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Review of the Energy Sector Integration in the Greater Mekong Sub-Region
A Focus on the Electricity sub-Sector[1]

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Introduction

This paper provides a brief overview of the ongoing cooperation and coordination in the energy sector in the Greater Mekong Sub-region (GMS). This is clearly an extremely broad and complicated area and a comprehensive review of the relevant issues is beyond the scope of this paper. Instead, this paper focuses on the electricity sub-sector and provides a review of the history and rationale for cooperation and development of integrated energy strategies in the GMS and highlights some of the key challenges that need to be addressed.

A Basic Description of the GMS

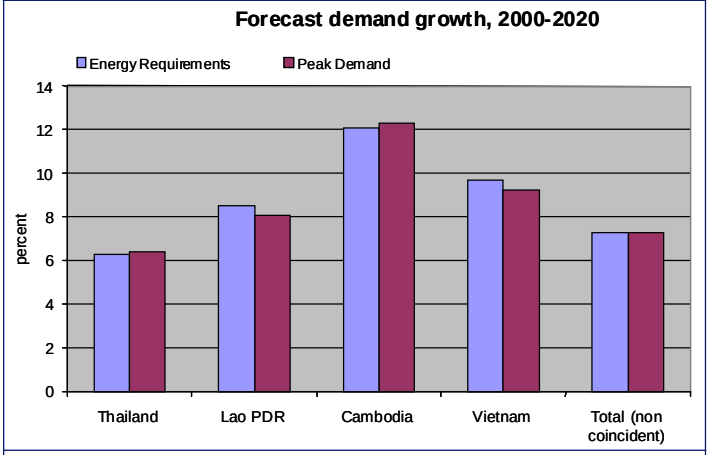
The GMS is generally considered to consist five nations – Cambodia, Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand and Vietnam – as well as parts of the People's Republic of China (PRC). As a whole, the GMS encompasses an area of over 2.5 million square kilometres and, as of 2004, the region had a population of approximately 313 million people. Within this region, there is incredible diversity with respect to economic development, political and legal structures. The greatest linkage between these countries from an economic perspective is their mutual access to the Mekong River – one of the most important natural resources of the region. While the GMS is rich in energy sources, it is also a region with growing energy demands, uneven distribution of energy resources and shifting needs with respect to sources of energy.

Table 1: Increasing Energy Needs in the GMS

	2000	2020
Thailand	**14,918**	**51,359**
Lao PDR	167	784
Cambodia	114	1,156
Vietnam	4,890	28,739
Non-coincident demand	**20,089**	**82,038**

Peak demand (MW)

Figure 1: Increasing Energy Needs in the GMS



Source: H.S. Woldstad, T. Holtedahl, G.L. Doorman. Large Scale Power Exchange in the Greater Mekong Subregion. 2004.

Based on recent World Bank rankings, Cambodia, Lao PDR, Myanmar and Vietnam are all considered low-income economies, while PRC and Thailand are considered lower middle income economies. These

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Table 2: Increasing Energy Needs in the GMS					
Peak Demand (MW)					
	Thailand	**Lao PDR**	**Cambodia**	**Vietnam**	**Total (non coincident)**
2000	14,918	167	114	4,890	20,089
2005	21,222	280	280	7,877	29,659
2010	28,912	442	529	12,589	42,472
2015	38,519	618	799	19,169	59,105
2020	51,359	784	1,156	28,739	82,038

Source: H.S. Woldstad, T. Holtedahl, G.L. Doorman. Large Scale Power Exchange in the Greater Mekong Subregion. 2004.

classification groupings, however, do not reveal the true range of economic development in the GMS. For example, recent estimates indicate that the gross domestic product (GDP) per capita of Thailand is over 10 times that of Myanmar and almost five times that of Vietnam.

Lao PDR, Cambodia, China and Vietnam are still transitioning from planned economies whereas Thailand has long had a market-oriented economy. Similarly, while Thailand has long been integrated with industrialised western economies, other GMS members, such as China and Vietnam are increasingly being more integrated as indicated by the significant international investments in the industrial sector of the respective countries. In contrast, Myanmar and Lao PDR are still relatively isolated from an economic perspective.

While there is a significant rural population throughout the GMS, there has also been rapid urbanisation. This, in addition to the significant increases in the industrial sectors of GMS countries such as Vietnam, has had a significant impact on the level of regional energy demands and the need to increase energy sources. Significant portions of the populations in many GMS countries are not connected to their national power grid. Many still rely on fuel wood – both cheap and relatively abundant although diminishing – as their primary source of energy. However, it is expected that urbanisation, industrialisation, improvements to transmission grids, government and other efforts to lessen fuel wood dependency and poverty reduction will lessen the relative importance of fuel wood and increase demand for other sources of energy throughout the GMS.

Many areas of the GMS still import significant amount of hydrocarbon resources although there has recently been a substantial increase in exploration and exploitation of these resources in the region. The exploitation of the hydrocarbon resources is already the basis for significant intra-regional energy trade. For example, Thailand has estimated recently that it imports a significant portion of its natural gas resources and more than 90 percent of its coal requirements.

Factors such as differing poverty levels, industrial bases, geography and access to electricity grids significantly affect the energy requirements of and types of energy sources used in each of the GMS member countries. Given the significant activity in the electrical sub-sector, this paper focuses on developments in that area. However, it is important to recognise the increasing desire for, and activity related to, integration across the broader energy sector.

The GMS is particularly well situated to take advantage of the benefits of increased energy sector coordination. Focusing on the electrical sub-sector, from a supply and demand perspective, GMS members generally have significant imbalances between current and forecasted demands and available and economically viable power generation resources. The high level of electricity demand in Thailand and the growth of demand as Vietnam's industrial sector develops, explain why they are the main destinations of electricity transfers in the planned regional power interconnections. At the same time, potential benefits of integration reflect the degree of surplus energy resources in the other GMS members, particularly in Lao PDR, which already exports most of its generated hydroelectric power and recognises power exports as a valuable source of capital. With their proximity to high demand markets and surplus in resources, Lao PDR and Myanmar are, therefore, in a particularly good position to reap significant additional benefits from increasing power exports to Thailand and Vietnam.

Table 3: Increasing Energy Needs in the GMS					
Energy Requirements (GWh)					
	Thailand	**Lao PDR**	**Cambodia**	**Vietnam**	**Total (non coincident)**
2000	96,781	865	586	26,722	124,954
2005	134,794	1,528	1,329	44,230	181,881
2010	184,213	2,468	2,502	72,014	261,197
2015	245,948	3,472	3,848	111,333	364,601
2020	328,429	4,437	5,720	169,428	508,014

Source: H.S. Woldstad, T. Holtedahl, G.L. Doorman. Large Scale Power Exchange in the Greater Mekong Subregion. 2004.

Geographically, the proximity of the GMS countries as well as their ties through the Mekong river makes economic international power interconnections and trade practical. To some extent, this is evidenced not only by historic and current large scale electricity transfers, but also by the long tradition of small scale international electricity interconnections to supply communities and regions that may not be on the national power grid of their own GMS member nation.

Equally important, as outlined in more detail below, the GMS members have a historically strong commitment to developing and implementing relevant policies and strategies to coordinate the GMS energy sector and create a regional power trade market. The strength of these commitments is evidenced by the degree of ministerial level support in the regional efforts described below and the GMS members' willingness to request international assistance in the development of regional energy sector cooperation and coordination.

A Selected History

Since 1992, the six member countries of the GMS have embarked on a programme of economic cooperation with the aim to promote development through closer economic linkages (the GMS Programme). The GMS Programme originally included only five-member countries and the Yunnan province of the PRC. However, regional cooperation was expanded with the inclusion of the Guangxi Zhuang Autonomous Region of the PRC in 2004. So far, cooperation in the energy sector in the GMS has focused on the building of physical and institutional infrastructure for bilateral and regional electricity trading. But recent developments have expanded the GMS members' focus on promoting regional energy sector coordination to include non-electricity sectors, such as oil and coal and intra-regional investments to more efficiently exploit power generation resources.

While large scale intra-regional bilateral trade can be traced at least to the 1970's when Lao PDR and Thailand signed an agreement for the export of power to Thailand, more modest cross-border exchanges for supply to border towns in neighbouring countries and for cross-border hydropower development have long been undertaken throughout the GMS.

The push towards broader regional cooperation gained momentum with the convening of the GMS Electric Power Forum (EPF) in April 1995. The EPF was intended to facilitate the implementation of priority GMS power projects, and promote GMS power system development by addressing both hardware and software technical issues relevant to GMS power systems as well as related economic, financial and institutional issues.

The EPF has met regularly since its inception, and has agreed to gradually expand cooperation to include other energy sectors such as oil, gas, and renewable energy as deemed necessary by the GMS members in the 11th meeting in 2004. At that meeting, the EPF changed its name to the 'Energy Sector Forum'.

In 1998, the Experts Group on Power Interconnection and Trade (EGP) was created to promote the development of a GMS transmission network and facilitate the expansion of cross-border power trade. In addition, the EPF and EGP adopted a Policy Statement on Regional Power Trade in 1999, which was subsequently adopted at the GMS Ministerial Meeting in January 2000. The Policy Statement was intended to provide a framework for promoting opportunities for extended economic cooperation on regional power trade and facilitating the implementation of priority power projects in the GMS. It called for an intergovernmental agreement to advance regional electricity trade. This represented a significant commitment by GMS ministers to integrating national power systems into a regional grid.

Another notable event in 2000 was the commencement of an Asian Development Bank (ADB) technical assistance project – the Regional Indicative Master Plan on Power Interconnection in the GMS. The scope of this project included:

- assessing the electric power demand and reviewing generation and transmission master plans in the GMS countries;
- updating previously identified power grid interconnections, based on revised supply and demand projections;
- formulating an indicative master plan to promote regional power trade; and
- identifying the institutional and regulatory issues that need to be addressed to properly implement the plan.

This project, completed in 2002, strongly supported the case for economic and environmental benefits arising from regionally harmonising the development of power systems in the GMS. It further recommended significant investments in power plants, transformer stations and the development of a high capacity interconnection grid with the goal of linking the GMS electricity pool.

The signing of the Intergovernmental Agreement (IGA) on Regional Power Trade in 2002 significantly accelerated this integration process. The IGA, fully ratified by all GMS members by 2005, represents a strong ministerial commitment by each of the signatories:

- to efficiently develop the GMS electricity sector and extend GMS energy cooperation;
- to help implement priority power projects; and

- to address technical, economic, financial and institutional issues in promoting power trade.

Further, primarily by supporting a transfer of generation from thermal to hydroelectric, the IGA aimed to reduce greenhouse gas (GHGs) emissions and other pollutants. The IGA is based on the principles of cooperation, gradualism and environmentally sustainable development with three specific objectives:

- all six countries coordinate and cooperate in planning and operating their systems to minimise costs while maintaining reliability;
- the six countries to fully recover their costs and share equitably in the resulting benefits including reductions in required capacity and fuel costs as well as improved use of cheaper electricity sources; and
- provide reliable and economic electricity services to customers in each country.

Further to these objectives, the IGA calls for the establishment of the Regional Power Trade Coordination Committee (RPTCC) to actively coordinate the implementation of regional power trade. The RPTCC was established in 2004 with a number of explicit responsibilities to:

- finalise a draft operating agreement setting out the rules of regional power trade – the Regional Power Trade Operating Agreement (RPTOA);
- make recommendations for the overall policy and day-to-day management of regional power trade;
- establish short, medium and long term priorities to achieve regional power trade within a specified timetable; and
- identify the means of financing and other steps required to develop regional power trade between the GMS countries.

A Memorandum of Understanding on the Guidelines for the Implementation of the RPTOA – Stage #1 was signed in 2005, set out rules and guidelines for bilateral power trading as part of the gradual process towards cross-border power interconnections and efficient and reliable power trading among the GMS countries.

Two sub-groups of the RPTCC were established in 2006. The Focal Group was meant to coordinate the implementation of the RPTCC activities in each GMS country and the Planned Working Group was created to perform priority activities of the RPTCC, such as determining training requirements, and setting pricing rules and technical standards.

In addition to other ongoing efforts by the RPTCC and other bodies, an ADB technical assistance project entitled, 'Developing the GMS Energy Sector Strategy', was approved in 2006. The objectives of the project were to:

- help articulate the GMS vision on energy cooperation;
- prepare an action plan to meet emerging energy challenges;
- identify priority projects to enhance energy trade and investment in the GMS; and
- discuss institutional and other policy aspects of enhancing energy security.

This project further signifies the GMS members' intent to expand GMS energy sector cooperation beyond electricity. An interim report was provided for consultation in May 2007, with the intent of a draft final report being considered in 2007.

In summary, there is a long progression of increasingly comprehensive initiatives to foster the development of a coordinated regional power market within the GMS. There is an even longer history of bilateral trade with respect to electricity within the GMS and the current and developing framework is expected to enhance this bilateral trade as the basis for a true regional power market and coordinated energy sector.

Benefits of a Coordinated Energy Sector

The 2007 ADB project interim report mentioned above cites four rationales for a regional approach to the energy sector in the GMS:

- topographical features of energy supply options do not correspond to national boundaries and there may be overall supply cost reductions with international source options;
- individual markets may be too small to justify large scale investments needed to achieve scale efficiency;
- cross-border energy supply provides diversification of sources and thus increases energy security; and
- environmental implications that transcend national boundaries need to be integrated in energy planning if sustainable development is to be achieved.

To expand on this, despite the GMS members' inventory of energy resources, a significant amount of energy is still being imported into GMS member countries – particularly hydrocarbon fuels and electricity. An interconnected energy market is expected to reduce the need for fuel imports by supplanting significant amounts of thermal energy with hydroelectric power. This will have both supply and environmental impacts throughout the GMS. Thailand's recent efforts to reduce its reliance on higher costing natural gas generated power and the environmental protests over its proposals to build new coal facilities evidence the importance of these issues.

These benefits are not only driven by high energy demand of GMS members like Thailand, but also by the developing economies of presently low energy

demand members such as Cambodia where it can be expected that greater percentages of the population will be put on the grid and/or switch a portion of their energy usage from fuel wood. For example, the Cambodian Minister of Industry, Energy and Mines recently stated that under that country's national policy on rural electrification, all villagers will have access to electricity by 2020 and at least 70 percent of Cambodia's families will have access to electricity by 2030. Also, energy demands from the industrial sector will increase.

Enhanced coordination, increased investment and exploration, and increased energy trade will likely create larger markets justifying not only the economies of scale, but also potential economies of scope. These scope economies will not only increase energy security through source diversification, but may also reduce energy production costs (particularly with respect to peak load generation) and increase reliability. Further, increased investments may also lead to improved quality of energy supplied throughout the interconnected regional grid.

It may be expected that regional power trading and an interconnected electricity market will thus lead to increased investments and necessitate closer economic and legal cooperation within the GMS. The coordinated approach to the power sector should also increase the efficiency of investments, and may even reduce total investments in generation capacity required across the GMS. A regional power market may also lead to more efficient resource exploitation and generation as new resources are discovered throughout the region. In addition to providing more efficient power generation, this may also increase the speed at which generation of assets become available which may foster improvements to national grid and distribution of power to the rural population.

This paper has focused largely on developments in the electricity sub-sector, as this has been the dominant arena for GMS energy sector integration to date. However, it seems clear that the rationale for and benefits of integration and cooperation discussed above will apply in the context of broader energy sector cooperation as well. For example, many of these points have been raised in discussions related to the Trans-Association of Southeast Asian Nations (ASEAN) gas pipeline.

The recent efforts by Thailand to address its projected energy shortages evidence the rationale for broader GMS energy sector integration. Faced with a shortage of generation assets, Thailand has recently explored initiatives to develop marine gas pipelines with Myanmar, increase coal imports from Myanmar, increase investments in hydroelectric and hydrocarbon generation facilities in Lao PDR and Myanmar and even entered into discussions with PRC about future electricity imports. In addition, Thailand has joined other GMS members in exploring the potential to add nuclear generation to its energy supply options. From Thailand's perspective, it thus appears that efficient energy planning involves cooperation in more than just the electricity sub-sector.

The decision by the GMS members to change the name of the EPF in 2004 and the ongoing ADB project signify their desire to explore expanding trade and integration efforts beyond the electricity sub-sector. More detail with respect to the benefits of integration and cooperation in the electricity sub-sector and broader energy sector are provided in the May 2007 interim report.

In summary, despite the increase in investments required to develop significant hydroelectric generation facilities and an interconnected transmission system, it is expected that a coordinated energy sector will at least produce:

- cost savings;
- efficiency gains;
- environmental benefits from reduced thermal generation;
- increased reliability and quality in electricity; and
- economic opportunities for the expected suppliers such as Lao PDR and Myanmar.

Challenges

While recognising the significant benefits of integration, it is important to be realistic in appreciating the challenges to be faced. Besides the significant amount of financial investments and operational costs required in order to realise these benefits, other significant barriers to regional coordination should be noted. These challenges to the successful implementation of a coordinated GMS energy sector include:

- Political issues, including territorial disputes and ensuring ongoing cooperation, costs sharing and coordinated decision making in the operation of the regional market;
- Coordination issues including conflicts between national and regional energy and investment strategies;
- Investment issues including the enormous financing requirements for expanding cooperation, such as developing generation assets, regional transmission network, and institutional and policy frameworks; as well as the high perception of risk by potential investors and developers (particularly in GMS members whose legal and political systems make protection of investments less certain), and the inability of the public sector to support these investments;
- Technical challenges of interconnecting disparate power systems and ensuring security including

communications, metering and allocations of responsibilities throughout a regional grid;
- Valuation issues arising from undeveloped power markets in GMS members creating uncertainty with respect to the determination of energy costs, tariffs and prices; and
- Social issues such as opposition to large hydropower projects and disputes over whether regionalisation of the GMS energy sector will actually enhance sustainable development or reduce poverty in light of concerns that the benefits might be captured by select groups within certain GMS members.

International Assistance

As recognised above, there has been a significant role for international assistance in this area. In particular, the ADB, the World Bank and other development partners have long supported energy related and other projects within GMS member countries as well as on a regional level through policy dialogue, technical assistance and financing. This support for regional cooperation can be traced back to the initial ADB support for the GMS Programme and continues with the ADB technical assistance project currently underway to help expand coordination efforts beyond electricity to include other power sectors.

International assistance has thus far included:
- helping establish regional forums for policy discussions, knowledge sharing, and consensus building;
- undertaking and/or participating in technical and economic studies;
- strengthening capacity of ministries and utilities in the region in energy trade and investments; and
- providing investment financing and risk mitigation.

Conclusion

It is clear that there is strong international support, both within the GMS and outside the region, for the development of a regional approach to the GMS energy sector. While a significant focus of current efforts is the creation of an interconnected regional transmission grid and electricity market, there is recognition of the additional benefits that are expected to arise from increased cooperation and coordination in other aspects of the GMS energy sector.

Addressing the challenges mentioned above will require ongoing significant efforts by the GMS members and a continued high level of commitment by their respective governments. In addition to the strong commitment of GMS members required in order to realise the benefits of energy sector integration and cooperation, it can be expected that there will continue to be a role for international assistance in this regard. Going forward, it is important for international assistance to continue to provide support in these areas in order to encourage the development of political consensus, address technical and operational concerns, assist and support strategic and technical studies and implement developing GMS energy sector strategies.

1 Much of the information provided in this paper is derived from source material made publicly available by the World Bank, Asian Development Bank and the Association of Southeast Asian Nations (ASEAN) Centre for Energy. While individual citations have not been provided, the author wants to recognise the enormous contribution of this reference material to this paper. Information with respect to specific developments have also been obtained from publicly available news reports and press releases.

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