Chapter 5

Model Assumptions

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Chapter 5
Model Assumptions

This chapter focuses on model assumptions for projecting future energy demand and greenhouse gas (GHG) emissions in the business-as-usual (BAU) scenario and other scenarios in the case studies. The assumptions used were based on future values of macroeconomic, energy price, and other activity indicators such as electricity generation technologies, as well as energy development policies.

1. Macroeconomic Assumptions

(1) Population. In 2016, Myanmar's population was 52.92 million and is projected to increase at an average annual rate of about 0.7%, reaching about 62.93 million in 2040. No difference in population is assumed between BAU and other scenarios in the case studies.

(2) Gross domestic product (GDP). Myanmar's GDP grew at an average annual rate of 11.1% during 2005–2010 and was slightly down to 7.3% during 2010–2015. GDP is assumed to grow at an average annual rate of 7.0% during 2016–2025, followed by 6.5% in 2025–2030, 6.0% in 2030–2035, and 5.5% in 2035–2040. These projections are used to develop the BAU scenario and provide a base for the scenario of GDP changes in the case studies.

The assumptions on the growth of GDP and population are in Table 5.1.

Table 5.1. Assumptions on Annual Average Growth of GDP and Population, Myanmar

Period	GDP Growth (%)	Population Growth (%)
2016–2025	7.0	0.9
2025–2030	6.5	0.8
2030–2035	6.0	0.6
2035-2040	5.5	0.6

GDP = gross domestic product.
Source: Author, based on consultation with relevant ministries.

2. Crude Oil Price

Future changes in crude oil prices remain highly uncertain. In this study, the crude oil price (Japan's average import price [nominal dollars per barrel]) is assumed to increase from US$48 a barrel in 2016 to US$76 a barrel in 2020, and from US$125 a barrel in 2030 to US$185 a barrel in 2040. These assumptions are used to develop the BAU scenario and provide a base for the scenarios of high and low oil prices in the case studies.

3. Electricity Generation Technologies

3.1. Electricity Generation Thermal Efficiency

Thermal efficiency of electricity generation reflects the amount of fuel required to generate a unit of electricity. Thermal efficiency was set exogenously based on historical data in electricity generation and future development trends.

The base year 2016 thermal efficiency by fuel type (coal and natural gas) was derived from the 2016 energy balance tables. The efficiency of the coal thermal power plant is only 17.2%, which is lower than the normal standard because domestic coal is of low quality and, while the power plant has a rated capacity of 120 megawatts (MW), it operates at only 40% capacity. The efficiency of coal power plants is assumed to stay unchanged because no coal power plants have been developed after 2019. The efficiency of natural gas power plants in 2016 was 25.5% and is expected to reach 38% by 2040 as additional power plants with advanced generation technologies become available.

3.2. Electricity Generation Fuel Mix

The energy mix used in electricity generation is an important input for the energy outlook because it is a key driver for primary energy demand and GHG emissions. The energy mix is an exogenous input to the model.

The main sources of electricity generation are hydropower and natural gas power plants. By 2016, total installed capacity reached 5,400 MW, with the share of hydro accounting for 60.3%; natural gas for 35.6%; and coal, diesel, and solar photovoltaic (solar/PV) for 4.1%.

Hydropower plants will still play a major role in the future. Natural gas, coal, and renewable energy (RE) capacity is assumed to increase, resulting in a lower share of hydropower in the total generation capacity mix. The future capacity expansion plan is based on existing development capacity and possible additional capacity until 2040. It is assumed that about 15,900 MW will be installed by 2030 and 24,550 MW by 2040.

4. Other Energy Development Policies

Myanmar does not have a comprehensive national energy policy setting out a systematic approach to energy planning, policy formulation, and sector development. The existing energy policy is generally aimed at ensuring energy independence by increasing national production of available primary energy resources through intensive exploration and development.

The national energy policy and sectoral development policies are summarised as follows:

(1) Implement short- and long-term comprehensive energy development plans based on systematically investigated data on potential energy resources that are feasible and can be practically exploited, considering minimum impact on the natural and social environments.

For electric power, implement the following:

- (a) Expand the national power grid to effectively utilise power generated from available energy resources such as hydropower, wind, solar/PV, thermal, and other alternative sources.
- (b) Generate and distribute electricity using advanced technologies, and boost and enhance private participation in regional distribution activities.
- (c) Conduct environmental and social impact assessments for power generation and transmission to minimise these impacts.

(2) Implement programmes on a wider scale, utilising RE resources such as wind, solar/PV, hydro, geothermal, and bioenergy for sustainable energy development. The objectives of the RE policy are the following:

- (a) Formulate a national RE policy, strategy, and road map based on international practices and in cooperation with ministries.
- (b) Improve research projects.
- (c) Train local practitioners and transfer technology to small and medium-sized enterprises.
- (d) Develop RE standards and provide testing services to the RE market.
- (e) Strengthen international cooperation and collaboration in the RE sector.

(3) Promote energy efficiency and energy conservation. The objective is to implement as a priority an energy efficiency and conservation (EEC) programme in accordance with Association of Southeast Asian Nations (ASEAN) targets. The energy policy framework aims to do the following:

- (a) Institute laws, rules, and regulations (legal framework) required to implement an EEC programme.

(b) Institute a dedicated department responsible for implementing an EEC programme.
(c) Conduct capacity-building programmes and awareness-raising campaigns to promote EEC.
(d) Implement EEC programmes in industry, commerce, and households.

5. Case Studies

The BAU scenario was developed based on the above assumptions, and its energy demand and supply were projected based on the relationship between energy consumption and macroeconomic indicators such as GDP, oil price, population, as well as energy development policies that promote EEC and RE development. But these assumptions include lots of uncertainty.

Case studies or sensitivity studies are effective ways to analyse uncertainty. Some case studies include changes in GDP, high oil price, additional energy efficiency promotion, and RE development, with the following assumptions:

(1) Changes in GDP. GDP annual growth rate is assumed to increase or decrease, with an additional ±3% at the end of 2035–2040 (compared with BAU) (Table 5.2).

Table 5.2. Changes in GDP Annual Growth Rate, Myanmar

Period	BAU	GDP Increasing 3%	GDP Decreasing 3%
2016–2025	7.0%	7.6%	6.4%
2025–2030	6.5%	7.9%	5.1%
2030–2035	6.0%	8.2%	3.8%
2035–2040	5.5%	8.5%	2.5%

BAU = business as usual, GDP = gross domestic product.
Source: Author.

(2) Changes in oil price. Crude oil price is assumed to increase from US$185 by 2040 in BAU to US$250 by 2040, or steeply decrease to US$20 by 2040 (Table 5.3).

Table 5.3. Changes in Oil Price, Myanmar (US$)

Scenario	2020	2030	2040
Business as usual	76	125	185
Oil price increasing	76	158	250
Oil price decreasing	76	43	20

Source: Author.

(3) Promotion of EEC. Total final energy consumption (TFEC) is assumed to reduce by 10% (case 1, EEC10) and 20% (case 2, EEC20) compared with BAU through EEC activities in 2040.

(4) RE development. The share of RE sources (solar/PV and wind) is assumed to reach 10% (case 1, RE10) and 20% (case 2, RE20) of total power capacity (compared with a negligible share in BAU) by 2040. These increases are assumed for replacing natural gas power plants.

The maximum capacity factor of wind plants is 40%, solar/PV power plants 15%, and natural gas power plants 52%. This means that about 3.5 MW of solar/PV power could be replaced by about 1 MW of natural gas power, with the same amount of power generation outputs.