INTEGRATED RESOURCE PLANNING FOR MYANMAR’S ELECTRICITY SECTOR

WORKSHOP PROCEEDINGS
11 FEBRUARY 2015, TUNGAPURI HOTEL
NAY PYI TAW, MYANMAR

Hosted By
THE RENEWABLE ENERGY ASSOCIATION OF MYANMAR (REAM) AND MEKONG ECOLOGY AND ENERGY NETWORK (MEE NET)
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# Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<tr>
<td>CO2</td>
<td>Carbon dioxide</td>
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<tr>
<td>DG</td>
<td>Distributed generation</td>
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<td>DRD</td>
<td>Ministry of Livestock, Fisheries and Rural Development</td>
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<td>DSM</td>
<td>Demand-side management</td>
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<td>EE</td>
<td>Energy efficiency</td>
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<td>EGAT</td>
<td>Electricity Generating Authority of Thailand</td>
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<td>IPP</td>
<td>Independent Power Producer</td>
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<td>IRP</td>
<td>Integrated Resource Planning</td>
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<tr>
<td>MEE Net</td>
<td>Mekong Ecology and Energy Network</td>
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<tr>
<td>MW</td>
<td>Megawatt (1000 Watts)</td>
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<tr>
<td>O&amp;M</td>
<td>Operation &amp; maintenance</td>
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<tr>
<td>PDP</td>
<td>Power Development Plan</td>
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<tr>
<td>PPA</td>
<td>Power Purchase Agreement</td>
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<tr>
<td>RE</td>
<td>Renewable energy</td>
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<tr>
<td>REAM</td>
<td>Renewable Energy Association of Myanmar</td>
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<tr>
<td>SPP</td>
<td>Small Power Producer</td>
</tr>
<tr>
<td>T&amp;D</td>
<td>Transmission &amp; distribution</td>
</tr>
<tr>
<td>US/USA</td>
<td>United States (of America)</td>
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<tr>
<td>VSPP</td>
<td>Very Small Power Producer</td>
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Foreword

Myanmar’s power sector is in rapid development. In an effort to ramp up the electrification rate, the country faces challenges such as limited resources, cost recovery and diversity of geographic regions. Planning for power sector expansion plays a crucial role in meeting the country’s development objectives. Planning also has multiple dimensions to consider: new generation vs. investments in energy conservation, the role of on-grid and off-grid options in expanding electricity access, role of state and private sectors, and the development for export vs. domestic use. How can the planning process serve the country’s needs in an effective and efficient manner?

Lessons learned and best practices from other countries may help inform the planning process of the electricity sector in Myanmar. Integrated Resource Planning (IRP) is a useful planning tool that may be adapted for the Myanmar context. The Integrated Resource Planning for Myanmar’s Electricity Sector Workshop was conceived and designed to create opportunities for participants to learn through presentations, exercises and discussions the concept of IRP, drawing from international experience, including that of the Pacific Northwest in the U.S.A.

Specifically, the objectives of the workshop were:

1. To enhance capacity of planners related to Integrated Resource Planning (IRP) and governance of the planning process
2. To streamline and coordinate planning of power sector development and rural electrification
3. To explore a framework for coordinating electrification options of grid expansion complimented by micro-grid or off-grid options.

Participants of the workshop included power sector planners, policy makers, private sector and civil society organizations. The workshop, held on 11 February 2015, Tungapuri Hotel Nay Pyi Taw, was co-hosted and organized by Renewable Energy Association Myanmar (REAM) and Mekong Ecology and Energy Network (MEE Net).
Agenda

11 FEBRUARY 2015, TUNGAPURI HOTEL

8.30-8.40 Welcome remarks by Chairperson of REAM

8.40-8.50 Opening address by a representative from National Energy Management Committee

8.50-9.10 Self introduction by participants

9.10-9.40 Lessons learned from Thailand’s power sector planning by Witoon Permpongsachareon, Director of MEE Net

9.40-9.50 Break

9.50-10.35 Planning objectives, constraints and framework for accountability
- Objectives of power sector and electrification planning
- Linking energy objectives and plans
- Institutional, governance and management framework
By Chuenchom Sangarasri Greacen, Independent Energy Researcher

10.35-12.00 Integrated Resource Planning: a Best Practice case from the Pacific Northwest, USA
by Dr. Chris Greacen, Independent Energy Consultant
Content: Best practices in power sector planning and how they can be adapted for Myanmar context. Key concepts include planning process, treatment of demand-side measures on par with supply options, costs and risks, treatment of transmission and distribution costs in generation planning, and considerations in integrating grid expansion and micro-grids or off-grid systems.

12.00-13.00 Lunch

13.00-15.00 Workshop Adapting IRP to Myanmar context: background and workshop framework (IRP exercise – planning to meet objectives)
- Presentation of workshop process
- Small group exercise
Facilitated by Witoon, Chris and Chuenchom

15.00-15.15 Break

15.15-16.15 Participants from small group sessions report back, followed by discussions

16.15-16.45 SPP regulations and other final thoughts

16.45-17.00 Closing remarks by Chairperson of REAM
Thematic Presentations

U Aung Myint, General Secretary of Renewable Energy Association Myanmar (REAM) welcomed participants to the workshop. Member of Parliament U Thein Lwin gave an opening address. U Aung Myint then presented Microhydro Workshop proceedings to U Ko Ko Latt, a member of the National Energy Management Committee. He then introduced resource persons. The list of participants as well as resource persons’ backgrounds can be found in the appendix of this proceeding.

The following sections summarize the key content covered in the subsequent sessions of the workshop.

Lessons Learned from Thailand’s Power Sector Planning

*led by Witoon Permpongsachareon, Director of Mekong Ecology and Energy Network*

Peak demand is used as a main basis for planning capacity addition. Planning for power sector is also based on long-term projection of demand even though the main assumption, economic growth projection, is normally done only 2-3 years ahead.
It is not surprising that past demand projections in Thailand have been erroneous, particularly on the side of over-projection. When demand projections were too high, investments in the sector were also too much compared actual demand. Over-investments mean economic inefficiency and burden on consumers.

If looking at past demand increases, during the early 1990s, we had a two-digit growth. But after the financial crisis of 1997, Thailand suffered negative economic growth, four times total. Even “sub-prime” crisis in the US affected Thai economic growth. So demand for electricity also followed closely the economic condition, which has been up and down. However, power sector planners assume very optimistic economic growth with no interruptions. Civil society groups argued that the assumed demand growth was way too high, more than double the past average.

If planning were to be based on the past average demand increase, 20,000 MW and billions of investment in capacity expansion could have been saved. (See the comparison between PDP 2010 and Alternative 2010). For the remaining load, Thailand also has the option of utilizing cleaner, more efficient, cheaper energy options first, such as energy efficiency, demand-side management (DSM), co-generation, DG.
Even in the government’s official plans, new power plants are added when the reserve margin is significantly higher than the required 15% level necessary for reliability of the system. The difference between what is required and what is actually being planned is over 7,000 MW, potentially saving a lot of investment money.

The over-investment is a vicious cycle, starting from over-projection of power demand, leading to over-investments. The cycle is made possible by the tariff structure that allows consumers to pay for electricity costs, some of which are unnecessary due to over-investment.

Such inefficiency is not unique to Thailand. Even in the US, over-projections also happened because of the assumption that the growth tomorrow will be the same as yesterday.

But demand does slow down. In Vietnam, such a situation is even more aggravated than in Thailand. Massive expansion is being planned (2 digit growth), expecting to surpass Thailand’s peak demand consumption starting this year. But the reality is not as optimistically painted. This kind of ambitious plan is not necessarily to the benefit of the Vietnamese citizens. Most of the profits will go to companies that build power plants, including Thai companies.

Such over-projections also drive ADB’s regional plan to have a regional grid. According to this vision, Myanmar would serve as a battery (providing base and intermediate load) to power hungry markets like Thailand and Vietnam. This kind of vision does not serve the majority of Myanmar citizens who need the precious resources in their country more than Thailand where consumption is inefficient and wasteful.

Lastly, small-scale generation (distributed generation) is not a thing of the past. It’s the future. In developing countries, this is the sector with the largest growth. Distributed generation has the advantage of being close of end-use load, requiring less investment in expensive transmission infrastructure, making electricity cheaper.
Planning objectives, constraints and framework for accountability

led by Chuenhom Sangarasri Greacen, Independent Energy Researcher

This session is about accountability framework. Before proceeding, it is important to have a shared understanding of what accountability means. Accountability is an important element of good governance. Good governance comprises: transparency (access to information), accountability (Government, other actors held accountable to their roles, and plans accountable to policy objectives), participation (Diverse, meaningful public inputs in decision-making process), and capacity (Diverse, meaningful public inputs in decision-making process).

Governance is important because how we make decisions shapes what decisions get made. It leads to democratic decision making. Despite higher transaction costs (more time consuming), decision making with good governance has greater legitimacy and acceptance by the public. It ensures a better outcome in the long run.

Thailand’s power sector development has many lessons learned as covered by the previous presentation. One way to look at the problems of Thailand’s cycle of over-projections and over-investment cycle is through the governance lens. A main challenge Thailand faces is the issue of lack of accountability in the planning process. The accountability problem is two folds: 1) a missing linkage between Power Development Plans and government's policy objective, and 2) unclear role of decision makers (serving the public or energy companies)?
The Energy Industry Act of 2007 clearly laid out a set of policy objectives governing the energy sector, including resource adequacy, minimum dependency on imports, affordability, energy & economic efficiency, and minimum environmental impacts. In actual implementation of the planning process, however, resource adequacy has been over-emphasized at the expense of other important objectives. The situation was also compounded by the fact that policy makers have unclear accountability due to their conflict of interest arising from serving on the board of directors of energy corporations while being government officials. It is questionable whether the public is well served by this arrangement as exemplified by their near impeccable attendance records of board meetings of an energy company. In contrast, they had lower attendance rate for the meetings to approve tariff increases.

Lack of accountability in planning leads repeated demand forecast errors and over-investments, causing inefficiency, economic burden, unnecessary environmental and social impacts. Unfortunately the impacts of Thailand’s inefficiency isn’t contained within Thai border. Thailand now increasingly draws on neighboring country’s resources, including gas from Myanmar.

Is there a better way? The answer is yes. In 2012, Chris and Chom Greacen did a study and proposed a framework for improving accountability of power sector planning as well as versions Power Development Plan that are designed to out-perform the official version in meeting the government’s objectives. The key findings of the study are presented below.

To make the planning process and PDPs accountable to the government’s policy objectives, a framework for evaluating the plans is needed. For each policy objective, a criteria or indicator is proposed as a measurement of how well a plan meets the said objective. (See chart below.)
Next, alternative plans to the official PDP (in this case, PDP2010) were developed to meet increasing demand but with different energy mixes. The first plan or scenario is based on the same demand projection as the official PDP2010, but in choosing supply options to meet the growing demand, investment in energy efficiency and demand-side management (DSM) is prioritized and so is high-efficiency co-generation technology over large-scale generation. Another scenario is similar to the first one except the demand projections are revised downward to be consistent with historical averages of actual demand growth. Compared to the official PDP2010, the alternative plans have less total capacity (displaced by energy savings from efficiency and DSM measures), particular from centralized coal, nuclear power plants and hydropower imports.
The different versions of PDPs are then evaluated based on criteria established earlier to see which one best meets different policy objectives. The results show that both versions of alternative PDPs, particularly the one with demand forecast revised downward, lead to less dependency on imported electricity and/or fuels, less exposure to price volatility risks of fossil fuels, less energy intensity, decreased pollutions, and lower overall electricity bills, compared to the official PDP 2012. The exercise of developing alternative PDPs and evaluating them against the official PDP is to illustrate that the official PDP process lacks a clear accountability framework and therefore may not be the best at achieving policy objectives. Plans that perform better against the performance indicators tend to be ones that incorporate energy efficiency investments and prioritize high efficiency energy options.

The governance framework developed for Thai power sector can also be adapted for the Myanmar context to ensure that power sector planning in Myanmar is consistent with the government objectives. Similar to Thailand, the Government of Myanmar is also interested in energy security, sustainable economic development, affordability and reliability of energy services, expanding use of renewable energy and limiting dependency on fossil fuels, for example.

But unlike Thailand, Myanmar has special considerations in planning its energy future. While Thailand’s relatively early economic development has led to a situation in which Thailand now has to look to its neighbors and beyond for energy sources to import to meet its growing domestic demand. Myanmar on the other hand is considered one of the “last frontier”. Though resource-rich, much of Myanmar’s energy sources
have been exported or slated to be exported to neighboring countries, leaving the country with limited supply for domestic uses. Planning therefore needs to balance between generating foreign-currency income and having sufficient resources to sustainably meet future growing domestic needs for energy.

Given such challenges, effective planning is crucial in ensuring that limited resources are put to effective use with a sustainable, affordable outcome. Sample candidate indicators linking the planning process to policy objectives, as shown in the side table, can be a useful tool to help make planning more effective.

<table>
<thead>
<tr>
<th>Policy objectives</th>
<th>Sample candidate indicators</th>
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<tbody>
<tr>
<td>Affordability</td>
<td>- Cost of electricity for avg. household (Kyat/month)</td>
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<tr>
<td>Efficiency</td>
<td>- Energy intensity (energy use per $ of GDP)</td>
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<tr>
<td>Environment &amp; social well-being</td>
<td>- Emissions of pollutants</td>
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<tr>
<td></td>
<td>- # people/land area submerged</td>
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<tr>
<td>Export income after meeting domestic demand</td>
<td>- # of yrs before demand exceeds remaining hydropower potential</td>
</tr>
<tr>
<td>Second phase</td>
<td>- NPV of export revenues vs. long-term value of domestic economic activities</td>
</tr>
<tr>
<td>Participation by community, private sector (local/foreign)</td>
<td>- % of investments by communities/private sector</td>
</tr>
<tr>
<td>Reduced dependency on imported and fossil fuels</td>
<td>- Amount of imported/fossil fuels used in electricity generation</td>
</tr>
<tr>
<td>Security, reliability</td>
<td>- Reserve margin &gt; 1.5%</td>
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<tr>
<td></td>
<td>- LOLP &lt; 24hrs, SAIDI, SAIFI</td>
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Integrated Resource Planning: a Best Practice case from the Pacific Northwest, USA

Led by Chris Greacen, Ph.D., Independent Energy Consultant
This presentation covers lessons learned from the Pacific NW, USA, where Chris grew up.

Government’s policy objectives have many elements that may be challenging to take all into consideration. IRP is a tool to try to incorporate all these considerations in the planning process.

The presentation starts with a brief history of the Pacific NW. The Pacific Northwest comprises four large US states: Washington, Oregon, Idaho, and Montana. This area has mountains and big rivers. Starting about 80 years ago, the government embarked on building a lot of dam projects. The development of hydropower helped start industries, such as aluminum industry, aviation (Boeing) and later Amazon.com. There was a high environmental cost to pay. Salmon fishery used to be a major economic activity in the region. Salmon live in the sea but need free flowing rivers to spawn and lay eggs. With the construction of dams blocking rivers, the rivers become staircases. 2 decades later, no more dams could be built. The potential was exhausted.

However, demand continued to grow. The power sector plan there also suffered from over-projections. Based on these projections, decisions were made to build many nuclear power plants. The construction of nuclear facilities was plagued with massive cost overruns, leading to high electricity price hikes and public opposition. Projects were abandoned despite massive investments already sunk. So the whole debacle led to the biggest municipality bond default in the US history.

To prevent future mistakes, the public passed legislation requiring utilities to do a Least Cost Planning or Integrated Resource Planning. Two key elements are 1) the need to consider EE and conservation as a resource option, 2) least cost planning.

What is IRP? IRP means meeting power sector objectives at the lowest cost. This is done by considering a wide range of different options, and choose one.
that best meets the objectives and has the lowest cost. *(See Appendix for a more detailed explanation of the IRP process.)*

First step of IRP is to define objectives. Then, collect data and do systems analysis to come up with costs of different options. Then, do demand projections as scenarios, using bottom-up approach. This means a detailed look at each different sector and see how each sector might change, how technologies might change. This is a lot of work but the work pays off in the end. In the case of Pacific Northwest, 300 of scenarios are generated.

In meeting electricity requirements, options are considered: 1) end-use efficiency improvements; 2) T&D improvements, 3) generation plants. In the US, the cheapest options turned out to be efficiency improvements. So these measures are chosen first to meet growing demand. After that, the remaining unmet demand will be met by new generations. For this area, wind turned out to be the cheapest generation option.

Another key feature of IRP is public participation. For each plan, many (7) public meetings were organized to gather inputs from a wide range of stakeholders. Public inputs do matter. An example is the case of South Africa. The energy plan has a different mix after public inputs: more renewables and less fossil fuels.

IRP is implemented to varying levels in different places. A “full featured” IRP has the following features: process required by law, approval of tariffs linked to IRP process.

In Washington, the energy mix is dominated by hydropower. Due to variability of rainfall, planning of IRP process needs to take into account this variability.

Looking at costs of different options, conservation is by far the cheapest. The next least expensive options are heat recovery, various renewables. By law, utilities are required to choose the cheapest options first. Utilities are not happy because they make less money by helping consumers to use less energy. There are however ways...
to help utilities recover costs and de-link revenues from sales.

In cost comparison, consider the cost curve of different resource options. The first energy options to choose are many different EE measures because they are the cheapest way to meet new power demand. For each resource option, planners also analyze uncertainties of prices. From the graph, it is clear that EE measures have little price risks whereas gas or coal plants have high price uncertainties due to volatile fuel prices and potential change in environmental regulations (resulting in more stringent environmental standards).

Examples of EE measures are high-efficiency appliances and light bulbs. Running these programs is not expensive but can lead to a lot of savings. The table shows that the 21 cheapest energy resource options are EE.

So in the Pacific NW, most of the new demand (>60%) is met by EE. The next chunk is met by RE (mostly wind). The remaining is met through fossil fuel power plants.
EE programs, when well-run, deliver results that even exceed the targets. Some believe over time opportunity to save energy would be used up. But surprisingly, the more EE is done, the better improved the technologies, and the more opportunities for more energy savings.

Average price of energy in the market is volatile and a lot higher than EE acquisition.

Even with low oil and gas prices, EE is still cheaper than electricity from gas or coal. EE is a good hedge against fuel price risk and carbon control risks. EE can also help delay decisions to build new power plants.

It takes REAL MONEY AND DATA and institutional capacity to run EE programs well.

**SPP Regulations**

*Led by Chris Greacen, Ph.D., Independent Energy Consultant*

There is a limit to IRP or any centralized planning process. Many investment activities can happen efficiently by the private sector. What needs to happen is for the government to create an environment in which private sector and communities can play a role. One such tool in allowing investments in the power generation sector for the domestic market is to create a regulatory framework for power purchase from Small Power Producers (SPPs).
An example of an SPP: a microhydro project in Mae Kam Pong that was a stand-alone project serving about 100 households. Eventually the grid expanded to the area. Another example = 4MW mini-hydro project in Tanzania, serving 20 villages and selling excess thee grid. Another example is a sugar cane factory in Tanzania (17.5 MW, selling 3-4 MW to the grid). A co-gen plant that serves the power and steam needs within the factory.

SPPs in Myanmar Electricity Law. The only relevant law defined "small-scale electrical project” as generating up to 10 MW". The law also says mid-sized projects = 10-30 MW.

SPP regulations has two components: technical regulations governing technical standards of interconnection and power quality while the commercial regulations specify how money changes hands between the utilities and the SPPs.

Key features of Tanzania’s SPP regulatory framework. Up to 10 MW export. Provisional license (only required if >1MW) is a way to prove to the government that the developer has land and has one year to develop projects. The regulations have standardized tariffs and PPAs (no need for individual negotiations putting developers at a disadvantage).

If selling to retail customers, SPP can propose a tariff based on cost of service. The regulator will oversee the tariff application with a spreadsheet provide to compare costs across different SPPs. For systems smaller than 100 KW, no need to seek retail tariff approval.

To avoid the problem of developers investing in a mini-grid, and then the grid arrives, the developers getting bankrupt because of grid arrival, the mini-grid operators are given the right to connect to the big grid.
To imagine a situation in Myanmar. If a SPP developer is thinking of investing in a micro-grid, but the developer is uncertain about when the grid would arrive, they may not invest due to the uncertainty of not being to recover their costs once the grid arrives. The utilities could benefit from the SPP helping to boost the voltage at the end of the line but may not want to connect for technical and other concerns. Regulator is also a key actor in overseeing the SPP program.

Discussions

**Dr. Chris Greacen**: Questions to consider regarding the SPP regulations

- Should SPP be allowed to interconnect and sell to the grid?
- How can communities and private sector be encouraged to develop mini-grids where needed?

**U Aung Mint** (REAM): DRD appears due to the need of the government for intervention. On the ground Rural Energy Supply Committee has already been set up comprising of only two ministries: DRD and Ministry of Electric Power. In the government policy, it’s clear that private sector participation is important and supported. But they need a clear regulatory framework. In addition, other forms of support are also needed: financing, technical, access to capital, capacity building, etc. The government also announced the policy to decentralize electrification to be close to people. Rural electrification is overseen by a committee comprising of only two ministries. The private sector have to be taken care of by SPP regulations. Also, PPP (private-public-partnership) is already happening. The question is how do support the growth and development of PPP in rural electrification.

**Dr. Ei Ei Thant** (DRD): we need rules and regulations to ensure a certain level of quality. Currently standards are very poor.

**Dr. Chris Greacen**: in Nepal and Sri Lanka, there are nice guidelines, technical standards that can be easily adapted for the Myanmar context. But one question: should we force everyone to up their standards? Or should we allow people to build to whatever standards but if they want to connect to the grid later, they have to meet a certain level of technical standards.

**U Hla Myo Aung** (Ministry of Science and Technology): we should do a SPP program. We have a lot of rural areas that could benefit from the regulations. On tariffs, should be fair for rural people. For last question, the government should encourage communities and private sector.

**Daw Sane Sane** (REAM): tariffs should be two tariffs (before and after the grid arrival). Currently government subsidizes 35 or 50 kyat/kWh. Tariffs should be modified to reduce
the differences. Some minimum amount of consumption could be free or subsidized but after that the price should be higher. So subsidy can be allocated to ensure energy access more equitably.

Daw Khin Seint Wint (Ministry of Electric Power): For power projects, there needs to be regulations to address logistic, technical and financial considerations. The 1st option is to encourage community contribution themselves, such as in the form of labor, with assistance/soft financing from donors or some subsidy from the government. Different villages are different. For tariffs, it would be preferable if tariffs allow for cost-recovery plus a little bit of profit. For allowing SPPs to connect to the grid, it may be difficult for very small-scale RE systems because the grid needs to maintain a certain level of standards.
Report from the “Adapting IRP to Myanmar Context” Workshop

During this session, participants were organized into three small groups and participated in exercises to simulate a simplified planning process. Within each group, participants worked together to brainstorm facts and answers to questions and presented the info on large pieces of paper and shared with other groups through oral presentation.

Ex 1: If Myanmar were to serve 3000 MW of domestic demand for electricity by year 2030, what would an ideal portfolio of energy resource options look like to you?

This exercise is based on what participants thought the national plan should look like given what they know of the Myanmar energy situation. All three group identified large-scale
hydropower as the primary source of electricity supply for domestic consumption, followed by coal, gas with renewables playing a minor role.

**Ex 2: Choose 3 Priorities of Key Elements of Policy Objectives**

Different groups prioritized different policy and development objectives. The top priority objectives chosen by each of the three groups were environmental & social considerations, energy security and participation by communities, private sector and local people. Environmental and social considerations were the only objective common among all three groups, whereas efficient consumption and utilization of domestic resources are prioritized by two groups. Other chosen objectives were: reduced dependencies on fossil fuels, and affordability and costs.

**Ex 3: Cost**
In thinking about the cost of procuring energy supplies to meet growing demand for electricity in Myanmar, participants in all groups identified not only direct costs (infrastructure, financing and O&M (operation and maintenance) costs such as generation, transmission, distribution and fuel costs which include fuel transportation and storage), but also indirect costs such as social and environmental costs (such as from pollution emissions), costs to acquire technical expertise, costs of decommissioning plants and costs associated with risks such foreign exchange.

**Ex 4: Developing Criteria / Indicators Case Study of "Affordability"**
To illustrate how an indicator could be used as a benchmark to evaluate if a policy objective is met, “affordability” was used as a case study. Affordability of electricity can be measured or compared using, for example, price of retail electricity (Kyat/kilowatt-hour), total electricity bill that an average low-income household has to pay, or the cost of subsidy the government has to provide for a given PDP option. After the case study, the groups then brainstormed together to think of potential criteria or benchmark for each of their top policy objectives, with results shown in the image above.

Ex 5: Planning to meet Objectives:

For this exercise, the participants were asked again to do power sector planning to meet 3,000 MW of electricity demand in Myanmar, but this time, participants were done purposely to meet the planning objectives identified earlier in exercise 2 (such as environmental and social consideration, energy security and participation by local communities). The notable difference in the plans produced in Exercise 5, compared to Exercise 1, are 1) the reduced contribution of large hydro and coal, 2) the increased role of renewable energy (small hyro, biomass, solar, wind), 3) the addition of energy efficiency as a supply option.
Appendices
Appendix 1: Background Info on Integrated Resources Planning

**What is Integrated Resource Planning (IRP)?**
IRP is a framework for least-cost power sector planning that has been in use for decades in North America and Europe.

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<tr>
<th>Aspect</th>
<th>IRP Practice</th>
<th>Current Practice (Thailand)</th>
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<tbody>
<tr>
<td><strong>Decision making process</strong></td>
<td>Transparent, participatory process in which public authorities, private shareholders, and citizens work together to identify priorities and evaluate options.</td>
<td>Closed-door process in which key decisions are made by experts (utilities, government, consultants, large power users and academics).</td>
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</tbody>
</table>
| **Planning objectives**       | • Defined through a participatory process  
• Allows for broader economic, social and environmental objectives to be integrated.                                                                                                                         | • No open discussion  
• Main objectives are energy-sector-specific (i.e. energy security, low costs, fuel diversification).                                                                                                                                                                           |
| **Costs Considered**          | • Generation (capital, fuel and O&M)  
• Transmission  
• Distribution  
• Environmental  
• Social  
• Risks                                                                                                                                  | • Generation (capital, fuel and O&M)                                                                                                                                                                                                                                             |
| **Technologies Considered**   | • DSM/Energy Efficiency  
• Renewable  
• Cogeneration (CHP)  
• Fossil fuels (coal, gas, oil)  
• Nuclear  
• Hydropower  
• Centralized  
• Decentralized                                                                                                                              | • Coal  
• Natural gas  
• Nuclear  
• Oil  
• Large Hydropower  
• Centralized                                                                                                                                                                                                 |
| **Regulatory Authority**      | Independent regulatory body (IRB) responsible for ensuring that public interest is upheld.                                                                                                                 | IRB established in 2008, but not given regulatory roles in planning.                                                                                                                                                     |
The IRP Process

IRP processes in other countries have more or less followed this procedure:

1. **Data Collection** of reliable data on end-use patterns and technical alternatives for improving their energy-efficiency or load profiles.

2. **Public discussion of goals** for the future electricity provision such as reliability, affordable power, risk management, minimizing human health impacts, minimizing ecosystem damage including climate change from CO₂ emissions, quality jobs for rural sector.

3. **Projection of future electricity demand scenarios** using improved bottom-up methods that address the systematic bias problems of past forecasts, and include greater public participation, transparency and accountability than current practices.

4. **Calculate costs and electric load impacts of demand side management (DSM) alternatives.**

5. **Investigate economic costs and environmental impacts of conventional and alternative supply options.**

6. **Design an integrated supply-side and demand-side plan.**

7. **Implement the plan.**

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**Benefits of IRP**

- Reduce costs, risks, impacts
- Further environmental protection
- Improve fuel supply diversity
- Reduce supply-side losses
Appendix 2: Background on Governance of Power Sector Planning

What are elements of good governance?

**Transparency and Access to Information:** Transparency is the process of revealing actions and information so that outsiders can scrutinize them. Attributes of transparency include the comprehensiveness, timeliness, availability, comprehensibility of information, and whether efforts are made to make sure information reaches affected and vulnerable groups as appropriate.

**Accountability and Redress Mechanisms:** Access to justice and redress are necessary to hold governments and actors in the private and public sector accountable. Accountability includes the extent to which there is clarity about the role of various institutions in sector decision-making; there is systematic monitoring of sector operations and processes; the basis for basic decisions is clear or justified; and legal systems are in place to uphold public interests.

**Participation:** Diverse and meaningful public input helps decision-makers consider different issues, perspectives, and options when defining a problem. Elements of access to participation include formal space for participation in relevant forums, the use of appropriate or sufficient mechanisms to invite participation, the inclusiveness and openness of such processes, and the extent to which the gathered input is taken into account.

**Capacity:** Capacity refers to the government’s social, educational, technological, legal, and institutional ability to practice good governance, and the ability of civil society to engage in decision making. This includes the capacity of government and official institutions to act autonomously and independently, the availability of resources (both human and financial) to provide access, and the capacity of civil society (particularly NGOs and the media) to analyze the issues and participate effectively.

Incorporating governance framework in power sector planning: examples from other countries

South Africa’s Policy Adjusted Integrated Resources Plan for Electricity 2010-2030, before and after public participation


A proposed framework to hold Thailand’s Power Development Plans accountable to the Thai Government policy framework.

Appendix 3: List of Resource Persons

**U AUNG MYINT**  General Secretary, Renewable Energy Association Myanmar (REAM)

Contact email: [am.ream@gmail.com](mailto:am.ream@gmail.com)

The Renewable Energy Association of Myanmar is an NGO based in Yangon focused on technology, policy, and capacity building dissemination and strategy for decentralized renewable energy knowledge in Myanmar. REAM is a member of the National Energy Management Committee and Energy Development Committee. U Aung Myint was a teaching staff and research scholar/leader at Departments of Botany, Marine Biology and Marine Science at Mawlamyine University between 1972 and 1989. In 1995, he founded the Renewable Energy Association of Myanmar (REAM), a local environmental NGO which works to educate the public and increase awareness of environmental and renewable energy resources. REAM implements grassroots projects to fulfill basic community energy needs by networking with international, government, and local organizations for the development of Myanmar villages, while advocating for conservation and management of the surrounding natural resources. U Aung Myint is a member of Myanmar’s National Energy Management Committee, Renewable Energy Working Group, and Village Electrification and Water Supply Committee. He also serves on the Ph.D. Supervision Board of the Marine Science Department of Mawlamyine University, the Central Committee of the Forest Resource Environment Development Association, and he is a lifetime member of the International Society of Mangrove Ecosystems (ISME).

**WITOON PERMPONGSACHAROEN**  Founder, Mekong Energy and Ecological Network (MEE Net)

Contact email: [witoon@terraper.org](mailto:witoon@terraper.org)

Mr. Permpongsacharoen has dedicated his working life to prominent environmental struggles in Thailand and the Mekong Region. In 1986, he formed the pioneer Thai environmental NGO, Project for Ecological Recovery (PER), to oversee a milestone campaign against destructive hydropower dams and later the campaign for a commercial logging ban, which raised public awareness and grew the Thai environmental movement in the 1980s and 90s. In 1992, Towards Ecological Recovery and Regional Alliance (TERRA), was developed to empower the civil society groups working on environmental sustainability in the Mekong region. Given the increasing role of energy as a driver of change in Southeast Asia, Witoon founded Mekong Energy and Ecological Network (MEE Net) in 2008, a network comprising over 40 partner organizations spanning across the six Mekong countries.

**CHRIS GREACEN**  Independent Consultant, Small Power Producer Regulations

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Dr. Greacen works on policy and hands-on implementation of renewable energy from village to government levels. As co-director of the non-profit organization Palang Thai he helped draft Thailand’s Very Small Power Producer (VSPP) policies and conduct studies in support of the country’s fed-in tariff program. He is co-founder of the Border Green Energy Team (BGET) in Western Thailand, where he works with rural communities build micro-hydropower and solar projects. As a World Bank consultant he has worked since 2008 with the Tanzanian Energy Water Utilities Regulatory Authority (EWURA) to help develop the regulatory framework for Tanzania’s Small Power Producer (SP) program. He has worked on renewable energy mini-grid projects in North Korea, Cambodia, Laos, Thailand, Myanmar, Vanuatu, Micronesia, and on Native American reservations in...
the USA. He has a Ph.D. in Energy and Resources from the University of California at Berkeley, where his doctoral dissertation focused on community-scale micro-hydropower projects in Thailand.

CHUENCHOM SANGARASRI GREACEN  Independent Energy Researcher, Palang Thai

Contact email: chomsgreacen@gmail.com

Chom Greacen co-founded a Thai NGO Palang Thai, where she conducted public interest power sector research and policy advocacy towards fair, sustainable and democratic development of the energy sector in Thailand and Mekong region. She helped draft the Thai Energy Industry Law, played a role in the adoption of the VSPP regulations in Thailand, and performed analyses and proposed alternatives to Thailand Power Development Plans. From 1999 to 2003, she worked as an electricity policy analyst currently with Thailand’s National Energy Policy Office (NEPO), where her main responsibilities concerned details of the country's electricity sector reform process. She now lives with her husband and two children on Lopez Island, Washington State, USA and continues to be engaged in energy activism locally and in SE Asia. She studied environmental engineering at Dartmouth College and has a MS from the Energy Resources Group at University of California, Berkeley.
Appendix 4: Workshop Participant List

**Myanmar Power Sector Capacity Building on Integrated Resources Planning (IRP) Workshop**  
13 Feb 2015 Tungapuri Hotel, Nay Pyi Taw Myanmar

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