Chapter 5

Key Findings and Next Step

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CHAPTER 5

KEY FINDINGS AND NEXT STEP

5.1. Key findings

The most fundamental thing that has been uncovered through this study is how the entire region could benefit from the strengthening of international grid interconnections. Within this region, there is a trend towards a widespread increase in power demand. But the situation relating to the presence of fuel resources for power generation differs from country to country. For that reason, while one country may be blessed with abundant resources, another country may have no choice but to rely on imports. Where relationships among neighbouring countries are adversarial, each country has no choice but to fulfil its own demand entirely with domestic supply. However, given the trend towards promoting economic integration within this region, from an economic perspective, it is more logical to find a balance between power supply and demand at a regional level rather than at an individual country level.

More specifically, in Laos, Cambodia, Myanmar and China's Yunnan Province, there is great potential for hydro power generation. Although the cost of hydraulic power generation varies greatly by location, in many cases, it is competitive with natural gas-fired power generation and coal-fired power generation. Furthermore, in terms of making a response to the problem of climate change, there is demand for the use of energy sources with the smallest possible carbon footprint. On that point, hydraulic power generation is thought to be an appropriate choice. In order to make the greatest possible use of this latent resource, there is a need for a regional interconnected power system.

In addition, utilising the different power demand patterns of each country, it is possible to reduce the cost of the power supply throughout the entire region. If a country is to meet its power demand on its own, it must maintain a

sufficient reserve margin in line with its peak demand levels. If, hypothetically, power interchange were possible with neighbouring countries with differing peak demand times, it would be possible to reduce the investment needed in order to maintain a reserve margin.

In such a way, regional grid interconnections would give rise to economic benefits for the entire region although the extent of those benefits would depend on the route. For instance, in cases where neighbouring countries also face a lack of sufficient fuel resources for power generation, or in cases where peak times occur simultaneously, it would not be possible to achieve the above effects even with grid interconnections. In addition, the cost of grid interconnections would naturally also affect this issue. If the economic benefits gained from the grid interconnections are less valuable than their investment costs, then there is no point in creating grid interconnections in the first place.

This study performed a cost-benefit analysis for each of the many routes thought to be promising for grid interconnections. In this regard, the Lao-Thailand-Malaysia-Singapore route was found to possess great potential.

Table 5.1: Possible interconnection and cumulative cost benefit

Case		Estimated cost benefit [mil.USD]		
		without interconnection line cost	net benefit with Route 1 line cost	net benefit with Route 2 line cost
A	THA-KHM	5,644	4,560	5,470
B	THA-LAO	21,387	19,282	20,604
C	THA-MYA	(352)	(4,607)	(2,766)
D	MYA-THA-MYS-SGP	5,628	(1,118)	3,064
E	VNM-LAO-THA	24,707	21,604	23,715
F	MYS-IDN	6,012	3,968	4,087
G	LAO-THA-MYS-SGP	27,490	23,217	26,557

* Numbers in brackets are negative.

Just how significant is the calculated economic benefit? Consider Laos where the GDP in 2011 was USD8,162 million. Similarly, in Cambodia, the nominal GDP that year was USD12,890 million. In Brunei, it was USD16,693 million. The calculated economic benefit is an amount greater than all of these GDP figures.

In addition, if the cost of constructing coal-fired power infrastructure is assumed to be USD2,000/kW, the resulting benefit would be equivalent to

approximately 10 or more ~~of~~ coal-fired power plants, each with a capacity of 1,000MW. In light of all these, there is indeed ~~a~~ sufficiently large economic benefit to be gained from grid interconnection.

Table 5.2: Cost benefit and equivalent investment

Case		Possible cumulative cost benefit range [mil.USD]	Equivalent investment cost for 1,000MW CPP [unit]	Equivalent investment cost for 400MW Gas CCGT [unit]
A	THA-KHM	4,560 -- 5,470	2	14 -- 17
B	THA-LAO	19,282 -- 20,604	9 -- 10	60 -- 64
C	THA-MYA	(4,607) -- (2,766)	-	-
D	MYA-THA-MYS-SGP	(1,118) -- 3,064	0 -- 1	0 -- 10
E	VNM-LAO-THA	21,604 -- 23,715	10 -- 11	68 -- 74
F	MYS-IDN	3,968 -- 4,087	1 -- 2	12 -- 13
G	LAO-THA-MYS-SGP	23,217-- 26,557	11 -- 13	73 -- 83

CPP: Coal-fired Power Plant USD2,000/kW

Gas CCGT: Gas-fired Combined Cycle Gas Turbine USD800/kW

* Numbers in brackets are negative.

What should be considered here is the size of the investment in interconnected lines. For instance, for the Laos-Thailand-Malaysia-Singapore route where the greatest benefit can be expected, the cost is estimated to reach USD 4,273 million. This is equivalent to approximately 52 percent of the GDP of Laos, as previously noted. Such big investment requires capital and manpower. In order to avoid a situation where construction of all the candidate routes were to commence at the same time, thereby running into physical difficulties, it would be necessary to set priorities wherein the prioritisation applied should consider the benefits and feasibility of each route.

Based on the potential economic benefits to be gained, routes B, E and G belong to the group of top priority among all the routes evaluated in this study.

Table 5.3: Possible interconnection line and their priority

Case		Possible cumulative cost benefit range [mil.USD]	Estimated cost of trasmission line [mil USD]	
A	THA-KHM	4,560 -- 5,470	162 -- 1,009	second priority
B	THA-LAO	19,282 -- 20,604	728 -- 1,957	first priority
C	THA-MYA	(4,607) -- (2,766)	2,244 -- 3,956	need careful assess.
D	MYA-THA-MYS-SGP	(1,118) -- 3,064	2,384 -- 6,272	need careful assess.
E	VNM-LAO-THA	21,604 -- 23,715	922 -- 2,885	first priority
F	MYS-IDN	3,968 -- 4,087	1,790 -- 1,901	second priority
G	LAO-THA-MYS-SGP	23,217-- 26,557	868 -- 4,273	first priority

* Numbers in brackets are negative.

Plans are already set in motion by the HAPUA to realize a grid interconnection in ASEAN. Thus, there is a need to confirm whether the candidate lines selected by this study conform with the plans that HAPUA is currently advancing.

It should be noted that first and foremost, each of the routes selected by this study has also been proposed by HAPUA. Second, the largest total transmission capacity of any of the lines currently under construction in the HAPUA plans is that of the Viet Nam-Laos-Thailand line, the same priority plan proposed by this study. And third, this study and HAPUA conform in terms of the recognition of a Thailand-Myanmar line as a future interconnection candidate.

Beyond the above, however, there is a need to establish the differences in the methodology employed by this study as compared to that of HAPUA. This study is the result of analysis focused only on economic considerations. On the other hand, HAPUA's assessment took into account another criterion meant to evaluate benefits of new interconnections beyond the economic realm. . For instance, even if a line does not produce as large an economic benefit as other lines, if it contributes to regional economic integration and the power supply, there are instances where that line might receive high prioritisation in the HAPUA plans. Indeed, decisions on selecting the appropriate interconnected lines should be based on a comprehensive set of criteria that considers a variety of aspects in addition to economic reasons.

Despite the slightly different approach, the results of this study can be said to generally conform with the plan being promoted by HAPUA. In addition,

while HAPUA's construction plans generally set a target of 2020, this study considers the accumulated benefit from 2020 to 2035, and is thus an extension of the HAPUA plans.

Table 5.4: HAPUA lead plan

		Existing	On-Going	Future	Total
Northern System		2,629	6,550	17,004	26,183
9	Thailand - Lao PDR	2,111	3,352	3,095	8,558
10	Lao PDR - Vietnam	248	2,898	TBD	3,146
11	Thailand - Myanmar	-	-	11,709	11,709
12	Vietnam - Cambodia	170	-	-	170
13	Lao PDR - Cambodia	-	300	-	300
14	Thailand - Cambodia	100	-	2,200	2,300
Southern System		450	600	1,800	2,850
1	P.Malaysia - Singapore	450	-	600	1,050
4	P.Malaysia - Sumatra	-	600	-	600
5	Batam - Singapore	-	-	600	600
16	Singapore - Sumatra	-	-	600	600
Eastern System		-	430	800	1,230
6	Sarawak - W.Kalimantan	-	230	-	230
7	Philippines - Sabah	-	-	500	500
8	Sarawak - Sabah - Brunei	-	200	100	300
15	E.Sabah - E.Kalimantan	-	-	200	200
Northern-Southern Link		380	100	300	780
2	Thailand - P.Malaysia	380	100	300	780
Southern-Eastern Link		-	-	3,200	3,200
3	Sarawak - P.Malaysia	-	-	3,200	3,200
Grand Total		3,459	7,680	23,104	34,243

Source: HAPUA

Based on the above analysis, this study makes the following proposals.

- Accelerate construction of the Viet Nam – Laos – Thailand – Malaysia - Singapore interconnection line.
- Place increased priority on the Thailand-Cambodia line.

Going back to the premise of this study, the economic benefit to be gained from the Viet Nam-Laos-Thailand-Malaysia-Singapore line is huge. There already exists a transmission link connecting these countries and plans are underway to reinforce that line. However, in order to enjoy the benefits that would arise from such an interconnection line to the greatest extent possible, it is desirable to further enhance transmission capacity and accelerate construction.

Although a Thailand-Cambodia line already exists, work has not yet begun on capacity addition. As the benefits that could possibly be gained from line capacity enhancements are quite large, it is desirable to promote the prioritisation of that line.

What must be highlighted here is the extent of progress on power resource development. The benefit to be gained from this grid interconnection will be achieved through the development and use of hydropower generation in Laos and Cambodia. In other words, the strengthening of the grid interconnection must be done alongside the improvement of hydropower generation capacities in both countries. Although both countries have a high hydropower generation potential, there is a need for complex adjustments among the Mekong Basin countries within the development of the main current of the Mekong River in particular. Should the development of power resources be delayed, the investment in the international grid interconnections will be wasted.

In addition, the need to strengthen electricity supply networks in each country and to adjust systems to make the transmission of power possible has to be emphasised. This study has illustrated a route from Myanmar to Singapore but in order to realise the transfer of power along such a route, each country would need to have 500kV main lines and a systematic guarantee of third party access.

As mentioned earlier, the interconnection routes for both HAPUA's and this study are very similar. HAPUA began its activities of strengthening grid interconnections in the region much ahead of this study. But it is unfortunate that progress has not gone well in some parts. It is therefore important for this study to have a sufficient recognition of the reasons behind this inasmuch as the causes of the delay of the APG plan may end up delaying the construction of the priority routes proposed by this study as well.

In this connection, the following points relating to the possible reasons for delays in the HAPUA plans were discussed in the WG meetings for this study:

- Systems and regulations related to the grid interconnections of relevant countries differ. Relatedly, there has not been sufficient bilateral or multilateral discussion and coordination in order to promote construction.
- **The investment environment is not transparent; hence, it does not**

attract sufficient private companies and foreign capital. Accordingly, there has not been a sufficient provision of capital.

Because the framework devised by HAPUA does not pursue economic benefits alone, the plan is unable to gather sufficient investments in the form of private and foreign capital. Therefore, direct and indirect participation by governments, including construction by public power companies, becomes indispensable.

In light of this, there is room for improvement in terms of relations between countries. For instance, in Europe, the European Commission (EC) is constructing unified regulation and market systems with the goal of achieving increasing benefits for all member states. In addition, the EC is also unifying regional power markets as well as selecting routes for which construction should be prioritised in order to improve the stability of supply. It is also offering capital support for this. It is believed that interstate frameworks are functioning effectively for the construction of a region-wide power transmission network running across national borders.

In the EAS region, the creation of a framework with the goal of streamlining the enhancement of benefits for the entire region could be expected to encourage the creation of grid interconnections. Specifically, taking the European experience as a case study, there is a group comprising the regulating bodies of each country, and a group comprising the power transmission companies of each country. These groups set the common regulations they believe should be applied, create common development plans, and set obligations that each country within the region is expected to equally follow. Because each county would have to relinquish part of its own market regulatory functions for this, there would likely be strong resistance to the formulation of such a system. However, this can also be said to be the logical choice, building on the great push towards the creation of the ASEAN Economic Community in 2015.

5.2. Next Step

Based on the results of the quantitative analysis done in this study of the potential economic benefits and costs stemming from international grid interconnections based on certain preconditions, a number of priority routes were selected.

It is hoped that ultimately, actual investments will be made to realise the construction of these routes and to reap the benefits expected to be gained. While the results of the analysis in this research may lead to further discussion and decisions, it has to be acknowledged that a number of issues had been insufficiently addressed in this study. For instance, there has to be a closer examination of the route selection for power transmission lines and of the cost calculations. In addition, certain barriers in terms of policies and, technology, among others, are believed to exist that affect the actual realisation of grid interconnections. These issues need to be addressed because the reliability of the analysis of this research would be improved by addressing these points which have been insufficiently analyzed at the moment. That is therefore the next step. And it is hoped that the improvement of the validity of this analysis will create an opportunity for the realization of investment. That is the direction aimed at by this study.