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To Build or Not to Build?

Designing Sustainable Hydro for Federalism in Myanmar

Prepared for

Proximity Designs | Myanmar

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Background

It appears that Myanmar's new government will review past MOUs (memorandums of understanding) and even contracts of infrastructure projects that were signed by the outgoing government. It is not clear if these will include large hydroelectric dams, primarily in Kachin, Shan and Karen states, but it is likely and would be desirable and justified. This paper analyzes the current state of large dam planning and investment, and suggests alternative approaches that would incorporate local voices in the decisions. Successful and sustainable development of hydroelectricity is necessary for adequate power supplies nationally and also for peaceful resolution of ethnic conflicts.

Why Hydro Is Needed in a Mix of Electricity Sources in Myanmar

Past investments in hydroelectric projects in Myanmar have often treated affected people poorly and caused environmental problems that fall on communities without much done to help those who suffer damages. As a result, many local activists and parliamentarians have argued for zero larger sized hydro – usually micro hydro is accepted – because other sources of electricity are available. Thermal and solar are typically the two alternatives which, they argue, can substitute for large hydro.

This argument is technically correct but flawed. It is completely true that Myanmar has offshore gas reserves which will certainly become an important source of additional power used in the south of the country. It is also true that there are a few places where adequate harbors and large demand will justify building coal plants if local environmental opposition to coal can be overcome with steps to reduce pollution. Similarly, solar can make sense in the Dry Zone where sunshine is ample and available year round. But for much of the northern part of Myanmar, there are few alternatives to hydro that are economically feasible. (This discussion does not address the issue of exporting energy – a separate topic.)

As it is now, the current price of utility scale solar is estimated at 12.5 cents per kWh in places like the Dry Zone even with low interest rates, although this price should continue to drop over time. Most gas and coal costs 7 to 10 cents at a wholesale level, depending on various factors such as fuel costs and pollution controls. Hydro is often less than 7 cents at a wholesale level (e.g. from the dam) but then transmission costs have to be added and these are often larger than thermal plants which can be sited closer to markets.

The major drawback of solar is that it is only available when the sun shines, which is not always when electricity is needed. Therefore, it needs backup generating sources - or storage, which is currently expensive and limited. Hydro is a good backup for solar power – it is fully available in the rainy season when solar is limited and less productive when the sun shines in the dry season. Of course, even in the dry season there is usually some hydro available, but solar allows hydro to be used more at night.

Another issue with solar is that as its share of the total power in the grid increases, it becomes harder to control the grid. This can be managed with investment in storage and a "smart grid" but that is an added

expense. Myanmar's grid is some distance from having either capability, but also a long way from reaching the 20%+ share that would cause difficulties to manage the grid. Still, this could limit the share of solar that is efficient.

Most electricity companies do not want to rely on only one type of generating capacity. A prolonged drought will hurt hydro production. An interruption in gas supplies will hurt gas generators. Coal plants have fewer problems, but often rely on large ships to deliver millions of tons of coal a year and a storm may disrupt port facilities. A mix of sources is more reliable and much preferred.

The conclusion is that hydro is cheaper, much more readily available in the northern part of Myanmar, and very useful even when solar is contributing to the grid. It would not be realistic or fair to the economic prospects of the north to completely restrict hydropower development. This does not mean that tens of thousands of megawatts of capacity have to be built (there are less than 5000 MW now from all sources in Myanmar), but it does suggest that any intelligent plan to provide electricity nation-wide has to include some hydro, including larger scale hydro. How the hydro is planned, selected, negotiated with local communities and built will determine if it is fully acceptable.

Large Dams – Why and Why Not

The argument for large dams is straightforward. They are a source of relatively cheap and carbon-free power that ASEAN, China and Myanmar need. With construction costs of $1,200 to $1,800 per kilowatt, and output of 4-5 thousand hours a year, the dams can be quite profitable if the electricity is sold at a wholesale price of 4-6 cents per kilowatt-hour. Because growing economies need increasing amounts of electricity and the demand is fairly reliable, it is possible to find investors and lenders for these projects. (Currently, only 30% percent of Myanmar's population has access to grid electricity.) There may be other benefits such as flood control, irrigation or reservoir fish which add to the benefits, but these benefits are typically much smaller than power sales and sometimes conflict with the need to provide reliable power year-round. As it is, some sites produce less power – or even none- during the dry season. This requires "backup" power from thermal sources, which can be expensive.

The argument against large dams is more complicated. One issue is more political than ecological. Past dams were imposed by military or central government authorities on states and local communities with little or no respect for local concerns. In many cases, hundreds of thousands of people were forcibly removed from construction/ reservoir areas to inadequate sites, more like refugee villages than satisfactory alternative living areas. Furthermore, most of the electricity is planned for export and sometimes the local areas get no benefit in terms of new electricity supplies. Often, these investments were part of a military effort to weaken ethnic groups trying to control areas historically under their control. The historic contracts were concluded under Senior General Than Shwe without any public discussion and on terms which were much more favorable to the investors than similar projects in other countries.

In addition, there are a range of ecological concerns about the impact of these dams. These include possible damage from flooding of areas essential to wildlife (and people!); lack of beneficial downstream siltation; erosion and dry season flooding from dam water releases; destruction of habitat or migration routes for many species such as river fish; earthquakes in zones where large reservoirs could increase risk; and pressure on forests from the displaced populations. In addition, there may be increased risks of malaria. These potential costs have often not been well studied and it is difficult to evaluate their importance or magnitude relative to the well-understood benefits.

In part because of the coercive and non-transparent nature of the projects thus far, many local organizations have opposed **any** large hydroelectric dams in the area. This is understandable, but the new government may be looking for alternative approaches. Options such as run-of-the river dams with small or no reservoirs (though with less total output and lower dry season flows) might be explored. These could focus on providing local power. More moderately sized dams with much smaller local impacts are another possibility. These dams may produce surplus power that can be transmitted to other parts of the country or to sell abroad. If wholesale power were sold at (say) 5-6 cents per kWh and profits taxed and spent locally, the hydro resources could prove to be a blessing to the areas that have faced so many difficulties. The question then becomes, what is a concrete mechanism to honestly canvas local sentiments and make plans which reflect local priorities. Who are the parties to any dam project? Who proposes and evaluates the options? Should only those living in the immediately impacted areas be consulted or the entire state population which may benefit? How can legitimate concerns of investors be weighted along with local interests? Once a deal is struck, how is it monitored and what sanctions are imposed if the deal is broken?

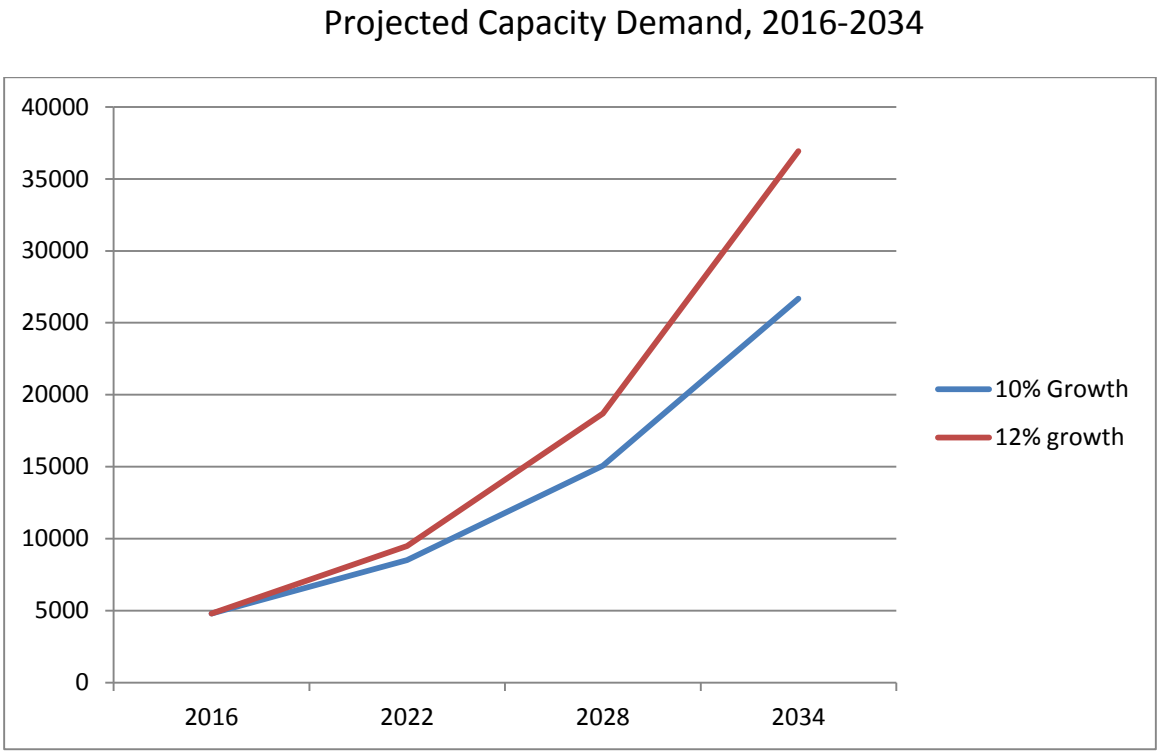
Current Plans for Large Dams

In a February 2013 announcement concerning Salween River dams, the Deputy Minister of Power Myint Zaw told parliament that six hydropower dams had been approved for the Salween.[1] These included Kunlon (1,400 MW; Naungpha (1,000 MW); Mann Thaung (200 MW); Mong Ton (or Tasang) (7,110 MW); Ywarthit (4,000 MW) and Hatgyi (1,360 MW). The first four are in Shan state; the fifth in Kayah state and the last in Karen state. The Tasang dam is perhaps furthest along, with preparation work underway.

The Myitsone dam (6,000 MW) is on the headwaters of the Irrawaddy River and has been suspended by President Thein Sein since 2011. The Myitsone Dam is part of the Confluence Region Hydropower Project (CRHP), which includes seven dams with a total installed capacity of 20,000 MW. CRHP alone accounts for 41 percent of the total power capacity called for by a 30-year strategic plan. Outlined by the military government in 2001, the plan includes 64 hydropower plants and three coal power plants with combined installed capacity of more than 40,000 megawatts.

[1] This is quoted in "The Salween River is not for Sale" (August 7, 2015) by Tom Fawthrop in East by Southeast, an online publication. http://www.eastbysoutheast.com/salween-dams-are-not-for-sale/

A Japanese presentation in November 2014[2] identified 36 dams, of which 29 were of a size of at least 100 MW. In total these amounted to 36,524 MW. The current total capacity of all electric generation capacity in Myanmar is 4,805 MW. The demand for electricity can be expected to double every six to seven years if Myanmar follows Vietnam's growth and development trajectory since 1990. That implies by 2034, there would be demand for more than 36,000 MW of capacity. The graph below shows the needed capacity at demand growth of 10% and 12% a year – and optimistically assumes current capacity is enough for current demand, which it is not, as frequent blackouts indicate.



Given the long lead times to survey, assess, build and bring into commission large hydroelectric projects, it is likely that there would be a domestic need for most of the output from all of the identified dams within two decades. Of course, not all electricity has to come or should come from hydroelectricity alone. However, this implies that if hydropower were to be developed with a long-term goal of exporting power, it may leave domestic supplies short, as is now the case with gas. *This would suggest that more emphasis be placed on development for local supplies and less on export – especially given the long lead times in bringing large dams online. By the middle of the next decade, the power supplied from many of the proposed dams that are finally built (and not all should be) will be needed to meet local demand.*

[2] The presentation was "Power Integration with Myanmar" at a workshop on the future direction of rural electrification in Myanmar under the auspices of the Policy Alternatives Research Institute of the University of Tokyo. The November 2014 slide presentation was authored by K. Yamaguchi, A. Sano, P. Reubroycharoen, H. Yoshikawa and I. Sakata. http://pari.u-tokyo.ac.jp/event/smp141128_yamaguchi.pdf

Developing a Process to Review Proposed Projects

If the new government wishes to develop a more inclusive process, it would start from the position that newly elected state governments should have a veto on any proposed project within their state. The state government would decide how heavily to weight the input from townships directly affected by the dam compared to other areas that might benefit from faster and more adequate electricity supply and any fiscal benefits from the proposed project. This policy could be implemented either by executive decisions or, better, by laws passed by the parliament recognizing the importance of local as well as central interests in a major hydroelectric project. (Smaller projects could be purely decided by the state, though investors would have to negotiate with the utility which would buy the electricity.) Since downstream environmental impacts in other states and divisions, as well as implications for the national power grid, are also important, any major project has to get both local and national approval to go forward.

Various kinds of expertise are needed to help make the process productive and meaningful. One input is a purely technical one – suggesting the alternative types of dams that might be built. An expert should provide rough estimates of their cost, likely seasonal and annual output, and types of environmental impacts. This is more like providing a menu that would allow non-specialists to decide on the kind of investment desired. It would not be a feasibility study or environmental impact statement – they would have to be done before going ahead. If only one project is defined, then the decision will be if locals should suffer (even with compensation) in order that others get electricity or if there should be no development. If a menu of options is on offer, some flexibility is possible between no project and a large one.

A second kind of expertise is economic. Once a technical menu is developed, the economic attractiveness of a proposed project to potential investors has to be explored. While smaller projects can be developed with aid or low cost financing or subsidies, larger projects will mostly have to pass an economic hurdle – the benefits, subtracting relocation and environmental costs, should be high enough to attract investors and lenders. The viability will partly depend on the export price or purchase price of power by the national utility. Choosing a project which is not economically feasible means it will not attract investors and get built. It is possible that “green credits” for low carbon, paid out of a global fund, could make a marginal project attractive enough to become feasible, but this is speculative.

A third kind of expertise is community-based. If some people are going to be displaced, what kind of compensation (land, housing or money?) will make them whole? Should they be paid a monthly amount rather than a lump sum? Can they or their children get a nonfarm job with adequate training instead of continuing as farmers? Close consultation with the adversely impacted groups is necessary to make sure the costs of development do not fall heavily on them. However, if the project will benefit the entire state and many more local people, the affected people should have a voice but not necessarily a veto. However, the elected state government should have a veto.

The local state government will no doubt lack sophisticated analytical capacity and some assistance will be required to help the commission or group they set up to navigate the options. Involving the civil society

groups and NGOs would help to ensure that local voices are heard, not only those of influential leaders. The fiscal structure of any project – for example, whether the electricity production results in local revenues – would need to be known for any decision. The national utility or foreign buyer would also have to be represented, since their "take or pay" contract would be required to make the project bankable. (Lenders and investors require a known and reputable buyer for the hydro power. They will not sink billions of dollars into a project to find there is no buyer.)

Assembling all of these types of expertise and interests need not prevent various pre-feasibility studies from proceeding. River flow studies, soil sampling and other related surveys could take place while the parallel process is going on. Road construction, training of workers[3] and sourcing cement are all part of any preparation for a major dam. The other consideration is that any process should have enough time to make a decision, but not drag on for many years. Once a decision is made, it could still, easily, be a decade before the project is completed. The longer it takes to complete a project, the more costs will be incurred. On the other hand, a legitimate process that has popular support is much more likely to be secure and less prone to political risk.

Local vs Export Projects

There will be a rapidly growing demand for electricity within Myanmar, though much of it will be in and around Yangon where thermal (gas fired) plants may be more economic and come on line sooner.[4] Still, given the time needed to complete large hydro projects, much of their output will be needed locally soon after completion.[5] Such domestic use need not be a "deal breaker" if the export price and domestic purchase price of electricity are the same – a private company should not care whether the electricity output is for domestic or foreign consumption, so long as it gets the revenue. On the other hand, EGAT (the Thai utility) already has the 7,100 MW Tasang dam in their power planning. An agreement was signed to export all electricity to Thailand and they may not want to support a project that would reduce exports to Thailand soon after completion. Since foreign buyers help provide finance, this is an important point that needs to be negotiated. It should be possible to find finance for viable projects even without major exports. But the loans may come at a higher cost. What is clear is that domestic demand that pays the

[3] It is likely that Chinese companies will be involved in the construction of many major dams. They tend to import workers. While some of that is inevitable and desirable, some provision for training should be required so that expertise and capability (at least for smaller dams) is built up with local workers.

[4] There is also a proposal for a very large coal plant in Dawei but this is controversial and the local market is quite small, so unless a decision is made to accept the disruption and pollution associated with large coal shipments and coal burning in order to export electricity, the project will be in doubt. Other proposed coal plants will work in only a few places where there are good port facilities and large electricity demand.

[5] In the next decade to meet interim electricity demand, it may be easier to build transmission lines to Yunnan and import power from China, as Vietnam does, for northern demand. This would have to be negotiated but amounts would be very small relative to Chinese capacity, even in Yunnan. Yunnan consumed more than ten times Myanmar's consumption in 2014.

same market price as exported electricity should take priority over exports if other domestic sources are not available at a similar cost.

It is worth noting that current utility charges in Myanmar are well below retail market prices. Prices should instead probably be, as in other countries, close to ten cents (130 kyats) a kilowatt-hour rather than five cents. This gap should gradually be closed so that domestic utility purchases can eventually compete with exports. Some subsidy for very modest users can be kept, but moderate and large users should not be subsidized.

Environmental Impact Statements and Human Displacement

All large dams have an environmental impact. The question is how widespread, important and severe these impacts are. If the company wanting to build a hydroelectric project pays for the environmental impact study, there are sometimes pressures to have the findings be relatively positive – that is, to minimize potential damages or problems that the project might create. Earthquake hazards, downstream siltation or scouring issues, and disruption of fish stocks are all possible examples of problems that are sometimes treated too lightly. On the other hand, in part because of the oppressive, top-down nature of past projects, civil society groups object to virtually any dam project. Environmental damages should be identified, mitigated where possible, and weighed against benefits after that. If a few thousand families are displaced, they should be consulted first through a transparent and inclusive process and be fairly compensated – and have typically not been in the past. But even if a fraction of those families have trouble in a new home, there may be millions who benefit from electricity. If efforts to identify problems and deal with them are sincere and persistent, the costs of many hydroelectric projects will be less than the benefits. The question is how to set up the study so it is serious and balanced; and how to ensure that subsequent efforts to minimize damages are well done. It may well be that some projects should not be built - at least not at the scale they are planned. This is why alternatives should be developed and examined.

The human impacts of a dam – especially a large reservoir – are often significant. Displaced families often have trouble setting up in unfamiliar areas where their traditional farming skills need to be modified. Too often, they are simply displaced and put into very poor housing with no way to earn a living, as in the case of Myitsone dam. Many projects have failed to deal with the displacement issues – in part because of corrupt officials, in part because of neglect and in part because it is hard to resettle people in new areas where they need new skills and lack social capital or cannot use their traditional knowledge. There are other issues such as the need to leave buried relatives and shrines that hold important cultural and religious significance. There is no single way to ensure that displaced people are well treated, but the Nam Theun 2 hydro-project in Laos did resettle a relatively small number of families with some success. Learning from their practices might help efforts in Myanmar.

While relatively few families may be living in some areas that could become submerged, there is a further problem in that many tens or even hundreds of thousands of people have been forced out of their homes

in the recent past to make space for planned projects and reservoirs. These movements were often part of counter-insurgent operations of the Tatmadaw. It will be up to the state government in consultation with affected groups to decide how to deal with people who are already displaced. This is more of a political than a project decision and will be complicated because some of these people are in Thailand. Possibilities for these displaced people include moving back as farmers to traditional places; moving to other places with compensation; finding new jobs (possibly in construction) or simply agreeing to cash payments. If hydro revenues are shared with the state government, paying compensation would be much easier.

Conclusion

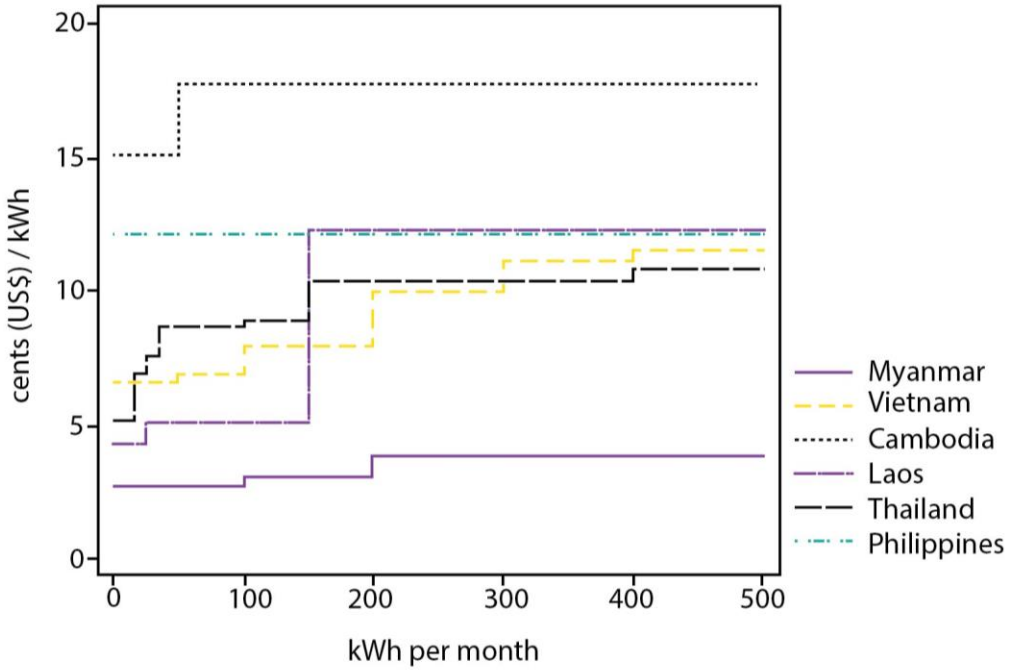
The problem with many aspects of hydro-development is that their poisoned history has made many people skeptical of any hydro investment. Some projects, such as the Myitsone dam, are poor projects for the country that should not have moved forward. Improving on this past history is not hard. How does one ensure that studies are professionally done and take relevant costs and alternatives into account? How does one ensure that funds for resettlement are honestly and intelligently used? Doing hydro right requires trust and skills, and both are in short supply. Yet there is a need for electricity in Myanmar and not moving forward also has high costs. Getting the balance right is hard but vital. Making sure that local governments and people benefit from the investments is one way to help move forward with enough popular support that the investing risks are tolerable.

Appendix One: Major Dams Proposed by Government and Investor Sources

	Location	*Name*	*River*	*Capacity*	
1	Bago	Bawgata	Bawgata River	160	MW
2	Bago/Kayin	Thaukyegat I	Thaukyegat River	150	MW
3	Bago/Kayin	Thaukyegat II	Thaukyegat River	120	MW
4	Kachin	Myitsone	Irrawaddy River	3,600-6,000	MW
5	Kachin	Chibwe	N'Mai River	2,000	MW
6	Kachin	Pisa	N'Mai River	2,000	MW
7	Kachin	Kaunglanphu	N'Mai River	1,700	MW
8	Kachin	Pashe	N'Mai River	1,600	MW
9	Kachin	Laiza	Mali River	1,560	MW
10	Kachin	Phizaw	N'Mai River	1,500	MW
11	Kachin	Lakin	N'Mai River	1,400	MW
12	Kachin	Yenam	N'Mai River	1,200	MW
13	Kachin	Lawndin	Nawchankha River	435	MW
14	Kachin	Tongxinqiao	Nawchankha River	320	MW
15	Kachin	Hkankan	Nawchankha River	140	MW
16	Kachin	Gawlan	Nawchankha River	100	MW
17	Kachin/Shan	Tarpien I	Tarpein River	240	MW
18	Kachin/Shan	Tarpien II	Tarpein River	168	MW
19	Karen	Weigyi	Salween River	4,540	MW
20	Karen	Hat Gyi	Salween River	1,200	MW
21	Karen	Dagwin	Salween River	792	MW
22	Karenni	Mobye	Balu Chaung River	168	MW
23	Karenni (Kayah)	Ywathit	Salween River	600	MW
24	Karenni (Kayah)	Nampon	Nam Pon River	130	MW
25	Karenni (Kayah)	Namtabat	Salween River	110	MW
26	Mon	Bilin	Bilin River	280	MW
27	Rakhine	Laymro	Laymro River	500	MW
28	Rakhine	Tha Htay	Laymro River	111	MW
29	Sagaing	Tamanthi	Chindwin River	1,200	MW
30	Sagaing	Shwesayay	Chindwin River	600	MW
31	Sagaing	Mawleik	Chindwin River	520	MW
32	Shan	TaSang	Salween River	7,110	MW
33	Shan	Kunlong	Salween River	2,400	MW
34	Shan	Naungpha	Salween River	1,000	MW
35	Shan	Shweli II	Shweli River	460	MW
36	Shan	Shweli III	Shweli River	360	MW
37	Shan	Namkha	Nam Kha River (same as #39?)	200	MW
38	Shan	Mantaung	Salween River	200	MW
39	Shan	Nam Kok	Salween River	100-150	MW
40	Shan/Naypyidaw	Paung Laung	Paung Laung River	280	MW
41	Tanintharyi	Taninthayi	Taninthayi River	600	MW

The sources are from the ADB 2012 Energy Sector Initial Assessment and a presentation in Hangzhou, China (2011) Country Report available at: http://nrec.mn/data/uploads/Nom%20setguul%20xicheel/Water/badrakh%20china/Myanmar.pdf and other NGO sources for location and updated capacities. When multiple numbers appeared, the more recent figure was used.

Appendix Two: Retail Electricity Rates in ASEAN Economies



Source: UNDP and ADB (Myanmar is the bottom line, far lower than the others.)