YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME

# A STUDY ON THE EFFECTS OF RURAL ELECTRIFICATION IN BAGO REGION (CASE STUDY: INTAGAW TOWNSHIP)

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MPA - 17 (18th BATCH)

JULY, 2019

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# A STUDY ON THE EFFECTS OF RURAL ELECTRIFICATION IN BAGO REGION (CASE STUDY: INTAGAW TOWNSHIP)

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Public Administration (MPA)

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This is to certify that this thesis entitled "**A Study on the Effects of Rural Electrification in Bago Region (Case Study: Intagaw Township)**" submitted as a partial fulfilment towards the requirements for the degree of Master of Public Administration has been accepted by the Board of Examiners.

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# ABSTRACT

A study on the effects of rural electrification in the Bago Region is conducted with the aim to investigate the changes in daily lifestyle among rural households after access to electricity. A quantitative case study research design with a face-to-face interview is used for this study. The structured questionnaires are used to collect data about the current rural electrification via 150 households taken as samples from three selected villages in Intagaw Township at Bago Region. According to the findings of the study, access to electricity has resulted that there is an agreement of respondents to the improvement in education, health, and income. The households get extra time due to the facilitation in doing their daily routine tasks by using electronic devices, and they can use that extra time in doing other works, or praying, or enjoying the entertainment with their family members. But the effect of electrification is inefficient because they are reluctant to take the risk of running their own business by taking advantage of electricity. Moreover, the perception of the respondents on the improvement in the provision of public services such as transportation networks and security related to the electrification is also low. All of the selected three villages experienced the positive effects of rural electrification, despite the additional income generated from new occupations that resulted from access to electricity is still low.

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| | |
|---|---|
| ALRI | Acute Lower Respiratory Infections |
| BOT | Built-Operate-Transfer |
| $CO_2$ | Carbon Dioxide |
| COPD | Chronic Obstructive Pulmonary Diseases |
| EIA | Energy Information Administration |
| EIA | Environmental Impact Assessment |
| EPC | Electric Power Corporation |
| ESB | Electricity Supply Board |
| GW | Giga Watt |
| IEC | International Electrotechnical Commission |
| IPP | Independent Power Producer |
| JV | Joint Venture |
| kW | Kilowatt |
| LED | Light-Emitting Diode |
| LNG | Liquefied Natural Gas |
| MEPE | Myanmar Electric Power Enterprise |
| MOE | Ministry of Energy |
| MOEE | Ministry of Electricity and Energy |
| MOEP | Ministry of Electric Power |
| MW | Mega Watt |
| NEP | National Electrification Plan |
| PPA | Power Purchase Agreement |
| SDGs | Sustainable Development Goals |
| SIA | Social Impact Assessment |
| W | Watt |

# CHAPTER I
# INTRODUCTION

## 1.1 Rationale of the Study

Access to electricity has become an indispensable factor not only for the development of the national economy but also for the facilitation and growth of households and firms. For economic activities and the overall health and well-being of communities, access to electricity and clean and modern form of energy is instrumental. So, access to electricity is one of the challenges at the global, regional and national levels. There is a strong linkage between universal access to electricity and the development of the economy. If a country electrified the whole country, it can exploit all of its resources with the maximum outputs and vice versa, if a country cannot do so, their economy can also be inefficient. Electricity can produce from various sources such as – fossil fuels as coal, oil, natural gas, and nuclear power; and renewable sources such as water, solar and wind. Sources of electricity can also be classified into chemical energy, thermal energy, kinetic energy, nuclear energy, rotational energy, and solar energy.

Electrification is deeply correlated with the socioeconomic status of the people since it can improve the education by getting more study hours even in the night time and using electronic devices and internet access, and the health by using more modernize electronic equipment in clinics and hospitals and some medicine which must store in the fridge. These cannot get if there is no modern form of electricity. Moreover, unreliable other energy sources can cause serious damage to the environment by cutting down the plants for wood fire and it also takes many risks to health by unclean air condition in the houses and it can even cause to firing. Since the electricity has the direct and indirect effect of the well-being of the people, access to electricity has an enormous and spillover effect onto the electrified region.

According to the World Bank data, there are four countries, Brunei, Malaysia, Thailand, and Vietnam, in the ASEAN regions which have a 100 percent electrification rate since 2016. Myanmar has become implemented to the 100 percent

universal access to electrification in 2030 with the loan provided by the World Bank. There are many factors that reluctant to expand the national grid system to the remoteness area of the country such as the geographical situation in the mountainous area and the weak institution of land policies. Moreover, the current electricity supply of Myanmar is too much depend on the hydropower and that resource is insufficient to meet the demand of the country.

Access to electricity in Myanmar is one of the lowest in the ASEAN region and it is about 57% of the total population and about 39% of the rural population of the country. Therefore, the majority of the people in rural areas cannot access to national-grid electricity and they still use the unclean or unreliable energy for cooking or lighting. Moreover, the states and regions in which access to electrifying also experienced the shortage of electricity especially in the summer. According to the data from the Ministry of Electricity and Energy, the highest peak load of electricity generation is 3,300 megawatts (MW) per day and the highest peak load of electricity demand is 3,680 megawatts (MW) in this April 2019.

At present, the Myanmar government is implementing the National Electrification Project (NEP) with the support of the World Bank to achieve universal access to electrification in 2030. To achieve a 100 percent electrification rate, Myanmar government also takes into account the participation of the private sector with the mini-grid electricity to the remoteness area and installation of coal-fired power plants which has many potential capacities in the whole country and it can meet the demand of higher over time. Myanmar government also tries to decentralize the energy sector by means of mini-grid of hydropower and solar panel with the participation of the private sector. The second phase of the NEP is to electrify that mini-grid by connecting to the national grid system.

Accessing electrification from the national grid is the most reliable energy source and it is one of the most crucial factors in driving the national economy. According to these inspirations described above, this study examines the effects of rural electrification after accessing the electricity with the case study of selected three villages in the Intagaw Township, Bago Region.

## 1.2 Objective of the Study

The objective of the study is to investigate the effects of rural households after access to electricity.

## 1.3 Method of Study

A quantitative case study research design and descriptive method are used for this study. The structured questionnaires are used to gather data about the perceptions of rural households on the current status of electricity supply in selected villages of the Intagaw Township, Bago Region.

Primary data are obtained from the survey and secondary data are obtained from Bago District Engineer Office, the website of MOEE, and other publications.

## 1.4 Scope and Limitations of the Study

The villages selected for the sample are met the following criteria: the villages in which access to national-grid electricity is within 5 years from the survey conducted year, 2019, and which is ranked as the village by the General Administration Department. Among all States and Regions, Bago Region is located to the nearest of Yangon Region, the most urbanize and commercialize region, but still have many rural characteristics.

The focus study area is conducted in Thar Noe Kone, Chan Thar Kone, and Thar Yar Kone Villages. A total of 150 households is selected for the survey focusing on the effects of electrification in these villages after 2015 when the electrification programs are initiated. A structured questionnaire is used which includes three main parts: the characteristics of the households, the perception of households on the status of education, health, and income generation activities, and the public services provision, to examine the effects of electrification in the rural area.

## 1.5 Organization of the Study

This study consists of five chapters. Chapter I is an introduction that includes the rationale, research objectives, method of study, scope and limitations and organization of the study. Chapter II presents literature review with three topics which are electrification, benefits of electrification to economic growth and poverty reduction, and electricity and sustainable development goals. Chapter III mentions the supply of electricity in Myanmar which composes of the evolution of the electric power sector in Myanmar, analysis of the electricity sector and distribution of electric power in Myanmar, and electrification policies and programs in Myanmar. Chapter IV is the empirical analysis on rural electrification effects in the Bago Region which

is organized with survey profile, socioeconomic background of the study area, the current condition of electricity distribution, and effects of electrification in the study area. Chapter V deals with the findings of the survey and recommendations.

# CHAPTER II
# LITERATURE REVIEW

An adequate supply of reliable energy is essential for economic development. There is a link between the amount of energy use and the growth of an economy. If increased energy use leads to increase economic growth of an economy and which in turn leads to poverty reduction.

## 2.1 Electrification

Electricity is the most versatile and easily controlled form of energy and it can be produced with entirely renewable methods, such as wind, water, and sunlight. Electricity is weightless, easier to transport and distribute, and it represents the most efficient way of consuming energy. Electrification is the conversion from using another form of energy to using electricity (International Electrotechnical Commission, 2019). There are many methods of generating electricity by means of heat engines fueled by combustion or nuclear fission and the kinetic energy of flowing water and wind or other energy sources of solar photovoltaics and geothermal power. The provision of electricity services can be performed by grid expansion, diesel generators, renewable energy sources and/or hybrid systems.

Grid extension is the widely used method to expand the existing national or regional networks to connect communities to get electricity. This type of electrification is an efficient way to support additional capacity and demand as it only needs to extend from the existing node (Vladimir, 2016).

The modern diesel generator can provide moderate amounts of electrical generation. The fuel is relatively common and can be stabilized, and has high volumetric and weight energy density. But fuel can be extremely expensive or completely inaccessible and maintenance of these generators is non-trivial, especially where spare parts may be unavailable. From the point of environmental impact assessment, the generators are often noisy, highly polluting and have low overall efficiency.

Nowadays, water power is more useful for off-grid, small scale electrical power. These systems range in size from ~100W to ~10kW. They may require only immersion in a rapidly moving stream, or possibly a simple pipe to build additional water pressure with a controlled descent. The amount provided by these generators is sufficient to recharge small battery-powered electronic devices such as mobile phones and LED lanterns. Larger micro-hydro plants require a small dam and can provide power for appliances such as refrigerators and desktop computers. The critical problem that both the small and large hydroelectric generation faces is they rely upon the consistent flow of water. These generators can fail during times of drought or dry season without the buffer afforded by a large dam. Moreover, they are quite environmentally friendly, simple to maintain and do not require fuel.

Solar photovoltaic power is an effective, affordable and accessible method to supply electricity to remote and isolate areas. Solar electricity has not required fuel and simple to maintain but solar energy is only available during the day, and even poor weather can render a system nearly useless. The energy storage can avoid this problem but this is difficult and costly.

In the last few decades, the large-scale development of wind turbines has advanced considerably but it has not had a significant impact on rural and remote electrification, especially in poverty-stricken areas. The relative complexity, high-cost and inconsistent generation has far restricted the application of wind power in rural electrification.

Thermoelectric generation from a temperature difference is not typically considered as a means of providing electricity, except in certain specialized applications such as waste heat recovery and harsh environment wireless sensing. The current state of the art thermoelectric generation is limited to small capacity and poor thermodynamic efficiency. And usual materials used for thermoelectric modules such as lead, tellurium, and bismuth are toxic.

These systems mentioned above (except grid extension) do not require massive capital investment but they are usually at low voltage and low power. These electrification modes can generate important amounts of electricity in locations such as Africa, Southeast Asia, and the Indian subcontinent.

Biomass is used for facility heating, electric power generation, and combined heat and power. The term biomass encompasses a large variety of materials, including wood from various sources, agricultural residues, and animal and human waste.

Biomass can be converted into electric power through several methods. The most common is direct combustion of biomass material, such as agricultural waste or woody materials. Woody biomass such as wood chips, pellets, and sawdust are combusted or gasified to generate electricity. Woody biomass used for generating electricity at a commercial-scale facility rather than a utility-scale project (U.S. Department of Energy, Federal Energy Management Program, 2016).

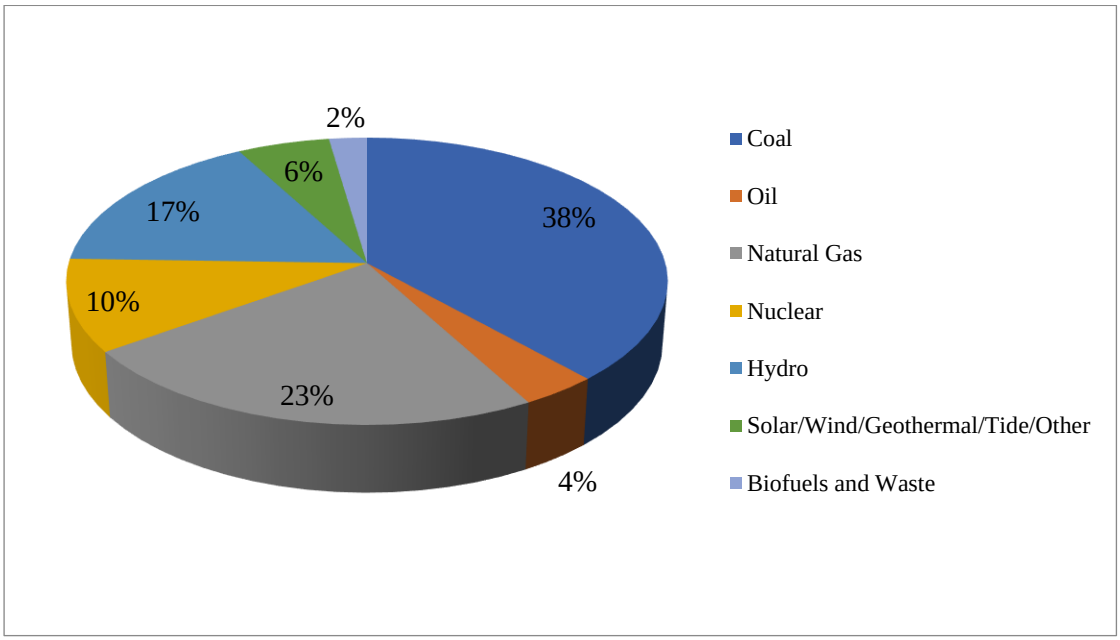
Coal plays a vital role in electricity generation worldwide. Coal-fueled power plants currently fuel 37% of global electricity and, in some countries; coal fuels a higher percentage of electricity (World Coal Association, 2019). Coal, like other fossil fuel supplies, takes millions of years to create but releases its stored energy within only a few moments when burned to generate electricity. Because coal is a finite resource, and cannot be replenished once it is extracted and burned, it cannot be considered a renewable resource. Moreover, coal emissions also cause urban smog, which has been linked to respiratory ailment, and coal-fired power plants also contribute to global climate change (Pace Energy and Climate Center, 2019).

Natural gas has become a very popular fuel for the generation of electricity because of its clean-burning nature. Since the 1990s, natural gas has become the fuel of choice for new power plants built due to economic, environmental and technological changes. New technology has allowed natural gas to play an increasingly important role in the clean generation of electricity. Indeed, natural gas is an extremely important source of energy for reducing pollution and maintaining a clean and healthy environment. Burning natural gas in the place of other fossil fuels emits fewer harmful pollutants, and an increased reliance on natural gas can potentially reduce the emission of many of these most harmful pollutants (Natural Gas and the Environment, 2013).

Nuclear power plants are fueled by uranium, a naturally-occurring element found in the Rocky Mountains and in countries such as Canada, Australia, and South Africa. The nearly infinite energy that is stored in uranium atoms makes nuclear power possible. Like fossil fuels, uranium is a finite non-renewable resource. The nuclear power plant can be seen as a "clean" electricity source since the nuclear plants themselves do not release any of the "traditional" power generation air pollutants, such as sulfur dioxide, carbon dioxide or nitrogen oxides. Besides, the requirements for the operation of nuclear power plants result in environmental impacts, including air emissions, at all stages of the uranium fuel procurement process. However, a major failure in a nuclear power plant's cooling system can create a nuclear meltdown, where

fuel rods melt within a matter of seconds. The heat from the uncontrolled reaction can melt everything it comes into contact with. Catastrophic accidents could injure or kill thousands of people. The risk of this type of catastrophic accident and the subsequent release of massive quantities of radioactive materials carries severe consequences for all forms of life (Electricity from Nuclear Power, 2019).

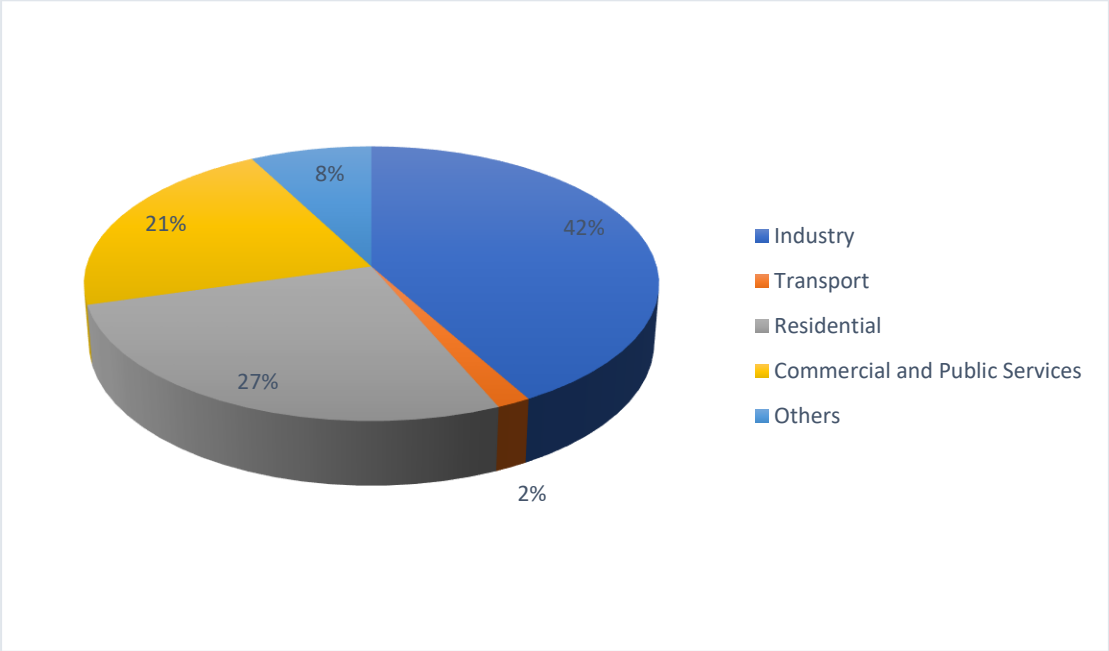
**Figure (2.1) World Gross Electricity Production, by Source, 2017**




Source: International Energy Agency, Electricity Database, 2017

In 2017, generation from combustible fuels accounted for 67.3% of the total world gross electricity production. Combustible fuels include coal and coal products, oil and oil products, natural gas, biofuels including solid biomass, industrial waste, and municipal waste.

**Figure (2.2) World Electricity Consumption, by Sector, 2017**




Source: International Energy Agency, Electricity Database, 2017

Figure (2.2) describes the consumption of world electricity consumption by sector in 2017. The industry sector which includes agriculture, mining, manufacturing, and construction used 42% of total world electricity consumption. Residential-use such as heating, lighting, and appliances, consumed 27% of the world's electricity. Public services and commercial uses such as lighting, heating, and cooling of commercial buildings, and the provision of water and sewer services consumed 21% of total world electricity consumption.

## 2.2 Benefits of Rural Electrification to Economic Growth and Poverty Reduction

All the conditions for economic growth cannot obtain from electricity alone, but it has a critical role for basic human needs and economic activity. Access to electricity can improve socioeconomic conditions in developing countries because it can influence important sectors of the nation such as health, education, income, and environment. Moreover, access to more efficient means of production, and access to the electrical grid and better electricity services can save the time of households and allow them to work more hours.

Lack of access to energy and more precisely to electricity is one of the major impediments to economic development. Chaurey, Ranganathan, and Mohanty (2004)

argue that a strong correlation exists between rural poverty and access to electricity because electricity is a pre-requisite for productive activities. In addition to improving productivity by giving access to more efficient means of production, access to an electrical grid and better electricity services could also lead to household time savings and allow them to work more hours by increasing their access to markets (Bernard and Torero, 2011). Rural electrification programs seem to be crucial to improve living conditions and promote development; however, there is also a need for evaluation of such programs' impacts to determine whether or not interventions are relevant and cost-effective. Evaluations would indeed provide measurements of results and help identify the causal link between the intervention's activities and these socio-economic outcomes.

Dinkelman (2011) uses panel data and two identification strategies, namely the instrumental variables strategy and fixed effects approach. Her main findings include a positive effect of electrification on female employment. She details that new infrastructure seems to increase hours of work for both men and women. If women are released from home production, their wages tend to decrease while men appear to earn more money.

Focusing on India, Bhattacharyya (2006) claims that “rural electrification alone is unlikely to resolve the energy access problem because of low penetration of electricity in the energy mix of the poor.” More recently, however, van de Walle et al. (2013) find positive effects of rural electrification on consumption and earnings, as well as on schooling girls. They find that wage rates are not affected by the intervention and find positive externalities for electrification.

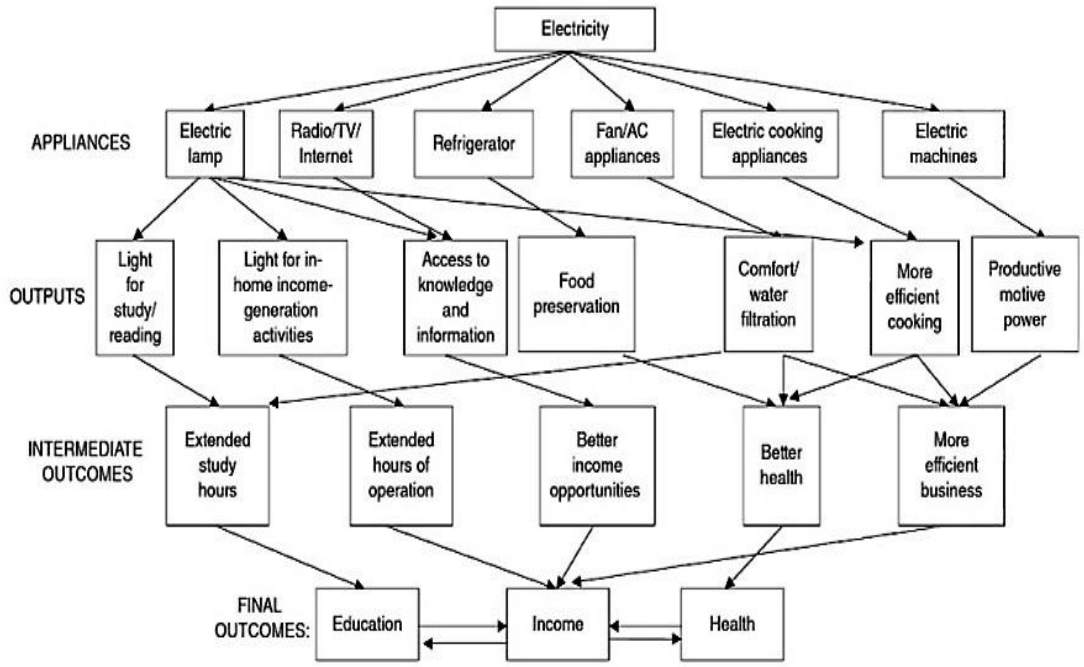
The more positive view of the role of rural electrification and its relation to poverty reduction has interesting implications for rural development strategies as a whole. Most people living in poverty are in rural areas living below the poverty line (70% in rural as opposed to 30% in urban areas). Earlier thinking was that rural poverty could be alleviated by raising agricultural productivity (Johnston and Mellor 1962). Underpinning this notion was agriculture as a labor-based activity suitable for income-earning possibilities in a labor abundant and capital scarce developing economy (Hayami and Ruttan, 1971).

In this case of poverty reduction could be served by encouraging urban and non-farm growth, although some attention would need to be given to raising farm productivity where this is low. Rural lighting, by improving possibilities for education, would help remove the bottleneck of failure to get an urban job by raising

skills and increasing prospects of rural non-farm employment (Gibson and Olivia 2009). In his book of Rural Electrification and Rural Development, Cook (2013) points out that the effect of rural electrification on small businesses should be determined by the nature of the local community, the complementary programs and the ability of rural entrepreneurs. He further emphasizes that although electricity is an important and essential input that can spur and help in the development of small industries, the other complementary conditions such as access to good rural markets and adequate credit should also be considered.

It is widely recognized that the larger share of benefits from rural electrification is captured by the non-poor. Two factors underpin this anti-poor pattern in electrification: which communities get connected and which households can afford the connection once the grid is available. In many countries communities to be connected to the grid are identified on a "least cost" basis, which favors larger communities nearer to the existing grid, roads, and towns. Although off-grid connections can serve remote communities that may not be connected to the grid for some years, they do not necessarily reach the poor better than grid extension does.

**Figure (2.3) Social and Economic Impacts of Electricity on Households**




Source: Khandker, Barnes, and Samad 2013

Figure (2.3) shows the evidence of the impact of rural electrification on household welfare and that in turn affect the rural economy as a whole. Farm

productivity improves with the use of electric pumps for irrigation. Non-farm productivity in both small commercial and home businesses also may increase due to the ability to keep working or stay open after dark. This improved productivity may be the result of having electric lighting during the evening hours or more efficient electric tools and machinery.

Other benefits are harder to quantify. But many of them are most likely internalized by the household and so reflected in the willingness to pay. The exceptions are public good benefits, such as street lighting, which increases security, and the so-called "global benefits" of reduced carbon dioxide emissions, where applicable. Benefits are further reduced by technical issues, including supply problems. Singh and Ali (2001) have reiterated that government expenditure on rural telecommunications, electricity, and roads can have a substantial impact on rural poverty reduction. It is estimated that more than two billion people live today in energy poverty, without the benefits of electricity. Rural electrification has gained prominence in recent years with the heightened interest in infrastructure in relation to the core part it can play in improving welfare and reducing poverty (Fishbein, 2003; Singh and Ali, 2001; World Bank, 2008).

Electricity as consumption and an intermediate good has been linked to income growth and therefore a causal relationship exists between income and infrastructure (Cook, 2012). Rural electrification promises a brighter future for many rural communities and in the long term, the benefits of providing electricity to poor households can be high. Whereas demand for energy in urban areas is high due to large commercial enterprises, the energy demands of the commercial sector, small industry, and communities in the rural areas follow similar evolutions to those of households as economic activity increases (World Bank, 1996). Electricity is an important condition for the development of rural businesses and that under the right circumstances it can result in significant economic growth.

Rural areas without electricity have a worse record of business development when compared to rural areas provided with electricity. A study conducted by the World Bank in the Philippines revealed that small home businesses wore more active in areas with electricity (World Bank, 2008). Rural electrification has the potential of improving the quality of life of rural life in various ways. The energy demand is rapidly growing throughout the developing world where there is an increased need for

energy to support various services like domestic and small-scale services (Abdullah and Markandyab, 2012; Barnes, 2012).

The relation to the provision of electricity to its rural population is still lagging far behind in the developing countries, several of the emerging economies have successfully provided electricity to their rural populations. As an example, over 90 percent of rural people have access to an electricity supply while in Costa Rica, more than 95 percent of the rural population receives electricity supply from cooperative and government energy agencies (United Nations, 2005). Similarly, more than 95 percent of the rural households in Tunisia have access to the electricity supply (World Bank, 2008). In Kenya, the government has fostered rural electrification in the country using grid and off-grid supply through diesel stations or renewable energy sources such as solar, wind, and biogas. The Rural Electrification Authority (REA) that was established in 2003 has been at the forefront in the provision of electricity to rural populations (Abdullah and Markandyab, 2012). The government continues to connect electricity to most public institutions in rural areas such as trading centers, public secondary schools and health centers due to their significant role in achieving rapid growth (Ondari, 2010).

## 2.3 Electricity and Sustainable Development Goals

The 2030 Agenda for Sustainable Development includes a set of 17 Sustainable Development Goals (SDGs) with 169 targets and 230 indicators. In which, seventh SDGs is to ensure access to affordable, reliable, sustainable and modern energy for all. With Goal 7, energy is finally recognized as a key enable for development. Universal access to energy, a higher share of renewable energy and massive improvements in energy efficiency are now part of the top global priorities for sustainable development in the years to come.

Energy is crucial for achieving almost all of the SDGs, from its role in the eradication of poverty through advancements in health, education, water supply, and industrialization, and to combat climate change. Energy access, renewable energy, energy efficiency, and other energy-related issues are also contributing to the achievement of almost all SDGs.

Energy, especially electricity, is the golden thread that impacts most of the 17 Sustainable Development Goals (SDGs) and the development of every nation and economies. The United Nations has recognized energy as a cornerstone for economic

development, facilitating poverty and hunger reduction efforts, improving education, women's empowerment and healthcare.

IEC claims that SDG 1, end poverty in all forms everywhere, is facilitated by accessing new technologies and basic services such as electricity and water supply. Access to reliable electric power is often the first step in overcoming poverty. Production and commercialization of efficient stoves as well as the rise of the renewable sector can create jobs and small businesses and can lead to income generation for both men and women. Furthermore, families save money and time due to reduced fuel demand for cooking and lighting. So, access to energy services is a pre-requisite for economic development and makes entrepreneurial activities beyond daylight hours possible.

More than 1/3 of food produced is not eaten and food waste is the third-largest emitter of greenhouse gases. Through the strengthening of the cold chain post-harvest and slaughter, food waste and greenhouse gas emissions could be halved to directly help reduce world hunger, SDG 2 which is known as the end hunger achieve food security and improved nutrition and promote sustainable agriculture, and that can be possible only where the areas which can access the electricity. To increasing agricultural productivity, energy is needed for irrigation as well as for cooking, drying, milling, pasteurizing, and further processing activities. Almost all irrigation systems need the energy to pump water.

SDG 3, ensure healthy lives and promote well-being for all at all ages, can be achieved when the cooling and proper conservation of medicines and vaccines are available by means of electricity. Over half of deaths among children less than 5 years old, from acute lower respiratory infections (ALRI), are due to particulate matter released from indoor air pollution from household solid fuels. According to WHO, 3.8 million premature deaths annually from non-communicable diseases including stroke, ischemic heart diseases, chronic obstructive pulmonary diseases (COPD) and lung cancer, are attributed to exposure to household air pollution. According to WHO, smoke form traditional cooking technologies causes 4.3 million premature deaths per year.

Electrical and electronic hardware can support education, including communication technology, computers, routers, video, and radio. So, the access of electricity can easily get the mission of SDG 4, ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. The efficient cooking energy makes that: children to spend less time on collecting firewood thus can have

more time to go to school, women, and girls to spend less time on cooking due to more efficient cook-stoves, using of less fuelwood to reduce the cost for school feeding programs, and thus more children attending school can get a warm meal. Nevertheless, lighting can permit home study even in the evenings and can make evening classes possible. The use of educational media and communications in schools, including computers, the internet or movies is not possible without electricity.

To fulfill SDG 6, ensure availability and sustainable management of water and sanitation for all, supplying water requires a large number of electrical and electronic water management systems such as the pumps extract water, transport it from wells through pipelines to purification, filtration and desalination systems. 663 million people do not have access to clean drinking water. Water purification and desalination using solar or wind energy could help to address this issue. Energy-saving cook-stoves and more efficient technologies for charcoal production reduce the pressure on forests and other woody ecosystems by reducing the demand for firewood and charcoal. Erosion can be diminished.

To promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, SDG 8, the relevance of energy is critical. The production and commercialization of improved stoves, as well as the production/selling / installing of PV products and related services, creates jobs and small businesses for men and women. Furthermore, energy access and energy efficiency enable enhanced productivity and inclusive economic growth. Renewable energy employed 8.1 million people around the world in 2015, excluding large hydropower.

To build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation, SDG 9, modern and efficient energy technologies are essential. With these techniques, the emission of $CO_2$ will be less. Information and communication technologies, including the internet and mobile phones, need the energy to work.

The impacts of all on-grid and off-grid energy generation effect the SDG 11, make cities and human settlements inclusive, safe, resilient and sustainable, by means of urbanization that involve electrical or electronic hardware for communication or data collection. Access to energy is a basic service to meet basic needs such as safe and healthy cooking and indoor and outdoor lighting in the evening. Clean cooking

and lighting address household and ambient air pollution.

The electricity is an integral part of implementation in SDG 12, ensures sustainable consumption and production patterns because there need to use the electronic technologies of harvesting, storage, production, and cooling. Efficient cook-stoves and sustainable forestry practices including efficient charcoal production contribute to sustainable management and efficient use of natural resources. Energy is crucial to reduce food losses along with food supply and value chains via cold storage, drying, etc.

Up to 25% of black carbon emissions come from burning solid fuels for household energy needs. Therefore, the access to electrification can only be achieved to the SDG 13, take urgent action to combat climate change and its impacts.

## 2.4 Review on Previous Studies

There are many studies that analyze the effects of rural electrification, especially in developing countries.

Rajib Bosu, Md. Mahbub Alam, and Md. Fazlul Haque (2017) studied the Socio-Economic Impact of Rural Electrification Program in Bangladesh. In this study, they examined how electric energy supply can be more cost-effectively and with fewer losses, which can be safer and more affordable to rural. They explore that cost-effective electric energy supply has been changing everyday lifestyle in about 90 percent areas of Bangladesh.

Valentine S. Kembo (2013) analyzed Socio-Economic Effects of Rural Electrification in Tala Division, Kenya. This study explores the households mostly use electricity for domestic appliances with lighting being 100 percent while few community-facilities are connected with shops at 79 percent connection. Although the households felt that they are developed and rural electrification has had positive improvements in their lives, it is not sufficient to have increased disposable incomes.

Lee, Miguel, and Wolfram (2019) explored Experimental Evidence on the Economics of Rural Electrification. In this study, they discuss implications for current efforts to increase rural electrification in Kenya and highlight how credit constraints, bureaucratic red tape, and low reliability. They explored average electricity consumption is low among newly connected households and they do not find medium-run impacts on economic and non-economic outcomes.

Litzow (2017) studied the Impacts of Rural Electrification in the Kingdom of Bhutan. This study finds that rural electrification program led to improvements in education and reduced fuelwood consumption. And there is inconclusive evidence of the effects of rural electrification on non-agricultural employment and no effect on health.

Burlig and Preonas (2016) analyzed Developments Effects of Rural Electrification in India. In this study, they find a substantial increase in electricity use but reject effects are larger than 0.26 standard deviations across numerous measures of economic development. They explore that rural electrification may be less beneficial than previously thought.

Khaing Zaw Nyein (2016) studied the impact of rural electrification in Myanmar with the case study of Thanlyin Township. This study found that electrification projects can immediately affect the improvement of household living conditions by having access to electric power followed by improvement in productive activities. But the effect of rural electrification relating to public services provision is low and most of the respondents experience positive impacts of access to electricity on their livelihoods.

# CHAPTER III
# SUPPLY OF ELECTRICITY IN MYANMAR

## 3.1 Evolution of the Electric Power Sector in Myanmar

In the pre-independence period, Myanmar national leaders formulated the two years plan for Economic Development of the Union of Myanmar (1947). In that plan, they decided to exploit the natural resources in Myanmar and use it in the implementation of the hydropower projects as they realized that to develop and modernize the agricultural system, the electricity played a vital role.

On 1951 October 1st, Electricity Supply Board (ESB) was established under the Ministry of Industry according to the Electricity Act 1948. The Electricity Supply Board was changed to the Electric Power Corporation (EPC) on March 16, 1972. On 1st April 1975, the Ministry of Industry was reorganized as the Ministry of Industry (1) and the Ministry of Industry (2), and the EPC was composed under the Ministry of Industry (2). On 12th April 1985, the Ministry of Industry (2) expanded the Ministry of Energy, EPC was composed under the Ministry of Energy. On 1st April 1989, EPC was changed into the Myanmar Electric Power Enterprise (MEPE). On 15th November 1997, the Ministry of Energy expanded the Ministry of Electric Power as the tripartite organization which is composed of the Department of Electric Power, the Myanmar Electric Power Enterprise and the Department of Hydropower. On 15th May 2006, the Ministry of Electrical Power was reorganized as the Ministry of Electrical Power (1) and the Ministry of Electrical Power (2). And then, these two ministries were merged again as the Ministry of Electrical Power on 5th September 2012, and under which there were three departments, two enterprises, and two corporations.

Burma Oil Company (B.O.C) controlled the Myanmar Oil Industry including production, refining, and distribution of oil since the British colonial period until the post-independence period of 31st December 1962. On 1st January 1963, the Myanmar Government undertook all the above operations with the name of the Public Oil Enterprise under the Ministry of Mine. On 28th February 1970, it was changed as Myanmar Oil Corporation by the notification letter (1/70) of the Ministry of Mine.

Myanmar Oil Corporation carried out the operations of the oil exploitation, drilling, production, refining and distribution of petroleum products.

On 12th April 1985, the Ministry of Energy was organized by the notification letter (41/85) of the State Council of the Socialist Republic of the Union of Burma and the notification letter of (5/85) of the cabinet, and under which there were six organizations such as (1) Minister's Office, (2) Energy Planning Department, (3) Myanmar Oil Corporation, (4) Petrochemical and Gas Corporation, (5) Petroleum Products Corporation, and (6) Electric Power Corporation.

Myanmar Electric Power Enterprise was changed and organized as the Ministry of Electric power by the letter No. 40/97 Ah Pha Ya 97 (3) of the cabinet of the Union of Myanmar dated on 16th November 1997. The departments and enterprises under the Ministry of Energy, therefore, became as follows:

(1) Minister's Office

(2) Energy Planning Department

(3) Myanmar Oil and Gas Enterprise

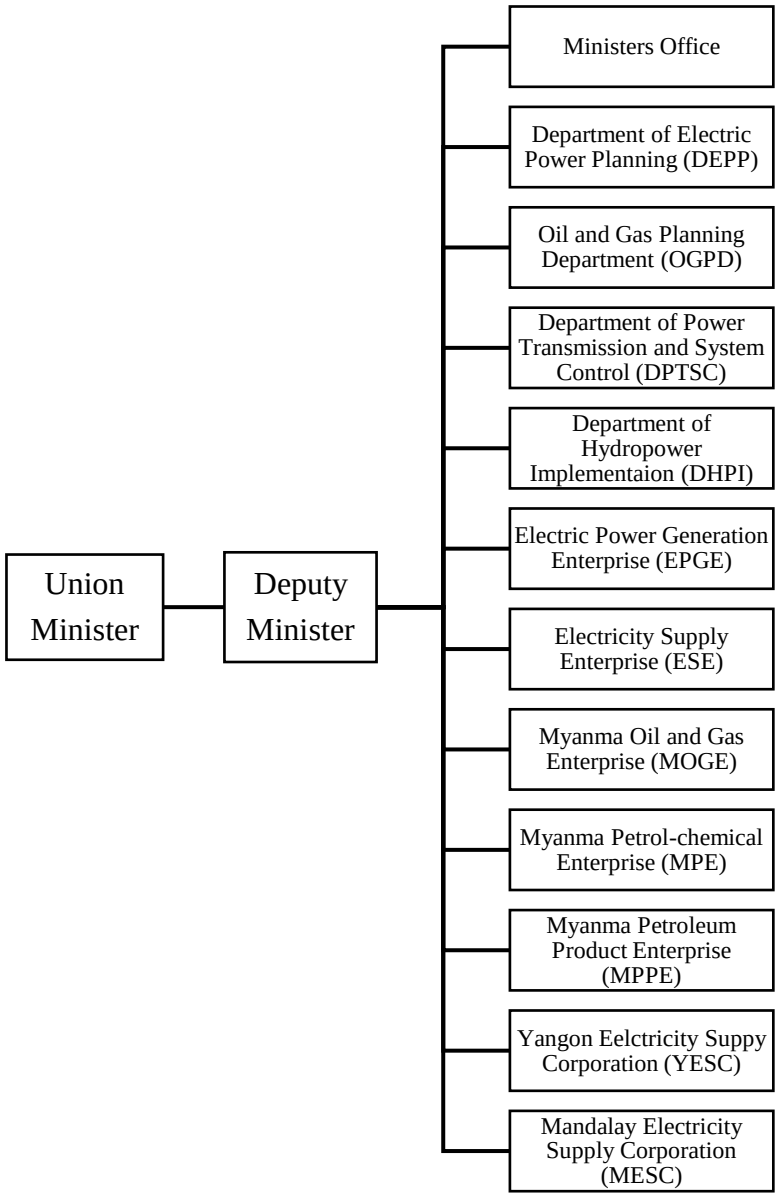
(4) Myanmar Petrochemical Enterprise

(5) Myanmar Petroleum Products Enterprise.

On 1st April 2016, Ministry of Electric Power (MOEP) and Ministry of Energy are merged as Ministry of Electricity and Energy (MOEE) which is taking the responsibilities of electricity, oil & gas and renewable energy (hydro, solar, bio-fuel & geothermal) sub-sectors (Statistics Ministry of Electricity and Energy, 2019).

Figure (3.1) shows the organizational structure of the Ministry of Electricity and Energy under which there were four departments, five enterprises, and two corporations.

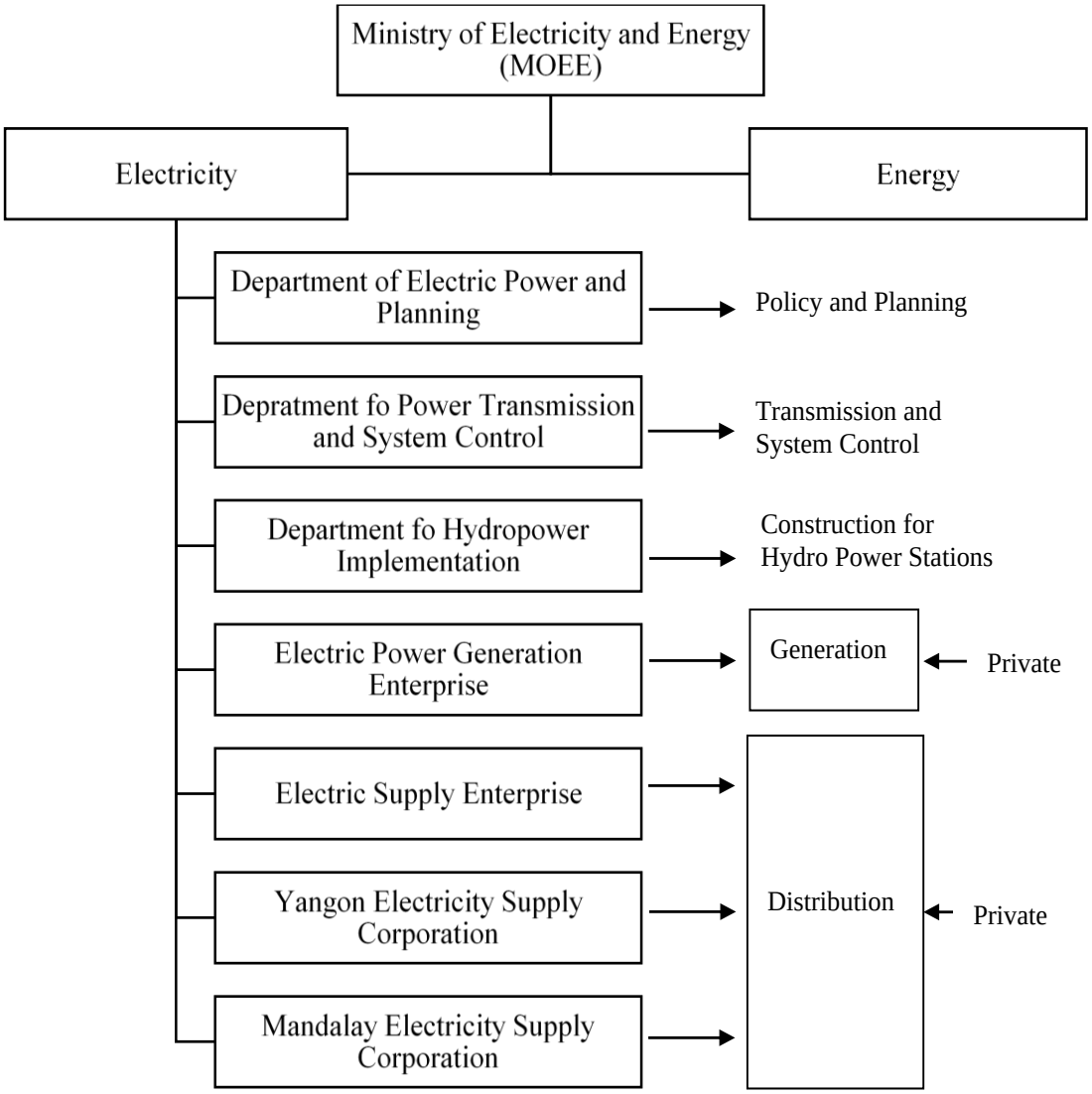
**Figure (3.1) Organization Chart of the Ministry of Electricity and Energy**




Source: Ministry of Electricity and Energy

This figure illustrates the organization chart of the MOEE and in which Union Minister is the highest rank of the MOEE and under which there is one deputy minister, and then followed by four departments, five enterprises, and two corporations.

**Figure (3.2) Functions of the Departments of the Ministry of Electricity and Energy**




Source: Ministry of Electricity and Energy

Figure (3.2) states the functions of the departments of the MOEE which is composite as the electricity and energy. The main functions of the department of electric power planning are to formulate the short-term and long-term planning of the renewable and hydropower projects, to analyze and recommend for expanding electric power plants to meet the additional demand. The brief responsibilities of the department of power transmission and system control are such as – to implement the policies and missions which are set out from the MOEE, to control the processes of electricity generation, transmission, and distribution which are connected with the national grid, and to report the financial statement. The department of hydropower

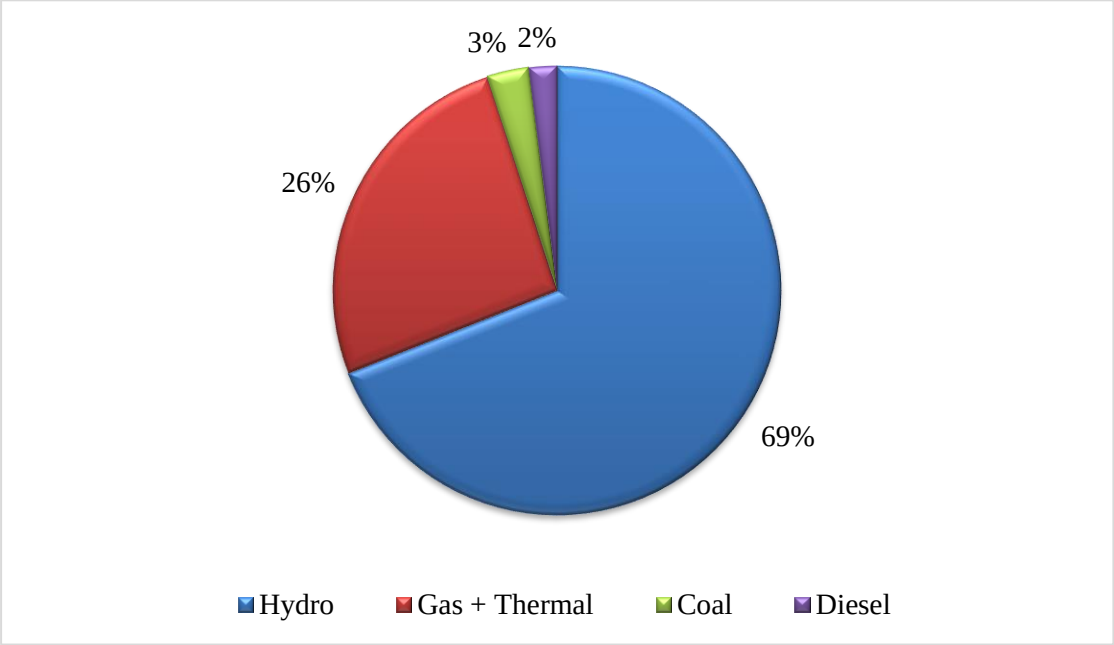
implementation is to exploit the hydropower resources and report the possibility of these resources, to analyze and implement of the new projects which are formulated from the ministry, and to monitor and report the progress of the projects. The duties of the electric power generation enterprise are – operation, maintaining, and generation processes of the existing state-own hydropower and thermal electric power plants, and purchasing of the electric power from the private sector such as – Joint Venture (JV), Build-Operate-Transfer (BOT), an Independent Power Producer (IPP) by mean of the system of Power Purchase Agreement (PPA). Electricity supply enterprise, Yangon electricity supply corporation, and Mandalay electricity supply corporation have the functions of building the electric power plants which are distributed from the private sector not connected to the power system (national grid) and maintaining the small-scale hydropower plants, and natural gas-fired power plants which are run by the private sector, and of managing and controlling the electric power distribution to be qualified and stationary.

## 3.2 Analysis of the Electricity Sector and Distribution of Electric Power in Myanmar

Current electrification rates in Myanmar are at about 40% and the remaining 60% of households are not connected to the national grid, instead of relying on local solutions such as diesel generators and solar home systems (MOEE).

Figure (3.3) shows the current status of electricity supply in 2017-2018.

**Figure (3.3) Current Status of Electricity Supply in 2017-2018**




Source: Ministry of Electricity and Energy

According to the figure (3.3), the main source of electricity in Myanmar is hydropower which contributes about 69% and as the second large source is natural gas and thermal energy which contributes about 26%, 3% from coal, and 2% from diesel Sixty percent of Myanmar's electricity sector in the hands of the public which is operated by the state-owned power plants. Although the supply of electricity has been partly de-bundled, all electricity is aggregated by the publicly-owned and managed Electric Power Generation Enterprise, which transfers it to the Department of Electric Power Transmission and System Control (DEPTSC) for transmission to distribution companies.

The table below shows the locations of 28 large hydropower projects (>10MW) with a combined capacity of 3,223MW, 19 gas power plants with a combined capacity of 1,725MW, and the 120MW coal power plant which is named as Tigyit, the only coal plant in operation.

**Table (3.1) Power Production by Region / State**

| Region / State | Generation Type | Quantity | Total capacity (MW) |
|---|---|---|---|
| Nay Pyi Taw Union Territory | Hydropower | 3 | 460 |
| | Gas | - | - |
| Yangon Region | Hydropower | - | - |
| | Gas | 9 | 979 |
| Mandalay Region | Hydropower | 3 | 871 |
| | Gas | 2 | 197 |
| Magwe Region | Hydropower | 3 | 189 |
| | Gas | 2 | 91 |
| Sagaing Region | Hydropower | 2 | 34 |
| | Gas | - | - |
| Bago Region | Hydropower | 7 | 370 |
| | Gas | 1 | 55 |
| Ayeyarwady Region | Hydropower | - | - |
| | Gas | 1 | 16 |
| Tanintharyi Region | Hydropower | - | - |
| | Gas | 1 | 6 |
| Kachin State | Hydropower | 2 | 339 |
| | Gas | - | - |
| Kayah State | Hydropower | 3 | 248 |
| | Gas | - | - |
| Kayin State | Hydropower | - | - |
| | Gas | - | - |
| Mon State | Hydropower | - | - |
| | Gas | 2 | 281 |
| Rakhine State | Hydropower | - | - |
| | Gas | 1 | 100 |
| Chin State | Hydropower | - | - |
| | Gas | - | - |
| Shan State | Hydropower | 5 | 714 |
| | Gas | - | - |
| | Coal | 1 | 120 |
| **Total** | **Hydropower** | **28** | **3,223** |
| | **Gas** | **19** | **1,725** |
| | **Coal** | **1** | **120** |

Source: Energy Guide 2019

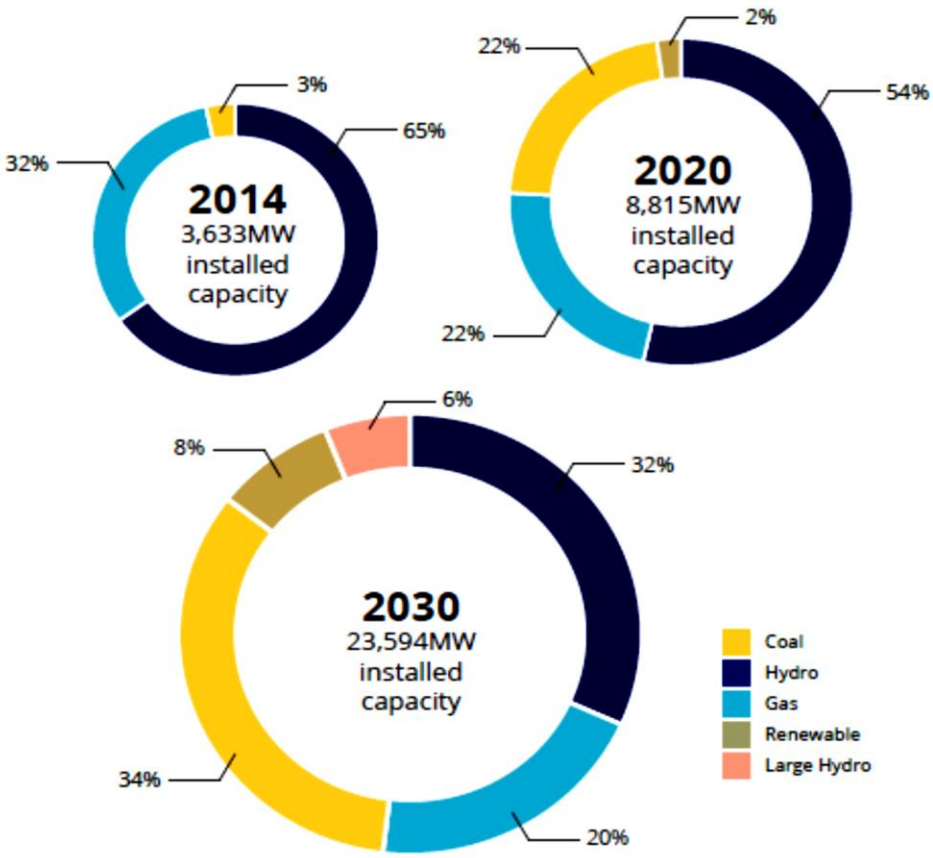
According to the table, Yangon Region has nine gas power plants and which have the largest installed capacity of 979MW. Mandalay Region is the second-largest producer of power and it has three hydropower plants and 2 gas-fired power plants which have 871MW and 197MW installed capacities respectively. The third one is Shan State and it has five hydropower plants that have a capacity of 714MW and the only large coal-fired power plant which has installed capacity of 120MW. In brief, there are twenty-eight hydropower plants, nineteen gas-fired power plants, one coal-fired power plants which in total installed capacity of 3,223MW, 1,725MW, and 120MW each.

The figure of the locations of hydropower plants in Myanmar is shown as Appendix-1 in the appendix, in which there are twenty-two state-owned power plants, three power plants which are operated under the BOT with the joint venture, and two power plants which are operated under the BOT with independent power producers.

Locations of gas and coal power plants in Myanmar are shown in Appendix-2 in the appendix. There are ten state-owned power plants, and the others are operated by private entities. There are five power plants that are operated under the BOT with the IPP, and there are four gas power plants and one coal power plant which are also operated with the IPP.

The Myanmar National Electricity Master Plan recommended a "power resources balance" scenario which is called for a large increase in coal power. It has been criticized for a large reliance on coal power which becomes the largest generation source by 2030. However, Myanmar has been reluctant to embrace coal power and prefer to choose liquefied natural gas (LNG-to-power) and hydropower plants instead.

**Figure (3.4) Power Resources Balance Scenario**




Source: Energy Guide 2019

Figure (3.6) states the power resources balance scenario in 2030, which is with the main source from coal power plants and hydro, gas, renewable and large hydropower plants are following.

Coal extraction in Myanmar has remained slow due to low investment and the remoteness of most of the country's 565 identified coal sites, although it has estimated domestic coal resources of 540 million tons. The only coal-fired power plant, Tigyit plant in Southern Shan State is operated under the Huagaung Electric Power Engineering which was selected as the winner for a tender.

Gas-fired power plants in Myanmar has a limited amount due to the declining domestic production and export contracts with Thailand and China. Currently, there are three significant gas plants are nearly completed with a total combined capacity of 380MW which are – Thilawa project at Yangon Region, Myingyan in Mandalay Region, and Thaton in Mon State. The overall potential for solar power in Myanmar is estimated to be 51,973 terawatt-hours per year.

There are 28 hydropower plants with a minimum capacity of 10MW that have been built in Myanmar and another six have been listed as under construction. On 10

September 2018, the Électricité de France received a Notice to Proceed for the 1,050MW Shweli-3 plant. Myanmar has a technical potential for the development of 4,032MW of wind energy in Shan State, Chin State, and along the Rakhine coast.

Table (3.2) presents renewable energy projects and their installed capacities by their respective states and regions.

**Table (3.2) Renewable Energy Projects**

| Region | Number of Projects | Capacity (MW) |
|---|---|---|
| Rakhine | 10 | 1,484 |
| Chin | 10 | 1,472 |
| Ayeyarwady | 5 | 478 |
| Yangon | 2 | 274 |

Source: ADB Sector Assessment: Energy 2015-2017

The table shows the renewable energy projects and their capacity in each respective region in which Rakhine and Chin have the wind-power projects and their capacities have 1,484MW and 1,472MW. The Ayeyarwady region has 5 renewable energy projects which include hydropower projects and their total capacity will be 478MW. The Yangon region has two solar energy projects and their total capacity will be 274MW.

## 3.3 Electrification Policies and Programs in Myanmar

After restructuring the Ministry of Electric Power into the Ministry of Electricity and Energy in 2016, the MOEE sets the ambitious goals for the development of the energy sector. To achieve the 100% electrification rate by 2030, the government enhances the involvement of the private sector. There are five main policies for electric power sector which include -

(1) for sufficient electricity supply throughout the country, to expand the national power grid for effective utilization of generated power from the available energy resources such as hydro, wind, solar, thermal and other alternative ones,

(2) to conduct the electricity generation and distribution in accordance with the advanced technologies and to uplift and enhance private participation in regional distribution activities,

(3) to conduct Environmental and Social Impact Assessments for power generation and transmission in order to minimize these impacts,
(4) to restructure the power sector with cooperation, boards, private companies, and regional organizations for more participation of local and foreign investments and formation of competitive power utilities, and
(5) to formulate the electricity acts and regulations with the assistance of the local and international experts in order to align with the open economic era.

The key objectives of the Ministry of Electricity and Energy are –

(1) in order to transmit the generated power, through National Grid System to regions and states by implementing the transmission lines and primary substations, and by carrying out the distribution plans for electricity supply to the industries and public,
(2) to provide the technical know-how and policy support for using renewable energy such as bio-mass with cooperation and participation of the local people in rural areas, remotely located from the National Grid,
(3) to meet the electricity demand for the inaccessible areas to National Grid, to be supplied by Mini Hydro and Diesel Generators,
(4) in order to be reliable, the quality of National Grid System for generation, transmission, distribution and consumption of electricity at the standard voltage level with the least of power interruption and losses, to be carried out by our skilled staffs and by getting technical know-how from abroad,
(5) in order to fulfill the electricity demand of Myanmar, to encourage the power generation not only hydro and also natural gas and coal, and to be widely and commercially operated by wind and solar power plants, and
(6) to generate more electricity from renewable energy resources.

The Myanmar National Electrification Plan (NEP) aims to electrify 100% of Myanmar's households by 2030. The National Electrification Plan (NEP) is funded by the World Bank through a loan of US$400 million and implemented by the Ministry of Electricity and Energy and the Department of Rural Development in the Ministry of Agriculture, Livestock, and Irrigation. The ultimate goal of the National Electrification Plan (NEP) is to achieve electricity in all regions in Myanmar Universal Access by 2030. This plan will help to new households' connections in urban and rural areas across the country. And, the plan will assist in establishing and

supporting a coordinated sector-wide institutional framework for the implementation of national electrification program, and strengthen the institutional capacity of implementing agencies, including both public and private sector active in the grid rollout and off-grid pre-electrification. The plan will also include an off-grid pre-electrification program as this can get directly benefit the poor and vulnerable households by targeting those who reside outside the realm of the power grid and are expected to receive grid-based electricity services more than 10 years after the first phase of NEP. There are four components in the National Electrification Plan which are – (1) grid extension, (2) off-grid electrification, (3) technical assistance and project management, and (4) contingent emergency response.

## 3.4 Current Rural Electrification in Myanmar

Myanmar is the country with an abundance of various resources, but it is still one of the lowest electrification rates in Asia. About 60% of the population cannot access to the modern form of electricity. Moreover, the rural population in Myanmar is about 70% of the total population and only 16% of the rural population have access to the national grid electricity system. A total of 5080 villages will receive electricity in 2019 as part of the National Electrification Plan (NEP).

Table (3.3) shows the electrified and to be electrified households by the proposed projects in 2017-2018.

**Table (3.3) Electrified and to be Electrified Households by the Proposed Projects in 2017-2018**

| No. | Region/State | Total Numbers of Households | Households already electrified in 2016-2017 | | Households already electrified up to September 2017 | | Households to be electrified in 2017-2018 | |
|---|---|---|---|---|---|---|---|---|
| | | | Quantity | % | Quantity | % | Quantity | % |
| 1 | Kachin | 269365 | 123331 | 45.79 | 130296 | 48.37 | 134122 | 49.79 |
| 2 | Kayah | 57274 | 40295 | 70.35 | 44283 | 77.32 | 44136 | 77.06 |
| 3 | Kayin | 308041 | 60483 | 19.63 | 63320 | 20.56 | 64646 | 20.99 |
| 4 | Chin | 91121 | 18040 | 19.80 | 19483 | 21.83 | 29465 | 32.34 |
| 5 | Mon | 422612 | 191523 | 45.32 | 194432 | 46.01 | 208567 | 49.35 |
| 6 | Rakhine | 459772 | 68994 | 15.01 | 74408 | 16.18 | 76608 | 16.66 |
| 7 | Shan | 1169569 | 330983 | 28.30 | 347317 | 29.70 | 359505 | 30.74 |
| 8 | Naypyitaw | 262253 | 129199 | 49.27 | 135183 | 51.55 | 146319 | 55.79 |
| 9 | Sagaing | 1096857 | 349653 | 31.88 | 356639 | 32.51 | 386040 | 35.20 |
| 10 | Bago | 1142974 | 401394 | 35.12 | 413447 | 36.17 | 421991 | 36.92 |
| 11 | Magway | 919777 | 223208 | 24.27 | 230024 | 25.01 | 233815 | 25.42 |
| 12 | Ayerawaddy | 1488983 | 234544 | 15.57 | 239276 | 16.07 | 255168 | 17.14 |
| 13 | Taninthayi | 283099 | 27678 | 9.78 | 29161 | 10.30 | 30136 | 10.65 |
| | **Total** | **7971697** | **2199325** | **27.59** | **2277269** | **28.57** | **2390518** | **29.99** |
| 14 | YESC | 1582944 | 1192362 | 75.3 | 1285580 | 81.21 | 1320000 | 83.40 |
| 15 | MESC | 1323191 | 583052 | 44.1 | 687985 | 51.99 | 734353 | 55.50 |
| | **Total** | **10877832** | **4111148** | **37.79** | **4250834** | **39.08** | **4444871** | **40.86** |

Source: Ministry of Electricity and Energy (2019)

This table presents the electrified households by their respective regions and states up to September 2017 and the number of households that will be electrified by the proposed projects to be carried out to the financial year 2017-2018. The percentage of households in the Yangon region and Kayah state that are already electrified in the 2016-2017 fiscal year was about 80% but for the Taninthayi region, there has only 10.30% of electrified households.

Table (3.4) presents the electrified villages up to September 2017.

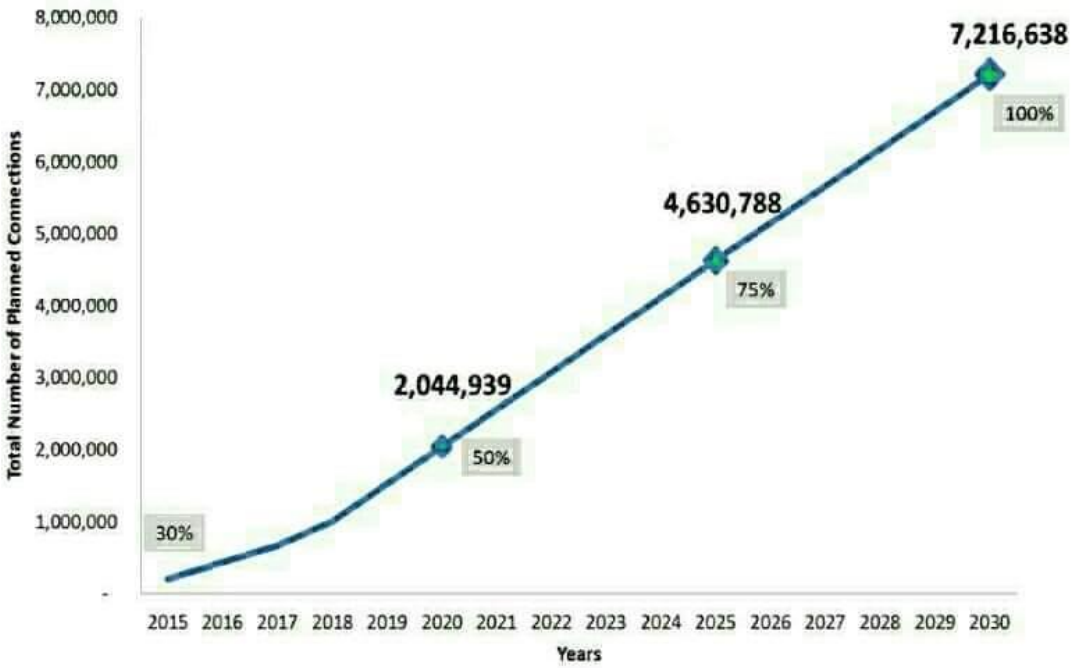
**Table (3.4) Electrified Villages up to September 2017**

| Types of Electrified Programs | Numbers of Villages | Percentage (%) |
|---|---|---|
| Electrified Villages by National Grid | 11326 | 17.73 |
| Electrified Villages by Off-Grid | 20503 | 32.11 |
| Villages to be Electrified | 32030 | 50.16 |
| Total Villages | **63859** | **100** |

Source: Ministry of Electricity and Energy (2019)

According to this table, the electrified villages by the national grid are about only 18% of the total villages and the other electrified villages are by means of an off-grid system which is about 32% of the total villages. The Ministry of Electricity and Energy proclaims that the electrified villages by off-grid will be connected to the national grid.

**Figure (3.5) National Electrification Rate**




Source: www.moee.gov.mm (2019)

This figure shows the scenario of the national electrification rate from 2015 to 2030. In that plan, 2020 is regarded as a mid-point to reach its target of 100% electrification by 2030.

# CHAPTER IV
# SURVEY ANALYSIS

## 4.1 Survey Profile

In this study, three villages from the Bago region are selected to analyze the effects of electrification in rural development. Bago region is situated closely to the main commercial city, Yangon, but it depends on the agricultural sector. The capital city of the Bago Region is Bago and it covers 39,405 $km^2$ and consists of 28 townships. It is the $5^{th}$ most populous region in the country with an estimated population of 4.84 million or 123 people per square kilometer. There are 17% of the population lives in urban areas, and the remaining 83% live in rural areas (General Administration Department of Bago Region, 2019).

Intagaw township is one of the townships of the Bago District and located on the beside of the Yangon-Mandalay highway road. Intagaw township comprises 2 main quarters and 6 villages. There are 5437 households with 23410 people in the Intagaw township. Three villages such as Thar Noe Kone Village, Chan Thar Kone Village, and Thar Yar Kone Village from Intagaw Township are selected as the study area. Each village has an average of 300 households and the agriculture sector is the main sector of these villages. Thar Noe Kone Village accesses the national grid electricity in 2015, and Chan Thar Kone Village and Thar Yar Kone Village access the national grid electricity in 2014.

## 4.2 Survey Design

This survey is conducted to explore the effects of rural electrification in the Bago Region. There are 50 households from each village that are selected by using convenient sampling and the responses of 150 respondents are collected in total. The survey is carried out in March and April of the year 2019 by using a survey questionnaire and face to face interview. The questionnaire includes three main parts: socioeconomic characteristics of the respondents, the current status of electricity

distribution and the effects of electrification on education, health services, public services, and their monthly incomes.

## 4.3 Survey Results

In this study, a total of 150 household respondents are selected to analyze the effects of rural electrification in Thar Noe Kone, Chan Thar Kone, and Thar Yar Kone villages at Intagaw Township in Bago Region, Myanmar.

### 4.3.1 Socioeconomic Characteristics of the Respondents

The socio-economic condition of the respondents includes demographic information, occupation status, and monthly income level. Age, education level, and occupation of the respondents from three villages are described in table (4.1).

**Table (4.1) Characteristics of the Respondents**

| Sr. No. | Factors | Number of Respondents | Percentage |
|---|---|---|---|
| 1. | **Age Distribution** | | |
| | 18-25 | 5 | 3 |
| | 26-35 | 17 | 12 |
| | 36-45 | 53 | 35 |
| | Above 45 | 75 | 50 |
| | **Total** | **150** | **100** |
| 2. | **Education** | | |
| | Basic 3 Rs | 4 | 3 |
| | Primary School | 45 | 30 |
| | Middle School | 47 | 31 |
| | High School | 13 | 9 |
| | Bachelor | 41 | 27 |
| | Master | 0 | 0 |
| | PhD | 0 | 0 |
| | **Total** | **150** | **100** |
| 3. | **Occupation** | | |
| | Agriculture | 46 | 31 |
| | Self-employment | 25 | 16 |
| | Government Staff | 14 | 9 |
| | Company Staff | 19 | 13 |
| | Others | 46 | 31 |
| | **Total** | **150** | **100** |

Source: Survey Data, 2019

Table (4.1) presents the characteristics of the respondents in three villages with age, education, and occupation. According to this table, most of the respondents 50% are aged above 45 years, the second largest group is aged between 36 to 45, and it is followed by the group of 26 to 35 years which is 12%. There is only 3% of the total respondents' age 18 to 25 years group. In terms of population, 3% have basic 3Rs (Reading, Writing and Arithmetic) skills, 30% have primary level education, 31% have middle school level, 9% have high school level and 27% of the respondents have

bachelor degree holders. There was no Master or Ph.D. Degree holders among respondents.

The occupation categories are sorted as agriculture, self-employment, government staff, private sector, and others which are the informal sector laborers and seasonal employment types. Most of the respondents in these three villages are working in the agriculture sector. But for Thar Noe Kone Village, 38% of the respondents work in the informal sector like the selling of fruits and vegetables which depends on the seasons. And the second large group of 22% of the respondents from that village is self-employment because that village is the closest one to the downtown of the Intagaw Township and they can do business easily in that place. And then, 18% of the respondents from Thar Noe Kone Village are engaging in the agriculture sector, followed by 12% of total respondents are government staffs, and followed by 10% of total respondents are company staffs. In Chan Thar Kone Village, most of the respondents work in the agriculture sector and the amount is 32%, 22% of each private-sector employees and workers of miscellaneous jobs, followed by 16% of respondents who are self-employed, and followed by 8% of respondents are the government staffs. For Thar Yar Kone Village, most of the respondents are in the agriculture sector as in 42%. The second-largest group, 32% of respondents, work in the informal sector. And 12% of respondents are self-employed, 8% of government staff and 6% of the company staff can be found. The next study section presents the current condition of electricity distribution in the selected three villages in Intagaw Township.

### 4.3.2 Current Condition of Electricity Distribution

The current condition of electricity distribution in the selected three villages is examined by the factors of monthly spending on electricity, frequency of electricity blackouts, and satisfaction of the respondents on the electricity supply distributed from the electric power plant. Table (4.2) shows the expenditure on electricity in the selected three villages.

**Table (4.2) Expenditure on Electricity in Selected Three Villages**

| Monthly Spending (Kyats) | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| <3,000 | 17 | 34 | 17 | 34 | 20 | 40 |
| 3,000 – 5,000 | 15 | 30 | 21 | 42 | 16 | 32 |
| 5,001 – 8,000 | 11 | 22 | 10 | 20 | 9 | 18 |
| 8,001 – 10,000 | 6 | 12 | 0 | 0 | 5 | 10 |
| >10,000 | 1 | 2 | 2 | 4 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

This table presents the households' monthly expenditure on electricity in three villages. Most of the respondents are spending below Kyats 3,000 per month on electricity. There are 34% of the respondents in Thar Noe Kone and Chan Thar Kone Villages, 40% of the respondents in Thar Yar Kone Village who are spending below Kyats 3,000 per month on electricity. There are 30%, 42%, and 32% of the respondents for respective each village who are spending between Kyats 3,000 and 5,000 for electricity. There is too little number of respondents who spend over Kyats 10,000 on electricity because they do not possess too many electrical appliances and there are too few commercial uses of electricity in these villages. Table (4.3) presents the frequency of electricity blackouts within the study area.

**Table (4.3) Frequency of Electricity Blackouts**

| Average Time per month | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Frequently | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 times and above | 0 | 0 | 1 | 2 | 0 | 0 |
| Twice | 1 | 2 | 15 | 30 | 0 | 0 |
| Once | 31 | 62 | 20 | 40 | 19 | 38 |
| Rarely | 17 | 34 | 12 | 24 | 28 | 56 |
| Never | 1 | 2 | 2 | 4 | 3 | 6 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019.

There is no response for frequently electricity blackouts per month, and there is 2% of electricity blackouts about 3 times and above in Chan Thar Kone Village. The majority of the respondents in Thar Noe Kone and Chan Thar Kone villages face only one time of electricity blackout per month, in which 62% of the respondents in Thar Noe Kone Village, 40% of the respondents in Chan Thar Kone Village respectively. In Thar Yar Kone Village, the majority of the respondents face rarely to electricity blackouts. Few respondents never experience electricity blackouts such as 2% of the respondents from Thar Noe Kone Village, 4% of the respondents from Chan Thar Kone Village, and 6% of the respondents from Thar Yar Kone Village. Table (4.4) explores the ownership of electrical appliances and the utilization of electricity for household and commercial uses.

**Table (4.4) Ownership of Electrical Appliances**

| Electrical Appliances | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| Electrical Stove | 17 | 34 | 26 | 52 | 17 | 34 |
| Rice Cooker | 50 | 100 | 50 | 100 | 50 | 100 |
| Mobile Phone | 49 | 98 | 50 | 100 | 46 | 92 |
| Computer | 6 | 12 | 0 | 0 | 5 | 10 |
| Television | 49 | 98 | 49 | 98 | 49 | 98 |
| DVD Player | 41 | 82 | 6 | 12 | 12 | 24 |
| Fan | 47 | 94 | 48 | 96 | 47 | 94 |
| Light Bulb/Fluorescent | 50 | 100 | 50 | 100 | 50 | 100 |
| Air Conditioner | 7 | 14 | 6 | 12 | 5 | 10 |
| Refrigerator | 17 | 34 | 17 | 34 | 13 | 26 |
| Water Pump | 28 | 56 | 32 | 64 | 35 | 70 |
| Other Business Usage | 0 | 0 | 0 | 0 | 2 | 4 |

Source: Survey Data, 2019

Table (4.4) shows the current possession of electrical appliances of the respondents from the selected three villages. According to this survey data, all of the respondents possess basic needs such as light bulbs, fluorescents, and rice cookers. Moreover, 98% of the respondents from these three villages possess televisions for the entertainment of their families. As the communication sector develops significantly, there are 100% of the respondents in Chan Thar Kone Village, 98% of the respondents in Thar Noe Kone Village, and 92% of the respondents in Thar Yar Kone Village possess the mobile phones.

The majority of the respondents possess the fans to relieve from the heat. Specifically, 94% of the respondents in Thar Noe Kone Village, 96% of the respondents in Chan Thar Kone Village, 94% of the respondents in Thar Yar Kone Village possess the fans. There is also a little ownership of refrigerators and air conditioners. There are 34% of the respondents from Thar Noe Kone Village and Chan Thar Kone Village, and 26% of the respondents from Thar Yar Kone Village who possess the refrigerators. Most of the households from these villages get the water from underground (wells) for households use and, or agricultural use.

Therefore, most of the respondents possess water pumps. There are 56% of the respondents from Thar Noe Kone Village, 64% of the respondents from Chan Thar Kone Village, 70% of the respondents from Thar Yar Kone Village who possess the water pumps. Table (4.5) analyzes whether the amount of electricity supply is enough or not for the use of households.

**Table (4.5) Satisfaction on the Electricity Supply Distributed from Electric Power Plant**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| Very dissatisfied | 0 | 0 | 2 | 4 | 0 | 0 |
| Somewhat dissatisfied | 15 | 30 | 23 | 46 | 13 | 26 |
| Neutral | 33 | 66 | 25 | 50 | 37 | 74 |
| Somewhat satisfied | 2 | 4 | 0 | 0 | 0 | 0 |
| Very satisfied | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

According to the table (4.5), 66% of the respondents from Thar Noe Kone Village, 50% of the respondents from Chan Thar Kone Village, and 74% of the respondents from Thar Yar Kone Village were neither satisfied nor dissatisfied for their daily use. But for 30% from Thar Noe Kone Village, 46% from Chan Thar Kone Village, and 26% from Thar Yar Kone Village, the supply of electricity somewhat dissatisfied with their daily use of households. Most of the respondents who somewhat dissatisfied, said they do not get enough amount of electricity even for lighting purposes, especially in summer.

### 4.3.3 Effects of Electrification in the Study Area

In this study area, the effects of electrification are examined by the factors of education, health, additional monthly income, and public services such as transportation and security. Table (4.6) shows the perception of the respondents on the improvement of education among young people by using electronic devices after access to electricity from the national grid.

**Table (4.6) Perception of the Respondents on the Improvement of Education after Access to Electricity**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | **No.** | **%** | **No.** | **%** | **No.** | **%** |
| Strongly disagree | 2 | 4 | 2 | 4 | 0 | 0 |
| Somewhat disagree | 2 | 4 | 4 | 8 | 9 | 18 |
| Neutral | 5 | 10 | 34 | 68 | 34 | 68 |
| Somewhat agree | 39 | 78 | 9 | 18 | 7 | 14 |
| Strongly agree | 2 | 4 | 1 | 2 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

This table presents the perspectives of the respondents about the improvement of education among young people by using electronic devices after access to electricity from the national grid. There are 78% of the respondents of Thar Noe Kone Village agree to an improvement in the education of their children by using electronic devices after access to electricity from the national grid. There are 68% of the respondents from Chan Thar Kone Village and Thar Yar Kone Village who thought this is the neutral for the progress of education of their children by using electronic devices after access to electricity from the national grid. Most of the respondents claim that their children get extra time for studying even in the night time because of the access to electricity. There is also a small number of respondents who think the ease of access to electronic equipment among their children is no help for education as they spend much time using that electronic equipment, not for their development. Table (4.7) examines the perception of the respondents on the improvement of using media in schools after access to electricity.

**Table (4.7) Perception of the Respondents on the Improvement of Using Media in Schools after Access to Electricity**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Strongly disagree | 2 | 4 | 0 | 0 | 0 | 0 |
| Somewhat disagree | 2 | 4 | 2 | 4 | 4 | 8 |
| Neutral | 5 | 10 | 5 | 10 | 5 | 10 |
| Somewhat agree | 39 | 78 | 34 | 68 | 34 | 68 |
| Strongly agree | 2 | 4 | 9 | 18 | 7 | 14 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

Using media, like televisions, radio cassettes, and audio recording tapes, in teaching rooms, is one of the effective ways of teaching technique. Table (4.7) explores the improvement status of using media in schools after access to electricity. There are 78% of the respondents in Thar Noe Kone Village, 68% of the respondents in Chan Thar Kone Village and Thar Yar Kone Village who agree to an improvement of media in schools. Moreover, there are 4% of the respondents from Thar Noe Kone Village, 18% of the respondents from Chan Thar Kone Village, and 14% of the respondents from Thar Yar Kone Village who are strongly agree to an improvement of media in schools after access to electricity. Most of the respondents answered there was an improvement in other schools' facilities such as the installation of fans and fluorescents in the classrooms after access to electricity.

So, access to electricity in these three villages improved the education of their children and the media and other school's facilities in schools.

The next part of the study examines the improvement in health services after access to electricity. Table (4.8) shows the perception of the respondents on the improvement of health services in clinics and hospitals after access to electricity.

**Table (4.8) Perception of the Respondents on the Improvement of Health Services from Clinics/Hospitals after Access to Electricity**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Strongly disagree | 5 | 10 | 14 | 28 | 0 | 0 |
| Somewhat disagree | 2 | 4 | 16 | 32 | 8 | 16 |
| Neutral | 42 | 84 | 17 | 34 | 39 | 78 |
| Somewhat agree | 1 | 2 | 3 | 6 | 3 | 6 |
| Strongly agree | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

This shows the improvement of health services from clinics and hospitals after access to electricity in the selected three villages. For this part, the majority of the respondents experience neutral in improvement in health services. In detail, there are 84% of the respondents from Thar Noe Kone Village, 34% of the respondents from Chan Thar Kone Village, and 78% of the respondents from Thar Yar Kone Village who has the perception of neutral in the improvement of health services from clinics and hospitals. Moreover, there are 4% of the respondents from Thar Noe Kone Village and, 32% of the respondents from Chan Thar Kone Village, 16% of the respondents from Thar Yar Kone Village who somewhat disagree with the improvement in health services after access to electricity. There is no response for strongly agree and a few responses for somewhat agree to an improvement of health services in these three villages after access to electricity. Table (4.9) explores the perception of the respondents on the improvement in using health-related electronic equipment in clinics and hospitals in these three villages.

**Table (4.9) Perception of the Respondents on the Improvement of Health-Related Electronic Equipment in Clinics/Hospitals after Access to Electricity**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| Strongly disagree | 6 | 12 | 2 | 4 | 0 | 0 |
| Somewhat disagree | 8 | 16 | 25 | 50 | 16 | 32 |
| Neutral | 29 | 58 | 20 | 40 | 30 | 60 |
| Somewhat agree | 5 | 10 | 3 | 6 | 4 | 8 |
| Strongly agree | 2 | 4 | 0 | 0 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

This table presents the improvement of health-related electronic equipment in clinics and hospitals after access to electricity in the selected study area. Most of the respondents have the perception of neutral for the improvement of health-related electronic equipment. Specifically, 58% of the respondents in Thar Noe Kone Village, 40% of the respondents in Chan Thar Kone Village, and 60% of the respondents in Thar Yar Kone Village have the perception of neutral for the improvement in health-related electronic equipment that is using in clinics and hospitals. The second majority of respondents somewhat disagree on the in detail; there are 16% from Thar Noe Kone Village and 32% from Thar Yar Kone Village. In Chan Thar Kone Village and Thar Yar Kone Village, there is no response to the perception of strongly agree for the improvement of health-related electronic equipment in clinics and hospitals. Therefore, most of the respondents have the perception of neutral and somewhat disagree with an improvement of health services and health-related electronic equipment in these three villages. The next table is to explore for the perception of the respondents on the improvement in other public services such as transportation networks, security, and street lighting after access to electricity.

**Table (4.10) Perception of the Respondents on the Provision of Public Services among Respondents after Access to Electricity**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Strongly disagree | 1 | 2 | 4 | 8 | 1 | 2 |
| Somewhat disagree | 4 | 8 | 29 | 58 | 21 | 42 |
| Neutral | 39 | 78 | 15 | 30 | 25 | 50 |
| Somewhat agree | 6 | 12 | 2 | 4 | 3 | 6 |
| Strongly agree | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

Table (4.10) shows the perception of the respondents on the provision of public services among respondents after access to electricity. There are 78% of the respondents from Thar Noe Kone Village, 30% of the respondents from Chan Thar Kone Village, and 50% of the respondents from Thar Yar Kone Village who have the perception of neutral in the provision of public services after access to electricity. There are 8% from Thar Noe Kone Village, 58% from Chan Thar Kone Village, 42% from Thar Yar Kone Village who somewhat disagree in the provision of public services after access to electricity. There is also a little response of the respondents who strongly disagree with the provision of public services. For the perception of strongly agree to the improvement in the provision of public services even after access to electricity, there is no response in all of these three selected villages.

The next part of the study is to examine the improvement of monthly incomes and additional incomes from new occupations that resulted from access to electricity. Table (4.11) shows the perception of the respondents on the improvement of monthly incomes after access to electricity.

**Table (4.11) Perception of the Respondents on the Improvement of Monthly Incomes after Access to Electricity**

| Opinion | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| Strongly disagree | 3 | 6 | 12 | 24 | 1 | 2 |
| Somewhat disagree | 4 | 8 | 5 | 10 | 4 | 8 |
| Neutral | 43 | 86 | 32 | 64 | 43 | 86 |
| Somewhat agree | 0 | 0 | 1 | 2 | 2 | 4 |
| Strongly agree | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **50** | **100** | **50** | **100** | **50** | **100** |

Source: Survey Data, 2019

This table shows that the majority of the respondents have the perception of the neutral in the improvement of monthly incomes after access to electricity. Specifically, 86% of the respondents in Thar Noe Kone Village, 64% of the respondents in Chan Thar Kone Village, and 86% of the respondents in Thar Yar Kone Village have the perception of neutral in the improvement of monthly incomes after access to electricity. There are 8% from Thar Noe Kone Village and Thar Yar Kone Village and, 10% from Chan Thar Kone Village who somewhat disagree on the improvement of their monthly incomes after access to electricity. There are 6% of the respondents from Thar Noe Kone Village, 24% of the respondents from Chan Thar Kone Village and 2% of the respondents from Thar Yar Kone Village who strongly disagree on the improvement in monthly incomes after access to electricity. There are a few responses to the perception of somewhat agree on the improvement in monthly incomes after access to electricity. And there is no response to the perception of strongly agree on the improvement of monthly incomes after access to electricity.

The reason for the ineffectiveness of electricity to their monthly incomes is most of the people in these villages work in the agriculture sector and other informal sectors and some of the respondents are government and company staff.

The next table explores it is reluctant to do businesses and other commercial activities by using electricity. So, there is a little number of the new creation of jobs in the selected three villages. Table (4.12) shows the additional incomes of the respondents from new occupations as access to electricity.

**Table (4.12) Additional Monthly Income of the Respondents from New Occupations as the Access of Electricity**

| Additional Monthly Income (Kyats) | Thar Noe Kone | | Chan Thar Kone | | Thar Yar Kone | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| <100,000 | 2 | 4 | 0 | 0 | 0 | 0 |
| 100,000 – 200,000 | 0 | 0 | 2 | 4 | 0 | 0 |
| 200,001 – 400,000 | 0 | 0 | 0 | 0 | 2 | 4 |
| >400,000 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: Survey Data

This table shows additional monthly incomes of the respondents getting from the new occupations by using electricity from the national grid-line. There are only 4% of the respondents from Thar Noe Kone Village got below Kyats 100,000 per month from the new jobs created by access to electricity. In Chan Thar Kone Village, there are also 4% who have got additional monthly incomes in the range of Kyats 100,000 to 200,000. For Thar Yar Kone Village, there are also only 4% of the respondents earned as the additional monthly incomes between Kyats 200,000 to 400,000. The new occupations of the respondents as the access of the electricity are teaching the classes for sewing by using sewing-machine which runs with motors and operating the stores which are selling soft-drinks and ice-creams which are storing in the refrigerators.

# CHAPTER V
# CONCLUSION

## 5.1 Findings

The rural population in Myanmar is about 70% of the total population and this is the critical point that needs to develop rural areas to achieve the country's development with all-inclusive growth. To do so, the role of electricity plays the main role as it has enormous and spilled-over effects by accessing the reliable, clean and modern form of electricity. Access to electricity can provide not only the lighting but also improve education by using electronic devices with internet access to learn whatever needed and getting some facilities in the schools like the fluorescents in the classrooms and using televisions and cassettes in teaching and so on. Moreover, it can also improve the health sector of the country by using electronic equipment in providing healthcare and it can available some medicines which need to store in refrigerators. It can also facilitate the households by using various forms of electrical appliances in their daily life.

The selected three villages in Intagaw Township, Bago Region access to electricity by mean of the national grid electricity system since 2014 and 2015. According to the survey results, the majority of the respondents from each village are engaging in the agriculture sector and the second largest group is a group of informal laborers.

The majority of the households spend between Kyats 3,000 and 5,000 and below Kyats 3,000 as the monthly spending for the electricity. There are 2% of respondents from Thar Noe Kone Village and 4% of respondents from Chan Thar Kone Village spend above Kyats 10,000 as the monthly spending on electricity. Most of the respondents from each village are spending about Kyats 3,000 to 5,000 for the electricity.

When the frequency of electricity blackouts per month is examined, the majority of the respondents from these selected three villages face only one time of or rarely happened to the blackouts of electricity. According to the survey, all of the

respondents from each village own necessities such as light bulbs and florescent, and rice cooker. And above 90% of the respondents from these three villages also possess television, mobile phone, and fan. The majority of them also own the electric stove, water pump, and DVD player. Some of the respondents possess the refrigerator and air conditioner. There are 12% of the respondents from each household in Thar Noe Kone Village and 10% of respondents in Thar Yar Kone Village who possess the computer and there was no respondent who possesses the computer in Chan Thar Kone Village. Only 4% of the respondents from Thar Yar Kone Village possess the other electrical appliances of refrigerators and copiers that used in commercial activities.

The majority of the respondents from each village have the perception of neutral on the amount of electricity that supplies from the electric power plant. There are 30% of the respondents in Thar Noe Kone Village, 46% of the respondents in Chan Thar Kone Village, and 26% of the respondents in Thar Yar Kone Village who have the perception of somewhat dissatisfied on the amount of electricity. Most of the respondents claim that they do not get enough amount of electricity even for lighting.

Most of the respondents from each village have the perception of neutral for the improvement of education of young people by using electronic devices after access to electricity. In specifically, 78% of the respondents from Thar Noe Kone Village have the perception of somewhat agree to the improvement and 68% of the respondents in Chan Thar Kone Village and Thar Noe Kone Village have the perception of neutral in the improvement of education by using electronic devices widely among the young people. For the improvement of access to media in schools, the majority of the respondents from each village have the perception of somewhat agree to an improvement. In specifically, there are 78% of the respondents in Thar Noe Kone Village, 68% of the respondents in Chan Thar Kone Village and Thar Yar Kone Village who have the perception of somewhat agree to the improvement of using media in schools after access to electricity. Therefore, access to electricity improves education and access to media and some school facilities in the selected villages.

The majority of the respondents from these three villages have the perception of neutral in the improvement of health services from clinics and hospitals. In detail, there are 84% of the respondents from Thar Noe Kone Village, 34% of the respondents from Chan Thar Kone Village, 78% of the respondents from Thar Yar

Kone Village who have the perception of neutral on the improvement of health services from clinics and hospitals. And some of the respondents who have the perception of somewhat disagree with the improvement of health services from clinics and hospitals even after access to electricity. Moreover, 10% of the respondents from Thar Noe Kone Village, and 28% of the respondents from Chan Thar Kone Village who have the perception of strongly disagree to an improvement in that. In the improvement of health-related electronic equipment in clinics and hospitals after access to electricity, 58% of the respondents from Thar Noe Kone Village and 60% of the respondents from Thar Yar Kone Village have the perception of neutral. There are 50% of the respondents in Chan Thar Kone Village who have the perception of somewhat agree to some improvements in that, and so they respond as slightly improvement in health-related electronic equipment in clinics and hospitals after access to electricity. Therefore, the access to electricity in these three villages can improve slightly to the health sector and it can depend directly on the allocation of budget to this sector and the access to electricity cannot affect significantly the providing facilities and sufficient amount of budgeting to the health sector.

The majority of the respondents from Thar Noe Kone Village and Chan Thar Kone Village have the perception of neutral in the improvement in the provision of public services. In detail, there are 78% of the respondents from Thar Noe Kone Village and 50% of the respondents from Chan Thar Kone Village who have the perception of neutral in the improvement of the provision of public services. But for Thar Yar Kone Village, 58% of the respondents have the perception of somewhat disagree on the improvement in access to public services. There are 86% of the respondents in Thar Noe Kone and Thar Yar Kone villages and 64% of the respondents in Chan Thar Kone Village who have the perception of neutral in the improvement of monthly income after access to electricity because most of the respondents are engaging in the agriculture sector and informal laborers and some are staffs of public or private sectors and a little bit amount of respondents are self-employed.

There is only a little number of respondents who get additional monthly income from new occupations that are related to access to electricity. There are 4% of the respondents in Thar Noe Kone Village who earn below Kyats 100,000, 4% of the respondents in Chan Thar Kone Village who earn between Kyats 100,000 and 200,000 and another 4% of the respondents from Thar Yar Kone Village who earn

between Kyats 200,000 and 400,000 as an additional income that received from new occupations which are related with the access to electricity from national grid-line.

## 5.2 Recommendations

Based on the findings and survey results, there needs to be managing in the load shed due to the peak of electricity consumption and to be using the standard quality of electrification grid-lines as the breaks in that lines are the common cause of electricity blackouts especially in summer. And there needs to be able to supply more electric power to the remote areas since the households in that area cannot get a sufficient amount of electrification even for lighting.

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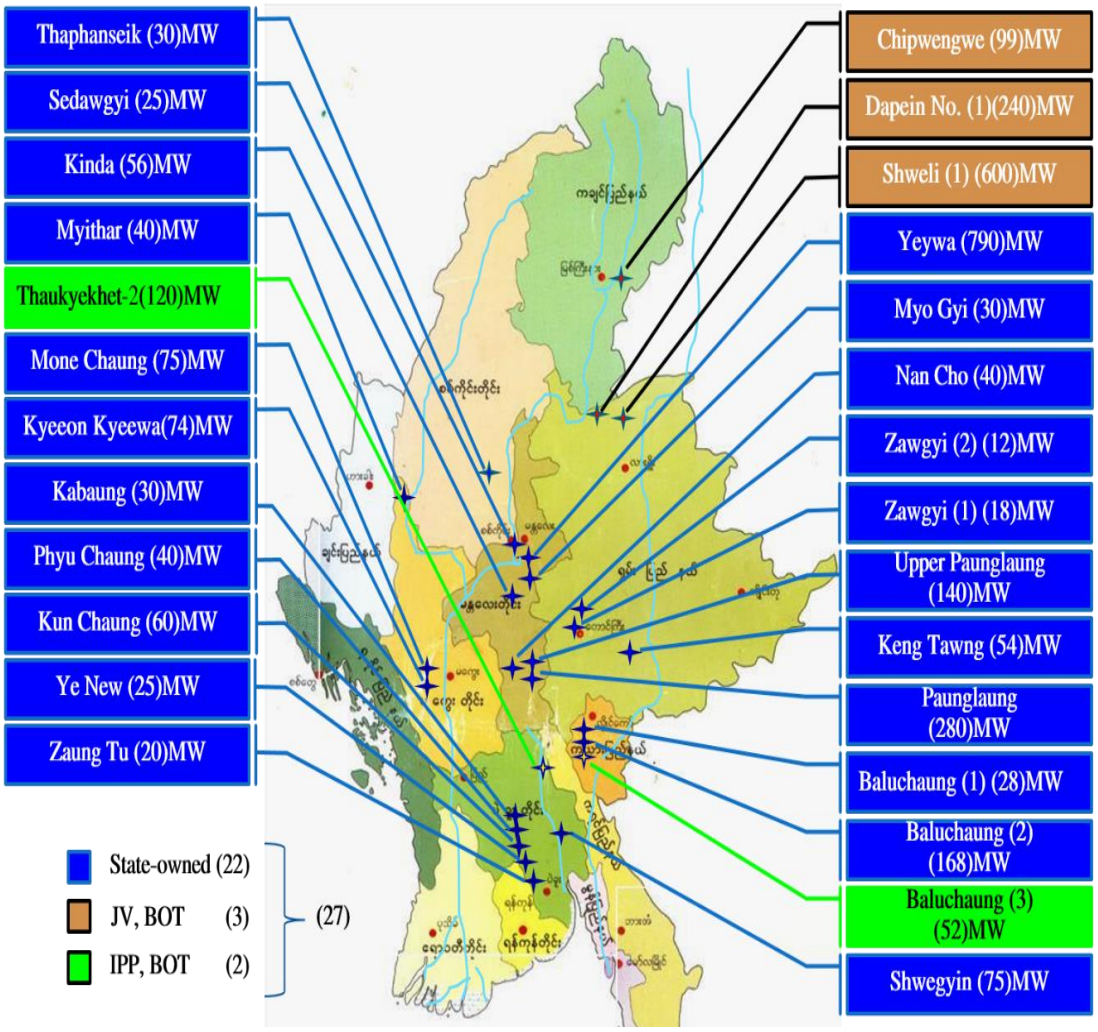
# APPENDIX 1

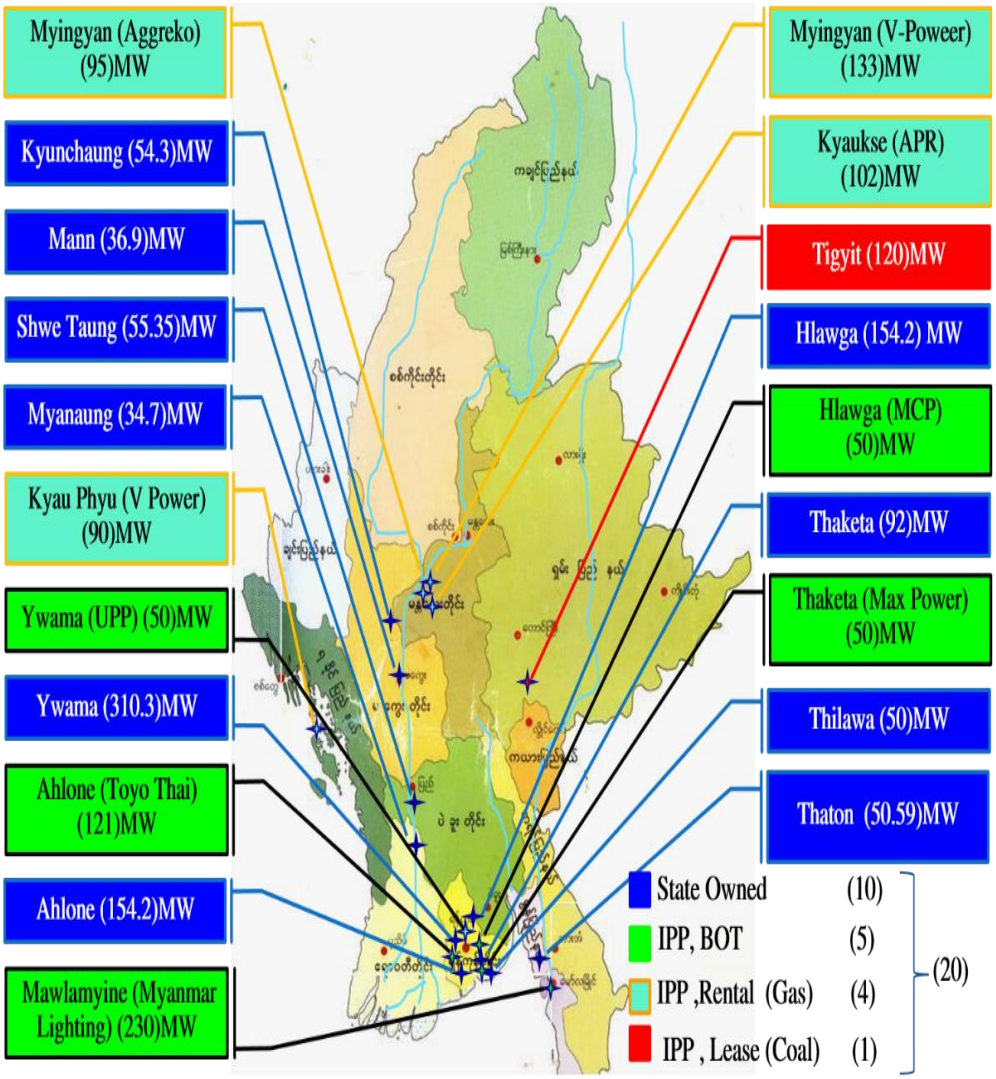
## Locations of Hydro Power Plants in Myanmar




Source: http://www.moee.gov.mm/en/ignite/page/601

## APPENDIX 2

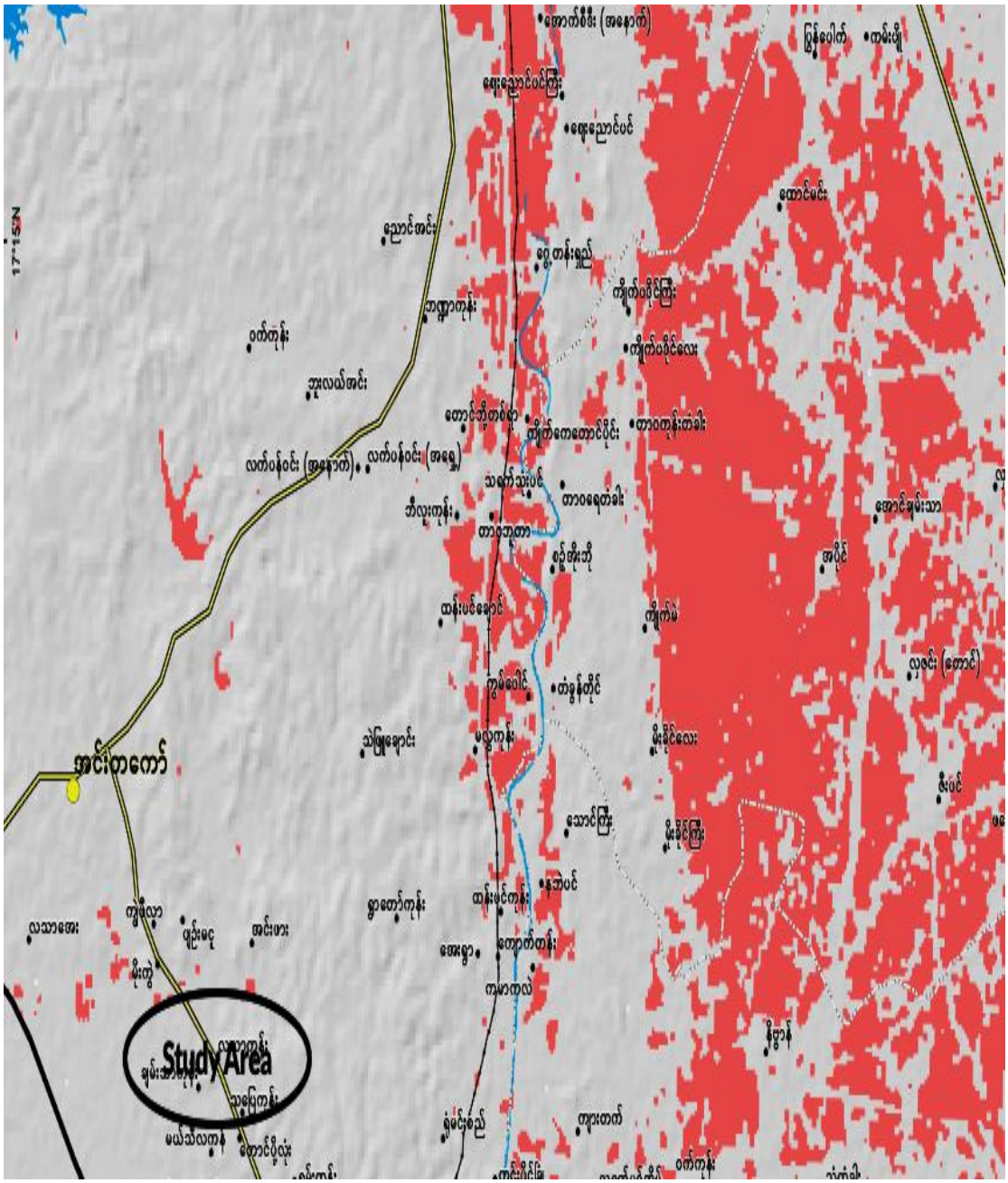
### Locations of Thermal Power Plants in Myanmar




Source: http://www.moee.gov.mm/en/ignite/page/601

# APPENDIX 3

## Map of Intagaw Township




Source: http://www.themimu.info

## APPENDIX 4

**QUESTIONNAIRE**

Village_____

1. Age □ 18-25 □ 26-35 □ 36-45 □ Above 45 years

2. Education □ Basic 3 Rs □ Primary □ Middle School
□ High School □ Bachelor □ Master □ PhD

3. Occupation □ Agriculture □ Own Business □ Government Staff
□ Company Staff □ Other

4. Monthly spending on electricity (Kyats)
□ <3,000 □ 3,000 – 5,000 □ 5,001 – 8,000 □ 8,001 – 10,000
□ >10,000

5. Frequency of electricity blackouts
□ Frequently □ Above and equal 3 times □ 2 times □ 1 time
□ Rarely □ Never

6. Ownership of electrical appliances
□ Electric Stove □ Rice Cooker □ Mobile Phone
□ Computer □ TV □ DVD □ Fan □ Light Bulb/ Fluorescent
□ Air Conditioner □ Refrigerator □ Water Pump
□ Other Business Use

7. The satisfaction of electricity supply distributed from electric power plant
□ Very dissatisfied □ Somewhat dissatisfied □ Neutral
□ Somewhat satisfied □ Very satisfied

8. Perception of the respondents on the improvement of education by using electronic devices after access to electricity
□ Strongly disagree □ Somewhat disagree □ Neutral
□ Somewhat agree □ Strongly agree

9. Perception of the respondents on the improvement of using media in schools after access to electricity

□ Strongly disagree □ Somewhat disagree □ Neutral

□ Somewhat agree □ Strongly agree

10. Perception of the respondents on the improvement of health services from clinics/hospitals after access to electricity

□ Strongly disagree □ Somewhat disagree □ Neutral

□ Somewhat agree □ Strongly agree

11. Perception of the respondents on the improvement of health-related electronic equipment in clinics/hospitals after access to electricity

□ Strongly disagree □ Somewhat disagree □ Neutral

□ Somewhat agree □ Strongly agree

12. Perception of the respondents on the provision of public services among respondents after access to electricity

□ Strongly disagree □ Somewhat disagree □ Neutral

□ Somewhat agree □ Strongly agree

13. Perception of the respondents on the improvement of monthly incomes after access to electricity

□ Strongly disagree □ Somewhat disagree □ Neutral

□ Somewhat agree □ Strongly agree

14. Additional monthly income of the respondents from new occupations as the access of electricity (Kyats)

□ <100,000 □ 100,000 – 200,000 □ 200,001 – 400,000 □ >400,000