

## **Toward a sustainable electricity policy in Myanmar:**

### **Recommendations for policy makers and development partners**

by

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### **Energy situation in Myanmar: A double challenge of expanding energy access in rural areas and securing reliable supply in thriving urban areas and special economic zones (SEZs)**

Myanmar is moving towards addressing the two main drawbacks in the power sector, namely securing a reliable supply in urban and economically active areas and bringing electricity supply to the vast population without access in rural areas. Together, these constitute an ambitious goal to move away from the current endemic power brownouts and blackouts and low level of electricity access, which is around 35% nationwide and below 20% in several peripheral areas.

Democratic transition has brought about the lifting of international sanctions and a rapid re-engagement of development partners. Furthermore, numerous studies and plans have been prepared in a very short period. For example, the Asian Development Bank (ADB) prepared an Energy Master Plan to outline the needs and opportunities for the energy sector, and the World Bank is supporting the preparation and implementation of the National Electrification Plan (NEP), which aims to achieve full electrification of the country. Finally, the Japan International Cooperation Agency (JICA) provided assistance for the National Electricity Master Plan (NEMP) to optimize plans to expand for power generation capacity expansion.

Moreover, the overall energy challenge is strongly linked to the pacification process, the top priority for the government of the National League for Democracy (NLD). In the past, the development of new energy resources and achievement of long-sought peace have been negatively influenced each other. In particular, focus on the development of new generation resources through large-scale hydropower and coal-fired power plants has increased tension between the central government and ethnic minority groups. The democratic government has opened a window of opportunity to reframe policy plans to include these considerations.

The Global Energy Policy and East Asia Research Unit of the Policy Alternatives Research at the University of Tokyo has engaged in efforts to support the Myanmar government, development partners, and relevant stakeholders in addressing challenges in the energy sector. The unit has engaged with local and international stakeholders, governmental and non-governmental as well as academic. In particular, research has been conducted on the sustainable development of the energy sector in Myanmar including a comprehensive review and analysis of overall power sector policies and the potential role of mini-grids for rural electrification. The unit is also committed to the so-called “Energy for Peace in Myanmar” as an attempt to integrate pacification considerations in the energy policy-making process. This paper summarizes our findings until today. The main outreach and engagement activities are summarized at the end of the paper.

### **Streamlining government’s administrative structure**

The landslide victory and subsequent rising to power by the NLD in 2016 has come with some major changes to the administrative structure of Myanmar. In the energy sector, this has translated into a need to develop new inter-ministerial coordination mechanisms and a new opportunity to improve sector development plans.

The abolishment of the National Energy Management Committee (NEMC) has created doubts regarding the required inter-ministerial coordination. The integration of the main governmental responsibilities under the umbrella of the MOEE is expected to improve this coordination; however, ensuring the effective integration of the two former ministries is not an easy challenge to address. Furthermore, a number of important components of energy policy-making remain outside the MOEE. While the MOEE is in charge of the national power grid, rural electrification initiatives fall under the Department of Rural Development (DRD) of the Ministry of Agriculture, Livestock, and Irrigation. Furthermore, the Ministry of Education is the leading governmental agency for renewable energy, the Ministry of Industry for energy efficiency standards, and the Ministry of Natural Resources and Environmental Conservation for coal. For these, the government of Myanmar must still implement a coordination mechanism.

The other two plans sponsored by development partners are also under discussion. The World Bank’s NEP with a target of full electrification by 2030 remains relevant for the government, although more decentralized options appear to be favored. Furthermore, the government of Myanmar should look for a higher utilization of renewable energy for off-grid electrification. While the NEP focuses solely on diesel generation, mini-hydro and potentially solar energy are emerging as more appropriate. Currently, the MOEE is updating JICA’s NEMP. This is an opportunity to improve some drawbacks of the previous version. Specifically, the government should avoid artificially limiting the contribution of renewables.

Our studies show that without it, and including the most recent cost assumptions, coal-fired generation could be avoided.

### **Forward-looking energy alternatives for Myanmar: Leapfrogging to escape a carbon-lock path**

The government of Myanmar should look for higher utilization of renewable energy, particularly solar energy, to supply the national grid, and to decentralized renewable systems for off-grid electrification. Our analyses show the combination of both as a superior alternative to the current approach of countrywide national grid access with increasing coal-fired and diesel generation for limited off-grid areas. Solar power combined with sustainable hydropower and backed by natural gas were identified as potential main contributors to the generation mix.

The potential of hydropower is large, and can possibly contribute to a low-carbon energy system at the regional scale. Nevertheless, its development must address existing environmental and social concerns and optimize economic returns. The Strategic Environmental Assessment (SEA) being conducted by the International Finance Corporation (IFC) should provide lessons in this regard. Furthermore, a new national strategy that considers the link between energy development and the national reconciliation process should be developed (Kittner and Yamaguchi, 2017).

Natural gas can introduce reliability into the system as a baseload resource, but the government should not rely exclusively on existing reserves in the country. Currently, most indigenous production is exported to Thailand and China, and it is expected that the reserves will begin depleting in a few years. Myanmar could potentially renegotiate these contracts to utilize a large portion for its own supply. However, even if successful, importing LNG represents a more solid opportunity in the medium and long terms. A Floating Storage and Regasification Unit (FSRU) has been proposed as a promising alternative.

The government should consider growing investment interest, declining prices, and geographical conditions of Myanmar to foster the rapid deployment of solar generation. Specifically, the centrally located dry zone has abundant potential that could be connected to the national grid without the need to construct large transmission lines in remote conflict-ridden areas. Myanmar's climate, which is divided into dry and wet seasons, makes solar and hydro energy seasonally complementary. Despite this potential, solar energy remains unexplored as a grid-connected resource. The current plans do not consider the potential role of solar energy in Myanmar's power mix. The rapid decrease in costs consequent to improvements to technological and policy mechanisms make obsolete the assumptions considered in the realization of these plans.

Policymakers should be aware of two principal obstacles for the deployment of an increasing penetration of solar energy in the mix. The first consideration is the lack of infrastructure and capability to manage variable renewable energy on the grid level and the present high costs estimated for Myanmar. Contributions from development partners should be utilized to upgrade Myanmar's aging physical infrastructure and institutional capability. Second, to reduce expected costs to the required levels, Myanmar should take advantage of their existing experience with policy instruments such as energy auctions and feed-in tariff schemes. International donors should provide support through capacity-building programs for the design of such schemes, because of current government limitations.

**Myanmar power development pathways: Enhancing the use of renewables and looking regionally to increase security at a lower cost**

Myanmar's power development can follow different pathways. To better assess the implications thereof, it is important to evaluate them through an investment modeling framework. This considers the fixed and variable costs of generating electricity over the entire lifecycle. We are re-analyzing the current NEMP (the JICA Master Plan) and alternatives by examining the role of renewable distributed power generation systems and development of the interconnections prioritized by the ASEAN.

Planners and decision-makers are investigating the rapid energy transition in Myanmar. With an electricity access rate of nearly 35% in 2016 and increasing foreign investment after the lifting of external economic sanctions, various international financial institutions and multilateral development banks have proposed development strategies for Myanmar. The country faces a suite of investment proposals in coal, hydropower, and large-scale natural gas facilities.

Our tentative modeling results and other analyses show that distributed renewables in Myanmar can contribute to both environmental conservation and cost-effectiveness. This has major implications for power sector planning and implies that the high penalty cost of transmission for large-scale projects may face future cost overruns. This would bring cost savings and eliminate future investment in thermal generation due to an oversupply of existing generation and low-cost availability of small, medium, and large-scale PV resources. The government of Myanmar should implement measures to attract domestic and international investors interested in promoting such sustainable energy options.

In addition, Myanmar should pivot its current regional power trade strategy into an importer, at least in the short term. The government of Myanmar should take advantage of electricity surplus from Thailand, Lao PDR, and China, and trade electricity in an integrated ASEAN market. This could achieve a significant lower levelized cost of electricity than the business-as-usual case, providing a rationale to promote regional coordination and cross-border IPP agreements. To better assess this, more knowledge is needed of the motivations, barriers, and policy processes internally (Yamaguchi, forthcoming) and in neighboring countries (Liu et al., 2017).

**Renewable mini-grids can more rapidly bring an appropriate power supply to rural areas, but the path towards price convergence remains unclear**

The government of Myanmar should consider more seriously the deployment of mini-grids for rural electrification (Sasaki et al., 2015). The current NEP foresees a major on-grid component, with 98% of the population connected to the national grid by 2030. Following this plan will likely prioritize the higher-demand urban or peri-urban areas, leaving rural areas behind.

Mini-grids can provide an alternative solution better catered to the needs of off-grid areas. From some time, private entrepreneurs and local and international NGOs have independently developed these solutions. More recently, the international donor community has launched initiatives to foster the deployment of mini-grids. The Department of Rural Development (DRD), with support from the World Bank, has started the so-called "60/20/20" project as part of the NEP. In this project, the private sector submits project proposals including design, development, operation, and transfer to the local village

electrification committee (VEC). The villagers select the members. The VEC decides on matters pertaining to energy such as fuel procurement, tariffs, and the exemption of poor households, and in some cases, is in charge of tariff collection. In the first years, 8 projects were selected of 40 proposals (34 solar PV, 4 hydropower, and 1 biomass). Nevertheless, this program cannot be financially sustained to cover the entire country. The government is currently lending the funds for later grants. To avoid this, more research must be conducted to identify the barriers and most promising alternatives to reduce the economic costs, which are currently superior to global and regional standards.

Thus far, the analyses show that micro-hydropower plants are mostly cost competitive. The result of the cost analysis for solar PV system is high because they include distribution and public equipment costs such as for streetlights. The dramatic price decline of solar PV modules means that prices in Myanmar are high considering the small capacity of these micro-grids. To make micro-hydropower cost-competitive, further cost reduction is needed in terms of equipment other than the solar PV system such as batteries (Numata et al., 2018).

The interventions by government and development partners must include the promotion of productive uses to ensure long-term program sustainability. The peak demand currently concentrates on night times, at least in the initial stage of electrification, for example, for lighting and entertainment such as televisions. As far as electricity is consumed solely during the night, only electricity stored in batteries can be used and excess energy during the day would be wasted as heat. The extra income generated through productive uses would increase the quality of the systems and attract more investment.

Rural electrification plans must also consider the importance of the quality of the systems implemented. The poor quality of some products, specifically solar PV, negatively affects villagers' perception of that option. It seems that mini-hydro alternatives can avoid such bad publicity, possibly because of the higher quality on average and the possibility for local manufacturing and/or repairing. The government should take measures to ensure the quality of electrical products, such as through the approval of specific regulations and adequate standards.

### **The government of Myanmar should increase the role of renewables and decentralized generation and regional power trade**

Current policy guiding documents propose a massive expansion of the national grid to reach the entire country coupled with a massive increase of coal-fired generation. Our studies highlight a more suitable and lower cost development path for Myanmar by increasing the contribution from renewables, expanding the use of decentralized solutions, and taking advantage of regional power trade.

The current official plans, against current global trends, leave a marginal role to renewables in the energy mix of the country for the coming years. Myanmar is endowed with indigenous hydro, natural gas, and renewable resources. A combination of these would be a more optimal solution than increasing the currently minimal coal-fired generation with imported resources. In particular, based on its location in the central area, solar energy could be rapidly increased. To achieve this, the introduction of policy instruments would be an important step in the right direction. Although its diffusion in Asia is still limited, energy auctions could be an attractive policy for Myanmar to leapfrog neighboring countries.

Rural electrification based on mini-grids can be a more effective and rapid manner to address urgent needs in peripheral areas. Mini-hydropower solutions are already an economically viable option. Solar PV-based mini-grids are still a more costly solution than diesel generation. Nevertheless, the rapidly decreasing prices increase their attractiveness. To collect the benefits of these trends, the development of a regulatory framework is needed for Myanmar. The promotion of productive uses in addition to merely lighting and basic services can increase the financial viability of these solutions.

Beyond national solutions, Myanmar would do well furthering regional energy connectivity. This would address the increasing energy demand in the short term. In the long term, Myanmar is expected to become an exporter to neighboring countries. A more integrated regional power sector in the Greater Mekong Subregion and ASEAN would have important consequences in facilitating a larger penetration of renewables, allowing a smoother transition to a regional low carbon system. However, the future of this regional system remains uncertain, demanding deeper analysis of the factors shaping the regional cooperation process including governmental and non-governmental actors.

### **Outreaching efforts**

The Global Energy Policy and East Asia Research Unit has organized and participated in several seminars, workshops, symposiums, and similar events to engage with local, regional, and international stakeholders to improve the validity and relevance of the research. Below is a list of major examples of these activities.

- Greater Mekong Forum 2017, Session 25: Energy for Peace in Myanmar. October 25–27, 2017. Yangon. <https://wle-mekong.cgiar.org/2017-greater-mekong-forum-on-water-food-and-energy/>
- Mekong Forum 2017: New geo-economics, reshaping the future of the GMS? Session II: Re-assessing impacts on development cooperation in the GMS. <http://www.mekonginstitute.org/mekongforum/>
- Roundtable for Energy Strategies for Peace building and Conflict Resolution in Myanmar. May 18, 2017. Yangon. [http://pari.u-tokyo.ac.jp/eng/event/smp170518\\_rep.html](http://pari.u-tokyo.ac.jp/eng/event/smp170518_rep.html)
- Stakeholders' Consultation for Integrating Water Resources Management, Sustainable Economic Development Goal. March 23, 2017. Yangon. [http://pari.u-tokyo.ac.jp/eng/event/smp170323\\_rep.html](http://pari.u-tokyo.ac.jp/eng/event/smp170323_rep.html)
- Workshop on the electricity future of Myanmar and the Greater Mekong Subregion. January 28, 2016
- 5<sup>th</sup> ERI-PARI joint workshop: September 24, 2015
- 2<sup>nd</sup> PARI-MLFRD joint workshop: May 25, 2015
- 4<sup>th</sup> ERI-PARI joint workshop: February 24, 2015
- PARI/GSDM symposium "Global Energy Trends": February 17, 2015
- International symposium "Energy Policy Development in Myanmar": February 6, 2015
- PARI-MLFRD joint workshop "The Future Direction of Rural Electrification in Myanmar"
- 3<sup>rd</sup> PARI-ERI joint workshop: October 2, 2014
- 2<sup>nd</sup> PARI-ERI joint workshop: April 4, 2014
- 1<sup>st</sup> PARI-ERI joint workshop: December 16, 2013

## Acknowledgment

This work has been supported by the Economic Research Institute for ASEAN and East Asia (ERIA). The views expressed in this paper are solely those of the authors.

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Yamaguchi, K. (forthcoming). Cross-border power trade with Myanmar: Barriers and their removal from the Thai perspective. *International Journal of Public Policy*. Retrieved from: <http://www.inderscience.com/info/ingeneral/forthcoming.php?jcode=ijpp>