Summary of Discussions
Sixth Meeting of the Focal Group (FG-6) of the
Regional Power Trade Coordination Committee (RPTCC)
Vientiane, Lao PDR, 18 June 2008

1. Objectives. The FG-6 meeting was held to undertake the following: (i) confirm the PWG-5 agreements and recommendations on the priority RPTCC studies and activities; (ii) discuss the results of the energy sector strategy study; (iii) discuss updates on assistance of various development partners to regional power trade development; and (iv) brief GMS representatives with the latest in private technology for transmission development.

2. The FG-6 meeting was held in Vientiane, Lao PDR and co-organized by the Department of Electricity of the Ministry of Energy and Mines (DOE-MEM) of Lao PDR and the Asian Development Bank (ADB). It was attended by FG nominees of the six GMS member countries, as well as by representatives of ADB, Agence Francaise de Developpement (AFD), Swedish International Development Cooperation Agency (SIDA), World Bank (WB) and Soluziona. Attached is the agenda and program of the meeting (Appendix 1) and the list of FG-6 participants (Appendix 2).

Opening Session

3. Mr. Yongping Zhai, Principal Energy Specialist, Infrastructure Division, Southeast Asia Department (SEID), ADB, welcomed the participants and explained that the FG-6 meeting will take a broader view of the power sector, such as relating the PWG agreements on priority RPTCC studies and activities, to milestones in the power trade road map. The meeting will also discuss the findings of the energy sector strategy study, and noted that one proposal, on regional electricity transmission development, is relevant to the RPTCC work program. Updates on the programs of assistance of development partners to regional power trade will also be presented. He said the meeting will take up the proposed timing and venue for the next RPTCC.

PWG Agreements/ Recommendations and Next Steps on Priority RPTCC Activities

4. Milestones in the Power Trade Road Map. Soluziona (Mr. Castrillo) presented the PWG agreements alongside the milestones in the road map included in the power trade MOU signed at the Third GMS Summit recently (Appendix 3). Details of the PWG agreements on the master plan, studies on performance standards and transmission regulation, training/ capacity building, and website/ database, are presented in Appendix 4.

5. On completing the master plan, Soluziona noted that the master plan results would be reviewed against the PDPs and priority lines of the GMS countries. Mr. Gulati (WB) suggested that the proposals for priority projects be prepared in the format that would attract donor interest. Mr. Zhai concurred and added that feasibility studies should contain the safeguard measures that meet standard requirements of donors. Soluziona (Mr. Patino) noted the economies of carrying out the master plan modeling exercise with other activities such as grid code development.

6. Soluziona (Mr. Castrillo) highlighted the proposed consultative approach in data collection for the studies on performance standards and transmission regulation. He noted that activities have not started on several milestones (studies on standard metering, identifying regulatory barriers, study on grid code and study on stage 2 transmission regulations). Mr. Zhai
suggested that these unfunded activities in 2010-2012 will be proposed to be developed by other partners, e.g. SIDA, AFD, for consideration.

Presentation on the Results of Energy Sector Strategy Study (Building a Sustainable Energy Future- the GMS)

7. Ms. Rita Nangia, Director, Special Projects, ADB, discussed the energy challenges in the GMS, such as the role of imports to meet demand growth and the uneven distribution of energy resources. She explained the rationale and economics for integrating the energy sector in the GMS. She presented the methodology and timeline for the study and noted that it is now in the process of finalizing the report. She briefly described the model used in the study called the Model for Energy Supply System Alternatives and their General Environmental Impacts (MESSAGE), explained the model’s assumptions and presented its main findings, which showed coal to be the primary energy supply flexibility for the next 20 years. Various scenarios were described (base, integrated, high growth-high risk, and low carbon) and their results in terms of cost, capacity additions, and increase in emissions were presented. Potential power trade flows (small and large scale) and their effect on electricity investments, were shown. She presented the overall economic environment for sustainable growth and the overall policy environments for electricity sector and natural gas. She reminded that trade in energy would take place only if energy is priced correctly. She discussed the overall policy environment for energy efficiency and the possibilities of leapfrogging in such technologies. Priority actions for a shared energy future in the GMS were presented, which go beyond power trade and which stress the feasibility of doing things as a regional group. Proposed projects cover cooperation in natural gas and transmission development, among others.

8. Discussions. Mr. Zhai (ADB) suggested that Soluziona consider the results of MESSAGE in calibrating the model of GMS master plan study. In response to Lao PDR’s query, Ms. Nangia explained the levels of integration assumed in the model simulations. Viet Nam inquired about the assumed technology for coal used in the model runs; this can be confirmed in the detailed tables of the study. Ms. Nangia stressed that fuel substitution would take place in an integrated system, which would lead to lower investment cost. Mr. Gulati (WB) stressed the importance of the study’s findings but cautioned on the possible environment and social effects of substituting biofuels and hydropower for other energy forms. Ms. Nangia stressed the large potential for regional cooperation in natural gas, and the need to consider environmental costs in the energy scenarios, including those for biofuels and hydropower.

Update on RETA 6440 “Facilitating Regional Power Trading and Environmentally Sustainable Development on the GMS” financed by SIDA

9. Mr. Duy Thanh Bui, Energy Economist, SEID, ADB, provided updates on the activities under the new SIDA RETA 6440, approved in December 2007 with a budget of $5 million, which will continue support for development of regional power trading currently implemented under RETA 6304. He informed of the status of selecting consultant for the RETA, which is expected to commence work in September 2008. He explained the contents of the RETA’s two components, namely (i) support to regional power trading (including conduct of feasibility studies for priority projects), and (ii) capacity building in environmental planning and monitoring of power projects.

10. Discussions. Mr. Zhai recalled that there are still unfunded activities to realize some of the milestones in the power trade roadmap which could be supported by RETA 6440 and complemented by programs of other development partners.
Update on Development Partners’ Assistance

11. **AFD.** Mr. Herve Breton, Senior Sector Specialist, Infrastructure and Urban Development, AFD Bangkok, informed that AFD at the moment is considering the possibility to provide additional grant support for follow on activities to the RPTCC, complementary to SIDA support, and which would be available by 2009. He said that this would require evaluation of current RPTCC activities funded by AFD and the new assistance would include financing of feasibility studies for priority projects coming out of the master plan.

12. **World Bank.** Mr. Mohinder Gulati, Lead Energy Specialist, Energy and Mining Sector, East Asia and Pacific Region of WB, informed of the WB’s projects/activities in the power sector in the GMS. He cited technical assistance support to Lao PDR and Cambodia related to, among others, optimizing hydropower revenues, promoting rural electrification and renewable energy, etc. He suggested (i) the need to look at ensuring sustainability of regional institutions for power trade, and (ii) the need to gradually implement the milestones of the power trade road map.

13. **Discussion.** Mr. Zhai noted that new support from development partners, including the SIDA TA, will include a component on institution building that will ensure the sustainability of power trade activities.

Next RPTCC Meeting

14. The meeting agreed to Viet nam’s offer to host the next RPTCC meeting by end November 2008. The next RPTCC meeting will take up the PWG/FG suggestions on the next steps for priority activities, including proposed approaches for realizing the milestones in the power trade road map.

Technical Presentation- RTE France

15. The presentation by RTE France later in the afternoon will be the third in a series of technical presentations from private sector power players, designed to provide useful technical alternatives in making decisions concerning grid transmission development. RTE France is a key player of interconnections in Europe.

Session VI: Closing Session

16. **Summary of Agreements.** Mr. Zhai gave a quick summary of the meeting highlights covering agreed next steps for the priority RPTCC studies and activities. Mr. Daovong called for more cooperation to ensure the success of efforts to promote power connectivity in the GMS.

17. **Consideration and Adoption of Proceedings.** Mr. Zhai announced the distribution of the draft summary of proceedings for review by the body. After the FG members reviewed the draft summary of proceedings, and after incorporation of suggested changes, the body therefore approved the minutes of the FG-6 meeting *ad referendum.*
Greater Mekong Subregion
Regional Power Trade Coordination Committee (RPTCC)
Fifth Meeting of the Planning Working Group (PWG-5)
Vientiane, Lao PDR, 17 June 2008

Agenda and Program

16 June (Mon) Arrival of Delegates

17 June (Tue) Day 1: PWG-5 Meeting

08:30am- 08:45am Registration

08:45am- 09:00am Opening Session

09:00am- 09:15am Election of New Chair for PWG and FG/Discussion on Rotation System for Chairmanship and Hosting Meetings/ Tenure of Chair
- ADB

09:15am- 10:00am Status Report and Proposed Next Steps of Studies on Performance Standards and Transmission Regulation
- ADB

Open discussions

Discussion on Implementation Arrangements and Defined/Detailed Structure for Training Program Implementation, Agreements
- Soluziona, ADB

Open Discussions

10:00am- 10:15am Coffee Break

10:15am- 10:45am Regional Power Database/Website: Launching, Appointment of Focal Point for Each Country
- Soluziona/ ADB

Confirmation/Agreement on Maintenance of Database/ Proposed Next Steps
- Soluziona/ ADB

Open Discussions

10:45am- 11:45nn Country Reports on Progress of Power Development Plans and Transmission Interconnection Projects (10 minutes each country)

Cambodia
People’s Republic of China
Lao PDR
Myanmar
Thailand
Viet Nam
11:45am- 12:00nn Updates on PRC-Thailand Interconnection Via Lao PDR

12:00nn- 01:30pm Lunch Break

01:30pm- 02:00pm Proposed GMS Interconnection Projects for Possible ADB Support
- Na Bon- Udon Thani Interconnection
- Bansok- Pleiku Interconnection
- Bansok- Stung Treng- Tay Ninh Interconnection

- Xavier Humbert, SEID, ADB

02:00pm- 02:30pm Discussions of Progress of Country PDPs
- ADB/PWG members

02:30pm- 03:30pm Priority Projects Identified in the Master Plan Study: Implementation Plan in Relation to Country PDPs
- Soluziona/ADB

Discussions

03:30pm- 03:45pm Coffee Break

03:45pm- 04:15pm Proposed Work Program per the Milestones for Power Trade Road Map Outlined in the “MOU on the Road Map for Implementing Cross-Border Power Trading” (Signed at the Third GMS Summit)
- Presentation of Matrix of Power Trade Milestones and Discussions on Activities that can be covered by ongoing technical assistance
- ADB

- Updating of the GMS Map on Cross Border Interconnections for Power Trading
- ADB

Discussions

04:15pm- 04:30pm Update on JBIC Assistance to Regional Power Trade Development
- JBIC

04:30pm- 04:45pm Presentation of Summary of Recommendations on Revised Activities and Timelines for Priority PWG Studies and Activities
- Soluziona

04:45pm- 05:00pm Consideration and Adoption of Proceedings

05:00pm- 05:10pm Closing Remarks

7:00 pm Dinner Hosted by ADB
(Venue to be announced)
### Agenda and Program

**18 Jun (Wed)**  
**Day 2: FG-6 Meeting**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08:45am – 09:00am</td>
<td>Registration</td>
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<tr>
<td>09:00am-09:30am</td>
<td>Opening Session</td>
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| 09:00am – 09:30am | Additional Issues/ Suggestions Regarding PWG Agreements/ Recommendations on next steps for: (i) Study on Performance Standards; (ii) Study on Transmission Regulation; (iii) Additional Training Program/ Proposed Arrangements; (iv) Regional Power Database/ Website Launch and Maintenance; (v) GMS Power Master Plan in Relation to Country PDPs; (vi) Power Trade Road Map Milestones  
- Soluziona, ADB |
| 09:30– 10:30am | Presentation on Results of the Energy Sector Strategy Study  
- Ms. Rita Nangia, ADB |
| 10:30am- 10:45am | Coffee Break                                                           |
| 10:45am- 11:00am | Update on RETA “Facilitating Regional Power Trading and Environmentally Sustainable Development in the GMS” financed by the Swedish International Development Cooperation Agency (SIDA)  
- Duy Thanh Bui, SEID, ADB |
| 11:00am- 11:45am | Comments and Updates from Development Partners on Assistance for the Development of GMS Power Trading  
- Agence Francais de Developpement (AFD), SIDA, World Bank (WB) |
| 11:45am- 12:15pm | Closing Session                                                        |
|                 | Synthesis of Discussions/ Agreements in PWG and FG  
- Chair of FG |
|                 | Consideration and Adoption of Proceedings                              |
|                 | Closing Remarks                                                        |
| 12:15nn– 1:30pm | Lunch Break                                                            |
| 01:30pm– 04:30pm | Technical Presentation by Industry Player (RTE France)                  |
Greater Mekong Subregion (GMS)  
Fifth Planning Working Group (PWG-5) and Sixth Focal Group (FG-6) Meetings  
of the Regional Power Trade Coordination Committee (RPTCC)  
17–18 June 2008  
Green Park Boutique Hotel, Vientiane, Lao PDR

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MEMORANDUM OF UNDERSTANDING

on the

ROAD MAP FOR IMPLEMENTING THE GREATER MEKONG SUBREGION CROSS BORDER POWER TRADING
PREAMBLE

The Governments of the Greater Mekong Sub-region (hereafter referred to as GMS), namely: the Kingdom of Cambodia, the People's Republic of China, the Lao People's Democratic Republic, the Union of Myanmar, the Kingdom of Thailand, and the Socialist Republic of Viet Nam (hereafter referred to as the Parties);

RECOGNIZING that the power utilities of the Parties are engaged in the electricity supply business in their own countries and that the said utilities agree on the benefits in continuing with the development of power interconnections between their countries power networks to: (i) enhance the reliability and security of power supply, (ii) coordinate the planning and operation of regional power generation and transmission facilities in the GMS, (iii) reduce total investments and operating costs, and (iv) share other benefits resulting from the interconnected operations of their systems;

MINDFUL that the Parties have demonstrated their recognition of the benefits of power sector cooperation by forming the GMS Electric Power Forum (EPF) in 1995 and the Experts' Group on Power Interconnection and Trade (EGP) in 1998 to study and provide recommendations regarding power exchanges in the GMS, and by signing the Inter-Governmental Agreement (IGA) on Regional Power Trade (RPT) in the GMS during the First GMS Summit of Leaders held in Phnom Penh, Cambodia in November 2002;

RECALLING that the Regional Power Trade Coordination Committee (RPTCC) established by the IGA in 2004 was primarily tasked to determine the initial steps to establishing and implementing the arrangements for regional power trading, including the preparation of a draft Regional Power Trade Operating Agreement (RPTOA) which will specify the technical operating rules, coordination arrangements and other necessary steps for achieving the objectives of regional power trading in the GMS,

CONSIDERING that studies undertaken after the signing of the IGA, specifically the study of options for the structure of the GMS power trade market, and the study for a regional power trade operating agreement (RPTOA) in the GMS, recommended a four (4) stage approach to the development of GMS Power Trade and following which, the Parties signed a Memorandum of Understanding (MOU) on the Guidelines for the Implementation of the RPTOA-Stage 1 during the Second GMS Summit of Leaders held in Kunming, PRC in July 2005 (hereinafter referred to as MOU-1), where it was agreed to set the guidelines for the first stage (Stage 1) of regional power trade.

CONSIDERING that the MOU-1 prescribed the institutional and other arrangements for stage 1 of power trade, including the transactional and operational aspects of cross-border interconnections and load flows, and has led to the establishment of the (i) Focal Group (FG) of RPTCC tasked with coordinating priority RPTCC activities in each country, and (ii) Planning Working Group (PWG), tasked to undertake planning and system operation studies that would help the GMS countries move towards common power trading guidelines.

ACKNOWLEDGING however that the MOU-1 does not specify timelines against which the GMS countries could measure the progress of their power development programs and cooperation in power trade development in relation to the objectives of the IGA. As defined in the RPTCC's tasks under the IGA, it is important for the GMS countries to agree on a Road Map for regional power trade with timelines that ensure timely implementation of all measures to fully achieve Stage 1 of power trade, and from thereon to prepare the GMS countries for advancing to Stage 2 of regional cross border power trading.

Now, through their duly authorized representatives who are the signatories of this Memorandum of Understanding (MOU-2), the Parties agree as follows:
ARTICLE 1: PURPOSE OF THE MOU-2

The purpose of this MOU-2 is to prescribe a Road Map with indicative timelines to fully achieve Stage 1 of regional cross border power trade during the period 2008-2012 and the measures to be taken during implementation of Stage 1 in order to prepare for Stage 2.

ARTICLE 2: CURRENT STATUS OF GMS REGIONAL CROSS BORDER POWER TRADE

In the GMS, regional cross border power trade is currently ongoing between some member countries — the People's Republic of China (PRC) to Viet Nam; Lao People's Democratic Republic (Lao PDR) to Cambodia; Lao PDR to Thailand; Thailand to Cambodia; Viet Nam to Cambodia; and Viet Nam to Lao PDR. These power flows are mostly one-way now but the aim of the GMS countries is to create regional cross border power trading to gain mutual economic and technical benefits, have a balanced generation from regional energy resources that enable electricity transfers across their borders and throughout the subregion. Given their different levels of technical capacity, the six GMS countries have agreed to a phased approach to enhancing regional power trading according to the MOU-1.

Stage 1 corresponds to the initial period when only country-to-country power transactions are possible, before a regional transmission network is established to enable power trading between any pair of member countries. During this period, the existing cross border transmission lines are mostly associated with Power Purchase Agreements (PPAs) between a power utility and Independent Power Producer (IPP) located in one GMS country selling power to a power utility in another GMS country. The cross border power trading in Stage 1 refers to opportunity exchange of power between power utilities of the Parties using the excess capacity of existing cross border transmission lines over and above the transmission capacity required for power transfers associated with PPAs.

Stage 2 corresponds to the moment when trading will be possible between any pair of GMS countries, eventually using transmission facilities of a third regional country. However in this stage the available cross border transmission capacity is limited and based on surplus capacity of lines linked to PPAs.

ARTICLE 3: ROAD MAP TO FULLY ACHIEVE STAGE 1

The following indicative timelines are prescribed to fully achieve Stage 1:

- Complete the study on a GMS Performance Standards for (i) new regional interconnections and for the synchronized operation of interconnected grids, and (ii) the transitional arrangements to achieve the GMS Performance Standards by 2010.

- Complete the study on Transmission Regulations to coordinate the operation and power flow control in grid-to-grid interconnections synchronization and operation by 2010.

- Complete the indicative power interconnection master plan by 2008 and select priority new interconnection projects for undertaking feasibility studies by 2009.
Complete the study on standard regional metering arrangements and communications system in grid-to-grid interconnections for implementation during Stage 1 by 2010.

Complete the study on power trade rules, including resolution mechanisms for disputes outside the existing PPAs by 2010 for implementation during Stage 1.

ARTICLE 4: ROAD MAP ACTIVITIES DURING STAGE 1 AND IN PREPARATION FOR STAGE 2

The following indicative timelines are prescribed the activities to be developed during implementation of Stage 1 as preparatory work for moving to Stage 2 of regional cross border power trading:

- Complete the study on a GMS Grid Code (Operational Procedures), which includes performance standards, metering, communication and coordination procedures for regional network interconnections.
- Undertake the study to identify the regulatory barriers to the development of power trade and implementation of next stages.
- Complete the study on Stage 2 Transmission Regulations to allow third party access in interconnections, giving priority to contracts/PPAs, including Stage 2 power trade rules, and Dispute Resolution Mechanism.

The Annex identifies the indicative activities and the timelines prescribed in this MOU-2.
Signed in Vientiane on 31 March 2008:

His Excellency Suy Sem
Minister of Industry, Mines and Energy
Kingdom of Cambodia

His Excellency Zhang Ping
Minister of National Development and Reform Commission
People's Republic of China

Her Excellency Khempheng Pholsena
Minister of the Prime Minister's Office,
Head of Water Resources and Environment Administration,
and Minister of GMS
Lao People's Democratic Republic

His Excellency U Soe Tha
Minister of National Planning and Economic Development
Union of Myanmar

His Excellency Somchai Wongsawat
Deputy Prime Minister and Minister of Education
Kingdom of Thailand

His Excellency Nguyen Thanh Bien
Deputy Minister of Ministry of Industry and Trade
Socialist Republic of Viet Nam
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<tr>
<th>Milestone</th>
<th>Activities</th>
<th>Schedule</th>
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<tr>
<td>Complete the Indicative power interconnection Master Plan and select</td>
<td>Complete the GMS indicative master plan for power development</td>
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<tr>
<td>priority new interconnection projects for undertaking feasibility studies</td>
<td>Select priority interconnection projects identified in the master plan</td>
<td>2009-2010</td>
</tr>
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<td>Develop feasibility studies of selected priority projects</td>
<td>2009 onwards</td>
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<td>Update the regional indicative Master Plan</td>
<td>Every two or three years</td>
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<tr>
<td>Complete the study on GMS Performance Standards</td>
<td>Complete the study on GMS Performance Standards and consider for adoption</td>
<td>2010</td>
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<tr>
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<td>the suggested GMS Performance Standards on new regional interconnections</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and for the synchronized operation of interconnected grids</td>
<td></td>
</tr>
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<td></td>
<td>Consider for adoption the proposed transitional arrangements to achieve</td>
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<tr>
<td></td>
<td>GMS Performance Standards</td>
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</tr>
<tr>
<td>Complete the study on Transmission Regulations</td>
<td>Complete the study on Transmission Regulations and consider for adoption</td>
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<td>the findings of the study to coordinate the operation and power flow</td>
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<td>control in grid-to-grid interconnections synchronization and operation</td>
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<td>Complete the studies on standard regional metering arrangements and</td>
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<td>power trade rules</td>
<td>communications system in grid-to-grid interconnection for implementation</td>
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<tr>
<td></td>
<td>during Stage 1 and consider for adoption the findings of the study.</td>
<td></td>
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<tr>
<td></td>
<td>Complete the study on power trade rules, including resolution mechanisms</td>
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<td></td>
<td>for disputes outside existing PPAs for implementation during Stage 1, and</td>
<td></td>
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<tr>
<td></td>
<td>consider for adoption the findings of the study.</td>
<td></td>
</tr>
<tr>
<td>Milestone</td>
<td>Activities</td>
<td>Schedule</td>
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<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Undertake the study to identify the regulatory barriers to the development of power trade and implementation of next stages.</td>
<td>Complete the study to identify the regulatory barriers to development of power trade and consider for adoption the measures and institutional arrangements to address regulatory barriers</td>
<td>2012</td>
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</tbody>
</table>
| Complete the study on a GMS Grid Code (Operational Procedures)          | Complete the study on a GMS Grid Code and consider for adoption the findings of the study, which includes:  
  - GMS Performance Standards  
  - Coordination procedures between System Operators to schedule and control cross border flows, management of deviations  
  - Metering and communications  
  - Sharing of power reserves and support during emergencies.                                                              | 2010-2012    |
| Complete the study on Stage 2 Transmission Regulations to allow third party access in interconnections, giving priority to contracts/PPAs, including Stage 2 power trade rules, and Dispute Resolution Mechanism | Complete the study on Stage 2 Transmission Regulations and consider for adoption the findings of the study to include development of payment agreements/tariffs for third party use, to compensate countries that host flows linked to third parties' trading | After 2012    |
|                                                                          | Develop and consider for adoption power trade rules for short term cross border trading                                                                                                                  | By 2012      |
|                                                                          | Develop and consider for adoption power trade rules for settlement of deviations to scheduled power trade in grid-to-grid interconnections                                                                               | By 2012      |
Priority Projects Identified in the Master Plan Study: Implementation Plan in Relation to Country PDPs

Vientiane, June 2008
Presentation Contents

• Master Plan activities
• Summary of Methodology and Assumptions
• Selected Projects
• Recommendations
Presentation Contents

• Master Plan activities
• Summary of Methodology and Assumptions
• Selected Projects
• Recommendations
**Component 1**: Develop a Systematic and Integrated Action Plan on Regional Power Trade Development. – Indicative Master Plan

**Component 2**: Facilitate Creation of Institutions to Coordinate and Develop Regional Power Trade – Support to FG and PWG

**Component 3**: Build Capacity and Develop Human Resources

**Component 4**: Establish a Platform or Database for Information Exchange and Communication
• July 2006: Inception Report includes a presentation of the methodology and initial data request
• November 2006: the methodology was presented during the Lijiang PWG and RPTCC meeting
• December 2006-March 2007: GMS countries provided the available information
• March 2007  Bangkok PWG meeting: a new project timeline was set, including dates for information completion,
• June 2007 - Workshop in Chengdu: preliminary results were presented and discussed. As agreed, an MP interim report shall be presented with an adjusted base case,
• August 2007: Interim report submitted to GMS countries representatives
August-September 2007: GMS countries submitted comments on the Interim Report

September 2007: A new version of the Interim Report was submitted, including the comments of GMS countries

October 2007: Final Report Draft was submitted, which includes answers to comments on the second version of the Interim Report.

November 2007: New comments received on the PWG held in Da Nang

December 2007-Jan 2008: more comments sent by GMS countries representatives and WB

February 2008: Final Report is submitted, including answers to all comments received.
Presentation Contents

• Master Plan activities
• Summary of Methodology and Assumptions
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Master Plan Methodology

• Goal of the Long Run Indicative Master Plan (LRMP) is to define the least cost expansion plan for generation and transmission in GMS that will simultaneously meet all strategic targets associated to critical issues.

• But also to create the seed of a regional planning system, which should constitute a permanent activity of the PWG.
• The LRMP has been developed based on two main qualities:
  – The ability to state appropriate scenarios, properly reflecting the present situation and the most critical issues that influence the system’s expansion
  – A powerful optimization model, suited not only to identify least-cost solutions, but also to assess the uncertainty regarding the critical variables and scenarios.
Basic Assumptions

- Planning horizon: 2010-2035, although main interest in expansion for years 2010-2015
- National Master Plans G&T expansions are assumed as existent. The model identifies additional capacity needs, regional scale projects and cross border interconnections
- Uniform discount rate: 8% (based on WACC criterion)
- Candidates for generation expansion:
  - Projects informed by GMS countries
  - Standardized expansion projects (thermal)
- Countries divided in zones to identify reinforcement needs
- Load modelled by region and season (wet and dry)
<table>
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<th>COUNTRY</th>
<th>AREAS</th>
<th>ASSOCIATED BUSES</th>
<th>DEMAND (%)</th>
<th>INSTALLED CAPACITY (%)</th>
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<tbody>
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<td>W</td>
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<td>8.70 %</td>
<td>1.33 %</td>
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<td></td>
<td>E</td>
<td>Sambor</td>
<td>91.30 %</td>
<td>98.67 %</td>
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<td>C</td>
<td>Yunnan &amp; Guangxi</td>
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<td>100 %</td>
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<tr>
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<td>8.75 %</td>
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<tr>
<td>Thailand</td>
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<td>Mae Moh</td>
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<td>Than Dinh</td>
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<td>34.09 %</td>
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### COUNTRY AREAS ASSOCIATED BUSES DEMAND (%) INSTALLED CAPACITY (%)

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<th>Demand (%)</th>
<th>Installed Capacity (%)</th>
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<td>All buses</td>
<td>100 %</td>
<td>100 %</td>
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<td>OTHERS</td>
<td>Other IPPs</td>
<td>8.75 %</td>
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<td>67.62 %</td>
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<td>S</td>
<td>Than Dinh</td>
<td>48.37 %</td>
<td>34.09 %</td>
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</tbody>
</table>
National Master Plans

- Vietnam: 2014 to 2025
- Cambodia: 2015 to 2022
- Thailand: 2015 to 2021
- China: 2017
- Laos: 2015
- Myanmar: 2014
### Standardised Candidates

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<th>Availability</th>
<th>Investment $/kW</th>
<th>Efficiency</th>
<th>O&amp;M $/kW</th>
<th>V. cost $/MWh</th>
<th>CO₂ t/GWh</th>
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</table>
• The alternatives considered by the model for cross border connections are:
  – 2 x 230kV AC lines,
  – 2 x 500 kV AC lines, and
  – DC links.
• The O&M costs of lines have been assumed to be a 3% of the investment.
• Lines capacity based on N-1 criterion
Presentation Contents

• Master Plan activities
• Summary of Methodology and Assumptions
• Selected Projects
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### Cross Border Lines

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<th>LINE</th>
<th>TIPE</th>
<th>Long Km</th>
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<th>2015</th>
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<th>2021</th>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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Expansions to be considered for feasibility studies.
Selected Transmission Expansions for 2012-2015

Cross border 500 kV

Internal 500 kV
Cross Border Flows - 2015

GMS power systems

Year
2015

ENERGY BALANCE (Avg TWh)

Myanmar - Dispatch [TWh]

Lao - Dispatch [TWh]

Thailand - Dispatch [TWh]

Cambodia - Dispatch [TWh]

Vietnam - Dispatch [TWh]

Myanmar - Demand [TWh]

Lao - Demand [TWh]

Thailand - Demand [TWh]

Cambodia - Demand [TWh]

Vietnam - Demand [TWh]

China - Demand [TWh]

China - Dispatch [TWh]

Lao - Demand 13.6

Thailand - Demand 16.6

Vietnam - Demand 190.5

Cambodia - Demand 6.2

Hydro
Gas
Coal
Renewable
Nuclear

Appendix 4
Page 21 of 37
### Assessment of Selected Alternatives

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**Robust alternatives**

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*Appendix 4*

Page 22 of 37
Generation Expansions 2012-2015

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Expansions based on:
- Security criteria
- Hydro to substitute expensive thermal generation
Sensitivities

1. DR10: Discount rate of 10%
2. DR12: Discount rate of 12%
3. AP70: Area Protection Criteria 0.7
4. AP50: Area Protection Criteria 0.5
5. TH1: no new gas capacity added after 2018 and no limitation of imported capacity after 2018.
6. TH2: 10% increase on imported energy price, no limitation on imported coal capacity after 2018, and new gas capacity no more than 30% of new capacity after 2021, new nuclear capacity no more than 30% of new capacity after 2021.
7. DEM-LO: for all the countries the yearly demand growth set 1% lower than the base case.
8. DEM-HI: for all the countries the yearly demand growth set 1% higher than the base case.
9. Viet1: The nuclear plants included in the Vietnam’s national plan are candidates and no part of the national Master Plan.
10. Coal-Cost: There is a 30% increase in the cost of imported coal.
11. Line-Cost: This sensitivity uses the costs of Vietnamese lines; these costs are 550 USD/km, about 100% higher than in the base case.
12. Emi 90%: reduction of CO2 emission to 90% of the base case.
13. Emi 80%: reduction of CO2 emission to 80% of the base case.
## Emissions Sensitivities

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Emissions Reduction– Impact on expansion

No changes in Myanmar-Cambodia
## Summary of Sensitivities Results

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Savings linked to cross border trading

Values in thousand USD
## Sensitivities Results

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<td>12.48 $/MWh</td>
<td>43376 MW</td>
<td>191437 MW</td>
<td>57000 MW</td>
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<tr>
<td>AP70</td>
<td>18.77 $/MWh</td>
<td>43640 MW</td>
<td>188246 MW</td>
<td>90000 MW</td>
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<tr>
<td>AP50</td>
<td>18.76 $/MWh</td>
<td>43640 MW</td>
<td>188144 MW</td>
<td>93000 MW</td>
</tr>
<tr>
<td>TH1</td>
<td>19.15 $/MWh</td>
<td>43789 MW</td>
<td>191332 MW</td>
<td>57000 MW</td>
</tr>
<tr>
<td>TH2</td>
<td>19.40 $/MWh</td>
<td>43640 MW</td>
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<td>40000 MW</td>
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<tr>
<td>MYANMAR</td>
<td>18.38 $/MWh</td>
<td>47959 MW</td>
<td>182935 MW</td>
<td>69000 MW</td>
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</tbody>
</table>
Presentation Contents

• Master Plan activities
• Summary of Methodology and Assumptions
• Selected Projects
• Recommendations
Recommendations on Results

- The least cost expansion plan includes abundant cross border trading, as anticipated in previous studies.
- Based on MP results, it would be convenient to develop feasibility studies of selected cross border connection and reinforcements of internal transmission links.
- Particularly those links that are present in the base case and most the sensitivities.
- Further to long term PPAs, these new lines should be available for opportunity trading. It will allow optimization of the dispatch at regional level, with significant fuel consumption (and emissions) savings.
- Develop feasibility studies of the regional scale hydro plant.
Achievements

- We have obtained an encouraging interest of the countries, which was reflected in abundant information, active participation in the discussions on the methodology and results, reflected in the workshop conducted in Bangkok on July 2007 and the comments received to the Interim and Draft Final Report.
- A planning methodology for least-cost expansion plans is available for future use.
- An initial regional database is available for planning purposes, with information on existing and new projects, load forecasts and primary resources,
- The results obtained include the identification of suitable expansions of the cross-border transmission capacity, as well as of some regional scale projects,
Future Improvements

• To implement a common methodology to estimate capital and variable costs of generation and transmission facilities.
• Development of a Regional Costs Manual to allow and expedite calculation of hydro plants costs, based on engineering data.
• To define and determine common planning parameters: discount rate, reliability criteria (based on performance standards), imported fuel costs, etc.
• To collect hydrological information from all the rivers or basins where existing and future hydro plants are located,
• To identify and compute costs of available indigenous fuels on a similar basis.
• To agree on common criteria for developing national Master Plans
• To define harmonized environmental targets,
• To collect and homogenize information about demand side and energy efficiency plans
Questions?
Revised activities & timelines
For priority PWG studies and activities

Vientiane, June 2008
Revised activities & timeline

• Activities/ General steps

• Timeline & Milestones
Activities/ General Steps

1. Preparation of new information request

2. Review regional grid code and update with newly acquired information

3. Development of standards for those countries that don’t have standards yet

4. Development of methodology for the power system studies when two GMS countries interconnect

5. Development of new guidelines for the design of new transmission facilities linked to PPAs

6. Development of guidelines on transmission regulation necessary for stage # 1.
## Timeline/Milestones

### PERFORMANCE STANDARDS METHODOLOGY WORK PLAN

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparation of Questionnaire</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>a. Send out to all GMS representatives</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>b. Receive response from all GMS representatives</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Review of the Regional Grid Code</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Development of Performance Standards</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Methodology for power system studies</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Guidelines for new transmission facilities</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Guidelines on Transmission regulation</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Workshops</td>
<td></td>
</tr>
</tbody>
</table>

- Workshops tentative schedule

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[Images and logos at the bottom of the page]
Training Program Implementation
Arrangements & Structure

Vientiane, June 2008
Training Program Implementation

• Implementation Arrangements

• Suggested/Requested training courses

• Training program implementation for future courses (for discussion)
Implementation Arrangements

Training Needs Analysis
Validation with Stakeholders
Execution

PSP
EM & CB
ER

SUPPORT FROM ADB
Suggested/Requested Training Courses

1. National and Regional Grid Code
   • Performance Standards
   • Systems Support (ex. network management, simulation tools, meter reading mgmt, etc.)

2. Tariff Mechanism for Cross Border Trading

3. Organizational Structure, Duties & Responsibilities of Regulator, System Operator, TSO and Market Operator

4. Other suggestions?

For discussion

- Estimate per training course: 3-5 days, 2-4 participants per country
- Remaining resources to be used for Performance Standards study validation/presentation workshop
Regional Power Database/Website:
Launch & Appointment of Administrators

Vientiane, June 2008
Database & Website

- Overview of recent milestones
- Key Features recap
- User Profiles
- Appointment of Administrators
- Issues/Next Steps
Overview of Recent Milestones

**Implementation**
- Database & website launch
- Appointment of administrators
- Use/Maximization of db & website

**Development**
- Database & website development
- Bidding of Hardware & Software

**Bidding**
- Released bidding documents to suppliers
- Failed bidding

**Development**
- Conceptual Design
- Validation
- Preparation of bidding documents
Key Features recap

Home Page
• About GMS - Documentation, presentations, proceedings
• News and Events - displays 5 articles at a time, 50 years storage
• Contact Us – Comments/Queries for web & country admins
• Power System Information – Access to technical, regulatory, & Economic data*
• Profile Settings – Personal info and access update for Administrators

Forum
• Opinion Forum – Public and private exchange of messages
• Working Groups – Formation of working groups for technical discussions and related studies
• Administration – Forum management, group management, user management, moderating, etc.
Key Features recap

Database Access

- Access to Power System Information – per country, categorized by different types of technical information
- Access to Regulatory Information – access to regulatory documents, policies, guidelines, etc.
- Access to Economic Information – Investments, trading, tariffs, market policies, etc.
- Limited Access – All data stored in the database per country and are tagged as public or private. Access depends on profile of user.

Database Maintenance

- GMS & Country documentation
- Power System Information modification
- Uploading of files
- Administration – Announcements, News & Events, & Registration of new members, Profile Management, Membership Applications, Comments and Requests
User Profiles

WEBSITE ADMINISTRATOR

• Only one web administrator
• Has all the functionalities and privileges given to the country administrators
• Responsible for website and database administration
  ✓ Processing of user requests (country admin access)
  ✓ Posting of Important news and announcements
  ✓ Resolving access issues or other concerns that may arise with regard to the website database between users

COUNTRY ADMINISTRATOR

• Preferably one per GMS member country
• Responsible for the following:
  ✓ Private user access administration
  ✓ Country database maintenance/updates
  ✓ Posting of public information (news, events, announcements, etc.)
  ✓ Respond to queries/comments sent by users
User Profiles

PRIVATE USER

• Online registration
• Shall be given access depending on approval of responsible country admin
• Has access to all public and private data of their assigned country (may be given access to other countries depending on approval of the other country’s admin)
• Limited to view and download of data, and access to the Opinion Forum

PUBLIC USERS

• Refers to the general public user
• No need to register or request for an application to access the website
• Limited access to viewing public data only
• Allowed to send queries, comments, requests to the country administrators via the ‘Contact Us’ page
Appointment of Administrators

WEB ADMINISTRATOR

• CSG (China) – Ms. Long Qing

Countries with nominated Administrators

• Thailand – Mr. Varavoot Siripol
• Lao PDR – Mr. Boungnong Bouttavong and Mr. Chansaveng Boungnong
• Myanmar – Dr. Maung Maung Kyaw

Countries without nominated Administrators yet

• Cambodia
• China
• Vietnam
Issues/Next Steps

Immediate Next Steps

• Completion of Country Administrators
• Website Launch (http://121.14.2.196/)
• Data Updating/Completion

Website Maintenance (for consideration)

• Server Room
• China Telecoms Fees

Subscription fees

• MySQL Support
• Domain Name

Other considerations

• Enhancements
• System maintenance