# Chapter 6

# Conclusions and Recommendations

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# Chapter 6

# Conclusions and Recommendations

## 6.1 Conclusions

Firstly, this study analysed the historical energy demand supply situation of Myanmar using Myanmar's national energy statistics. Myanmar basically has been depending on three major domestic energy types of hydropower, natural gas, and biomass and their share was 5%, 19%, and 43%, respectively (total of 67%) in 2017. The oil share was 32% in 2017 but it fully depends on imports. So far the coal share was just 1% in 2017 and surplus coal was exported to neighbouring countries. As a result, the import dependency ratio has worsened from 7% in 2010 to 19% in 2017 due to significant increases in petroleum demand such as gasoline and diesel oil used as transport fuel.

Next this study assessed the supply issues of each energy source, which are natural gas, oil, coal, hydropower, and renewable energy. The country's energy system contains energy security risks. Both oil and natural gas production have been showing a downwards trend. Further, existing plans to develop hydropower and coal-fired power plants may not be carried out as expected because of ongoing campaigns against their development.

When estimated under certain conditions, the magnitude of the economic effect of policy failure is large in underdevelopment of hydropower (US$91–US$321million per year) and overdevelopment of renewable energy (US$205–US$323 million per year), followed by underdevelopment of natural gas (US$75–US$112million per year). It suggests the government should place high priority on addressing issues related to these systems.

Next this study examined an energy mix, more precisely a power generation mix, target in 2040, which is considered desirable from an energy security point of view. In the process, access to energy, affordability, and environmental sustainability viewpoints are taken into account.

Two scenarios have been developed. One is a **clean scenario,** which suggests that coal use will be limited to domestic coal with high priority on the reduction of environmental loads. In other words, under this scenario, import amounts of natural gas will become larger. The other is a **least-cost scenario,** which pays attention to electricity rates, proposing that natural gas use is limited to a domestically available amount, 3.6 billion cubic metres per year. In this scenario, the rest of electricity will be generated from imported coal.

Which scenario is preferable for Myanmar? The gross domestic product per capita of Myanmar is projected at US$5,140 in 2040, which is almost equivalent to Thailand (US$6,128) and Indonesia (US$4,131) in 2017. Low electricity rates have great significance in Thailand's and Indonesia's policies. Therefore, it is not difficult to imagine that affordability will be still a key factor in 2040 for Myanmar to take into account in deciding the best energy mix target. In view of this, the study recommends the **least-cost scenario**,

which places high priority on low electricity rates, as the most viable option for Myanmar to take.

Base on the result of chapters 2 and 3, this study forecasts a new energy outlook scenario of Myanmar, namely the energy supply security (ESS) scenario base on the least-cost scenario mentioned in chapter 3. If Myanmar seeks affordability of energy supply, Myanmar will need to shift to more coal, hydropower, and biomass, with coal will be a key role player in future. Unfortunately, since the domestic coal supply chain is poor from the coal production sites in the north of the country to the coal demand sites in the south, transportation of coal will be limited. Therefore, the ESS scenario assumes a remarkable amount of imported coal. Import dependency and $CO_2$ emissions levels of the ESS scenario are almost same as in the business as usual (BAU) scenario, but energy supply affordability, oil demand, and preservation of natural gas resources are better than in the BAU scenario. As a result, this study recommends the ESS scenario as a feasible energy policy to maintain energy supply security for Myanmar.

Finally, this study presents recommended measures for enhancing energy security. The measures can be grouped into two: one is accompanied by structural changes in the energy supply and demand, including (i) improve energy efficiency, (ii) create well-balanced energy and/or import mix, (iii) improve environmental sustainability of coal-fired power plants, (iv) utilise LNG as a competitive fuel, and (v) cleaner use of traditional biomass and others. The measures for an emergency case includes (i) contingency plan and demand restriction, (ii) oil stockpiling, (iii) preserve gas and coal resources as a natural stockpile and (iv) develop a last-resort power plant.

### 6.2 Recommendations

This report describes the future energy demand supply situation if Myanmar can implement the energy supply security scenario, indicating: (i) power generation mix to shift to more coal and hydropower ,(ii) continued use of biomass, (iii) saving natural gas consumption, and (iv) appropriate increase of renewable energy such as solar PV and wind power generation. In addition, this report also emphasises the energy supply security scenario with three criteria: accessibility, affordability and sustainability. To realise the security scenario in the future, the Ministry of Electricity and Energy (MOEE) should establish comprehensive and appropriate energy policies with the support of laws, sub-decrees, and regulations. Otherwise, Myanmar will not be able to succeed in the implementation of the energy supply security scenario.

For the promotion of coal-fired power generation, the MOEE will be mindful of the need for the application of clean coal technologies. The MOEE will establish sub-decrees to regulate the owners of new coal-fired power plants to require them to apply super critical or ultra-super critical technologies to their power plants on a mandatory basis under stringent environmental regulation on air quality.

The MOEE will develop hydropower generation aggressively, but regulate environmental assessment sub-decrees and enforce hydropower entities to conduct environmental assessments before the construction of dams to mitigate damage to the ecosystem in the surrounding areas of the dams. As this is a matter for the Ministry of Environment, the MOEE should regulate the assessment sub-decrees with the collaboration of the Ministry of Environment.

The Oil and Gas Planning Department will request oil companies in Myanmar to stockpile 30 days of oil on a mandatory basis, and will establish a sub-decree on oil stockpiling. If some oil companies do not follow the sub-decree, the department will be able to demand them to stop business activities for around 1–2 months.

The continuous use of biomass will fully depend on the MOEE's support, which will provide efficient types of biomass cooking stoves to households especially in rural areas at reasonable prices. In addition, the MOEE will encourage private companies to develop a biomass supply chain in rural areas on a business basis. The MOEE will provide licences to private companies to engage in biomass logistics and monitor their business activities.

Regulations will not be needed for the promotion of various renewable energy types such as solar PV and wind power generation. On a business basis, the penetration of solar PV will depend on its affordability. In addition, the MOEE will seek international cooperation such as with ADB and the International Renewable Energy Agency to support the increase of variable renewable energy in Myanmar.

Last but not least, an Energy Efficiency and Conservation (EEC) Act will improve the energy supply security situation in Myanmar through savings of energy consumption. This is a matter for the Ministry of Industry, but as the EEC Act will be an important energy policy, the MOEE and the Ministry of Industry should cooperate to formulate this Act.

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