Chapter 4

SWOT Analysis of Utility-Scale Solar Energy in Myanmar

Endowed with one of the best solar resources in the region, Myanmar can profit from more intensive use of solar energy. Although solar energy is increasingly being advocated, little progress has been achieved. To provide insights into the strategic planning on energy currently being undertaken, the authors conducted a SWOT analysis of utility-scale solar energy in Myanmar. Its development data were collected from a variety of sources including academic and grey literature as well as informal conversations with relevant stakeholders.

Although the main objective here is to diagnose the development of utility-scale solar power generation in Myanmar, this SWOT analysis also provides some important insights that can be used as takeoff points for further discussion amongst experts. First, utility-scale solar energy is proven to bring several strengths to the country's power sector. The photovoltaic technical potential is located in the Central Dry Zone, which is relatively flat and close to the national grid, facilitating the installation of the solar panels and the interconnection to the grid.

Second, the combination of utility-scale solar energy and increasing regional energy trade is an opportunity for Myanmar to export clean energy to neighbouring countries, given that the nation is part of several regional initiatives such as the Greater Mekong Subregion, ASEAN Power Grid, and South Asia Subregional Economic Cooperation. Lao PDR has for long positioned itself as 'the battery of Southeast Asia'; Myanmar can likewise position itself as a champion of solar energy in the region.

Third, there is a need for a transparent policy framework to streamline investments. Although a limited number of utility-scale projects have been signed, there is a lag in the implementation phase. Specifically, none of the projects has been finalised yet.

Finally, it is noted that the solar energy initiatives in Myanmar have been directed only to rural areas. Expanding this focus to the national grid should be the next viable step.

4.1 Introduction: Policy Framework to Support Renewable Energy Generation in Myanmar

Myanmar has one of the lowest levels of energy access to energy in the world – lower even than its neighbouring countries. As mentioned in Chapter 2, Myanmar is currently working to attain a universally sustainable electricity access by 2030. This puts Myanmar in a bind with regard choosing its generation technologies. It is hoped that the country will avoid a carbon lock-in pathway by developing and implementing policies that support the deployment of low-carbon technologies.

A previous study (Del Barrio and Sugiyama, 2018) found that Myanmar's plans currently underestimate the potential of solar energy. In particular, while there has been an apparent shift towards solar-based solutions for off-grid electrification, utility-scale solar development has yet to be mainstreamed. Current guiding policy documents prepared by the government have downplayed the potential role of renewables such as solar energy.

This situation in Myanmar is counter to the global trend where there are decreasing prices and faster deployment of solar PV systems. Furthermore, the above-mentioned weaknesses in Myanmar's plans do not help existing conditions that already favour more intensive use of solar energy to thrive. The country's Central Dry Zone has the solar potential that would allow it to be connected to the national grid, thus avoiding the cost – in time and money – of having to develop large transmission lines.

4.2 A SWOT Analysis of Utility-Scale Solar Energy in Myanmar

Using the Del Barrio and Sugiyama (2018) findings as its reference, the study team aimed to identify the drivers of and barriers to the development of utility-scale solar generation infrastructure in Myanmar.

To take advantage of its existing potential, Myanmar needs to develop a strategic plan for utility-scale solar facilities. A participatory process will be required to catalyse the discussion amongst stakeholders. Terrados et al. (2007) list a five-phased process for the development of a strategic plan: (i) preliminary phase; (ii) diagnosis and initial reports elaboration phase; (iii) collective participation phase; (iv) synthesis phase; and (v) plan approval phase.

Since a diagnosis of the state of utility-scale solar facilities in Myanmar is still lacking, this study undertook a SWOT analysis.

Through the SWOT analysis, this chapter looks at utility-scale solar energy as a strategic alternative for Myanmar's present and future energy needs. In that sense, this chapter contributes to the ongoing discussion on the power generation capacity's expansion plans.

The SWOT analysis originated in the business field as a tool for strategic analysis and planning (Pickton and Wright, 1998). It has the ability to 'yield useful information about the future viability of the considered system' (Paliwal, 2006). Its application has extended to numerous other fields (Terrados, Almonacid, and Hontoria, 2007).

Notably, SWOT analysis is widely applied in the energy sector. Chen et al. (2014) applied SWOT to examine renewable energy policies in three East Asian economies: Republic of Korea, Japan, and Taiwan. Lupu et al. (2016) conducted a SWOT analysis of solar energy resource in Romania and identified key factors for its development. The European Commission (2005) ran a project that used a SWOT analysis to compare Europe, the United States, and Japan and identified the most important gaps in research in different energy technologies. The World Bank, too, briefly introduced a SWOT analysis for solar resources in Myanmar (Suri et al., 2017). Shi (2016) employed a SWOT analysis to highlight the possibility for ASEAN to move from a fossil fuel–dominated energy mix towards a green energy strategy, as advocated by the ASEAN's regional vision and action plan. Greacen (2015) applied SWOT to evaluate the options and consequences of further deployment of mini-grids in Myanmar.

The Asian Development Bank has used a SWOT analysis for Myanmar's food crops, water resources, and environmental subsectors (ADB, 2013).

SWOT analysis is usually presented in the form of a 2 x 2 chart, is divided into four categories (Start and Hovland, 2004), as shown in Table 4-1. Strengths and weaknesses are internal factors; opportunities and threats result from the external environment or external forces (Paliwal, 2006).

Table 4-1. SWOT Framework

Strengths Internal + Helpful	Weaknesses Internal + Harmful
Opportunities External + Helpful	Threats External + Harmful

SWOT = Strengths, weaknesses, opportunities, and threats.

Source: Created by the authors.

Different approaches in undertaking a SWOT analysis can be found in literatures. Some studies have obtained information from experts through such collective exercises as seminars (Markovska, Taseska, and Pop–Jordanov, 2009; Terrados et al., 2007) or through surveys (European Commission, 2005). However, most investigations have based their analyses on a review of the existing literature (Chen et al., 2014; Soimu, 2014).

As an initial approximation, this chapter draws from existing literature (academic, journalistic, and official reports) and from information collected through discussions with local and international experts during visits, workshops, and seminars held and attended by the research group.

This chapter first provides an overview of the lack of inclusion of solar energy in current guiding policy documents and discusses the related drivers and impediments. Then, the SWOT analysis is presented, further analysing each factor. Finally, this chapter discusses the results and policy recommendations.

4.3 Solar Energy in Myanmar's Power Sector Plans

Starting 2011, reforms towards the democratisation of Myanmar opened the door for the nation's rapid re-engagement with the international community. President Obama ended the United States' economic sanctions in 2016 (Exec. Order No 13742 v.81 no.197 p.70593, 2016). The European Union has also lifted its sanctions, although an arms embargo remains in place (Council of the European Union, 2013). Following the United States and European Union's lifting of sanctions, Myanmar re-engaged in cooperation programmes with development partners such as Japan International Cooperation Agency (JICA), ADB, World Bank, the German Corporation for

International Cooperation (GIZ), and the Norwegian Agency for Development. Local and international nongovernmental organisations are also involved in Myanmar's energy sector.

The current National Electrification Plan and the National Electricity Master Plan (NEMP), which were developed with support from the World Bank and JICA, respectively, do not assign an ambitious role for renewables. The National Electrification Plan (NEP) recognises diesel mini-grids only, leaving solar energy as a solution at the individual household level (Castalia Strategic advisors, 2014). The NEMP, meanwhile, caps the penetration of renewables at 10% by 2030 (JICA, 2015). There are alternative studies, however, that have examined the possibility as well as seen the merits of raising the targets for the penetration of renewables in Myanmar (Denruyter, 2016; Kean, 2017). Table 4-2 compares the power generation mixes estimated by the official plan (i.e., JICA's) and one alternative plan proposed by the World Wildlife Fund. The large discrepancy in the figures of the two plans suggests that it is necessary to update capacity expansion plans without externally constraining renewables (Del Barrio–Alvarez and Sugiyama, 2018).

Table 4-2. Installed Capacity Under Official and Alternative Scenarios by 2030 (MW)

Resource	Japan International Cooperation Agency *	World Wildlife Fund **
Coal	7,940	0
Natural gas	4,758	1,774
Hydro (all sizes)	12,350	7,413
Other renewables	2,000	8,959 solar 5,149 onshore wind 1,250 biomass

* The proposed power resources balance scenario is presented in this table.

** The most conservative of the scenarios proposed (the Sustainable Energy Scenario) is presented in this table.

Source: (Denruyter, 2016; Japan International Cooperation Agency, 2015)

The 10% cap on renewables is currently being reconsidered. An ongoing study funded by the United States (US) Trade and Development Agency is examining the grid impact of three different scenarios of integration of variable renewables (Depierreux, Shumway, and Sparavier, 2017). The first scenario is based on thermal plants; the second and third scenarios estimate a 10% and 19% renewables penetrations, as a percentage of peak demand. The study's target year is 2020, including the transmission system considered by Myanmar's Ministry of Energy and Electricity (MOEE). Results show that even the most ambitious scenario is possible without any negative impact on the reliability of the system.

4.4 Drivers of and Barriers to Implementing Solar Energy in Myanmar

While there seems to be a low interest in solar energy amongst government officials, the large potential of solar energy and the growing electricity needs of Myanmar have captured the attention of private sector investors.

The MOEE has presented its plans for 1.5 GW utility-scale pipeline solar power plants, which are in different stages of development (Beetz, 2018; Oo, 2017). Table 4-3 summarises the planned projects, based on the scant information available.

However, the progress of these projects was slow. In 2014, the Thai firm Green Earth Power signed an agreement with the government to develop a 220-MW solar plant in Minbu (Magway region), which was reported as the most advanced utility-scale solar investment in Myanmar. The project was initially expected to complete its first phase in 2016 (Phyo, 2014). Information about its progress is scarce, and only 40 MW of the Minbu project is expected to be achieved by the first quarter of 2019 (Shumkov, 2018).

Appropriate policies are needed to address the discrepancy between the potential of utility-scale solar energy and investment interest, and actual progress. Vakulchuk et al. (2017) evaluates the attractiveness of the energy sector in Myanmar to investors based on a project jointly developed by the Myanmar Institute for Strategic and International Studies and the Norwegian Institute of International Affairs, and supported by the Ministry of Foreign Affairs of Norway.

Table 4-3. Utility-scale Solar Projects Under Development in Myanmar

Project / Location	Region	Installed Capacity	Developer	Current Status
Minbu	Magway	220 MW (170 MW?)*	Green Earth Power (Thailand)	MoU+PPA
Nobuai	Mandalay	150 MW	ACO Investment Group (USA)	MoU+PPA
Wandwin	Mandalay	150 MW	ACO Investment Group (USA)	MoU+PPA
Shwe Myo	Nay Pyi Taw	10 MW		MoU
Sagaing and Mandalay	Sagaing and Mandalay	880 MW (80 MW?)**		MoU
Thapaysan	Nay Pyi Taw	100 MW		MoU

MoU = memorandum of understanding; PPA = power purchase agreement.

* Initial information reports 220 MW (Phyo, 2014), more recent data mention 170 MW (Shumkov, 2018).

** No evidence exists about this project other than the official presentation by the MOEE. The media have reported another 80 MW project in the same region (Hammond, 2016), which may indicate potential errata in the official information.

Source: Adapted by the authors from Beetz, 2018; M. M. Kyaw, 2017; Oo, 2017; US Embassy, 2017.

The report includes a list of factors that lessen the attractiveness of renewables in Myanmar, including:

- No national target or legislation on renewable energy;
- No dedicated public agency regulating the sector;
- Lack of business associations;
- Subsidies for grid electricity generated from fossil fuels, which put off-grid renewables at a disadvantage;
- Access to suitable land;
- Mountainous terrain and protected areas as well as political instability in key areas;
- Underdeveloped grid system for large-scale production;

- Lack of data on the renewable energy resource potential;
- Limited infrastructure for technical support and maintenance;
- High installation cost of solar panels and wind turbines;
- Disintegrated biofuel production and supply markets;
- Lack of local specialists;
- No taxation system for renewables;
- Security risks in conflict-prone Kachin, Rakhine, and Shan states

4.5 SWOT Analysis of Utility-Scale Solar Energy in Myanmar

Table 4-4 summarises the result of the SWOT analysis of the utility-scale solar energy in Myanmar. Each quadrant in the table is discussed in detail in the following subsections.

Table 4-4. SWOT Analysis of Utility-Scale Solar Energy in Myanmar

Strengths	**Weaknesses**
• Available potential to be developed • Best resource areas located in flat areas near national grid • Public support for solar energy and opposition to coal and large-scale hydro • Shorter lead times of solar power plants in contrast with other technologies • Increasing experience on solar PV technologies through off-grid projects	• Uncertainty regarding the establishment of an independent regulatory commission • Low electricity tariff requiring very low generation prices • No supporting policy for the deployment of renewables
Opportunities	**Threats**
• Regional power trade • Seasonal complementarity with hydro • Decreasing global prices	• Potential land disputes • High levels of perceived corruption • Delays in the implementation of current projects

• International investment interest in Myanmar • Growing investment in solar energy • Support from international donors	• Security and reputation concerns • Absence from national plans

Source: Prepared by the authors based on secondary data.

4.5.1 Strengths

Available potential to be developed

Myanmar has amongst the highest potential for solar photovoltaic power potential in Southeast Asia. The country's technical potential has been estimated at between 40 TWh/year (ADB, 2015) and 118.2 TWh/year (Siala and Stich, 2016). More than half of the country (about 60%) is suitable for solar electricity generation (Oxford Business Group, 2016). Figure 4-1 shows the photovoltaic power potential in Myanmar.

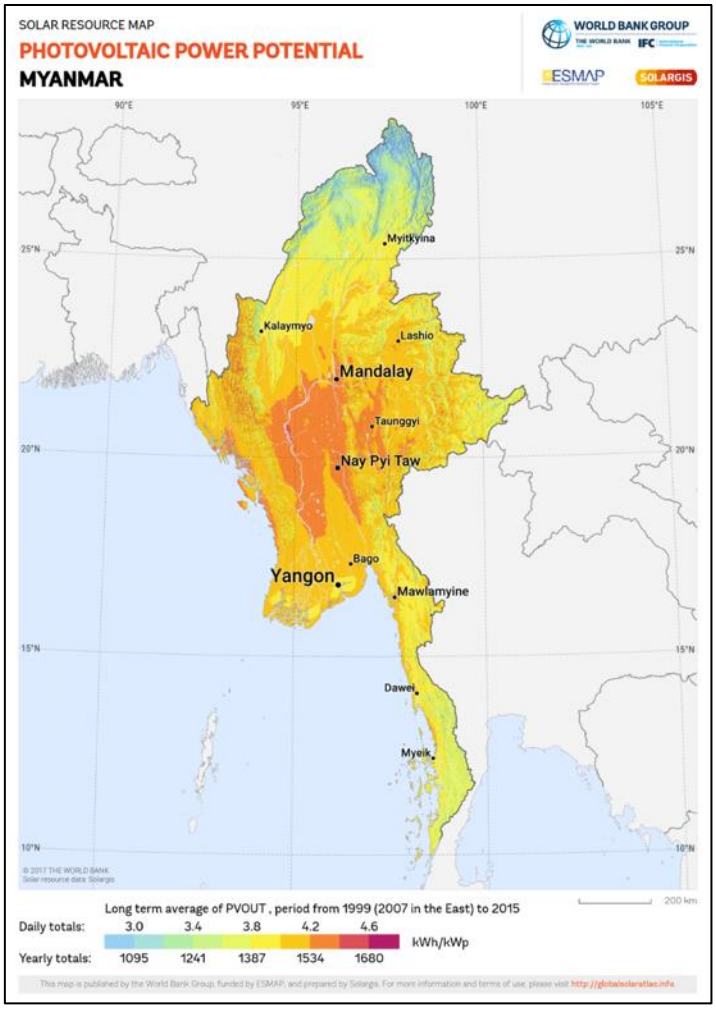
This potential remains mostly unexplored for grid-connected projects. With the exception of a couple of rooftop solar PV installations in the Junction commercial complex in Yangon and in a garment factory (Balch, 2016; Djordjevic, 2017), no utility-scale or commercial solar plants have yet been finalised. The fate of most planned projects remains unclear.

Against this background, the alternative scenario proposed by the World Wildlife Fund considers almost 9,000 MW by 2020; and 27,459 MW of solar PV systems and 4,800 MW of concentrated solar energy by 2050. That would make solar energy the dominant energy source in Myanmar's generation mix by the mid-century (Denruyter, 2016).

Best resource area is located in a flat area and near the national grid

The main area of interest for utility-scale solar generation in Myanmar is the Central Dry Zone, a flat plain (Kyi, 2016) whose potential remains undeveloped. Figures 4-1 and 4-2 show the PV power potential in the country and how the areas of highest potential are located in flat areas.

Figure 4-1. Photovoltaic Power Potential in Myanmar



Source: © 2017 The World Bank; solar resource data: Solargis.

The Central Dry Zone is composed of infertile soils (ADB, 2013), reducing concerns about conflicting uses of the land. Furthermore, the Central Dry Zone is mostly near the national grid, facilitating the connection of new power plants. To conduct the power generated by dams in the north, the national transmission system in Myanmar runs from north to south. With only one 500 kV line being built with bilateral support, the grid currently comprises a network of 230 kV, 132kV, and 66kV transmission lines (ADB, 2016).

Figure 4-2. Elevation Map of Myanmar

Source: Google Maps.

Public support

Solar energy enjoys public support as a viable alternative to coal-fired plants. Coal-fired generation is the subject of severe criticisms. Currently, there is only one coal-fired power plant in Myanmar, and the NEMP anticipates the opening of more coal-fired plants. However, environmental organisations and other local and regional nongovernmental organisations had mobilised their campaign against such plan (Nyein, 2017b).

The Union government has reconsidered its position following its democratisation since 2011. Currently, 'all coal-fired projects are cancelled' (M. M. Kyaw, 2017). However, a dispute has emerged at the federal level. The Kayin regional government has supported the development of a 1,280-MW Hpa-An coal power plant. The Union government has criticised the move and taken measures against it. The dispute remains unresolved (Han, 2017, 2018; Nyein, 2017a; Yimou Lee, 2017).

Shorter lead-time

Electricity demand is growing rapidly in Myanmar, and it is expected to continue — at least in the near term. Therefore, securing greater power generation is an urgent need. In this context, the ability to deliver electricity rapidly after the approval of a project becomes an important consideration. In addressing short-term needs, the shorter lead time and lower construction risks of solar energy compared with other technologies are important factors (Sovacool, Gilbert, and Nugent, 2014).

Developing the other types of generation plants faces challenges that are specific to Myanmar. For instance, coal power has traditionally faced strong public opposition. Moreover, the current Union government has taken a position against coal power use. Because of these barriers, these projects would take longer to complete.

Hydropower is the traditionally preferred choice of the government. The available potential is great, but in the short term, hydropower involves complications that are difficult to address. From an environmental and river management perspective, the Ayeyarwady (Irrawaddy, which crosses the country from north to south and a large proportion of the population depends on it), and the Thanlwin (Salween) rivers do not have dams in their main streams. How the construction of their dams would affect these rivers has yet to be studied (IFC, 2018).

Chapter 3 of this report describes a study on the influence on sediments during different scenarios of dam building. From a national reconciliation viewpoint, tension has increased over proposals for large-scale hydropower dams in some areas; those proposals are opposed by the central government. Alternative strategies could avoid those problems (Kittner and Yamaguchi, 2017).

Government has shown a recent interest in liquified natural gas (LNG). The signing of power purchase agreements for LNG power plants has been a highlight in the recent power policy development. The plants are expected to start operations by 2020, although there are some concerns over future costs (Kean, 2018a, 2018b).

Increasing experience with solar PV technologies through off-grid projects

Myanmar is rapidly gaining experience with renewable energies through rural electrification programmes. Pilot projects have been and are being implemented by different organisations with support from development partners. More recently, extensive programmes have been examining the use of renewables for rural electrification. In particular, a large number of solar home systems have been implemented (Greacen, 2015). As mentioned in Chapter 2, the DRD's National Electrification Plan, which had the help of the World Bank, has supported the development of solar-based mini-grids through what is widely known as the 60/20/20 programme. Under this programme, the government provides a grant for 60% of the cost of the mini-grid, while the developer and the local community cover 20% each. Village Electrification Committees are established in each village. The programme is still in its initial years of operation, and its scalability is uncertain. No similar programmes have been proposed for the national grid.

4.5.2 Weaknesses

Uncertainty in the establishment of an independent regulatory commission

To attract the appropriate investments, there should be mechanisms in place to resolve potential conflicts and secure transparency in the regulatory process. Myanmar's power sector is under the control of the state-owned, vertically integrated utility Electric Power Generation Enterprise (EPGE), and has a partly private energy generation component consisting of independent power producers (ADB, 2016; OECD, 2014). The Electricity Law of 2014 replaced the previous legislation dating back 1954 and introduced some major changes. Decision-making became partly decentralised when state governments were allowed to approve off-grid projects smaller than 30 MW (Oxford Business Group, 2016; Ross, 2015). More importantly, the creation of a regulatory commission has been envisioned in the 2014 law. However, such commission has not yet been created as of this writing, and the prospect of having a working commission remains unclear.

Low electricity tariff

Electricity tariff is highly subsidised in Myanmar. It is the responsibility of the MOEE to develop its own power generation products or sign power purchase agreements with private developers.

In 2017–2018, the subsidy was about K378 billion (approximately US$280 million) (Chern, 2017; Htwe, 2017a), and is expected to increase to K450 billion (US$330 million) in 2018 (FMR Research and Advisory, 2018). Ever since the tariff increased in 2014, households pay around US$0.03–US$0.04/kWh; industrial consumers pay US$0.05–US$0.10 cents/kWh (ADB, 2016). Tables 4-5 and 4-6 summarise the electricity tariffs for residential, industrial and commercial consumers. The MOEE has indicated that it wishes to raise the tariffs (Khin, 2017; Lynn, 2017b), but is faced with public opposition.

Table 4-5. Electricity Tariff for On-Grid Residential Consumers

Consumer range	Kyats / kWh	US$ cents / kWh
Up to 100 kW/h	35	2.6
From 101 kWh to 200 kWh	40	2.9
From 201 kWh and above	50	3.6

kWh= kilowatt-hour.

Source: Anbumozhi and Tuan (2015).

1 US$ = K1,370.71 (xe.com, 2017)

Table 4-6. Electricity Tariff for On-Grid Industrial and Commercial Consumers

Consumer Range	Kyats / kWh	US$ cents / kWh
Up to 500 kWh	75	5.5
From 501 kWh to 10,000 kWh	100	7.3
From 10,001 kWh to 50,000 kWh	125	9.1
From 50,001 kWh to 200,000 kWh	150	10.9
From 201,000 kWh to 300,000 kWh	125	9.1
300,001 kWh and above	100	7.3

kWh= kilowatt-hour.

Source: Anbumozhi and Tuan (2015).

1 US$ = K1,370.71 (xe.com, 2017).

No supporting policy

Myanmar has not adopted any specific policy to attract investments into renewable energy. The Regulatory Indicators for Sustainable Energy, developed by the Energy Sector Management Assistance Program of the World Bank, provide a global comparison of the energy situation in different countries. In sustainable energy, Myanmar offers only fiscal incentives in the form of reduced import taxes as well as reduced sales taxes and other taxes (World Bank, 2016b). Neighbouring countries have implemented more sophisticated instruments such as feed-in tariffs and renewable energy auctions (Tongsopit et al., 2017).

4.5.3 Opportunities

Regional power trade

Myanmar is located between India, China, and the rest of Southeast Asia (through Thailand and with a small border with Lao PDR). Interconnections could be developed in the near future so as Myanmar can import electricity from neighbouring Lao PDR (Billen, 2016) and Yunnan (China). India has also proposed some schemes for exporting electricity. Currently, the interconnection with Yunnan appears to be the most advanced.

In the long term, Myanmar could utilise these interconnections to export electricity as well. The World Wildlife Fund's alternative scenarios show a rapid, large increase in power generation for export to neighbouring countries in the Greater Mekong Subregion. In particular, it has been forecasted that Myanmar will be able to export 40,000 GWh to Thailand by 2040 (Denruyter, 2016).

Seasonal complementarity with hydropower

Hydropower accounts for around 60% of Myanmar's power supply, although the contribution from natural gas is increasing. Power generation capacity is sufficient during the rainy season but becomes restricted during the dry season.

The Energy Master Plan, which was developed with support from the ADB, identified good seasonal complementarity between hydropower and solar energy (Emmerton et al., 2015). Maximum solar irradiance occurs between January and May, which is the time of minimum

output for hydropower; the situation is reversed from July to November. During the dry season, when the power supply is restricted, solar energy can be tapped to mitigate the chances of frequent blackouts (Ross, 2015).

Decreasing global prices

The world has seen a 70% decrease in the price of new solar PV systems since 2010 (IEA, 2017c). Reasonable PV system prices are already at the level of US$0.06–US$0.08/kWh (Dobrotkova et al., 2018). However, the final prices of solar energy vary from country to country.

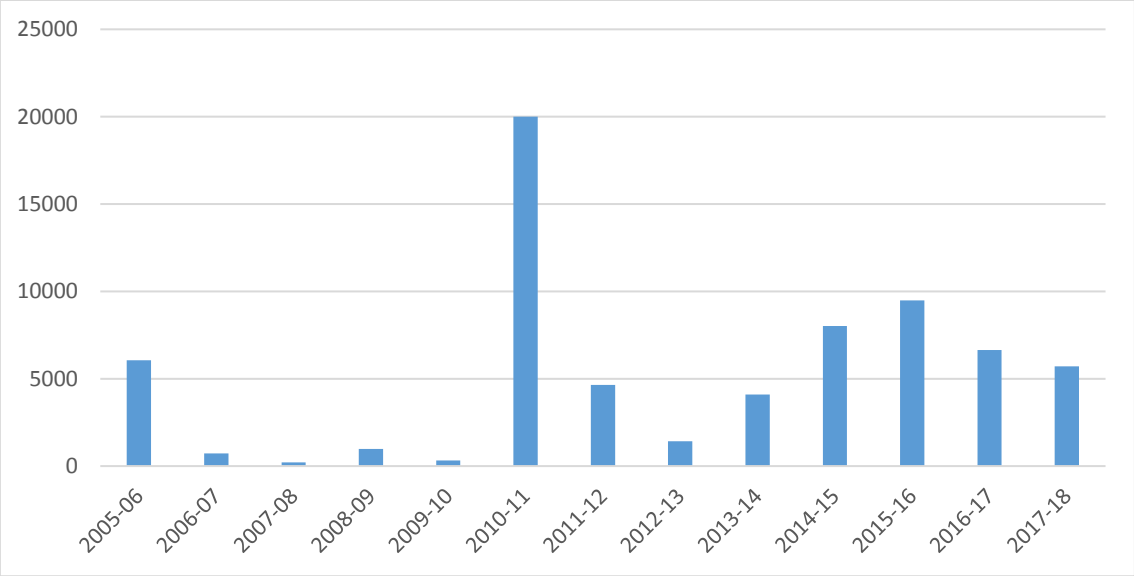
As Myanmar has had little experience in using solar energy, the initial actual prices could be higher in comparison with those in neighbouring countries. The outcome of policy innovations, such as the recent widespread application of energy auctions, is strongly dependent on several factors related to their design (Azuela et al., 2014; Del Río and Linares, 2014; Kruger and Eberhard, 2018; Mora et al., 2017).

International investment interest in Myanmar

In Myanmar, its democratic transition and opening up to the world have attracted the interest of many international investors and donor organisations. The lifting of economic sanctions by the United States and European Union has allowed investments to flow into Myanmar (Pun, 2016; Xu and Albert, 2016). Figure 4-3 shows the increase in investments compare to the previous decade.

In 2014, the Myanmar government announced the development of special economic zones. Since then, four special economic zones (SEZs) have been proposed: Thilawa, Fawei, Kyauk Phyu, and Sittwe (Khandelwal and Teachout, 2016). The Thilawa Special Economic Zone, supported by Japan, is the only one in operation; it had attracted about US$700 million from over 70 companies by 2016 (Hunter et al., 2018). Considering the rising electricity demand linked to Myanmar's economic growth, the power sector itself can become another business opportunity for investors if a clear, transparent framework is developed (Matsui, 2017a).

Figure 4-3. Yearly Approved Amount of Foreign Investment in Myanmar (US$ million)



Source: Myanmar Directorate of Investment and Company Administration (DICA).

Growing investment in solar energy

The cost reductions in technology, together with stronger efforts from governments, have also attracted large private investments in renewables, particularly solar PV systems. In 2017, solar energy became the fastest-growing source of power worldwide, with the global installed capacity increasing by 50% (IEA, 2017b). This development represents an important opportunity for Myanmar as a new market.

Support from international donors

Myanmar has been a recipient of loans and grants from multiple countries and multilateral institutions, particularly after its transition out of military rule. In addition to projects and programmes supported by JICA, the World Bank, and ADB, Myanmar receives help from the German Development Agency, Norwegian Agency for Development, and China. The Asian Infrastructure Investment Bank, the World Bank, and ADB are involved in the Myingyan gas-fired power plant project. Myanmar is part of the One-Belt, One-Road initiative, which includes building of gas and oil pipelines, and linking Kyauk Pyu Port in southwestern Myanmar with Yunnan Province in China. (Liu, Yamaguchi, and Yoshikawa, 2017).

4.5.4 Threats

Potential land disputes

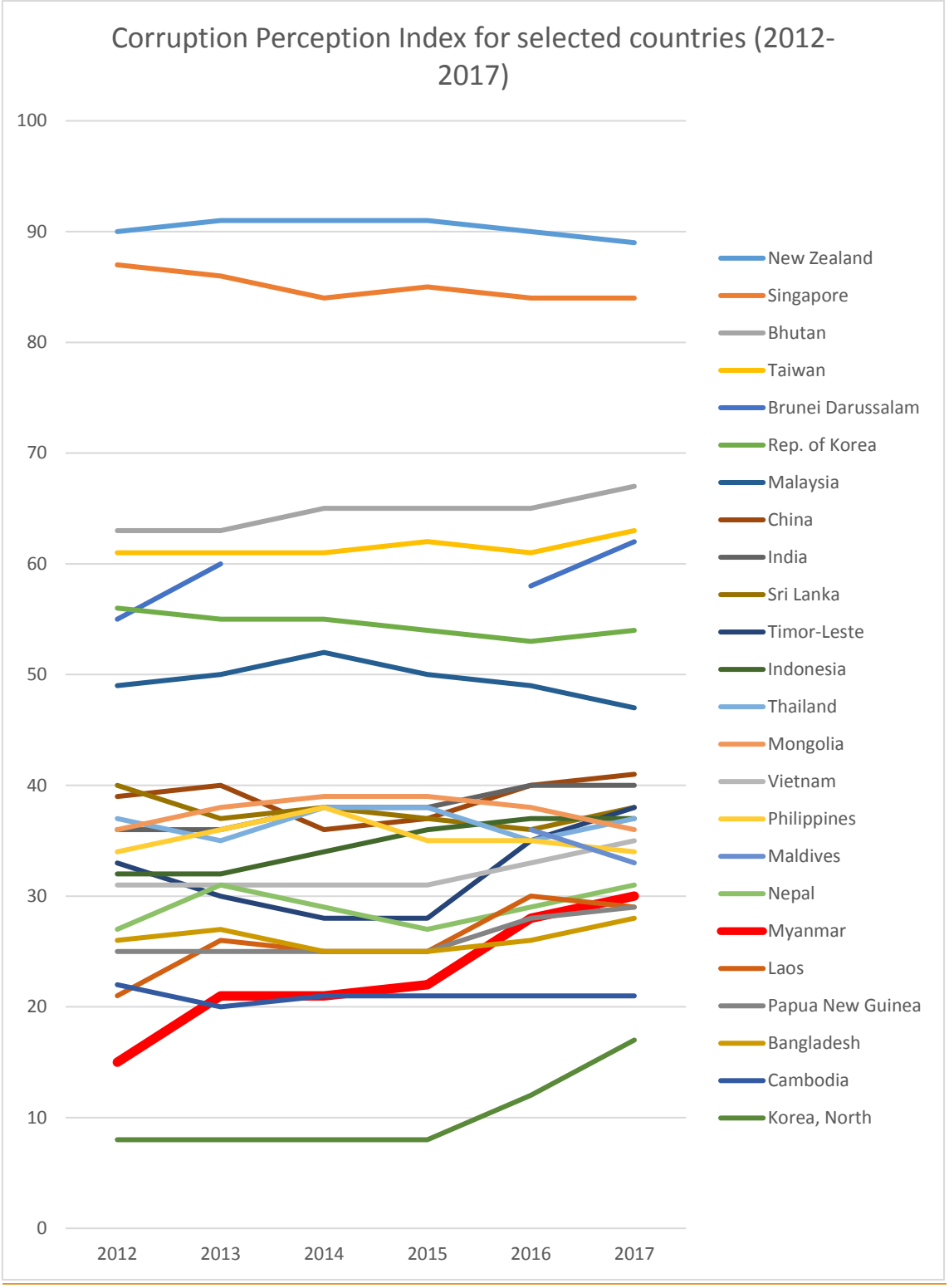
Utility-scale solar plants require vast areas of land, which may not be easy to obtain. The main challenges may come from securing the rights for such land. After decades of forced expropriations, many farmers in Myanmar are calling for the return of land ownership to them. Although the current government has expressed its intent to deal with this problem, little progress has been made (Barany, 2018; Myint, 2017b). The actions taken by the transitional government of Thein Sein may have had some negative consequences regarding the land-grabbing occurred during the years of military rule, such as the formalisation of the land-grabbing patterns and encouragement of land speculation (McCarthy, 2018). Today, the National Land Use Policy in Myanmar was adopted by the central government after an extensive consultation process (Oberndorf et al., 2017): This could represent an initial step in the long process of resolving the disputes.

High levels of perceived corruption

In Transparency International's Corruption Perception Index, the lower a country's ranking, the higher is its perceived corruption (Figure 4-4). In 2012–2017, Myanmar was ranked 130th out of 180 countries. Likewise, corruption is recognised as an obstacle for businesses (Ferrie, 2014).

An Anti-Corruption Law and Commission were established in 2013 and 2014, respectively, but had little impact (Soe, 2018). The NLD-led government has made the fight against rampant corruption a key objective, and improvement has been seen in recent years (Control Risks, 2017; Naing, 2017).

Figure 4-4. Corruption Perception Index for Selected Countries (2012–2017)



Source: Adapted from the Corruption Perception Index, Transparency International.

Delays in implementing currently approved projects

The lack of visible progress in already-agreed projects can dampen Myanmar's attractiveness to potential investors. As noted above, several utility-scale solar power plants are being development. In particular, Green Earth Power (Minbu) and ACO Investment Group (Nobuai and Wandwin) have already signed MoUs and power purchase agreements with the government for three projects. Nevertheless, none of those projects has yet been finalised. Even the Minbu project, which was way ahead of the rest, has been hit by a long delay. Signed in 2014, the first phase of the Minbu project was expected to be operational in 2016 (Petrova, 2014), but such target has long changed. Currently, the project's rollout is expected to be by the end of 2018.

Security and reputation concerns

Myanmar's long-standing internal conflict continues. The new government has made signing a peace agreement with ethnic armed military groups a top priority. The Thein Sein government proposed a Nationwide Ceasefire Agreement with ethnic armed groups, although only some agreed to sign (Mark, 2018). The NLD government launched the 21st Century Panglong Union Peace Conference to promote broader peace talks. The first session was held in late August to early September 2016, with succeeding sessions to be held every six months. The third session has been delayed several times (Nyein, 2018; Pwint, 2018; Thar, 2018; Z. M. Win and Thiri, 2018). Negotiations have yet to be concluded.

The management of clashes in Rakhine state between the Tatmadaw (national armed forces of Myanmar) and minority Rohingya have severely affected international support for the NLD government, especially from major Western countries (Barany, 2018). Being involved in Myanmar while it is undergoing its weak democratic transition can damage an investor's reputation (Simpson, Park, Simpson, and Park, 2013).

Increasing international scepticism in the government's ability to deal with the conflict has added to such reputational risk. It is unlikely that the United States, European Union, or United Nations will re-impose international sanctions; however, reputational issues may affect companies investing in the country (Lee and Zaharia, 2017; Peel, 2017). This can be particularly troublesome for companies from predominantly Muslim countries (Rajan, 2017).

Absence from national plans

The National Electricity Master Plan (NEMP) draws on the current government's capacity expansion plan. It was drafted before the commencement of the NLD government but is now undergoing revision.

The NEMP remains the most important guiding policy in the energy sector and in fact, represents a major milestone in Myanmar's energy policy development. However, the scenario analysis underlying NEMP imposed an exogenous cap of 10% on renewables. As a result, the role of renewables in general, and solar energy in particular, is underplayed (Del Barrio–Alvarez and Sugiyama, 2018).

4.6 Discussion and Conclusions

It is widely acknowledged that renewables can play a major role in the power mix for Myanmar. This role will be fundamental for rural electrification, but need not be limited to that. Renewables, particularly solar energy, can contribute to increasing the supply and reliability of Myanmar's national grid.

Recent studies have contributed to understanding the power situation in Myanmar. However, beyond technical considerations, the government should develop an appropriate policy framework to attract international financing and expertise and to secure its needs. Since the start of the democratic transition, Myanmar's energy sector has captured the interest of development partners and international investors. However, this investment has yet to materialise in the solar energy sector in a robust, transparent manner.