



Technical Assistance Report

Project Number: 41611
Capacity Development Technical Assistance
November 2008

India: Capacity Building for Himachal Pradesh Power Sector Agencies

CURRENCY EQUIVALENTS

(as of 21 November 2008)

Currency Unit	–	Indian rupee/s (Re/Rs)
Re1.00	=	\$0.0199
\$1.00	=	Rs50.18

ABBREVIATIONS

ADB	–	Asian Development Bank
EA	–	executing agency
GOHP	–	government of Himachal Pradesh
HPERC	–	Himachal Pradesh Electricity Regulatory Commission
HPHPC	–	Himachal Pradesh Hydropower Company
HPSEB	–	Himachal Pradesh State Electricity Board
kV	–	kilovolt
MFF	–	multitranches financing facility
MW	–	megawatt
RMIS	–	regulatory management information system
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Capacity development
Targeting Classification	–	General intervention
Sector	–	Energy
Subsector	–	Energy sector development
Themes	–	Sustainable economic growth, capacity development
Subthemes	–	Institutional development, fostering physical infrastructure development, developing urban areas, developing rural areas

NOTE

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

Vice-President	X. Zhao, Operations 1
Director General	K. Senga, South Asia Department (SARD)
Director	T. Kandiah, Energy Division, SARD
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I. INTRODUCTION

1. During discussions for the country operations business plan 2008–2010, the Government of India (the Government) requested technical assistance (TA) from the Asian Development Bank (ADB) to enhance the capacity of power sector entities in Himachal Pradesh. ADB conducted a fact-finding mission from 30 March 2008 to 4 April 2008 and reached an understanding with the government of Himachal Pradesh (GOHP) on the TA's objective, scope, cost estimates, financing plan, implementing arrangements, and consultants' terms of reference. The design and monitoring framework is in Appendix 1.¹

II. ISSUES

2. Himachal Pradesh's power sector ranked seventh out of 29 in a state power sector performance rating study mandated by the Government.² Strengths included satisfactory progress in distribution reforms, particularly metering and energy accounting, and achievement of 100% rural and consumer electrification. Himachal Pradesh is one of the few states where energy delivered to consumers is 100% metered, and its distribution system has 97.4% availability, which is high. It has also achieved more than 90% metering of its distribution transformers and feeders up to 33 kilovolts (kV), resulting in aggregate technical and commercial losses of a comparatively low 16.3%.

3. The state's power generation potential is 20,415 megawatts (MW)—about 25% of India's total hydropower potential—out of which around 6,150 MW has been developed. Recognizing the state's comparative advantage in hydropower generation, the main strategy of GOHP, outlined in its state Hydro Power Policy, 2006, is to become the country's "Hydro Power State" by providing affordable, reliable power to its residents, and selling excess power to other states and earn revenue. GOHP has targeted its comparative advantage in hydropower with planned investments in installed capacity backed by institutional reforms and capacity development. A new corporate entity, Himachal Pradesh Hydropower Company (HPHPC), has been established with a mandate to develop and operate new hydropower plants in the state.

4. As of March 2007, the state has installed capacity of 535 MW; this rises to 1,866 MW with a share from the national power capacity. In 1991, Himachal Pradesh opened hydropower development for private sector participation. Two private projects totaling 386 MW were commissioned. Currently, the state is able to meet about 50% of its demand from its own resources and experiences energy shortages in the winter months. Power demand³ in the state is expected to increase by 11.37% from 2006 to 2012 and 6.69% from 2012 to 2017. To meet this, GOHP is expanding its hydropower development plans by adding 5,744 MW capacity by 2012. The identified hydropower sites have been allocated to state, central, and private sector investors. Central public sector utilities are expected to develop about 2,754 MW; the private sector about 1,850 MW; and the state sector 1,140 MW. An additional 750 MW of mini-hydropower is expected to be developed privately.

5. GOHP requested ADB assistance to accomplish 1,140 MW investments. Since the state's clean energy agenda is in line with ADB's clean energy and the environment program, ADB is preparing a multitranche financing facility (MFF) of \$800 million to assist GOHP in selected hydropower projects totaling 856 MW. The MFF will be implemented by the new corporate entity, HPHPC, which has substantial human capital in the form of senior technical

¹ The TA first appeared in the business opportunities section of ADB's website on 23 May 2008.

² State Power Sector Performance Ratings - Final Report to the Ministry of Power, Government of India, June 2006.

³ The Central Electricity Authority periodically publishes electric power surveys which include power sector data and forecasts gathered from all sector agencies to be used for sector planning purposes.

staff and is hiring financial and legal professionals to support its growing business. HPHPC's technical staff has experience in implementing investments funded by external donors but not the MFF modality, so capacity building is essential for preparation of further MFF tranches.

6. Himachal Pradesh's transmission assets consist of 2,100 kilometers (km) of transmission lines rated 66 KV and above and about 100 power transformers, totaling around 2,000 megavolt-amperes of capacity. These physical interconnections of transmission network enable the state to exchange power with its regions, depending on the daily power supply balance. However, with considerable hydropower capacity additions in various stages of planning, development, and construction, there will be significant need for additional transmission capacity to be able to wheel the power in the state and out of state. In the absence of a framework for planning, ad hoc capacity additions are made in response to the availability of funding. Regional long-term demand forecasting is crucial along with concept development for the power system to meet prospect demand. This could be addressed by developing a planning framework and power system master plan (the master plan). Himachal Pradesh State Electricity Board (HPSEB) does not have long-term planning capability to develop a master plan that could (i) consider various generation scenarios, and (ii) design a transmission grid capable of supplying in-state and out-of-state consumers as efficiently as possible with an appropriate level of supply reliability.

7. The state's power sector is regulated by Himachal Pradesh Electricity Regulatory Commission (HPERC). GOHP established a functioning regulatory commission in 2001, and it has been issuing tariff orders since then. HPERC is mandated to take measures conducive to the development and management of the electricity industry in an efficient, economic, and competitive manner. It also acts to safeguard consumer interests and improve the quality of service, and holds regular review meetings to monitor compliance with the various directives. In its 2005–2006 tariff order, HPERC made efforts to reduce cross-subsidies and optimize power purchase costs by authorizing the procurement of power on a merit order dispatch basis. HPERC has developed all regulations, codes, and standards (including open access) required by the Electricity Act, 2003; and is developing a multiyear tariff framework. A strong regulatory structure is being formed in Himachal Pradesh. However, new sector developments such as the establishment of a new hydropower company and planned generation increase make it essential to develop HPERC's capacity further.

8. ADB will provide TA in the following areas:

- (i) **Component 1.** This component will develop a comprehensive master plan that addresses the state's power sector planning issues, considering the wide range of supply and demand scenarios in Himachal Pradesh. The master plan will be linked to the state's sector policy and will summarize a clear planning framework, planning criteria, and a detailed and disaggregated demand forecast at the power substation level. The master plan will (a) provide a series of staged, least-cost, 10-year network expansion programs matched to demand growth and under various clean energy generation scenarios; (b) run a cost and benefit analysis for options with and without the clean development mechanism; and (c) identify risk factors and a risk management plan for the state power system. A rolling 5-year capital works plan linked to the master plan will be developed and updated regularly, with detailed project reports prepared for projects covered in the first 1–2 years of the capital works plan. The master plan will include a loss reduction framework and a staged capital works program designed to reduce technical and nontechnical losses along a reasonable and agreed path.

- (ii) **Component 2.** This component of the TA will assist HPERC in assessing user requirements, information availability for identification of functional specification of a regulatory management information system (RMIS). The TA will also assist HPERC in developing methodology to compute the cost of supply at various voltage levels.
- (iii) **Component 3.** This component will provide bridge assistance to HPHPC to prepare periodic financing requests for further tranches of the MFF and set up a project monitoring mechanism for projects financed under the facility.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

9. The impact and outcome of the TA will include the following:

- (i) **Component 1:** The outcome of this component will be a comprehensive power system master plan that will provide the blueprint for development of the power sector in Himachal Pradesh. The master plan will tie together generation, transmission, and distribution expansion to ensure that all proposed capital investments are part of a long-term, structured plan rather than ad hoc. It will also ensure that network expansion is economically efficient and will provide a realistic framework for loss reduction.
- (ii) **Component 2:** The outcome will be specifications for an RMIS and a reporting framework for the power sector entities. Using these specifications, HPERC will acquire an RMIS using its own resources. Assessing information requirement of HPERC and reporting necessities of the power sector entities will facilitate purchasing or developing the correct RMIS, and ultimately facilitate implementation of the multiyear tariff structure. The RMIS will also support review of performance standards in the multiyear tariff framework. Developing a methodology to compute the cost of supply at various voltage levels will support (a) rationalization of tariff across different voltage levels, (b) rationalization of cross-subsidies, and (c) determination of open access surcharges.
- (iii) **Component 3:** Preparation of periodic financing requests for further tranches of the MFF.

1. Outputs

10. Outputs for each component are as follows:

- (i) **Component 1:** (a) A detailed long-term (10-year) demand forecast for Himachal Pradesh at the power substation level, with demand disaggregated between main consumer groups; (b) a series of realistic long-term generation capacity expansion scenarios, considering prospects for in-state generation development as well as generation sourced outside the state; (c) a series of least-cost transmission expansion plans, matched to the generation expansion scenarios developed; (d) an assessment of the quantum and timing of generation and transmission investments for each system development scenario; (e) an estimate of distribution investment costs to meet demand growth; (f) cost and benefit analysis for options with and without the clean development mechanism; (g) identification of risk factors and a risk management plan for the state power system; (h) institutional reform recommendations for HPSEB to develop capacity to implement the master plan and revise it as necessary; (i) a power system

analysis software program and equipment (computers);⁴ and (j) a detailed 5-year program of capital works, and preparation of detailed project reports for projects to be covered in the first 2 years.

- (ii) **Component 2:** (a) Specifications for a RMIS, (b) a reporting framework for the power sector entities, and (c) a cost of supply framework and model.
- (iii) **Component 3:** Periodic financing requests for further tranches of the MFF.

B. Methodology and Key Activities

11. By using least-cost analysis to compare various options for generation, transmission, and distribution in line with ADB's *Guidelines for the Economic Analysis of Projects*,⁵ key activities under the TA will include:

- (i) assessment of existing electricity demand and preparation of a demand forecast, using both bottom-up (location-specific) data and top-down (macroeconomic) parameters;
- (ii) investigation of demand-side management options;
- (iii) assessment of potential energy sources for generation development in Himachal Pradesh, and comparison of the likely development costs of in-state generation versus the expected costs of interstate purchase of electricity in the long term;
- (iv) development of a series of staged generation expansion plans, including in-state options, out-of-state options, and combinations of both;
- (v) computer modeling of the state's current power system down to the power substation level, and analysis of constraints;
- (vi) development and computer modeling of network expansion options to match the various generation expansion plans and forecast demand growth;
- (vii) calculation of annual investment requirements and investment net present values under each of the expansion plans and for a reasonable set of input cost assumptions;
- (viii) cost and benefit analysis for the clean development mechanism option;
- (ix) identification of risk factors and a risk management plan for state power system;
- (x) assessment of annual distribution investment costs for the period of the plan, based on expectations regarding load density, age and condition of existing equipment, and a realistic program of rural electrification;
- (xi) identification, analysis, and cost estimates of options and opportunities for loss reduction, including projects forming part of the overall master plan and stand-alone projects;
- (xii) preparation of a detailed transmission and distribution capital works program for the first 5 years of the master plan, including loss reduction subprojects;
- (xiii) preparation of detailed project reports for projects included in the first 2 years of the capital works program;
- (xiv) training of trainers on power system analysis software;
- (xv) assessment of HPERC user requirements and information availability in the sector;
- (xvi) identification and development of functional specification of an RMIS for HPERC;
- (xvii) analyses of overall cost structure and identification allocation between fix and variable cost across voltage levels, and benchmarking them against best practices; and

⁴ Equipment and software purchased under the TA will be turned over to the Government after TA completion.

⁵ ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila

- (xviii) training of HPHPC officials on the preparation of periodic financing requests for further tranches of the MFF.

12. The TA consultants will conduct on-the-job and classroom-based training of GOHP, HPERC, HPSEB, and HPHPC staff in modern power system planning techniques and tools; and will run regular workshops to update stakeholders on progress in preparation of the master plan and to discuss and debate assumptions and scenarios. In addition, the power system analysis software to be purchased will include a training component for HPSEB users.

C. Cost and Financing

13. The total cost of the TA is estimated at \$1,300,000 equivalent. The amount of \$900,000 will be financed on a grant basis from ADB's TA funding program. GOHP will finance the remaining \$400,000 equivalent in kind through the provision of administrative setup, including office space, office equipment, and local transportation. The detailed cost estimates are in Appendix 2.

D. Implementation Arrangements

14. HPSEB will be the Executing Agency (EA) for component 1, HPERC for component 2, and HPHPC for component 3. A project management office will be established for each component of the TA in the relevant EAs. Project management offices will be responsible for the day-to-day management of the TA and will coordinate with all government and nongovernment stakeholders. The project management office will also oversee consultants' activities and facilitate all ADB's TA administration. EAs will provide (i) office accommodation and facilities, internet access, and secretarial support; and (ii) land transportation within Himachal Pradesh for consultants. EAs and agencies concerned will provide the consultants with existing data, preliminary analysis, and reports; and will guide consultants in data collection, in liaising with other government ministries and agencies. EAs, other relevant agencies, and consultants will jointly organize dissemination workshops for counterpart staff and other stakeholders. EAs will ensure close coordination with consultants of other ongoing ADB TAs. The consultants will incorporate lessons from past ADB TAs in the power sector. The consultants will be accountable to both ADB and the EAs.

15. The TA will finance the services of international consultants for a total of 13 person-months and local consultants for a total of 25 person-months (Appendix 3). Consultants will be recruited by ADB in accordance with its *Guidelines on the Use of Consultants* (2007, as amended from time to time) for each TA component. For component 1, a consulting firm or consortium of firms will be engaged under the quality- and cost-based selection process, and simplified technical proposals will be requested. A standard quality–cost ratio of 80:20 will be used. Consultants will procure the power system analysis software following ADB's *Procurement Guidelines* (2007, as amended from time to time). For components 2 and 3, individual consultants will be recruited. The outline terms of reference for consultants are in Appendix 3.

16. The TA will commence in February 2009 and will be completed by the end of January 2010. For each component, consultants will submit an inception report two weeks after the commencement of services for all components. The inception report will detail initial findings and the consultants' proposed action plan. An interim report will be submitted in July 2009 and a draft final report in December 2009. For component 2, an interim report will be submitted in March 2009 and a draft final report in July 2009. Tripartite meetings between GOHP, ADB, and consultants will review the inception report in Shimla within 2 weeks of receiving the inception, interim, and draft final reports. An interim report will describe the TA's progress, person-months

utilized, problems encountered, and proposed revision of the work plan; and will incorporate detailed reports on completion of the current policy analysis. A draft final report will detail consultants' finding and recommendations. The final report will be submitted within 4 weeks after the tripartite review of the draft final report. The consultants will prepare monthly status reports for their scope of work, highlighting any issue that could become critical for timely implementation and completion of the TA.

IV. THE PRESIDENT'S DECISION

17. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$900,000 on a grant basis to the Government of India for Capacity Building for Himachal Pradesh Power Sector Agencies, and hereby reports this action to the Board.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>Impact Economic development in Himachal Pradesh</p>	<p>Per capita gross state product increasing by at least 6% per annum by 2015</p>	<p>Annual budget reports ADB estimates</p>	<p>Assumptions GOHP gives high priority to power sector development Funding is available for power system expansion and augmentation Sufficient investment is made in other infrastructure</p>
<p>Outcome Component 1: Provide a platform for optimal development of HP electricity generation, transmission and distribution networks.</p> <p>Component 1: The outcome will be specifications for a RMIS and reporting framework for the power sector entities.</p>	<p>Fully articulated, least-cost power system master plan for Himachal Pradesh by 2009</p>	<p>Power system master plan steering committee periodic reports Himachal Pradesh Electricity Regulatory Commission annual reports</p>	<p>Assumption Cooperation from Powergrid and HPSEB to provide grid connection inputs and data to least-cost planning process</p>
<p>Outputs Component 1: A detailed 10-year demand forecast for Himachal Pradesh at the power substation level, with demand disaggregated between main consumer groups</p> <p>A series of realistic long-term generation capacity expansion scenarios, with consideration given to prospects</p> <p>A series of least-cost transmission expansion plans, matched to the generation expansion</p> <p>An assessment of the generation/transmission investments</p> <p>An estimate of distribution investment costs to meet demand</p>	<p>TA final report in the form of a power system master plan by July 2009</p>	<p>Power system master plan steering committee periodic reports TA final report</p>	<p>Assumptions Unencumbered access to data Availability of suitable counterpart staff</p>

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>growth</p> <p>Cost and benefit analysis for options with and without the clean development mechanism</p> <p>Identification of risk factors and a risk management plan for the state's power system</p> <p>Institutional reform recommendations for HPSEB to develop capacity to implement the master plan and revise it as necessary</p> <p>A power system analysis software program and equipment</p> <p>A detailed 5-year program of capital works, and preparation of detailed project reports for projects to be covered in the first 2 years</p> <p>Component 2: Specifications for an RMIS</p> <p>Reporting framework for the power sector entities</p> <p>Cost of supply framework and model</p> <p>Component 3: Periodic financing requests for further tranches of the MFF</p>			
<p>Activities with Milestones</p> <p>Component 1:</p> <p>1. Power System Master Plan</p> <p>1.1 Assess existing electricity demand and prepare a demand forecast by February 2009</p> <p>1.2 Prepare a long-term, least-cost generation development plan by April 2009</p> <p>1.3 Prepare a long-term, least-cost transmission development plan by May 2009</p>			<p>Inputs</p> <p>Consulting services ADB: \$900,000 Government: \$400,000</p>

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>2. Distribution System Planning</p> <p>2.1 Estimate annual distribution investment costs for the medium term by June 2009</p> <p>2.2 Identify and cost options and opportunities for loss reduction by July 2009</p> <p>3. Project Formulation</p> <p>3.1 Prepare a detailed transmission and distribution capital works program for the first 5 years of the master plan by August 2009</p> <p>3.2 Prepare detailed project reports for projects included in the first 2 years of the capital works program by September 2009</p> <p>4. Reporting</p> <p>4.1 Produce an interim report by July 2009</p> <p>4.2 Produce a TA final report by December 2009</p> <p>5. Training</p> <p>5.1 Provide on-the-job training for counterpart staff throughout the TA</p> <p>5.2 Regularly update stakeholders through formal and informal workshops</p> <p>Component 2:</p> <p>1.1 Develop specifications for an RMIS by May 2009</p> <p>1.2 Produce reporting framework for the power sector entities by July 2009</p> <p>1.3 Estimate cost of supply framework and model by July 2009</p>			

ADB = Asian Development Bank, GOHP = government of Himachal Pradesh, HPSEB = Himachal Pradesh State Electricity Board, MFF = multitranche financing facility, RMIS = regulatory management information system, TA = technical assistance.

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Total Cost
A. Asian Development Bank (ADB) Financing	
Component 1	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	250.0
ii. National Consultants	90.0
b. International and Local Travel	40.0
c. Reports and Communications	10.0
2. Power System Analysis Software	100.0
3. Trainings, Seminars, and Conferences	35.0
4. Miscellaneous Administration and Support Costs	10.0
5. Contingencies	65.0
Subtotal Component 1	600.0
Component 2	
1. Consultants	
a. Remuneration and Per Diem	
i. National Consultants	180.0
b. Local Travel	5.0
c. Reports and Communications	5.0
2. Contingencies	10.0
Subtotal Component 2	200.0
Component 3	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	50.0
ii. National Consultants	25.0
b. International and Local Travel	12.0
c. Reports and Communications	3.0
2. Contingencies	10.0
Subtotal Component 3	100.0
Subtotal (A)	900.0
B. Government Financing	
1. Office Accommodation and Transport	200.0
2. Remuneration and Per Diem of Counterpart Staff	200.0
Subtotal (B)	400.0
Total	1,300.0

^a Financed by ADB's technical assistance (TA) funding program.

^b Software purchased under the TA will be turned over to the government of Himachal Pradesh after TA completion.

^c The government of Himachal Pradesh's contribution will be in the form of office space, transportation, and counterpart staff.

Source: ADB estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Component 1

1. The outcome of this component will be a comprehensive power system master plan (the master plan) that will provide the blueprint for development of the power system in Himachal Pradesh. The master plan will tie together generation, transmission, and distribution expansion to ensure that all proposed capital investments are part of a long-term, structured plan rather than ad hoc. Consultants will be engaged to develop the master plan in close consultation with the Himachal Electricity Regulatory Commission (HPERC) and Himachal Pradesh State Electricity Board (HPSEB), Power Department of the government of Himachal Pradesh, and the power system master plan task force (to be formed).
2. The international power planning expert will be designated the team leader for this component, responsible for overall management of the study. The team leader will coordinate the technical assistance (TA) among all relevant government agencies and the Asian Development Bank (ADB) to ensure smooth implementation and non-duplication of work, and will ultimately be responsible for all deliverables of the TA study. Other consultants will assist the team leader in the tasks specified below. The team leader will also coordinate closely with the consulting teams of other relevant ADB studies.
3. The consulting firm or a consortium of firms to be engaged under the TA will provide experts with relevant experience in technical and economic aspects of power system development (including generation, transmission, and distribution) and will have experience in and knowledge of the Indian power sector (including central and state approaches to sector planning and development).
4. Information dissemination and skill and technology transfer will be an important part of the TA. The consultants will conduct regular workshops in addition to those identified below to ensure that stakeholders are fully informed and have an opportunity to participate in the planning process. The consultant will provide hands-on experience to selected HPSEB staff in the use of the power systems planning software and techniques that the consultant uses in the preparation of the master plan.
5. Least-cost analysis will be used to compare various options for generation, transmission, and distribution in line with ADB's *Guidelines for the Economic Analysis of Projects*.¹
6. The consultants' responsibilities will cover, but not be limited to, the following tasks.
 1. **Power System Planning Expert, Team Leader** (international, 5 person-months)
 - (i) Conduct a review of the present approach to power system (generation, transmission, and distribution) planning in Himachal Pradesh, and identify and analyze the linkages between state-level planning, regional planning, and national planning.
 - (ii) Assess potential energy sources for generation development in Himachal Pradesh in the short term (5 years) and medium term (10 years), taking into account committed, expected, and possible development of generating plants by independent power producers. Prepare a series of possible generation expansion

¹ ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

scenarios, including a 100% import strategy. Comment on generation development beyond the horizon year.

- (iii) Estimate investment and operating costs under each expansion scenario for a reasonable range of assumptions regarding base prices, and identify a preferred generation development strategy.
- (iv) Conduct a workshop to discuss generation development scenarios and seek agreement on a development strategy to use as the basis for development of the master plan.
- (v) Procure suitable power system analysis software as well as equipment (computers, etc.) and coordinate software training for relevant stakeholders.
- (vi) In conjunction with the transmission and distribution expert, prepare a staged transmission network development program, down to the 33/11 kilovolt (kV) substation level, to deliver forecast power demand to load centers in the state.
- (vii) In conjunction with all TA team members, prepare the inception, interim, and final reports in the form of an overall master plan for Himachal Pradesh.

2. Hydropower Expert (international, 1 person-month)

- (i) Review existing plans, reports, and policy regarding hydropower development in Himachal Pradesh.
- (ii) Produce a realistic, staged, least-cost, long-term hydropower development program, and estimate the annual capital and operating costs of the program.
- (iii) Support the power system planning expert in producing a series of generation development scenarios for the short and long term.

3. Distribution Expert (international, 3 person-months)

- (i) Model and analyze the performance of the existing 33 kV network down to the 11 kV side of 33/11 kV substations under a range of realistic operating scenarios.
- (ii) Identify, analyze, and produce cost estimates for a series of loss reduction options and opportunities in the short, medium, and long term, including projects forming part of the general capital investment program (such as replacement of old equipment) as well as stand-alone projects (such as power factor correction and line upgrading). Estimate the distribution loss reduction path that these works and the overall distribution investment program would be expected to deliver.
- (iii) Prepare a distribution capital works plan for the first 5 years of the power system master plan. This should include a reasonable level of cost detail and should be in a form that can be regularly updated and submitted to the HPSEB.
- (iv) Prepare detailed project reports, in a suitable format for submission to and approval by the Ministry of Power, for projects included in the first 2 years of the distribution capital works plan.
- (v) Assist the power system planning specialist, team leader in procurement of suitable power system analysis software.
- (vi) Conduct on-the-job and classroom-based training of government of Himachal Pradesh (GOHP) and HPSEB staff in modern power system planning techniques and tools, and run regular workshops to (a) update stakeholders on progress in preparing the master plan, and (b) discuss and debate assumptions and scenarios.
- (vii) Coordinate the training program to be conducted for GOHP and HPSEB staff as part of the software package.

4. Power Economist (international, 2 person-months)

- (i) Prepare a 10-year demand forecast for Himachal Pradesh at the distribution circle level, disaggregated by major consumer groups (domestic, industrial, commercial, agricultural, and government), and incorporating bottom-up (location-specific) and top-down (macroeconomic) drivers of demand growth. Demand forecasts under both average and maximum load growth scenarios should be prepared, and the economic rationale of both should be clearly articulated.
- (ii) On the basis of the generation, transmission, and distribution development plans, estimate the discounted average cost of supply, the average incremental cost of supply, and the average cost of supply at the 33 kV and 11 kV voltage levels. Comment on the implications of these costs for future tariff paths, assuming a move to full cost recovery over time.

5. Transmission Expert (national, 2 person-months)

- (i) Model and analyze the performance of the current transmission network under a range of realistic operating scenarios.
- (ii) Assess the suitability of HPSEB's transmission planning framework and reliability criteria and, if necessary, propose changes to it.
- (iii) On the basis of the proposed planning framework and criteria, estimate transmission network investment costs for the each realistic generation expansion scenario through to the horizon year.
- (iv) Produce a detailed, staged, least-cost plan for development of the transmission network for the base generation expansion plan to meet forecast demand growth. Estimate the annual capital and operating costs of the program. Model and analyze the performance of the proposed transmission network under a range of realistic operating scenarios.
- (v) Prepare a transmission capital works plan for the first 5 years of the master plan. This should include a reasonable level of cost detail and should be in a form that can be regularly updated and submitted to the HPSEB.
- (vi) Prepare detailed project reports, in a suitable format for submission to and approval by the Ministry of Power, for projects included in the first 2 years of the transmission capital works plan.

6. Distribution Expert (national, 3 person-months)

- (i) Work together with the international distribution expert and assist the power system planning specialist to develop the distribution component of the master plan.
- (ii) Assist in modeling and analyzing the performance of the existing 33 kV network down to the 11kV side of 33/11 kV substations under a range of realistic operating scenarios.
- (iii) On the basis of demand forecasts at the distribution circle level, assist in preparing staged, least-cost, 33kV network and 33/11 kV substation expansion plans for the medium term (10 years). Model and analyze the performance of the proposed 33 kV network and 33/11 kV substations under a reasonable range of operating scenarios.
- (iv) On the basis of demand forecasts and taking into account the present condition, age, and adequacy of the 11 kV and low voltage distribution networks, estimate distribution network capital investment requirements for the medium term (10 years).
- (v) Assist in identifying, analyzing, and producing cost estimates for a series of loss reduction options and opportunities in the short, medium, and long term, including projects forming part of the general capital investment program (such as

replacement of old equipment) as well as stand-alone projects (such as power factor correction and line upgrading). Estimate the distribution loss reduction path that these works and the overall distribution investment program would be expected to deliver.

7. Power Economist (national, 2 person-months)

- (i) Work together with the international power economist.
- (ii) Assist in the preparation of a 10-year demand forecast for Himachal Pradesh at the distribution circle level, disaggregated by major consumer groups (domestic, industrial, commercial, agricultural, and government) and incorporating bottom-up (location-specific) and top-down (macroeconomic) drivers of demand growth. Demand forecasts under both average and maximum load growth scenarios should be prepared, and the economic rationale of both should be clearly articulated.

B. Component 2

7. This component of the TA will assist HPERC in assessing user requirements, information availability for identification of functional specification of a regulatory management information system (RMIS). The TA will also assist HPERC to develop a methodology to compute the cost of supply at various voltage levels.

8. The system specialist will be designated the team leader for this component, responsible for overall management of the study. The team leader will coordinate the TA among all relevant government agencies and ADB to ensure smooth implementation and non-duplication of work, and will ultimately be responsible for all deliverables of the TA study. Other consultants will assist the team leader's tasks specified below. The team leader will also closely coordinate with the consulting teams of other relevant ADB studies.

9. Individual consultants to be engaged under the TA will provide experts with relevant experience in technical and economic aspects of power system development (including generation, transmission, and distribution) and will have experience in and knowledge of the Indian power sector (including central and state approaches to sector planning and development).

10. Information dissemination and skill and technology transfer will be an important part of the TA. The consultants will conduct regular workshops in addition to those identified below to ensure that stakeholders are fully informed and have an opportunity to participate in the process.

1. Financial Management Expert (national, 6 person-months)

- (i) Collect all relevant data/information from relevant sector entities.
- (ii) Review and analyze all financial and commercial information collected.
- (iii) Analyze overall cost structure and identify allocation between fix and variable cost across voltage levels, and benchmark them against best practices.
- (iv) Allocate these costs along the various functional lines based on allocation principles.
- (v) Analyze the cost structure and financial data of sector entities (including all relevant commercial information on demand and sales) and allocate all the costs first along functional lines (i.e., generation, transmission, and distribution).
- (vi) Classify the costs into various components of demand, energy, and customer based on the basis of the utility service being provided.
- (vii) Using the regulatory economist's report, develop a cost of supply methodology and a framework for the allocation of cost.

2. System Specialist (national, 4 person-months)

- (i) Identify and develop functional specification of an RMIS for HPERC.
- (ii) Develop reporting framework for the power sector entities.

3. Regulatory Economist (national, 6 person-months)

- (i) Work closely with the financial management expert.
- (ii) Analyze the various allocation principles.
- (iii) Develop a methodology to allocate these costs for demand, energy, and customer components; and allocate it across various consumer categories.
- (iv) Prepare a report on the framework to be adopted for allocation of cost into demand, energy, customer components.

C. Component 3

11. This component of the TA aims to develop capacity in preparation of periodic financing requests for further tranches of the multitranche financing facility. An international economist/financial analyst with strong power sector knowledge (preferably with an engineering degree) will be hired for 1 person-month, an international hydropower engineer for 1 person-month, and national social assessment and environmental assessment experts for 2 person-months each to guide HPHPC to prepare further tranches of the multitranche financing facility.