Chapter 2

Overview of Myanmar Energy Situation

Myanmar is experiencing a major political, economic, and social transition from what was once under a military regime to today's open democracy. In this process, electrification of the country is expected to play a fundamental role in its development.

The energy policy landscape of Myanmar remains in flux. A new minister of Energy and Electricity was appointed in 2017, bringing new perspectives to the ministry. Liquefied natural gas (LNG) was chosen as a strategic option in the face of rising energy demands. Four projects were approved and expected to start operation by 2021. Meanwhile, liquefied petroleum gas (LPG) has been recently targeted as a means to reduce the electricity consumption in urban areas.

Coal remains a highly disputed resource. The union government has explicitly refused to continue its development, while the Kayin state government is working to support a 1,280 MW coal-fired project. In all these, one needs to also remember that rapid urbanisation will continue to drive the electricity demand in major cities.

In rural areas, on the other hand, the government has made some headways in its support for mini-grids. Recent policy directions have been focusing on the formulation of regulations for off-grid projects.

2.1 Background: Myanmar Transition from Military to Democracy

Myanmar, formerly known as Burma, is the largest country in continental Southeast Asia. It is even slightly larger than Thailand. It is a multi-ethnic country, with 135 different groups recognised. Majority is composed of ethnic Burmese, while other large groups include Chin, Kachin, Karenni, Karen, Mon, Rakhine, Rohingya, and Shan (Oxford Burma Alliance, n.d.).

The country was under various phases of British colonial control between 1824 and 1948, after the defeat of the Burmese monarchy in three wars. A British-like administration was attempted to be introduced during this period (Thant Myint-U., 2008). After it obtained its independence

in 1948, Myanmar entered its democratic era. It then experienced a period of military dictatorship after General Ne Win staged a *coup d'etat* in 1962.

Myanmar initiated a gradual opening and transition towards democracy in 2008. A new constitution was approved and elections were held. U Thein Sein, who became president in 2007 and led the transition towards democratic elections, was in charge of this process. After the elections in 2012, the National League for Democracy (NLD) won most of the seats. The NLD was the main party opposing the military rule and founded by Aung San Suu Kyi, the main figure of the opposition, daughter of the country's hero Aung San, and Peace Nobel laureate (Rieffel, 2016).

The NLD achieved a landslide victory during the 8 November 2015 election (Hulst, 2015; Whiteman, 2016). However, Aung San Suu Kyi did not become president because the constitution does not allow locals from assuming the presidency if they have foreign family members (Cochrane, 2017). Instead, her close ally U Htlin Kyaw became president, while the new position of state counsellor was created for her (Mclaughlin, 2016).

2.2 Energy Sector in Myanmar: Country-wide Implications

Energy is expected to play a central role in the democratisation and modernisation of Myanmar (Loftus, 2016). However, the nation's electrification rate as well as the consumption of electricity remain very low.

In urban areas, the reliability of the supply remains an issue. A successful country-wide electrification process also affects the legitimation of the reform agenda in Myanmar (Ross, 2015). Myanmar needs to also increase its generation capacity to meet the needs of the population and the rapid rise in urban population and industry. Moreover, to be consistent with the United Nations Sustainable Development Goals and the Paris Agreement, Myanmar must meet such goals in a sustainable and inclusive manner by harnessing the potential of renewable energy.

Myanmar is eminently rural (Table 2-1), with the exception of Yangon, the former capital city and still the country's major economic hub.

Table 2-1. Population in Administrative Divisions in Myanmar

State / Region	Male	Female	Total	% of Total	Area (sq km)	Urban Area (%)	Rural Area (%)
Kachin	878,384	811,057	1,689,441	3	89,041.80	36	64
Kaya	143,213	143,414	286,627	1	11,731.51	25	75
Kayin	775,268	798,811	1,574,079	3	30,382.77	22	78
Chin	229,604	249,197	478,801	1	36,018.90	21	79
Sagaing	2,516,949	2,808,398	5,325,347	10	93,702.48	17	83
Tanintharyi	700,619	707,782	1,408,401	3	43,344.91	24	76
Bago	2,322,338	2,545,035	4,867,373	9	39,404.43	22	78
Magway	1,813,974	2,103,081	3,917,055	8	44,820.58	15	85
Mandalay	2,928,367	3,237,356	6,165,723	12	30,888.09	35	65
Mon	987,392	1,067,001	2,054,393	4	12,296.64	28	72
Rakhine	1,526,402	1,662,405	3,188,807	6	36,778.05	17	83
Yangon	3,516,403	3,844,300	7,360,703	14	10,276.71	70	30
Shan	2,910,710	2,913,722	5,824,432	11	155,801.38	24	76
Ayeyawady	3,009,808	3,175,021	6,184,829	12	35,031.88	14	86
Nay Pyi Taw	565,155	595,087	1,160,242	2	7,075.10	32	68
Union	24,824,586	26,661,667	51,486,253	100	676,577.23	30	70

Source: Ministry of Immigration and Population (2015).

Myanmar has become one of the fastest growing countries in the region: up until 2014, its economic growth had been constantly above 7% (Lwin, 2015) (Table 2-2). Its low labour cost has made Myanmar an attractive location for manufacturing industries (Matsui, 2017b). Nevertheless, natural gas has traditionally been, and still is, the largest export product of the country and the main source of foreign currencies during its period of isolationism. Myanmar

exports about 90% of its natural gas production from four active gas fields, signing export contracts with countries such as Thailand and China. Agriculture constitutes the main part of the national economy – about 38% of the GDP – and employs 60% of the population (World Bank, 2016a). It also comprises 25% to 30% of the export earnings (FAO, 2018). It is commonly said that anything can be planted in Myanmar because the soil is considered to be the most fertile in Asia (Zorya, 2016). Nevertheless, isolation and stagnation have led the country to be the least profitable in the region. In 2015, the government decreed a rice export ban for six weeks (Wai and Aung, 2015). Tourism has been growing and the government has tried to stimulate it; however, it still is largely limited by political factors.

Table 2-2. Economic and Trade Indicators

Indicator	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Population (million)*	47.67	49.98	51.73	52.13	52.54	52.98	53.44	53.90
GDP (current US$ billion)*	8.90	11.97	49.54	59.98	59.73	60.13	65.57	62.60
GDP growth (%)*	13.75	13.57	13.08	11.99	10.26	10.55	9.63	5.59
GDP per capita (current US$)*	187	239	958	1,151	1,137	1,135	1,227	1,161
Human Development Index (HDI)**	0.427	0.474	0.526	0.533	0.540	0.547	0.552	0.556
Inflation (average consumer prices)***	15.63	48.499	97.379	96.314	100.855	107.164	113.72	123.33
FDI approved (US$ million)****	-	6,065	19,999	4,644	1,419	4,107	8,010	9,481
FDI, net inflows (current million US$)*	255	235	901	2,520	1,333	2,254	2,175	4,083

FDI (%GDP)*	2.86	1.96	1.82	4.20	2.23	3.75	3.32	6.52
Import value index (2000 = 100)*	100	80.48	200.75	380.40	388.10	507.93	684.39	738.34
Export value index (2000 = 100)*	100	233.09	534.58	570.19	547.90	693.31	680.84	685.49
Exports (US$ million)*	-	-	8,829	10,228	10,379	11,957	14,653	16,459
Imports (US$ million)*	-	-	– 8,184	– 10,453	– 12,499	– 13,987	– 16,341	– 18,403

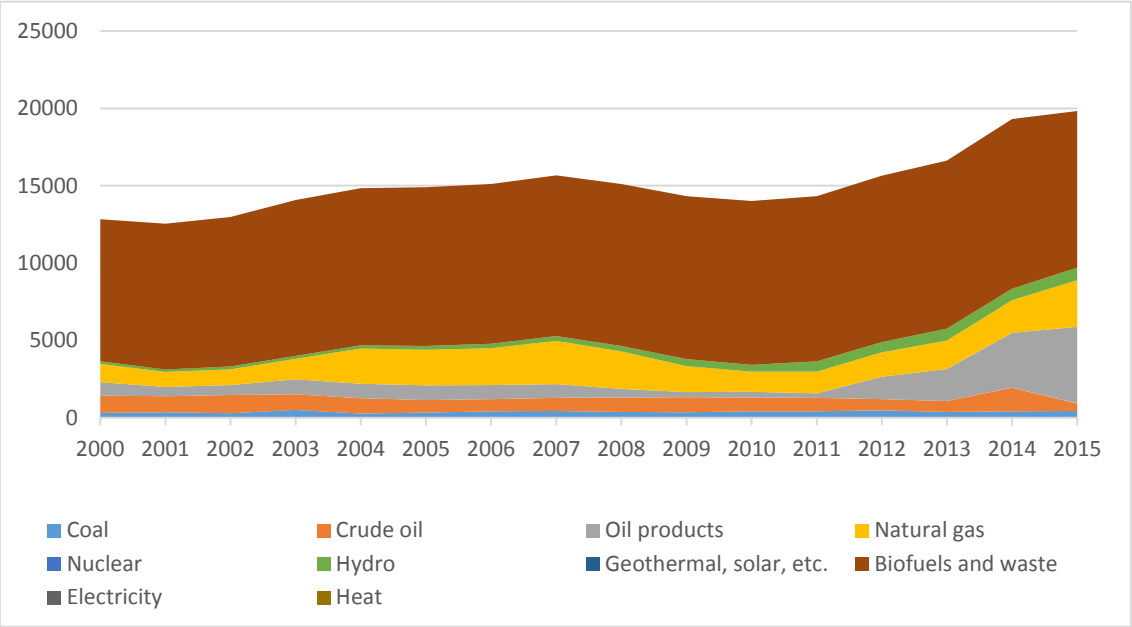
Sources: *World Bank (WB), **United Nations Development Programme (UNDP), ***International Monetary Fund (IMF), ****Directorate of Investment and Company Administration (DICA).

2.2.1 Energy Demand and Usage in Myanmar

Myanmar's energy supply is highly dependent on traditional biomass. Figures 2-1 and 2-2 show the total primary energy supply and final consumption in the 2000s. From about 70% at the beginning of the century, the portion of biofuels and waste in the total energy supply has only slightly dropped to 60%. Today, oil products have been experiencing an abrupt increase since 2011. Meanwhile, natural gas production and consumption have remained relatively stable. The contribution from coal has not been significant.

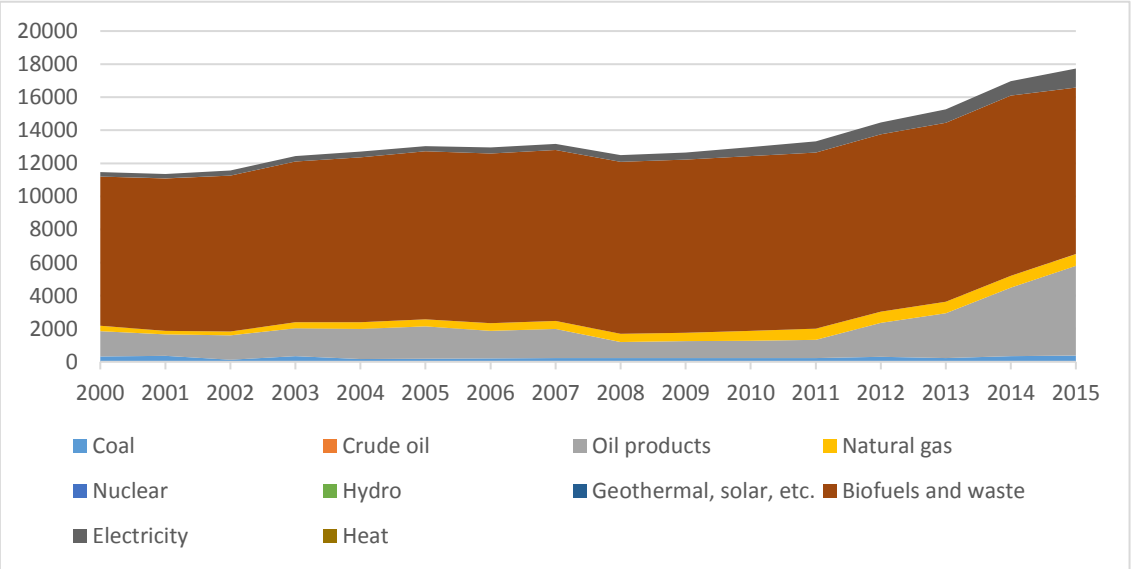
The residential sector is the largest energy consumer, as seen in Figure 2-3, although consumption by the transport sector has been growing in the last decade. Meanwhile, industry has remained stable at about 10%–12% of the total consumption. Other sectors' consumption continues at much lower levels.

Figure 2-1 Total Primary Energy Supply (ktoe)



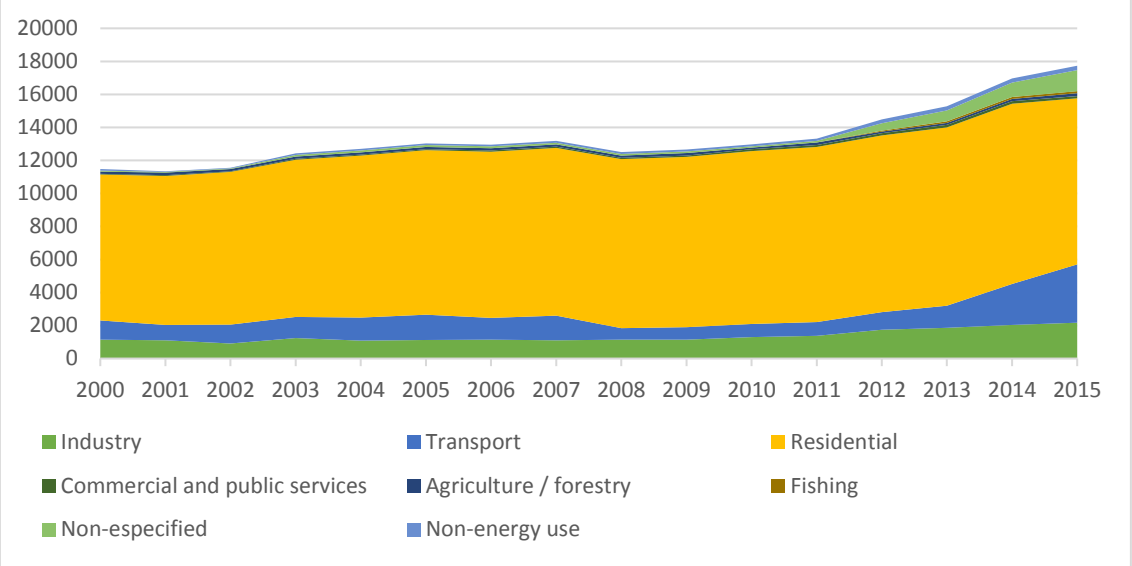
Source: International Energy Agency data.

Figure 2-2 Total Final Consumption (in ktoe)



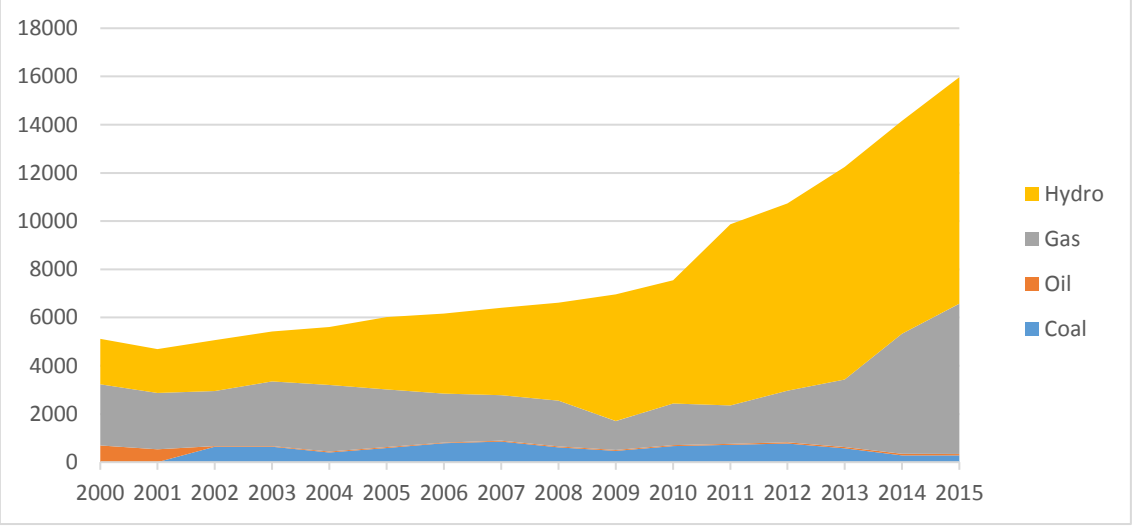
Source: International Energy Agency data.

Figure 2-3 Total final consumption by sector (ktoe)



Source: International Energy Agency data.

Figure 2-4. Electricity Production (GWh)



Source: International Energy Agency data.

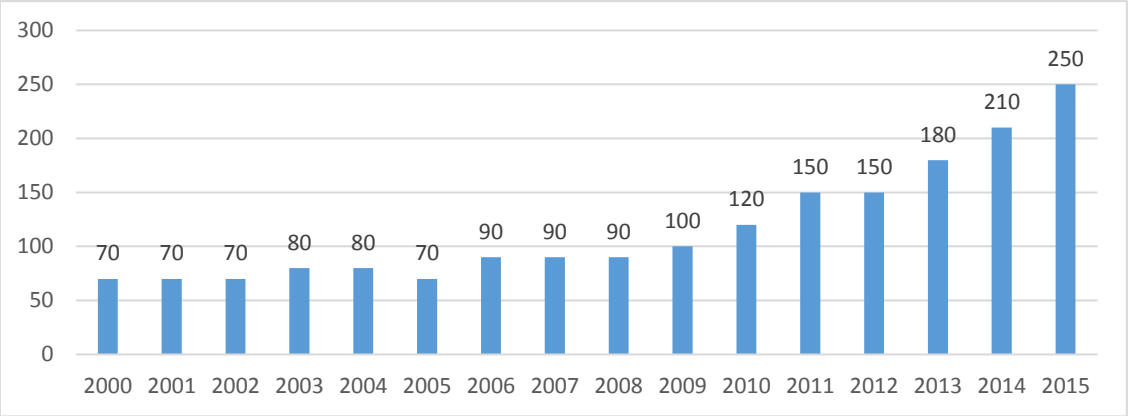
2.2.2 Rising Electricity Demand

Myanmar's electricity production was near 16,000 GWh in 2015 – a two-fold increase since 2010. The generation mix is dominated by hydropower and gas. Hydropower constitutes between 60%

and 70%, while natural gas accounts for the remaining 30%. Other sources comprise only a minority in the mix.

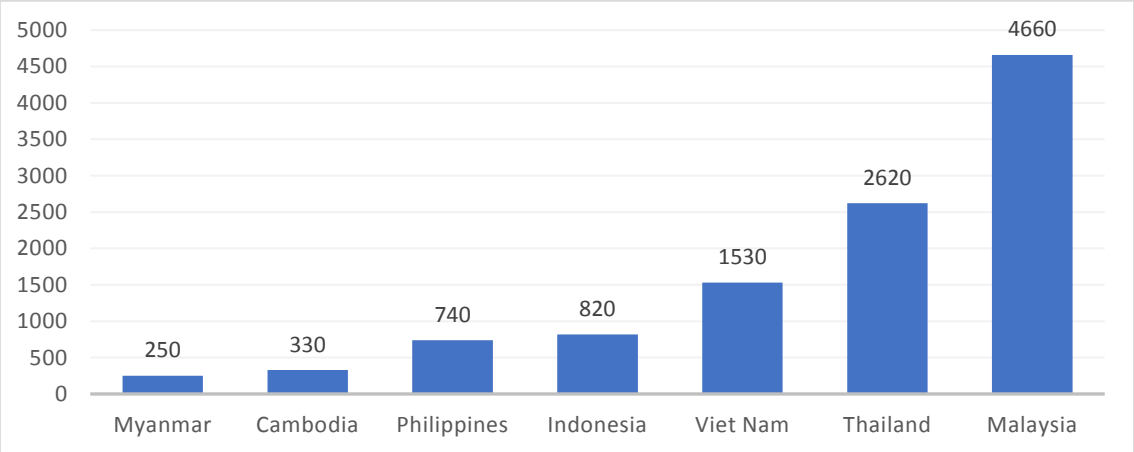
Figure 2-4 shows the rise in electricity production, which is accompanied by the rapid increase in electricity consumption per capita (see Figure 2-5). This notwithstanding, Myanmar remains to have the lowest electricity consumption per capita amongst ASEAN countries (see Figure 2-6).

Figure 2-5. Electricity Consumption Per Capita (kWh/capita)



Source: International Energy Agency.

Figure 2-6. Electricity Consumption In Selected ASEAN Countries (kWh/capita, 2015)



Source: International Energy Agency data.

2.3 Two-pronged Power Sector Challenge in Myanmar's Rural Electrification, Generation Expansion, and Tariff Reform

Myanmar is facing a two-pronged problem in the power sector. On one hand, a large portion of the population has none or little access to electricity; on the other hand, the population connected to the national grid experiences frequent blackouts.

2.3.1 Rural Electrification

Although there are varied figures available on Myanmar's access to electricity, all sources agree that at least half of the population lacks access to modern electricity. Furthermore, most electrified rural communities rely either on diesel generators, which are economically and environmentally costly; or on solar home systems, which do not provide sufficient power for productive uses.

The government of Myanmar aims to achieve universal electricity access by 2030. The National Electrification Plan, prepared with support from the World Bank, foresees that this will be achieved mainly by expanding the national grid. However, a shift towards decentralised alternatives such as mini-grids is gaining wider support. The Department of Rural Development (DRD) is Myanmar's leading governmental agency for rural electrification. The Electricity Law of 2014 favours decentralising the decision-making process for small off-grid projects. The Ministry of Electricity and Energy's (MOEE) approval is therefore not needed for projects of less than 30 MW and not connected to the national grid. The DRD has a wide network of representatives across the country that facilitates its work with local communities. Nevertheless, an inefficient coordination between the MOEE, which is in charge of the national grid, and DRD, which is under the Ministry of Agriculture, Livestock, and Irrigation, can become a drawback in the realisation of grid-ready projects.

2.3.2 Expansion of Generation Capacity

Increasing Myanmar's generation capacity is a priority of the government. The National Electricity Master Plan (NEMP), which the nation prepared with support from the Japan International Cooperation Agency (JICA), analysed three possible scenarios for capacity expansion:

1) **Domestic Energy Consumption Scenario**: maximisation of domestic power generation. Hydropower and gas-fired plants are fully developed.

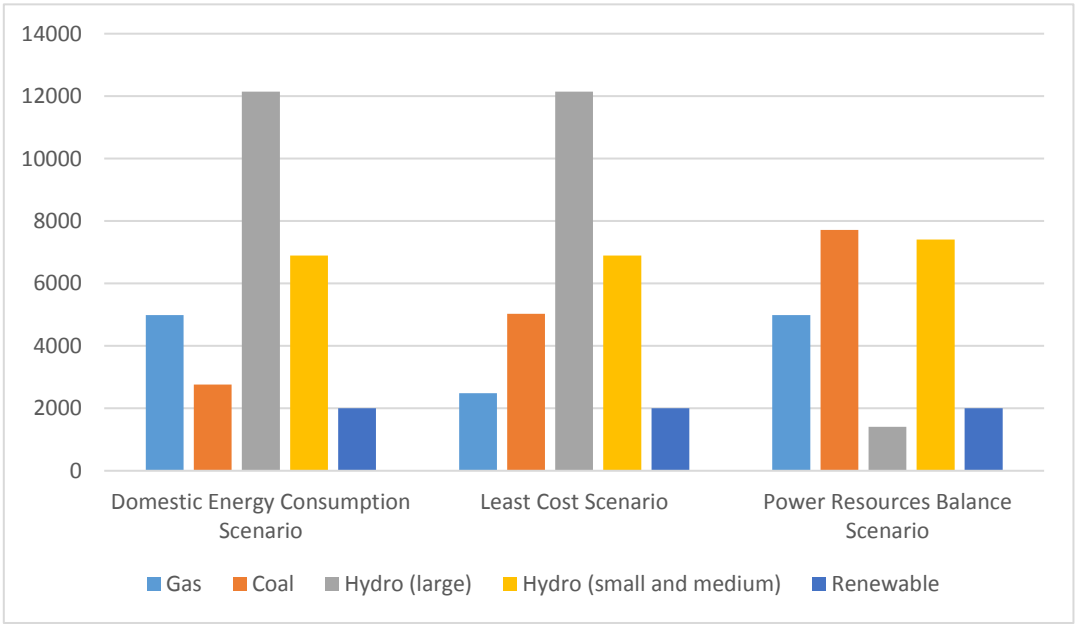
2) **Least Cost Scenario**: minimisation of overall generation cost. Coal-fired plants' contribution increases, while that of gas-fired generation decreases.

3) **Power Resource Balance Scenario**: feasibility of projects is also considered. Only hydropower plants with shorter lead-time and nearest to demand centres are developed. Gas-fired generation is developed but constrained by secured fuel supply. Coal-fired generation compensates the reduction in gas and hydro-power sources.

The Power Resource Balance Scenario was finally selected for the plan. Nevertheless, the large-scale development of coal-fired generation plants has become very controversial. Currently, the central government does not support the commissioning of new coal-fired generation plants.

The contribution from renewables as an exogenous assumption was set at 10% of the energy capacity in the NEMP. The role of variable renewables eventually lessened. In Chapters 3 and 4, such potential as well as barriers to the penetration of solar energy in the generation mix are explored.

Figure 2-7. Installed Capacity by Scenario and Source in the NEMP by 2030 (MW)



NEMP = National Electricity Master Plan.

Source: Japan International Cooperation Agency (2015).

2.4 Update on the Myanmar Power Sector

2.4.1 Power Demand Will Continue Rising with New Mega-development Plans in Urban Areas

Myanmar's economy is expected to continue to grow in the coming years (Rab et al., 2016). Urban areas are experiencing a refurbishing of the inner areas as well as expanding to adjacent townships. Yangon, for example, has new development projects. With assistance from JICA, the local government is drafting the Yangon 2040 Master Plan (Aye, 2017; JICA and YCDC, 2014), which includes plans on a new airport, a second special economic zone, and access to a deep-sea port (Mon and Aye, 2016). The Yangon New City project will extend Yangon to the other side of the Yangon River. Its specially created authority, the New Yangon Development Company Limited, has proposed a public–private partnership-based development of the 30,000 acre (about 121 sq km) area, of which 20,000 acres will be developed during the first phase (Ko, 2018; Shine and Ko, 2018). The Union government has also presented four large-scale development projects in Yangon and Mandalay recently (Tha, 2018). All these initiatives represent an opportunity to integrate rooftop solar systems in the urban development process.

2.4.2 Political Re-shuffle

The year 2017 saw a reshuffle of leadership at the MOEE and the country's national government. In July 2017, U Win Khaing was appointed as the new minister of Energy and Electricity, replacing U Pe Zin Tun while remaining as head of the Ministry of Construction (Lynn, 2017a). After Myanmar's President U Htin Kyaw resigned, U Win Myint was appointed to the position in March 2018. Both are seen as loyal allies of Aung San Suu Kyi (Nang and Paddock, 2018).

The new energy minister identified his minister's new priorities. In his first interview with international media outfit Reuters (Lewis and Naing, 2017), the minister pointed out that: (i) hydropower remains a priority, but in the future, no large dams are expected to be constructed *before* 2025; and (ii) imports of LNG and small-scale hydropower projects will be prioritised, with LNG to be used as part of the base load.

2.4.3 New Minister Advocates for Securing Supply in the Short Term: The Rise of LNG in the Power Generation Mix and a Boost for LPG

The new minister strongly emphasised the need to increase the generation capacity in the fastest

possible manner. Such priority facilitated the speedy approval of the construction of four new generation facilities, of which three are using imported LNG (Table 2-3). These are expected to be operational, at least partly, by 2020. Some memoranda of understanding (MoUs) have been signed with the MOEE while the signing of the power purchase agreements is still pending. The final agreement on the price to be paid by the government will be critical in the sustainability of the sector (Kean, 2018b).

Table 2-3. New Natural Gas and LNG Power Generation Projects Approved in 2018

Power plant	Capacity (MW)	Fuel	Consortia	Estimated Cost (US$ million)
Ahlone	356	LNG to power, FSRU	Toyo–Thai	321
Kanbauk	1,230	LNG to power, FSRU	Total and Siemens	
Kyaukphyu	135	Combined-cycle gas turbine (natural gas from Shwe)	Sinohydro and Supreme	180
Mee Laung Gyaing	1,390	LNG to power, FSRU	Zhefu and Supreme	2,507

FSRU = Floating Storage Regasification Unit; LNG = liquefied natural gas.

Source: Kean (2018).

Liquefied Petroleum Gas has been identified recently by the government of Myanmar as a way to reduce the consumption of electricity in urban areas. The current number of households that utilise LPG for cooking is very low; a shift in consumption to LPG is seen as an opportunity to 'free up' the nation's power generation capacity (K. Kyaw, 2018). The target is to increase the consumer base of LPG users from the current 100,000–150,000 households to 1 million–1.5 million households by 2020 (Htoon, 2018; K. Kyaw, 2018).

There are a number of challenges the government must overcome to be able to scale up the use of LPG. Adequacy of safety standards is the most worrisome (Chern et al., 2018). Myanmar has also little capacity to generate LPG and to meet most of the current consumption demand. The country demands 6,500 tons of LPG per month, of which 5,000 tons are currently being imported

(Eleven, 2018). Constraints in the supply chain and inadequate investments in the sector are also identified as drawbacks (Chern et al., 2018).

2.4.4 Coal

The merits and downsides of coal-fired generation of electricity remain a highly deliberated issue. The Union government does not favour any further development of the coal-fired electricity and coal mining plants (Phyo, 2017). Nevertheless, a 1,280 MW coal-fired project in the Kayin state has triggered a debate between the central and regional governments.

In the state government's proposal, the project would be built near Hpa-an, the capital of Kayin, by Toyo–Thai for US$2.8 billion (Mon, 2018). The state government reasoned that the project is necessary to increase electrification and attract more foreign investments (Myint, 2017a). Part of the public, however, opposed the project, claiming that there was lack of transparency in the process (Han, 2018; Naing, Lee, and Yimou Lee, 2017; S. P. Win, 2018).

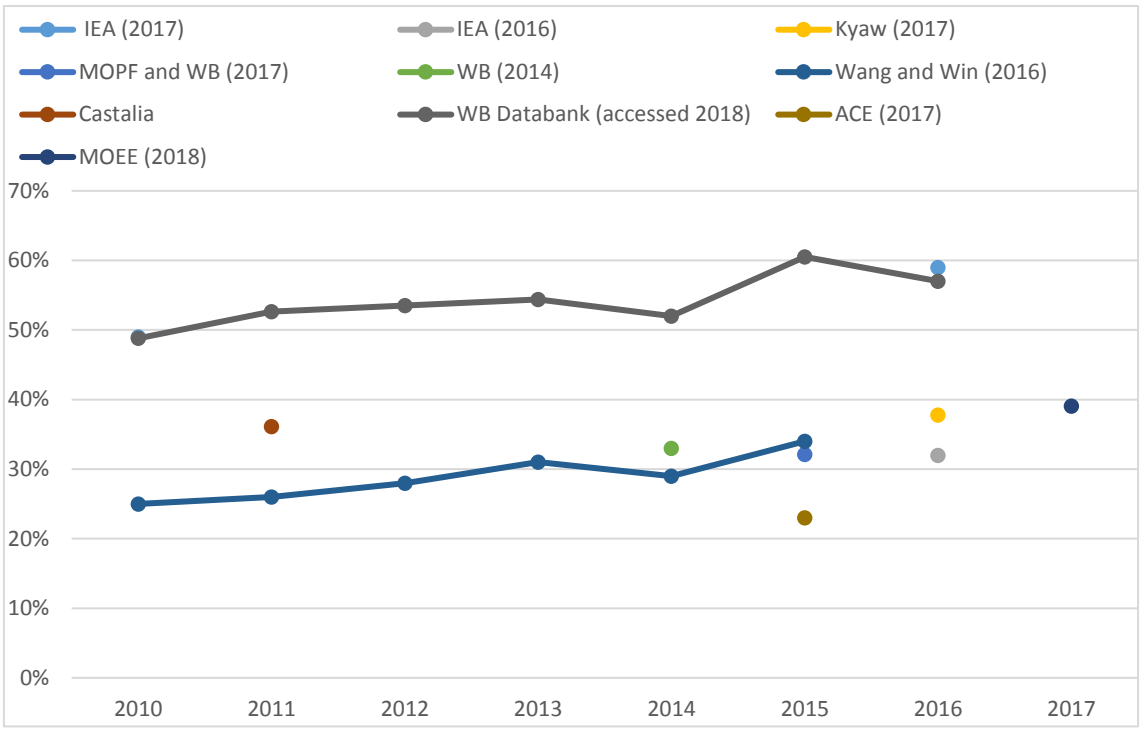
The Union government has, thus, stopped the project by virtue of the Electricity Law, which limits state governments' authority to approve power generation projects to those that are up to 30 MW only and not connected to the national grid (Htwe, 2017b; S. M. Mon, 2018b).

2.4.5 Rural Electrification Policy

The Myanmar government has set the goal of universal electrification by 2030, consistent with Goal No. 7 of the 2015 United Nations Sustainable Development Goals. To explore how to transition from the current situation to the desired state, it is crucial to understand the current level of electrification. Numbers vary from report to report, however Figure 2-8 shows the varying electrification rates based on different definitions, which makes it difficult to determine the actual rate. According to a report that looked at electrification in detail (Myanmar Ministry of Planning and Finance and Bank, 2017), the breakdown shows electrification through the main grid of 32.5%; by communal or private grids, 10.6%; by SHS, 17.4%; by rechargeable battery systems, 17.2%; and by others (e.g., power generator, solar lantern), 6%.

Most figures on electrification through the main grid are in the 23% to 32% range (ACE, 2017; MOPF and World Bank, 2017). It seems that the main grid's electrification rate is in the low 30% range, growing to 40% when mini-grid connections are included, and jumping to around 60% if SHSs are included.

Figure 2-8 Electrification Rates From Multiple Sources



Notes: International Energy Agency (2017a and 2016) and World Bank Databank (2018): for % of population.

Myanmar Ministry of Planning and Finance and Bank (2017): % of population weighted, connected to main grid only.

M. M. Kyaw (2017), World Bank (2014), Wang and Win (2016), and Ministry of Electricity and Energy Myanmar (2018): % of households.

Castalia Strategic advisors (2014): % of connections, national average excluding Yangon.

ASEAN Centre for Energy (2017): % grid-connected.

Under the National Electrification Programme funded by the World Bank, an initiative called '60/20/20' has been conducted since 2016 to encourage the installation of renewable energy-based mini-grids. The scheme involves the government subsidising 60% of the capital costs while villagers and developers/operators invest 20% each. This has proven to be a great incentive for developers, as the number of projects had increased from eight in the first year to 74 accepted project proposals by 2018 (Frontier Myanmar Research Ltd., 2018).

On the regulatory front, the World Bank and Deutsche Gesellschaft für Internationale Zusammenarbeit are working on a regulatory framework. Rather than instituting a new law, they are revising the present law known as the 2014 Electricity Law to institutionalise mini-grids. With this revision, the treatment of mini-grids will be facilitated. The framework will cover, for instance, the approval/licensing of mini-grid applications, permission for tariff setting with a reasonable profit, and options to take when the main grid arrives earlier than planned. Mini-grids connected to the centralised grid are expected to be under the jurisdiction of MOEE, while mini-grids that are not connected and therefore operate autonomously will be under the jurisdiction of state/regional governments (Pawletko, 2018; Greacen, 2018; Schmidt–Reindahl, 2018).

However, how the framework will be operationalised after the revision is still unclear. For example, the 2014 Electricity Law states that an 'electricity regulatory commission' should administer electricity activities, but such commission does not exist yet (Polastri Wint and Partners, 2014).