker & Yasmin, n.d.). The country already distributed around 4.5 million Solar Home Systems (SHS) and more than 3.1 million Improved Cook Stoves all over its territory, which provides off grid electricity access in rural areas. Besides, nearly 14 MW of solar has been installed in the vicinity of roof-tops of public and private buildings under the Solar Roof-top program, and around one thousand solar irrigation system are installed in different regions across the country (Ibid).

A growth in energy sector is vital for the country's economic development while the country is aiming to have self-efficacy in energy security, economic growth and environmental protection. The GoB has expanded a re-financing scheme for renewable energy projects, i.e. energy production through small scale solar and micro grid so that the accessibility of energy access in off-grid regions are attainable. Estimation shows that 519.62 MW renewable energies with having 2.77% share of entire energy generation mix are being allocated (MoEFCC, 2018).

Bangladesh currently imports 600 MW energy from India but the PSMP forecasts that the country will need to import 9000MW power from its neighboring countries to meet domestic energy demand, which accounts about 18% of total installed capacity by 2040. It is worth taking point that lean on fossil fuels will widen the carbon-footprint. The electricity production from hydropower seems declining over the years, for instance, 1.4% in 1990 to 0.7% in 2017 because of insufficient water flow with required water heights for power generation (Salam, et al., 2020). A small scale of hydropower generation from the Sangu and Matamuhuri River basins estimated about 167 MW electricity generation whereas potential small hydropower accounts even lower at approximately 0.15MW (Sarker & Yasmin, n.d.).

Given the context, the country can expand its dependency on potential renewable energies like solar power, bio-fuel and nuclear power. Conversion of wastes into energy will be a viable option for energy production. The alternative energy resources like biogas is a beneficial renewable resource for sustaining rural livelihoods. Bangladesh is producing biogas from animal wastes only, and it accounts 2.97×10^9 m^3 of gas that is equivalent to 1.52×10^6 tons of kerosene or 3.04×10^6 tons of coal (MoEFCC, 2018). Though the country has high potential of biomass-based energy production (373.71 TWh) and produces 182.22 million tons of biomass each year but only 0.2% actual share of electricity production

comes from biomass among all renewable energy resources (RERs). Almost 40,000 bio-gas based power plants have been implemented and the country is planning to ascend the number to 60,000 (Salam, et al., 2020). Table 2 illustrates an overview of RERs current practice in power sector in the country to meet its NDC targets through both conditional and unconditional contributions by 2030.

Table 2: Best Practice in Bangladesh

Solar Home System	• 5 million SHS (data:2017-18) • Presently around 6.5 million • 13 Million People benefitted • Reduced use of 180000litre use of Kerosene • Saved 225Million USD • Job Opportunities: 70,000 people
Solar Irrigation Pump	1.3 million diesel based irrigation pump • 3.4 Million hectare lands • Approved: 1429 solar irrigation pump • 1186 established • Capacity:26.59MWp
Solar Mini Grid	• Will be established in 1078 off grid village • 18 already established
Solar Roof System	29 MW power generated

5.2 Mitigation Actions in Transport Sector

The transport system of Bangladesh comprises roads, railways, inland waterways, seaports for maritime shipping and civil aviation facilities while the demand for road transportation has been increasing substantially over the years (IMC Worldwide, 2020). In 2018, the growth rate of urbanization exceeded 36%, which fuels transportation demand surge. The mode of road transportation became the dominant mode in 2015 that accounts 70% of passenger and 60% of freight traffic (Ibid). Bangladesh Railway (BR), another important mode for transportation manages nearly 300 diesel locomotives, 1,500 passenger carriages and about10, 000 freight wagons.

A rise in vehicle growth rate is seen around 6-8 % over the last few years with 3.04 million registered vehicles till May 2017 result in increase 2.62MT of oil products and 1,136 million cubic meter (MMcm) natural gas are consumed by the transportation sector in 2016 while about one-third of emission come from bus and trucks (MoEFCC, 2018). According to World Data Atlas, CO_2 emissions from transportation sector was 14.2% in 2014 and the sector stifles due to lack of standardization, inefficient and outmode freight sector (Knoema, 2014) . Figure 8 illustrates CO_2 emissions in giga-gram (Gg) from the

entire transport sector in the country from 2006 to 2012 and represents CO_2 emissions mostly release from heavy-duty trucks and buses, and cars.

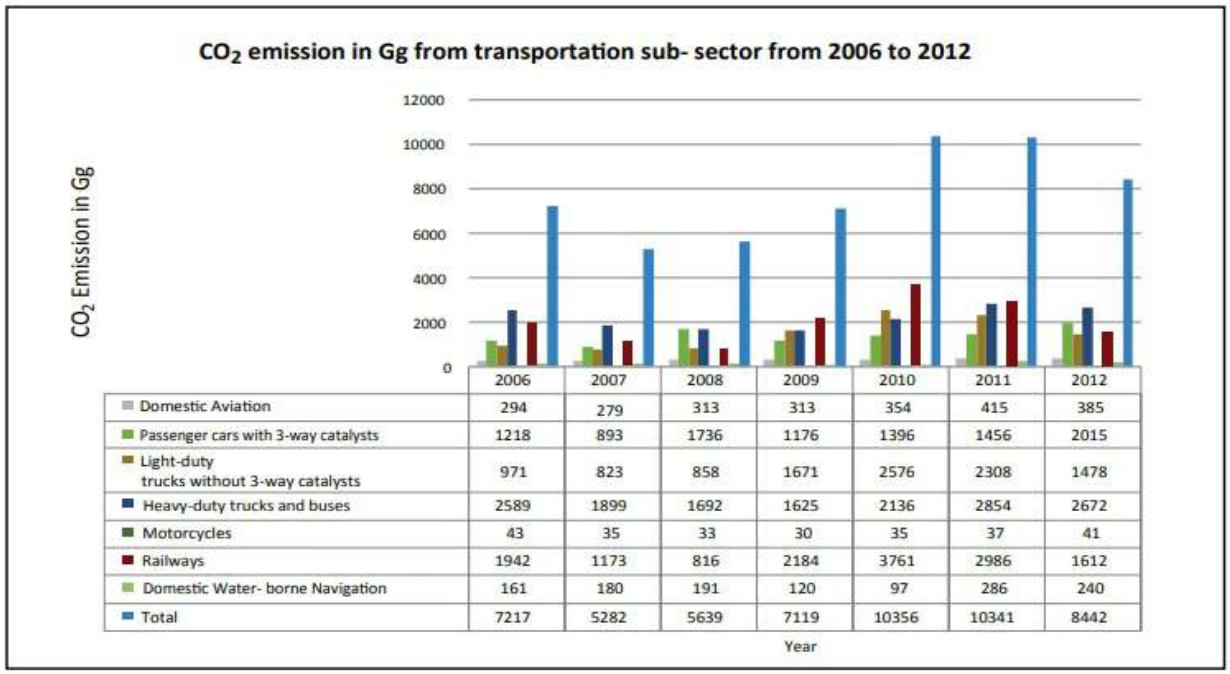


Figure 8: CO_2 emissions from the transport sector from 2006 to 2012

[Source: (MoEFCC, 2018)]

The country anticipated that under its current NDC, a reduction of 9% below BAU as unconditional and 24% below BAU as conditional by 2030 from the transportation sector would be achievable (Sarker & Yasmin, n.d.) & (MoEFCC, 2018). The government is expecting to meet the country's NDC targets through existing and planned measures to modernize the transportation network system and increasing travel efficiency. A set of strategic plans, for instance, continuous efforts to reduce travel needs, shifting towards more sustainable mode of transport system, improving fuel efficiency and quality, introducing and ensuring better engine technology will generally make the pathway to reach NDC goals (Ibid).

However, the actions and ambitions are taken over the past decade have simply been inadequate, so more transformable and faster actions are required to have safe, efficient, environmental friendly transport system. The country conceive several strategic plans and policy discourses for better public transport, greener environment, and cleaner vehicles. The Prospective Plan of Bangladesh (Vision 2010-2021) aimed to modernize and technologically viable sustainable inter-modal transport system. Bangladesh's Climate Change Strategy and Action Plan (BCCSAP) of 2009 stresses on low cost rapid transit, enhancement of energy efficiency, substitution of fossil fuels for emissions reduction and

improving energy consumption pattern in the transportation sector (Sarker & Yasmin, n.d.).

Also, the Revised Strategic Transport Plan (RSTP), 2016 -2035 emphasis on efficient public transport system to ensure safer, equitable and sustained mobility and accessibility to urban services, which are essential for the people and society. In 2013, the Integrated Multi-Modal Transport Policy has been adopted to create a safer, efficient, cleaner and fair transport system with due consideration of greener, cleaner vehicles and better public transports including non-motorized transport so that the rate of road traffic growth can be controlled (Sarker & Yasmin, n.d.) & (MoEFCC, 2018) While Road Master Plan (2009) and National Road safety strategic action plan are guiding documents to analyze the existing problems and potential challenges on road networks and to reduce the number of road accident injuries and fatalities (Ibid).

Nonetheless, a mandate in social and environmental guidelines usage the specific policy performance for road transports can considerably reduce GHGs emissions. For instance, the Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) under Urban Nationally Appropriate Mitigation Actions (NAMA) can reduce 1.4 MT of CO_2 by 2030 while about 3.03 MT of CO_2 including black carbon emissions can be avoided through Inter-Urban Rail NAMA implementation during the period of 2018-2030 (Ibid). There is a projection of CO_2 emission reduction by 42 tons per day through replacement of current fuel-inefficient fleet with environmental friendly articulate bus that will carry 12,000 passengers per direction per hour and reduce private transports usage, and improvement of average speeds on the corridor (Ibid). The MRT Line-6 is expected to carry 60,000 passengers per hour that subsequently carried a total of 38.4 million passenger-km per day or 140 billion passenger-km per year that will take away nearly 14.9% passenger load from road to rail sector in the capital city, Dhaka (Ibid) & (Dhaka Tribune, 2020). As a result, a subsequent increase in passenger-km for rail will contribute to about 10% reduction in passenger-km travelled and 5% reduction in fuel consumption per km travelled by road transport within 2030 under unconditional scenarios of NDC (MoEFCC, 2018). While under the conditional scenario, NDC assumes that 25% reduction in passenger-km travelled by road and shifting it to rail will be achievable by 2030 (Ibid).

The GoB has set up a number of targets to improve the overall road condition of national highway to 90% (good to fair) by 2021 that can contribute GHG emissions reduction by 2-3% (MoEFCC, 2018). The Dhaka Transport coordination Authority (DTCA) has taken a plan to introduce 4000 modern buses with high fuel efficiency will definitely fulfill the target of developing quality, reliable, sustainable and resilient transport infrastructure (Ibid). Other remarkable initiatives such as e-ticketing, e-billing, establishment of over 4500 Union Digital Centers, embracing of video conference for official meetings, online results publication of public exam and application submission in the education sector etc. certainly reduce travel demand. Moreover, recent initiatives from the GoB to reserve 40% seats in school for the residents who live nearby also can lessen school related travel distance in certain areas (Ibid). Finally, expansion and modernization of mass transit,

enhancement of road safety, controlling waste dumping in waterways from vessels, keeping adequate space for cycling and walking, introducing affordable and sustainable transport system will be steeped towards to achieve NDC targets and reduce enduring traffic congestion as well.

5.3 Mitigation Actions in Industry Sector

The industry sector in the country accounts for about 50% of national primary energy consumption while construction is the biggest sector for GHG emissions (MoEFCC, 2018). In 2012, 55% of total manufacturing energy-related GHG emissions came from mostly brick manufacturing, 24% from textiles and leather, 4% from chemicals, 3% from food, beverages paper and tobacco, and 6% from other non-specified industries (Ibid).

Bangladesh anticipated a reduction of unconditional 4% and conditional 10% below BAU by 2030 through international assistances in implementation of climate change mitigation measures (Ibid). It is estimated that the implementation of green building guidelines (GBG) in industry will curtail overall GHG emission while reduction in energy consumption by 50% and expenditure by 30% will be attainable through the use of light-emitting diode (LED) lighting instead of fluorescent lights in garment industry (Ibid).

The textile and food processing sector particularly can contribute overall energy consumption reduction entailing the process of waste heat recovery. All industrial sub-sectors can play a significant role in strengthening climate resilience and meet sustainable development goal (SDG) 9 through systematic planning and decision-making process for resilient infrastructure, inclusive and sustainable industrialization and fostering innovation (MoEFCC, 2018).

A sharp growth in the brick industry supersedes all the GHG emission sources in the industry sector. The brick industry surpasses the fertilizer industry, have a steady growth rate of 6 to 7% in the last decade, and uses more carbon intensive fuel- carbon than natural gas. While fertilizer industry is categorized under the IPCC head Chemical, consume about 10% of the total gas, experienced downturn growth since 1995, and the energy supplied to the fertilizer industry (30% natural gas) is non-energy as most of carbon is stored in urea.

6. POTENTIAL CARBON-INTENSIVE SECTORS FOR NDC ENHANCEMENT

Bangladesh submitted its interim NDC in last year on 31st December 2020 where the country considered only three sectors: industry, power and transport for taking mitigation actions to meet PA goals. But the country failed to follow the UNFCCC guidelines for NDC implementation while its interim NDC report just emphasized on current undertaken schemes on mitigation and adaptation and mostly ignored the precise quantification of CO_2 emissions reduction targets in sector wise, and failed to address carbon-intensive sectors to enhance its NDC. In the report, Bangladesh commits to promote rice paraboiling system for ensuring carbon emissions shorten and energy efficiency; promote research on suitability of various tree species for carbon fixation and encourage low carbon development in waste sector. However, all these commitments do not quantify the

reduction targets, so certainly, Bangladesh should consider quantitative figures for truncate GHG emissions from carbon intensive sectors to ensure NDC implementation.

As the country is highly susceptible to climate change and climate induced disasters, and only contribute very negligible share of emissions trajectory but the country can consider few more sectors to enhance NDC. A brief of some potential carbon intensive sectors are included here so that the country could take strategic plans for progressing actively in mitigation related actions.

- **GHG Emissions from the Brick Manufacturing Industry:**
- **GHG Emissions from the RMG:**
- **GHG Emissions from the LULUCF sector**:

Land use, land use change and forest is one of the potential sector to contribute GHG emissions and the rate is ascending over the years. In 2000, LULUCF sector contributed nearly 13 MT CO2 emissions and the rate increase at 12% by 2010 as a result of substantial loss of cropland and forestland area with a substantial increase in settlement from 2000 to 2010 for the growing population (MoEFCC, 2018). Estimation (2000) shows that the emissions mainly come from forest and grassland conversion (3.6MtCO2eq), removal from soil and forest (16MtCO2eq) and other woody biomass stocks as carbon sequestration (5.9MtCO2eq) (Ibid). GoB took some strategies to increase production forest cover by 20% by 2021, which will contribute a reduction in emissions to 12MtCO2eq and 13MtCO2eq by 2020 and 2025 respectively from 15MtCO2eq in 2010 (Ibid).

- **GHG Emissions from the Agriculture & Livestock Sector:**

Since Bangladesh stands in 3rd position globally in rice production after India and China; and produced 3.6 crore tons of rice in 2020. Most of its inhabitants take this staple food as daily consumption of meals. As rice cultivation require a saturated field condition, so huge amount of methane gas (CH4) release from paddy field add to GHG trajectory and account for nearly 437.7 Gg in 2006 and 497.6 Gg in 2012. While direct N_2O emissions from nitrogen based fertilizers and CO_2 release from urea based fertilizers estimated to18.0 Gg in 2006 and 183374.0 Gg in 2012 respectively (MoEFCC, 2018). While CH_4 emission from livestock total enteric process is estimated at about 495.6 Gg in 2006 and 537.9 Gg CH_4 in 2012 (Ibid). The country assumes that non-dairy (draft) cattle will fall by 20% due to introducing mechanized agricultural system; fertilizer usage will increase at a rate of 4.2% per year while a 50% increase in organic uses of nitrogen fertilizer (Ibid).

- **GHG Emissions from the Waste Generation Sector:**

The curve of population growth is upward and the total urban population is increasing due to rapid urbanization and climatic disasters. The people from disaster prone areas move to urban cities for maintaining their livelihoods. The present waste generation per day is 25,000 tons while it was, 23,688 tons in 2014. It is estimated that solid waste generation from urban areas will be about 47,000 tons per day in 2025 with a total urban population

of 78.44 million. Statistics represent that the rate of daily waste generation per capita was 0.56 kg while in 2025 it will be 0.60 kg (The Daily Star, 2019).

The conversion of waste to energy will be most viable strategic plan for the country to make its NDC enhancement. For instance, for high ambition scenario, 50% of waste can be diverted from landfill while 30% of waste collection and landfill can be converted to composting under medium ambition scenario (MoEFCC, 2018). There are potential options for methane gas recovery from landfill and dry fermentation, i.e. 70% and 90% (high ambition scenario) CH_4 collection and power generation in gas engines whereas under medium ambition scenario, 30% CH_4 gas collection from landfill and 50% from dry fermentation (Ibid).

7. RECOMMENDATIONS FOR NDC

Energy/Power Sector:

- The revised Power System Master Plan (2016) conceives 70% of power generation through two fossil fuels, i.e. coal and natural gas, each comprises 35% share while GoB has committed to 10% renewable energy by 2021. The country should adopt super/ultra-super critical technology for clean coal technology to meet the targets set out in its NDC, and pursue alternate or non-fossil fuel based options like renewable energy resources (MPEMR, 2016).

- 33% fuel (diesel) is used in the agricultural sector for running irrigation pumps and other farm equipment, while 90% of irrigation pumps are run by old and energy-inefficient diesel engines. So, alternate drying and wetting of rice fields can reduce GHGs emission by low ambition 10%, medium ambition 15% and high ambition 20% respectively. Consequently, use of organic manures can reduce emissions (low 35% medium 40% high 45%), and introducing mechanized agricultural tools instead of draft cattle for farming eventually minimize the emissions by low ambition 35%, medium ambition 40%, and high ambition 45% (MoEFCC, 2018).

- Biogas is a beneficial renewable resource for sustaining rural livelihoods. Bangladesh is producing biogas from animal wastes only, and it accounts 2.97 x 10^9 m^3 of gas that is equivalent to 1.52 x 10^6 tons of kerosene or 3.04 x 10^6 tons of coal. Expansion of biogas production rate, and analyze potential alternative sources like rice husks, sugar cane and wheat straw for electricity generation with sufficient incentives can surpass the targets of NDC by 2030 (MoEFCC, 2018).

- Switching diesel based irrigation pumps to solar irrigation pumps, and multi-purpose land-use schemes to continue agricultural activities (grazing, free-range poultry etc.) with solar farm in non-arable lands. Government owned land or no-ownership land can also be utilized for solar-PV application.

- In the country, liquid processed gas (LPG), natural gas, and kerosene are used in the residential sector while natural gas and LPG are mainly used for cooking. However, kerosene is primarily used by rural households for lighting; so shifting towards biomass as cooking fuel especially in rural areas in Bangladesh can undeniably curb the GHGs emissions. Besides, the clean energy, biomass based improved cooking stoves are about 2.4 times more efficient than traditional ones (MoEFCC, 2018).

- Bangladesh entirely relies on fossil fuel (99.1%) combustion to meet its energy demand whereas natural gas has always been the major source of energy in different sectors. The country meets its energy demand from natural gas (67%), and oil (22.7%) while oil is solely imported to run the oil-fired power plants due to no existence of internal resource of oil. Furthermore, the coal consumption per annum is growing by 33% since 1990, and the government has a plan to start coal-based power plants with the capacity of 7.5 GW electricity production by 2021. It is worth taking point that dependency on fossil fuels will widen the carbon-footprint. While electricity production from hydropower seems declining over the years, for instance, 1.4% in 1990 to 0.7% in 2017 because of insufficient water flow with required water heights for power generation, so the country can expand its dependency on potential renewable energies like solar power, bio-fuel and nuclear power. Conversion of wastes into energy will be a viable option for energy production (Salam, et al., 2020).

- Total energy consumption is highest in building sector (55%) followed by industrial sector (30%), transport (12%), and agriculture (4%) respectively. The country is witnessing a sharp rise of energy demand at households by 30% since 2006 with annual rise of 3%. Economic progress, population growth, rapid urbanization increase energy consumption to about +28.1% in the residential building sector and + 2.8% in non-residential building sector for the period of 2006-2016. So, for energy conservation, ensure stringent implementation of the Bangladesh National Building Code (BNBC), and energy saving building codes with high energy efficiency equipment will result in high energy conservation, and the GHGs emission will be curtailed as well (Salam, et al., 2020).

- An electricity audit in commercial buildings of Bangladesh showed that in Dhaka, nearly 8–15% of electricity can be saved using energy efficient equipment and 28% to 45% of electricity consumed in lighting can be reduced with efficient components (salam et al, 2020).

- For medium ambition, 30% and 50% of CH_4 gas can be collected from landfill by modern engineered landfill and dry fermentation technology (MoEFCC, 2018).

Industry Sector:

- Industry has the largest share of power sector at 47.8%, and accounts for lion share of GHGs emission trajectory. Since Bangladesh government took plan to increase installed capacity around 60,000 MW by 2041, and the country is developing fast; thereby there will be rapid industrialization, and makeshift of labor-intensive to energy intensive industries like Readymade Garments (RMG). Thereby, energy efficient tools in garments sector will reduce carbon-footprint (MoEFCC, 2018).

- Since 2010, there has been an upward energy demand rate by 8% in commercial buildings. It is estimated that energy efficient equipment in commercial sector can reduce 50% energy consumption and energy-saving building codes can minimize primary energy demand by - 20% (MoEFCC, 2018).

- Fertilizer industry, one of the major gas consuming sector in Bangladesh, and nearly 30% of gas allocation in this sector is mainly for non-energy use like carbon store in urea. Alternatives to chemical fertilizers, i.e. Bone meal, compost manure, cottonseed meal etc. are sustainable solutions to reduce GHGs emissions. Besides, the technique- applying liquid stabilizers to urea can prevent ammonia volatilization, which in result will reduce GHGs emissions.

- Although more emphasis is given to fertilizer and cement industries for NDC targets, a cursory focus should be given to construction sector, mainly brick manufacturing that accounts large share of GHGs emissions. Statistics reveals that 55% of total manufacturing energy-related GHG emissions released from brick manufacturing in the year of 2012. The emission of CO_2 from this sector surpasses the fertilizer sector. Besides, coal is used as a major source of fuel and it is very carbon intensive. So, shifting from earthen brick manufacturing to eco-friendly materials for building construction will enhance NDC target-outcomes (MoEFCC, 2018).

- Take into account other potential sectors for GHG emissions like leather and textile (24%) and from non-specified sectors (6%). It is noteworthy to reduce fugitive sources of gas leakage for limiting GHG emissions (Sarker & Yasmin, n.d.).

Transport Sector:

- No specific guidelines or measures are made in NDC regarding shifting transport mode from road to shipping; and shifting 25% of passenger load from road to rail. Both requires a major transformation with detail effective plan to execute (MoEFCC, 2018).

- There was a rise in vehicle growth rate around 6-8 % over the last few years with 3.04 million registered vehicles till May 2017 result in increase the total passenger-km per year, and aggravate the GHGs scenarios. It is estimated that 2.62MT of oil products and 1,136 million cubic meter (MMcm) natural gas are consumed by the

transportation sector while about one-third of emission come from bus and trucks. Therefore, an urgent inventory is required to make comprehensive list of both registered and non-registered vehicles so that replacement of existing fuel-inefficient fleet can be done, and quantification of emissions from the sector could be achievable for further NDC enhancement targets (MoEFCC, 2018).

- Dhaka city alone comprises the total 940 billion passenger-km per year for the road sector, therefore, mass rapid transit systems should be encouraged to reduce the passenger load from the road, i.e. metro line 6 alone can take away about 14.9% passenger load. Such transformation can achieve unconditional scenario for NDC targets to 10% reduction the passenger-km travel by 2030 (MoEFCC, 2018).

- Allocation of fuel-efficient fleet with average improvement speed in the corridor and replacement of existing fuel-inefficient fleet for both Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) as per urban National Appropriate Mitigation Action (NAMA) can reduce 1.4 $MTCO_2e$ by 2030. While around 3.03 $MTCO_2e$ can be avoided with adequate investment from shifting road to rail transportation mode (MoEFCC, 2018).

- An increase in proportion of the overall national and regional highways in good condition can reduce GHGs by 2-3% (MoEFCC, 2018).

Other:

- 20% increment of production forest by 2021, will cease the upward emission trend by decreasing emissions to 12MtCO2eq and 13MtCO2eq by 2020 and 2025 respectively from 15MtCO2eq in 2010 (MoEFCC, 2018).

8. CONCLUSION

Bangladesh needs a robust political shift in momentum towards stronger climate actions, mitigation co-benefits actions including adaptation actions and economic diversification plans, inclusion of comprehensive vulnerability approaches, ensuring quality of information, detail plan of implementation strategies that linkage to relevant national plans, legislative and regulatory processes and SDG as well for its NDC enhancement. The country is confronting some barriers and limitations for NDC implementation: competing priorities of investments, lack of concessionary loans, inadequate data on GHG emission from carbon intensive sectors, poor data accuracy and reliability, transparency and verification efforts etc. Bangladesh requires an extensive quantifiable analysis of mitigation actions and more conclusive targets aligned to UNFCCC climate goals, a workable and acceptable MRV system for the efforts and outcomes of climate actions, and subsidizes or incentives to industrial entrepreneurs from the govt. for implementation of capital intensive energy efficiency measures for tackling climate change impacts and move forward towards climate goals adhering to the spirit of global actions.

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