CLIMATE ANALYTICS

COUNTRY PROFILE BANGLADESH

DECARBONISING SOUTH AND SOUTH EAST ASIA

Shifting energy supply in South Asia and South East Asia to non-fossil fuel-based energy systems in line with the Paris Agreement long-term temperature goal and achievement of Sustainable Development Goals

MAY 2019

This country profile is part of the ***Decarbonising South and South East Asia*** report and examines how to shift the energy supply in South Asia and South East Asia to non-fossil fuel-based energy systems in line with the Paris Agreement long-term temperature goal and achievement of Sustainable Development Goals.

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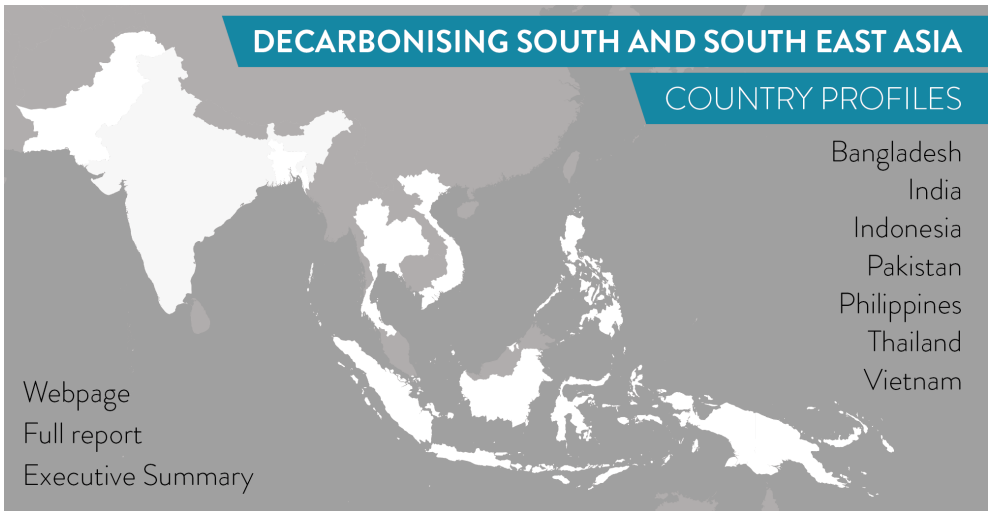

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BANGLADESH

Key Messages

Climate Change Impacts – Paris Agreement temperature goal matters for Bangladesh

- Bangladesh is one of the most vulnerable countries to climate change in the world.
- Bangladesh is already highly vulnerable to the impacts of climate change at present level of global warming of about 1°C above pre-industrial levels.
- In a 3°C warmer world, risks related to extreme heat and flooding are projected to be very high.
- Warming beyond 1.5°C would result in sea level rise of as high as 2.3 m in the long run.

Bangladesh's energy system: Large increase in fossil fuel based infrastructure

- The share of fossil fuels in electricity production in Bangladesh is very high; it increased from 95% to almost 99% between 2000 and 2015. The existing power plants are mostly oil and gas fired. As oil needs to be imported and local gas resources are not sufficient to cover increasing demand, Bangladesh is seeking alternatives to reduce its dependence on oil and gas.
- Increases in capacities for renewable energy technologies have mainly concentrated on solar PV. To cover the energy demand, Bangladesh is already importing substantial shares of its power from India.
- The massive expansion of coal power plants under planning is completely inconsistent with the Paris Agreement, which Bangladesh has signed.
- Expansion of coal-fired power generation is at odds with the goal of stable electricity provision to underserved communities.
- This expansion risks locking Bangladesh into a carbon-intensive development path, and will prevent Bangladesh from reaping the benefit of cheap, clean renewable energy.

Transition to renewable energy offers massive benefits

- Investing in renewable energy capacities can contribute to strengthening energy independence, leading to lower expenditures on fossil fuel imports.
- The decentralised nature of many renewable energy technologies can foster progress with regard to energy access and eradication of energy poverty.
- This also contributes to reducing indoor air pollution and related health hazards.

Targets, projections, and Paris Agreement benchmarks

- Bangladesh's NDC commits the country to an unconditional emissions reduction of 5% below Business-as-Usual emissions by 2030. This can rise to 15%, conditional on international support.
- Current plans to develop domestic coal production, importing LNG to meet domestic gas demands and expansion of coal-fired power (projected to reach a share of 35% by 2041) are not in line with the need to decarbonise the energy system and phase out coal for power generation by 2040, as a Paris Agreement compatible pathway for South Asia shows.
- There is significant scope to develop an ambitious long-term strategy towards 100% renewable energy power generation and electrification of end-use sectors, to align Bangladesh's energy future with the goals of the Paris Agreement and reap benefits for sustainable development, as well as with the goal of the Climate Vulnerable Forum (CVF) countries to achieve 100% renewable energy generation as soon as possible.

Introduction

Bangladesh is one of the most densely populated countries in the world. As a 'lower middle income' country, it faces significant development challenges. Among these is the challenge of providing stable and universal access to electricity at affordable prices. Bangladesh aims to do this by shifting from an electricity mix which is dominated by oil and gas, to one which is dominated by coal-fired power generation.

This risks locking Bangladesh into a carbon intensive development pathway, which fails to recognise the country's vulnerability to the impacts of climate change. Bangladesh faces the choice of a development pathway driven by renewable sources, with significant co-benefits such as reduced pollution related deaths, or one driven by fossil fuels.

1 Climate Change Impacts: Risks, vulnerability and benefits of limiting mean temperature rise to 1.5°C

1.1 Present day vulnerabilities and risks

Similar to many countries of the region, Bangladesh is also acutely susceptible to adverse impacts of climate change. Being a predominately low-lying country, Bangladesh is particularly vulnerable to increased flooding related to sea level rise and storm surge as presented in Table 1. Bangladesh suffers the most from tropical cyclones (storms) which have caused highest number of deaths (approx. 150 000) in the past 30 years. In terms of financial damages, floods come up as the most devastating disaster type resulting in the loss more than 8.5 billion USD as shown in Table 1. Droughts and extreme heat events also have negative repercussions which are likely to exacerbate in the future. Bangladesh currently holds 7th position in the list of Germanwatch long-term climate risk index[1] (Eckstein *et al* 2018).

Table 1: Climate disaster statistics for Bangladesh based on EMDAT database[2] for the period 1989-2018

Disaster Type	Events Count	Total Deaths	Total affected (million people)	Damage (million US$)
Drought	2	No data	5	No data
Extreme temperature	23	2 474	0.4	No data
Floods	65	6 067	139.1	8 862.3
Storm	106	149 495	46.1	5 957.7

[1] The Germanwatch Global Climate Risk Index is an analysis based on one of the most reliable data sets available on the impacts of extreme weather events and associated socio-economic data. However, the index must not be mistaken for a comprehensive climate vulnerability1 scoring. It represents climate-related impacts and associated vulnerabilities but, for example, does not take into account important aspects such as rising sea-levels, glacier melting or more acidic and warmer seas. https://germanwatch.org/en/cri

[2] https://www.emdat.be

1.2 Projections on climate impacts comparing 1.5°C and temperature increase under current pledges

With a global mean temperature increase of 3°C above pre-industrial levels, corresponding to the warming projected for current NDCs, risk associated with extreme heat is likely to worsen with temperature reaching to almost 45°C bearing negative consequences for labour productivity, along with flooding risks which also show an increase of 8% and 17% in 1.5 and 3°C warmer worlds respectively.

Table 2: Future projections of different climatic variables averaged over Bangladesh, based on an ensemble of CMIP5 Global Climate Models for 1.5°C and 3°C warmer than pre-industrial worlds [3]

Indicator	Historical (1986–2015)	+1.5°C World (Paris Agreement)	+3.0°C World (Current NDCs)
Annual Averages			
Near-Surface Air Temperature (°C)	24.75	+1	+2.6
Precipitation	1320 mm	+2.2%	+8%
Extreme Events			
Drought: Consecutive drought days (Days)	49.6	-0.7	-1.8
Heat: Annual Maximum of Daily maximum Air Temperature (°C)	42	+1	+2.2
Flooding: Annual Maximum 5-day Consecutive Precipitation (mm)	176.2	+14.8	+30.5

Table 3: Future projections of Sea Level Rise (cm) as compared to today's level for Bangladesh based on the data from Robert Kopp et al. (2014). Average values of 4 tide gauged stations across Bangladesh are presented. The values in the brackets in the left column are the temperature difference for each future scenario between the end of 21st century (2081-2100) and pre-industrial period (1850-1900)

Sea Level Rise (cm)	2050	2100	2150	2200
RCP 2.6 (1.6°C)	23	68	100	135
RCP 4.5 (2.4°C)	34	79	122	164
RCP 8.5 (4.3°C)	37	97	159	233

Bangladesh is among the countries which are most susceptible to sea level rise (SLR) due to global warming. The Paris Agreement limit of 1.5°C would result in substantially lower sea level rise than for higher levels of warming, in particular in the long run, with a sea level rise of around 2.33m instead of 1.35m by the end of the 22nd century in a 4.3°C world compared to a 1.6°C warmer world (Table 3)[4]. Risks that tropical cyclones pose to Bangladesh are projected to increase substantially. Under a 2.4°C

[3] The presented values are based on an ensemble of general circulation models (GCMs) from CMIP5 archive. Global Mean Temperature (GMT) increase of 1.5°C and 3°C above pre-industrial levels are derived for 20-year time slices with the respective mean warming for each model separately. The warming levels are derived relative to the historical period 1986-2005 and this period is considered to be 0.6°C warmer than pre-industrial levels (1850–1900). For definitions of extremes indicators, please see (Schleussner et al 2016)

[4] Due to a lack in the scientific literature, we cannot yet provide projections for a 1.5°C scenario. However, global sea level rise by 2100 is about 10cm lower under a warming at 1.5°C compared to a 2°C scenario [IPCC 1.5°C Special Report]. Beyond 2100, only limiting warming to 1.5°C may limit global sea level rise to below 1m,at least 0.5m less than what a 2°C would entail.

scenario, the number of Category 4 and 5 cyclones will increase by about 130%[5]. The severity of the tropical cyclone hazard will be further amplified by increases in extreme precipitation and sea level rise.

2 Socio-economic context

2.1 Economic background

Table 4: Overview on socio-economic characteristics and development over time (Bangladesh)

Indicators on economic and human development		Source	2000	2010	Most recent (2017)
Per capita income	GDP/capita in current US$	WB-WDI	406	758	1,517
	GDP/capita adjusting for purchasing power (in PPP, constant 2011 international $)	WB-WDI	1,642	2,443	3,524
Economic growth	GDP growth rate per capita (annual, in %)	WB-WDI	3.3%	4.4%	6.2%
Human development	Human Development Index (HDI)	UNDP	0.468	0.545	0.608 *(Rank 136)*
Population	Population in millions	WB-WDI	132	152	165

Notes: PPP – Purchasing Power Parity. GDP – Gross Domestic Product.

Sources: WB-WDI – World Bank World Development Indicators (The World Bank 2019). *UNDP – United Nations Development Program* (United Nations Development Program 2018a).

Bangladesh has a population of over 160 million people and is one of the world's most densely populated countries. It is classified by the World Bank as a "lower middle-income country" since 2014. In 2018, Bangladesh for the first time fulfilled all three criteria for graduation from the UN's list of "Least developed Countries" (LDC), meaning that it could graduate from the list in 2024 (The World Bank 2018). Since 2010, Bangladesh has achieved enormous economic growth rates (per capita) of between 4 and 6% (The World Bank 2019). Between 2000 and 2017, Bangladesh has achieved to more than triple its per capita income (in US$) and more than doubling it in terms of purchasing power parity in the same period (see Table 4).

Bangladesh also made progress in reducing poverty, decreasing the share of people living in extreme poverty (with less than 1.90$ (2011 PPP) a day) from almost 35% in 2000 to under 15% in 2016 (The World Bank 2019). However, in 2016 still over 84% of the people in Bangladesh have been living with less than 5.50$ (2011 PPP) a day (compared to over 91% in 2000) (The World Bank 2019).

Between 1990 and 2017, Bangladesh has increased its Human Development Index (HDI) value from 0.387 to 0.608, an increase of about 57% (United Nations Development Program 2018b). Bangladesh's 2017 HDI is below the average of all countries in the HDI-category of 'medium human development', and also below the average for countries in South Asia (United Nations Development Program 2018b). When Bangladesh's 2017 HDI value is discounted for inequality, it falls to 0.462, a loss of almost 24% due to inequality (United Nations Development Program 2018b).

[5] Relative to 1986-2005 for the North Indian Ocean basin, from Bhatia K, Vecchi G, Murakami H, et al (2018) Projected Response of Tropical Cyclone Intensity and Intensification in a Global Climate Model. J Clim 31:JCLI-D-17-0898.1. doi: 10.1175/JCLI-D-17-0898.1

2.2 Energy System status and historic development

Table 5: Energy system indicators for Bangladesh: current status and recent development

Energy system indicators		Source	2000	2010	Most recent	
					Value	Year
Primary Energy intensity of the economy (energy / GDP)	Energy intensity level of primary energy (MJ/$2011 PPP GDP)	WB-WDI*	3.54	3.44	3.01	2017
Carbon intensity of energy	kg CO_2 per MJ energy use	WB-WDI	63.89	82.24	86.51	2014
Carbon emissions per capita⁺	t CO_2 /population	EDGAR	0.20	0.39	0.46	2016
Fossil fuel share in total energy	Share in total primary energy (%)	WB-WDI	57.94	70.97	73.77	2014
Electricity use	Electric power consumption (kWh per capita)	WB-WDI	101.49	239.83	310.39	2014
Fossil fuel share in electricity production	Electricity production from oil, gas and coal sources (% of total)	WB-WDI	95.25	98.21	98.77	2015
Share of coal in electricity production	Electricity production from coal sources (% of total)	WB-WDI	0.00	1.89	1.69	2015
Modern RE share in electricity production	Electricity production from renewable sources, excluding hydroelectric (% of total)	WB-WDI	0.00	0.00	0.27	2015
Renewable energy capacities	Installed RE capacity (in MW)	IRENA				
	Wind (onshore)		0	2	3	2017
	Wind (offshore)		-	-	-	-
	Solar (Concentrated)					-
	Solar (Photovoltaic)		0	32	176	2017
	Biogas					2017
	Bioenergy (Solid Biomass)		0	1	5	2017
	Hydropower		230	230	230	2017
	Geothermal		-	-	-	-

*Notes:*Calculation of most recent value based on latest available WB-WDI data and growth rates from BP* (BP 2018). *⁺CO2 emissions do not include emissions from LULUCF. PPP – Purchasing Power Parity. GDP – Gross Domestic Product.*

Sources: WB-WDI – World Bank World Development Indicators (The World Bank 2019). *IRENA – International Renewable Energy Agency Database* (IRENA 2019). *EDGAR emissions database* (JRC 2016).

Energy use (total) in Bangladesh has almost doubled between 2000 and 2014 (The World Bank 2019). In per capita terms however, Bangladesh's energy use has increased by 60% between 2000 and 2014 and was only about 11% of the world average in 2014 and only about a third of the average lower middle income country energy use (The World Bank 2019).

Bangladesh has achieved to slightly decrease the energy intensity of its economy between 2000 and 2017, meaning that energy demand grew slower than economic growth. However, its carbon intensity of energy has increased between 2000 and 2014. One reason for this is that Bangladesh's share of fossil fuel sources in total energy consumption has risen from below 58% in 2000 to almost 74% in 2014.

Bangladesh's CO_2 emissions per capita[6] have more than doubled from 0.2 to 0.46 metric tons of CO_2 per capita between 2000 and 2016 (see Table 5), but remaining very low (less than one tenth) compared to the world's average of 4.8 tCO_2/capita (JRC 2016).

Electricity consumption per capita has more than tripled in Bangladesh between 2000 and 2014. With 310 kWh per capita, Bangladesh's electricity consumption remains comparably low, amounting to below 10% of the world's average per capita electricity consumption (3,127 kWh/capita) and only 40% of the average electricity consumption of lower middle income countries (767 kWh/capita) in 2014 (The World Bank 2019). The CIA World Factbook estimates that Bangladesh's electricity consumption has risen to 329.2 kWh/capita in 2016 (CIA 2019).

The share of fossil fuels in electricity production in Bangladesh is on a very high level, even increasing from 95% to almost 99% between 2000 and 2015. However, coal so far as played only a minor role in Bangladesh with a share of 1.7% of coal in electricity production in 2015. The existing power plants in Bangladesh are mostly oil and gas fired, but as oil needs to be imported and local gas resources are not sufficient to cover increasing demand, Bangladesh is seeking for alternatives to reduce its dependence on oil and gas (Islam and Khan 2017).

So far, the share of electricity produced from renewable sources (excluding hydro) has remained low although slightly increasing from 0% in 2010 to 0.3% in 2015. Also including hydro, the share of RE in total electricity output was only 1.2% in 2015 (The World Bank 2019). Increases in capacities for renewable energy technologies have mainly concentrated on solar PV. To cover the energy demand, Bangladesh is already importing substantial shares of its power from India, recently adding another 500MW increasing overall power imports from India to exceed 1,000MW (Dhaka Tribune 2018).

Distribution loss remains an important issue in Bangladesh, although it has achieved to already reduce the share of output lost due to transmission and distribution losses from 15% in 2000 to 11% in 2014 (WDI). In 1990-91, its was at almost 36% (Islam and Khan 2017).

[6] Excluding carbon emissions from land-use, land-use change and forestry.

2.3 Energy system and sustainable development – potential for benefits of a transition to renewable energy

Table 6: Indicators showing sustainable development implications of the current energy system and potential for benefits of a transition to renewable energy (co-benefits) (Bangladesh)

Indicators for co-benefits potential		Source	Most recent	
			Value	Year
Fuel import dependency	Share of national income (GDP) spent on fuel imports (%)	WB-WDI+	2.4	2015
	Public expenditures spent on fuel imports (in billion current US$)	WB-WDI+	4.6	2015
Reliability of electricity supply	Share of firms experiencing electrical outages (%)	WB WDI	73.4	2013
	Power outages in firms in a typical month (number)	WB WDI	65	2013
	Share of sales lost for firms subject to power outages (%)	WB WDI	5.5	2013
Access to modern energy	Share of population with access to electricity (in %)	WB WDI	75.9	2016
	Share of rural population with access to electricity (in %)	WB WDI	68.9	2016
	Share of urban population with access to electricity (in %)	WB WDI	94.0	2016
	Share of primary schools with access to electricity (in %)	SDG-database	43.3	2016
	Share of population with access to clean fuels or technologies for cooking (in %)	WB WDI	17.7	2016
Indoor air pollution and health impacts	Number of deaths attributed to indoor air pollution* (per 100 000 inhabitants)	SDG-database	102	2016
Outdoor air pollution and health impacts	Share of population exposed to levels of fine particulate matter (PM 2.5) exceeding WHO guidelines (in %)	WB WDI	100.0	2016
	Number of deaths attributed to ambient air pollution* (per 100 000 inhabitants)	SDG-database	74	2016

*Note: *age standardised mortality rate of WHO. ⁺Own calculations based on WB-WDI. GDP – Gross Domestic Product. WHO – World Health Organisation.*

Sources: WB WDI – World Bank World Development Indicators (The World Bank 2019). SDG-database -Sustainable Development Goals data base (United Nations 2019).

Due to an expansion of oil-based power plants to cope with ceasing natural gas resources, Bangladesh has recently turned from a net fuel oil exporting country to a net fuel oil importer, with fuel oil imports expected to increase by about 25% in 2019 (S&P Global Platts 2018). In 2015, Bangladesh has spent about 2.4% of its GDP on fuel imports, amounting to public expenditures of about 4.6 billion USD (see Table 6). Additionally, Bangladesh increasingly relies on large scale electricity imports from India. A

transition to renewable energy could contribute to reducing energy security concerns and public expenditures on fossil fuel imports freeing resources for other investments.

Lacking reliability of electricity supply is also a serious issue in Bangladesh, affecting private households as well as businesses and industry. Over two thirds of the firms in Bangladesh (73%) report to have been affected by power outages in 2013, with on average 65 outages happening every month (see Table 6). These firms affected by power outages are estimated to have lost a value of about 5.5% of their sales due to the outages. In November 2014, Bangladesh experienced a country wide blackout, forcing hospitals and companies to rely on back-up generators or stop service (Reuters 2014). Decentralized RE technologies can provide an alternative to inefficient fossil fuel based back-up generators.

Lack of access to modern energy remains a problem in Bangladesh. Overall, less than 75% of the population had access to electricity in 2016, with 94% in urban areas compared to only 69% in rural areas (see Table 6), leaving about 39 million people without access (ESMAP 2019). Moreover, more than half of all primary schools in Bangladesh had no access to electricity in 2016, affecting developments prospects with regard to education. Renewable energy, especially in the form of mini-grid and off-grid systems such as solar home systems, can provide opportunities for providing access for rural areas (see below).

In 2016, the share of people with access to clean cooking fuels was still only 17.7% (see Table 6). leaving more than four fifths of the population exposed to health hazards from indoor air pollution due to the burning of traditional biomass inside of dwellings. Accounting for age structure, about 102out of every 100,000 inhabitants in Bangladesh die due to indoor air pollution. The World Health Organization (WHO) estimated the number of deaths attributed to indoor air pollution in Bangladesh to amount to over 113,000 in 2016 (World Health Organisation 2018).

Also, outdoor air pollution is a serious health concern in Bangladesh, especially in urban areas. In 2016, all of Bangladesh's population was exposed to fine particulate matter concentration levels exceeding recommended limits by the WHO. The number of deaths attributed to outdoor air pollution in Bangladesh is estimated to amount to about 82,000 in 2016 (World Health Organisation 2018) – with about 74 out of 100 000 inhabitants dying because of outdoor air pollution.

3 Policies and projections on future development

In its NDC Bangladesh pledged to reduce GHG emissions from the power, transport and industry sectors by 2030 by 5% in comparison to BAU scenario. Conditional upon international assistance, a 15% emissions reduction could be achieved. Also a target of generating 10% of energy from renewable sources by 2020 has been mentioned (MOEF 2015a).

In 2016 almost 76% of Bangladesh population had access to electricity, with 94.01% and 68.85% of the urban and rural populations having access to electricity respectively (ESMAP 2019). According to projections from 2010, electricity demand was expected to grow between 7.5 and 16 times between 2005 and 2035 (Mondal *et al* 2010). Between 2005 and 2016 it has already increased fourfold (Mondal *et al* 2010, BP 2018). The increasing energy demand is partly the result of subsidized energy costs. In 2016 the subsidies amounted to between USD 500-600 million (The World Bank 2016).

The country's Power System Master Plan (PSMP) published in 2016 by the Bangladeshi Ministry of Power, Energy and Mineral Resources saw the development of domestic coal production infrastructure as a key goal and strategy to reduce dependency on imports and on natural gas. By 2041, 38% of the energy supply was expected to be sourced from natural gas, 25% from oil, 20% from coal, 9% from nuclear sources, 3% from biofuels, and 5% from imports, and only about 197 ktoe from renewable sources (MPEMR 2016).

BOX: relevant key policies related to energy supply sector

- **Nationally Determined Contribution:** Unconditional 5% GHG emissions reductions by 2030, with a conditional target of 15%. By 2020, 10% of energy demands are to be renewably sourced (MOEF 2015b).
- **Renewable Energy Policy of Bangladesh 2009:** aims to encourage the development of and investment in renewable energy technologies for rural and urban energy supply. Renewable sources should meet 10% of the total Bangladeshi energy demand by 2020 (IEA 2009).
- **Power System Master Plan 2016:** The plan outlines policies and projections until 2041. Aims to develop domestic coal production. Importation of LNG to meet domestic gas demands will increase exponentially to supply 70% of Bangladeshi gas by 2041. Import 9GW of cross-border energy by 2041 and encourage cross-border South Asian energy trade. The plan recommends shifting towards renewable energies when the technology has lower investment costs than fossil fuels (MPEMR 2016).

4 Projections on planning for coal

Currently, coal plays a negligible role in Bangladesh's power mix with a share of only about 2%, with only 561 MW of coal-fired operating capacity. However, the government is betting on coal for meeting the fast-growing energy needs of the national population and is planning a massive expansion of coal-fired generation capacity. Motivations for the planned expansion of coal are multiple, but diversification of the power mix (currently gas dominates with a share of 60%), against the background of decreasing gas reserves, remains an important policy objective of the country.

Focus: The Power System Master Plan

The Power System Master Plan provides projections of the share of coal in the electricity mix until 2041 (Ministry of Power 2016). The share of coal is projected to see a large rise from just 1.81% in 2017 to 35% by 2041.

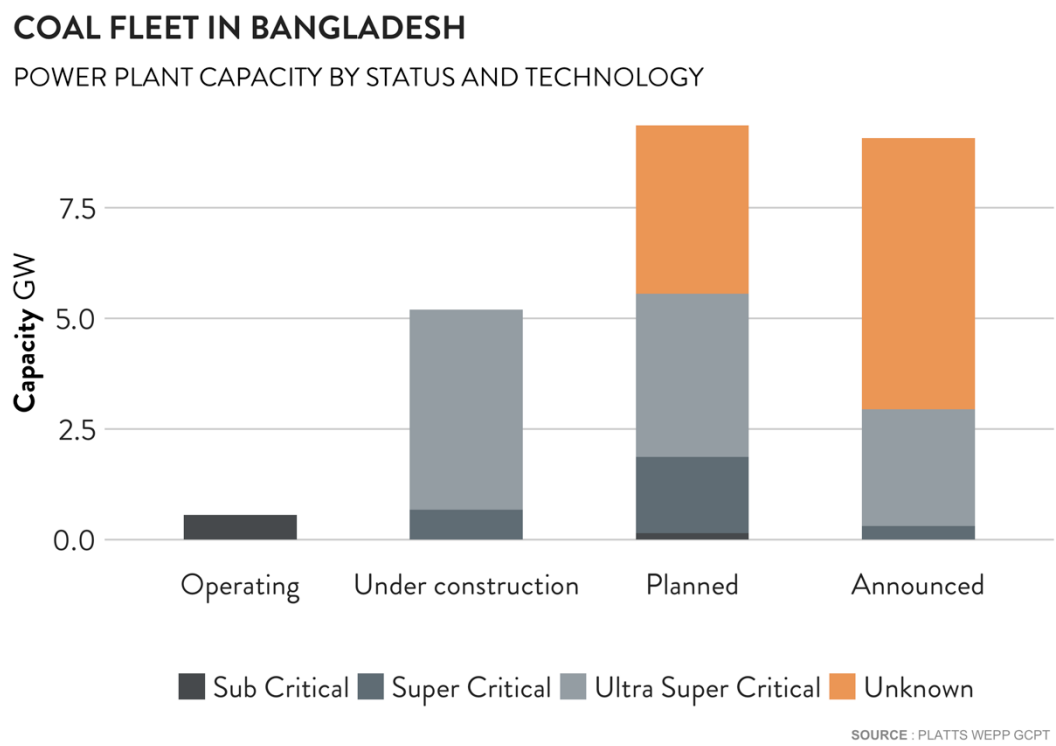

Figure 1: Bangladesh's coal fired power generation capacity

Bangladesh's coal-fired expansion plans amount to nearly 320% of the current capacity[7] in the country (Figure 1). At a global level, this expansion accounts for over 5% of the global coal-fired expansion plans. While most of the coal plants in the pipeline are super or ultra-super critical, with a lower emission intensity than the current fleet, construction of these plants would represent substantial additions to the emissions profile of the country.

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[7] Here, we define current capacity as total operating capacity + capacity under construction, and to expansion plans as planned capacity (permitted and pre-permitted units that have not started construction) + announced capacity.

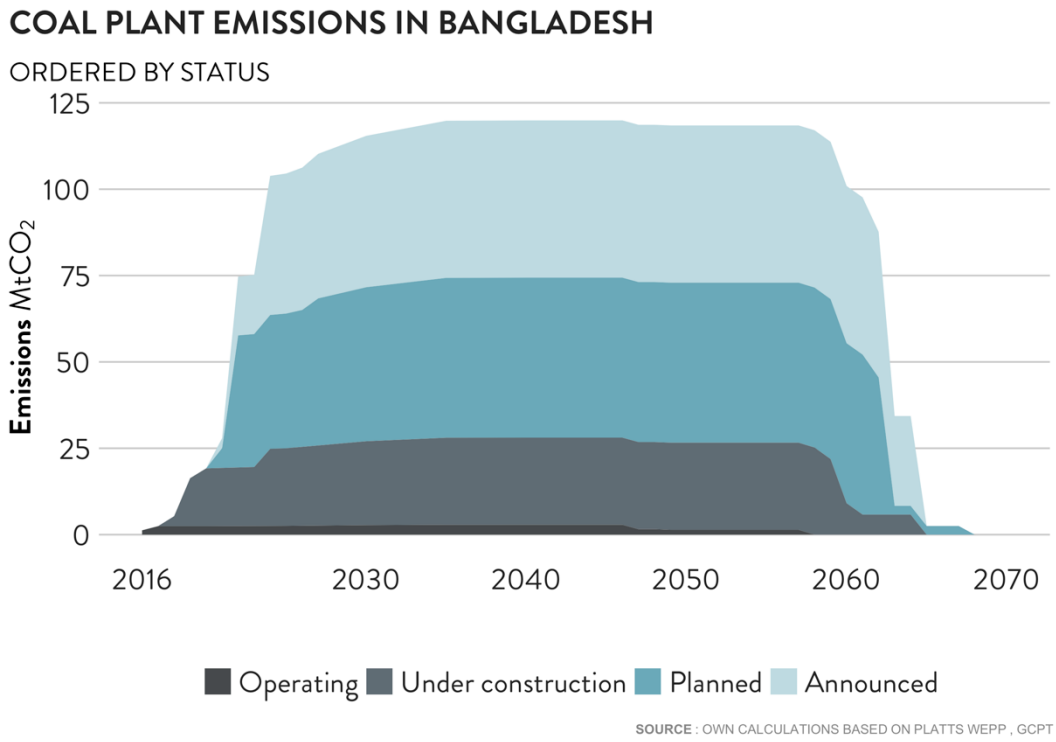

Figure 2: Committed emissions from Bangladesh's coal plants

The committed emissions from the massive expansion of coal-fired power plants in Bangladesh mean that emissions are likely to peak only by 2060, with an eventual phase-out only by 2067 (Figure 2). This far exceeds any Paris Agreement compatible pathway for the energy sector as discussed in Chapter 3, which requires coal-fired power being phased out in South Asia countries by 2040 at the latest.

Moreover, as most of the planned fossil fuel generation capacity expansion would rely on fossil fuels imports, the current energy plan would instill a long-term energy dependence. This would make the national economy vulnerable to external shock, and potentially bringing a drag to the current account deficit, eroding the currency, and importing inflation (Buckley *et al* 2016).

5 Transition to renewable energy – pathway characteristics, benchmarks, options, potentials, benefits

5.1 Potential and technology options for renewable energy

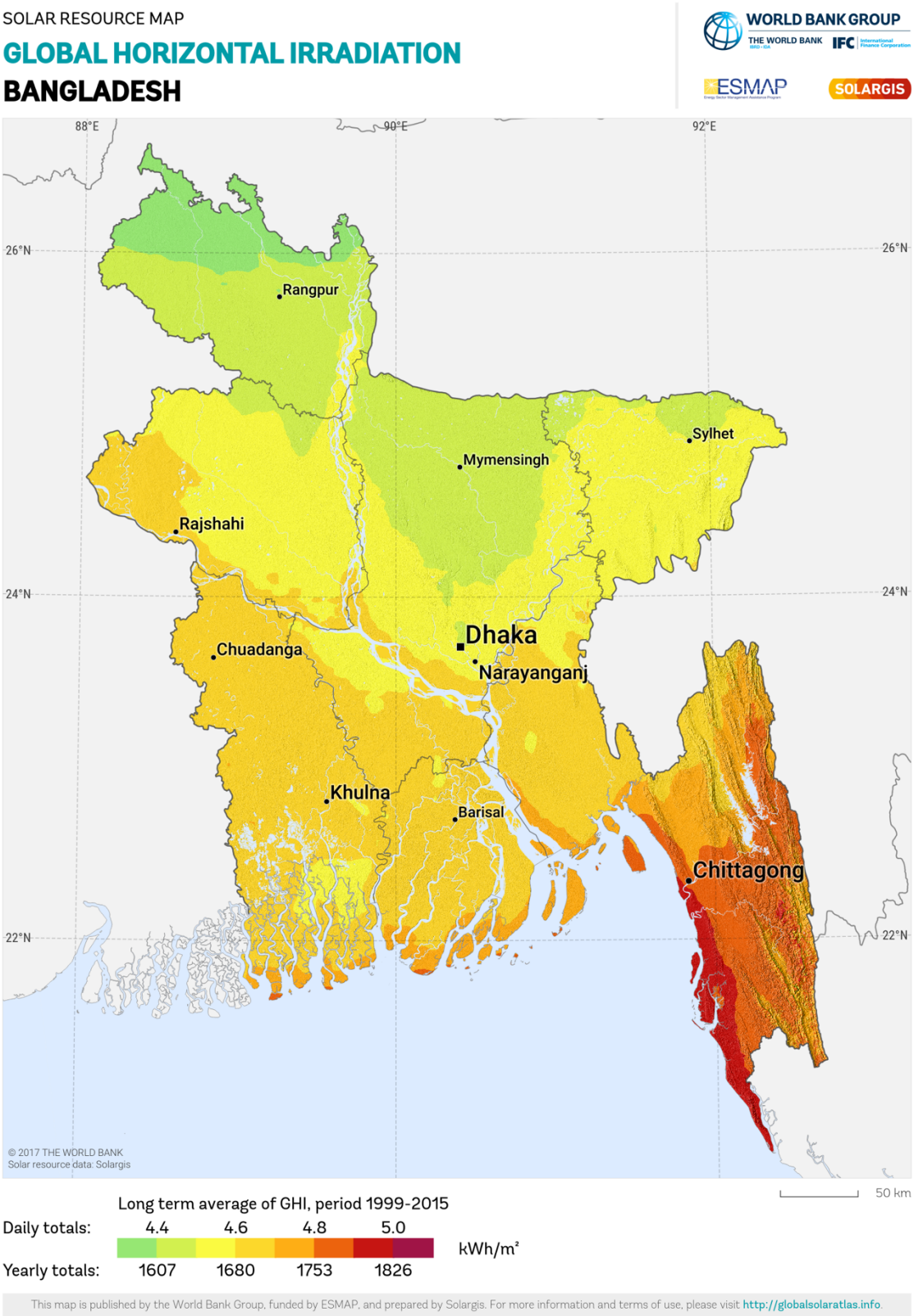

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Figure 3. Global horizontal irradiation based on Global Solar Atlas (The World Bank Group 2016)

Bangladesh has modest solar potential compared to other countries in the region, with the very few areas receiving over 5 kWh/m2 of average Global Horizontal Irradiance daily. However, covering 1.5% of Bangladesh's land area with optimally oriented PV panels could potentially generate 3080 TWh of electricity, which is equivalent to 7 times the total consumption of electricity in 2016 (NREL 2014, BP 2018). Bangladesh has relatively poor wind potential, with average wind power densities of 145 W/m2 in the top 10% windiest regions in the country.

5.2 Reaping opportunities of transitioning to renewable energy: Implications for local jobs and affordability of energy

Renewable energy can contribute to addressing several of the socioeconomic challenges Bangladesh is facing (see section 5.3.3).

Investing in RE capacities can contribute to strengthening energy independence, leading to lower expenditures on fossil fuel imports, less susceptibility to international market price fluctuations or geopolitical shocks.

The decentralized nature of many RE technologies can moreover foster progress with regard to energy access and eradication of energy poverty in Bangladesh, thereby also contributing to reducing indoor air pollution and related health hazards. Also, outdoor air pollution could be reduced by shifting away from fossil fuel combustion. Moreover, renewable energy technologies provide opportunities for local employment.

In a scenario towards 100% renewable energy (Teske *et al* 2019) Bangladesh is together in a sub-region with Thailand and Myanmar. By 2030 renewable sources make up two-thirds of electricity supply, and rise to 80% by 2050, with a decarbonisation of end use sectors.

6 Gap analysis: targets, projections, and Paris Agreement benchmarks

Bangladesh's NDC commits the country to an unconditional emissions reduction of 5% below Business-as-Usual emissions by 2030. This can rise to 15%, conditional on international support.

Current plans to develop domestic coal production, importing LNG to meet domestic gas demands and expansion of coal-fired power (projected to reach a share of 35% by 2041) are not in line with the need to decarbonise the energy system and phase out coal for power generation by 2040 as a Paris Agreement compatible pathway shows for South Asia.

A Paris Agreement consistent pathway shows a complete decarbonisation of the electricity generation by 2050 and a share of at least 60% of decarbonised electricity generation in 2030. Similarly, in a scenario towards 100% renewable energy described in chapter 2 (Teske *et al* 2019), where Bangladesh is together in a sub-region with Thailand and Myanmar. By 2030 renewable sources make up two-thirds of electricity supply, and rise to 80% by 2050, with a decarbonisation of end use sectors.

This shows there is significant scope to develop an ambitious long-term strategy towards 100% renewable energy power generation and electrification of end-use sectors, to align Bangladesh's energy future with the goals of the Paris Agreement and reap benefits for sustainable development, and also align them with the goal of the Climate Vulnerable Forum (CVF) countries to achieve 100% renewable energy generation as soon as possible.

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