



# Technical Assistance Report

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Project Number: 47129-001  
Regional—Policy and Advisory Technical Assistance (R-PATA)  
December 2014

## Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade (Cofinanced by the People's Republic of China Regional Cooperation and Poverty Reduction Fund)

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Asian Development Bank

## ABBREVIATIONS

ADB	–	Asian Development Bank
GMS	–	Greater Mekong Subregion
IGM	–	intergovernmental memorandum of understanding
Lao PDR	–	Lao People's Democratic Republic
PPA	–	power purchase agreement
PRC	–	People's Republic of China
RPTCC	–	Regional Power Trade Coordination Committee
RPCC	–	Regional Power Coordination Center
WGPG	–	Working Group on Performance Standards and Grid Codes
WGRI	–	Working Group on Regulatory Issues
TA	–	technical assistance

## NOTE

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

<b>Vice-President</b>	S. Groff, Operations 2
<b>Director General</b>	J. Nugent, Southeast Asia Department (SERD)
<b>Director</b>	C. N. Chong, Energy Division, SERD
<b>Team leaders</b>	D.T. Bui, Senior Energy Economist, SERD J.I. Kim, Lead Energy Specialist, SERD
<b>Team members</b>	R. Kausar, Unit Head, Project Administration, SERD H.J. Lee, Energy Economist, SERD M.T. Nieto, Associate Project Analyst, SERD C. Samaniego, Senior Operations Assistant, SERD
<b>Peer reviewer</b>	P. Wijayatunga, Principal Energy Specialist, South Asia Department

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## POLICY AND ADVISORY TECHNICAL ASSISTANCE AT A GLANCE

<b>1. Basic Data</b>		<b>Project Number: 47129-001</b>	
<b>Project Name</b>	Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade	<b>Department /Division</b>	SERD/SEEN
<b>Country Borrower</b>	REG not applicable	<b>Executing Agency</b>	Asian Development Bank
<b>2. Sector</b>		<b>Financing (\$ million)</b>	
✓ Energy	Energy sector development and institutional reform		1.50
		<b>Total</b>	<b>1.50</b>
<b>3. Strategic Agenda</b>		<b>Climate Change Information</b>	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Climate Change impact on the Project	Low
Regional integration (RCI)	Pillar 1: Cross-border infrastructure		
<b>4. Drivers of Change</b>		<b>Gender Equity and Mainstreaming</b>	
Governance and capacity development (GCD)	Organizational development	No gender elements (NGE)	✓
Knowledge solutions (KNS)	Knowledge sharing activities		
Partnerships (PAR)	Bilateral institutions (not client government) Official cofinancing		
Private sector development (PSD)	Conducive policy and institutional environment		
<b>5. Poverty Targeting</b>		<b>Location Impact</b>	
Project directly targets poverty	No	Regional	High
<b>6. TA Category:</b>	B		
<b>7. Safeguard Categorization</b>	Not Applicable		
<b>8. Financing</b>			
<b>Modality and Sources</b>		<b>Amount (\$ million)</b>	
<b>ADB</b>		<b>1.00</b>	
Sovereign Policy and advisory technical assistance: Technical Assistance Special Fund		1.00	
<b>Cofinancing</b>		<b>0.50</b>	
PRC Regional Coop. and Poverty Reduction Fund		0.50	
<b>Counterpart</b>		<b>0.00</b>	
None		0.00	
<b>Total</b>		<b>1.50</b>	
<b>9. Effective Development Cooperation</b>			
Use of country procurement systems	No		
Use of country public financial management systems	No		



## I. INTRODUCTION

1. This regional technical assistance (TA) is designed to support the continued work of the Regional Power Trade Coordination Committee (RPTCC), the Working Group on Performance Standards and Grid Codes (WGPG), and the Working Group on Regulatory Issues (WGRI) to facilitate regional power trade in the Greater Mekong Subregion (GMS).<sup>1</sup> Through these institutions, much more will be done by the GMS members themselves in developing a full-fledged GMS power market where all countries can realize and share the full benefits of synchronous operations. Interventions include (i) establishment of the Regional Power Coordination Center (RPCC); (ii) harmonizing performance standards and grid codes that dictate the technical rules for the coordinated planning and operation of the regional electricity market; and (iii) harmonizing the regulatory framework, pricing, legal framework for third-party grid access, and wheeling obligations, all of which contribute to development of a unified, fair, and transparent regional electricity market. This TA is aligned with ADB's Strategy 2020—and especially the regional integration development agenda—and ADB's Energy Policy.<sup>2</sup> It is likewise aligned with the GMS Regional Cooperation Operation Business Plan, 2013–2014 (which implements the Regional Cooperation Strategy and Program), as well as the GMS Economic Cooperation Program Strategic Framework, 2012–2022.<sup>3</sup> The design and monitoring framework is in Appendix 1.<sup>4</sup>

## II. ISSUES

2. The GMS is well endowed with energy resources, including 229 gigawatts of potential hydropower, about 1.2 billion cubic meters of proven reserves of natural gas, 28 billion tons of coal, and 0.8 billion tons of oil. But these energy resources are unevenly distributed throughout the GMS. Thus, since the launch of the GMS Economic Cooperation Program in 1992, energy was identified as one of the nine areas for subregional cooperation, focusing on the regional power trade and grid interconnection. Starting with the 1999 Policy Statement on Regional Power Trade, GMS members have consistently affirmed the principles of cooperation, gradualism, and respect for the environment.<sup>5</sup> They concur that the regional power trade will develop in phases, and that a regional market will evolve through institutional strengthening and reforms, as well as infrastructure development, influenced by sustainable energy, environment, and social factors.<sup>6</sup>

3. A regional TA for Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion, completed in June 2012, was implemented by the Asian Development Bank (ADB) and financed by the Government of Sweden through the Swedish International Development Cooperation Agency.<sup>7</sup> The TA helped foster and address the environmental aspects of regional power

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<sup>1</sup> The Regional Power Trade Coordination Committee has been operating since 2003 to implement regional power trade in accordance with the Intergovernmental Agreement in Regional Power Trade. The two working groups were formed in 2011 (para 4).

<sup>2</sup> ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila; ADB. 2009. *Energy Policy*. Manila.

<sup>3</sup> ADB. 2012. *Greater Mekong Subregion Regional Cooperation Operations Business Plan, 2013–2014*. Manila; ADB. 2006. *Greater Mekong Subregion: Beyond Borders (2007–2009)*. Manila; ADB. 2011. *The Greater Mekong Subregion Economic Cooperation Program Strategic Framework, 2012–2022*. Manila.

<sup>4</sup> The TA first appeared in the business opportunities section of ADB's website on 5 September 2014.

<sup>5</sup> The 1999 Policy Statement on Regional Power Trade in the Greater Mekong Subregion was signed in October 1999 (during the Sixth Electric Power Forum meeting in Phnom Penh).

<sup>6</sup> ADB. 2012. *Greater Mekong Subregion Power Trade and Interconnection: 2 Decades of Cooperation*. Manila.

<sup>7</sup> ADB. 2007. *Technical Assistance for Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion*. Manila (RETA 6440).

interconnections and trading in the GMS, from October 2008 to June 2012.<sup>8</sup> It also facilitated an intergovernmental memorandum of understanding (IGM) for establishing an RPCC in the GMS dedicated to subregional power trade, replacing current efforts that are undertaken on an ad hoc basis, and constituting a major step toward realizing a GMS regional power market. The IGM was signed by four GMS members during the 19th GMS Ministerial Conference in December 2012. The Government of Myanmar signed it in June 2013 and the Government of Thailand in December 2013. GMS members also agreed, at the 11th Meeting of the RPTCC in November 2011, to set up two working groups—the WGPG and WGRI—to help facilitate a GMS regional power market and execute the activities prescribed in the Memorandum of Understanding on the Road Map for Implementing the Greater Mekong Subregion Cross-Border Power Trading. The working group terms of reference were adopted at the 12th Meeting of the RPTCC in May 2012 and their first meetings were held in June 2012.

4. The energy endowments of the GMS countries are limited and spread across the region with large hydropower potential in some countries and increasing dependence on fossil fuels in others. Plugging the gap between supply and demand through the development and utilization of additional energy resources efficiently will make electricity more affordable and the subregion secured and self-sustainable. Power trade will enable members to (i) reduce national investments in the power reserves maintained to meet peak demand; (ii) provide a more reliable supply of electricity, including power supply from an interconnected network in case of power failure; (iii) reduce operational costs; (iv) reduce greenhouse gas emissions and other pollutants; and (v) increase consumer access to the subregion's lowest-cost and most environmentally sustainable source of electricity.

5. Confirming that the subregional power trade will develop in phases, the RPTCC will be systematically anchored on four development stages: (i) stage 1: bilateral cross-border connections through power purchase agreements (PPAs); (ii) stage 2: grid-to-grid power trading between any pair of GMS countries, eventually using the transmission facilities of a third regional country; (iii) stage 3: development of transmission links dedicated to cross-border trading; and (iv) stage 4: involving most GMS countries, with multiple seller-buyer regulatory frameworks, towards implementation of a wholly competitive regional market.

6. To date, the GMS power market has built on cross-border interconnections associated with power exports and bilateral PPAs, as described in stage 1. This was achieved through a two-pronged approach to develop the GMS power market—focusing on a policy and institutional framework for promoting the power trade, and physical interconnections to facilitate cross-border power transmission. Before 1992, the only significant cross-border power transmission in the subregion existed to export hydropower from the Lao People's Democratic Republic (Lao PDR) to Thailand. Some low-voltage lines also connected certain areas in the Lao PDR to Thailand and separately to Cambodia, distributing power to remote border regions. By 2010, the total electricity trade in the GMS was approximately 34,139 gigawatt-hours. Thailand is the largest importer at 6,938 gigawatt-hours, comprising hydropower purchases from the Lao PDR. Myanmar, the Lao PDR, and the People's Republic of China (PRC) are the region's net exporters, with the Lao PDR exporting the largest electricity volume and offering the most competitive supply price. Competitively-priced electricity from the PRC and Lao PDR has helped Thailand and Viet Nam meet their large and rapidly growing demand. Likewise, Cambodia can access more affordable electric power from its GMS neighbors than it can produce domestically.

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<sup>8</sup> ADB. 2012. *Final Narrative and Financial Report on the Implementation of RETA 6440: Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion*. Manila.



Moreover, remote border regions of Cambodia, the Lao PDR, and Viet Nam have benefitted from accessing cross-border power supplies based in neighboring countries. Overall, electricity access has roughly doubled, from about 37% on average in 1994 to around 69% in 2009, mostly benefiting remote rural populations.

7. Completed power projects in the GMS with subregional impacts that were implemented after 1992 with ADB assistance include the 200-megawatt capacity, 230 kilovolt transmission line connecting Cambodia to Viet Nam (completed in 2008), and 1,358 megawatts (total) of new capacity from three hydropower plants in the Lao PDR, built primarily for electricity exports.<sup>9</sup> The 115 kilovolt transmission lines comprising the northwest grid of the Cambodian system and enabling access to more affordable power imports from Thailand was energized in 2007. A hydropower plant of Xe Kamen 3 in the Lao PDR that exports power to Viet Nam was completed in 2013.

8. To make further progress on the regional power trade and help accelerate graduation into stage 2 (para. 6), GMS members should do much more to realize and share the full benefits of synchronous operations. In this regard, the establishment of the RPCC will tangibly demonstrate the ownership and leadership by members of the regional power trade and market development process. The institution will have a legal identity and be fully dedicated to managing cross-border power infrastructure and trade in the GMS. All six members of the GMS signed the IGM for the establishment of the RPCC as of December 2013. A host country will be selected in the RPTCC meeting. Subsequently, the RPCC's articles of association should be finalized for approval at the first RPCC board meeting.

9. Regional power trade necessitates regionally integrated power systems, which require a high degree of technical compatibility, and careful system planning and operational coordination to minimize the threat of voltage collapse, dynamic and transient instability, or supply disruption. In the absence of such coordination and compatibility, multiple systems across member countries may be downed by cascading outages arising from technical (or other) faults that originate in a single country. The presence of varying organizational frameworks, technical capabilities, and even cultural distinctions can all contribute significantly to supply interruption.<sup>10</sup> The WGPG and WGRI will help bridge gaps between GMS country technical standards and the regulatory framework to enable a regional trade in power by harmonizing (i) performance standards and grid codes that establish technical rules for the coordinated planning and operation of the regional electricity market; and (ii) regulatory frameworks, pricing, legal frameworks for third party grid access, and wheeling obligations. These prerequisites are fundamental in the construction of a unified, fair, and transparent regional electricity market.

### **III. THE POLICY AND ADVISORY TECHNICAL ASSISTANCE**

#### **A. Impact and Outcome**

10. The impact of the TA will be to improve energy security through enhanced cross-border regional power trade. The outcome will be GMS performance standards, grid codes, and regulatory framework developed and harmonized at a regional level.

<sup>9</sup> These hydropower plants are Theun-Hinboun completed in 1998, Nam Leuk in 2000, and Nam Theun 2 in 2010.

<sup>10</sup> ADB. 2010. *Update of the Greater Mekong Subregion Regional Master Plan*. Manila.

## **B. Methodology and Key Activities**

11. Building on the achievements and recognizing the lessons of past initiatives, the TA will intensify support to the GMS power systems while working more closely with GMS countries and development partners. This TA aims to deliver the following outputs: (i) RPCC established and operations commenced through continued guidance by the RPTCC; (ii) GMS performance standards and grid codes considered by the WGPG; and (iii) guidelines for GMS regulatory framework improvement proposed by the WGRI.

12. The key activity for output 1 is continued support to RPTCC activities, including the establishment and start of operations of the RPCC. The key activity for output 2 is support to WGPG activities, including (i) consolidating identified gaps and proposed remedies from each GMS member country, and making recommendations regarding an implementation plan to meet regional performance standards and grid codes; (ii) completing the study on transmission regulations and making recommendations regarding a three-tiered protocol for technical coordination; and (iii) completing the study and making recommendations on standard regional meeting arrangements. Output 3 includes support to WGRI activities, such as (i) providing strategic guidance to WGRI in setting up a system of power trading in the GMS; (ii) completing and making recommendations regarding the guidelines for regulatory framework improvement for midterm GMS cross-border power trading; and (iii) completing the study on, and making recommendations regarding GMS transmission market and pricing mechanisms.

## **C. Cost and Financing**

13. The TA is estimated to cost \$1,800,000, of which \$1,000,000 will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-V) and \$500,000 will be financed on a grant basis by the People's Republic of China Regional Cooperation and Poverty Reduction Fund and administered by ADB.<sup>11</sup> The six GMS governments will provide counterpart support in the form of counterpart salaries, office space, local administration, knowledge generation, monitoring and reporting services, and other in-kind contributions. The utilities in GMS member countries will continue to finance their own participation in the working groups.

## **D. Implementation Arrangements**

14. ADB will be the executing agency and the Energy Division within the Southeast Asia Department will serve as the focal point, in full consultation with other divisions and departments involved in GMS countries and related program activities. The Energy Division will be responsible for coordination with counterpart institutions, recruitment of consultants, preparation and management of implementation schedules, and coordination amongst participating countries and other development partners.

15. Each country's chief representative to the RPTCC will serve as a focal point and together with the working groups' chairs they will liaise directly with the regional TA secretariat. The WGPG is chaired by Thailand and co-chaired by the PRC. The WGRI is chaired by the PRC and co-chaired by Viet Nam. Each working group will prepare their workplan and identify the tasks, inputs, and deliverables that will guide the implementation of the regional TA. Counterpart agencies will provide all necessary data, information, support, and facilitate the work of the secretariat and consultants by providing in-country services for the regional TA.

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<sup>11</sup> The ADB Technical Assistance Special Fund (TASF-V) will finance outputs 1 and 3, and the PRC Regional Cooperation and Poverty Reduction Fund will finance output 2.

16. The TA will require 32 person-months of international consulting inputs and 24 person-months of national consulting inputs. The outline terms of reference are in Appendix 3. ADB will administer the TA and recruit the consultants, manage the contract administration, and be responsible for ensuring the consultants deliver the TA reports and contribute meaningfully to the RPTCC and working group meetings. GMS members will actively participate by delivering the studies and contributing significantly to data gathering and analysis.

17. The consultants will be hired on an individual basis in accordance with ADB's *Guidelines on the Use of Consultants by Asian Development Bank and its Borrowers* (2013, as amended from time to time). All procurement under the regional TA will be in accordance with ADB's *Procurement Guidelines* (2013, as amended from time to time). All disbursements under the TA will be done in accordance with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). The TA will be implemented over a period of 36 months starting from 1 January 2015 to 31 December 2017. Consulting inputs are to be delivered on an intermittent basis.

18. Monitoring, consultation, and reporting will be done through the regular meetings of the RPTCC, working groups, and eventually the RPCC. Progress and agreements will be recorded in official documentation including summaries of proceedings. Technical study reports will likewise be available for progress monitoring and to inform on collaboration between GMS members and adaptive management in project implementation.

#### **IV. THE PRESIDENT'S DECISION**

19. The President, acting under the authority delegated by the Board, has approved (i) ADB administering a portion of technical assistance not exceeding the equivalent of \$500,000 to be financed on a grant basis by the People's Republic of China Regional Cooperation and Poverty Reduction Fund; and (ii) ADB providing the balance not exceeding the equivalent of \$1,000,000 on a grant basis for Harmonizing the Greater Mekong Subregion Power Systems to Facilitate Regional Power Trade, 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><b>Impact</b> Improved energy security through enhanced cross-border regional power trade</p>	<p>By 2022 Power traded among GMS countries: 70,000 gigawatt-hours (baseline: 34,139 gigawatt-hours in 2010)</p>	<p>Power trade agreements</p>	<p><b>Assumption</b> GMS member countries remain politically committed to regional energy cooperation and the vision of power trading in a full-fledged regional power market</p>
<p><b>Outcome</b> GMS performance standards, grid codes, and regulatory framework developed and harmonized at a regional level</p>	<p>By 2017 A standing institution dedicated to GMS power trade and managing cross-border power infrastructure operationalized</p> <p>Milestones set on performance standards and grid codes, transmission regulations, and a regulatory framework delivered in the Memorandum of Understanding on the Road Map for Implementing the Greater Mekong Subregion Cross-Border Power Trading</p>	<p>Various technical study reports and resulting recommendations</p> <p>Meeting minutes of RPTCC and working groups</p>	<p><b>Assumption</b> GMS member countries remain committed to new institutional and legal arrangements for the energy sector.</p> <p><b>Risk</b> Disparities between GMS country member economies and capacities may lead to inconsistent advantages and disadvantages assessed among and between members that could constrain or compromise harmonization.</p>
<p><b>Outputs</b></p> <ol style="list-style-type: none"> <li>1. RPCC established and operations commenced through continued guidance by the RPTCC</li> <li>2. GMS performance standards and grid codes considered by WGPG</li> <li>3. Guidelines for GMS regulatory framework proposed by WGRI</li> </ol>	<p>By 2017 RPCC articles of association and headquarter agreement approved</p> <p>GMS performance standards and grid codes endorsed by WGPG for RPTCC adoption</p> <p>Reforms to harmonize the electricity sector across GMS member countries proposed by WGRI for RPTCC consideration</p> <p>Fair and transparent transmission tariff methodology proposed by WGRI for RPTCC consideration</p>	<p>Official RPCC documents</p> <p>Approved articles of association</p> <p>Summaries of proceedings of the RPTCC and working group meetings</p> <p>Various technical study reports and resulting recommendations</p>	<p><b>Assumption</b> GMS member countries make timely and relevant contributions to in-country data gathering and regional consultation processes</p> <p><b>Risk</b> Insufficient data available for complete, meaningful analysis</p>

Activities with Milestones	Inputs
<p><b>1. RPCC established and operations commenced through continued guidance by the RPTCC</b></p> <p>1.1 Recruitment of consultants (January 2015–June 2015)</p> <p>1.2 Finalize legal and logistical arrangements for RPCC headquarters in a GMS member country (March 2015–December 2015)</p> <p>1.3 Finalize and approve articles of association (January 2015–May 2015)</p> <p>1.4 Implement start-up activities of RPCC (August 2015–July 2017)</p> <p>1.5 RPTCC meetings (January 2015–December 2017)</p> <p><b>2. GMS performance standards and grid codes considered by WGPG</b></p> <p>2.1 Recruit consultants (January 2015–December 2015)</p> <p>2.2 Undertake coordinated in-depth network studies for validation of the proposed GMS performance standards (February 2015–June 2015)</p> <p>2.3 Complete the study on transmission regulations and three-tier protocol on technical coordination (July 2015–December 2016)</p> <p>2.4 Complete the study on the standard regional metering arrangements and communication systems for grid-to-grid interconnections (July 2015–December 2016)</p> <p>2.5 Facilitate the adoption and promotion by the RPTCC of the suggested GMS performance standards, transmission regulations and technical coordination protocol, and standard metering arrangements (January 2015–June 2017)</p> <p>2.6 WGPG meetings (January 2015–November 2017)</p> <p><b>3. Guidelines for GMS regulatory framework proposed by WGRI</b></p> <p>3.1 Recruit consultants (January 2015–December 2016)</p> <p>3.2 Provide strategic guidance to WGRI in setting up a system of power trading in the GMS (January 2015–March 2017)</p> <p>3.3 Complete the study on regulatory barriers and corresponding institutional arrangements to overcome them (January 2015–March 2017)</p> <p>3.4 Complete the study on enabling a GMS power market, including fair and transparent wheeling charge mechanism (January 2015–March 2017)</p> <p>3.5 Facilitate adoption and promotion of stage 2 transmission regulations and reforms to harmonize and effectively monitor the electricity sector across GMS countries (January 2015–June 2017)<sup>b</sup></p> <p>3.6 WGRI meetings (January 2015–December 2017)</p>	<p><b>ADB: \$1,000,000</b></p> <p><b>People's Republic of China Regional Cooperation and Poverty Reduction Fund: \$500,000</b></p> <p>Note: Six GMS governments will provide counterpart support in the form of counterpart salaries, office space, local administration, knowledge generation, monitoring and reporting services, and other in-kind contributions.</p>

ADB = Asian Development Bank, GMS = Greater Mekong Subregion, RPCC = regional power coordination center, RPTCC = regional power trade coordination committee, WGPG = Working Group on Performance Standards and Grid Codes, WGRI = Working Group on Regulatory Issues.

<sup>a</sup> Risks are mitigated by ensuring ownership by GMS members of the design, implementation, and monitoring and evaluation of the project, through the RPTCC, the two working groups, and eventually the RPCC. Moreover, there is minimal to no risk in achieving output 1, given the commitment by GMS members to establishing an RPCC. Regarding output 2, the WGPG has a clearly defined mandate, supported by fair in-country capacity in the People's Republic of China, Thailand, and Viet Nam, and supplemented by experts in Cambodia, the Lao People's Democratic Republic, and Myanmar. Finally, for output 3, there may be a risk that GMS members will have difficulty in agreeing to a regional market design and structure, but this will be mitigated by obtaining administrative and technical expertise to help manage the issues.

<sup>b</sup> Stage 2 of regional power trade development is when trading is possible between any pair of GMS countries, eventually using transmission facilities of a third regional country, but constrained by available cross-border capacity (i.e., limited to the surplus capacity of lines linked to power purchase agreements).

Source: Asian Development Bank.

**COST ESTIMATES AND FINANCING PLAN**

(\$'000)

Item	Amount
<b>A. Asian Development Bank<sup>a</sup></b>	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	400.0
ii. National consultants	48.0
b. International and local travel	105.0
c. Reports and communications	5.0
2. Workshops, trainings, meetings, seminars, and conferences <sup>b</sup>	315.0
3. Miscellaneous administration and support costs <sup>c</sup>	5.0
4. Contingencies	122.0
<b>Subtotal (A)</b>	<b>1,000.0</b>
<b>B. People's Republic of China Regional Cooperation and Poverty Reduction Fund<sup>d</sup></b>	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	240.0
ii. National consultants	48.0
b. International and local travel	55.0
2. Workshops, trainings, meetings, seminars, and conferences <sup>e</sup>	135.0
3. Contingencies	22.0
<b>Subtotal (B)</b>	<b>500.0</b>
<b>Total</b>	<b>1,500.0</b>

Note: The technical assistance (TA) is estimated to cost \$1,800,000, of which contributions from the Asian Development Bank (ADB) and the People's Republic of China Regional Cooperation and Poverty Reduction Fund are presented in the table above. Six governments will provide counterpart support in the form of counterpart salaries, office space, local administration, knowledge generation, monitoring and reporting, and other in-kind contributions. The value of government contribution is estimated to account for 16.66% of the total TA cost.

<sup>a</sup> Financed by ADB's Technical Assistance Special Fund (TASF-V).

<sup>b</sup> Includes meeting costs of Regional Power Trade Coordination Committee and Working Group on Regulatory Issues, honorarium and travel costs of resource persons, facilitators, participants, and ADB staff acting as resource persons and/or speakers, as well as costs of representation during the events. This also includes costs of supplies, materials, miscellaneous secretarial support, and other operational costs that may arise during the TA implementation.

<sup>c</sup> Includes publication, communication, reports, and other information materials.

<sup>d</sup> Administered by ADB.

<sup>e</sup> Includes meeting costs of the Working Group on Performance Standards and Grid Codes; honorarium and travel costs of resource persons, facilitators, participants, and ADB staff acting as resource persons and/or speakers; and the costs of representation during the events. This also includes the cost of supplies, materials, miscellaneous secretarial support, and other operational costs that may arise during the TA implementation.

Source: Asian Development Bank estimates.

## OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. Under the regional technical assistance (TA) for Harmonizing the Greater Mekong Subregion (GMS) Power Systems to Facilitate Regional Power Trade, international and national consultants will be engaged to work toward the milestones set in the Memorandum of Understanding on the Road Map for Implementing the Greater Mekong Subregion Cross-Border Power Trading signed in 2008 to support (i) the continued work of the Regional Power Trade Coordination Committee (RPTCC), the Working Group on Performance Standards and Grid Codes (WGPG), and the Working Group on Regulatory Issues (WGRI); and (ii) establishment of the Regional Power Coordination Center (RPCC) to facilitate the GMS regional power trade.

2. These milestones include completing studies (i) on GMS performance standards, transmission regulations, standard regional metering arrangements, and grid codes operational procedures; and (ii) that will help facilitate stage 2 implementation, e.g., by identifying the regulatory barriers to power trade development, developing transmission regulations (including power trade rules and dispute resolution mechanisms) to allow third-party access to interconnections, and prioritizing power purchase agreements (PPAs) or similar contracts. Stage 2 of regional power trade development will exist when trading is possible between any pair of GMS countries, eventually using transmission facilities of a third regional country, but constrained by available cross-border capacity (i.e., limited to the surplus capacity of lines linked to power purchase agreements).

3. The consultants will be responsible for the quality and timely delivery of the assigned tasks, such as reports, procedures, and related knowledge development activities. A broad outline of the tasks and activities will include, but not limited to, the following:

### **A. Output 1: Activities Supporting the Establishment and Operations of the Regional Power Coordination Center**

4. **Regional power trade institutional specialist** (international, 8 person-months). The international regional power trade institutional specialist should have extensive knowledge of and experience in the regional power trade and have strong international experience and expertise in the institutional setup of the international organizations. The expert should have a master's degree with at least 15 years of experience in the power sector and regional power trade. The consultant will undertake the following tasks:

- (i) review the existing draft articles of association (AOA) of the RPCC;
- (ii) facilitate discussions and consensus among GMS members in finalizing the AOA;
- (iii) help the board of the RPCC to adopt the AOA and other necessary documents;
- (iv) draft the RPCC headquarters agreement in consultation with the host country;
- (v) assist the RPCC representative in negotiating and finalizing the RPCC headquarters agreement;
- (vi) assess the initial RPCC governance structure and necessary physical requirements;
- (vii) prepare the terms of reference for each proposed RPCC position, the RPCC work plan, and four technical groups; and
- (viii) other tasks necessary for the operation of the RPCC.

## B. Output 2: Activities Supporting the Working Group on Performance Standards and Grid Codes

5. **Regional performance standards and grid codes specialist** (international 10 person-months; national, 12 person-months). The international regional performance and grid codes specialist should have extensive knowledge of and experience in establishing technical performance and grid codes in the regional power trade, and strong international experience and expertise in technical aspects of regional transmission interconnections. The expert will have a master's degree with at least 15 years of experience in power transmission system engineering and regional transmission interconnections. The national consultants will assist the international specialist in accomplishing their work in each member country. The consultants will undertake the following tasks:

- (i) review and propose for adoption by the WGRI and RPTCC the suggested GMS Performance Standards proposed under the projects for Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the GMS and GMS Power Trade Coordination and Development;<sup>1</sup>
- (ii) consolidate the identified gaps and propose remedies and investment needs from each GMS member country;
- (iii) undertake coordinated in-depth network studies for validation of the proposed GMS performance standards;
- (iv) recommend an implementation plan to meet regional performance standards;
- (v) complete the study on transmission regulations, and recommend a three-tiered protocol for technical coordination, by completing the study on and proposing for adoption and promotion by the RPTCC the (a) following GMS policies: scheduling and accounting, coordinated operational planning, communication infrastructure, and data exchanges; and (b) GMS technical coordination organized on three levels: coordination center, control blocks, and control areas;
- (vi) in line with regional performance standards, regional metering arrangements, and transmission regulations, propose a regional grid code for the GMS;
- (vii) compare the gap between the regional grid code and each member's national grid code;
- (viii) consolidate the identified gaps and propose remedies and investments needs for each member;
- (ix) facilitate adoption of the regional grid code by WGPG and RPTCC; and
- (x) recommend an implementation plan to enable each member to meet the regional grid code and monitor its implementation.

6. **Regional metering specialist** (international, 2 person-months). The international regional metering specialist should have extensive knowledge and experience in establishing regional metering arrangements in the regional power trade and have strong international experience and expertise in technical aspects of regional metering. The expert should have a master's degree with at least 15 years of experience in metering arrangements. The consultant will propose standard regional metering arrangements in power trading and facilitate adoption by the WGPG and RPTCC of the standard regional metering arrangements and communication systems for grid-to-grid interconnections.

<sup>1</sup> ADB. 2012. *Final Narrative and Financial Report on the Implementation of RETA 6440: Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion*. Manila; ADB. 2011. *Technical Assistance Completion Report: GMS Power Trade and Coordination and Development*. Manila (RETA 6304).



### C. Output 3: Activities Supporting the Working Group on Regulatory Issues

7. **Regional power regulatory framework specialist** (international, 7 person-months; national, 12 person-months). The international regional power regulatory framework specialist should have extensive knowledge of and experience in establishing regulatory frameworks and needed structures for the regional power trade, and have strong international experience and expertise in designing markets and formulating regulatory frameworks for the regional trade in power. The expert should have a master's degree with at least 15 years of experience in regulatory frameworks for regional and/or interregional power trading. The national consultant will provide inputs to the international regional power regulatory framework specialist. The consultants will undertake the following tasks:

- (i) review the proposed market design for the GMS prepared under the Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the GMS Project, and assist the RPTCC in considering the design for adoption;
- (ii) develop a regional market framework for RPTCC approval;
- (iii) define tasks and responsibilities for detailed market monitoring at the national and regional levels;
- (iv) provide strategic guidance to the WGRI in setting up a system of power trading in the GMS;
- (v) complete the study identifying the regulatory barriers to development of the power trade and propose for adoption and promotion by the RPTCC measures and institutional arrangements to address such regulatory barriers;
- (vi) complete the study on stage 2 transmission regulations and propose for adoption by the RPTCC study findings, to include development of payment agreements or tariffs for third-party use to compensate countries that host flows linked to third-party trading;
- (vii) propose approaches to introduce and enforce third-party access in each GMS country and at the regional level;
- (viii) recommend approaches to harmonize regulatory functions at the regional level, as reflected in the functions at each GMS member country;
- (ix) develop monitoring tools, such as regulatory benchmarking reports, and transmission system operators' benchmarking and annual reports;
- (x) develop and propose for adoption power trade rules for short-term cross-border trading;
- (xi) develop and propose for adoption power trade rules for settlement of deviations to scheduled power trade in grid-to-grid interconnections; and
- (xii) complete and recommend guidelines for improvement of the regulatory framework for midterm GMS cross-border power trading.

8. **Regional power pricing specialist** (international, 5 person-months). The international regional power pricing specialist should have extensive knowledge of and experience in establishing the pricing schemes and formulas for the regional power trade, and have strong international experience and expertise in the financial and commercial aspects of regional power trading. The expert should have a master's degree with at least 10 years of experience in pricing for regional or interregional power trading. The consultant will undertake the following tasks:

- (i) review the proposed updated road map towards an integrated power market, prepared under the Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the GMS Project, and assist the RPTCC in considering the road map for adoption;

- (ii) consider the steps needed to enable a national (stage 1) and regional (stage 2) wholesale electricity market;
- (iii) draft a fair and transparent wheeling charge methodology for adoption by the RPTCC;
- (iv) draft a fair and transparent cross-border trade compensation mechanism for transits;
- (v) develop a regional market framework and define tasks and responsibilities for detailed market monitoring at the national and regional level; and
- (vi) complete the study on and recommend GMS transmission market and pricing mechanisms.