Chapter 5

Action Plans for Achieving the Energy Supply Security Scenario

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Chapter 5

Action Plans for Achieving the Energy Supply Security Scenario

Chapter 5 presents recommended measures for energy security enhancement. The measures can be grouped into two: one is accompanied by the structural changes in energy supply and demand, and the other group is the measures for emergency cases. We will discuss each group of measures in the following order.

Action plan for structural change	1.	Improve energy efficiency
	2.	Create well-balanced energy and/or import mix
	3.	Improve environmental sustainability of coal-fired power plants
	4.	Utilise LNG as a competitive fuel
	5.	Cleaner use of traditional biomass
Action plan for emergency case	1.	Contingency plan and demand restriction
	2.	Oil stockpile
	3.	Preserve gas and coal resources as a natural stockpile
	4.	Develop the last-resort power plant

Source: Authors.

5.1 Actions Plan for Structural Change

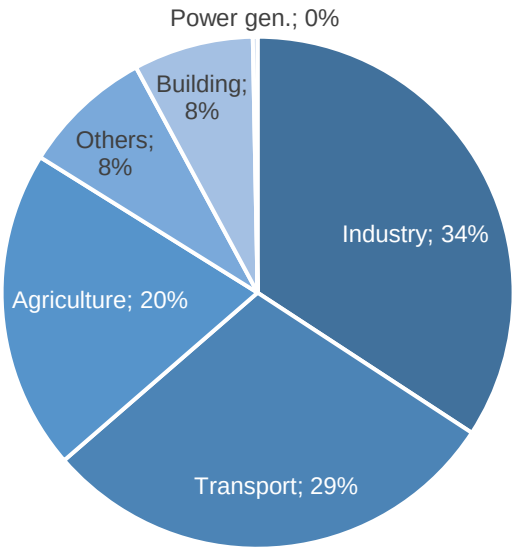
5.1.1 Improve energy efficiency

Every measure is required in all the sectors in order to reduce energy demand, hence the energy import requirement.

Oil

A reduction in oil imports is particularly important from the perspective of energy security because its self-sufficiency rate is the lowest. Industry and transport each account for about one-third of the total demand for oil (Figure 5.1). They are the two largest consumers of oil. Accordingly, measures for these two sectors will have the strongest impacts.

Figure 5.1: Structure of Oil Demand, 2017



Note: 'Others' consist of 'fishing' and 'final consumption not elsewhere specified'.
Source: IEA (2019a), World Energy Balances 2019.

Possible measures for the two sectors are listed in Table 5.1.

Table 5.1: Energy Efficiency Measures for Industry and Transport Sectors

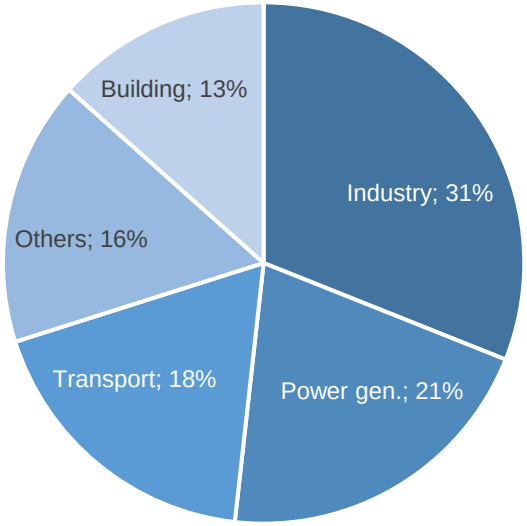
Industry	a.	Request energy consuming company to appoint a certified energy manager
	b.	Request energy consuming company to submit an annual energy report (energy efficiency target and achievement)
	c.	Provide energy efficiency learning programme
	d.	Provide energy audit service or invite an energy service company
	e.	Set a minimum energy performance standard (MEPS) for major industrial equipment
	f.	Change to cost reflective oil price
Transport	a.	Set MEPS for vehicle
	b.	Preferred tax rate for high efficiency vehicle
	c.	Periodical vehicle maintenance certificate
	d.	Request freight transport company to submit an annual energy report
	e.	Change to cost reflective oil price
	f.	Develop mass rapid transport mode, e.g. train or bus
	g.	Parking regulation that disincentivises passenger car

Source: Authors.

Other sectors

Industry occupies the largest share in the consumption of total energy, followed by power generation, transport, others, and the building sector (Figure 5.2).

Figure 5.2: Structure of Total Energy Consumption, 2017



Notes: Building: Sum of residential sector and commercial/public sector. It excludes consumption of biofuel and waste. 'Others' consist of 'agriculture/forest', 'fishing', and 'final consumption not elsewhere specified'.
Source: IEA (2019a), World Energy Balances 2019.

The industry and transport sectors consume mostly oil as sources of energy, the energy efficiency improvement measures for which are described above. Energy efficiency improvement measures for the power generation and building sectors are shown in Table 5.2.

Table 5.2: Energy Efficiency Measures for Power Generation and Building Sectors

Power generation	a.	Request power generator to adopt high efficiency technology
	b.	Set a maximum allowable degradation rate of thermal efficiency from design efficiency
	c.	Replace inefficient transformer
Building	a.	Set MEPS for heat insulation of building
	b.	Set MEPS for major appliances
	c.	Preferred tax rate for high efficiency building and appliances
	d.	Energy efficiency education in schools

Source: Authors.

5.1.2 Create well-balanced energy and/or import mix

The diversification of energy to use and the decentralisation of import countermeasures are important, as mentioned earlier. The government should nurture an environment for business and the people to take appropriate actions to achieve a well-balanced energy and/or import mix.

Establish, at least 10 years long, long-term plan

Changing the energy and/or import mix will require more than 1 decade. It is therefore necessary to establish long-term plans for a time span of 10 years or longer. The national and international energy situations and technologies will keep changing in the course of the long-term plan, but the commitment to achieving an optimum energy mix must not change. However, at the same time, it is not realistic to adhere to the share percentages of each energy component because of changes in surrounding conditions and technology. The energy mix targeted in the plan should be regarded as an overarching guide for decision making in specific policies and activities.

Share the principle of long-term plan amongst stakeholders

Energy supply and consumption involve many stakeholders. A good deal of consensus and concerted actions will help achieve the desired energy mix more efficiently. It is the responsibility of the government to not only formulate an energy mix plan, but also to broadly communicate its importance. Considering that the public sector is deeply involved in energy supply in Myanmar, consensus amongst government agencies and with energy suppliers is important. Already from the initial stage of plan formulation, public hearings and other measures should be carried out to enhance engagement of stakeholders.

Implement policies to guide the society

If the choice of energy type is left to the market, the use of inexpensive energy will increase and the desired mix will become unattainable. The same is true about the import mix. If left to market principles alone, dependence on cheap energy supply sources will be allowed to go up. Hence policy intervention is a must. Policy measures to guide the nation to the desired mix include the following:

- Set up targets and mandate compliance
- Set out a ceiling for each energy type and/or each supplier country
- Subsidise use of certain types of energy
- Make adjustments in taxes (lower rate for encouragement and higher rate for curbing)

5.1.3 Improve environmental sustainability of coal-fired power plants

To attain the recommended energy mix goals this study recommends the existing Tigyit coal-fired power plant needs to be continued and the two new projects (Kalewa and Keng Tong) must be steadily advanced. In addition, new projects based on imported coal must be realised.

One possible major impediment for the successful project implementation is opposition from the local communities. It must be reiterated that project acceptance by the local citizens is extremely important. Unless sufficient attention is paid in this regard, no successful project completion or stable plant operation will be possible. Environment protection measures must be implemented to the best possible extent to prevent local opposition. Specific actions will include:

- Review and upgrade the environmental standards for coal-fired power plants and apply such upgraded standards to all new plants.
- Review and upgrade the environmental assessment method for coal-fired power plants and apply such upgraded standards to all new plants.
- Study upgrade of environment protection measures at the Tigyit coal-fired power plant.
- Promote public relations (political importance of coal-fired power plants, environment protection measures).

In order to gain better acceptance, the involvement of local residents through the entire process of plant construction to operation will be needed to enhance their engagement and sense of participation.

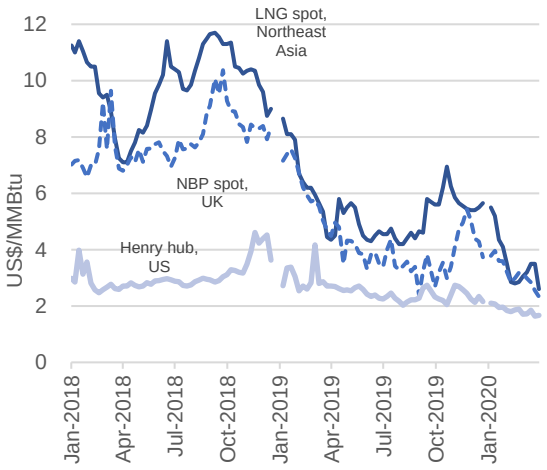
5.1.4 Utilise LNG as a competitive fuel

The recommended energy mix is based on the assumption that Myanmar will have kept supply of 10.8 Bcm of domestic natural gas in the year 2040. If this assumption is incorrect, the significance of using natural gas for energy self-sufficiency enhancement will be diminished and the energy and/or electricity mix picture will be altered substantially. It is necessary therefore to ensure the needed investment be made for the development of new natural gas resources. Needless to say, competitive terms and conditions should be offered to attract foreign investors in comparison to other gas producing countries.

If no new domestic resources are developed, is it better to exclude natural gas at all from consideration? The answer is no. As mentioned earlier, a well-balanced mix is key to attaining energy supply security. Even if domestic supply cannot be relied on, the use of natural gas as a component of the mix should be continued.

Imports of natural gas, particularly LNG, have perceived to be a costly option, especially in comparison to coal. It should be noted however that since 2019 the LNG spot price has been at unprecedentedly low levels because new liquefaction plants have come on stream and demand has slowed (Figure 5.3). The international market price is low enough to compete against the wholesale price of domestic natural gas to power plants in Myanmar (Table 5.3). Natural gas, although imported, would help lower the price risks considerably. Put differently, the development of domestic natural gas resources would pose big economic risks to Myanmar if the international price of LNG is to remain low. Even though the importance of domestic natural gas in energy supply security remains unquestionable, switching from domestic development to imports is worth considering if the domestic production is excessively higher than the import price.

Figure 5.3: World's Natural Gas/LNG Spot Price



LNG = liquefied natural gas; MMBtu = million British thermal units; NBP = national balancing point.
Source: Created from World Gas Intelligence.

Table 5.3: Comparison of Natural Gas Delivered Price at Power Plant (US$/MMBtu)

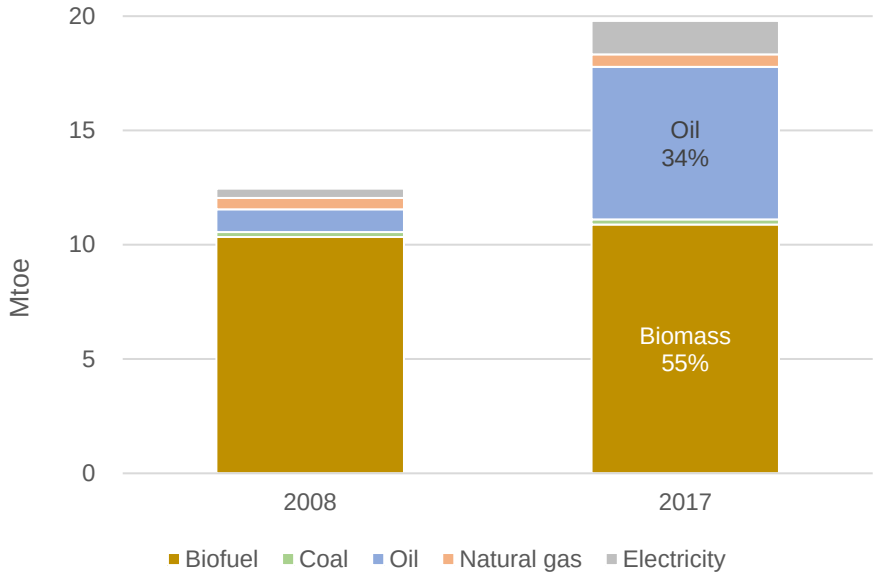
Import	Spot LNG price, cif	3–7
	Re-gas cost	1
	Delivered price at the power plant adjacent to re-gas terminal	4–8
Domestic	Delivered price at the power plant	10–12.5

cif = cost, insurance, and freight; LNG = liquefied natural gas.
Sources: IEEJ databank, World Gas intelligence.
Estimate from data provided by Ministry of Energy and Electricity, Dec. 2019.

5.1.5 Cleaner use of traditional biomass

Biomass is the predominant energy source in the household sector (Figure 5.4). Whilst biomass energy will be replaced by electricity, petroleum, or natural gas eventually, conversion by households will take a long time. Continued use of biomass is also a desirable option in terms of energy security as well as affordability and environmental sustainability. If Myanmar supplied LPG to all households instead of biomass, it will more than double the oil demand. Accordingly, proactive continuation of biomass use in households, accompanied by energy efficiency improvements and pollution prevention is a viable and realistic option.

Figure 5.4: Final Energy Consumption by Energy Type



Mtoe= million tons of oil equivalent.
Source: IEA (2019a), World Energy Balances, 2019.

Clean biomass cookers should be purchased by individual users, ideally speaking. However, a voluntary switch is unlikely to occur because the convenience and socioeconomic importance of such cookers is not well recognised by the general public. In addition, most households that depend on biomass energy are believed to have limited cash revenue. Thus, in order to effectively spread the use of clean cookers, subsidies or even free distribution must be considered.

5.2 Action Plan for Emergency Case

5.2.1 Contingency plan and demand restriction

The first thing to do in an emergency situation is to draw up a contingency plan. A contingency plan should consist of actions to cut demand and secure supply. Here, we discuss drawing up a contingency plan and cutting demand.

A contingency plan is drawn up in the following sequence.

a) Categorise the demand sector and count their demand

A decline in energy supply will force allocation to various users according to their relative importance. To do so, first determine the order of priority for energy supply and calculate their respective demand.

The highest priority will be given to keeping the government running and ensuring other functions indispensable for the lives of people (Table 5.4). The second group to be given priority are households because they are vulnerable compared to enterprises.

Table 0.4 Example of Priority to Protect Energy Supply

Primary	Government offices
	Military force, police, fire departments
	Water, energy supply
	Telecommunications
	Agriculture, food supply
	Hospitals
Secondary	Households
Tertiary	Other industries
	Other services

Source: Authors.

b) Study options of demand cut

For each sector, the possibilities of demand reduction should be explored, looking into every end use. For instance, the petroleum demand of a household can be cut by restricting the use of automobiles. Car use restriction can vary from selective restrictions (car number plate) to a complete ban. The demand cut can vary depending on the restriction intensity. It is recommended to have multiple demand cut options prepared in this way according to restriction intensity. This will make the subsequent work of supply and demand balancing easier.

c) Formulate scenarios of supply interruption

For every type of energy, the possibility of supply interruption should be assessed for the entire supply chain. The scenarios should be grouped according to their probability of occurrence and magnitude (severity). Large amounts of data would be required for a quantitative assessment of interruption probability. It may be

substituted by a qualitative assessment such as high, medium, or low probability. For the assessment of interruption magnitude, the 'N-1' method used for adequacy assessment of power supply can be applied.

d) Calculation of supply availability

For each scenario, the supply availability should be calculated in the case that supply is interrupted. In the supply availability, any additional supply possibilities should also be considered. Examples of such additions could include increasing production, tapping oil stockpile, and suspending natural gas exports.

e) Allocation of supply

The supply availability assessed in C) is compared against the prioritised demands assessed in A) and the demand cut options determined in B) to determine the allocation of the supply. The process described in A) through E) is not linear or sequential. The assessments should be repeated and modified with feedback from each assessment step until the best possible solution is found.

The next subsection will discuss the major measures to secure energy supply.

5.2.2 Oil stockpile

Stockpiling is an effective measure against oil import interruption. Myanmar has already embarked on oil stockpiling (Table 5.5). The focus is on the stockpiling of petroleum products, a strategy consistent with the currently low capacity utilisation of the oil refineries. Oil demands in Myanmar are expected to grow steadily. Oil stockpiling capacity is required to progress at a rate faster than the demand increase.

Table 0.5 Oil Stockpile in Myanmar

		2016 actual	2020	2025
National	Crude	12 days	10 days	9 days
	Product	28 days	30 days	33 days
Private	Product	6 days	8 days	12 days

Number of days is consumption equivalent.
Source: MOME (2019b).

There are two ways to stockpile (Table 5.6). One is to build tanks within the national territory and the other is to purchase use rights of oil stockpiled in a foreign country ('ticketing'). Each method has its advantages and disadvantages. Myanmar should decide whichever best suits, or a mix of both, the country's circumstances. The partial use of the ticketing method is a good option, since the stockpile can be built up quickly and the risk can be spread out geographically by ticketing.

Table 0.6 Comparison of Oil Stockpiling Method

	Construct storage tank in national territory	Ticketing
Risk	Free from foreign risk	Free from homeland risk
Development	Need construction time	Immediate
Discharge	Immediate	Need shipping days

Note: Ticketing is a contract with another country to make use of oil in their tanks when necessary.
Source: Authors.

5.2.3 Preserve gas and coal resources as a natural stockpile

Myanmar possesses its own natural gas and coal resources. They can be considered as natural stockpiles. From the energy security perspective, these natural resources should be conserved as long as possible and should be maintained to be immediately ready for production and supply in emergency situations.

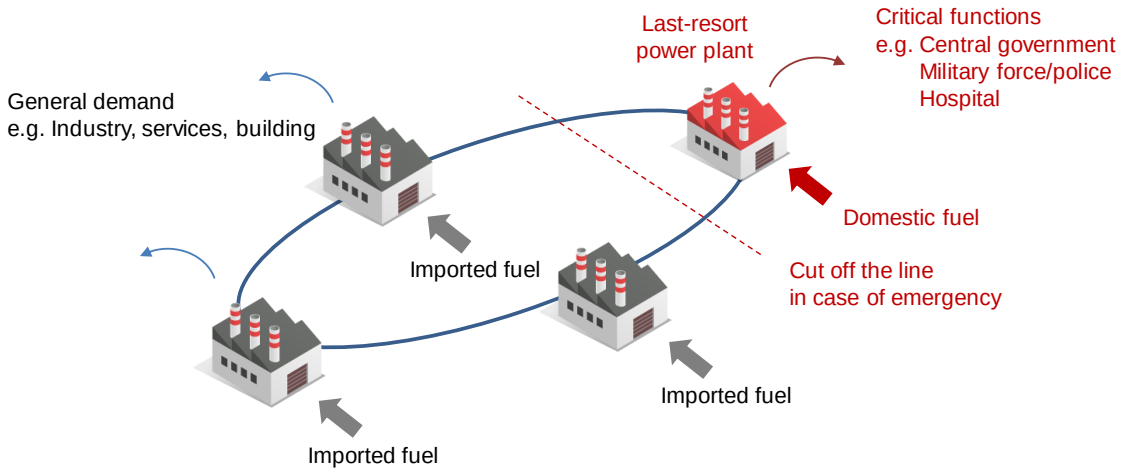
To secure domestic natural resources for long periods, investment for exploration and development should be made constantly and production levels should be controlled to prolong the production plateau for the longest time possible and moderate the pace of decline. Exports of natural gas, meanwhile, earn foreign currency, and in this sense exports should be maximised ideally. Natural gas conservation for energy security and export maximisation for acquisition of foreign currency are a trade-off. A fine balance must be maintained between them.

For maintaining a production and supply system, a certain level of production must be maintained at all times including in normal times. Once production is discontinued, it takes a long time to resume operations of the natural gas field or the coal mine. No prompt response is feasible. Therefore, the most realistic strategy will be to control the production with attention to the conservation requirement, accompanied by a contingency plan and procedures for production increase in emergency situations.

5.2.4 Develop a last-resort power plant

Electric power supply can be interrupted for many reasons. Coal-fired power stations could be halted by fuel shortages. Even with hydropower generation or renewable energy, it can easily happen that power generation is disrupted unexpectedly affected by river volume, sunshine, or other weather conditions. A way to reinforce readiness against such power disruptions is to select a last-resort power plant especially outfitted with features to counter potential risks and continue generating electricity (Figure 5.5).

Figure 5.5 Concept of the Last-resort Power Plant



Source: Authors.

In the selection of such a last-resort power plant, the risks and the availability of countermeasures should be weighed (Table 5.7). For instance, hydropower generation is domestically produced energy and generally free from risks originating in other countries. However, it is exposed to meteorological risks. Weather risks are beyond control and there can be no remedies once the risk becomes a reality. In contrast, thermal power generation based on imported energy has low weather risks but is vulnerable to overseas risks. Overseas risks however can be addressed by stockpiling and other preventive measures.

Table 0.7 Potential Risk and Availability of Counteraction

	Hydropower Plant	Gas / coal power plant	Oil power plant
Foreign risk	Zero – Low *1	Low – High *2	High
Meteorological risk	High	Low	Low
Availability of counter action			
Against foreign risk	-	Available	Available
Against meteorological risk	Not available	Available	Available

*1 Risk is low if a hydropower plant is located downstream of an international river.
*2 Risk is low if a power plant is fuelled by domestically produced energy. Risk is high if a power plant is fuelled by imported energy.
Source: Authors.

If power generation in any circumstances is to be pursued, the best option is to use a dual fuel (natural gas and oil) combined cycle gas turbine. The turbine is operated by natural gas alone in normal times. In the event of natural gas supply interruption, power generation is continued using oil from the stockpile tank. This kind of power plant will enable continued supply of electric power if meteorological or international incidents should occur. Note that oil stockpile costs are required in this option.

The second-best option is hydropower generation. In normal situations, power generation is stable and at low cost. However, it is subject to uncontrollable weather risks. This option alone does not guarantee 100% security.