



In quest of a Sustainable Low-Carbon Bangladesh



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Ensuring energy security while lowering carbon emissions will be the key challenge for Low-Carbon Development in Bangladesh. Despite the insignificant share of past and current emission of global greenhouse gases, Bangladesh has been trying to adopt a low carbon development pathway since 2009. In contrast, the gradual declining of gas reserve for power generation is pushing the country towards the carbon-intensive path. Considering coal as a primary fuel for the next 20 years, Bangladesh government has been investing heavily in coal-fired power plants to meet the current and future energy security. Too much policy attention on the development of fossil fuel-driven power plants is expected to take down Bangladesh towards carbon-intensive development paths. To reverse the current carbon-intensive and fossil-fuel driven development paradigm, Bangladesh shall set its own national targets guided by the global level of ambition but taking into account national circumstances. Bangladesh should consider to devise a new policy framework to impose climate change and low-carbon development obligations on both public and private entities. Public awareness for the reduction in consumption of water, energy and natural gas at the household level will be very cost-effective approach for adopting low-carbon lifestyle among citizens. Women should be involved in the low-carbon transition in a planned way. More emphasis needs to be put on the capabilities of people and institutions, not just climate change threats and risks. If low-carbon development paradigm is appropriately oriented towards poverty reduction, better nutrition, quality education, green infrastructure and sound health, then climate change risk and vulnerability will decline consistently to lead a low-carbon development pathway. The World also need to support Bangladesh for this endeavor, because Bangladesh has to suffer an annual loss of 2% of GDP by 2050 and 9.4% of GDP by 2100, if the World fails to take ambitious action for reducing carbon emissions.

INTRODUCTION

The adoption of United Nations General Assembly Resolution “*Transforming our world: the 2030 Agenda for Sustainable Development*”, the adoption of the Addis Ababa Action Agenda on “*Financing for Development*”; the adoption of the *Sendai Framework for Disaster Risk Reduction* and the Adoption of the *Paris Agreement* by the Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) are indicating that *Global Development Paradigm has started a transformational journey involving all the countries of the world including Bangladesh towards Sustainable Climate Resilient Low-Carbon Pathway*. The Paris Agreement urges all nations to undertake progressively ambitious efforts towards a low carbon future through “Nationally Determined Contributions (NDCs)”. The Article 2 of the Paris Agreement calls for a paradigm shift of the economic development away from its dependency on fossil fuels and energy intensive systems both at global and national level. A Sustainable Climate Resilient Low-Carbon Development Pathway is anticipated to guide the policy regime for the gradual transformation of the existing carbon dependent social-economic development paradigm 'til 2030.

Studies have recognized that socio-economic and political inequalities increases climate change vulnerabilities of the societies¹. The avoidance of difficult domestic structural changes for ambitious emission reduction, and the avoidance of challenging the unsustainable pattern of production and consumption within the national boundary are generating emissions inequalities in both developed and developing countries. Climate-induced migration² and displacement³ increases the possibility of violent conflict. Since, adaptive capacity is socially and politically determined⁴, any efforts to build adaptive capacity for reducing climate threats, must simultaneously address the development needs to gradually eliminate historical socio-economic and political inequalities⁵. The world needs 80% emission reductions on 1990 levels by 2050 in order to stand a chance of avoiding temperature rises above 2°C⁶. If all the NDC pledges submitted by the Parties to the UNFCCC are fully implemented, the world will still remain on an emissions path closer to 3°C warming⁷. This envisage that keeping the Paris objective of “well below” 2°C requires sustained reduction of carbon emissions from both developed and developing countries over many decades.

THE DEVELOPMENT CONTEXT OF BANGLADESH

Bangladesh recognizes climate change as an additional challenge to reduce poverty and environmental degradation. The 7th Five Year Plan (2016-2020) of Bangladesh has integrated the 2030 sustainable development agenda outlined in the UN post-2015 Sustainable Development Goals (SDGs) and the Rio+20 outcome (the future we want) in the National Five Year Plan (FYP). Although the rapid eradication of extreme poverty is core focus, Bangladesh aims to ensure the equitable sharing of the benefits among the citizens from the development process and drive the country towards Sustainable Climate Resilient Development Pathway in the coming days. The 7th Five Year Plan (7th FYP-2016-2020) of Bangladesh centers on three themes; Development Effectiveness, People’s Empowerment and Sustainable Climate Resilient Development Pathway.

1 Eakin, H. and A. L. Luers (2006). Assessing the vulnerability of social-environmental systems. *Ann. Rev. of Env. and Resources* 31: 365-394.

2 Raleigh, C., 2011: The search for safety: the effects of conflict, poverty and ecological influences on migration in the developing world. *Global Environmental Change*, 21(sup.1), S82-S93

3 Hartmann, B. 2010. Rethinking climate refugees and climate conflict: Rhetoric, reality & the politics of policy discourse, *Journal of International Development*, 22(2): 233-246.

4 Adger, W. N., S. Dessai, et al. (2009). "Are there social limits to adaptation to climate change?" *Climatic Change* 93(3-4): 335-354.

5 Lemos, M. C., E. Boyd, et al. (2007). "Developing Adaptation and Adapting Development." *Ecology and Society* 12(2).

6 Parry, M., Palutikof, J., Hanson, C., Lowe, J., 2008. Squaring up to reality. *Nature Reports Climate Change* 2, 68-70.

7 UNEP, 2015. The Emissions Gap Report 2015. United Nations Environment Programme (UNEP), Nairobi.

From 1992 to 2015, Bangladesh managed to uplift around one-third (32.2%) of the population who were living below the national poverty line (Head Count Poverty was 24.8% in 2015 and 57% in 1992). The incidence of extreme poverty declined to 12 per cent.⁸ Two-fifth (40%) of the population are under 18 years of age.⁹ Around one-fourth of the population or 40 million people (51% male and 49% female) still live below the national poverty line, and around 120 million (76% of the population) subsist below the international poverty line of \$1.90 per day.¹⁰ Even though the agriculture shares in GDP, cultivable land and employment in agriculture are declining, rice production is increasing in Bangladesh. Bangladesh is now world's sixth largest producer of rice. The share of agriculture in GDP declined from over 60% in 1972 to 16% in 2014, with a decline in employment from about 75% to 45% today. Bangladesh has tripled its rice production since its independence, from 10 million MT in 1971 to around 35 million MT today even in the face of declining arable land, on the threshold of exporting food grains.

Development Targets in the Seventh five-year plan (2016-2020) of Bangladesh		Base Year 2010	Vision 2021	Progress under 6 th FYP 2015	7 th FYP 2020
Production, Income Generation and Poverty					
	Real GDP Growth (%)	6.1	10	6.5	8
	Head Count Poverty (%)	31.5	13.5	24.8	18.6
	Reduction of extreme poverty (%)	17.6		12.9	8.9
	Gross National income per capita (in US \$)	843	2000	1314	2009
Sector Development					
	Growth in agriculture (%)	6.15		3.04	3.34
	Growth in industry (%)	7.03		9.6	10.9
	Growth in services (%)	5.53		5.83	6.49
Human Resource Development					
	Population Growth Rate (% per annum)	1.4	1	1.37	1
	Literacy Rate (7+)		100	57.2	100
Water and Sanitation					
	Access to improved sanitation facilities (% of population)	53	100	57	100
	% of rural population with access to improved water source	83	100	84	100
Gender Equality and Social Protection					
	Ratio of girls to boys in tertiary education (%)	32		70	100
	Income Inequality (Gini coefficient)	0.458			0.450
	Spending on Social Protection (% of GDP)			2.02	2.3

HDI Rank	Country	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014	Status of Human Development
171	Afghanistan	0.228	0.273	0.297	0.321	0.334	0.399	0.448	0.456	0.463	0.464	0.465	Low
142	Bangladesh	0.338	0.356	0.386	0.424	0.468	0.505	0.546	0.559	0.563	0.567	0.570	Medium
132	Bhutan							0.573	0.582	0.589	0.595	0.605	Medium
90	China	0.430	0.467	0.501	0.545	0.588	0.641	0.699	0.707	0.718	0.723	0.728	High
130	India	0.362	0.397	0.428	0.462	0.496	0.539	0.586	0.597	0.600	0.604	0.609	Medium
104	Maldives					0.603	0.638	0.683	0.690	0.695	0.703	0.706	High
145	Nepal	0.279	0.325	0.384	0.416	0.451	0.480	0.531	0.536	0.540	0.543	0.548	Low
147	Pakistan	0.353	0.380	0.399	0.424	0.444	0.495	0.522	0.527	0.532	0.536	0.538	Low
73	Sri Lanka	0.571	0.597	0.620	0.645	0.679	0.712	0.738	0.743	0.749	0.752	0.757	High

Source: Human Development Data (1980-2015) <http://hdr.undp.org/en/data#> Highest Human Development Index = 1.000

Bangladesh, at present, puts greater emphasis on disaster and climate change resilient development pathway; sustainable use of natural resources; and management of urbanization transition. The development and implementation of a long term Bangladesh Delta Plan-2100 will be a major long-term policy and institutional initiative to adapt to climate change and manage the water challenges.

8 Government of Bangladesh, 2014. Seventh five-year plan

9 National Institute of Population Research and Training et al. 2015. Bangladesh Demographic and Health Survey 2014 (DHS 2014). Dhaka.

10 Asian Development Bank. 2015. "Key Indicators for Asia and the Pacific. www.adb.org/sites/default/files/publications/43030/ki2014_0.pdf.

CLIMATE RISK STATUS OF BANGLADESH

Bangladesh ranks 6th among the countries of the world¹¹ and ranks 1st among the SAARC countries with long-term climate risk. The World Risk Report 2015, ranks Bangladesh as the world's sixth most at-risk country, with a score of 56.69 per cent for adaptive capacity.¹² Bangladesh has to suffer an annual loss of 2% of GDP by 2050 and 9.4% of GDP by 2100¹³, if the world continues to allow the current trend of carbon emissions. On average, 30% of the country experience annual flooding and 10% of the country area vulnerable to cyclone damage. By 2050, more than one-tenth (10% to 15%) land of the country could be inundated due to 45 cm rise of sea level. One meter sea level rise may force 40 million Bangladeshi people to be internally displaced forever due to the loss of nearly one-fifth (30,000 km²) of land area in Bangladesh.¹⁴

Table 1: SAARC countries in the Long-Term Climate Risk Index (annual averages from 1995 to 2014)

CRI Rank	Country	CRI Score	Fatalities (annual average)		Fatalities per 100,000 Inhabitants (annual average)		Losses in million US\$ (PPP)		Losses per unit GDP	
			Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank
			6	Bangladesh	22.67	725.75	8	0.5157	33	2 438.332
8	Pakistan	31.17	487.40	10	0.3190	53	3 931.403	5	0.699	33
16	India	39.17	3449.05	2	0.3120	54	9 514.966	3	0.248	61
17	Nepal	40.83	246.90	18	0.9963	16	108.908	75	0.250	60
53	Sri Lanka	62.67	44.00	50	0.2277	69	247.865	50	0.199	69
103	Bhutan	97.33	1.20	139	0.1887	73	5.064	149	0.170	75
181	Maldives	175.50	0.00	176	0.0000	176	0.059	179	0.002	173

Source: www.germanwatch.org/en/cri

Currently, half of the people (88 million) of Bangladesh are flood vulnerable. Every year 26,000 people lose their land due to flooding and erosion.¹⁵ Social safety-net schemes provide only limited coverage, with up to 64 per cent of the poor unable to access to any form of social protection¹⁶. Within a decade (2001- 2011), the share of urban population has increased from 20% to 28%. Nevertheless, the annual average growth¹⁷ of CO₂ emission (6.7%) is higher than the annual average growth of GDP (5.25%) and energy consumption (4.77%), calls for enduring commitment of the country for reducing CO₂ emission.

Climate change is reducing the access to adequate nutrition for the poor & overall nutrition security in Bangladesh. The intergenerational cycle of under nutrition is one of the greatest challenges of Bangladesh and malnutrition costs Bangladesh \$1 billion a year¹⁸. Under nutrition reduces a nation's economic advancement by at least 8% (direct productivity losses, losses via poorer cognition, and losses via reduced schooling)¹⁹. In Bangladesh²⁰, nearly one-fourth (24.1%) of the poor households are always living with food insecurity and more than half of the households (62%) reduce their food intake to adjust with any crisis.

11 Sönke Krefit, David Eckstein, Lukas Dorsch & Livia Fischer, 2015: Global Climate Risk Index 2016; Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2014 and 1995 to 2014. Germanwatch, www.germanwatch.org/en/cri

12 Alliance Development Works and United Nations University. World Risk Report, 2015.

13 <http://www.adb.org/news/bangladesh-could-see-climate-change-losses-reach-over-9-gdp-report>

14 Brown, L.R. (2011). World on the Edge: How to Prevent Environmental and Economic Collapse. New York and London: Earth Policy Institute.

15 International Union for Conservation of Nature. 2014. Situation Analysis on Floods and Flood Management. Dhaka.

16 National Social Security Strategy of Bangladesh. 2015. General Economic Division, Planning Commission Bangladesh. July. xix.

17 Md. Sujahangir Kabir Sarkar, SumaiyaSadaka, Md. Mehedi Hasan Sikdar, and Badiuzzaman, 2015: Energy Consumption and CO₂ Emission in Bangladesh: Trends and Policy Implications, Asia Pacific Journal of Energy and Environment, Volume 2, Number 3/2015

18 HKI/IPHN (2001). The Nutritional Surveillance Project in Bangladesh in 1999. Dhaka: Helen Keller International.

19 Bhutta ZA, Das JK, Rizvi A, et al 2013: Maternal and Child Nutrition Study Group. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Lancet 2013. [http://dx.doi.org/10.1016/S0140-6736\(13\)60996-4](http://dx.doi.org/10.1016/S0140-6736(13)60996-4).

20 S. Jahangir Hasan Masum, 2012: Battling the Twin Crises of the 21st Century & Stories of Community Resistance in Asia-Pacific: The Case of Bangladesh, Asia-Pacific Research Network (APRN) & Coastal Development Partnership (CDP).

Prospects & Capabilities in adopting Low Carbon Development Pathway

Despite the insignificant share of past and current emissions of global Greenhouse Gases (GHGs), Bangladesh has been trying to adopt a low carbon development pathway since 2009. Bangladesh was the first Least Developed Country (LDC) who had incorporated forestry, energy (renewable energy, energy efficiency, and natural gas), urban waste and agriculture emission reduction as potential low-carbon development sectors in the Bangladesh Climate Change and Strategy Plan (BCCSAP) in 2009. Sustainable Climate Resilient Development Pathway is one of the three themes of the 7th Five Year Plan (2016-2020) of Bangladesh. The Seventh Five Year Plan considers the integration of environment, climate change adaptation and mitigation in a broader development context as a high priority issue. The Seventh Plan has also incorporated a Green Growth strategy to harmonize economic growth for better environmental sustainability. Bangladesh Bank has lined up a USD 200 million longer term 'Green Transformation Fund' to support green transition of manufacturing practices in the export oriented textiles and leather sectors. Bangladesh Government has adopted a pro-poor Climate Change Management strategy to address low carbon development, mitigation, technology transfer and climate finance within the context of sustainable development goals. Climate change programs will be incorporated in the growth and fiscal policy management. Sustaining agricultural production, developing alternative livelihoods and building community resilience to climate change will continue to be a key issue.

According to the World Bank data for Bangladesh from 1972 to 2011, the average carbon dioxide emissions value for Bangladesh during that period was 0.17 metric tons with a minimum of 0.05 metric tons in 1972 and a maximum of 0.37 metric tons in 2011. The ongoing mitigation initiatives in Bangladesh are mainly focused on energy efficiency, alternative energy use, cook stoves, solar home system, solar irrigation initiatives, energy efficient bulbs, Biogas plants, green belt forestry, carbon sink and CDM. At present, Bangladesh Government is highly interested to reduce carbon emissions from the key sectors (Transport, Infrastructure, Energy and steel & cement manufacturing) through the improvement of manufacturing processes. The government has undertaken many mega-projects (Padma Bridge, metro rail, deep-sea port, Coal-fired Power Plants, Nuclear Power Plant, LNG Terminal and Dhaka Elevated Expressway) which currently consume about 40% of the total production of cement and steel. Bangladesh Bank has been offering 50:50 financing for the non-resident Bangladeshis (NRBs) to boost the real-estate industry. The ongoing process of rapid urbanization will create more demand for cement and steel. The steel sector is expecting 15% growth which will also boost other sectors such as transportation, energy, engineering and construction. At present, more than 400 re-rolling mills are operating in Bangladesh, with an estimated market size of 300 Billion BDT. According to of Bangladesh Re-Rolling Mills Association, the country has the capacity to produce around 7.0 million tons of rod a year, while the local demand is around 4.0 million tones. More than 125 cement companies are currently manufacturing cement.

Renewable energy resources are one of the most efficient and effective solutions for clean and sustainable energy development in Bangladesh²¹. At present, renewable energy is derived from a number of sources, including solar, wind, biomass and biogas. Solar energy is the primary source of renewable energy. The Renewable Energy policy 2008 envisioned 5% of total generation from

21Ahiduzzaman, M. and Islam, A.K.M. S. (2011), Greenhouse gas emission and renewable energy sources for sustainable development in Bangladesh, *Renewable and Sustainable Energy Reviews*, 15(9): 4659–4666.

renewable sources by 2015 and 10% by 2020. Bangladesh government will accelerate the implementation of scalable power generation through renewable energy (solar and wind power) to meet the energy demand in areas where grid supply is not possible during the 2016-2020 under public & private initiatives. In 2002, only 7,000 Bangladeshi households were using solar panels and currently 4 million Solar Home System (SHS) units are delivering 150MW equivalent of power to provide basic lighting services in the off-grid areas²². However, the delivered cost of electricity by SHS unit is high (about Tk. 76/kWh). The Government plans to generate 800MW of power through renewable energy by 2017.

Emergence of the Low-carbon Development Paradigm

In the context of the global development Paradigm, 2015 is a remarkable year for redesigning the global development architecture with the intention of gradually changing the pathways for driving global development vehicles from carbon-concentrated roads to low-carbon development roads. A low-carbon pathway demands gradual transformation of the existing carbon dependent social- economic development paradigm. The term “low-emissions development strategies” was first introduced in the United Nations Framework Convention on Climate Change (UNFCCC) negotiations in April 2008 in the context of a shared vision. In 2009, the Copenhagen Accord have recognized that “*low-emission development strategies are indispensable to sustainable development*”. In 2010, the Cancun Agreements encouraged “*developing countries to develop low carbon development strategies or plans in the context of sustainable development*” as part of their national mitigation action and it should be mandatory for developed countries and encouraged for developing countries. The Cancun Agreements also recognized that “*addressing climate change requires a paradigm shift towards building a low-carbon society*. In 2015, the Paris Agreement brings all nations into a shared vision to undertake take progressively ambitious efforts to transform the world towards a sustainable low carbon future. The Paris Agreement requires all Parties to put forward their best efforts through “*nationally determined contributions*” (NDCs). The Article 2 of the Paris Agreement calls for a paradigm shift of the economic development away from its dependency on fossil fuels and energy intensive systems both at global and national level. Article 4 Paragraph 19 of the Paris Agreement calls that “*All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies*” taking into account of their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances. The low-carbon development pathway has environmental “*co-benefits*” like reduction of fossil-fuel pollution (air and water quality improvements), biodiversity protection and forest conservation.

The following definitions are some guiding outline to understand the terms and concepts linked with Low-Carbon Development paradigm

- **Climate-compatible development (CCD)** safeguards development from climate change impacts (climate-resilient development) and reduces emissions or keeps them low without compromising development goals (low-emissions development)²³. **CCD** as an inclusive development framework aims to addresses both *adaptation with climate risks and vulnerabilities, and mitigation of anthropogenic greenhouse gas emissions* simultaneously.
- **National Low-Carbon Development Pathway (NLDP)** is an integrated policy framework to identify how a country can benefit from pursuing a low-carbon development pathway, and present opportunities, long-term goals, and country-driven priorities for actions in key sectors.

Bangladesh has established the Sustainable and Renewable Energy Development Authority (SREDA) to drive the country towards renewable energy future. The Sustainable and Renewable Energy Development Authority (SREDA) Act 2012 aims to promote, develop and coordinate renewable energy and energy efficiency programs in the country. Bangladesh government is offering fiscal incentives to

22 Zubair KM Sadeque, Energy Finance Specialist, The World Bank, Solar energy is changing the face of the remote, rural areas of Bangladesh. The pace of installation has simply skyrocketed in the last couple of years||, June 13, 2012.

23 CDKN, 2013: ‘Defining Climate Compatible Development’. <http://cdkn.org/resource/defining-climate-compatible-development-3/>

Renewable Energy project developers and investors. Government has also extended fiscal incentives including duty exemption on certain renewable energy products, e.g. solar panel, solar panel manufacturing accessories, LED light, solar operated light and wind power plant. Bangladesh Bank and IDCOL along with private commercial banks are offering dedicated funding support for Renewable Energy project. The government is considering income taxes weavers for foreign and local investors for 15 years. The government is also considering license waiver for installation and operation of renewable power plants with less than 5 MW (megawatts) capacity. The government has allocated about Taka 400 crore (USD 40 million) to promote renewable technologies in Bangladesh. In the 7th Five Year Plan (2016-2020), Government has adopted the 500MW Solar Programme (340MW of commercial sector and 160MW of social sector as a part of social responsibility of the Government).

Renewable Energy Progress during 2011-2015 ²⁴	
Programme	Achievement
Solar Home System (SHS)	150 MW
Solar Irrigation	1 MW
Roof-top solar PV at Government buildings	14 MW
Wind energy	2 MW
Biomass based electricity	1 MW
Biogas based electricity	5 MW
Total	173 MW

According to International Renewable Energy Agency (IRENA), Bangladesh has the 9th largest renewable energy workforce and 4th largest in solar energy workforce²⁵. The solar-related jobs nearly doubled between 2011 and 2013. Among the 129,000 renewable energy workforce, 115,000 jobs were created as a result of the manufacturing, installation and repair of solar power equipment. Urban power authorities in

major cities have also made it mandatory for new electricity consumers to install solar-based renewable units to cover 3% of estimated power demand for the particular building. Keeping the World in-line with the 2-degree global warming target without any net economic cost, the International Energy Agency (IEA)²⁶ recommends four policies interventions, which are: adopting specific energy efficiency measures (49% of the emissions savings), limiting the construction and use of the least efficient coal-fired power plants (21%), minimizing methane emissions from upstream oil and gas production (18%) and phasing out fossil fuel subsidies (12%). Bangladesh has already prepared the “Energy Efficiency and Conservation Map” and “Energy Efficiency Action Plan”. Bangladesh Government with the assistance from the Japan International Cooperation Agency (JICA) is currently formulating a 25-year Power System Master Plan (2016-2041) to meet the growing power demand over 60,000MW by 2041.

Bangladesh imports fossil fuels to provide energy to the citizens. Bangladesh Petroleum Corporation (BPC), the national oil company has a monopoly on importing and marketing fossil fuels in Bangladesh. Nevertheless, this monopoly can be used positively to accelerate the low-carbon transition process if government wants. Bangladesh Government has been popularizing energy saving technologies such as compact fluorescent lamps/bulbs, Light emitting diode electric bulbs and solar energy trapping technologies. Hybrid cars with much higher energy efficiency up to 2,500cc engine are allowed to be imported in the country without having to pay direct tax that are generally imposed for cars with regular engines. The GOB has imposed a ban on the import of old passenger cars which is more than three years old to achieve higher energy efficiency and reduction of particulate emission from old motor engines. GOB has also been promoting electrified irrigating pumps in place of diesel based

24 GED, 2011. The 6th Five Year Plan, General Economics Division (GED), Ministry of Planning, Government of the People’s Republic of Bangladesh

25 International Renewable Energy Agency (IRENA), 2015: Renewable Energy and Jobs: Annual review

26 IEA (2013) Redrawing the Energy- Climate Map. Paris: IEA.

pumps for achieving greater energy in agricultural sector. In 2014, over 20% of an estimated 1.7 million shallow pumps have been running on electricity across Bangladesh.

Nationally Determined Contributions of Bangladesh – Mitigation

Type of Contribution	Needs for international support	GHG emissions reduction targets of Bangladesh with timeline	Targeted Sectors	Types of support requires for NDC implementation
Unconditional contribution	no additional international support	12 MtCO ₂ e by 2030 or 5% below Business as Usual (BAU) emissions for the targeted sectors.	Power, Transport & Industry sectors	national financial resources, staff time
Conditional contribution	additional international support	36 MtCO ₂ e by 2030 or 15% below Business as Usual (BAU) emissions for the targeted sectors.		international support in the form of finance, investment, technology development and transfer, and capacity building

Bangladesh through the Nationally Determined Contributions (NDC) has expressed commitment to reduce future emissions as part of a robust and ambitious international agreement though Bangladesh emissions are less than 0.35% of global emissions²⁷. Bangladesh NDC is built on existing national strategies and plans, particularly the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), Renewable Energy Policy 2008, the Energy Efficiency and Conservation Master Plan (E&CC Master Plan), the National Adaptation Plan, the National Sustainable Development Strategy, the Perspective Plan (Vision 2021) and the Sixth Five Year Plan, the National Disaster Management Plan and the Disaster Management Act. Bangladesh is expected to produce an NDC implementation roadmap by 2016 to review the current situation with respect to implementation of the BCCSAP, identify gaps and support needs, review barriers to implementation and present proposals for NDC implementation next steps.

The focus on strengthening public administration and local governments will be a key priority for the Seventh Plan. Efforts will be made to strengthen institutional capacities of relevant institutions (such as Bangladesh Energy Regulatory Commission, Power Cell, Ministry of Industries, Ministry of Commerce, etc.) in relation to mitigation and realizing the national objecting of achieving LCD.

Livestock contribute both directly and indirectly to climate change through the emissions of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Cattle produce methane gas as part of their digestion and it represents almost one third of the emissions from the Agriculture sector. The sector contributes 18 percent (7.1 billion tons CO₂ equivalent) of global greenhouse gas emissions. Livestock emissions strongly depend on the animal housing, and on the manure management. Poor manure management is a major source of water pollution. About 20 percent of the population of Bangladesh earns their livelihood through work associated with raising cattle and poultry. Manure management offers promising options for mitigation of greenhouse gas emissions in Bangladesh.

Challenges in adopting Low Carbon Development Pathway

Bangladesh has advanced to 83rd position on the Economist Intelligence Unit's Index of Democracy 2010 (which was 91st in 2008). This index is an encouraging notion that democracy is trying to be on track in Bangladesh. However, civil liberties, which are necessary conditions for democracy, have not yet been deep rooted in Bangladesh. A strong local democratic system is yet to be in place to ensure peoples participation for increased acceptance of the decisions political institutions make. In 2016,

²⁷ Ministry of Environment and Forests (MOEF), 2015: Intended Nationally Determined Contributions (INDC), Government of the People's Republic of Bangladesh, September, 2015

Bangladesh ranked 147th out of 167 countries on the Transparency International corruption perception index, and 73rd out of 102 countries on the open government index.²⁸ This envisage significant works are ahead for the government to address the existing gaps. Leadership and political commitment from the highest level is required to initiate the journey towards a low-carbon development path.

The lack of accessible, affordable and efficient energy is forcing Bangladesh to be highly dependent on fossil fuel imports. At the same time, government has to narrow down the ongoing widespread rural energy poverty (living without any or limited access to energy). Sustainable renewable energy is critical to ensuring energy security of the community and mitigating climate change impacts. Ensuring energy security while lowering carbon emissions, will be the key challenge for Low-Carbon Development (LCD) in Bangladesh. The gradual declining of gas reserve for power generation is pushing the country towards the carbon-intensive path through Mega Energy Projects like Rooppur Nuclear Power Plant Project, Rampal Coal Power Project and Matarbari Coal Power Project to meet energy security. It has to be noted that the power sector is the main source of CO₂ emission (0.67 ton CO₂ /MWh) in Bangladesh. In doing so, Bangladesh has been neglecting the required precautionary approach in addressing ecosystem-based adaption, nuclear risks and climate change mitigation impact.

The aspiration of Bangladesh to achieve middle income status is directly linked with meeting the challenge of ever-increasing electricity demand in the coming years. In Bangladesh, the demand for electricity is increasing almost 10% a year and government has been investing heavily in coal fired power plants to meet the current and future energy security. By 2041, 35 percent (around 20,000 MW) power of Bangladesh will be generated from coal. Government is trying to formulate a coal policy considering the role of coal as a primary fuel for the next 10-20 years. Several large coal-based power plants will be completed by 2020 to reach power generation capacity to 23,000 MW and to meet such capacity, Bangladesh will require around 60 million tons of coal per year. Handling this massive volume of coal import will require huge investment for adequate port, rail transport and coal stocking infrastructure. The on-going deep-sea port project in Matarbari Island, currently dedicated for Matarbari Ultra Super Critical Coal-fired Power Plant, will be able to cater ships having 80,000 tons' capacity. Government intends to expand Matarbari deep-sea port and develop a "Coal Center" with the capacity of 12 million tons through Public Private Partnership (PPP) scheme to serve multiple coal-fired power generation projects across the whole country. Too much policy attention on the development of coal-driven power plants is expected to take down Bangladesh towards carbon-intensive development paths. Nevertheless, there is an evidence that the link between economic growth and emissions growth is weakening²⁹. According to the median of the IPCC 2°C scenarios, coal-fired electricity generation without carbon capture and storage (CCS) needs to be almost completely phased out by 2050³⁰.

Since 2010, Petroleum import has grown by 8 percent specially for meeting growing demand of furnace oil for power plants. Bangladesh currently produces 30 percent of its total electricity generation from 45 oil-fired power plants. The government will set up 10 new oil-fired plants under private sector power generation policy on build-own-operation (BOO) basis in Chandpur, Noakhali,

28 www.transparency.org/cpi2015; and <http://worldjusticeproject.org/open-government-index>.

29 <https://www.iea.org/newsroomandevents/pressreleases/2016/march/decoupling-of-global-emissions-and-economic-growth-confirmed.html>

30 Rogelj, J., G. Luderer, R. C. Pietzcker, E. Kriegler, M. Schaeffer, V. Krey and K. Riahi (2015). "Energy system transformations for limiting end-of-century warming to below 1.5°C." *Nature Clim. Change* 5(6): 519-527.

Feni, Meghnaghat, Bagerhat, Takurgaon, Rangpur, Bagura, Santahar and Jamalpur districts. Bangladesh also foreseeing more prospect in power trading. The country currently imports 500 MW from India and expects to increase the import around 5000 MW by next five years. The country is also exploring the potentials of regional cooperation on hydro-power generation and trading.

According to the GenderCC³¹, "Gender sensitive low carbon development is a multi-dimensional approach that encompasses social transformation and changes in production patterns and technologies, avoiding dangerous climate change". There exists a gap in understanding the connections between low carbon investments and poverty reduction. There also exists limited understanding on gender differentiation on Low carbon development (LCD) in public sector. In Bangladesh, Women's labor force participation rate is 34 per cent, versus 82 per cent for men,³² and women's earnings are only 52 per cent of men's.³³ Only 8 per cent of Bangladeshi entrepreneurs are women,³⁴ and only 25 per cent of women have an account at a formal financial institution.³⁵ Levels of gender-based violence remain high, with 87 per cent of married women reporting experience of domestic violence.³⁶ The rural women and girls usually collect fuel wood and fetch water for their households in Bangladesh. This envisage that any LCD pathway should improve women's current situation through preferential measures. Government has expressed commitment to devise a pathway for addressing gender friendly energy efficiency with special emphasis to LCD, which is still waiting to be developed. Bangladesh Climate Change and Gender Action Plan 2013 is a key policy document for integrating gender into low-carbon development.

Since primary objective of Bangladesh has remained adaptation, LCD has not yet received serious attention among the stakeholders. Low-Carbon Development (LCD) paradigm requires appropriate qualifications and new skills on renewable energy production, low-carbon energy efficient technologies, technology transfer and low-carbon energy services with cutting edge technologies. The emission reduction opportunities in manufacturing industries, agriculture, livestock and dairy sectors requires skilled workforce. The lack of technical experts both in government and private sector, with having full understanding on LCD are hindering the advancement of low-carbon development measures. Bangladesh has a very low skilled workforce³⁷. In 2010, 40% of the workforce had no education and 23% had only primary level education. Without a sufficient and capable human resource base, it will be difficult for Bangladesh to make a transition to a low carbon development path. Scaling up low-carbon finance which requires a structural investment shift across the whole economy, is a big challenge for Bangladesh. IPCC also noted that many potentially attractive energy efficiency investments do not meet the short-term financial return criteria of businesses, investors, and individuals³⁸. The unplanned & extremely populated cities are the most climate vulnerable habitat of the future. Although cities account for two-thirds of global emissions, urban climate mitigation has yet to receive the deserved attention from the government.

31 <http://comm.gendercc.net/course/view.php?id=12>

32 Bangladesh Bureau of Statistics (BBS). 2013. Labour Force Participation.

33 "World Economic Forum. 2014 The Global Gender Gap Report – Country Profiles, Bangladesh.

34 Shituma Zaman. 2013. "Women in Business: A Study on the Development of Women Entrepreneurship in Bangladesh". World Journal of Social Sciences. 3 (6) November. 175-188.

35 The World Bank. 2015. The Global Findex Database.

36 BBS. 2013. Report on Violence Against Women Survey, 2011. Dhaka. September.

37 Ryan P, Wager K, Teuber S, Backes-Gellner U, (2010), Corporate ownership and initial training in Britain, Germany and Switzerland, Research Paper No. 99, Centre on Skills, Knowledge and Organisational Performance (SKOPE), Department of Education, University of Oxford, Oxford/School of Social Sciences, Cardiff University, Cardiff, UK

38 IPCC, 2014. 5th Assessment Report-Climate Change 2014: Mitigation of Climate Change, Intergovernmental Panel on Climate Change.

RECOMMENDATIONS FOR LOW-CARBON DEVELOPMENT IN BANGLADESH

The following set of recommendations are mainly surfacing different aspects of Low-Carbon Development in the context of Bangladesh and intends to be thought-provoking for further intensive research:

Nationally Determined Contribution (NDC) can drive Bangladesh towards the Low-Carbon Development Pathway: Nationally Determined Contribution (NDC) could be the key instrument for adopting Low-Carbon Development Strategies to build the Climate-Resilient Bangladesh. Bangladesh has to revise NDC in every five years pursuant to Article 4, paragraph 9, of the Paris Agreement. Bangladesh NDC can set forth mitigation actions for moving the country to a low-carbon, climate-resilient economy without crossing the average per capita emissions of the developing world. The extension of the principles of equity and the CDRRC from the international sphere to the domestic sphere is essential for meaningful climate governance through Nationally Determined Contribution (NDC). NDC should be interpreted in addressing the emission inequality within the context of national sustainability and should be institutionalized at the national level to local level. The country commitments on NDC (Nationally Determined Contribution) under the UNFCCC is expected to directly contribute to the national implementation of the global 2030 Agenda.

Bangladesh needs a Low-Carbon Development (LCD) Policy Framework: Low-Carbon Development Policy Framework combines development and climate urgencies for reducing greenhouse gas emissions without hindering the sustainable growth of the economy and human welfare. Bangladesh has no policy for the formation and development of skills for low-carbon economy. To promote climate resilient low carbon economic development, Bangladesh should consider to devise a new policy framework to impose climate change and low-carbon development obligations on both public and private entities. Bangladesh should develop a robust Low-Carbon Development (LCD) framework incorporating the following strategies:

- ✓ Design Low-carbon development interventions with pro-poor and Human Rights-based approach
- ✓ Integrate social justice and gender issues in LCD planning from the very beginning.
- ✓ Use low-carbon technologies that provide adaptation co-benefits and improve climate resilience.
- ✓ Promote low-carbon life-styles and consumption habits among the citizens.
- ✓ Increase access to clean energy and low-carbon public transport services
- ✓ Devise low-carbon transition plans for all development sectors and cities
- ✓ Avoid risky technologies such as nuclear power and carbon capture & storage.
- ✓ Drive the private sector towards low-carbon investments, research and development.
- ✓ Integrate skills training and education into national low-carbon development plans
- ✓ Gradually reduce the proportion of coal in primary energy consumption
- ✓ Provide subsidies to prosumers, who both produce and consume their own electricity
- ✓ Minimize the waste generation and re-uses waste as a resource

Bangladesh should explore appropriate legislative actions for the transition to a low-carbon economy: To reverse the current carbon-intensive and fossil-fuel driven development paradigm, Bangladesh shall set its own national targets guided by the global level of ambition but taking into account of national circumstances. A Low Carbon Development Act could be helpful for the transition to a low carbon economy, climate resilient sustainable development. Bangladesh may also consider to establish a lead agency of the government on national low-carbon development plans and actions

to provide an overarching national coordination mechanism for the Whole-of-Government approach. The lead agency could be in the form of Council or Secretariat or Directorate. A multidisciplinary expert body to support national level low-carbon development planning can be formed. As Bangladesh has provided serious attention to energy efficiency, a National Commission for Efficient Use of Energy could be helpful for promoting energy efficiency, providing scientific advice in matters of clean energy, and drafting the National Energy Security Strategy with medium (15 years) and long term goals (30 years). Bangladesh government can consider to formulate an Energy Transition Act to promote sustainable and efficient use of energy, regulate the obligations of power companies related to the mandatory share of clean energies as well as tax credit programs for solar electricity generation. Government shall set minimum energy consumption requirements for public buildings and procurement of new low-carbon vehicles.

Bangladesh Government should capitalize the current opportunity for integrating low-carbon development paradigm in the private sector: Bangladesh is currently experiencing a big boom in infrastructure development (power generation, highways, bridges, buildings and telecom). The government is undertaking many mega-projects (Padma Bridge, Metro Rail, Deep-Sea Port, Coal-fired Power Plants, Nuclear Power Plant, LNG Terminal and Dhaka Elevated Expressway) which foresees the increasing demand of energy, cement and steel. It has to be noted that cement and steel both are highly energy and emissions intensive sectors. Production of a ton of steel generates almost two tons of CO₂ emissions and producing a ton of cement generates nearly a ton of CO₂ and requires about 400 pounds of coal. Bangladesh government currently consume about 40% of the total production of cement and steel and this gives an opportunity for the government to transform the private (for example, manufacturing & transport) sectors towards low-carbon development as a policy priority and can include in the future Nationally Determined Contributions (NDCs) of Bangladesh.

Low-Carbon Development requires Whole-of-Government approach for sustained well-being of the citizens: Bangladesh government has expressed commitment to adopt low-emission development strategies if the process does not put additional burden on national economy and financial capacity of the government. All countries of the world have the challenge and the opportunity of building a whole-of-government approach for the transformation of carbon-based economies into a sustainable low-carbon economy.³⁹ Whole-of-Government is an approach that integrates the collaborative efforts of the departments and agencies of a government to achieve a shared goal⁴⁰ and an integrated government response to particular issues on policy development, program management and service delivery⁴¹. A clearly defined accountability arrangements are important for successful whole of government work⁴². The literature identifies importance of planning⁴³ and risk management⁴⁴ to the whole of government approach. According to the 7th Five-Year Plan, a Whole-of-Government approach will be adopted to set up electronic dashboards with administrative alerts across all ministries, directorates, districts, upazilas and union parishads, in order to monitor the speed and quality of service delivery. To improve the coordination within the Government (between ministries, directorates and other levels), GOB is considering to adopt greater decentralization. The National Portal has virtually integrated nearly 42,000 offices of the government in one address

39 OECD, 2015: Better Policies for Development 2015: Policy Coherence & Green Growth, OECD Publishing, Paris.

40 <http://glossary.usip.org/resource/whole-government-approach>, United States Institute of Peace

41 <http://www.apsc.gov.au/publications-and-media/archive/publications-archive/connecting-government/challenge>

42 A Thurley, 2003: 'Whole-of-government outcomes', Canberra Bulletin of Public Administration, vol. 106, pp. 30-35.

43 Fitzpatrick, 2000: Horizontal Management-Trends in Governance & Accountability', Action Research Roundtable on the Management of Horizontal Issues, Canadian Centre for Management Development.

44 Organization for Economic Cooperation and Development (OECD), 2003: Emerging Risks in the 21st Century: An Agenda for Action, OECD Publications Service, Paris.

bangladesh.gov.bd. The Government has adopted the National Sustainable Development Strategy (NSDS) to address the challenge of mainstreaming sustainable development & climate resilient development across all sectors and at all levels of government. More work is required to institutionalize a whole-of-government and broader-society approach to risk management, including in preparing for mega disasters and in implementing the Sendai Framework for Disaster Risk Reduction, particularly for policies and measures targeting women.⁴⁵ Nonetheless, Bangladesh should not use the Whole of Government approach just to make the country energy-secure putting the burden of pollution, social and environmental degradation on the citizens by heavily relying on the coal and nuclear power based energy generations.

Public awareness is the cheapest option for low-carbon lifestyle: Public awareness for the reduction in consumption of water, energy and natural gas at the household level will be very cost-effective approach for adopting low-carbon lifestyle among citizens. The GO & NGO initiatives for the construction and installation of solar system and energy efficient stoves in rural areas has already created a mass-awareness towards low-carbon development pathway. The urban community engagement in building climate friendly urban space (e.g. reducing energy waste, water use) could be an effective approach to raise awareness about climatic change. Building Low Emission Zone or Green Zone such as hospitals, park or residential areas to restrict entry of polluting vehicles may provide signals to the citizens for adopting low-carbon lifestyle.

Women should be the key stakeholder for sustaining low-carbon lifestyle: Climate change is imposing more burden over women who are already struggling with their responsibility to ensure nutrition, water and energy security of their households. Women should be involved in the low-carbon transition in a planned way. A significant reduction in the current household use of fuel wood is expected because of the depletion of forest resources and development-driven deforestation in rural and highland areas of Bangladesh. To make-up the reduced wood, the households use of coal as an energy source for cooking may increase 5 times higher quantity than current practice within the next 20 years. In this context, women have the potential to control domestic coal use in future. The ongoing clean cook-stoves are improving women's health benefits while enhancing energy efficiency in rural areas. Women entrepreneurship on smokeless cook stoves can be explored as an income generation strategy for advancing women-led low-carbon rural economy. More public and private support is required to promote women's involvement for the installation, maintenance and repairs of solar cookers, solar lanterns and solar panels.

Energy auditing and energy efficiency measures should be integrated in corporate sector and urban areas: Advancing low-carbon industrial development pathways has the potential to transform the country towards low-carbon economy. The energy consumption in the residential housing and corporate sectors of Bangladesh are increasing rapidly due to high-rise building construction and rapid urbanization. Lighting consumes about 30% of total electrical energy used in Bangladesh. The Sustainable and Renewable Energy Development Authority (SREDA) has the potential for introducing energy efficiency in corporate sector and urban areas along with promoting renewable energy in rural development. Energy auditing deserves serious attention from the government.

Climate mitigation measures in urban building can transform the city towards low-carbon pathway: In Urban areas, climate change adaptation & mitigation measures should be integrated during the construction of any new building; or else, it will remain unmitigated for at least 20 years considering

⁴⁵Haque, Wöerlen, Islam, and Neelormi, 2015: Towards a More Resilient and Greener Bangladesh: Midterm evaluation of UNDP Bangladesh country programme, 2012-2016, outcome 3.1 and outcome 3.2..

the lifecycle of a building between 20 and 100 years. The energy consumption for mechanical air conditioning could be reduced using vegetation to maintain comfortable temperatures in buildings⁴⁶ and such approach could save about 3%⁴⁷ to 10%⁴⁸ energy needed to heat and cool nearby buildings. The rooftop gardens in urban buildings can act as 'carbon sinks' and contributes in mitigating urban heat island effect, by absorbing greenhouse gases such as carbon dioxide and other air pollutants.

More efforts on Renewable energy innovation is required: Bangladesh has potential to generate 380TW (terra-watts) electricity per annum through solar PV installations and utility solar should be the focus of policy makers. Although land availability in Bangladesh is a constraint, just 20,000 hectares of land (0.15% of Bangladesh land) would be required, for even an ambitious goal of 10GW of utility solar by 2025. Rooftop solar can bring electricity immediately to the one-third of Bangladeshis who have no access to the centralized grid. Besides solar energy other renewable energy options like bio-gasification and wind energy should be explored and promoted.

Conclusion

Bangladesh, due to the challenge of meeting growing energy demands, is still reluctant to adopt the low carbon resilient development paradigm by integrating climate mitigation, and climate adaptation together as one development agenda. It is also challenging for Bangladesh to reduce its greenhouse gas emissions at the same time as adapting to climate change. As Bangladesh is developing in a steady way, the country should not embark the short term economic gain in the expense of long-term cost in the future. Bangladesh should respond to the climate change through a gradual transition process towards a low carbon economy with the long-term vision. If low-carbon development paradigm is appropriately oriented towards poverty reduction, better nutrition, quality education, green infrastructure and sound health, then climate change risk and vulnerability will decline consistently to lead a low-carbon development pathway. More emphasis needs to be put on the capabilities of people and institutions, not just Climate Change threats and risks.

46 Gill, S, J. Handley, R Ennos, S. Pauleit (2007) Adapting cities for climate change: the role of the green infrastructure'

47 Trees, Shelter and Energy Conservation', Arboriculture Research and Information Note 145, AAIS1998

48 National Urban Forestry Unit (2005) Trees Matter: bringing lasting benefits to people in towns