



Technical Assistance Report

Project Number: 48277-004
Capacity Development Technical Assistance (CDTA)
December 2014

People's Republic of Bangladesh: Study on Energy Security

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Asian Development Bank

CURRENCY EQUIVALENTS

(as of 31 October 2014)

Currency unit	–	taka (Tk)
Tk1.00	=	\$0.0127
\$1.00	=	Tk76.01

ABBREVIATIONS

ADB	–	Asian Development Bank
BPDB	–	Bangladesh Power Development Board
TA	–	technical assistance

NOTE

In this report, "\$" refers to US dollars.

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CONTENTS

	Page
CAPACITY DEVELOPMENT TECHNICAL ASSISTANCE AT A GLANCE	
I. INTRODUCTION	1
II. ISSUES	1
III. THE CAPACITY DEVELOPMENT TECHNICAL ASSISTANCE	2
A. Impact and Outcome	2
B. Methodology and Key Activities	3
C. Cost and Financing	3
D. Implementation Arrangements	3
IV. THE PRESIDENT'S DECISION	4
APPENDIXES	
1. Design and Monitoring Framework	5
2. Cost Estimates and Financing Plan	7
3. Outline Terms of Reference for Consultants	8
4. Outline of the Final Report	11

CAPACITY DEVELOPMENT TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data		Project Number: 48277-004	
Project Name	Study on Energy Security	Department /Division	SARD/SAEN
Country Borrower	Bangladesh Bangladesh	Executing Agency	Bangladesh Power Development Board (BPDB)
2. Sector		ADB Financing (\$ million)	
✓ Energy	Conventional energy generation		0.80
	Energy sector development and institutional reform		0.20
		Total	1.00
3. Strategic Agenda		Climate Change Information	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Climate Change impact on the Project	Low
4. Drivers of Change		Gender Equity and Mainstreaming	
Governance and capacity development (GCD)	Institutional development	Some gender elements (SGE)	✓
Knowledge solutions (KNS)	Application and use of new knowledge solutions in key operational areas Knowledge sharing activities		
5. Poverty Targeting		Location Impact	
Project directly targets poverty	No	Nation-wide	High
6. TA Category:	B		
7. Safeguard Categorization	Not Applicable		
8. Financing			
Modality and Sources		Amount (\$ million)	
ADB		1.00	
Sovereign Capacity development technical assistance: Technical Assistance Special Fund		1.00	
Cofinancing		0.00	
None		0.00	
Counterpart		0.20	
Government		0.20	
Total		1.20	
9. Effective Development Cooperation			
Use of country procurement systems	No		
Use of country public financial management systems	No		

I. INTRODUCTION

1. With the demand for electricity doubling every 7 years and the country's overdependence on dwindling reserves of domestic natural gas, the Government of Bangladesh requested Asian Development Bank (ADB) assistance in April 2014 to conduct a study on energy security in the country and to provide recommendations on diversifying the fuels it uses to generate electricity. This capacity development technical assistance (TA) project will undertake this study on the energy security issues facing Bangladesh, recommend priority power generation projects, and conduct feasibility studies on these projects. The outline of the TA, with emphasis on its impact, outcome, outputs, activities, implementing arrangements, cost and financing, and terms of reference for consultants, was discussed with the relevant government agencies during ADB reconnaissance and fact-finding missions.¹ The design and monitoring framework is in Appendix 1.

II. ISSUES

2. The energy sector in Bangladesh is characterized by an acute shortage of electricity generating capacity. Meanwhile, demand is increasing for power to serve the growing economy and to provide the essential needs of the segment of the population that is not connected to grid electricity. The national grid of Bangladesh generally covers the entire country. The only major electricity grid interconnection to neighboring countries is the 500-megawatt interconnection with India established in 2013 with ADB assistance.² In 2013, only 62% of the people in Bangladesh had access to electricity, and the country's annual per capita electricity consumption of 321 kilowatt-hours was the second-lowest in South Asia. A major challenge is to provide modern energy services to the remaining section of the population that lacks access to such services. This requires additional investments in electricity generating capacity as well as in the transmission and distribution networks.

3. Domestically sourced natural gas has played a key role in providing the country's energy needs and accounted for 66% of the primary commercial energy supply in 2013. Gas has been even more dominant in the power sector. In 2013, 78% of the country's electricity was generated by gas-fired power stations, which consumed more than one-half of total domestic gas production. However, growth in the country's gas production has not kept up with the increasing demand for power generation purposes and from other gas-intensive industries, such as fertilizer production. As a result of the supply shortfall, existing gas-fired power stations are not operating at the full capacity. This makes the use of gas to power the additional new electricity generation the country urgently needs problematic. Bangladesh's useable onshore gas reserves are shrinking, and only an estimated 12 trillion cubic feet remain. That is only enough to meet about 10 years of projected consumption. In addition, off-shore gas exploration has made extremely slow progress, largely because of delays in the resolution of disputes with the neighboring countries on the ownership of off-shore exploration blocks. The other main commercial energy source is oil, which is largely imported. Bangladesh has an estimated 2.7 billion tons of largely untapped coal reserves, but exploiting these would present its own challenges in this very densely populated country, particularly in the area of safeguards. These energy sector issues were highlighted in a 2009 ADB evaluation of its energy sector program in Bangladesh.³

¹ The TA first appeared in the business opportunities section of ADB's website on 11 November 2014.

² ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of Bangladesh for the Bangladesh-India Electrical Grid Interconnection Project*. Manila.

³ ADB. 2009. *Sector Assistance Program Evaluation: Energy Sector in Bangladesh*. Manila.

4. The heavy reliance on domestic natural gas to produce electricity has created a major bottleneck in government plans and efforts to add generation capacity to meet the current and future demand for power and provide electricity to the many citizens who now must do without it. Inadequate gas supplies meant that the country's 10,416 megawatts of generation capacity were not fully used in 2014. A 2004 estimate put the economic losses in the industrial sector because of power outages at 1.7% of gross domestic product.⁴ These factors point to the pressing need to diversify the fuels used to generate the country's power, provide a more reliable supply of electricity, and strengthen energy security. Some progress has been made by establishing an ADB-financed grid interconnection between Bangladesh and India in 2013 and increasing the country's oil-fueled generation capacity.⁵ The government adopted a fuel diversification policy in 2010 that recommends primary energy sources for generating electricity, such as nuclear power, coal, and imported liquefied natural gas. Studies have shown that replacing gas with coal as a primary fuel in the power sector and allocating more gas to other sectors will bring economic benefits to the country. However, a systematic study is needed on fuel diversification and the related energy security issues to help the government plan the country's energy future. Such a study needs to consider the options for primary fuels in power generation as well as both intraregional and interregional power trade options, including power imports from Myanmar and Nepal through India and contributions of renewable energy sources such as wind and solar power.

5. Other energy issues confronting Bangladesh include inefficient allocation of gas among sectors, such as power, transport, and fertilizer. Financial sustainability in the energy sector is poor, mainly because large government subsidies lead to underpricing of gas and electricity. An ADB financed study has estimated that pricing of gas in line with prices in India and Pakistan would have increased annual gas revenues from \$300 million to \$2.9 billion in 2011.⁶ Such a price increase would have encouraged the efficient use of gas, while the additional revenues could have helped reduce government subsidies in the energy sector. Both electricity and gas pricing are within the purview of the Bangladesh Energy Regulatory Commission. However, the commission's independence and competence have not yet been fully proven, and some government interference has been experienced in the past. The commission has also suffered from a lack of internal capacity. ADB and other development partners address these policy, regulatory, and institutional issues during their policy dialogue with the government.

III. THE CAPACITY DEVELOPMENT TECHNICAL ASSISTANCE

A. Impact and Outcome

6. The impact will be enhanced primary fuel diversification in Bangladesh's power sector. The outcome will be the increased capacity of the Power Division of the Ministry of Power, Energy, and Mineral Resources to diversify fuel sources for power generation.

⁴ P.D.C. Wijayatunga and M.S. Jayalath. 2008. Economic Impact of Electricity Supply Interruptions on the Industrial Sector of Bangladesh. *Energy for Sustainable Development*. 7 (4). pp. 5–12.

⁵ ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan for Additional Financing to the People's Republic of Bangladesh for the South Asia Subregional Economic Cooperation for the Bangladesh–India Electrical Grid Interconnection Project*. Manila.

⁶ H.Gunatilake and D. Roland-Holst. 2013. Energy Policy Options for Sustainable Development in Bangladesh. *ADB Economics Working Paper Series*. No. 359. Manila: Asian Development Bank.

B. Methodology and Key Activities

7. The TA will deliver two outputs: (i) understanding of the overall security of energy supplies in Bangladesh improved, and (ii) feasibility of the most attractive baseload generation options confirmed with specific case studies provided. These two outputs will be achieved through the following key activities:

- (i) Reviewing literature on energy options for Bangladesh (with emphasis on the power sector), paying particular attention to the lessons learned in using these energy options in both developing and developed countries, especially in the South Asia region;
- (ii) Comparing and contrasting these options for baseload power generation, fully considering such factors as the availability of energy sources domestically and internationally; the cost of exploitation and transportation and whether uninterrupted supplies can be ensured; and the economic, social, gender, and environmental impacts of using each of them as a primary fuel supply in power generation;
- (iii) Critically examining the other barriers to the development of the power sector, such as inefficient operation and management of the country's power utilities and the lack of financial sustainability in the energy sector, which is an obstacle to power sector development;
- (iv) Consulting fully with different stakeholders to obtain their views on whether these options are reasonable solutions to the energy supply security issues in the country;
- (v) Ranking the options after giving due attention to all the factors considered in the comparative analysis of the options and to the opinions expressed during the stakeholder consultations;
- (vi) Identifying specific projects based on the most highly ranked options; and
- (vii) Conducting due diligence on these projects, with emphasis on techno-economic feasibility, financial viability, environmental and social safeguards, gender issues and safeguards, and financial sustainability.

C. Cost and Financing

8. The TA is estimated to cost \$1,200,000, of which \$1,000,000 will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-V). The government will provide counterpart support in the form of counterpart staff, office space, and other in-kind contributions.

D. Implementation Arrangements

9. The executing agency will be the Bangladesh Power Development Board (BPDB), operating under the overall supervision of the Power Division of the Ministry of Power, Energy, and Mineral Resources. The BPDB will facilitate access by the TA consultants to available data and documents related to the country's energy sector and liaise between the consultants and the government institutions relevant to the TA activities. ADB will administer all the contracts under the TA.

10. The TA will require 34 person-months of international consultant services and 40 person-months of services from national consultants. Expertise will be engaged in the areas of energy sector policy; power sector planning; mechanical, electrical, and civil engineering;

project economic and financial analyses; financial management; environment and social safeguards; and poverty and gender. ADB will recruit a consulting firm and some individual consultants in accordance with its Guidelines on the Use of Consultants (2013, as amended from time to time). Because the contract budget is less than \$1,000,000, simplified technical proposals will be requested from short-listed firms, where applicable. The recruitment of consultants will be carried out using quality- and cost-based criteria, with a quality–cost ratio of 90:10. Procurement of goods will be carried out in accordance with ADB’s Procurement Guidelines (2013, as amended from time to time). To the extent possible, payment for consultancy services will be based on the achievement of milestones. All disbursements under the TA will be made in accordance with ADB’s *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). The consultancy deliverables will be the reports on the overall energy security study and on the subsequent feasibility studies of specific projects identified by the overall study. Goods procured under the TA will be handed over to the BPDB on completion of the TA project.

11. The TA project is expected to be implemented from January 2015 to December 2017. Progress will be monitored through inception, interim, draft final, and final reports on the study. A senior advisor appointed under the TA will continuously monitor and guide the consulting team during implementation. At least two stakeholder meetings will be held to validate the approach of the study and the final findings. These meetings, a final dissemination seminar, and an ADB publication will be used to deliver the findings of the study to the key stakeholders.

IV. THE PRESIDENT’S DECISION

12. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$1,000,000 on a grant basis to the Government of Bangladesh for the Study on Energy Security, and hereby reports this action to the Board.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
<p>Impact</p> <p>Enhanced primary fuel diversification in Bangladesh's power sector</p>	<p>At least one project recommended by the study is commissioned by 2022</p>	<p>Annual report of the Bangladesh Power Development Board</p>	<p>Assumption</p> <p>The government commitment to implement the optimal power generation plan developed by the study continues.</p>
<p>Outcome</p> <p>Increased capacity of the Power Division of the Ministry of Power, Energy and Mineral Resources to diversify fuel sources for power generation</p>	<p>Recommendations of the study included in an updated optimal power generation plan by 2017</p>	<p>ADB aide-mémoire</p>	<p>Assumption</p> <p>Key stakeholders will be willing to accept the expert opinion expressed as recommendations of the study.</p>
<p>Outputs</p> <p>1. Understanding of the overall security of energy supplies in Bangladesh improved</p>	<p>Final energy security study report submitted to the Power Division of the Ministry of Power, Energy, and Mineral Resources by 2017</p>	<p>ADB aide-mémoire</p>	<p>Assumption</p> <p>The data required for the study analysis is readily available and is provided in time by respective agencies.</p>
<p>2. Feasibility of the most attractive baseload generation options confirmed with specific case studies provided</p>	<p>Feasibility study report(s) of the specific case studies submitted to the Power Division, Ministry of Power, Energy and Mineral Resources by 2017</p>	<p>ADB aide-mémoire</p>	<p>Assumption</p> <p>Relevant agencies are committed to consulting key stakeholders during the study.</p>
<p>Activities with Milestones</p> <p>1. Understanding of the overall security of energy supplies in Bangladesh improved</p> <p>1.1 Conduct a review of literature on energy options for Bangladesh, with emphasis on the power sector (April 2015–June 2015).</p> <p>1.2 Compare and contrast different options for power generation, giving due emphasis to energy security aspects, economic costs, and environmental and social safeguards, including gender issues (April 2015–June 2015).</p> <p>1.3 Conduct a stakeholder meeting to discuss available options (July 2015).</p> <p>1.4 Provide a draft final report with recommendations for different generation options for Bangladesh, based on sound criteria and considering all</p>			<p>Inputs</p> <p>ADB: Technical Assistance Special Fund (TASF-V) \$1,000,000</p> <p>Note: The government will provide counterpart support in the form of counterpart staff, office space, and other in-kind contributions.</p>

Activities with Milestones	Inputs
<p>aspects of generation development (August 2015–September 2015).</p> <p>1.5 Provide the final report, addressing comments from all stakeholders (1 October 2015–31 December 2015).</p> <p>1.6 Present the findings to the key stakeholders (December 2015).</p> <p>2. Feasibility of the most attractive baseload generation options confirmed with specific case studies provided</p> <p>2.1 Rank the generation options, and identify specific projects for each of these options (August 2015).</p> <p>2.2 Conduct due diligence on the priority projects, emphasizing techno-economic feasibility and giving adequate attention to environmental and social safeguards, including gender issues and financial sustainability (August 2015–December 2016).</p> <p>2.3 Provide the draft final report on the feasibility of each of the projects (1 September 2016–31 March 2017).</p> <p>2.4 Present the findings to the key stakeholders (April 2017–June 2017).</p>	

ADB = Asian Development Bank.
Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Amount
Asian Development Bank^a	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	600.0
ii. National consultants	150.0
b. International and local travel	70.0
c. Reports and communications	10.0
2. Equipment ^b	5.0
3. Training, seminars, and conferences	40.0
4. Surveys	20.0
5. Representative for contract negotiations	5.0
6. Contingencies	100.0
Total	1,000.0

Note: The technical assistance (TA) is estimated to cost \$1,200,000, of which contributions from the Asian Development Bank are presented in the table above. The government will provide counterpart support in the form of counterpart staff, office space, and other in-kind contributions. The value of government contribution is estimated to account for 17% of the total TA cost.

^a Financed by the Asian Development Bank's Technical Assistance Special Fund (TASF-V).

^b Equipment will include three laptop computers and a printer for the use of the consultants during the TA activities. The equipment will be handed over to Bangladesh Power Development Board at the end of the TA project.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Introduction

1. The consultants engaged by the Asian Development Bank (ADB) for its technical assistance (TA) to Bangladesh for the Study on Energy Security will conduct a comprehensive study on energy security in the country, with emphasis on the power generation sector. Based on the findings of this study, the consultants will also undertake feasibility studies on the high-priority power generation projects the study recommends, providing the due diligence that would be required for an investment by ADB. The executing agency will be the Bangladesh Power Development Board.

2. The TA will require 74 person-months of intermittent services from international and national consultants, comprising about 34 person-months of international consultant services and 40 person-months of services from national consultants. The TA will require expertise in (i) energy sector policy; (ii) power sector planning; (iii) mechanical, electrical, and civil engineering; (iv) project economic and financial analysis; (v) financial management; (vi) environment and social safeguards; and (vii) poverty and gender issues.

B. Scope of Work

3. In addition to the specific tasks indicated in paras. 4–12 all consultants are expected to participate in ADB's missions and contribute to preparing aide-mémoire as mission members. The professional positions and a brief description of the activities related to the respective positions are provided in paras. 4–12. To the extent possible, the payment for consultancy services will be based on achievement of milestones.

4. **Energy policy specialists** (international, 6 person-months; national, 6 person-months). The energy policy specialists should have a bachelor's degree in economics, engineering, or any related field. Postgraduate qualifications in a related field will be given preference. The specialists should have a working knowledge of the treaties and agreements in climate change and environmental protection to which Bangladesh is a signatory, which will enable them to draw up policies that will help improve electricity supply and energy security as well as reduce greenhouse gas emissions and achieve climate change mitigation and adaptation. The international specialist will act as the overall team leader and should have at least 15 years of experience in advising on and drafting energy policies in developing countries, preferably in South Asia. The consultant will provide expertise relating to overall energy policy aspects including areas such as a review on production-sharing arrangements with international oil companies to support off-shore oil exploration. The national specialist will be the leader of the team of national consultants. The national specialist will assist the international specialist and should have at least 10 years of experience in advising on and drafting energy policies in Bangladesh.

5. **Power sector planning specialists** (international, 4 person-months; national, 6 person-months). The power sector planning specialists should have a bachelor's degree in electrical engineering or any related field. Postgraduate qualifications in a related field will be given preference. The specialists should have a working knowledge of the treaties and agreements in climate change and environmental protection to which Bangladesh is a signatory, which will enable them to draw up policies that will help improve electricity supply and energy security as well as reduce greenhouse gas emissions and achieve climate change mitigation and adaptation. The international specialist should have at least 10 years of experience in power

system planning and operation in more than one developing country, preferably in South Asia. The national specialist will assist the international consultant and should have at least 10 years of experience in power system planning in Bangladesh.

6. **Mechanical, electrical, and civil engineering experts** (international, 6 person-months; national, 6 person-months). The mechanical, electrical, and civil engineering experts should have a bachelor's degree in their field of engineering. Postgraduate qualifications in a related field will be given preference. The international expert should have at least 10 years of experience in siting, constructing, operating, and maintaining power plants in more than one country, preferably in South Asia. The national expert will assist the international consultant and should have similar experience in Bangladesh.

7. **Project economists** (international, 3 person-months; national, 4 person-months). The project economists should have a bachelor's degree in economics or engineering and will be responsible assessing the economic viability of the priority projects. This will include economic analyses and the related sensitivity studies for each project. The international economist should have at least 10 years of experience in related work in more than one country. The national economist, who will assist the international economist, should have at least 10 years of experience in Bangladesh.

8. **Financial specialists** (international, 3 person-months; national, 4 person-months). The financial specialists should have a bachelor's degree or the equivalent in finance or accountancy and will be responsible assessing the financial viability of the projects. Preparation of project costs, financing, financial analyses, and related sensitivity studies will be carried out for each of the projects. The specialists will also analyze and report on the past financial performance of potential executing agencies for these projects and present financial projections for the projects. The international specialist should have at least 10 years of experience in related work. The national specialist, who will assist the international consultant, should have at least 10 years of experience in Bangladesh.

9. **Environment specialists** (international, 3 person-months; national, 5 person-months). The environment specialists should have a bachelor's degree in a relevant discipline. They will be responsible for the environmental safeguard assessments and for developing or reviewing and finalizing the required documentation in line with ADB guidelines and national environmental regulations. The international specialist should have at least 10 years of experience in related work in more than one country. He or she should also have a working knowledge of national laws and regulations and ADB's Safeguard Policy Statement (2009), which will enable the specialist to ensure that safeguards are reconciled in a way that complies with both the national and ADB policy frameworks. The national specialist, who will assist the international specialist, should have similar experience in Bangladesh.

10. **Social safeguard specialists** (international, 3 person-months; national, 5 person-months). The social safeguard specialists should have a bachelor's degree in a relevant discipline. They will be responsible for the social safeguard assessments and developing or reviewing and finalizing the required documentation in line with ADB guidelines and relevant national regulations. They will also conduct the necessary surveys to establish baseline socioeconomic data in the project areas. The international specialists should have at least 10 years of experience in related work in more than one country. They should also have a working knowledge of national laws and regulations and ADB's Safeguard Policy Statement, which will enable them to ensure that safeguards are reconciled in a way that complies with both the

national and ADB policy frameworks. The national specialist, who will assist the international specialist, should have similar experience in Bangladesh.

11. **Poverty and gender specialist** (national, 4 person-months). The poverty and gender specialist should have a bachelor's degree in a relevant discipline. The specialist will identify issues related to pro-poor and gender-inclusive access to energy resources and services; document promising and/or emerging practices in Bangladesh for possible incorporation in the projects; and identify modalities through which projects can effectively promote greater access to energy resources, services, and opportunities for the poor, vulnerable groups, and women. The specialist will also prepare a gender action plan for each of the projects. The specialist should have at least 10 years of experience in related work.

12. **Senior advisor** (international, 6 person-months). The senior advisor should have a postgraduate degree in economics, engineering, or any related field. The advisor will assist the project officer in coordinating the activities of the consulting team. The advisor should have extensive experience in advising on and drafting energy policies and broad knowledge of the different power-generating options in developing countries, preferably those in South Asia.

OUTLINE OF THE FINAL REPORT

1. **Executive summary.** A summary of 2–3 pages covering the important elements of all the chapters of the study.
2. **Chapter 1.** Introduction: Importance of the study, terms of reference, and organization of the report.
3. **Chapter 2.** Review of literature on security issues related to energy, covering policy, financing, technological, environmental, social, and economic factors, with particular emphasis on developing countries and South Asia.
4. **Chapter 3.** Critical analysis of the issues involved when energy security aspects relating to the power sector are examined. Recommendations for different options for power generation, with due consideration given to other related issues, such as environmental and social safeguards.
5. **Chapter 4.** Ranking of generation options for Bangladesh, with proper justification of the weights given to different factors affecting this ranking. Several scenarios may be presented under different conditions.
6. **Chapter 5.** List of possible projects under high priority generation options.
7. **Chapter 6.** Summary of due diligence on each of the projects identified. The format of this chapter needs to be in line with the due diligence sections of the report and recommendation of the President used for approval of project loans by the Board of Directors of the Asian Development Bank.
8. **Appendix.** Detailed due diligence reports for each of the priority projects identified.