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## Bangladesh – Power hungry

- Bangladesh is facing a power crisis; liquid fuel-based power plants are not a sustainable solution
- Clarity is needed on domestic coal extraction; progress being made on imported coal and nuclear
- Inefficiencies in project implementation need to be addressed
- Significant room for private-sector and bank financing of power projects in the coming years

### Summary

Bangladesh's power deficit is a well-known fact. Both electricity consumption and access to electricity are relatively low compared with other South Asian economies'. The demand-supply gap leads to regular load shedding, with a 23% peak shortfall in generation recorded in FY13 (year ended June 2013).

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The current government's strategy has been to use short-term liquid fuel-based rental power plants to temporarily plug the electricity gap given the depletion of domestic natural gas resources. This strategy has borne fruit, but is also a costly form of electricity generation. Hence, progress is needed on developing long-term lower-cost sustainable sources of power generation (new gas exploration, coal, nuclear).

Bangladesh has significant high-quality coal reserves, but a number of contentious issues serve as roadblocks to domestic extraction. These include open versus closed pit mining, energy versus food security, environmental costs, and land acquisition versus displacement of people. Clarity is needed on these issues and on a national coal policy. Progress is being made on developing plants for imported coal, which highlights the government's resolve on this front. On nuclear power generation, progress has been slow for several years but the government is now making progress on building the Rooppur nuclear power plant; talks on another plant in the south are underway. Finally, resolution of maritime disputes should allow new gas-reserve exploration.

The government's energy master plan sees electricity generation at 39,000MW by 2030, versus estimated demand at 34,000MW at that date. To achieve these targets, project implementation will be crucial. Between 2010 and 2013, only c. 50% of planned electricity generation was added to the grid. Inefficiencies in project implementation need to be resolved at the earliest. Building transport and storage infrastructure for coal will also be critical in solving the power crisis.

In every crisis there is opportunity: plugging the energy gap will require USD 60bn of additional investment up to 2030. The government will not be able to fund this solely, which lends significant room for private-sector involvement. Private or public-private partnership projects rely partially on bank lending for financing. On this basis, we see room for bank financing of power projects to grow; our estimates for bank financing range between USD 10bn and USD 20bn cumulatively up to 2030. Investing in energy capacity is likely to have a positive effect on growth. USD 60bn of investment has the capacity to raise nominal GDP by USD 50bn by 2030 (*ceteris paribus*).



*Consumption of electricity and access to electricity are relatively low in Bangladesh*

**Bangladesh’s power deficit provides large investment opportunities**

Bangladesh’s power deficit is a well-known fact. Three indicators can be used to demonstrate a shortage of electricity – electricity consumption per capita, access to electricity, and the demand-supply gap in electricity. Consumption of electricity per capita in Bangladesh stands far below that of regional peers. Bangladesh consumes c. 259kWh per capita, versus a South Asia average of 605kWh, and tellingly lower even than Pakistan’s consumption, which stands at 449 (Figure 1).

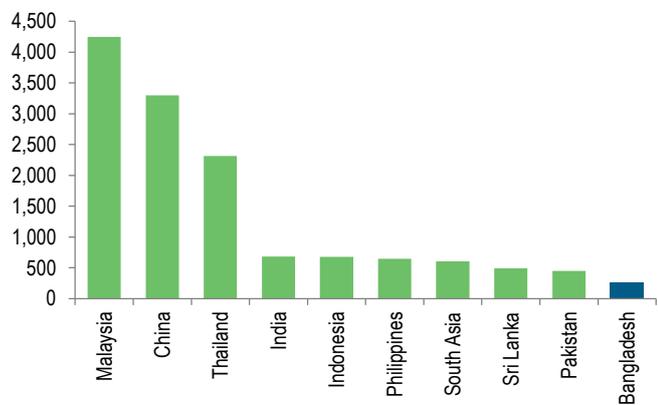
*The demand-supply gap leads to load shedding in excess of 1,000MW during peak hours*

On access to electricity, Bangladesh again ranks extremely poorly versus other Asian economies. At 60%, access to electricity is lower than the South Asia average of 73% and lower than that of countries that are also struggling with power crises, such as India and Pakistan (Figure 2). The government targets providing electricity to all by 2021. On the last metric, Bangladesh witnessed load shedding in excess of 1,000MW during peak hours as of FY13. In FY13, peak generation was 6,434MW (with a maximum generation capacity of 8,537MW), versus peak demand of 8,349MW. This represents a 23% shortfall during peak times. As this data shows, though maximum installed capacity exceeds maximum demand, maximum generation falls short of demand (Figure 3). The reasons for this are (1) some plants are out of operation for maintenance, rehabilitation and overhauling; (2) productivity in some plants is low due to ageing (25% of generation capacity as of 2011 had a life of more than 20 years; these plants are frequently subject to shutdown and operate at high maintenance costs); and (3) the natural gas shortage.

*Generation falls short of installed capacity for a variety of reasons*

**Figure 1: Relatively low electricity consumption**

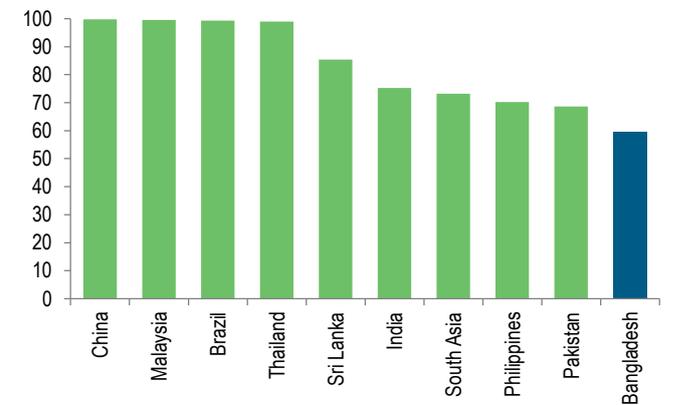
*Electric power consumption (kWh per capita)*



Source: World Bank, Standard Chartered Research

**Figure 2: Access to electricity is relatively low as well**

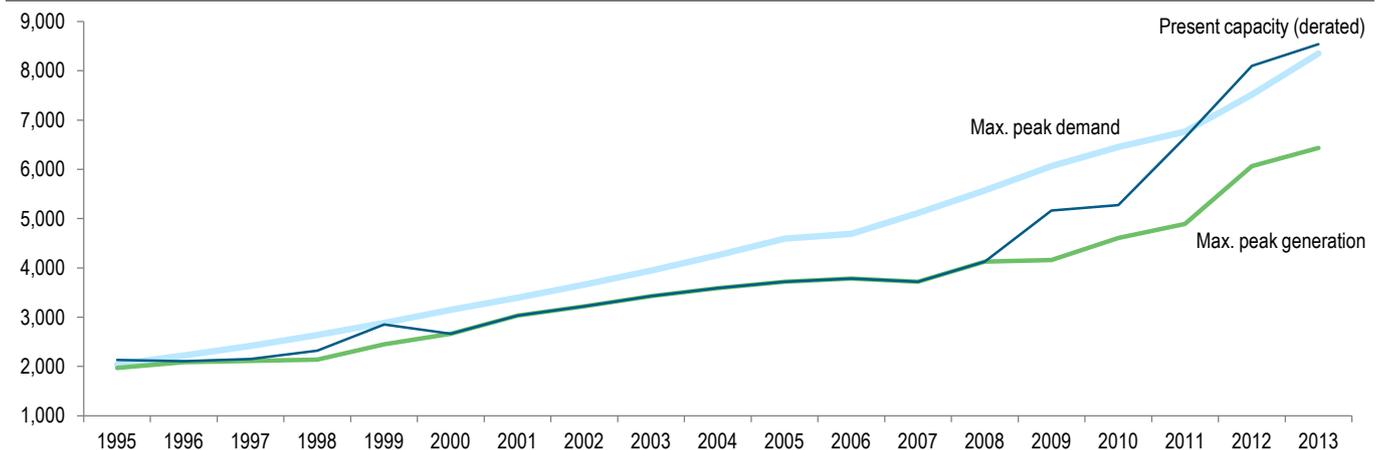
*Access to electricity (% of population)*



Source: World Bank, Standard Chartered Research

**Figure 3: Maximum demand outstrips maximum generation**

*Demand versus supply dynamics (MW)*



Source: BPDB Annual Report FY13, Standard Chartered Research



### *The economic costs of electricity shortage are high*

Electricity shortage has high economic costs. The World Bank estimates that load shedding represents a loss of c.0.5% in GDP and a USD 1bn loss in terms of industrial output per year. There are also financial and environmental costs of owning generators to compensate for power outages. In Bangladesh, 63% of firms either own or share a generator, versus the South Asia average of 40%. In the 2014 World Bank Enterprise Survey, 52% of Bangladeshi firms cited electricity as being a major constraint, versus the South Asia average of 49%.

As energy intensity typically rises as countries grow at low levels of GDP per capita, Bangladesh will have to make a concerted effort to plug the energy gap. Conversely, achieving high rates of growth will be difficult in the absence of adequate electricity.

### *Significant investment will be required to plug the energy deficit*

The good news is that significant investment will be required to improve infrastructure standards, which provides large scope for private-sector participation. The World Bank estimates that Bangladesh will require USD 74-100bn of total infrastructure investment up to 2020 (of which USD 11-17bn is estimated for electricity alone). If this is achieved, the investment-GDP ratio should rise from 27% at end-2013 to a range of 33-40% by 2020 (all else equal). Achieving this ratio would also mean reaching the government's target of an investment-GDP ratio of 38% by 2021.

In the long term, this incremental investment should also raise potential growth. An academic research estimate of long-run elasticity of economic growth with respect to investment is c.0.8<sup>1</sup>. Hence, USD 74-100bn of incremental investment up to 2020 should boost nominal GDP by USD 60-80bn over the period (all else equal).

### *USD 60bn of investment in electricity required up to 2030 – this has the capacity to raise nominal GDP by USD 50bn by then*

If we look at the investment requirement just for the electricity sector, the government estimates that c.USD 60bn of incremental investment will be required up to 2030. This should raise nominal GDP by USD 50bn by 2030, again all else equal.

### **Potential for higher bank participation in project financing**

The government's 2030 energy master plan forecasts that BDT 4.9tn, or c.USD 60bn (at a USD-BDT exchange rate of 80), of investment in the power sector will be required cumulatively up to 2030. This represents c.50% of 2013 GDP, and amounts to USD 3bn p.a. (2.3% of 2013 GDP p.a.).

### *The public sector will not be able to finance this wholly; private participation is needed*

The public sector will not be able to finance this wholly; private and foreign involvement will be necessary. The government already spends a large part of its budget on the energy sector; c.20% of the FY14 Annual Development Programme (ADP) budget was allocated for power and energy. Energy subsidies weigh on non-development spending. In FY13, 56% of the subsidy bill went towards fuel and electricity subsidies. The fuel-subsidy bill has been rising rapidly given increased dependence on imported fuel-based rental power plants (Figure 4). We note inefficiencies arising from several layers of energy subsidy – energy is subsidised at the fuel level; i.e., rental power plants are supplied imported fuel at a price below the international market price, the Bangladesh Power Development Board (BPDB) receives a transfer in compensation for the gap between the average cost of electricity purchase versus the price at which it sells to distributors, and electricity is subsidised to the end consumer. We believe it will be more efficient to integrate energy subsidies and apply them at one level only – both for the purpose of administration and assessment of financial cost.

### *The government already spends a substantial portion of the budget on energy*

### *Restructuring the subsidy structure could increase efficiency*

<sup>1</sup> Electricity consumption and economic growth in Bangladesh: co-integration and causality analysis; Masuduzzaman, 2012

Artificially low energy costs distort consumer behaviour by encouraging excessive consumption. For instance, Figure 5 shows that power tariffs are comparatively not that high in Bangladesh. As natural-gas use wanes and consumption of more expensive oil increases, there will be increasing pressure on the government to raise retail electricity tariffs and lower fuel subsidies.

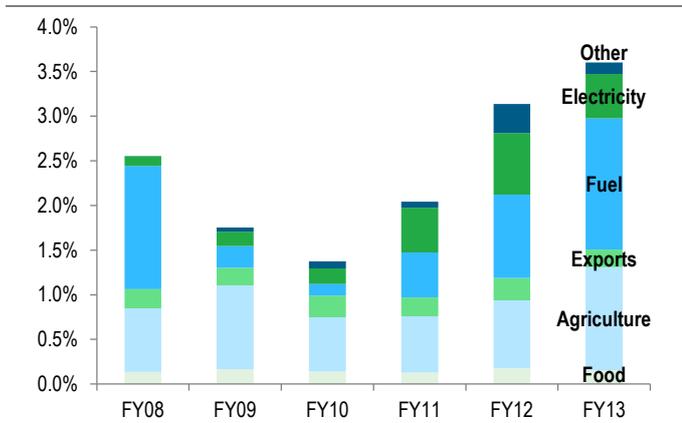
**USD 40bn of investment for the energy sector will likely have to come from private sources**

Nonetheless, in the mean time, the power sector needs increased private participation, either from domestic or foreign sources. The BPDB's annual report sees the share of private-sector financing of power projects increasing to 58% by 2016 (Figure 6). If we assume a 60% private-sector share over the medium term, this suggests that c.USD 40bn of the additional investment required for power projects up to 2030 must come from private sources.

Previous large independent power producer (IPP) projects had a debt component of around 60-70%, with the rest coming from equity financing. Of the debt component, c.30% of project financing has historically been funded by commercial banks (loans provided against guarantees), with the remainder coming from multilateral lenders and public participation through the Infrastructure Development Company Limited (IDCOL), the Investment Promotion and Financing Facility (IPFF), and the Infrastructure Investment Facilitation Company (IIFC).

**Figure 4: Fuel subsidies have significantly increased**

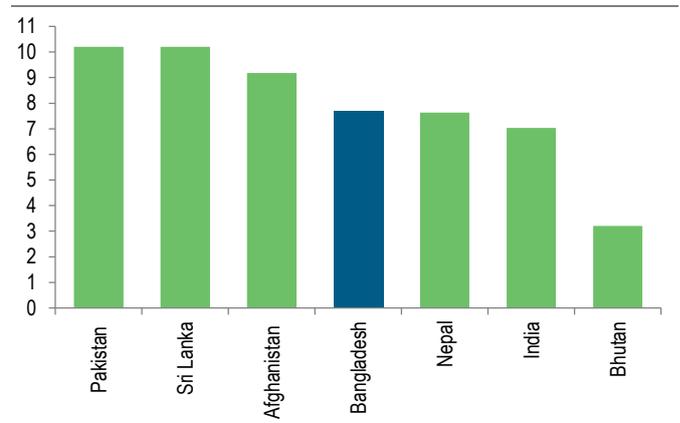
*Subsidies, % of GDP*



Source: Ministry of Finance, Standard Chartered Research

**Figure 5: Power tariffs are not that high, comparatively**

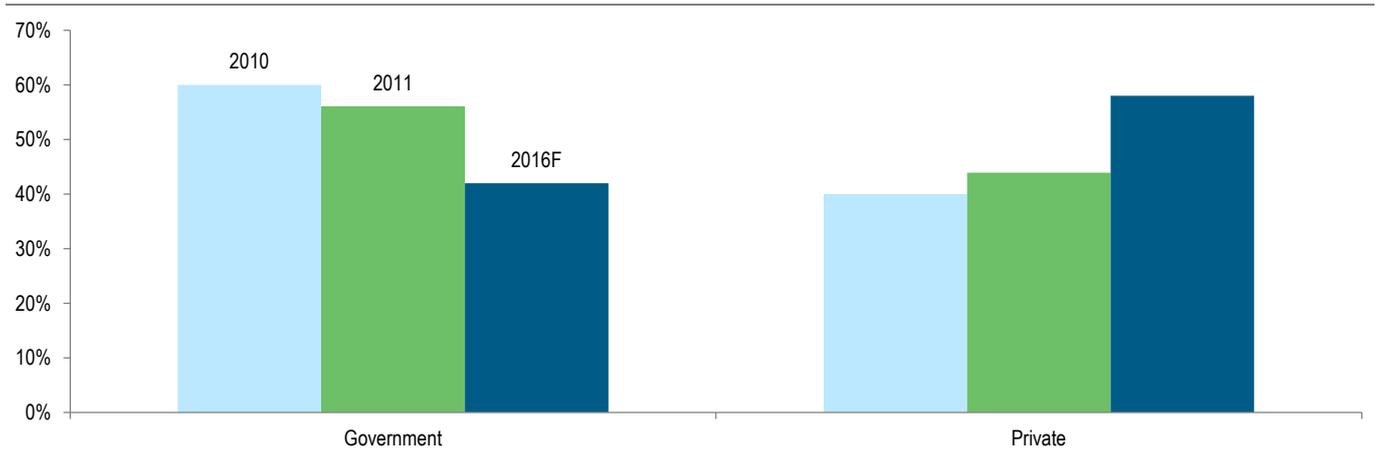
*Power tariff (cents per kWh)*



Source: World Bank, Standard Chartered Research

**Figure 6: Private-sector participation in electricity generation must increase**

*Share of electricity generation from public vs. private sector*



Source: Power-sector roadmap 2012, Standard Chartered Research

Over time, as Bangladesh moves up the income ladder, a larger part of the debt financing is likely to come from bank lending, as the country is likely to become less eligible for multilateral concessional debt. We think banks could provide up to a maximum of 50% of project financing over the medium to long term.

*This raises scope for higher bank lending; bank financing of power projects could range between USD 10bn and USD 20bn from now until 2030*

**On this basis, we see minimum potential for bank financing of power projects until 2030 at USD 10bn (8% of GDP) and maximum potential at USD 20bn (14% of GDP).**

*Steps must be taken to encourage higher private participation in funding power projects*

To encourage private-sector involvement in funding infrastructure projects, a variety of measures are needed, including

- Improving the business climate for investment
- A stronger financial standing of the single power-purchasing entity (BPDB). As the BPDB sells electricity to distributors at prices lower than the cost of electricity purchase, it persistently reports financial losses. Though the government provides assistance via loans, repayment of these loans is difficult. Loss accumulation on its balance sheet has constrained the development of the IPP market<sup>2</sup>. Raising bulk electricity tariff rates (i.e., the rates that the BPDB charges distribution companies) is one way to improve BPDB finances
- Better implementation capacity of government institutions
- A more favourable policy regime (improved transparency, timeliness of decision making, better enforcement of government commitments, better accessibility to land)

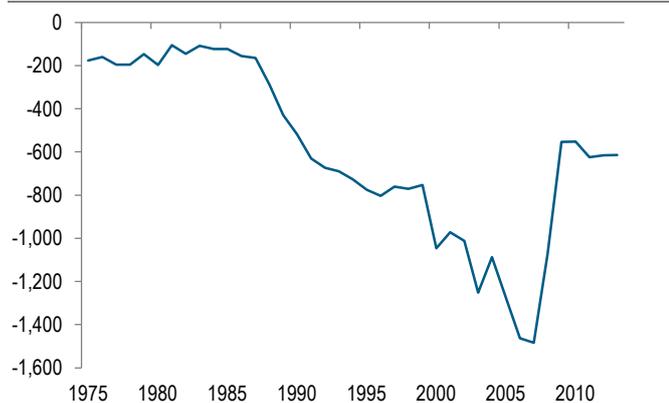
### Temporary rental power electricity generation provides an interim solution to the energy crisis, but has raised costs

*The government's strategy of using liquid fuel-based rental power plants to alleviate the energy crisis in the short term has borne fruit*

To address the imminent power crisis, the Awami League government, which took office in 2009, focused on establishing quick rental power plants using liquid fuels (predominantly diesel and heavy fuel oil, HFO). Oil-based plants were contracted because there was a shortage of natural gas, and developing plants for generating coal, nuclear, or hydro power was not a short-term solution. This strategy has borne fruit; since 2009, 5,008MW of new power generation has been added to the grid, which includes 500MW of power imported from India; improvements have also been made in improving the efficiency of installed capacity (Figure 7). Load shedding has come down from c.1,500MW in 2010 to c.1,000MW currently (Figure 8). The participation of private players in electricity generation increased significantly, rising

**Figure 7: Efficiency improvements to existing capacity**

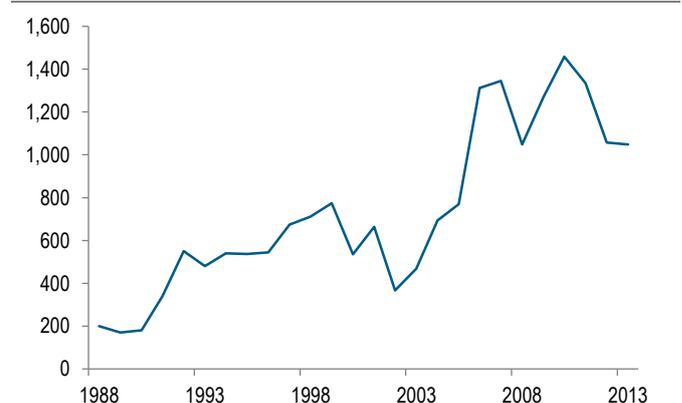
*Present (de-rated) capacity less installed capacity*



Source: BPDB Annual Report FY13, Standard Chartered Research

**Figure 8: Load shedding has improved**

*Maximum load shedding (MW)*



Source: BPDB Annual Report FY13, Standard Chartered Research

<sup>2</sup> Power-system master plan 2010; 2030 vision

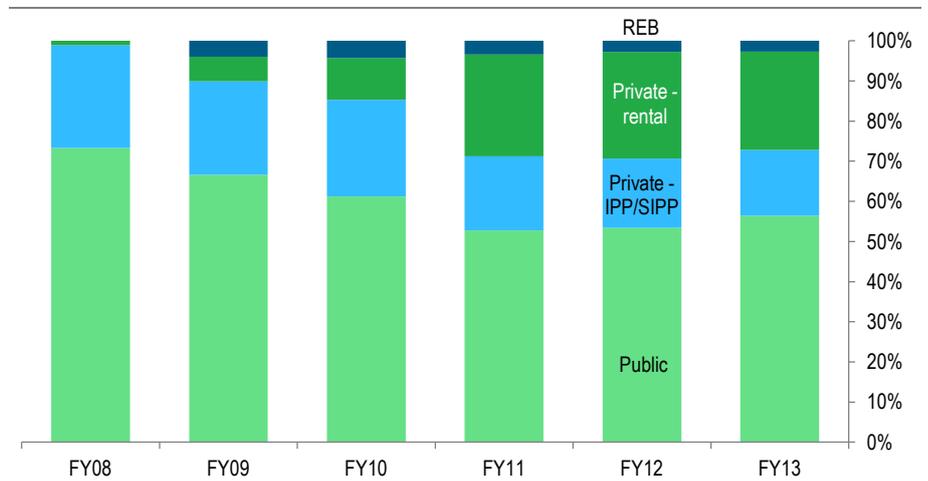


**Load shedding has come down** from 27% in FY08 to 41% in FY13. The share of rental power in electricity generation increased from 1% in FY08 to 25% in FY13 (Figure 9). This has partly closed the demand-supply electricity gap (Figure 8).

**But this is a costly form of electricity generation** All these factors are extremely positive for the short term. However, the usage of rental power plants for electricity generation has also increased costs:

1. These plants predominantly use expensive imported fuel (diesel, furnace oil, HFO) for generation. Over the past 10 years, the administered price of furnace oil has increased 500%, diesel oil has increased 240%, coal has increased 75%, and natural gas has increased only by 14%. Price changes are a reflection both of an increase in the actual cost of the fuel and lower subsidies. Though we do not have enough data to make a like-for-like comparison, we can say that higher administered price increases for imported liquid fuels are likely due to higher increases in their international prices. Due to increased demand for and price of crude oil, the petroleum import bill has increased by c.90% from USD 2.6bn in FY10 (11% of total imports) to USD 4.8bn in FY13 (14% of total imports). This compares with only a c.40% increase in the total import bill over this period.
2. They make use of outdated/second-hand equipment and machinery, which results in low efficiency.
3. Most plants operate on relatively short-term contracts of three to five years, in which the per unit cost of power becomes expensive as the producer tries to absorb the depreciation of the plan within a limited time.

**Figure 9: Share of rental power generation has increased**  
Share of electricity generation (MW)



Source: BPDB Annual Report FY13, Standard Chartered Research

**Figure 10: Rental power plant electricity generation puts upward pressure on electricity costs**

The BPDB's electricity cost in FY13

BDT/kWh	
BPDB's generation	3.8
Purchase from IPPs	4.07
Purchase from rental	10.99
Purchase from public plant	1.97
Interest on budgetary support	0.12
Provision for maintenance and development fund	0.2
<b>Total</b>	<b>5.77</b>

Source: BPDB Annual Report FY13, Standard Chartered Research

*The BPDB's costs have increased by 150% since FY08 due to higher costs of electricity purchase from rental power plants*

Due to increased reliance on rental plants, the BPDB's costs have increased significantly, from BDT 2.33/kWh in FY08 to BDT 5.77/kWh as of FY13 (Figure 10). Upward pressure on this cost comes predominantly from the cost of electricity purchase from rental plants, which costs BDT 10.99/kWh. Indeed, c.50% of BPDB's total operating cost comes from electricity purchase from rental plants.

The rise of rental power plants for electricity generation marks a trade-off between quantity and the price of electricity. Though prices have gone up, at least the electricity deficit has narrowed.

*A sustainable long-term solution is needed for electricity generation*

The improvement in the electricity situation in the short term is positive, but should be matched with an equally compelling sustainable solution for the medium to long term. On this front, more progress is needed on developing long-term sustainable sources of electricity generation (coal, new gas exploration, renewables, nuclear).

*Bangladesh has historically been overly reliant on natural gas for electricity generation*

### Concrete and diversified strategy required for long-term electricity generation

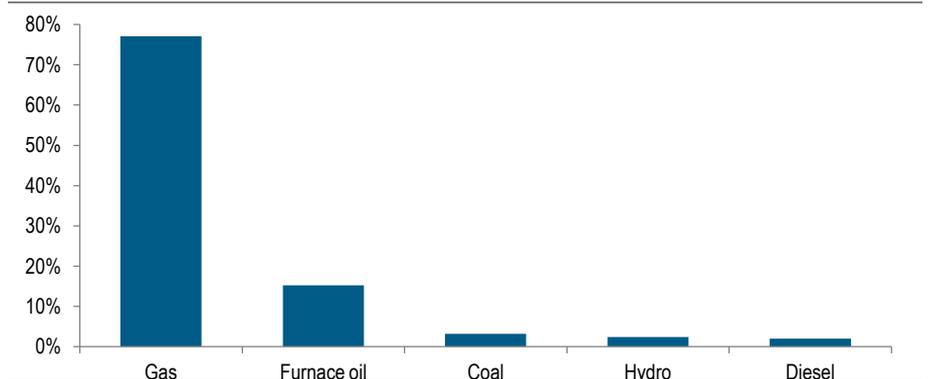
In comparison with other developing Asian countries, Bangladesh is the least well diversified in terms of energy sources. We use 2011 World Bank data for the purposes of comparison here, which differs quite significantly from the current situation in Bangladesh. Nonetheless, it highlights the point that Bangladesh is overly dependent on natural gas for electricity generation, while its share of coal and hydro electricity in electricity generation is the lowest among developing Asian economies (Figure 11). It also lags the South Asia average on nuclear and renewable power (excluding hydro) generation. The latest data from the BPDB shows that c.77% of total electricity generation comes from natural gas, which is an improvement from the 2011 World Bank figures (Figure 12), but still skewed towards gas-based generation.

**Figure 11: Bangladesh has the least diversified electricity generation structure**  
*Share of electricity generation from various sources, 2011*

	Coal	Hydro	Natural gas	Nuclear	Oil	Renewable ex-hydro
<b>Bangladesh*</b>	<b>2</b>	<b>2</b>	<b>91</b>	<b>0</b>	<b>5</b>	<b>0</b>
China	79	15	2	2	0	2
India	68	12	10	3	1	5
Sri Lanka	9	40	0	0	50	1
Myanmar	8	70	22	0	0	0
Malaysia	41	6	45	0	8	1
Philippines	37	14	30	0	5	15
South Asia	59	14	15	3	4	4
Thailand	22	5	68	0	1	3

\*Figures may differ from national data, Source: World Bank, Standard Chartered Research

**Figure 12: Natural gas still Bangladesh's main source of electricity generation**  
*Electricity generation by source (% of total); FY13*



Source: BPDB Annual Report FY13, Standard Chartered Research

*Existing natural gas reserves are depleting, and no major new source has been discovered in recent years*

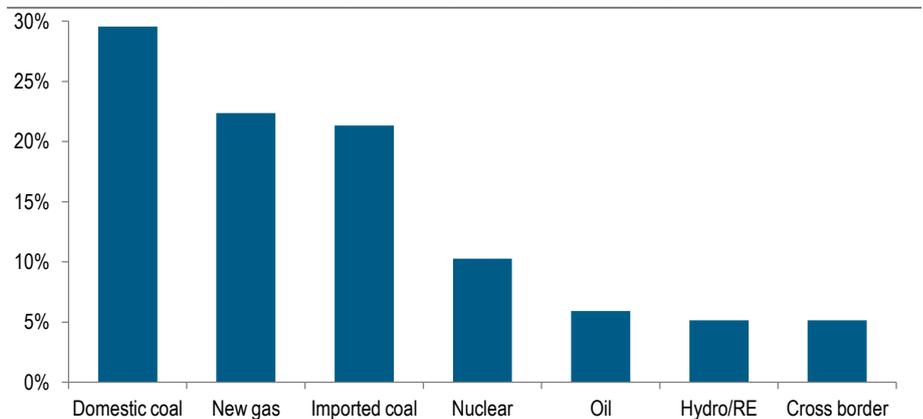
*The resolution of maritime disputes in the Bay of Bengal should lead to new gas exploration*

*The government's 2030 energy master plan projects diversification of energy sources away from existing gas reserves*

Over-reliance on natural gas is a problem given depletion of gas reserves and no new major discovery in recent years due to financial constraints and maritime boundary issues with India and Myanmar<sup>3</sup>. The shortage of natural gas has led to several power plants lying idle, or being under-utilised. Recent media reports suggest that new gas reserves have been found in an exploration well near Rupganj; however, the size of the reserve has not yet been confirmed. The resolution of the maritime dispute with India over Bay of Bengal waters in favour of Bangladesh should also support new gas exploration in the blocks within the disputed area.

The government's 2030 energy master plan forecasts that oil and the discovery of new natural gas resources will compensate for the depletion of existing gas resources in the short term. Medium-term, imported coal should play a bigger role in meeting energy demands. Longer-term, the government is relying on the extraction of domestic coal, increase in imported coal, higher electricity generation from nuclear

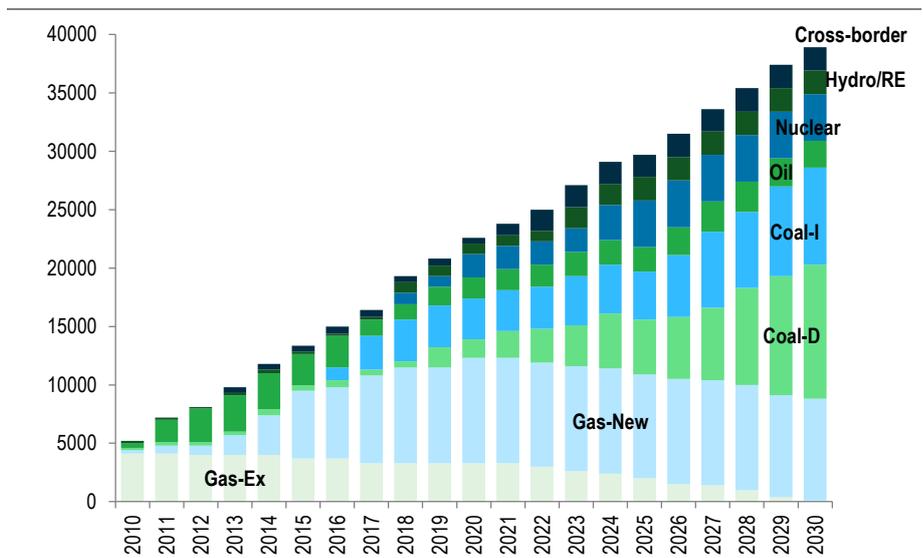
**Figure 13: Coal likely to be dominant source of electricity generation by 2030**  
*Share of electricity generation by source (% of total); 2030 projection*



Source: Energy master plan 2030, Standard Chartered Research

**Figure 14: Energy master plan forecasts increased reliance on non-gas sources of energy generation**

*Total electricity generation (MW); D is domestic, Ex is existing*



Source: Bangladesh Power Sector Energy Master Plan, Standard Chartered Research

<sup>3</sup>Various impediments to new gas field discovery – exploring gas is capital-intensive and risky. Discovering a gas field needs an investment of BDT 7bn, while the success rate is only 20-25%. One option is to involve the private sector, particularly international oil companies (IOCs) that are financially and technically better placed to conduct this exercise.

power plants and renewable energy (including hydro), and cross-border regional agreements (Figures 13-14).

**Concrete plans for implementation are required to achieve forecasts set out in the energy master plan**

Construction of coal, nuclear, and renewable energy plants must be a priority for the government given that these projects typically take years to construct. We note that no coal or renewable power plants are expected to be completed before 2015 at the earliest. In 2015, 4% of incremental generation capacity is planned to come from renewable energy. From 2016 onwards, we should see imported coal-based plants being plugged into the electricity grid, assuming there are no delays to current plans (Figure 15).

In the BPDB's latest annual report, it makes no concrete reference to building power plants for either nuclear energy or hydro power generation (Figure 15). Current plans outline the creation of minimal capacity for generation of domestic coal- and renewable energy (solar, wind)-based electricity. Progress is needed on developing a concrete plan to achieving the long-term targets set out in the energy master plan.

**Coal is likely to be an increasingly important source of electricity generation**

**Coal – Strong political will required to resolve contentious issues**

According to the government's energy master plan, coal's share of electricity generation should increase from 3% currently to 20% by 2020, 30% by 2025, and 50% by 2030. This forecast includes both domestic and imported coal.

**Bangladesh has substantial high-quality domestic coal reserves**

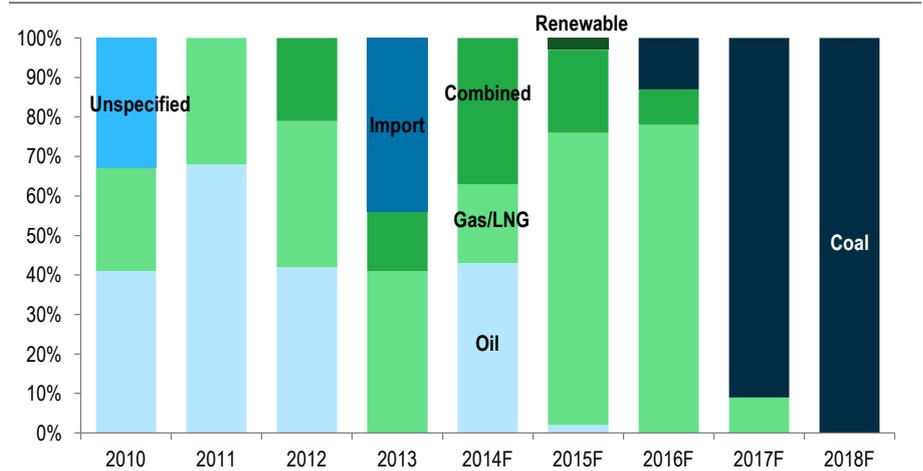
Currently, the entire 3% of electricity generation through coal comes from domestic coal. Bangladesh has significant coal reserves of high quality, but a number of outstanding issues have led to the inability to tap these resources for energy generation. In particular, there is intense debate on whether and how to extract this coal. This debate includes

**Extraction has so far not occurred in a big way due to a number of outstanding issues**

1. Open versus closed pit mining: Underground mining would be complex and costly, with a high likelihood of floods/accidents, and would allow extraction of only 20-30% of coal deposits; open mining pumping out large amounts of water would likely lead to environmental problems, though it would lead to higher extraction of 80-90% of deposits.

**Figure 15: No plans outlined for nuclear or hydro power generation in the latest BDPB annual report**

*Power plants implemented and planned (by year)*



Source: BPDB Annual Report FY13, Standard Chartered Research

2. Energy security versus food security: The coal-reserve area is extremely fertile and usually sustains two to three crops per year. This is a particularly sensitive issue given that natural gas is already diverted from production of fertiliser to energy.
3. Land acquisition versus the displacement and resettlement of persons: The coal area is densely populated and concentrated (see Figure 16),
4. Energy security versus environmental degradation.

*Political will and consensus building are required to resolve these issues; clarity is needed on the national coal policy*

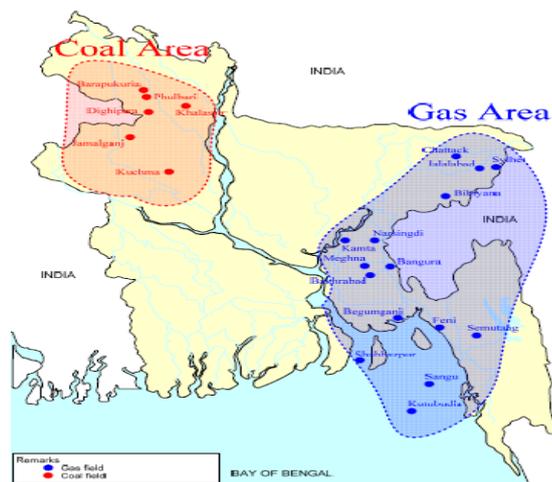
These are not issues peculiar to Bangladesh – similar issues have been noted in India. For the above reasons, the government currently generates only around 250MW of electricity using coal from its lone coal-fired power plant at Barapukuria. The government has drafted several coal policies, but there is no consensus on the above issues yet. Political will and consensus building will be required to push forward domestic coal extraction – not easy when the issue of food security in a high-inflation country is at stake. However, given that energy security is a top government priority, we are optimistic that clarity on the national coal policy will be forthcoming sooner rather than later.

For imported coal as well, there are a number of questions. The first is supply of imported coal – Indonesia has stopped exporting coal due to inadequate reserves, India is plagued with domestic problems, and South African coal is expensive. Relying on the lone option of Australia seems risky. Other issues include adequate space required for storage of imported coal, logistics of coal transport, handling capacity at ports, and environmental damage, as imported coal is likely to be of much lower quality than domestic coal.

*The government has made progress in building plants for imported coal, showing its resolve in this area*

The go-ahead given to the 1,320MW Rampal power station for imported coal (built in collaboration with India, to be operational by 2019) is a testament to the government’s will to override environmental concerns. This plant has been vehemently opposed given that the 40km from the port to the plant cuts through the Sunderbans area (one of the world’s largest mangrove forests) in Bangladesh. Environmentalists claim that coal-carrying vehicles will disburse large amounts of toxic chemicals in the area and the emanating pollution will put the forest area at risk. However, the advantages of locating the plant in this area are proximity to the port and no displacement costs, as this area is not densely populated. The Matarbari 1,200MW coal plant for imported coal planned in Cox’s Bazaar is again a positive and should start supplying electricity to the grid by 2022.

**Figure 16: Bangladesh has substantial coal reserves**  
*Geographical distribution of coal and gas*



Source: Government energy master plan 2030, Standard Chartered Research



*The energy master plan sees a small role for renewable energy-based electricity generation*

### **Limited renewable-energy potential**

Renewable energy power is expensive to set up and generally has lower productivity (i.e., electricity produced per unit of input compared with traditional sources of energy). Hence, a relatively large investment will be required to produce even small amounts of energy. Possibly for this reason, the government's 2030 energy master plan forecasts that only 2,000MW or c.5% of total electricity generation will come from renewable energy sources by 2030.

*Limited potential in hydro, wind energy development underway, significant progress has been made on off-grid solar power generation*

In hydro, the lone plant operating in Bangladesh produces 230MW of power, with the BPDB looking to increase this to 330MW. The government's renewable energy policy states that there is limited potential in hydro. It is exploring the possibility of developing wind energy across the 724km Bangladesh coast line – this includes 15MW in the coastal regions and 50-200MW of wind power projects in Chittagong. Currently, only 2MW of energy is sourced from wind power. Given its geographical location, Bangladesh's potential for solar power electricity generation is substantial. The country receives more than 10 hours of sunlight daily over the course of the year; average solar radiation varies between 4.0kWh and 6.5kWh/square meter per day. However, given the high cost of setting up solar thermal-powered plants, initiatives in solar photovoltaic energy have so far been led by the private sector/multilateral organisations, which supply off-grid home-based solutions. For instance, the World Bank's International Development Association (IDA) recently pledged to provide a USD 78.4mn concessional loan intended to add 480,000 solar home systems in the country. With World Bank support, Bangladesh has reportedly already installed 3mn solar home systems. This helps reduce consumer demand for electricity from the grid. Biogas is currently being used as a source of energy in rural areas. The potential for biodiesel has yet to be seriously explored.

### **Nuclear energy – Government must expedite projects near-term**

In the government's energy master plan, c.4,000 MW of electricity generation is expected to come from nuclear energy from 2025 onwards (or c.10% of total electricity needs at that point). Efforts must be made to build capacity as soon as possible, keeping in mind likely delays in implementation.

*Progress is being made on building the Rooppur nuclear power plant, after years of delay*

Bangladesh is now making efforts to expedite projects for nuclear energy generation, after years of delay. The government first proposed the idea of building a nuclear power plant in the west of the country in 1961. The Rooppur site was selected in 1963, and government approval was given in 1980. After years of deliberation, work on the Rooppur Nuclear Power Plant (built in collaboration with Russia), began in October 2013. This project is on the government's fast-track priority infrastructure list, and should get special attention. Two plants are planned at the site, each with a capacity of 1,000MW, and the project is expected to be completed by 2022. They will operate for 60 years, with an option to extend by another 20 years.

*Talks are underway for another plant in the south*

Following the January elections, the Awami League (AL) government has expressed desire to build another 2,000MW nuclear plant in the south of the country. Talks are reportedly on with Japan for this project. The government should treat this project as priority in order to meet its own targets for nuclear energy electricity generation over the coming years. Given the limited foreseeable electricity generation from renewable and obvious challenges to domestic coal extraction, Bangladesh should aim to increase its current targets for nuclear energy-based electricity generation. This has the potential to become a sustainable and long-term source of power.

*Nuclear energy generation should be given priority given its potential to become a long-term sustainable source of power*

*Cross-border power sharing is likely to be part of the long-term solution for Bangladesh's power crisis*

**Regional agreements – Part of the long-term solution**

The government expects c.5% of electricity supply, or c. 2,000MW, to come from cross-border arrangements by 2030. Indeed, we think that regional agreements, particularly with smaller countries that have lesser energy needs, could be part of the solution for Bangladesh's energy crisis. However, given the nascent state of energy-sector development in these neighbouring countries, power sharing is likely to be a solution only in the very long term. Under current agreements, Myanmar should export 500MW of hydro-power energy from 2017 onwards; Bangladesh is already importing 500MW worth of energy from India.

Nepal and Bhutan have significant untapped hydro-electricity potential. In Nepal, high-potential rivers are thought to be able to generate 83,000MW, half of which is thought to be economically feasible. Presently, Nepal has only developed c.600MW of power. In Bhutan, hydroelectricity potential is estimated at 21,000MW. At present, it has developed only c.1,500MW of capacity. Hydro-power potential is estimated to be large in India as well, at 150,000MW; hydro energy generated in northeastern India could partially supply Bangladesh en route to West Bengal. Myanmar also has sizeable gas reserves – a resource that China has already tapped. According to the Energy Information Agency, Myanmar has 10tn cubic feet of proven gas reserves versus 6.49tn in Bangladesh. A Myanmar-Bangladesh-India pipeline was proposed in 1997, but disagreements on certain issues stalled talks. The new government is likely to make efforts to revive talks on this matter.

*To achieve the target of 39,000MW of generation capacity by 2030, project implementation must be given priority*

**Fast-tracking project implementation is required**

According to the government's Power System Master Plan 2010, maximum peak electricity demand is likely to increase from c.8,000MW to c.34,000MW in 2030. In order to meet the growing demand for electricity, significant investment in power is required – the government targets reaching 39,000MW of generation capacity by 2030. However, the key as always lies in the implementation of planned power projects. In the initial and subsequent revised power roadmaps, it was estimated that 8,482MW worth of additional power would be brought to the grid between 2010 and 2013. Unfortunately, only 4,652MW of this has been achieved, marking a 45% slippage versus targets (Figure 17). In the latest revision of the roadmap as of 2014, c.11,000MW of additional electricity generation is forecast up to 2018. Unless the government significantly improves its implementation capacity, this target is unlikely to be achieved either.

*During 2010-13, only c.50% of planned energy projects were implemented*

**Figure 17: Implementation needs improvement**

*Targets versus realisation (in MW); for targets, we use initial and revised versions of the energy roadmap*

	Targets	Actual	Total % utilisation	Private-sector % utilisation	Public-sector % utilisation	Imports
2010	792 (2010F)	775	98%	120%	71%	N/A
2011	2,194 (2011F)	1,763	80%	72%	94%	N/A
2012	2,157 (2011F)	951	44%	26%	72%	N/A
2013	3,339 (2012F)	1,163	35%	4%	40%	100%
2014	1,249 (latest)					
2015	2,511 (latest)					
2016	2,489 (latest)					
2017	2,771 (latest)					
2018	1,950 (latest)					
2010-13	8,482	4,652	55%			

Source: Power sector roadmap 2010-12, Standard Chartered Research

*ADP implementation also typically falls short of targets, though we have seen some improvement in the past three years*

As we highlighted in *On the Ground, 21 May 2014, 'Bangladesh budget – In search of lost ground'*, ADP implementation is typically sluggish, leading to the downward revision of targets through the course of the fiscal year. ADP spending rarely meets even revised budget targets<sup>4</sup>. Implementation of energy and power projects falls prey to the same pitfalls, though we do notice that project implementation in this sector has improved over the past three years, as it has been given priority by the AL government (Figure 18). Inefficiencies in project implementation need to be resolved in order to find a sustainable solution for Bangladesh's power crisis. Given that power is a priority for the AL government, we expect policy makers to expedite implementation on this front.

*Significant improvements in transport and storage infrastructure is required to facilitate coal usage*

### Building infrastructure for fuel transportation is critical

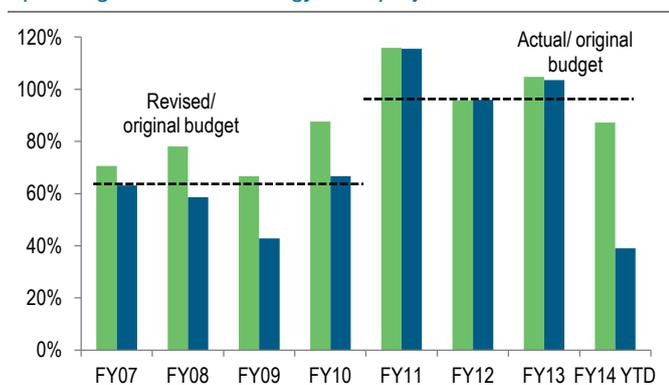
Significant improvements in infrastructure are needed to transport both domestic and imported coal:

1. For imported coal, Bangladesh needs to construct a deep-sea port facility for ships carrying coal (talks are underway for this with China and India), conduct river dredging required to improve the navigability of rivers, procure ships for the transportation of coal, and build coal terminals. Implementation is key – progress on the deep-sea port at Sonadia, originally planned in 2006, is crucial.
2. Improvement in domestic connectivity and transport infrastructure is required for domestic coal transport. Bangladesh's deficiency in road and railway infrastructure is well-known, a point we touched on in *On the Ground, 26 February 2014, 'Bangladesh – Riding out the storm'*. Despite Bangladesh's under-developed and low-quality road network (only 10% of all roads are paved, versus 50% in India and 80% in Sri Lanka; Bangladesh has 0.1km of road per 1,000 persons, versus 3.5km in India and 5.5km in Sri Lanka), 60% of freight is transported via roads, and only 12% by railway. This is a testament to poor rail connectivity and frequent delays. Only c.700mn tonnes of freight is transported per kilometre via rail. This is less than half the South Asia average, which stands at c.1,800mn (Figure 19), and substantially below other developing Asian economies'.

According to a recent World Bank study, Bangladesh will require between USD 36bn and USD 45bn of investment in transport infrastructure between 2011 and 2020. This is roughly 3-4% of GDP p.a. – the highest proportionate requirement among South Asian economies.

**Figure 18: ADP implementation has improved**

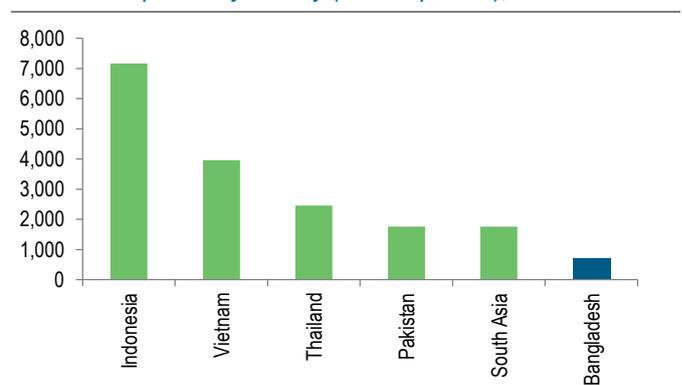
*Spending on fuel and energy ADP projects*



Source: Ministry of Finance, Standard Chartered Research

**Figure 19: Railway infrastructure needs improvement**

*Goods transported by railway (mn ton per km), 2012*



Source: World Bank, Standard Chartered Research

<sup>4</sup>Sluggish ADP implementation is due to a variety of reasons including overambitious and unrealistic ADP targets to begin with, delays in the preparation of project documents and the approval of projects, inadequate and delayed release of funds, difficulty in land acquisition, and inefficient project management among others.

### *Talks on building an LNG import terminal are reaching a conclusion*

Bangladesh is in the process of finalising an agreement on building a liquid natural gas (LNG) import terminal at Moheshkhali (with a US consortium); this project has been in the planning stage for several years and should be expedited. Bangladesh already has an agreement with Qatar on importing LNG, but imports cannot begin until receiving infrastructure is built.

### *Bangladesh has made considerable improvement in the distribution and transmission of electricity*

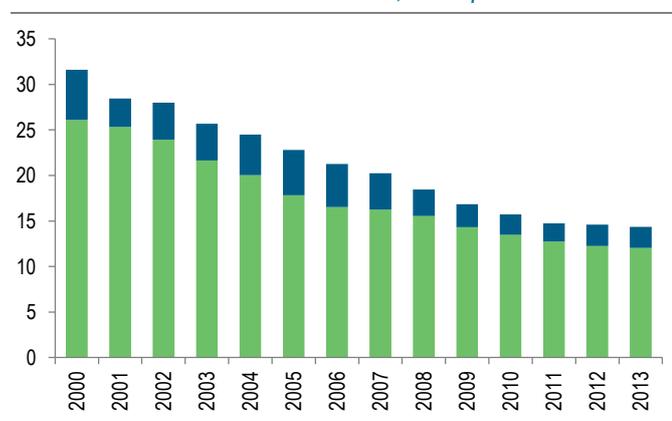
#### **Significant improvements made in distribution and transmission**

Bangladesh has made significant improvements in the transmission and distribution of electricity. Transmission losses fell to 2.33% of total output in FY13, down from 5.51% in FY00<sup>5</sup>. Total interruption of the national grid was 14.5 hours in FY13, down from c.40 hours in FY12. The total distribution loss was 12.03% in FY13, down from 26.09% in FY00 (Figure 20). Transmission losses can be attributed to two broad factors: technical losses caused by energy dissipation in the conductor and equipment used for transmission of power and non-technical losses, which comprise half the losses in developing countries. These losses are due to pilferage of energy and energy metres becoming defective due to poor quality or deterioration over time. Though Bangladesh has made progress on these fronts, further progress is needed to match the loss levels of more advanced developing countries (Figure 21). New transmission and distribution infrastructure is needed along with the renovation and preservation of old distribution networks. Providing electricity in rural areas is a critical part of this. About half the country's power is provided by the Rural Electrification Board (REB). The REB's capacity for transmission and distribution is limited with respect to demand, but we are confident that improvements will continue to be made in this regard.

### *Losses in this space have come down substantially both on an absolute and a relative basis*

**Figure 20: Distribution and transmission losses are steadily declining**

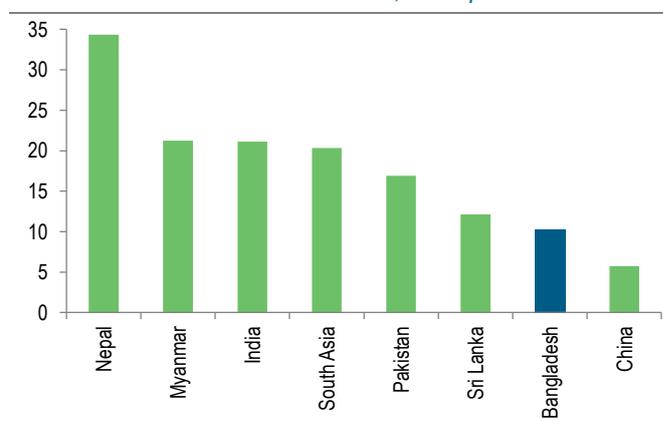
*Distribution and transmission losses, % output*



Source: Power division, Standard Chartered Research

**Figure 21: Bangladesh has made significant improvements to distribution and transmission capacity**

*Distribution and transmission losses, % output*



Source: World Bank, Standard Chartered Research

<sup>5</sup> BPDB is the single buyer of electricity in the Bangladesh power market – buying from both private and public players, and selling to distribution utilities. The distribution entities that purchase electricity from the BPDB include the Dhaka Power Distribution Company (DPDC), the Dhaka Electric Supply Company (DESCO), the West Zone Power Distribution Company Limited (WZPDCL), the Rural Electrification Board (REB), and the BPDB's six distribution zones.



## Disclosures Appendix

SCB has managed or co managed a public offering for this company within the past 12 months, for which it received fees: Rural Electrifications Corp Ltd.

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