



Technical Assistance Report

Project Number: 47275
Policy and Advisory Technical Assistance (PATA)
March 2014

Kingdom of Bhutan: Promoting Clean Energy Development in Bhutan (Financed by the Government of Norway)

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 6 January 2014)

Currency unit	–	Norwegian krone/kroner (Nkr)
Nkr1.00	=	\$0.1621
\$1.00	=	Nkr6.1682

ABBREVIATIONS

ADB	–	Asian Development Bank
DHPS	–	Department of Hydropower and Power Systems
DRE	–	Department of Renewable Energy
JCG	–	joint consultation group
MRV	–	measurement, reporting, and verification
MW	–	megawatt
NAMA	–	nationally appropriate mitigation action
NEC	–	National Environment Commission
PMU	–	program management unit
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Policy and advisory technical assistance (PATA)
Targeting classification	–	General intervention
Sector (subsectors)	–	Energy (renewable energy, energy efficiency and conservation, large hydropower)
Themes (subthemes)	–	Environmental sustainability (eco-efficiency, environmental policy and legislation); social development (human development); capacity development (institutional development); private sector development (a conducive policy and institutional environment)
Climate change	–	Climate change mitigation
Location (impact)	–	National (high), urban (low), rural (low)
Partnership	–	Government of Norway, Energy+ Partnership, Sustainable Energy for All Initiative

NOTE

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

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CONTENTS

	Page
I. INTRODUCTION	1
II. ISSUES	1
III. THE PROPOSED TECHNICAL ASSISTANCE	3
A. Impact and Outcome	3
B. Methodology and Key Activities	3
C. Cost and Financing	4
D. Implementation Arrangements	4
IV. THE PRESIDENT'S RECOMMENDATION	5
 APPENDIXES	
1. Design and Monitoring Framework	6
2. Cost Estimates and Financing Plan	9
3. Outline Terms of Reference for Consultants	10
 SUPPLEMENTARY APPENDIXES (available on request)	
A. The Framework for Energy + Cooperation with Bhutan	
B. Joint Implementation Note	
C. Terms of Reference for Consultants	
D. Indicative Procurement Plan	

I. INTRODUCTION

1. The Government of Bhutan has requested technical assistance (TA) from the Asian Development Bank (ADB) to support its efforts to enhance the development of clean and sustainable energy in the country under the Framework for Energy+ Cooperation with Bhutan. The framework was signed by the Government of Bhutan, the Government of Norway, and ADB on 1 February 2013 in New Delhi, India.¹ Energy + Cooperation Partnership with Bhutan supports increased access to sustainable energy and avoided greenhouse gas emissions through deployment of renewable energy and energy efficiency in Bhutan.

2. The partnership led by the Government of Norway, follows a three-phased approach of readiness, implementation, and scaling up. The TA will support activities in the initial readiness phase of the partnership. ADB fielded missions to Bhutan on 20–22 May 2013, 2–6 September 2013, and 21–23 January 2014 to consult with the Government of Bhutan on a joint implementation note, which provided details of the collaboration, and agreed with the executing agency and implementing agencies in terms of the impact, outcome, cost estimates, terms of reference, implementation arrangements, and key activities of the TA.² The note, as agreed, is in Supplementary Appendix B. The concept paper for the TA was approved by ADB's Vice-President, Operations 1 on 13 December 2013.³ The design and monitoring framework of the TA is in Appendix 1.

II. ISSUES

3. Bhutan has abundant natural renewable energy resources, dominated by an estimated 30,000 megawatts (MW) of hydropower potential, of which, only 5% has been developed.⁴ Hydropower is the backbone of Bhutan's economy, generating 99% of the country's electricity supply, and accounting for 18% of total national revenue and 20% of gross domestic product in 2013. The Government of Bhutan recognizes hydropower's central role in Bhutan's development and sets out in its Eleventh Five Year Plan 2013-2018⁵ to accelerate expansion of hydropower capacity. Bhutan's power system master plan has identified 75 prospective hydropower sites for development, but only a few prefeasibility studies have been conducted. Expedited prefeasibility studies are needed to secure project funding, particularly from private investors.

4. The high upfront costs of hydropower and other renewable energy development pose a major challenge for Bhutan. The hydropower sector is dominated by public funds from bilateral aid and development financial institutions such as ADB, which are insufficient to realize Bhutan's energy development objectives. Private sector investment is necessary to bridge funding gaps, and to this end, the Government of Bhutan has adopted a series of policies during 2008–2013 that provided frameworks and incentives for domestic and foreign private

¹ The International Energy and Climate Initiative (Energy+) supports transformational change to achieve universal access to sustainable energy and avoid greenhouse gas emissions in developing countries by scaling-up access to renewable energy sources and increased energy efficiency. The Framework for Energy+ Cooperation with Bhutan is in Supplementary Appendix A. The framework formalizes an earlier commitment by the Government of Norway made on 14 October 2012 to provide Nkr100 million to Bhutan under the Energy+ Cooperation Partnership.

² ADB mission participated in the first meeting of the joint consultation group of Energy+ Cooperation Partnership with Bhutan, which was chaired by the secretary of the Ministry of Economic Affairs, the Government of Bhutan, on 6 September 2013.

³ The TA first appeared in the business opportunities section of ADB's website on 16 December 2013.

⁴ Of the 30,000 MW estimate, 23,760 MW considered to be technically and economically feasible.

⁵ The Government of Bhutan Gross National Happiness Commission. 2013. *Eleventh Five Year Plan (2013-2018)*. Bhutan.

investors to participate in the development of medium and large hydropower projects and other renewable energy projects.⁶ Limited progress on hydropower development has been made so far due to the absence of detailed regulatory guidelines for implementing these policy frameworks. The country's private sector is small and underdeveloped, and foreign private investment in the hydropower sector is at the "pioneer" stage. The enabling environment must be improved to attract private sector participating in the development of hydropower and other clean and sustainable energy.

5. The excessive dependence on the single resource of hydropower imperils Bhutan's energy security. The country's current hydropower assets are all run-of-the-river plants that have no storage capacity, and rely exclusively on seasonal water flows: generation output can drop to less than 20% of installed capacity during the dry seasons. Enhancing energy security requires diversification of the energy mix, supplementing hydropower with other renewable resources such as wind, solar, and small hydropower; diversification of energy supply will also mitigate hydrological and meteorological risks. Although less cost-effective than large hydropower, the country will benefit from developing these other renewable resources via increased access to electricity in remote areas, which will enhance energy security while delivering environmental dividends. Bhutan's Eleventh Five Year Plan targets 20 MW of alternative renewable energy generation by 2025 which will require elucidation of a robust enabling policy environment, of which the highest priorities are (i) formulation of renewable energy⁷ master plan to identify, assess, and forecast the resources; (ii) formulation of feed-in-tariff⁸ framework; and (iii) preparation of implementation rules and guidelines of the alternative renewable energy policy.

6. Bhutan is on an actual low emissions development trajectory. Its clean energy resources are more than sufficient to meet domestic needs for the foreseeable future, but a pure supply-side approach will result in sub-optimal energy development. A strategic national energy efficiency policy is a near-term priority, as promoting the use of efficient technologies, processes, and products throughout the energy supply and consumption chains will eliminate energy and other resource waste, accelerating access to energy for all consumers and facilitating growth of energy exports. A research in 2012 identified good potential for savings in energy-intensive sectors in the country.⁹ Lighting was identified as a near-term opportunity for technological leap-frogging: a pilot program is proposed to replace incandescent bulbs with white light emitting diodes (WLEDs).

7. As a party to the United Nations Framework Convention on Climate Change, the Government of Bhutan is identifying nationally appropriate mitigation actions (NAMAs) which are a prospective pipeline of activities to reduce greenhouse gas emissions relative to the business-as-usual scenario, to be implemented on a unilateral basis. For NAMAs to be successful as a policy instrument, a measurement, reporting, and verification (MRV) system needs to be in place to define the business-as-usual scenario and quantify avoided greenhouse gas emissions. Well-defined NAMAs, a robust MRV system, and a national energy registry

⁶ These policies included Sustainable Hydropower Development Policy (2008), Foreign Direct Investment Policy (2010) and Alternative Renewable Energy Policy (2013).

⁷ Renewable energy here refers to solar (both photovoltaic and thermal), wind, bioenergy, geothermal, pico hydropower, micro hydropower, mini hydropower and small hydropower up to 25 MW and waste to energy.

⁸ A feed-in-tariff (FIT) is a policy mechanism used to encourage deployment of renewable electricity technologies. A FIT program typically guarantees that customers who own a FIT-eligible renewable electricity generation facility, such as a roof-top solar photovoltaic system, will receive a set price from their utility for all of the electricity they generate and provide to the grid. <http://www.eia.gov>.

⁹ United Nations Development Programme. 2012. *Bhutan Energy Efficiency Baseline Study*.

system are necessary elements to mobilize future climate change financing, including private sector investment, and to monetize the benefits of low-emissions development.

8. In parallel with the policy framework, NAMA and MRV mechanisms, Bhutan must address an acute shortage of skilled professionals and specialists at all levels of the public and private sectors. The country still depends on foreign expertise to fill the gaps. Weak institutional capacity and inadequate human resources constrain the efficiency and responsiveness of energy services delivery. Human resource development has been given high priority in the Eleventh Five Year Plan, with institutional capacity building at the top of the energy sector development agenda. The staff of Bhutan government agencies: the Department of Renewable Energy (DRE) and the Department of Hydropower and Power Systems (DHPS) under the Ministry of Economic Affairs, and the National Environment Commission (NEC), are in need of on-the-job training.

9. The TA is aligned with ADB's Energy Policy and follows recommendations of an ADB evaluation study of ADB's performance in Bhutan energy sector¹⁰ to (i) consider supporting the development of the renewable energy sector by addressing policy, institutional, financial, and technical barriers; (ii) develop public-private partnership transactions in the hydropower sector; and (iii) provide extensive capacity-building assistance. The TA has been included in ADB's country operations business plan for Bhutan.¹¹ All the activities to be supported under the TA have been agreed with the Government of Bhutan and the Government of Norway.

III. THE PROPOSED TECHNICAL ASSISTANCE

A. Impact and Outcome

10. The impact will be enhanced clean and sustainable energy development in Bhutan. The outcome will be improved enabling environment for the development of hydropower and other renewable energy resources in the country.

B. Methodology and Key Activities

11. The outputs will be (i) the preparation of investment projects; (ii) the formulation of policy and development of enabling environment; and (iii) the strengthening of institutional capacity. Key activities include the following:¹²

(i) **Output 1: Investment projects prepared.** The TA will (a) conduct prefeasibility studies for the Shongarchhu hydroelectric project, the Dagachhu-II hydroelectric project, and the Manas hydroelectric project;¹³ (b) conduct a feasibility study for one 30 MW solar power plant project in Bumthang district; (c) finance a pilot project to encourage the use of higher efficiency lamps, such as WLEDs, to eliminate energy waste in lighting subsector; and (d) conduct reconnaissance studies for four mini or small hydropower projects—Haachu hydropower project in Paro district,

¹⁰ ADB. 2010. *Evaluation Study: Bhutan Energy Sector*. Manila.

¹¹ ADB. 2014. *Country Operations Business Plan: Bhutan, 2014–2016*. Manila.

¹² Details of the activities and the plan for implementation and scaling up in the ensuing phases of Energy+ Cooperation with Bhutan are described in Joint Implementation Note (Supplementary Appendix B). Parts A, B, and C are ranked in relative order of priority, recognizing that investment projects can influence and accelerate policy evolution, and also recognizing that capacity building may be most effective when directly connected to investment projects.

¹³ The three hydropower projects are included in the Bhutan power system master plan and prioritized by the Government of Bhutan for prefeasibility studies under Eleventh Five Year Plan (2013–2018).

Wachi hydropower project in Trongsa district, Bambuchu hydropower project in Lhuntse district, and Cherchhu hydropower project in Tsirang district.

(ii) **Output 2: Policy formulated and enabling environment developed.** The TA will (a) formulate a renewable energy master plan; (b) formulate an energy efficiency policy; (c) formulate a feed-in-tariff framework for renewable energy technologies; (d) conduct a study on the deployment of solar water heating system in Bhutan; (e) formulate rules and guidelines for implementing alternative renewable energy policy; (f) formulate guidelines and/or manuals for private sector participation in the hydropower sector development; (g) develop environmental and social safeguards and standards for energy sector; (h) identify NAMA opportunities in the energy sector; (i) develop an MRV system; (j) develop a national energy registry system; (k) assess resource requirements for implementing minimum energy performance standards; and (l) update Bhutan energy data directory.

(iii) **Output 3: Institutional capacity strengthened.** The TA will (a) conduct an assessment of the training needs of the TA executing agency and provide training to the TA implementing agencies; and (b) establish a program management unit (PMU).

C. Cost and Financing

12. The TA is estimated to cost \$6,241,691, of which \$5,674,265 will be financed on a grant basis by the Government of Norway and administered by ADB.¹⁴ The Government of Bhutan will provide counterpart support in the form of counterpart staff, office space, technical data, and other in-kind contributions.

D. Implementation Arrangements

13. The DRE will be the executing agency of the TA. The DRE, the DHPS, and the NEC will be the implementing agencies responsible for three distinct sets of activities.

14. The DHPS will be responsible for the following activities: (i) conducting prefeasibility studies for the three hydropower projects; (ii) formulating guidelines and/or manuals for private sector participation in the hydropower sector development; and (iii) participating in training.

15. The DRE will be responsible for the following activities: (i) conducting a feasibility study for the 30 MW Shingkhar solar power plant project in Bumthang District; (ii) financing a pilot project to encourage the use of higher efficiency lamps; (iii) conducting reconnaissance studies for the four mini or small hydropower projects; (iv) formulating renewable energy master plan; (v) formulating energy efficiency policy; (vi) formulating feed-in-tariff framework for renewable energy technologies; (vii) conducting a study for the deployment of solar water heating system in Bhutan; (viii) formulating the implementation rules and guidelines of the alternative renewable energy policy; (ix) conducting assessment of the resource requirements for implementing minimum energy performance standards; (x) updating Bhutan energy data directory; (xi) conducting training needs assessment and participating in training; and (xii) establishing the PMU.

¹⁴ On 6 January 2014, \$5,674,265 was the equivalent of NKR35,000,000 at the exchange rate of \$1=NKR6.1682. Dollar amounts used in this TA report are based on the same exchange rate.

16. The NEC will be responsible for the following activities: (i) preparing environmental and social safeguards and standards for energy sector; (ii) identifying NAMA opportunities in the energy sector in Bhutan; (iii) developing an MRV system; (iv) developing a national energy registry system; and (v) participating in training.

17. The joint consultation group (JCG)¹⁵ has been established pursuant to the Framework for Energy+ Cooperation with Bhutan and the joint implementation note to oversee the overall implementation of the TA. A PMU will be set up within the DRE to be responsible for day-to-day project implementation activities, which will include the coordination of agencies, the monitoring of progress, and project reporting.

18. The TA will be implemented over 3 years from the date of effectiveness.¹⁶ It will require 262.25 person-months of consulting services from both firms and individuals, comprising 183.25 person-months from international consultants and 79.00 person-months from national consultants. The consultants will have expertise in such areas as hydropower engineering; geology; hydrology; electromechanical design engineering; economic and financial analysis; renewable energy; energy efficiency; climate change; public-private partnership; energy law, regulation and standards, environmental and social safeguards; project coordination; and project implementation. Due to the complexity of the assignments, four consulting firms will be engaged using the quality- and cost-based selection approach with a 90:10 quality-cost weighting based on a full technical proposal. Individual consultants will be required for specialized and country-specific expertise. ADB will engage all consultants in accordance with its Guidelines on the Use of Consultants (2013, as amended from time to time). During TA implementation, vehicles, computers, software, office equipment, other specialized equipment, and WLEDs will be purchased by the consulting firms in accordance with ADB's Procurement Guidelines (2013, as amended from time to time). All the assets purchased under the TA are ADB's property and will be turned over to the Government of Bhutan, executing agency, and implementing agencies upon TA completion. All disbursements under the TA will be made in accordance with the ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time).

19. The DRE, as the executing agency, will be required to submit (i) semiannual progress reports under the TA for timely monitoring, and (ii) a project completion report to ADB within 3 months of physical completion of the TA. ADB will submit progress reports to the Government of Norway as stipulated in the cofinancing agreement. An evaluation will be conducted by ADB at the time of TA conclusion to evaluate the impact of the TA. Good practices and lessons learned from the TA will be disseminated through workshops, seminars, publications, and the websites of ADB and the Government of Bhutan.

IV. THE PRESIDENT'S RECOMMENDATION

20. The President recommends that the Board approve ADB administering technical assistance not exceeding Nkr35,000,000 to the Government of Bhutan to be financed on a grant basis by the Government of Norway for Promoting Clean Energy Development in Bhutan.

¹⁵ The JCG currently comprises representatives from the Government of Bhutan, ADB, and the Government of Norway. The Government of Bhutan is represented by the secretary of the Ministry of Economic Affairs who also serves as the chair. ADB is represented by the director of the Energy Division, South Asia Department, and the Government of Norway is represented by the Norwegian ambassador to Bhutan and the policy director of the Energy+ Secretariat of the Ministry of Foreign Affairs.

¹⁶ The TA is expected to be implemented from April 2014 to April 2017.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
<p>Impact Enhanced clean and sustainable energy development in Bhutan</p>	<p>An additional 2,022 MW of hydropower capacity installed by 2023 (baseline of about 1,488 MW by 2013)</p> <p>20 MW of power generated through a mix of renewable energy technologies^a by 2025 (baseline of less than 1 MW in 2013)</p> <p>Greenhouse gas emissions controlled at less than 6300.00 Gg in 2020 (projected^b baseline of 2234.45 Gg in 2013)</p>	<p>For all indicators: Ministry of Economic Affairs reports</p> <p>Bhutan energy data directory</p> <p>National communication reports to UNFCCC</p> <p>Biannual update report to UNFCCC</p>	<p>Assumptions Political stability continues.</p> <p>Bhutan's strong economic growth continues.</p> <p>Risks Unexpected economic shocks occur in the region.</p> <p>The approvals of the policy, plans, and frameworks by the Government of Bhutan are delayed.</p>
<p>Outcome Improved enabling environment for the development of hydropower and other renewable energy resources</p>	<p>By 2017: At least one PPP or IPP hydropower project identified</p> <p>Renewable energy master plan, energy efficiency policy, and feed-in-tariff framework submitted to the competent authority for approval</p> <p>Frameworks of MRV and the national energy registry systems submitted to the respective competent authorities for approval</p>	<p>For all indicators: Ministry of Economic Affairs reports</p> <p>Implementing agencies' program reports</p> <p>National communication reports to UNFCCC</p> <p>Biannual update report to UNFCCC</p>	<p>Assumption The Government of Bhutan continues to prioritize hydropower and alternative renewable energy development.</p>
<p>Outputs 1. Investment projects prepared</p>	<p>Prefeasibility study reports for the three hydropower projects endorsed by DHPS in 2015</p> <p>The feasibility study report for the mega solar project endorsed by the DRE in 2015</p> <p>Reconnaissance study</p>	<p>For all indicators: Ministry of Economic Affairs reports</p> <p>Implementing agencies' program reports</p>	<p>Assumption All the required reviews and approvals by the executing agency and implementing agencies are received on time.</p> <p>Reliable data is available.</p> <p>Risk High turnover of trained staff occurs in the</p>

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
<p>2. Policy formulated and enabling environment developed</p> <p>3. Institutional capacity strengthened</p>	<p>reports for the four mini or small hydropower projects endorsed by DRE in 2015</p> <p>The renewable energy master plan endorsed by DRE in 2015</p> <p>The energy efficiency policy endorsed by DRE in 2015</p> <p>The feed-in-tariff framework endorsed by DRE in 2015</p> <p>The guidelines and/or manuals for private sector participation in hydropower sector development endorsed by DHPS in 2015</p> <p>The frameworks of MRV and national energy registry systems endorsed by NEC in 2016</p> <p>At least four training workshops completed in 2016. 30% of the trainees are women.</p> <p>Program management unit established in 2014</p>		<p>executing agency and implementing agencies.</p>
<p>Activities with Milestones</p> <p>1. Output 1: Investment projects prepared</p> <p>1.1 Recruit consultants by Q2 2014</p> <p>1.2 Submit draft prefeasibility study reports for the three hydropower projects to DHPS by Q3 2015</p> <p>1.3 Finalize the prefeasibility study reports by Q4 2015</p> <p>1.4 Submit draft feasibility study report for the mega solar project to DRE by Q2 2015</p> <p>1.5 Finalize the feasibility study report by Q3 2015</p> <p>1.6 Submit draft strategy report for scaling up the use of higher efficiency lamps to DRE by Q1 2015</p> <p>1.7 Finalize the strategy report by Q2 2015</p> <p>1.8 Complete procurement of the pilot project by Q3 2015</p> <p>1.9 Complete pilot project by Q4 2015</p> <p>1.10 Submit draft reports of reconnaissance study for the four mini or small hydropower projects to DRE by Q2 2015</p> <p>1.11 Finalize the reconnaissance study reports by Q3 2015</p>			<p>Inputs</p> <p>Government of Norway:\$5,674,265</p> <p>Note: The Government of Bhutan will provide counterpart support in the form of counterpart staff, technical data, office space, and other in-kind contributions.</p>

Activities with Milestones	
2. Output 2: Policy formulated and enabling environment developed	
2.1	Recruit consultants by Q2 2014
2.2	Submit draft renewable energy master plan to DRE by Q3 2015
2.3	Finalize the renewable energy master plan by Q4 2015
2.4	Submit draft energy efficiency policy to DRE by Q3 2015
2.5	Finalize the energy efficiency policy by Q4 2015
2.6	Submit draft feed-in-tariff framework to DRE by Q1 2015
2.7	Finalize the feed-in-tariff framework by Q2 2015
2.8	Submit draft implementation plan for solar water heating system to DRE by Q1 2015
2.9	Finalize the detailed implementation plan for solar water heating system by Q2 2015
2.10	Submit draft of implementation rules and guidelines of alternative renewable energy policy to DRE by Q2 2015
2.11	Finalize the implementation rules and guidelines of alternative renewable energy policy by Q3 2015
2.12	Submit draft of guidelines and/or manuals for private sector participation in hydropower sector development to DHPS by Q3 2015
2.13	Finalize the guidelines and/or manuals for private sector participation in hydropower sector development by Q4 2015
2.14	Submit draft of environmental and social safeguards and standards to NEC by Q2 2015
2.15	Finalize the environmental and social safeguards and standards by Q3 2015
2.16	Submit draft of NAMA proposal to NEC by Q2 2015
2.17	Finalize final the NAMA report by Q3 2015
2.18	Submit draft of MRV system framework to NEC by Q3 2015
2.19	Finalize the MRV system framework by Q1 2016
2.20	Submit draft framework of the national energy registry system to NEC by Q3 2015
2.21	Finalize the national energy registry system framework by Q1 2016
2.22	Submit draft assessment report for implementing minimum energy performance standards to DRE by Q2 2015
2.23	Finalize the assessment report by Q3 2015
2.24	Update Bhutan energy data directory by Q2 2015
3. Output 3: Institutional capacity strengthened	
3.1	Recruit consultants by Q2 2014
3.2	Complete the training needs assessment for DRE by Q4 2014
3.3	Submit draft training modules to executing agency and implementing agencies by Q2 2015
3.4	Complete the training workshops by Q2 2016
3.5	Submit draft proposal of organizational structure, staff composition, and detailed terms of reference for each of the position to DRE by Q3 2014

DHPS = Department of Hydropower and Power Systems; DRE = Department of Renewable Energy; Gg = gigagram; IPP = independent power producer; MRV = measurement, reporting, and verification; MW = megawatt; NAMA = nationally appropriate mitigation action; NEC = National Environment Commission; PPP = public-private partnership; UNFCCC = United Nations Framework Convention on Climate Change; Q = quarter.

^a Renewable energy here refers to solar (both photovoltaic and thermal), wind, bioenergy, geothermal, pico hydropower, micro hydropower, mini hydropower, and small hydropower up to 25 MW and waste to energy.

^b The baseline data in 2013 is projected by the National Environment Commission because the most recent data available was for 2009—2085.63 Gg.

Source: Asian Development Bank estimates.

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Amount
Government of Norway^a	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	2,694
ii. National consultants	206
b. International and local travel	552
c. Reports and communications	33
2. Equipment ^b	77
3. Training, seminars, and conferences ^c	200
4. Vehicle ^d	100
5. Surveys ^e	425
6. Miscellaneous administration and support costs	
a. Administration fees and other costs ^f	404
b. Administration and support costs ^g	9
7. Representative for contract negotiations	20
8. Pilot testing ^h	420
9. Contingencies	534
Total	5,674

Note: The technical assistance (TA) is estimated to cost \$6,241,691. The contribution from the Government of Norway is presented in the table above. The Government of Bhutan will provide counterpart support in the form of counterpart staff, office space, technical data, and other in-kind contributions. The value of the Government of Bhutan's contribution is estimated to account for 9% of the total TA cost.

^a Administered by the Asian Development Bank (ADB). This amount also includes ADB's administration fee, audit costs, bank charges, and provision for foreign exchange fluctuations (if any), to the extent that these items are not covered by the interest and investment income earned on this grant.

^b Equipment is limited to that required for implementing the TA activities by the executing agency and implementing agencies, which will include but not be limited to (i) office equipment (e.g., computers, software, printers, scanners, fax machines, digital video camera, and other related office equipment); and (ii) specified equipment required for conducting the prefeasibility studies for hydropower projects. The equipment being purchased under the TA will be turned over to the TA recipient (executing agency and implementing agencies) when the TA ends.

^c Workshop, training, seminar, and conference costs cover venue rental and food. They also include costs for printing, communications, couriers, study tour expenses, and other workshop-related expenses.

^d Vehicles purchased under the TA will be limited to those required for implementing the TA activities and will be turned over to the TA recipient (executing agency and implementing agencies) on completion of the TA.

^e The costs for surveys also include expenses necessary for conducting the prefeasibility studies for hydropower projects.

^f This amount is budgeted for ADB's administration fee, audit costs, bank charges, and provision for foreign exchange fluctuations.

^g Administration and support costs cover interpretation costs and translation costs.

^h Products such as white light emitting diodes will be purchased under the pilot project.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The technical assistance (TA) will require 262.25 person-months of consulting services from both firms and individuals. This will include 183.25 person-months from international consultants and 79.00 person-months from national consultants. Four consulting firms will be engaged in accordance with the Asian Development Bank (ADB) Guidelines on the Use of Consultants (2013, as amended from time to time). Individual consultants will also be required due to the need for specialized and country-specific expertise. The consulting firms will be selected using the quality- and cost-based method, with a 90:10 quality–cost weighting based on a full technical proposal.

Table A1: Summary of Consulting Service Requirements

Item	International Position	Person- Month Required	National Position	Person- Month Required
Firm 1	Hydropower specialist and team leader	7.00		
	Hydropower engineer (I)	5.00		
	Hydropower engineer (II)	5.00		
	Hydrologist (I)	3.75		
	Hydrologist (II)	3.75		
	Geologist (I)	4.50		
	Geologist (II)	4.50		
	Survey engineer	4.00		
	Electromechanical design engineer	3.00		
	Energy economist	3.75		
	Environmental specialist	2.00	Environmental specialist	4.00
	Social specialist	1.50	Social specialist	4.00
	Legal advisor	1.50		
	Public–private partnership specialist	4.00		
	Bid advisor	4.00		
Firm 2	Renewable energy specialist and team leader	5.00		
	Renewable energy specialist	4.00	Renewable energy specialist	3.00
	Wind resource specialist	4.00		
	Solar resource specialist	4.00		
	Small hydropower resource specialist	8.00		
	Biofuel energy resource specialist	3.00		
	Engineering geologist	3.00		
	Energy economist	6.00		
	Environmental specialist	6.00	Environmental specialist	3.00
	Social specialist	6.00	Social specialist	5.00
	Legal advisor	3.00		

Item	International Position	Person-Month Required	National Position	Person-Month Required
Firm 3	Bid advisor	3.00		
	Energy efficiency specialist and team leader	7.00	Energy efficiency specialist	3.00
	Transport sector energy efficiency specialist	5.00		
	Industry sector energy efficiency specialist	5.00	Industry sector energy efficiency specialist	2.00
	Building sector energy efficiency specialist	2.00		
	Appliance sector energy efficiency specialist	4.00	Appliance sector energy efficiency specialist	2.00
	Energy economist	3.00		
Firm 4	Energy sector specialist	3.00	Energy sector specialist	3.00
	Legal advisor	4.00		
	Climate change specialist and team leader	3.00		
	Energy specialist	3.00	Energy specialist	3.00
	Environmental specialist	1.00	Environmental specialist	1.00
	Social specialist	1.00	Social specialist	1.00
	Individual	Project coordinator	12.00	
Project implementation specialist		12.00	Project implementation specialist (I)	15.00
			Project implementation specialist (II)	15.00
			Project implementation specialist (III)	15.00
	Procurement specialist	6.00		
Total		183.25		79.00

Source: Asian Development Bank estimates.

2. The outline terms of reference for consulting firms and individual consultants are in paras. 3-18.

A. Consulting Firm 1

3. A consulting firm will be recruited to (i) conduct prefeasibility studies of three hydropower sites; (ii) prepare guidelines and/or manuals and bidding documents for hydropower projects to be implemented under independent power producer mode or public-private partnership mode; and (iii) provide training for staff of Department of Hydropower and Power Systems (DHPS) under the Ministry of Economic Affairs. The consulting firm shall have expertise in the fields of hydropower engineering, geology, hydrology, electromechanical design engineering, economic and financial analysis, environmental and social safeguards, public-private partnership, energy law, regulation, and standards. A total of 65.25 person-months of service inputs will be required,

comprising 57.25 person-months from international consultants and 8.00 person-months from national consultants.

4. The team leader of the consulting firm will be fully responsible for the overall planning and coordination with ADB, the DHPS, and the consultants' team for the smooth implementation of tasks under the TA. Apart from the technical tasks assigned to the team leader, his or her tasks will include but not be limited to (i) coordinating with other team members to develop a detailed work plan and implementation schedule; (ii) working closely with ADB and the DHPS to supervise, monitor, and manage the consulting team and to compile, edit, and ensure the quality and timely submission of the reports to be delivered under this assignment; and (iii) presenting the inception report, interim report, and the draft final report to DHPS through a seminar or conference and incorporating comments.

5. The team leader will have a master's degree in hydropower engineering with 20 years of experience in the fields of hydropower sector planning, costing and financing, bidding process for hydropower projects implemented through the independent power producer mode or public-private partnership mode. Other international consultants will have master's degrees with 15 years of experience in their related fields. The national consultants will have master's degrees with 8 years of experience in their related fields.

B. Consulting Firm 2

6. A consulting firm will be engaged to (i) prepare a renewable energy master plan and a regulatory framework for the promotion of renewable energy projects; (ii) develop renewable energy implementation guidelines, rules, and regulations per the provisions of the Alternate Renewable Energy Policy (2013); (iii) formulate a feed-in-tariff framework for renewable energy technologies; (iv) conduct reconnaissance studies for four mini or small hydropower sites; (v) conduct a feasibility study for one 30 megawatt solar power plant; (vi) conduct a study for the deployment of solar water heating system in Bhutan; (vii) conduct assessment of the resource requirements for implementing minimum energy performance standards; (viii) conduct training needs assessment for the Department of Renewable Energy (DRE) under the Ministry of Economic Affairs; and (ix) provide training for staff of the DRE. The consulting firm shall have expertise in renewable energy, geology, economic and financial analysis, environmental and social safeguards, energy law, regulation and standards. A total of 66 person-months of services will be required, comprising 55 person-months from international consultants and 11 person-months from national consultants.

7. The team leader of the consulting firm will be responsible for the overall planning of the TA and coordination with ADB, the DRE, and the consultants' team for smooth implementation of TA tasks. Apart from the technical tasks assigned to the team leader, his or her tasks will include but not be limited to (i) coordinating with other team members to develop a detailed work plan and implementation schedule; (ii) working with the DRE to oversee the consulting team; (iii) compiling, editing, and ensuring the quality of reports to be issued under the assignment; and (iv) presenting the inception report, interim report, and the draft final report to the DRE through a seminar or conference and incorporating comments.

8. The team leader will have a master's degree in engineering with 15 years of experience in the energy sector and have extensive knowledge of the technical, regulatory, and policy aspects of the renewable energy sector. Prior experience in developing sector specific plans is preferable. Relevant experience in the wind, small hydropower, and solar subsectors will be an added advantage. Other international consultants will have master's degrees with 15 years of

experience in their related fields. The national consultants will have master's degrees with 8 years of experience in their related field.

C. Consulting Firm 3

9. A consulting firm will be recruited to (i) formulate energy efficiency policy; (ii) implement one pilot project to encourage the use of higher efficiency lamps, (iii) update Bhutan energy data directory; and (iv) provide training for staff of the DRE. The consulting firm shall have expertise in energy efficiency, economic and financial analysis, energy law, regulation, and standards. A total of 43 person-months of service inputs will be required, comprising 33 person-months from international consultants and 10 person-months from national consultants.

10. The team leader of this firm will be responsible for the quality and implementation of the firm's assignments, providing the required support to the DRE, and reporting to ADB's project officer. Apart from the technical duties assigned to the team leader, his or her tasks will include but not be limited to (i) coordinating with other team members to develop a detailed work plan and implementation schedule; (ii) working with the DRE to oversee the consulting team; (iii) compiling, editing, and ensuring the quality of reports to be issued under the assignments; and (iv) presenting the inception report, interim report, and the draft final report to the DRE through a seminar or conference and incorporating comments.

11. The team leader will have a master's degree in engineering with 10 years of experience in the energy sector and have extensive knowledge of the technical, regulatory, and policy aspects of energy efficiency. Prior experience in developing sector specific plans is preferable. Other international consultants will have master's degrees with 10 years of experience in their related fields. The national consultants will have master's degrees with 7 years of experience in their related fields.

D. Consulting Firm 4

12. A consulting firm will be recruited to (i) identify nationally appropriate mitigation actions related to the energy sector in Bhutan; (ii) help the National Environment Commission (NEC) implement a low-emission capacity building project; (iii) develop a measurement, reporting, and verification system and a national energy registry system; and (iv) prepare environmental and social standards and safeguards for energy sector. The consulting firm shall have expertise in the fields of energy, climate change, environmental and social safeguards. A total of 13 person-months of service inputs will be required, comprising 8 person-months from international consultants and 5 person-months from national consultants.

13. The team leader of this firm will be responsible for the quality and implementation of the firm's assignments. He or she will also provide the required support to the NEC and report to ADB's project officer. Apart from the technical duties assigned to him or her, the team leader's tasks will include but not be limited to (i) coordinating with other team members to develop a detailed work plan and implementation schedule; (ii) working with the NEC to oversee the consulting team; (iii) compiling, editing, and ensuring the quality of reports to be issued under the assignments; and (iv) presenting the inception report, interim report, and the draft final report to NEC through a seminar or conference and incorporating comments.

14. The team leader will have a master's degree with 10 years of experience in the field of climate change. Prior experience in developing a measurement, reporting, and verification system and national energy registry system is preferable. Other international consultants will

have master's degrees with 10 years of experience in their related fields. The national consultants will have master's degrees with 7 years of experience in their related fields.

E. Individual Consultants

15. **Project coordinator** (international, 12 person-months). The project coordinator will have a master's degree in engineering with 15 years of experience in the energy sector and extensive knowledge of the technical, regulatory, and policy aspects of the renewable energy sector. The specialist will serve as the overall coordinator of all the TA activities. His or her tasks will include but not be limited to (i) coordinating the activities between implementing agencies and the consultants, reporting to the ADB project officer; (ii) monitoring project implementation and helping the implementing agencies prepare progress reports; (iii) helping ADB and the implementing agencies track all the deliverables under the TA and conducting an initial review, as necessary; (iv) organizing training, conferences, workshops, and meetings; (v) establish an energy+ partners' coordination group of the participants in the energy+ partnership to improve coordination within the energy sector; and (vi) preparing minutes of the coordination group meetings.

16. **Project implementation specialists** (international, 12 person-months; 3 national, 45 person-months). The international project implementation specialist will have a bachelor's degree in business administration or engineering and detailed, up-to-date knowledge of ADB project implementation systems, including those for consultant recruitment, disbursements, and project processing. Recent experience in ADB project implementation is required, preferably in power or energy sector projects in South Asian countries. The international specialist's tasks will include but not be limited to (i) assisting the ADB project officer in the TA administration, including budget preparation and liquidation of all individual activities under the TA; (ii) helping the implementing agencies coordinate activities and undertake day-to-day activities; (iii) assisting international experts in arranging for their travel and organizing meetings and workshops, including aspects such as the logistics, documentation, secretariat services, and dissemination of information and materials; (iv) preparing and maintaining a comprehensive and orderly filing system for the TA, updating it regularly; and (v) drafting routine communications.

17. The national project implementation specialists shall have bachelor's degree in engineering and/or finance with 7 years of experience in renewable energy sector. The national specialists' tasks will include but not be limited to (i) providing technical and administrative support to the program management unit; and (ii) helping the unit to coordinate activities and undertake day-to-day activities.

18. **Procurement specialist** (international, 6 person-months). The procurement specialist will have a bachelor's degree in business administration or engineering with detailed, up-to-date knowledge of ADB procurement and project implementation systems, including those for procurement, consultant recruitment, disbursements, and project processing. Recent experience in ADB project implementation is required, preferably in power or energy sector projects in South Asian countries. The specialist's tasks will include but not be limited to (i) reviewing and providing preliminary comments on draft bidding documents; (ii) providing preliminary review of the technical and financial evaluation reports, in coordination with ADB project officer; (iii) reviewing other documents related to procurement activities during project implementation; (iv) facilitating local procurement; and (v) performing other activities that may be required by the ADB project officer.