Executive Summary

Two years have passed since Daw Aung San Suu Kyi took office in 2016 as state counsellor of Myanmar, a key country in the Greater Mekong Subregion. Although the new administration has implemented various policies, the electric power sector has remained one of the bottlenecks to economic development. Urban areas continue to suffer from frequent blackouts, discouraging foreign investments in factories. Many rural residents have yet to enjoy modern electricity services. The lack of economic progress is one of the reasons ethnic conflicts continue in remote areas. This report's policy analysis of the Myanmar power sector aims to assist policymakers and stakeholders as it looks at electricity futures that foster sustainable and inclusive development, which then could help address the conflict issues.

Main-grid power development and connectivity

In 2014, the government of Myanmar released its power development plan for review. The plan contains a vast number of large-scale hydropower plants as well as coal-fired power plants, which could create a myriad of sustainability issues. In this study, a power capacity expansion model is thus used to analyse the impacts of the power sector policy. The analysis demonstrates that scenarios featuring variable and small-scale renewables and Association of Southeast Asian Nations (ASEAN) interconnections are not only environmentally friendly but also economically efficient (Table 1). A combined energy-hydrology model analysis was also conducted, which showed that removing the most damaging hydropower dams from the energy mix can still retain a significant amount of electricity generation capacities as well as will conserve the Salween (Thanlwin) and Irrawaddy (Ayeyarwady) river ecosystems by reducing sediment trapping.

Table 1. Summary of the Analysis Using a Power Capacity Expansion Model

Scenario	Notes	Estimated Capital Cost Expenditure
2014 National Electricity Master Plan	Follows guidelines and assumptions in the 2014 power development plan. In the original study, renewables are treated exogenously; renewables are added into the assumption mix and optimise endogenously.	US$11.7 billion
Low-cost distributed energy resources	Follows current technology innovation and learning for renewable energy resources including solar photovoltaics, small-scale hydropower, wind, and energy storage facilities	US$8.1 billion

ASEAN Power Grid (APG) Participation	Follows current technology innovation and learning while participating in an expanded power trade market for electricity imports and exports; APG includes 15 priority interconnection projects identified at the ASEAN level	US$8.4 billion

Source: Authors.

The analysis shows the importance of utility-scale solar photovoltaics, along with other renewables. A strengths, weaknesses, opportunities, and threats (SWOT) analysis of utility-scale solar energy in Myanmar was done as a preparatory step towards developing a solar policy framework. The Central Dry Zone is endowed with great solar resources and close to the main grid. In light of the global trend of ever-falling costs of solar photovoltaics, it would be possible to generate solar power at an affordable price. Solar plants can be built with a short lead-time so as to rapidly expand the generation capacity, which will help reduce the blackouts in urban areas. The question of how to streamline regulations for investment is an area that needs policy attention.

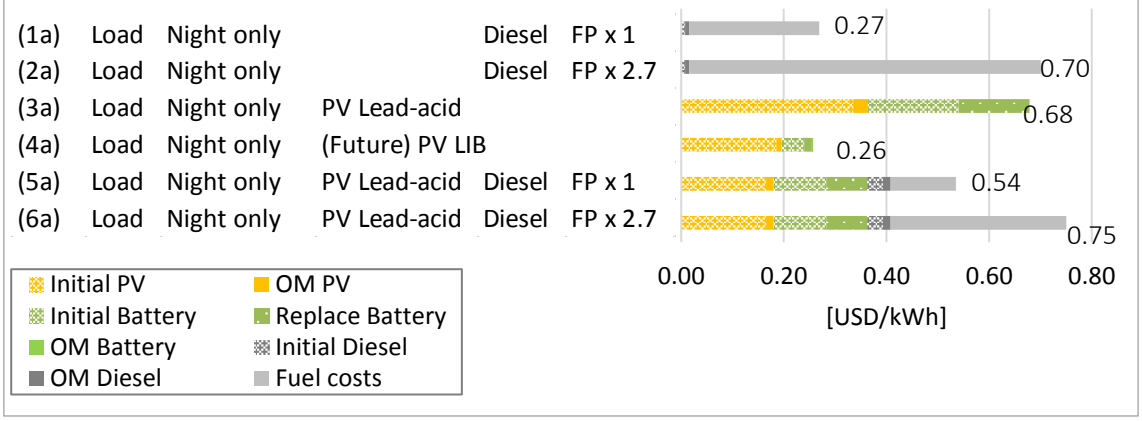
With regard to large-scale hydropower projects, the study conducted a case study on the Myitsone mega-dam project and analysed the decision-making process on the Chinese side. Findings show that the campaigns launched and the subsequent public sentiments against the Myitsone hydropower project led to the adoption of environmental and social guidelines on power plants in China. This guideline from China defines the responsibility of their investors over the environmental and social impacts of their investment activities on host countries.

Rural electrification with renewable-based mini-grids

The Myanmar government has set the goal of universal electrification by 2030. To accelerate rural electrification, the nation should look at all possible solutions: main-grid extension, solar home systems (SHSs), and mini-grids. In particular, mini-grids can be used not only for lighting and mobile charging but also for entertainment purposes as well as productive uses. One of the barriers to the wide diffusion of mini-grids is stakeholders' lack of an understanding of both the financial and non-financial aspects of renewable-based mini-grids.

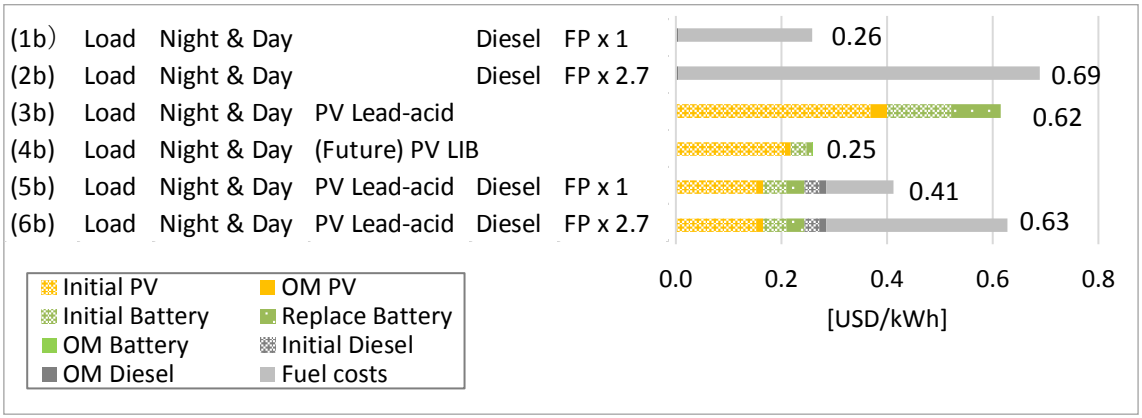
The financial viability of mini-grids was assessed by calculating the levelised costs of electricity for various types of mini-grids (Figures 1 and 2). Compared to the currently dominant diesel option, mini-grids for renewables are found to be economically viable, especially in remote rural areas faced with high diesel prices.

Figure 1. Levelised Costs of Electricity of Different Mini-Grid Configurations: For Cases With a Night-Only Load Profile



PV = photovoltaic; OM = operation and maintenance; LIB = lithium ion battery; FP = fuel price
Source: Authors.

Figure 2. Levelised Costs of Electricity of Different Types of Mini-grids: For Cases with a Load Profile for Both Day and Night



PV = photovoltaic; OM = operation and maintenance; LIB = lithium ion battery; FP = fuel price.
Source: Authors.

Despite good economic prospects, the distribution of mini-grids has been slow. This shows that there is a need to understand the barriers to the development of mini-grids in Myanmar. Table 2 shows the barriers to mini-grid development, based on the literature review and discussions with stakeholders and experts. The study found that although Myanmar shares a common problem with low electrification with other developing countries, certain issues such as indigenous mini-grid technologies are unique to Myanmar and deserve careful consideration.

Table 2. Barriers to the Development of Mini-grids

Category	Sub-categories
Financial	Access to financing, high capital cost, insufficient capital (developer), Insufficient capital (consumer), currency risk, long payback period.
Economic	High transaction costs, small market size, low demand, tariff structure: (cost-revenue gap), customers' ability to pay, revenue collection uncertainty
Social/cultural	Negative externalities caused by international organisations, education, community acceptance, geographical difficulty, perception of inferior quality, theft and non-technical loss, shared resource
Technical	Indigenous technology, lack of local expertise, durability and quality, operation and maintenance, intermittency, lack of interoperability with main grid
Regulatory	Lack of regulatory framework, institutional capacity, lack of technical standards and codes, threat of grid extension, lack of enforcement

Source: Authors.

Policy Recommendations

Based on its results, the study provided the following policy recommendations:

Main-grid capacity expansion

- Alternative power development plans that exclude those large-scale hydropower plants contributing the most damage to the environment can help towards ecological and social stability while achieving economic efficiency. In addition, Myanmar can take advantage of the falling cost of solar electricity by making a strategic priority in the power development plan.

Rural electrification through renewables-based mini-grids

- To accelerate the diffusion of mini-grids, businesses' use of electricity during daytime hours in rural areas should be encouraged to make mini-grid businesses sustainable. It is also crucial to create a supportive financing scheme for mini-grid developers/operators. Finally, the establishment of technical standards and codes for renewable energy equipment is urgently needed.
- To better achieve effective and strategic electrification, a single governmental body should be responsible for both on-grid and off-grid measures.

Investment environments and connectivity

- Participation in a regional power grid markets (e.g., Greater Mekong Subregion, ASEAN Power Grid, and the South Asia Subregional Economic Cooperation) will provide Myanmar an opportunity to expand its access to electricity, meet rising urban power demand, and minimise environmental and societal risks.
- International society should help secure communication lines between foreign investors and Myanmar's local communities as early as the pre-project phase of large-scale hydropower developments.
- The government of Myanmar should prioritise the development of a policy framework that will streamline investments (e.g., for utility-scale solar).