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## Developing International Power Markets in East Asia

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The Greater Mekong subregion has good potential for international power trade. Initial interest in this market is being spearheaded by private developers negotiating bilateral cross-border trade agreements. But experience in power trade zones in Europe and North America shows that to achieve the benefits of fully fledged trade, the countries in the subregion need to closely coordinate electricity sector policy, operating protocols, and network development. This Note sets out the market development options, reviews sector reforms so far, assesses the obstacles to full power trade, and briefly outlines multilateral efforts to promote an infrastructure that will support international power trade in the subregion.

FIGURE 1 THE POTENTIAL EAST ASIAN POWER MARKET



### Potential benefits

The Greater Mekong subregion—Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Vietnam, and the Yunnan Province of southern China—has significant potential for cross-border power trade. The subregion is well endowed with low-cost hydro resources—the Mekong River Basin is the world's twelfth largest river system—and China, Lao PDR, Thailand, and Vietnam have large coal and natural gas reserves. The potential for trade stems from imbalances in costs and in supply and demand between countries in close proximity: the low-cost hydro potential is in Lao PDR, Myanmar, and Yunnan Province, but the main markets are Thailand and the more distant Malaysia-Singapore grid about 1,000 kilometers away (table 1).

Recent studies comparing scenarios of electricity self-sufficiency in each country with a full trade scenario show that full trade could yield cost savings of at least US\$10.4 billion in 2001–20 and a reduction of airborne pollutants valued at US\$160 million a year. (These estimates assume a significant slowing in power demand



TABLE 1 SELECTED ECONOMIC AND POWER INDICATORS IN EAST ASIA (1996)

	Cambodia	Lao PDR	Myanmar	Thailand	Vietnam	Malaysia	Singapore
Population (millions)	10	5	43	61	76	20	3
GDP per capita (U.S. dollars)	1,266	2,071	677	13,235	1,263	8,763	21,493
Annual electricity use (kilowatt-hours per capita)	55	55	60	900	198	1,777	6,451
Electrification (percent)	10	18	15	98	30	95	100

*Note:* Estimates of GDP are based on purchasing power parities rather than exchange rates as conversion factors.

*Source:* World Bank estimates.

over the next few years in Thailand as a result of the current financial crisis.) The savings would arise from:

- Lower operating costs due to economic power exchange, postponed and lower investments in generation due to least-cost development of regional energy resources, and reduced spinning reserve costs.
- Lower coincident peak load (compared with the sum of individual peak loads), mutual access to generation reserves for interconnected systems, a more robust power supply to meet such unexpected events as load growth above forecast or delayed commissioning of generation and transmission projects, and increased system reliability.
- Lower greenhouse gas emissions and other pollutants, largely due to a shift from thermal to hydro generation in the long term.

There is growing interest in cross-border bilateral power trade in the subregion, spearheaded by private developers in Lao PDR selling power to Thailand. The government of Thailand has agreed to buy 3,000 megawatts from these private power developers by 2006, and several independent power producer (IPP) projects are moving ahead. China's Ministry of Electric Power is encouraging studies of

the export potential of Yunnan's planned Jing Hong hydropower plant and associated transmission lines to Thailand, through Lao PDR, with the support of the Lao and Thai governments. The Vietnam and Lao governments have signed a memorandum of understanding on purchases of about 2,000 megawatts of power by 2010.

### Developing international markets

Experience in power pool development in Europe and the United States suggests that to get the full benefits of that trade, countries in the Greater Mekong subregion will have to go beyond the proposed bilateral power purchases. An international market requires coordinated development and operation. The countries involved will have to ensure compatibility in their power sector structures, conditions for private entry, and market competitiveness.

The three main models for international power markets can be regarded as three phases of a continuum:

- The single-buyer model.
- The third-party or open access model.
- The spot market or wholesale market (power pool) model.

### Single buyer

In a single-buyer market a single entity, such as the Electricity Generating Authority of Thailand (EGAT; see box 1), purchases power from all producers on a contractual basis. This approach does not require a radical separation of integrated utilities or significant power sector reform. But the long-term contracts should be structured like IPP contracts, providing for separate payments for capacity and energy to compensate producers that maintain high levels of plant availability. This model would provide limited benefits for competition because sales would tend to be based on long-term contracts. It might also lead to inefficiencies in investment, such as duplication in transmission.

More competitive single-buyer models require some vertical and horizontal separation of generation, transmission, and distribution. Vertical separation facilitates competition among power generators and makes it possible to identify the costs of transmission and to set prices for grid use. These prices normally need to be regulated through a transparent and predictable price review mechanism. To get the benefits of competition, though, governments should ensure that no large generators command excessive market power.

### Open access

The open access, or third-party, model opens the transmission system to generators so that they can wheel power directly to distributors or large bulk customers. Access to transmission must therefore be regulated, and pricing policies compatible, transparent, and efficient. Vertical separation of transmission avoids the conflicts of interest that can arise if a transmission entity favors its own generation source. Under the open access model most exchanges would still be based on long-term contracts, but short-term trade could occur if countries have spare capacity or energy.

### Power pool

The final stage in developing an international power market is to form a regional power pool

## BOX 1 SECTOR OPERATORS

The power sectors in the Greater Mekong subregion are structured differently.

**Cambodia.** *Electricité du Cambodge* is a state-owned utility responsible for the supply of electricity nationwide. Electricity supply is largely restricted to the capital, Phnom Penh, and a few provincial towns; there are no transmission facilities in Cambodia.

**China.** In Yunnan Province, the Yunnan Provincial Electric Power Corporation operates as a fully integrated power company, wholly owned by the government. The South-East China Electric Power Corporation (SCEP) was set up as a joint venture company in Guangzhou by China's central government, the State Energy Investment Corporation, and Guangdong, Guangxi, Guizhou, and Yunnan province in 1991. The SCEP constructs and manages jointly funded generation and transmission projects. It is exploring the feasibility of a regional power pool.

**Lao PDR.** The national utility *Electricité du Lao*, established in 1961, is responsible for all supply in the country. But electricity supply is largely restricted to the capital, Vientiane, and a few provincial towns, since transmission facilities are limited.

**Malaysia.** *Tenaga Nasional Berhad* operates as a fully integrated power company; it purchases all power produced by independent power producers.

**Myanmar.** Myanmar Electric Power Enterprise was constituted in 1989 as a government-owned, fully integrated utility. It is responsible for planning, designing, constructing, maintaining, and operating electricity supply facilities throughout the country.

**Thailand.** The country has three government-owned utilities: Electricity Generating Authority of Thailand (EGAT), Metropolitan Electricity Administration (MEA), and Provincial Electricity Authority (PEA). EGAT is responsible for bulk supply, MEA for distribution in Bangkok, and PEA for supply in the rest of the country. These utilities are well established, profitable, and well managed. The government plans to privatize them through public stock offerings.

**Vietnam.** Electricity of Vietnam was established in 1995 as a wholly government-owned holding company for the power sector. It coordinates the three formerly fully integrated power companies, which had been based in Hanoi, Danang, and Ho Chi Minh City.

TABLE 2 STATUS OF POWER REFORM IN EAST ASIA

	Fully integrated sector	Independent regulation	Degree of unbundling	IPPs permitted	Single-buyer model	Transmission access	Wholesale competition
Thailand		Under study	Unbundling of distribution and generation in progress	√	√	Limited access planned	No
Malaysia	√	Set up in 1991	Unbundling of generation and transmission under consideration	√	√	No	No
China		Under study	Partial unbundling of generation and transmission	√	√	No	No
Vietnam	√	Law being drafted	Generation and transmission to be operated as profit centers	√	√	No	No
Lao PDR	√	Not planned	Creation of separate transmission company being considered	√	√	Under study	No
Cambodia	√	Law being drafted	Not planned	√	√	No	No
Myanmar	√	Not planned	Not planned	√		No	No

or wholesale market allowing regional power producers to sell directly to any distributor or bulk customer. This model requires a regulatory framework to guarantee a fair and efficient market, including mechanisms to facilitate and coordinate trade. Again, governments must ensure that a few large generators do not dominate the market and inhibit competitive power pooling.

### Market reforms so far

All governments in the subregion have fostered the beginnings of power trade by opening the

generation market to IPPs, though their success in attracting private investment has varied. IPPs have been active in Lao PDR, Malaysia, and Thailand, but they have shown less interest in other countries. Nearly all governments are moving toward a single-buyer model (table 2). In Thailand, for example, EGAT's transmission entity is responsible for power purchases—though IPPs (with 10 percent of generating capacity) will have some access to the grid for direct sales to large consumers. In Malaysia Tenaga Nasional Berhad (TNB), the government-owned, fully integrated utility, purchases

all power produced by IPPs (which have about 30 percent of generating capacity).

Thailand has made the most progress in unbundling transmission, distribution, and generation. In China the central government is moving slowly to encourage competitive generation. The Yunnan provincial power corporation is developing the single-buyer model and has signed long-term power purchase agreements with projects sponsored by other government entities. The Lao government plans to establish a separate transmission company to provide wheeling services to the region. It also is considering separating export power plants from local supply. The government of Vietnam plans to operate generation and transmission as profit centers, but whether it will permit full unbundling is unclear. The governments of Cambodia, Lao PDR, and Vietnam seem reluctant to relinquish control over the sector.

No government has yet contemplated introducing open access to transmission, though Malaysia is well placed to do so, with IPPs accounting for such a large share of its generating capacity. Nor has any country made much progress in setting up independent regulation and designing coherent pricing policies.

## Market barriers

There are many barriers to achieving the full potential of power trade in the Greater Mekong subregion. The following are the most crucial.

### Institutional and public policy

- **Leadership and priorities.** Only Lao PDR and Thailand rate cross-border trade highly. There is no authoritative regional group or agency to provide leadership in network development. Environmental issues, too, must be addressed at a regional level to resolve conflicts and ensure that no country bears an environmental burden so that others can have clean power. Failure to mitigate the environmental impact of dams will become a barrier to hydro development and thus a barrier to trade.
- **Laws, regulations, and contracts.** In every country laws, regulations, and power purchase contracts include long-term provisions that hamper the move to more competitive markets. For example, the lack of flexibility to reassign parts of the generation purchased under a long-term power purchase agreement will limit the scope for introducing more competition in the near term.
- **Transmission ownership.** Some governments have not yet decided which agency or entity will be responsible for building and operating transmission.
- **Open access rules.** Governments have not established open access rules for transmission facilities. Thus where private developers are building a transmission line to connect their plant to load-serving points, it is unclear whether a second generator could connect to this line. A need to construct additional transmission facilities could put a proposed project at a competitive disadvantage, particularly if the first plant added a unit at the existing site. There also is no policy allowing through-flows—required, for example, if Lao PDR were to permit sales from Vietnam to Thailand (though the Lao government has agreed in principle to allow output from China to be transported through its system into Thailand). Transmission facilities should be open to all generating plants on a non-discriminatory basis.
- **Independent regulation.** The absence of independent regulatory agencies increases the risk for developers of arbitrary changes in tariffs.

### Technical barriers

- **Network development.** Transmission construction needs to be coordinated to minimize the cost of long-term investment. There are plans to develop project-specific facilities to transmit output from one country to another. But developing a robust market will require a network of facilities rather than point-to-point links. A network would provide parallel facilities to ensure delivery of electricity in the event of outages.

- **Transmission protocol.** There is no protocol to govern the operation of a regional transmission network. If as a result one system constructs facilities to a standard lower than that of another, it could impose a reliability risk on the system with higher standards. Lack of a protocol also puts the reliability and quality of service at risk if operators in different countries are unsure about what procedures govern routine and emergency operations.

#### Commercial and financial barriers

- **Transparency of costs.** Whether trade develops will depend on the relative cost of power in neighboring countries. But comparing electricity rates in the region is extremely difficult because most currencies are nonconvertible, power suppliers do not separate generation and transmission costs, and accounting procedures vary.

- **Generation tariffs.** Generation dispatch decisions appear to be based on one-part energy tariffs. Yet dispatch decisions should be made by comparing generators' variable costs of production—information not provided by a one-part tariff. Only Thailand is moving toward a two-part tariff, however. An approach to pricing bulk electricity based on a one-part tariff acts as a barrier to economic trading both within a country and across borders.
- **Transmission tariffs.** The transmission tariff plays a key part in financing the creation and expansion of a transmission network. But no country has a separate transmission tariff. Instead, where cross-border transmission is being developed, costs are bundled into a delivered capacity and energy price at a remote point from the plant. Transmission tariffs have been defined only on a case-by-case basis.
- **Construction uncertainty.** Many plants for delivery of power to EGAT are in the planning stage, but there is much uncertainty about which will be built. This uncertainty has increased because the East Asian financial crisis may make it harder to raise finance for projects. Moreover, recent low bids for plants in Thailand threaten the viability of the least competitive hydro plants in Lao PDR. Uncertainty about which generation projects will be developed impedes sound decisions about transmission investments. And where governments have agreed to build and operate transmission facilities, there are doubts among generation developers about whether some of the facilities will be completed on time for the scheduled completion of generation projects.
- **Country and cross-border risk.** Funding for power generation for export may be hampered by financiers' perception of risk related to country-specific issues or to the multinational character of projects. The nature and degree of risks vary by country, but the most common are the financial weakness of buying utilities, currency nonconvertibility, government interference, breach of contracts or concession agreements, and the seller's possible lack of access to

#### BOX 2 PROPOSED MARKET DEVELOPMENT STRATEGY

- **Reach agreement to make power trade a high priority.**
- **Set up a regional coordinating body to establish a protocol for the new interconnected system and handle environmental issues.**
- **In each country decide who will own and operate transmission and adopt regulations requiring nondiscriminatory open access.**
- **Ensure that domestic laws and regulations and long-term power purchase agreements are compatible with power trade.**
- **Develop a master plan for plant and transmission locations and get governments to commit to the transmission facilities.**
- **Develop an operating protocol to ensure safe, reliable, and efficient operation of the transmission system.**
- **Design a two-part tariff and a transmission tariff that will encourage investment in transmission facilities.**
- **Set stable tax and royalty policies for export.**

transmission lines. All these can undermine a project's financial viability and thus make financial closure more difficult. For many projects, official credits, loans, or guarantees may be needed to give comfort to commercial banks.

## Future development of the power market

Developing an international power market in the Greater Mekong subregion will be a long-term process. Because of the long construction periods, most benefits will accrue after 2010. Thus while the current financial crisis may slow the process initially, it should not have a major impact on the overall benefits of developing international trade.

Market development is under way. Potential channels for regional cooperation have been established. The regional Electricity Power Forum (sponsored by the Asian Development Bank) provides governments an opportunity to discuss how to develop this cooperation. The Mekong River Commission has been conducting regional studies on the interconnection of the subregion's power systems. Under the umbrella of the Association of Southeast Asian Nations (ASEAN) governments have established a technical working group to coordinate interconnection efforts. And the World Bank has just completed a study to help promote power trade, assessing the potential benefits and proposing a strategy for developing a regional market (box 2). This strategy systematically addresses the barriers outlined in this text and will be discussed at a regional seminar scheduled for June 1998.

This Note is based on a World Bank-sponsored study, "Power Trade Strategy for the Greater Mekong Sub-region" (Report 17033-EAP, World Bank, East Asia and Pacific Region, January 1998).

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