Behind the ASEAN Power Grid

Analysis of the Asian Development Bank's Master Plan for Regional Power Interconnections and Power Trade in the Greater Mekong Subregion

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PART I

Introduction

The following paper does not dispute the merits of targeted investments in new transmission lines within the GMS or the potential advantages of cross-border power trade. The aim is to examine whether or not the Asian Development Bank's 2002 Master Plan for Regional Power Interconnections and Power Trade in the Greater Mekong Subregion provides a credible economic and technical justification for high-capacity transmission lines linking Thailand's grid to large hydro dams in neighbouring GMS countries.

Based on a review of the Master Plan, GMS power utilities are preparing for a billion-dollar borrowing spree to pay for long-distance transmission lines linking power consumers in Thailand and ASEAN countries further south to remote large-scale hydro dams in the Mekong and Salween river basins.

The Master Plan, prepared by Norwegian hydro consultant, Norconsult, assumes the conventional power utility approach to expanding power supply: expanding generating capacity to meet projected demand with a reserve margin in case of unusual weather, demand patterns, and unscheduled plant or transmission line failures. Costs focus on capital cost of generation projects at the point of output rather than price by the time power is delivered to customers.

Norconsult has sidestepped critical issues regarding power economics, including: the financial risk associated with large-scale generation capacity investments, environmental liability, customer demands for higher reliability and end-use efficiency technologies, the advantages of competitive gas-fired combined cycle technology, the affordability and desirability of more large hydro dams, the lack of political commitment to establishing rules for dam builders or to establishing the regulatory capacity to protect consumers from monopoly abuse, and the chronic lack of financial and operating transparency on the part of GMS utilities.

Based on the Master Plan's recommendations, the ADB has proposed more than US$4.5 billion worth of loans and grants to GMS utilities for regional grid-related investments:
http://www.probeinternational.org/pi/documents/mekong/ADB_GRIDLoansGrants.pdf

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PART II ASEAN POWER GRID: MASTER PLANNERS

2.1 The ADB Greater Mekong Subregion 'Flagship Initiative'

The US$1.4 million Master Plan was funded by the Norwegian government and the Asian Development Bank. Prepared by Norwegian hydro consultant, Norconsult, under the auspices of the Bank's "GMS Flagship Initiative on Regional Power Interconnection and Power Trade Arrangements," the Plan recommends a series of long-distance transmission lines and transformer stations linking Thailand's existing national grid with future large hydro dams on the upper Mekong (Yunnan), Mekong tributaries (Lao PDR and Vietnam), and the Salween River (Burma).

Greater Mekong Subregion representatives endorsed the Plan in Rangoon (Burma) in October 2002 at the ADB-sponsored GMS Electric Power Forum. The proposed high-capacity (500-kV) transmission lines are considered the "backbone" of an even more ambitious plan to link the six-country Greater Mekong Subregion grid with the power grids of ASEAN countries south of Thailand.

Thailand is the region's lead proponent of the Asian Development Bank's GMS grid investment program. Prutichai Chonglertvanichkul, Assistant Director of the state-owned Electricity Generating Authority of Thailand is the Chairman of the Greater Mekong Subregion (GMS) Experts Group on Power Interconnection and Trade. At the seventh (May 2002) meeting of the GMS experts group (minutes are posted on the ADB Web site), EGAT asked the Japan Bank for International Cooperation to pay for feasibility studies for hydro and related transmission projects in Burma and Cambodia.

International participants in the GMS Experts Group on Power Interconnection and Trade include representatives from the Japan Bank for International Cooperation, the Tokyo Electric Power Company, Sweden's power utility, Vattenfall, and Swedish hydropower consultant, Swedpower International.

Based on Norconsult's 'Regional Indicative Master Plan,' the ADB has prepared a list of US$4.58 billion worth of loans and grants for financing 32 grid and grid-related projects in the GMS countries. This is broken down into four categories as follows:

- US$2.4 billion for regional transmission lines and switching stations;

- US$2 billion for "private sector mobilization" (read subsidies) for large hydro dam and transmission line construction. The ADB describes this as "institutional and policy support and co-financing for independent power producers (IPPs) through build-and-operate schemes for power generation and transmission." Included in this budget category as a "main component" is the US$1.2 billion Jinghong dam on the upper Mekong in China's Yunnan province, but no further details are provided.

- US$183 million for power market/power trade system development – power sector loans and grants to GMS utilities.

Table 1 Norconsult-recommended transmission lines

2006/2007	500-kV reinforcement of northeast Thailand grid
2008	500kV sub-regional interconnection linking the 500kV systems of Thailand and Vietnam
2012	2- 500kV lines from Tasang dam to 500-kV system at Mae Moh
2013	500kV line from Jinghong dam to Thailand

Note: no high-capacity lines are included for Cambodia although several medium-voltage interconnections with Vietnam and Thailand are in the pipeline. The ADB has recently financed a US$44 million 230-kV line linking Cau Doc province in southern Vietnam to Phnom Penh. Another connection between western Cambodian and Thailand is awaiting financing.

Table 2 Norconsult-recommended hydro projects

"At a minimum, the regional network should serve the following competitive hydropower projects." – Norconsult

2008	Nam Theun 2	Lao PDR	Export to Thailand
2010	Xe Kaman 1	Lao PDR	Export to Thailand
2010	Xe Pian-Xe Namnoy	Lao PDR	Export to Thailand
2012	Nam Theun 1	Lao PDR	Export to Vietnam
2012	Nam Kong 1	Lao PDR	Export to Vietnam
2012	Xe Kaman 3	Lao PDR	Export to Vietnam

2.2 The ASEAN power grid

Overlapping with the ADB Master Plan is the ASEAN Interconnection Master Plan Study, also completed in 2002, which includes five interconnections in the GMS between 2007 and 2016. The other six interconnection projects are between Brunei, Malaysia, Sabah/Sarawak, Singapore, Sumatra and West Kalimantan (Indonesia).

To promote the ASEAN grid, EGAT launched a multi-media public relations campaign in 2003, which includes promotional CDs, radio, TV, and magazine ads, and billboards at Bangkok's international airport. Under the slogan, "connecting nations, linking people," the campaign promotes the ASEAN power grid as the key to providing a stable and secure power supply for the region's future. The ASEAN Power Grid Information Centre is based at EGAT headquarters in Nonthaburi province outside Bangkok.

EGAT describes the grid as a "win-win economic relationship within ASEAN countries." Those countries with abundant natural resources but with little requirement for electric supply can generate income from their surplus power . . . countries with high power demand can meet their electricity shortfalls with power import from neighbouring countries at reasonable prices." [sic]

The ASEAN power grid will provide "cheaper electricity supply for all members and ensure sustainability of energy resources as well as energy efficiency" which will enable ASEAN "to be more competitive in the world markets," according to EGAT.

EGAT's Thai-language briefing is more explicit about the utility's motivation. Contrary to the rationale presented by Norconsult and the ADB, reducing peak power demand is not EGAT's main interest in the grid. The utility already has plenty of surplus capacity for meeting peak power demand and does not plan to

increase its capacity (either by building power plants at home or purchasing power from neighbouring countries) until 2009. As of 2003, Thailand's power system has 26,000 MW of installed capacity and an over-capacity of 4,500 MW (in addition to its 3,500 MW reserve capacity). EGAT points to ASEAN countries, where power demand is expected to double within the next decade, as a growing market for power supply. EGAT thus envisions ASEAN to the south as its new market for 'surplus' hydropower from dams along the Salween and Mekong Rivers.

Linked to EGAT's promotion of the ASEAN power grid is EGAT's partial privatization and initial public offering (IPO) planned for 2004. Under the government's restructuring plan, the Finance Ministry will remain the utility's majority shareholder. The utility will be divided into four business units – development, electricity generation, transmission, and administration – with a senior energy ministry official in charge of overseeing each new group.

Before EGAT lists its shares on the stock market next February or March 2004, it plans to promote the offering in Europe and North America. EGAT is set to become the largest business listed on the Stock Exchange of Thailand, based on its current assets of about 400 billion baht [US$10 billion] and 100 billion baht in liabilities.

PART III BEHIND THE GRID

DEFICIENT ECONOMIC AND TECHNICAL ANALYSIS

3.1 Financial viability not established

The Master Plan calculates that regional interconnections could eliminate the need for roughly 1000 to 2000 MW of installed capacity to meet peak power demand, which is equivalent to a savings of about US$900 to US$1,300 million. The cost of the proposed grid connections is about US$1.2 billion.

The Master Plan is inconsistent and uncertain about cost, vacillating between promotion of the regional grid as inherently worthwhile or warning that its real costs and financial risks cannot be assessed without further information.

The chapter on financing warns that high capacity connections might initially be underused and could "carry a high financial cost (and risk) for limited initial benefits."

Elsewhere in the report: "plant characteristics, construction cost estimates and possible environmental implications are quite uncertain. This is important for

consideration of potential risks associated with power interconnection investments."

And more uncertainty: "Whether [interconnections are] economic or not depends for each interconnection project not only on the generation project costs, but also on the domestic power demand and transmission development within each country."

The Plan repeatedly presents six planned hydro projects in Laos as "competitive" (Nam Theun 2, Xe Kaman 1, Xe Pian-Xe Nam Noy, Nam Kong 1, and Xe Kaman 3) without explaining how "competitive" is defined, and compared with what.

It is worth noting here that the Plan's author, Norconsult, is commercially affiliated with Nordic Hydropower of Sweden, the Nordic consortium that is part-owner of the 210-MW Theun Hinboun hydro project in Laos. Theun-Hinboun sells almost its entire output to EGAT for 4.3 US cents per kilowatt-hour. Completed in 1998, it is the first major public-private venture in hydro development in the GMS. The Asian Development Bank financed the government's stake in the project with a US$60 million loan. The ADB has publicly asserted that the project has been a good investment for the government of Lao PDR, earning US$95 million for state coffers over the dam's first five years of operation. But the Master Plan provides no evaluation of Theun-Hinboun either way.

3.2 Advocacy substituted for appraisal

The Master Plan is an endorsement of regional grid investments without the rigorous cost analysis that would be required in a proper regulatory setting. It fails, for example, to assess whether or not it makes financial and economic sense for debt-strapped GMS utilities to borrow billions of dollars to build hydro-export schemes plus long-distance transmission lines.

It recommends "early implementation" of two high capacity (500kV) transmission lines linking hydro-export projects in Lao PDR to Thailand's and Vietnam's grid. Yet it also states that the viability of its recommended projects "need to be verified in more detailed studies before investment decisions are made."

The Plan acknowledges the potential for decentralized energy options such as energy efficiency improvements and renewable energy technologies, noting such measures "may result in reduction in need for grid-based power supply." It also notes that demand side management could reduce peak power demand and thus "reduce benefits of interconnections." But Norconsult does not suggest any further analysis of these options before investment decisions are made.

Instead, Norconsult offers a simplistic assumption: power consumption in the GMS is so low compared to industrialized countries – 34 kilowatt-hours per year in Cambodia, and 1,300 kilowatt-hours per year in Thailand, compared with

5,000 to 8,000 kilowatt-hours per year in industrialized countries – that large-scale power plants are needed. “It is difficult to see,” writes Norconsult, “how [GMS] countries can attain higher levels of development without substantial contribution from large-scale electricity generation.”

3.3 Large hydro is costly and uncompetitive

The Master Plan proposes transmission links for large hydro dams only.

In terms of capital costs per kilowatt of installed capacity (excluding the cost of transmission), large hydro dams are costlier than conventional coal-fired plants or gas-fired combined cycle plants, and take longer to build. Gas-fired combined cycle plants cost between US$300 and $700 per MW and can be installed within 18 months. Large hydro dams typically cost $1,000 to $1,700 per kWh and can take three to ten years to build. For example, Vietnam’s 720-MW Yali Falls dam took US$1 billion and eight years to build while its gas-fired equivalent, the 720-MW combined cycle plant, took just two years to commission for less than half the cost (US$420 million).

The Master Plan acknowledges that some of the proposed hydro projects in the GMS are uneconomic. Add to this an earlier ADB study conducted by hydro consultants, Worley of New Zealand, which states: “All non-mainstream river hydropower projects in the Mekong Basin in the Lao PDR Cambodia and Vietnam are marginal in terms of their economics as a result of their small size.” Worley suggests that if multilateral development bank loans be provided to defray social and environmental costs, this would improve “the chances that marginal hydropower projects will become economically viable.”

The prospects for financing large hydro schemes in the GMS are even more threatened by the successful performance of low-cost high-efficiency combined cycle plants (fuelled with relatively low-cost and abundant natural gas) in Thailand and Vietnam. Much of Thailand’s supply expansion in the booming 1980s was based on gas-fired combined cycle plants; similarly, Vietnam has begun to invest in combined cycle plants now that natural gas is available in the south.

Norconsult is well aware of the competitive threat posed by gas-fired producers. Its 1995 energy study for the ADB reported that private investors would prefer to invest their capital in gas-fired combined cycle plants rather than large hydro dams. Large hydro dams take longer to build and are prone to cost overruns, technical problems, geotechnical surprises, resettlement opposition and environmental liabilities – all of which translate into unacceptably high risk for private investors.

The Mekong River Commission –the UN-sponsored intergovernmental agency responsible for sustainable management of the Mekong River – also recognized

this trend in its 2001 hydro development strategy: “most hydropower projects will have handicaps compared to fossil fuelled plants, particularly to gas-fired combined cycle plants.”

The Master Plan nevertheless remains loyal to the cause of building more large hydro dams whatever their final cost to power consumers and the region’s rivers. It assumes that financing will be forthcoming from publicly-funded institutions to “mobilize” private sector financing in projects that may otherwise be unbankable.

3.4 Social and environmental costs not counted

The Master Plan does not include social and environmental costs of hydro dams and related transmission lines in its cost estimates. (It also wrongly assumes that GMS utilities will indefinitely have authority to expropriate rivers and riparian resources without obligation to provide compensation or win public consent for doing so.)

“In principle,” Norconsult writes, “all environmental costs related to hydropower should be quantified and evaluated in monetary terms and incorporated in the economic analysis of the various generation projects as well as the transmission line projects. This includes also social costs related to loss of habitat and resettlement, which are complex and difficult to handle in traditional cost-benefit analysis. . . . part of the accrued wealth from the project being developed should be floated back to the local communities that were harnessing the resources.”

In practice, however, the ADB does not make cost internalization a condition of financing. ADB-funded power utilities routinely and explicitly externalize the social and environmental costs of hydro dams. They also expect other governments, aid agencies, and affected communities to assume costs they don’t wish to take responsibility for. As a result, large hydro dams invariably provoke controversy if not outright opposition from those who are victimized and threatened.

Environmental costs translate into liabilities for would-be private investors. As the ADB discovered with the 230-MW Se San 3 dam – now under construction in Vietnam’s central highlands - “the technical and environmental issues associated with the Project were substantially more complex than had originally been envisaged. . . . related primarily to basic management and cross border issues associated with hydropower development on an international waterway [the Se San River is shared by Vietnam and Cambodia].” The ADB discovered that the unresolved environmental problems and public safety concerns caused by the first dam on the Se San, Yali Falls, had “raised the potential risks” associated with a second dam downstream, Se San 3. The ADB concluded that it ”would be difficult to allocate [such risks] contractually in a traditional BOT or JV arrangement” without driving up the private sector costs “significantly.”

3.5 Uncreditworthy GMS utilities

Adding to the financial uncertainty surrounding the proposed grid and dam investments, is the poor financial shape of GMS utilities. GMS power utilities (with the exception of EGAT) are not creditworthy. The ADB and other taxpayer-funded institutions may be prepared to cajole private investment by subsidizing some of the transmission and dam construction costs with low-interest loans and grants. But the chronic financial instability and lack of financial transparency of GMS utilities will likely remain a major deterrent to private capital. Under these circumstances, international interest in the Mekong power grid is expected to come mainly from state-protected utilities in a position to risk taxpayers' money: Hydro-Québec of Canada, Tokyo Electric Power Company, Vattenfall of Sweden, and Electricité de France for example.

GMS utilities will also have to offer long-term fixed-price contracts with a financially creditworthy buyer, namely EGAT, which as a state-protected monopoly can guarantee cost and profit recovery from captive ratepayers. This is consistent with EGAT's policy to become the single dominant buyer of power in the region.

3.6 All power to EGAT: a high-risk and anti-competitive strategy

The viability of the ASEAN power grid rests on one key assumption: EGAT will be the main buyer of hydro generated in neighbouring countries. Under this "single buyer model," all generators, including future hydro exporters in neighbouring countries, will be required to sell their output to EGAT. Generators will not be allowed to negotiate deals directly with distributors or large customers. EGAT will also retain ownership of the transmission network and decide who has access to the grid.

The single buyer model has major disadvantages. Based on studies done in Indonesia, Hungary, Pakistan and Thailand, World Bank analyst Laszlo Lovei found that "it invites corruption, weakens payment discipline, and imposes large contingent liabilities on the government."

The single buyer model allows the state utility to keep "an artificial monopoly over the wholesale trading of electricity even after the vertically integrated power company is unbundled." It increases the risk of overinvestment in oversized plants because those signing the power purchase deals are not directly responsible for the financial consequences of their decisions. EGAT assumes the market risk but Thai ratepayers and taxpayers will incur the losses if electricity demand or sales fall short of projections.

Bernard Tenenbaum and John Besant-Jones, the World Bank's utility reform experts, also warn of the "substantial risk that the political and commercial interests that benefit from [the single buyer model] will block further reform"

toward competition and financial accountability. EGAT's status as monopoly buyer will discourage investment in smaller-scale and decentralized technologies. All GMS utilities, in turn, can be expected to discourage competition from decentralized technology providers and focus investment on grid-plus-dam infrastructure to facilitate bulk power sales to Thailand.

3.7 ASEAN power grid: increasing vulnerability to failure

What proponents claim will be the 'backbone' of the region's future electricity supply may turn out be the least-suited option for delivering reliability.

Certainly, interconnections can help avoid outages. If a problem occurs in one part of the region, interconnections allow utilities to dispatch power from neighbouring jurisdictions. But the greater the reliance on large plants, the more vulnerable the system becomes as a whole. A relay failure in any one part of the regional grid could, if not isolated from the rest of the grid, cause a blackout in another. The failure of a big plant is a more serious event than the failure of a small plant and could trigger other failures that could cascade across a whole region. The traditional utility response to this vulnerability has been to build more backup in case a big block of capacity should suddenly fail.

Similarly, the Master Plan rests on the invalid assumption that building long distance transmission lines to remote hydro stations can assure more reliability than building power plants where power is needed. EGAT, in particular, is so narrowly focused on expanding its power supply business that it fails to see how it may be increasing the system's vulnerability to failure, and thus increasing the very costs and risks the interconnections were meant to reduce.

Hydro dams, like any other large power plants are centralized and hence vulnerable to disruption and in large increments, due to natural drought, technical accidents, and grid failures (i.e., power lines overheating, shorting or downed by floods, lightning strikes, landslides or vandals).

North American experience with long-distance transmission lines carrying power thousands of kilometers from remote power stations indicates an inherent and growing vulnerability to grid failure as the system grows. The central grid linking customers to remote power stations has become the main source of increased costs and power quality problems in North American systems, especially now that consumers using digital equipment require extremely high levels of reliability.

As the system becomes larger and more complicated, nobody can predict all the ways it can fail. Power system engineers normally design the grid to high reliability standards but increasing reliance on more centralized power plants means that when the grid does fail, it can be disastrous. In Canada, it took several weeks for Hydro-Québec, one of North America's largest utilities, to restore power after a severe ice storm crippled its grid in 1998. Canadian energy

watchdog Energy Probe attributed this crisis to the utility's excessive reliance on long-distance lines linked to remote hydro dams. US energy analyst Amory B. Lovins provides another extreme example: "On 21 January 2002, failed transmission from the 12.6 GW Itaipu hydroelectric dam, the world's largest, cut off 18 percent of Brazil's electricity for several hours, blacking out six major cities in five states."

The Master Plan acknowledges this problem, stating that the proposed 3600 MW Tasang dam on the Salween is "vulnerable to the possibility of collapse of [the] steel [transmission] towers." Grid failure would mean 3,600 MW of power "suddenly unavailable to the grid." Norconsult's solution: build two transmission lines from the dam instead of one – the cost of which is not included in its cost-benefit analysis.

Quite apart from questions about grid reliability, the Master Plan overlooks the inherent unreliability of hydro dams in the GMS. Vietnam's reliance on hydro in the wet season with backup diesel in the dry season has proven an expensive and inefficient strategy. Power consumers in Vietnam suffer frequent blackouts every dry season when water levels behind the country's dams are at their lowest. Diesel backup units are expensive to run and only used intermittently. To improve system reliability, Vietnam is now adding more thermal plants to its system. But Electricity of Vietnam continues to build more hydro dams in the central highlands to serve distant towns and cities, with funding for long-distance transmission courtesy of the World Bank and other donors.

3.8 Will the regional grid deliver cheap power supply?

If large hydro dams are so costly and uncompetitive, how can the Master Plan claim that dams are "competitive."

Norconsult, like its GMS counterparts, is focused only on the economy of scale in construction while ignoring other diseconomies of scale. Larger projects are treated as more economical because their fixed costs per unit can be spread over more units of capacity and output. The bigger the project, the less construction cost per kilowatt of capacity.

EGAT, for example, claims it can build a 5,000 MW dam on the Salween River for 2 cents per kilowatt-hour or for about half the cost of power from the 210-MW Theun Hinboun dam in Lao PDR or gas-fired producers in Thailand. A 2003 ADB study of hydro costs in Lao PDR reports that the 1090-MW Nam Theun 2 dam will generate power for an average cost of 1.4 US cents per kilowatt-hour.

Electricity of Vietnam considers large hydro its least-cost supply option because it can borrow discount capital from foreign governments to cover capital costs, including transmission lines. Also, because EVN has not traditionally been required to carry the capital cost of dam construction on its books, hydro appears

considerably cheaper than other sources. EVN reportedly carries only US$100 million on its books for construction of the 1,920-MW Hoa Binh dam, the country's largest, even though it actually cost about US$2 billion. Water is regarded as a free and unlimited fuel, preferable to natural gas, which happens to be controlled by another state monopoly. And environmental damages are systematically externalized onto rural communities, other divisions of government and sectors of the economy.

What the Master Plan wrongly assumes about the planned hydro dams is that other key cost variables, such as reliability, operational flexibility, construction time, geological conditions and public acceptability will not vary significantly with project scale or location. This unfounded assumption turned out to be a major error for US utilities in the 1970s and 1980s as the actual costs of building ever larger power plants ballooned to many times the original cost estimates.

The Master Plan wrongly assumes that power consumers in the GMS all require the same degree of reliability when, in reality, millions of power consumers could do with less reliability than the central grid is designed to provide, while others may require a level of uninterrupted service the central grid can not technically deliver.

PART IV: WHY THE NORDIC MODEL IS UNWORKABLE

The second part of the Master Plan is a primer on reforming the GMS electricity industry based on the Norwegian model developed in the 1990s to allow free power trade between Norwegian hydropower producers and producers in other Scandinavian countries.

Today the Nordic power exchange (Nord Pool) operates much like a commodity or stock exchange, allowing power producers to buy and sell power at prices determined by supply and demand. While the wholesale price of electricity is set by the market exchange, the transmission and distribution rates in each country remain government regulated.

In this regime of competition among power suppliers, state producers no longer get preferential treatment, according to Norconsult. "If the state or local authorities choose to continue to operate actively as power producers, such owners must be subject to the same rules and regulations and requests for comparable profitability as the private owners."

Norconsult recommends this competitive power market model as the best way to provide customers with the cheapest power and attract investment in the system:

“Equal opportunities and just rules in a competitive regime are the best means to attract private investors to engage in power supply business. Such regimes are likely to provide the customers with low cost electricity.”

For GMS countries, the Master Plan states that “stepwise development of the institutional structure is necessary to get away from the present structure of one vertical state owned electricity supply regime that is monopolizing the electricity supply over the entire country.”

The suggested target is for “a flexible power market in operation in each of or in common for the GMS countries with a timeframe of five to ten years.”

Much of what Norconsult advocates for moving toward a more decentralized and competitive regime is based on sound power economics principles and experience: transparent electricity pricing and full-cost accounting for generation, transmission, and distribution; separate ownership of generation assets from transmission; non-discriminatory access to the grid; consistent rules for state and private power producers; and the creation of independent regulatory bodies to ensure fair competition and protect consumers from monopoly abuse.

But Norconsult’s claim that these market-oriented reforms are “a precondition of implementation of the Master Plan” lacks credibility. EGAT and its GMS utilities are not restructuring for competition. If anything, they are gearing up for monopoly expansion with massive subsidies from the Asian Development Bank and other international financiers. None of the GMS utilities plan to separate generation from transmission as prescribed, which means continued monopoly control of the grid, certainly not non-discriminatory access for competing producers as is the case in Nord Pool.

EGAT’s partial privatization now under way is a definite retreat from earlier plans to setup a competitive power market. The utility envisions a power cartel, not competition. Similarly in Vietnam, electricity industry reform toward competition is stalled despite pressure from the Asian Development Bank and the World Bank. Three state monopolies control the power supply business and electricity rates remain controlled by the central government.

Norconsult even admits that promoting market reform while there are still “politically set restrictions on electricity prices” is “unworkable.” It reports that electricity rates are still too low in the GMS to attract private investment. It describes uniform (or government-fixed) electricity rates as a “scourge so difficult to revoke” – and one that “leads to no or poor supply in areas with scarce population.”

In general, Norconsult’s promotion of Norway’s experience as a model for the GMS is divorced from political reality in the GMS power sector and thus largely irrelevant.

First, Norway has a power system that is almost 100 percent hydro-based; so competition in the Norwegian market was setup among only one kind of supplier. The system is decentralized, made up of state and private producers, large and small, and a grid network serving the entire population. Producers have bought and sold electricity at regulated prices for decades. So when Norway began developing its national power market exchange – a process that took two decades from 1970 to 1990 – the conditions were ripe for creating competition among the existing pool of suppliers. This was set up first within Norway and later extended to Sweden in 1996 and then to all Scandinavian countries. Today, electricity prices fluctuate depending on water availability. Power production has remained decentralized: the two largest state utilities, Vattenfall of Sweden and Statkraft of Norway, control only about 40 percent of the hydropower traded in the regional power exchange.

No such conditions exist in the GMS. Power production is monopolized by state utilities operating not just large hydro dams but coal- and gas-fired plants. There is no separation of transmission from generation – as was the case in Norway. Some of Thailand's largest industrial power consumers rely on smaller-scale (100 MW range) gas-fired or biomass-fired combined cycle plants for power and heating or cooling needs. But under existing rules, these small power producers are not allowed to sell directly to customers or compete with state producers for new customers. The single buyer model prevails.

Second, when Norway began developing its regional power exchange, Norway and its neighbours each had enough installed generation and transmission capacity to serve all power consumers, urban, industrial, and rural. Again, the conditions for competition between existing suppliers were ideal. In the GMS, on the other hand, several countries do not have the generating capacity or grid infrastructure to meet even a fraction of their domestic needs. In fact, there are more than 90 million people (using Norconsult's estimates of electrification) without access to grid-based electricity in the GMS.

Therefore, Norconsult's promotion of developing spot markets and regional bulk power trade may be an interesting exercise for ADB consultants but it is largely irrelevant to the immediate challenges faced by countries such as Cambodia, and Vietnam: lack of electricity service, high distribution losses, and lack of investment in new generating capacity.

In contrast to the ADB Master Plan, the World Bank's power experts advise countries with very small power systems to concentrate on creating competition among suppliers vying for access to new customers. "In countries that have not achieved substantial household electrification, it will generally be more productive to focus on encouraging competition to serve those who do not presently have access to electricity. . . . For example, in poor, rural areas, the competition may be for the right to receive a government subsidy (whether it is capital, operating

costs or both) in return for an obligation to provide level of grid or off-grid service (Argentina and Chile). . . . In other countries, privately or cooperatively owned mini-grids with an accompanying generating unit in rural areas can be encouraged in rural areas if regulatory licensing requirements are kept to a minimum and the mini-grid providers are allowed to offer electrical service with lower quality of service standards than the main grid distribution companies. If the mini-grid operator wants the option of being connected to the main grid for enhanced reliability, then the key regulatory issue is the terms and conditions of the backup service that is provided to it by the main grid distribution company or a separate generation company."

A third critical difference between Norway and the GMS: Norway's power market was developed based on the rule of law. Its regulatory framework governing hydropower producers evolved over more than a century and is based on legally enforceable property rights for riparian communities and fisheries rights holders. (Note that Norway has in the past empowered its utility, Statkraft, to expropriate riparian resources, but property rights holders never lost their right to seek damages, and regulators held the dam operators accountable for damages to a degree unheard of in the GMS countries.) More generally, the rules and organizational structure governing dam builders were developed within an open and democratic government framework – another key condition that does not exist in the GMS. Nordic regulators have had a tradition of regional cooperation dating back to 1960. No such rule of law exists for dam building utilities in the GMS. Hydro planning and construction is underway without the kinds of legal and regulatory protection afforded Nordic consumers and citizens. GMS utilities build and operate hydro dams without accountability or liability for their actions. Efforts to introduce rules and regulation at arms length from politicians and power producers have moved at a glacial pace. Indeed, GMS utilities have no incentive to develop rules that could hold them accountable for their actions as long as foreign governments and financiers provide them funding regardless of performance.

In effect, the Master Plan promotes two fundamentally incompatible concepts: one is the expansion of a regional grid linking large hydro dams that are viable only by monopoly and state subsidy; the second is competitive power markets, which would require market discipline, the breakup of power monopolies, and the rule of law.

The Asian Development Bank, for its part, is clearly favouring the power monopolists and a regional electricity cartel, to the detriment of power consumers, the environment, and the economy.

PART V: BEYOND THE GRID

BETTER AND CHEAPER OPTIONS FOR GMS POWER CONSUMERS

The Master Plan does not address the needs of more than 90 million people in the GMS without basic electricity service. Its focus is a 500-kilovolt “backbone” system for bulk power trade between power monopolists.

The diseconomy of large-scale

By focusing only on the investment cost per kilowatt of capacity, GMS planners overlook larger diseconomies of scale caused by the huge difference in scale of supply versus the scale of most consumers’ needs. A single conventional power plant of the scale of Nam Theun 2 produces about a million kilowatts. But even the region’s largest industrial consumers require a fraction of that. According to the Electricity of Vietnam, the country’s largest industrial consumers – about 90 of them – require only about 1,000 kilowatt-hours per day. Where decentralized options can be better matched to the kilowatt scale of most customers’ needs, or a microgrid scale, they offer important economic advantages over giant plants.

Electricity demand generally exists in very small and dispersed amounts at the household and commercial customer level. And peak demand likely occurs only a few hours per day and only a few days per week or month. To meet demand during peak times, centralized systems tend to be overbuilt with capacity that is used only a few times per year if at all. For example, Electricity of Vietnam recorded a peak demand of 4,100 MW in 1999 but its average demand was only 2,900 MW. Its total installed capacity at that time was 5,000 MW. Thailand’s system currently has 4,500 MW of capacity that is not needed and therefore is not generating revenue.

Less risky approach

With so much financial uncertainty surrounding the actual costs and electricity demand, combined with fierce competition for capital, it seems reasonable that GMS utilities should seek ways to add new generating capacity in smaller increments, which can be added more quickly than large stations, and with far less risk to government finances (and the environment).

The Nordic-Asian Development Bank promotion of the regional-grid-plus-large-dams scheme should not preempt detailed analysis of rival technologies and strategies for delivering electricity service in the GMS. In particular, DE (decentralized energy) systems are those that produce electricity at or close to the point of consumption and include high efficiency cogeneration (regardless of fuel, size or technology) and decentralized renewable generation (including solar photovoltaics, micro gas and hydro turbines, and wind.)

The potential for DE systems deserve much closer analysis before GMS utilities sink investment capital into assets that could be rendered “stranded” (i.e., costs

unrecoverable from ratepayers as the utility's largest customers opt out of the grid to pursue cheaper and more reliable options on-site or closer to customers).

DE options are no longer limited by cost or technology. They can provide power at lower cost and greater reliability than the cost of extending the central grid to individual households and communities. But DE in the GMS remains obstructed by state-sanctioned electricity monopolies and laws that have made wasteful large-scale power production the norm. The value of smaller scale generators and DE technologies is not yet reflected in system pricing – to reflect values such as voltage and frequency support, grid reliability and stability, reductions in transmission and distribution losses, and reduced requirements for reserve capacity.

Some distributed technologies, such as solar and fuel cells, are still made in low volume and therefore cost more than competing sources. But as research by the Rocky Mountain Institute indicates, it is their *value* – "due to improvements in financial risk, engineering flexibility, security, environmental quality, and other important attributes . . . that can often more than offset their apparent cost disadvantage."

Michael Brown, Executive Director of the Edinburgh-based World Alliance for Decentralized Energy writes: "increasing capacity at least economic and environmental cost is best done through substantial investment in on- and off-grid DE, and not in less efficient and more costly central power with its associated transmission and distribution network."

As Cambodia's 2003 Renewable Action Plan notes, the rules must be rewritten to provide a fair and stable investment environment for renewables and other decentralized service providers. "Now is the time to ensure renewable technologies have a role to play. The regulatory framework must specifically lean toward renewable electricity technologies or the one-big system will inhibit all future growth. Plans to import power from Thailand and Vietnam, while on the surface appear better than using imported diesel fuels, still locks Cambodia into a future of dependence. Renewable electricity technologies offer the opportunity for Cambodia to be self reliant."

DE for improving system reliability

Distribution utilities in the GMS could be rapidly improving system reliability without relying on more big plants and longer transmission lines: they can help the largest industrial customers use electricity more efficiently or self-generate – note that EGAT's first demand-side management programs have reportedly exceeded targeted savings by more than 300 percent; they can 'unbundle' or separate the different services (generation, transmission, distribution) in order to offer more choice in different levels of reliability and power quality at corresponding prices. Reliability can be assigned different values depending on

end-use, whether the electricity will be used to run a water heater, hospital or manufacturing equipment and so on.

Utilities can use distributed resources to serve regions with particularly rapid load growth, to replace obsolete equipment and to avoid costly transmission extensions to remote areas or to boost reliability within existing grids. According to the US-based Rocky Mountain Institute, the use of solar photovoltaics in grid applications has increased tenfold in the last decade. Utilities in Arizona and Texas are using solar PV to shave peak load and, at the same time, prolong the life of grid and transformer equipment by reducing current and heat strain on equipment. Such applications would be well-suited to GMS distribution utilities. In Ho Chi Minh, for example, the city which consumers one-quarter of Vietnam's power supply: in the 2002 dry season, it experienced a 20 percent surge in power consumption resulting in 110 power outages due to overloaded substations.

Utilities can also encourage installation or improvements in distribution automation to allow the grid to handle power flows in any direction, which would encourage investment in decentralized and renewable generating technologies.

DE in Cambodia

In contrast to Thailand's planned centralized expansion, the Cambodian government supports a decentralized approach to extending electricity service to rural areas. In May 2003, the Ministry of Industry, Mines, and Energy published its Renewable Electricity Action Plan (with funding from the World Bank's Energy Sector Assistance Program) following several years of consultation with private power producers, regional energy experts, rural entrepreneurs, government, NGOs, and aid agencies. The result is a made-in-Cambodia guide for renewable electricity development. It advocates a participatory and decentralized approach to encourage private investment in renewable energy technologies, based on an open and efficient regulatory framework for governing private power providers, and respect for the rights of consumers and citizens.

Decentralized (or distributed) generation technologies, including solar, micro-hydro, biomass, and biogas could be developed quickly "given the entrepreneurial zeal already demonstrated by the 600 to 1,00 Rural Electricity Enterprises, several solar power firms, and donors," according to the Cambodian plan. Dr. Sat Samy, Director of the Department of Energy Technique at the Ministry of Industry, Mines, and Energy, sees private sector involvement in rural electrification as the way the government can reach its goal of providing safe and reliable power supply to 70 percent of the population by the year 2030.

The REAP is supported by hundreds of rural power providers who run battery charging companies and diesel generators, and want to modernize and expand their businesses. These rural entrepreneurs have already challenged the central

utility, EDC, over its plans to centralize power production and shut down private power producers in western Cambodia. The central utility, backed by the Asian Development Bank, argues that only it can provide cheap and reliable service. The incumbent rural power providers find this unfair and arbitrary. In his 2003 letter to Cambodia's energy minister and the Asian Development Bank, Leap Man, president of the Cambodian Federation of Rural Electricity Enterprises writes: "EDC does not have a record of operating sustainable efficient low cost electricity services in the provincial towns. Therefore, EDC should not be given automatic preference over the private sector concerning the right to operate these businesses. The private sector should be permitted equal opportunity to develop these services to the agreed upon standard. Development assistance should be offered to public and private sector operators on equivalent terms and conditions. This will ensure that the consumers interests will be best served."

DE in Vietnam

Vietnam's central government recognizes that renewable energy can play an important role delivering service to remote areas, although not yet as competitors on equal footing with large-scale suppliers. Legal and regulatory barriers remain in place favouring incumbent electricity, gas, and coal monopolies.

A 2002 World Bank project, which is supposed to be developing rules and standards for renewable power providers in Vietnam, warrants further scrutiny. This US$225 million loan for the "System Efficiency Improvement Equitization and Renewables Project" lists its objectives as reducing peak load on the central system, improving local distribution, and expanding service to about 10,000 rural households using community-based renewable hybrid power plants.

In addition, Japan International Cooperation Agency has prepared a renewable energy master plan (2001) for prioritizing investments in off-grid rural electrification based on renewable energy sources such as micro-hydro or photovoltaics.

PART VII: CONCLUSIONS

The ADB Master Plan for regional grid interconnections in the GMS promotes two fundamentally incompatible concepts: one is the expansion of a regional grid linking large hydro dams that are viable only by monopoly and state subsidy; the second is competitive power markets, which would require market discipline and the rule of law.

The ADB Master Plan for the GMS Regional Grid promotes:

- Investment in oversized and outmoded hydro dams that, if built, will damage the environment, victimize riparian communities, raise power system costs, and divert capital from better, cheaper generation options.

- Public subsidies for large hydro public-private ventures that otherwise could not attract commercial financing;

- Over-centralization of power production and increased dependence on remote large-scale hydro dams, thus increasing system vulnerability to drought and grid failure; and

- Concentration of ownership into hands of fewer utilities with the technical and financial capacity to handle megaprojects and operation of the regional grid.

In terms of GMS energy policy and future, the Master Plan's grid-plus-dams program will:

- Discourage private sector initiatives in decentralized and renewable generating technologies;

- Deprive millions of would-be power consumers of choice in service providers that are appropriately scaled to meet their needs;

- Delay utility reforms needed to modernize the GMS power sector and extend service; and

- Distort electricity investment decisions in the GMS power sector with ADB loans and grants for outmoded large hydro and long distance transmission, thus further entrenching obsolete generation monopolies.

Appendix 1: Examples of DE Applications in Vietnam

- Mini-hydro turbines (200 kw to 2 MW) serving more than one million people; and more than 100,000 family owned micro-turbine units (less than 200kW) in northern mountainous regions of Vietnam, according to the Hydropower Centre at Ho Chi Minh University. JICA has been working to improve the financial viability of micro-hydro turbines: a typical 500 kw system serves 100 households and can be built for less than $100 per household, which is a fraction of the cost of earlier projects. The lowered cost is due to standardization, domestic manufacturing of parts, low-voltage distribution, and the use of local labour. With a 50 percent one-time subsidy users will be able to cover costs and maintenance over the life of the project.

- Over 800 small wind generators in more than 40 provinces, mainly used to power batteries for household electricity.

- Solar systems in 65 villages and several hundred solar home systems throughout the country. Solar Lab at the Institute of Technology, Ho Chi Minh University and the Institute of Hanoi are the two leading institutes developing solar power generation systems. In the Mekong delta, Solar Lab is developing financing strategies for solar PV sales as well as credit programs for families interested in buying solar systems.

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