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Energy System Analysis and Cost Optimization of Domestic Airport: A Case Study of Dhangadhi Airport, Nepal.

by
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APPROVAL PAGE

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LIST OF ABBREVIATIONS

AC/DC	Alternating current/ Direct current
ATS	Auto Transfer Switch
CAAN	Civil Aviation Authority of Nepal
CCR	Constant Current Regulator
C/O	Changeover
DG	Diesel generator
DHI	Dhangadhi Airport
HVAC	High Voltage Air Conditioning
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IRR	Internal rate of return
IWI	Illuminated wind direction indicator
kW	Kilo-Watt
LED	Light emitting diode
NEA	Nepal Electricity Authority
NPV	Net present value
PAPI	Precision approach path indicator
RTIL	Runway threshold Identification light
UPS	Uninterrupted power supply
VIP	Very important person
VOR/DME	VHF omnidirectional range / Distance Measuring Equipment
WFP	World food Programme

CHAPTER ONE: INTRODUCTION

1.1 Background

For the operation of an Airport, consumption of large amount of energy such as the natural resources among which electrical energy is the key most essential energy (ICAO, 2009).

Airports in general have high-energy consumption. Influenced by many factors, the characteristics of airport energy consumption are stochastic, nonlinear and dynamic (Yang, Jin, Du, Fan, & Yang, 2010). In recent years, airport managers have made huge efforts to harmonize airport operation with environmental sustainability by minimizing the environmental impact, with energy conservation and energy efficiency as one of their pillars (Upham, 2001). A key factor in order to reduce energy consumption at airports is to understand the energy use and consumption behavior, due to the multiple parameters and singularities that are involved. This methodology can be also used in airports in order to determine the way energy is used, to establish the classification of the electrical charges based on their operation way as well as to determine the main energy consumers and main external influence NPR. Results show that airport present a daily energy demand pattern since electric load profiles follow a similar curve shape for every day of the year, having a great dependence of the terminal building behavior, the main energy consumer of the airport, and with heating, ventilation and air conditioning (HVAC) and lighting being the most energy-intensive facilities, and outside temperature and day lighting the main external influencers (Ortega Alba & Manana, 2017).

1.2 Airports, Energy Consumption Areas:

Before we perform an energy analysis of the Airport, we must have a clear understanding of airport systems, their operations, and energy models in general. About the overall world consumption market, airports are relatively high energy consume NPR. Because of the high consumption of energy, airport efficiency teams are looking to minimize the use of energy and optimize their efficiency. Such teams have different options to achieve their objectives: one, replacing the current system with an energy-efficient system; Second, they can analyze the energy use of the Airports to find the most promising energy-saving methods and many other prospective to design for the energy-saving strategies. As the non-aeronautical load is more dynamic and more than the aeronautical load, there must be an energy saving strategy for the saving of the energy for the non-Aeronautical equipment and loadings.

1.2.1 Classification of electrical loads at Airports:

From a general point of view, all the electric charges that can be found in an airport can be classified in three types based on their operation way: fixed, opening and variable loads:

- Fixed loads:

Electric loads with continuous operation 24/7, which generate a minimum base energy demand that is necessary to maintain some critical airport facilities operative. These loads would mainly be the data processing center, security, radio navigation and meteorological systems. Additionally, there are other type of facilities, that are principally composed of opening loads, which have several fixed loads as they are permanently switched-on: Information and communication systems (ICTs) facility contains fixed loads related to network communication devices and some specific computer systems; Signaling and information facility contains fixed loads related to some specific signaling and information computer systems; and Equipment various facility contains fixed loads related to devices such as refrigerators, automatic teller machine (ATM) and similar. In Equation (1) this set of electric charges is represented by F, and each fixed load $f \in F$ is characterized by its active power $P^{F}_{f\,n}$.

- Opening loads:

Electric charges with operation only during the opening hours of the airport, but that are necessary to allow the start of the process of attention to passengers and aircraft, and that are independent from the number of passengers or air operations. These charges would be HVAC, lighting, signaling and information, ICT and various equipment. In Equation (1) this set of electric charges is represented by O, and each opening load $o \in O$ is characterized by its active power P_{on}.

- Variable loads:

Electric charges with variable operation during the opening hours of the airport depending on the number of passengers or aircraft operations. These charges would be electromechanical facilities for luggage and persons and airfield lighting, which in both cases depend on the departures and arrival flights schedules. In the case of airfield lighting, it also depends on the requirements established by ATC service. Additionally, there are other types of facilities that are mainly composed of opening loads, which have several variable loads that are switched-on depending on flight schedules, such as HVAC and lighting in public spaces for passengers related to arrival or departures halls. In Equation (1) this set of electric charges is represented by V and each variable load v ∈V is characterized by its active power $P^{V}_{v\,n}$. In the case where there were no aircraft operations, this $P^{V}_{v\,n}$ would be 0, as these facilities would not have to be operatives. The model presented in Figure 8 is designed to manage the sets of electric loads of the airport over a period represented by a set N of time slots of equal duration (typically 15 min). The total set N is divided into two main subsets NO and NC representing opening and closing hours with the condition N = NO ∪ NC. Finally, considering the time is divided in quarter-hourly slots then, for each time slot n ∈ N, the theoretical active power P_{n}^{TOT} of the airport can be calculated as:

$$P_n^{TOTc} = \sum_{f \in F} P_{fn}^{Fc} \quad \forall\, n \in N/N^0 \ldots\ldots 1$$

$$P_n^{TOTo} = \sum_{f \in F} P_{fn}^{Fo} + \sum_{o \in O} P_{on}^{O} + \sum_{v \in V} P_{vn}^{V} \quad \forall\, n \in N/N^0 \ldots\ldots 2$$

Where:

- P_n^{TOTc} and P_n^{TOTo} are the theoretical total active power during closing and opening hours of the airport, respectively;
- P_{fn}^{FC} and P_{fn}^{FO} are the theoretical active power of fixed loads during closing and opening hours of the airport, respectively;
- P_{on}^{O} is the theoretical active power of opening loads during opening hours of the airport;
- P_{vn}^{V} is the theoretical active power of variable loads during opening hours of the airport;
- n represents a time slot, typically 15 min;
- N represents a set of n time slots;
- N^{O} represents a subset of n time slots during opening hours of the airport;
- N^{C} represents a subset of *n* time slots during closing hours of the airport.

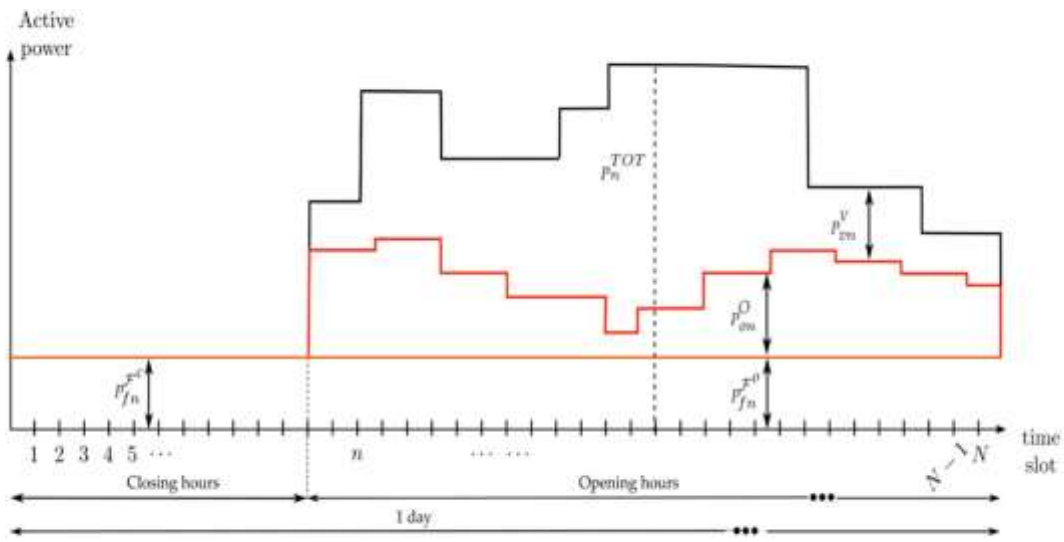

Figure 1. 1: Active power demand for Electric loads

1.2.2 Energy Inventory:

An energy inventory consists of collecting several technical and electrical characteristics about the different loads which make up the system under evaluation, in this case an airport, in order to obtain their theoretical energy consumption and to determine main energy consumers and influencer. Firstly, it is necessary to identify the main buildings and facilities of the airport, in order to segregate loads as much as possible. Then, the researcher must be assisted by airport maintenance personnel to collect energy data of each identified Technical and electrical fields of the energy inventory that are necessary to collect are proposed below, and are considered the minimum necessary to perform an energy inventory at airports. It is recommendable to collect, store and process this energy inventory with a spreadsheet in order to facilitate its management and mathematical calculation. Also, airport staff may possess some very valuable additional information about the load under evaluation, especially relating to schedules, external influences, settings or operation. Such information may complement these proposed fields.

Electric charge/Load: Name or description of the loads.

- Facility associated: The most common classification of electric charges by facility/system in airports are HVAC, lighting, airfield lighting, radio navigation, data center processing, ICT, signaling and information, security, meteorological, electromechanical, and various equipment.
- Typology of charge: Fixed, opening or variable loads, as explained previously.

- Number of elements: The number of equal charges in that location.
- Company: The electric charge can be associated to the airport operator or to the different companies located at the airport.
- Location: Zone, building, plant or area.
- Electric power: Electrical power under normal conditions and under stand-by conditions. It is based on both the theoretical electric power shown in the corresponding technical datasheet of the load under evaluation and on specific electric measurements to confirm or to obtain this data. In the case study, a 325 Clamp Meter was used for the energy measurements of individual loads.
- Operation hours: Annual operating hours including stand-by hour. This time can be determined by several sources: Information provided by maintenance personnel, information obtained during visits, or output data of the measuring equipment. Number of days: The number of days per year that the facility is operative.
- External influences: Description of the external influences that can affect the greater or lesser use of such electric charge, such as the temperature, the day lighting, or the number of passengers and air operations.

With this energy data collected, it is possible to calculate the estimated annual energy consumption for each load, which is a very useful information to perform the energy balance in those facilities whose metered data are not available or are not possible to measure, and to understand the energy behavior patterns. This estimated annual energy consumption E_l^{Total} for each load $l \varepsilon L$ can be obtained by its electric power under normal conditions P_l^{normal} and standby conditions $P_l^{standby}$ and by operating hours under normal conditions t^{normal} and standby conditions $t^{standby}$ as is described in Equation 3:

$$E_l^{total} = \sum_{l \varepsilon L} [(P_l^{normal} * t_l^{normal}) + (P_l^{standby} * t_l^{standby})] \qquad \ldots\ldots\ldots 3$$

In the case of Dhangadhi Airport, energy electrical charges have been characterized during the research works.

1.2.3 Metering:

In the scope of this research, energy consumption data of 16 electricity meters were collected at Dhangadhi airport with a monthly frequency.

1.2.4 Energy Balance:

The energy balance allows us to ascertain the most energy-intensive facilities, areas or buildings of the airport and therefore those that will have the most impact on electric load profiles and therefore on energy demand patterns. The aim of the energy balance is to calculate the total energy consumption of the airport and the individualized energy consumption of each facility and building, in order to know what percentage each one represents. For this issue, previous energy inventory and metered data must be used. Firstly, monthly readings from the previous electricity meters installed must be taken. On the one hand, data from the electricity meters for building measurements must be selected and summed to obtain yearly and monthly building or areas energy consumption.

1.3 Case Area:

Dhangadhi Airport (IATA: DHI, ICAO: VNDH) is an airport serving Dhangadhi, the district headquarters of the Kailali District in the Seti Zone in Nepal and also the Main city of the Sudurpaschim province. The airport is located at Dhangadhi sub-metropolitan which is 9 km far from Dhangadhi city and 8 km from Attariya Chowk. Dhangadhi airport is one of the most emerging domestic airports in Nepal. From the establishment point of view, it has been targeted as the hub airport for the far western region where it would connect the very remote place of the far western hilly region to the Dhangadhi city and also to the capital city Kathmandu. It was expected to be the pioneering airport for the multifaceted development for a far western region where people get facilitation for the traveling, and also be the gateway to the domestic and the international tourist to show the more diversify culture, ethnicity, historical place and the natural beauty of the region. It was established in 2032 B.S as the unpaved AFIS airport where the small-sized plane could land. This airport has recently been extended and blacktopped to be able to accommodate larger aircraft. With periodic up-gradation, Dhangadhi airport is now one of the most facilitative domestic airports having 1800m bitumen paved runway with a new terminal building where aircraft such as ATR-72, ATR-42, CRJ-200, CRJ-700, and Bombardier Dash could land and also proving the night flight facility. The airport is located at an elevation of 210 meters (689ft) above mean sea level. It has one runway which is 1,800 meters (5,906ft) in length. . It is Nepal's second-largest domestic airport after TIA in terms of Runway length.

Figure 1. 2: Google map of study area

1.4 Rationale of study:

Airport is the big consumer of energy, because of the fast growing aviation sector in the world scenario and future projection seen to be obviously increasing sector. As an Airport, passenger and facility upgraded each year, the energy consumption scenario also increases in each year. (Reddy, 2014). Energy saving issues are arising all over the world. Airport technology are continuously improving each year and as standard and recommendations set by the ICAO, airports also has to improve energy efficient technology up gradation continuously (ICAO, 2009).

In this scenario, Dhangadhi airport is also the one the fastest growing domestic airport of Nepal. Civil aviation authority of Nepal (CAAN) has declared the 20 years master plan for the up gradation of the Dhangadhi airport into Regional International Airport (Republica , 2020). There is no any energy system analysis for the airport till the date. So it is relevant to analyze the energy consumption pattern of different loads at the airport and to analyze which systems are inefficient, and possible effective energy saving and cost saving measures. This research work will be fruitful as the benchmark for future planning and extension of the new loads to the system at the Dhangadhi Airport.

1.5 Dhangadhi Airport Existing Supply System:

The Electrical supply system of the Dhangadhi airport is shown in the fig

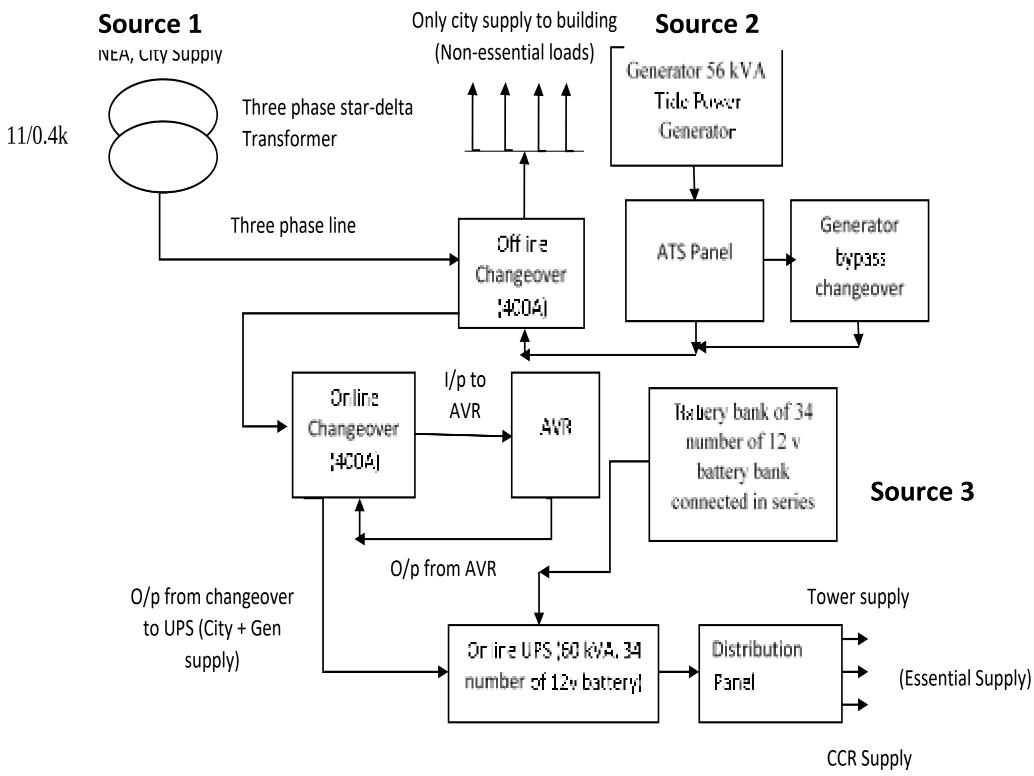

Figure 1. 3: Dhangadhi Airport existing Electrical supply system

The major load category of the Dhangadhi airport are shown below.

- Lighting: Buildings inside terminal building, taxiway, runway, day lighting, interior lighting, exterior lighting, runway lighting, PAPI light, Approach lighting, Beacon, obstruction, Apron floodlighting, IWI, Mast lighting.
- Induction/Heating coil: For cooking purpose
- Air Conditioning (HVAC): Cooling /Heating
- Conveyance System: Pass through metal detector, Public announcement devices
- Battery invertor system of Airlines: For charging heavy duty cycle inverter and inversion
- Compressor: Air compressor
- Charging load: battery charger, VHF, UHF, operating and charging load
- Computer and printer, fax, photocopy machine Laptops
- Residential load for staff quarters

- Electrical power supplied to the WPF (world food program) office
- Ceiling fan, Table fan, cooler, AC/DC Siren, Electric kettle, dispenser, TV, Vacuum cleaner, Tower console supply
- VOR/DME equipment
- Three phase and single phase motors
- Electrical power supplied to the Canteen
- Electrical power supplied to the Security staff quarters

1.6 Problem Statement:

The Electric load profiles and the energy demand pattern have not been studied earlier in order to characterize and analyze the way energy is used and to classify electric loads according to their operation way. In addition there is no any research regarding the energy consumption analysis of domestic airport for the Nepalese airports. On the primary audit at the Dhangadhi airport, an issue of energy consumption seems to be inefficient so it is necessary to analyze detailed demand response and energy consumption pattern at the airport during the summer and winter seasons and possible measures for the energy and cost saving opportunity.

1.7 Objectives

Main Objectives:

- To analyze the detailed electrical energy system and cost optimization at Dhangadhi Airport.

Specific objectives:

- To analyze the different categories of loads that is, opening, variable and fixed.
- To analyze the hourly, weekly, monthly and annually energy consumption patterns.
- To make the cost optimization model for the cost saving opportunities.

1.8. Assumptions and Limitations:

- The energy consumption pattern considered for this research work is for the normal days of scheduled operations.
- The average daily demand is similar throughout the year due to the scheduled flights and airport operations.

- The analysis is done on the load end side on the basis of real time consumption data using monitoring and recording equipment Power consumption is only from the electrical energy sources and all other energy sources are not considered. The power interruption due to the outages are not considered in this research works.

CHAPTER TWO: LITERATURE REVIEW

The energy efficient management program of Bengaluru International Airport, energy at airport significantly contributes towards sustainability and growth in the present depleted global environmental scenario. Every airport, be it large, medium or small has the potential to save and manage energy in a more efficient manner and implement sustainable practices. Situational awareness, technical knowhow and understanding the impact on future generation would kick start the process at all levels. (Reddy, 2014).

South Korean Incheon International Airport high efficiency heating and cooling system, LED lighting, Separation of window side lights from other lights, energy saving sensors, timers for bidets and drinking fountains and circuit breakers for standby power saved 10262 Mwah of energy and 4791 ton of CO_2 (Baek, 2016).

Electricity Energy management i.e. enhancing electrical power system is the process of monitoring, controlling and conserving electrical energy in organization/ airports. As electrical energy consumption in non-aeronautical equipment is more than aeronautical equipment so there needs arrangement of proper electrical power utilization mechanism as Kotoka International Airport Ghana (Nartey & Nyarko, 2016).

In more recent research, the energy efficiency index is characterized through energy performance indicators (EPIs), which relate energy consumption generated in a particular process with indicators based on economic, thermodynamic, or physical principles. In the case of airports, EPIs most commonly used are (kWh/passenger (Pax)), (kWh/terminal building surface), and (kWh/HVAC surface) (Rehault, Ohr, & Maier, 2016).

2.1 Previous research:

The previously done researches related with the airport energy system analysis and their major findings and the limitations are tabulated in Table 2.1.

Table2. 1: Previous research for energy system analysis for Airports

Authors/Date	Research/Topic	Method/Approach	Finding	Limitations
(Ortega Alba & Manana, 2017)	Characterization and analysis of energy patterns in Airports	3-step methodology based on monitoring and sub metering.	Terminal building and HVAC are main energy intensive facilities	EPI's directly cannot be used for benchmarking with other airports due to different situation and factors.
(Ceyhan & Zeren, 2010)	Energy performance analysis of Adnan Menders International Airport, Turkey	Simulation with the Energy plus software	1) month Cooling electricity consumption increase 2.8 times in each year 2) Heat gain decreases between 2% and 11% in winter, autumn and spring months and increases between 3% and 14% in	Energy plus requires interface software such as in buildings.

			summer months. 3) HVAC system has constituted almost 80% of total energy consumptio n	

The different airports in the world has established their own energy saving strategies which are shown in the Table 2.2.

Table2. 2: Different airport energy reduction strategies

Airport Name/Country	**Method to reduce energy**
Hong Kong international Airport/ Hong Kong (Yazdani, Wei, Dennis, & Hodapp, 2017)	• Turn off the (APUs) in order to reduce the emission from apron and use the GPU provided by the airport operations. • Follow green procurement specification as far as practicable
Dallas Fort worth International Airport (Yazdani, Wei, Dennis, & Hodapp, 2017)	• Auxiliary power units on aircraft are responsible for about 2% of the Airport's emission inventory. Recommendations include extending and improving gate power and preconditioned air systems and adopting an ञairport-wide policy that these systems be used instead of auxiliary power units.

Airport Name/Country	Method to reduce energy
Changi Airport (Yazdani, Wei, Dennis, & Hodapp, 2017)	• Using energy efficient lighting and installing motion sensors throughout the airport. • Using natural lighting in passenger areas where possible. • Shutting down of escalators and Travellators during off peak hours at night. • Switching off peripheral lighting during day time. • Installing a 250kwp photovoltaic system to the Budget Terminal. Expected to generate over 280,000kwh/year. Carbon emission are reduced by approximately 122,000kg of CO_2 per year. • Maintain the temp inside the terminal buildings at 24 degree centigrade.
Incheon (Baek, 2016)	• Temperature set for passenger comfort in the HVAC system in the terminal building and for the offices. • Passenger Terminal and boarding Gates 25 degree centigrade. • Heating temperature: Office Building 18 degree centigrade (under government policy), Passenger Terminal and Boarding Gates 20 degree centigrade. • Use of LED lighting for internal and External lighting –replaced 20% of the existing airport lighting facilities with LED lamps in 2011 and will replace > 50% of existing lighting facilities with LED lamps by 2015

Energy modeling in the building or infrastructures seeks to quantify energy consumption based on input parameter NPR. It is used to forecast energy demand characterize the factors that influence the demand or to predict the energy impact of the adoption of new technologies (Swan & Ugursal, 2009) . In the energy modeling of different buildings and facilities can be classified in the calculation-based approaches and measurement-based approaches as shown in the fig 2.1.

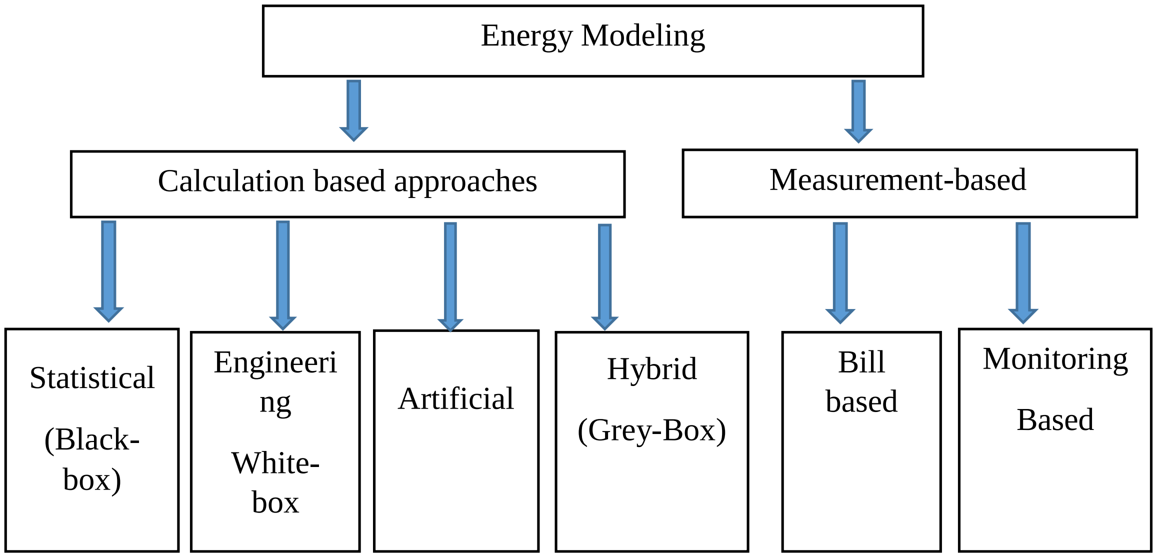

Figure 2. 1 Scheme of energy modelling

Calculation-based methods use mathematical tools to calculate or simulate the energy consumption of buildings or infrastructure. The methods can be divided into engineering, Artificial, and hybrid forms.

- Engineering methods: - They're also known as forward modeling, classical modeling, or white box modeling. These approaches employ comprehensive physics to simulate the energy behavior and thermal dynamics of the system under evacuation, with the inputs known and the outcomes predicted. Special software tools such as DOE-2, energy plus, and the Transient System Simulation Program describe them (B.Crawley, W.Hand, Kummert, & T.Griffithd, 2008). Since it is important to construct an adequate model whose accuracy improves as more information and data on the system's features become available, this methodology demands a great deal of attention to detail and high level of technical understanding. Simplified approaches, such as the degree –day or bin method, have been developed to overcome these drawbacks.
- Statistical methods: - They're also known as inverse modeling, data-driven modeling, or black box modeling. These procedures do not need any physical information about the system being evaluated. Simple or multiple linear regression (NelsonFumo &

Biswas, 2015) or conditional demand analysis are employed to define the mathematical description of these statistical models because both input and outcome are known (Aranda, Ferreira, & Mainar-Toledo, 2012).

- Artificial methods: These methods are similar to statistical methods such that they employ historical data to model the system under evaluation and are particularly beneficial for solving nonlinear energy consumption problems. Neural networks, support vector mechanics (Lai, Magoules, & Lherminier, 2008) , decision trees (Yu, Haghighat, Fung, & Yoshino, 2010) and genetic algorithms are examples of artificial models ((Ooka & Komamura, 2009).
- Hybrid methods: - Since statistical approaches based on operation data are utilized to create the coefficients of the model, they are also known as gray-box models. They use simplified detailed physics to simulate the behaviors of systems, reducing the need for training data and calculation time. Resistance capacitances (RC) models are an example of artificial models. (Braun, 2002).

In case of airports, measurement-based approaches measure the building or, infrastructures energy consumption from the simple bill-based methods to intensive monitoring methods.

- Bill based methods: Because most owners have availability to a power bill, this would be the simplest way to model and quantify energy use. However, because such data are naturally aggregated across end-uses, these data, which are typically collected on a monthly basis, do not give adequate information for energy efficiency assessments or characterization.
- Monitoring methods: They enable better building or infrastructure energy control, as well as the quantification of energy efficiency and the detection of facility failures. End-use sub-metering methods, non-intrusive load monitoring methods, non-intrusive load monitoring methods, and building energy management systems (BEMS) based methods can be categorized as such. Sub-metering methods use separate metering hardware in each system under investigation to determine the energy consumption of particular loads.

Such methods are principally used because they are a precise way to obtain accuracy energy data for energy investigations, although they are normally considered to be too expensive for conventional buildings (Yu & Chow, 2007). The non-intrusive load monitoring method is a pattern recognition based method which is capable of analyzing energy consumption placing only a small amount of hardware (Pihala, 1998).

Lastly, BEMS are computer-based system that help to manage, control and monitor the facilities under evaluation, typically heating, ventilation and air conditioning (HVAC) and the energy consumption of devices used (Masoero, Silvi, & Toniolo, 2010). They also provide the information and tools to understand the energy behavior of buildings to control and improve energy efficiency. These latest monitoring methods make it possible to obtain electric load profiles in buildings or infrastructure under evaluation. These electric load profile is simply a record of electric power consumed at any point in time. The data are manually collected every 5-15 min and over time, the large amount of data collected provides very detailed information about how the facility uses energy and is extremely useful tool for optimizing energy use (Mathieu, Price, Kiliccote, & Piette, 2011).

The analysis of these electric load profiles allows to determine if they may be any periodic pattern during specific period during specific period of time, determine this way their energy demand patterns.

CHAPTER THREE: RESEARCH METHODOLOGY

Research methodology is the method with which we address the issue arising during research. It is the systematic procedure to be carried out to design the problems into the standard framework so that possible desired outcomes be addressed. To carry out the research, several steps are to be used to achieve the final target of the research. Research methodology is intended to provide a guideline of systematic steps to address an issue and find its solution. Research methodology for the energy issue arising in the Dhangadhi airport is developed in figure below. Before starting any research work first step comes to is the research question that is what the main issue is interposing. This consists of issues identification of issues arising from the need for energy analysis of the existing system of the Dhangadhi airport, Data collection, and optimization model development, Energy-saving opportunities, results, conclusion, and recommendation.

In this section methodology will be developed for the characterization and analysis of energy demand patterns in airports, applying it to the real cause of the Dhangadhi Airport. Each one of these steps is divided into sub-sections that make the replication of this methodology easier in other airports; describing the generalities, tools required, the actors involved, the methods and materials, as well as partial conclusions of these sub-sections, which will be useful for the final energy analysis. This methodology is summarized in Figure 3.1.

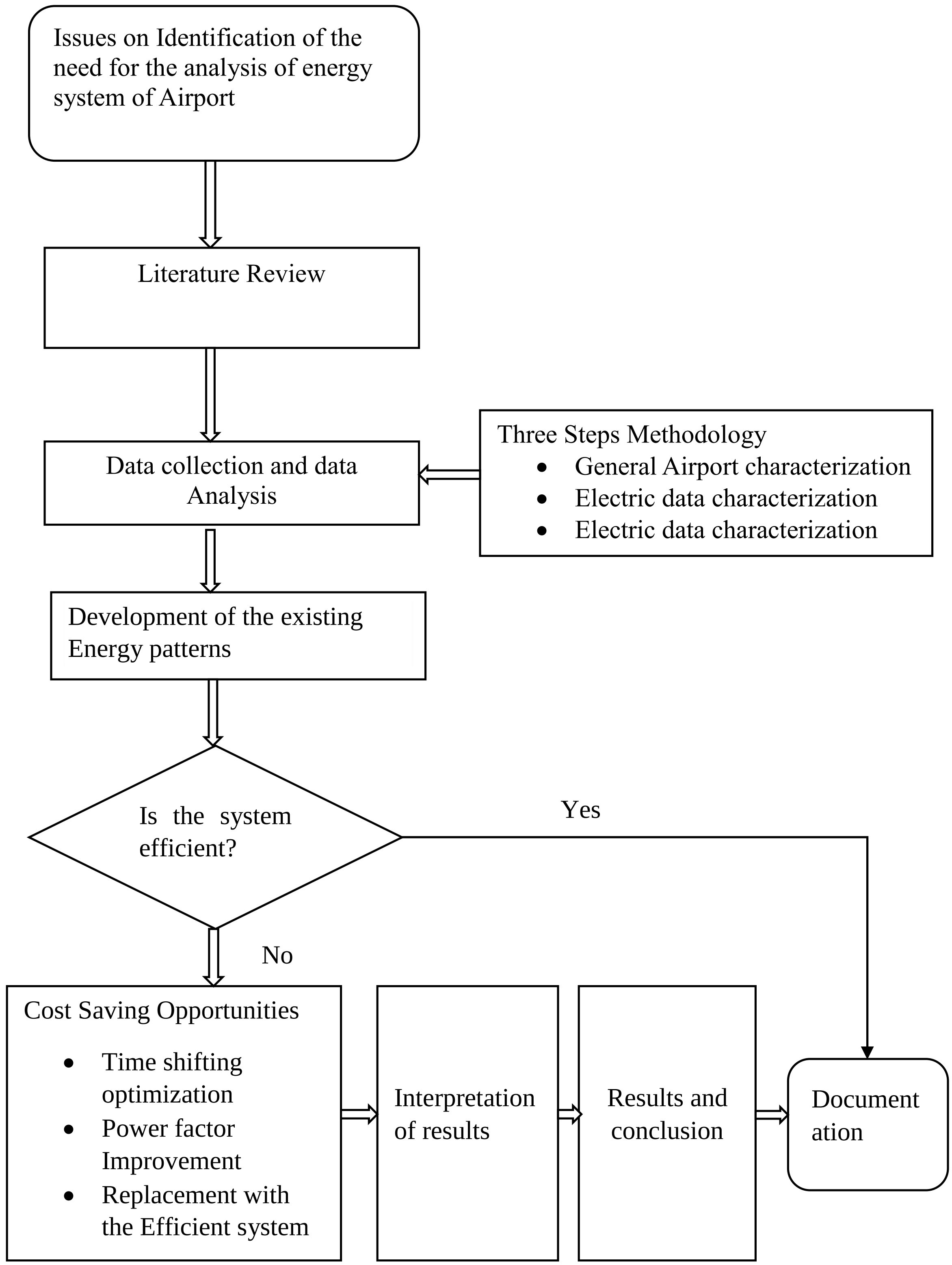

Figure 3. 1: Research Framework

3.1 Data collection:

The second step consists of collecting electrical data via historical information provided by the airport operator and in-site measurements at the Dhangadhi airport. Initially, a study of the typology of the main facilities and loads connected to the system has been done. The quarter-hourly energy consumption pattern and the energy bill for different time scales have taken from the TOD meter, making it possible to classify the different loads by facility and operation way. Moreover, these steps are useful to determine electricity consumption in each one of the loads connected to the system. The current pattern of utilization of the energy in the Airport is measured by using Power Analyzer tools. The power ratings and working of each device consuming power in the Airport are noted. The overall power factor of the Airport is noted. Mainly operation time for airports varies from the summer season to the winter so that the loading and overall energy consumption pattern varies, so during the operation hour of the airport, data of the different loads are taken thoroughly. These data are categorized as the Shift-able Load and Non-shift-able load so that the energy-saving strategy could be made for in the future. In data collection necessary three steps methodology is followed for the precise data analysis. Where each step follows the general four sub-steps that make the replication of methodology easier in other airports as well as describing the generalities, tools required, and the actors involved, the methods and materials as well as the partial conclusion of these subsections which will be useful for the final energy analysis. The necessary four steps for the data collection and for its analysis is shown in the figure below.

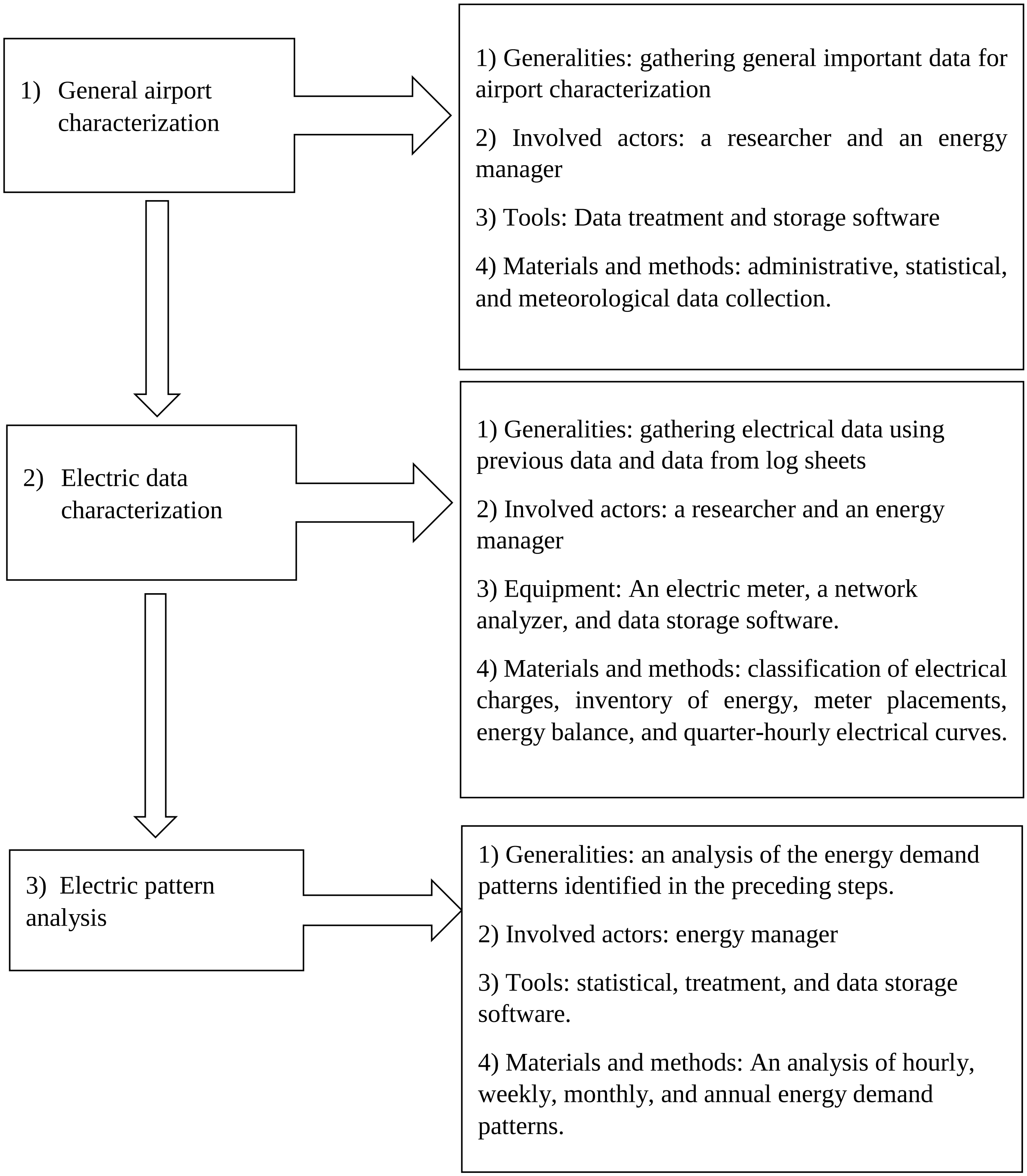

Figure 3. 2: Data collection and data analysis

3.1.1 Step 1:- General Airport Characterization

3.1.1.1 Generalities:

The first phase is to gather preliminary relevant data for characterization of the airport under scrutiny. This preliminary phase of general airport characterization is crucial since it is necessary to have basic information about the airport's operation and facilities that can affect

Energy usage. This knowledge will be useful in understanding why electric charges are used and how they behave in the future. These initial statistics will be based on the airport's administrative, statistical, and meteorological information, as well as the airport operator's knowledge and experience in the management and operation of the facilities as the primary user of the system.

The method for obtaining these data for airport characterization is next demonstrated and discussed. In addition, data from the case study is presented in tables and figures.

3.1.1.2 Actors involved:

The researcher as well as the airport's energy manager would be involved in this stage (who is usually also the maintenance manager). The latter should provide additional airport information that isn't accessible online. It is not necessary to visit the airport at this point because the information gathered on the internet and provided by the airport operator is sufficient.

3.1.1.3 Tools:

Measuring tools are not required in this step, but simple data treatment and storage tools, such as MS Excel are, as detailed in the next subsection.

3.1.1.4 Methods and materials:

General data collection from an airport can be divided into the following categories: administrative, statistical and meteorological.

3.1.2 Step 2: General Electrical characterization

3.1.2.1 Generalities:

The second step consists of colleting electrical data via historical information provided by the airport operator and in site measurements. Initially, a study of the typology of the electric charges and an energy inventory must be done. This previous work will help to arrive at a theoretical description of the main energy consumers and their hours of operation, making it possible to classify the different electric charges by type, facility and location. In that way, one can determine the optimal location of the electric measurement devices. These devices are necessary to obtain the metered energy consumption data and the electric load profiles of the airport through its quarter-hourly power demand data, as well as to perform the energy balance. Moreover, this energy inventory and balance should also serve to determine the main factors influencing electricity consumption in each one of the electric charges collected and the percentage of influence on airport energy demand.

3.1.2.2 Actors Involved:

The actors involved in this step would be both researcher, the energy manager of the airport (who is also usually the maintenance manager) and the airport maintenance personnel. The maintenance personnel should provide the requested data and collaborate in the implementation of the electrical measurement equipment. This step requires a visit to the airport for both energy charges collection and the implementation of electricity consumption measurement tools. The interviews with airport staff are also very important because they know the operation of the different facilities that make up the airport.

3.1.2.3 Tools:

In this step the use of measuring tools is necessary, such as electric meters, power analyzers and clamp meters, as well as treatment and storage data tools, for example, MS Excel.

3.1.2.4 Methods and materials:

From a general point of view, all the electric charges that can be found in an airport can be classified in three types based on their operation way: fixed, opening and variable loads:

3.1.3 Step 3: Electric Pattern Analysis

3.1.3.1 Generalities:

The third step consists of obtaining the energy demand patterns through the analysis of the electric load profiles. These load profiles, collected in the previous step through the power demand analyzers installed for the entire airport, terminal building and its HVAC system, are completed with the additional information collected by the electricity meters located in buildings and facilities. Different general, hourly, daily, monthly, seasonal and yearly energy analyses are proposed in the sub-section methods and materials, and developed and explained for the case of Dhangadhi Airport.

3.1.3.2 Actors involved:

The actor involved in this step would be the researcher, applying the methodology to analyze electric load profiles and energy demand patterns in the airport under evaluation.

3.1.3.3 Tools:

In this step the use of treatment and storage data tools, for example MS Excel, is necessary.

3.1.3.4 Methods and materials*:*

As explained previously, electric load profiles are based on the collected power demand data, and are simply a record of the electric power consumed each 15 min. After collection, quarter-hourly power demand data must be downloaded and validated. Data which does not pass the validation tests are excluded from further analyses. For determining the energy demand patterns is necessary to determine any periodic or energy behavior pattern during a specific period of time in the electric load profiles collected. In the case of medium-sized airports, there are several general features that can be analyzed in these load profiles in order to determine if any energy demand patterns are presented:

- Night load: Night power demand (or during closed hours).
- Base load: The minimum electric power demand that is necessary to maintain operative 24/7.
- Morning start-up and ramp-up: The effect of the start-up and ramp-up operation on power demand, identifying the amount of electric charges that are switched-on.
- Peak or maximum demand: The time, magnitude and duration of peak demand period.
- Evening setback and shut-down: The effect of the evening setback and shut-down operation on power demand, identifying the amount of electric charges that are switched-off.

Other types of energy analyses are related to the weekly, monthly or yearly patterns:

- Weekly analysis: The repetition of the energy pattern must be studied in order to establish the energy behavior on weekdays and weekends or holidays.

- Monthly analysis: The influence of the different seasons, mainly related to the outside temperature and day lighting on the energy demand must be analyzed.
- Annual analysis: Annual energy consumption are calculated on the basis of summer and winter monthly consumption and overall energy consumption by the different facilities are calculated.

3.2. Development of the existing Consumption curves:

After the required primary and secondary data collection of the respective areas has done through the different monitoring and the recording equipment, these data has been analyzed and the current existing energy consumption curves for the airport system has developed for the summer and winter season for different time period i.e., Daily, weekly, monthly. With this, currently existing average annual energy consumption and the annual energy cost has been calculated.

3.3 Financial Parameters:

Discounted Cash Flow (DCF):

Financial analysis is necessary to identify the profitability and investment payback. The tool uses discounted cash flow (DCF) method using free cash flow and weighted average cost of capital (WACC).

$$E_0 + D_0 = PV_0(WACC_t; FCF_t) \quad \ldots\ldots 4$$

Equation (1) indicates that the present value of expected free cash flows (FCF) that the company will generate, discounted at the weighted average cost of debt and shareholder's equity after tax (WACC) will be equal to the value of the debt (D) plus that of the shareholder's equity (E) (Fernández, 2007).

WACC is given by equation (2):

$$\mathrm{WACC_t} = \frac{\{\mathrm{E_{t-1}Ke_t + D_{t-1}Kd_t(1-T)}\}}{\{\mathrm{E_{t-1} + D_{t-1}}\}} \quad \ldots\ldots 5$$

Ke is the required rate to equity, Kd is the cost of debt, and T is the effective tax rate applied to earnings. $\mathrm{E_{t-1} + D_{t-1}}$ Are market values.

By using DCF, we obtain financial indicators such as Payback period, internal rate of returns and net present value of the study work.

$$DPP = \frac{ln\left(\frac{1}{1-\frac{Ixr}{A}}\right)^{-1}}{ln(1+r)} \quad ....6$$

$$NPV = -I + \frac{F_1}{(1+r)} + \cdots + \frac{F_n}{(1+r)^n} \quad ....7$$

IRR is given as

$$0 = NPV = -I + \frac{F_1}{(1+IRR)} + \cdots + \frac{F_n}{(1+IRR)^n} \quad ....8$$

Where,

DPP : Discounted Payback Period

NPV : Net Present Value

IRR : Internal rate of return

I : Initial Investment

A : Annual return

F : Future Values

r : Interest rate

Subtracting the present value of cash outflows from the present value of cash inflows yields net present value.

$$NPV = PV_{inflows} - PV_{outflows} \quad ....9$$

The project should be accepted if NPV is positive (i.e. NPV >0) otherwise rejects.
Similarly, IRR is the discount rate which makes NPV=0.
The project will be accepted if the internal rate of return (IRR) is greater than the cost of capital otherwise rejects.
Discounted Payback period is calculated using discounted cash flows of the project at given required rate of return. It gives the number of years for breakeven of project.

CHAPTER FOUR: RESULTS AND DISCUSSION

The results of applying this methodology to the real case of Dhangadhi Airport energy systems are presented next.

4.1 General analysis:

Electric load profiles at Dhangadhi Airport follow a curved shape every day of the year, similar to the one presented in Figure 4.1, and Figure 4.2 which represent the average quarter-hourly power demand curve for the summer and winter for entire airport during the year 2019. This figure has been plotted with the average power demand data collected during the year 2019 by the power analyzer located at the main electrical panel board that supplies electricity to the entire airport. This curve shape be considered as the average daily energy demand pattern of the airport. This affirmation is based on the analysis and observation of the raw quarter-hourly power demand data for the entire airport, which daily and seasonal analysis are presented below and in Section 4.1 and Section 4.2, next, main characteristics of this daily energy demand pattern are explained:

4.1.1 Night load:

Between Normally 8:00 p.m. and 06:00 a.m. the airport is closed. This night load is composed of fixed loads, stand-by loads of facilities that are switched-off during the night but are plugged-in, and loads related to facilities that are switched-on but should be off due to inefficiencies.

4.1.2 Morning start-up:

At 06:00 a.m., the activity of the terminal building, urbanization and several buildings start, as reflected, producing a morning start-up and ramp-up between 6:00 a.m. and 7:30 a.m., related to the switching-on of facilities like HVAC, lighting, ICT and information and signaling systems, etc. This ramp-up also includes all the equipment needed by the airport operator and the different companies located at the airport, and their employees. This energy demand, called morning start-up, is the minimum necessary to start the process of attention to passengers and aircraft at 7:30 a.m., and is composed of fixed and opening loads, which are independent of the number of passengers and aircraft operations.

4.1.3 Peak or maximum demand:

It occurs approximately at 7:15 a.m. due to the mandatory test of all airfield lighting for 10–15 min, which increments the energy demand of the airport approximately 10-15 kW. This on-peak can be maintained longer if some air operations are scheduled at 7:30 a.m., and by ATC is considered necessary to keep them switched-on. This peak demand occurs again in the evening after sunset, due to the repeated mandatory test of all airfield lighting during the evenings. The schedule of this second test is variable throughout the year depending on the sunset hour. Operative energy demand: Between 7:30 a.m. and sunset, period during which the airport is open, a variable energy demand exists due to different external influences. This operative energy demand is composed of fixed, opening and variable loads, mainly associated to the terminal building, urbanization and airfield lighting. During the day, this energy demand decreases and stabilizes due to the progressive shut-down of urbanization and airfield lighting, and the lower energy demand of HVAC systems due to thermal inertia of terminal building.

4.1.4 Evening setback:

Between sunset and 7:30 p.m. approximately, the energy demand increases again due to the need for artificial lighting and airfield lighting in case of aircraft operations.

4.1.5 Evening shut-down:

Between 07:30 p.m. and 8:30 p.m., the progressive shut-down of electric charges takes place until the night load is reached.

4.2 Hourly analysis:

Energy demand pattern presented previously must be disaggregated between the main airport energy consumers to find out the buildings or facilities that most contribute on its power demand, and this way to understand where, when and why this energy is consumed. For this issue, a specific day of the year has been analyzed. The reason for choosing a given day rather than the average quarter-hourly power demand of the complete year is because it is not possible to generalize the disaggregation for the whole year. Although every day the electric load profile follows a similar curve shape that represents the daily energy demand pattern of the airport, the power demand values vary as will be seen later depending on several parameters such as temperature, day lighting or flight schedules, and these parameters are different depending on the day of the year. Nevertheless, the conclusions obtained for this hourly analysis carried out for one specific day can be extrapolated and replicated to any other day of the year.

The analyzed day is 15 JULY 2019 for summer and 19 JAN 2019 for winter. Day lighting conditions of this day 15 JULY obtained from the World weather online are: sunrise at 05:20 a.m. and sunset at 07:07 p.m. and that for 19 JAN, 2019 are 06:58A.m and 05:44 P.m. respectively. Outside and inside average temperatures are listed in figure 4.1 and figure 4.2. The flight schedules are shown in Table 4.1.

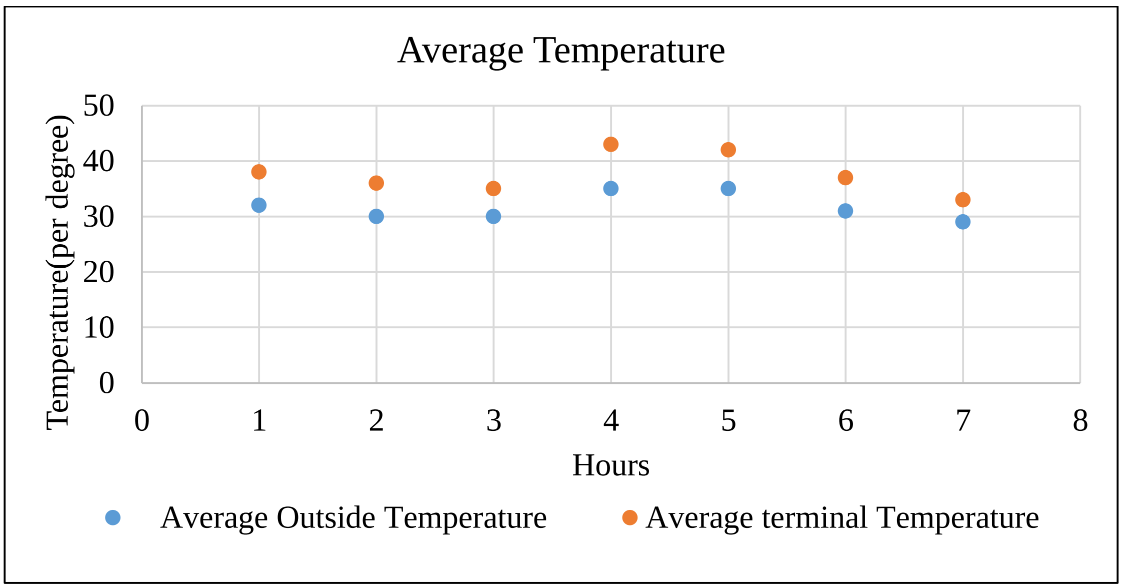

Figure 4. 1: Average Temperature for day-15 July, 2019

Note* HVAC point set equal to 24^0C, (Source: World weather division)

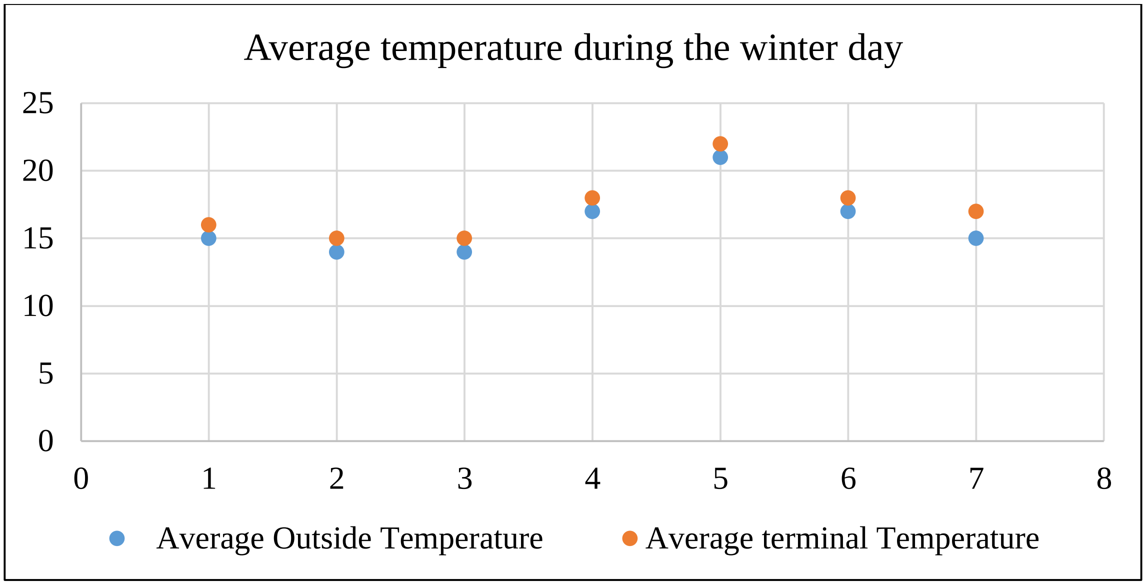

Figure 4. 2: Average Temperature for day-19, January, 2019

Table 4. 1: Flight Schedule

Flight no	Local time	Airlines	Status
1	6:30 AM	Summit	Departure
2	7:30 AM	Summit	Arrival
3	7:45 AM	Summit	Departure
4	8:30 AM	Summit	Arrival
5	8:40 Am	Buddha	Arrival
6	8:45 Am	Summit	Departure
7	9:15 Am	Buddha	Departure
8	9:20 Am	Shree	Arrival
9	9:25Am	Summit	Arrival
10	9:45 Am	Summit	Departure
11	9:55 Am	Shree	Departure
12	10:40 Am	Summit	Arrival
13	4:30 Pm	Buddha	Arrival
14	5:00 Pm	Buddha	Departure
15	5:20Pm	Shree	Arrival
16	6:00Pm	Shree	Departure

The quarter-hourly power demand curve for the entire airport divided by buildings or areas during the 15 July 2019 and 19 Jan, 2019 is represented in figure 4.1 and figure 4.2 each one of its components are explained.

4.2.1 Terminal building:

This quarter-hourly power demand curve has been plotted with the power demand data collected during the 15July 2020 by the power analyzer located at the main electrical panel board that supplies electricity to the terminal building. As was seen previously in Table 3.7, the terminal building represents 56% of annual energy consumption of the airport, and therefore is also the main influencer of the airport energy demand patterns.

4.2.2 Parking (Outside Lighting):

This quarter-hourly power demand curve is based on the power demand data collected during the 15 July 2019 from the three electricity meters located at the main electrical panel boards that supply electricity to this area, in the period that lighting systems were switched-on. This lighting is automatized through timer switches, having a constant power demand of 4 kW from the opening hour of the airport at 6:00 a.m. until 8:00 a.m. (approximately 45 after the sunrise), and between 05:00 p.m. (approximately 45 before the sunset) to 08:00p.m. During nights, only a minimum lighting is switched-on for security reasons, with a constant power demand of 3.2 kW.

4.2.3 Aircraft movement area (Airfield Lighting):

This quarter-hourly power demand curve has been plotted with the power demand data collected during 15 July 2019 from the three electricity meters located at the main electrical panel boards that supply electricity to this area. On the one hand, this airfield lighting is switched-on based on the requirements established by ATC service depending on the flights schedules. The influence of aircraft operations on the power demand of this area is clearly reflected during the time periods associated with flight schedules and without day lighting, with on-peaks of 14 kW approximately. On the other hand, during the rest of the opening hours of the airport with day lighting, a minimum constant power demand of approximately 10 kW is consumed, related principally to aircraft warning lights and similar devices. As previously commented, at 7:15 a.m. all airfield lighting is switched-on for 10–15 min, which increments the energy demand of the airport approximately 10.965 kW, in order to test the operation of all airfield lighting. This test is also repeated in the evening after sunset, in this case at approximately.

4.2.4 Radio navigation:

The radio navigation consumes the 7.14% of the total energy consumption of the Dhangadhi airport. The category includes the VOR/DME, VHF/HF chargers and the AC related to this equipment. These loads are the fixed and opening load types thus during the night times it consumes the minimum demand of 1.756kW and during the peak hour period it consumes 2.65 kW during the morning 7:30 A.m. to evening 4:45 to 5:00 P.m.

4.2.5 Tower Control:

The tower control category consumes the 6.69% and 7.29% during the summer and winter season of the overall energy consumption through the Airport. These types of loads are of fixed loads during the night period and the variable loads during the peak hour and the opening loads during the opening hours of the airports. These loads consumes the demand of 0.18683 kW and during the peak hour it consumes the peak demand of 5.01kW during the morning period of 8 to 9 A.M, and the 3.89kW during the evening hour of 5 to 6 P.M. During the opening hours of the airports due to the opening loads it consumes the demand of 3.78 kW. During the day period it consumes the stabilized loads of 2.78kW.

4.2.6 HVAC:

The HVAC is the inductive load that consumes the 17.79% and 18.6% of overall airport total energy consumption during the summer and winter. HVAC is the vital energy consumption facilities with respect to the Airsides. It consumes 30.98% and the 26.10% with respect to the Airsides. During the night hours it consumes minimum demand of 0.5-0.7 kW. During the evening peak period it consumes the 18.6 kW at 5:00 to 5:15 P.M. and during the morning period the maximum demand is 17.49 at 9 to 9:30 A.M. During the summer season the HVAC load is the Cooling loads whereas in the winter season the HVAC load is the heating loads. The overall energy consumption during the summer period is greater than the winter loads because the Dhangadhi airport is basically in the torrid region so that the cooling load is greater than the heating loads.

4.2.7 General Lighting:

In the Landside without considering the airfield lighting the lighting load consumes the 15.44% and 12.18% with respect to the overall energy consumption by the airport during the summer and winter loads respectively and 26.89% and 23.89% with respect to the Airsides during the summer and winter season. The night fixed load is the minimum lighting loads that are placed to be in on position during the whole night. During night time Lighting load consumes about 2.4 -3.5kW demands. And during the morning and the evening time the peak loads are 11.04kW at 6:30 – 6:45 A.M and 12.9kW at 6:15-6:30 P.M.

4.2.8 Electromechanical:

The Electromechanical Equipment consumes 20.02% and 20.55% With respect to the overall Energy consumption during the summer and winter. And also it consumes 34.86% and 40.33% with respect to Airsides during the summer and winter respectively. The constant night load is the 0.5734 kW and the morning and the evening peak loads are 18.13 kW at 9:00 to 9:15 and 19.94 kW at 5:00 to 5:15.The electromechanical loads consist of many shift able loads such as three phase water pumps and the other water pumps, inverter charging, Electric induction Heater, Water Dispenser etc.

4.2.9 Security Equipment:

The security equipment consumes the 1.12% and 1.54% of the overall energy consumption at the Dhangadhi Airport. It consists of the mainly the fixed loads such as the CCTV camera and the variable loads such as X-ray equipment.it consumes the fixed loads of 0.09216 kW and the 1.1792 kW peak at 9:00--9:15Am in the morning and 0.76kW at the evening period.

4.2.10 Auxiliary Buildings:

The Auxiliary building consists of the 7.98% and 5.38% of the overall energy consumption at the Dhangadhi Airport during the morning and the Evening periods. And it consumes the 22.19% and 14.55% of energy consumption with respect to the Airside. And during the night load the auxiliary building consumes the 2.2-2.5KW energy that is fixed type loads.

4.2.11 Others:

The term others represent the remaining facilities not included previously (ICT and various equipment), that due to the multitude of electric circuits related to them, is not possible to have direct metered data about these facilities. For this reason, this quarter-hourly power demand curve is based on the difference between the power demand data collected by the power analyzer located at the main electrical panel board that supplies electricity to the entire terminal building during the 15 July 2020, and the sum of the power demand of lighting, electromechanical, information and signaling, security and data center processing facilities seen previously. During nights, a power demand of approximately 0.3566kW remains, due to the fixed loads associated with the Equipment various facility (Signaling and Display equipment etc.) and the ICT facility (network communication devices, etc.), to the stand-by loads that are switched-off during the night but are plugged-in (computers, monitors, etc.), and loads related to facilities that are switched-on but should be off due to inefficiencies. During the morning ramp up and the operation hours the energy consumption by the ICT and the Signaling equipment would be 1.3 to 1.5 kW during the peak loads.

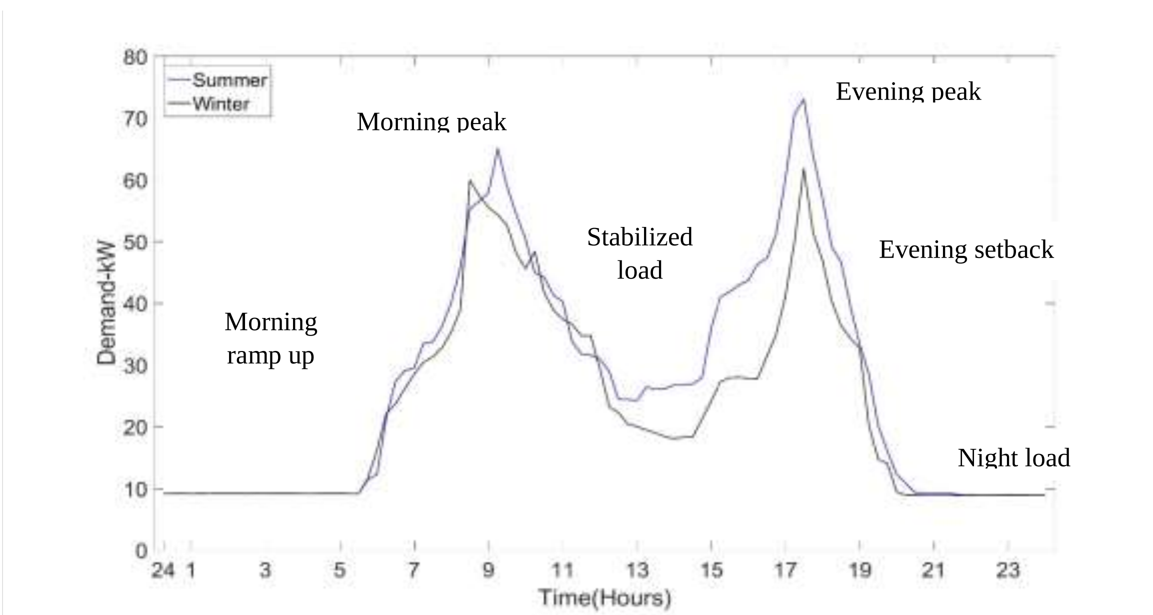

Figure 4. 3: Quarter hourly Demand comparison for summer and winter

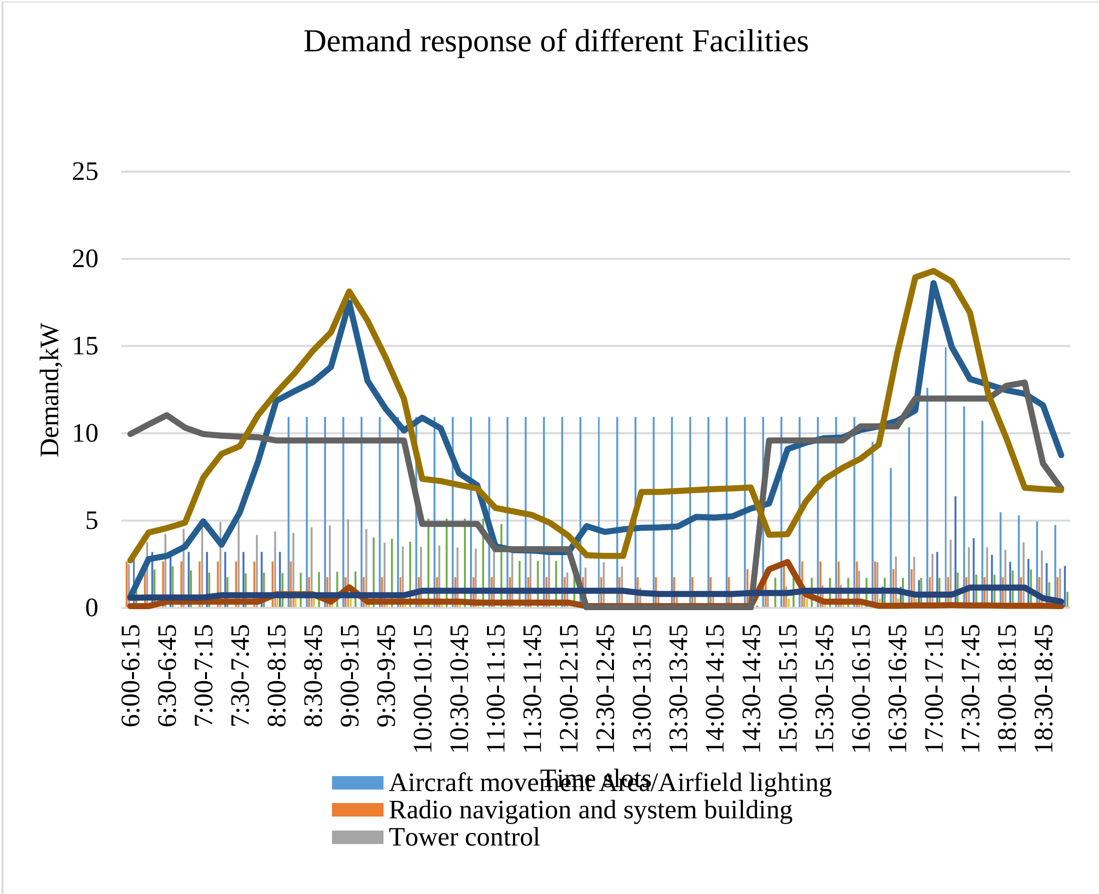

Figure 4. 4: Power demand by different facilities

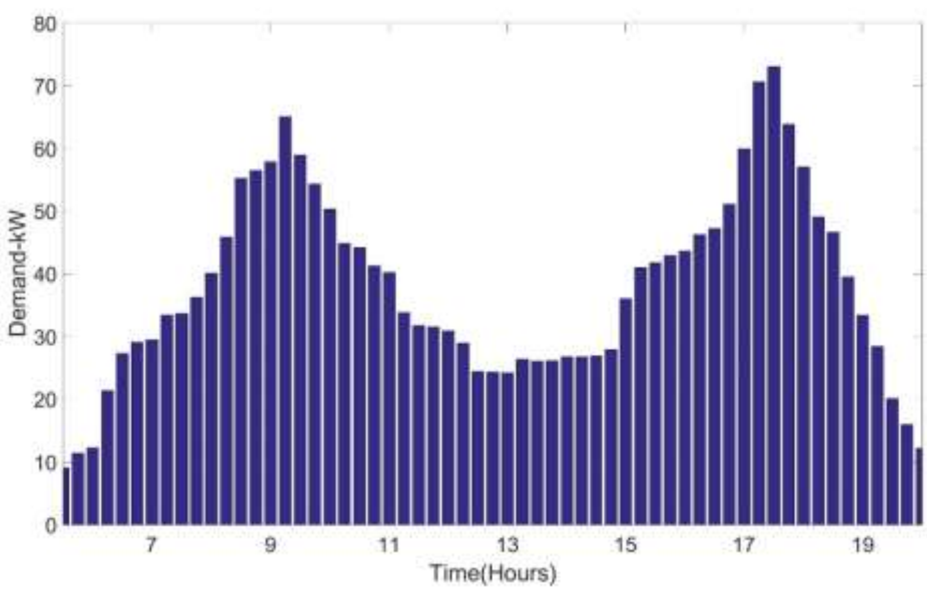

Figure 4. 5: Quarter hourly energy consumption at summer

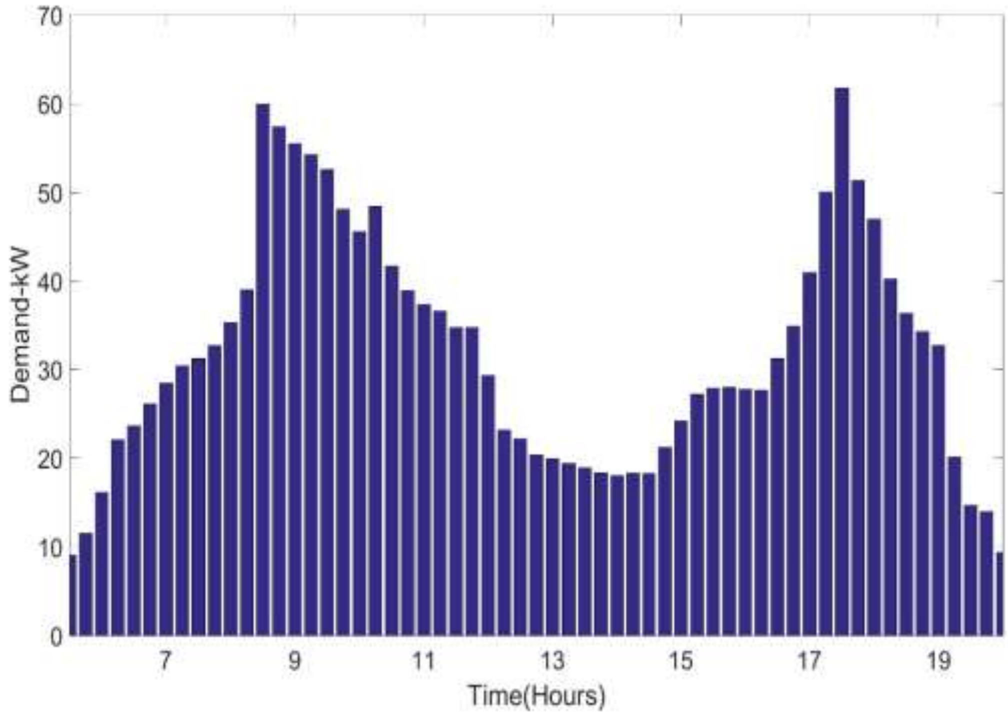

Figure 4. 6: Quarter hourly energy consumption at winter

The average Quarter hourly energy consumption during the summer and winter is shown in the figure 4.2 and 4.3. The average demand during the summer and winter is shown in the table 4.4.

Table 4. 2: Average energy demand during summer and winter

Hour	Average demand for an hour for Summer (kW)	Average demand for an hour for Winter (kW)
1	9.12	9.11
2	9.15	9.13
3	9.16	9.14
4	9.15	9.13
5	9.15	9.13
6	10.46	11.47
7	26.81	25.08
8	35.86	32.42
9	53.86	52.95
10	57.15	50.12
11	42.63	41.58
12	32.00	33.84
13	25.47	21.45
14	26.34	18.69
15	29.41	20.51
16	42.33	27.71
17	51.12	33.70
18	66.15	52.53
19	42.16	35.89
20	19.19	14.54
21	9.23	10.23
22	9.01	8.85
23	8.91	8.88
24	8.91	8.89

Table 4. 3: Hourly energy consumption at Airside

Airside					
Areas	Total kW	Total Energy consumption during summer(kWh)	% KWh at Summer on Airside	Total energy consumption during Winter(kW)	% KWh at winter on Airsides
Aircraft movement Area/Airfield lighting	24.0	113.7	40.86%	148.9	55.04%
Radio navigation and system building	7.4	45.9	16.49%	22.7	8.38%
Tower control	8.4	43.7	15.70%	40.2	14.88%
Signaling and displaying equipment	510.0	2.6	0.94%	2.6	0.97%

Table 4. 4: Hourly energy consumption at Landside

Landside					
Areas	Total Kw	Total Energy consumption during summer(kWh)	Percentage KWh @ Summer@Air side	Total energy consumption during Winter(kW)	Percentage KWh @winter@Air sides
HVAC	34.02	116.2	31%	73.39	26%
Security Equipment	2.60	7.3	2%	8.50	3%
Lighting	19.40	100.9	27%	67.20	24%
Electromechanical	30.18	130.8	35%	113.40	40%
ICT	2.40	20.0	5%	18.74	7%
Total	88.60	375.21	100 %	281.22	100%

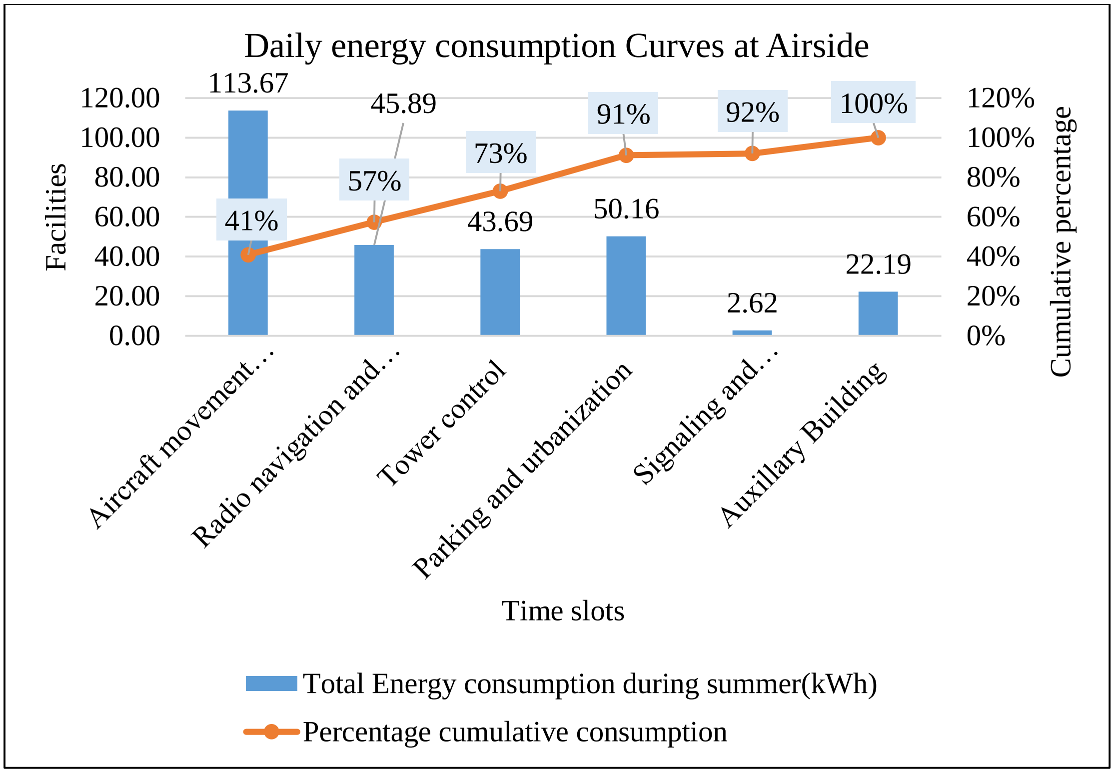

Figure 4. 7: Average daily energy consumption curve at Airside

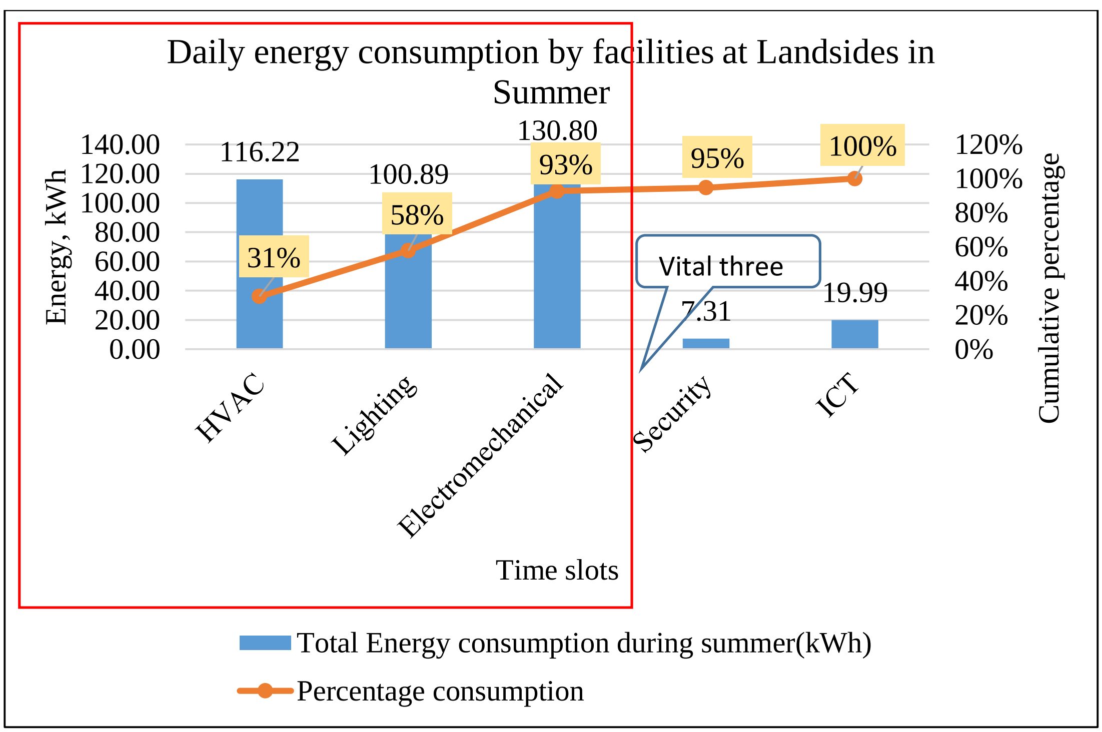

Figure 4. 8 : Average energy consumption curve at Landside

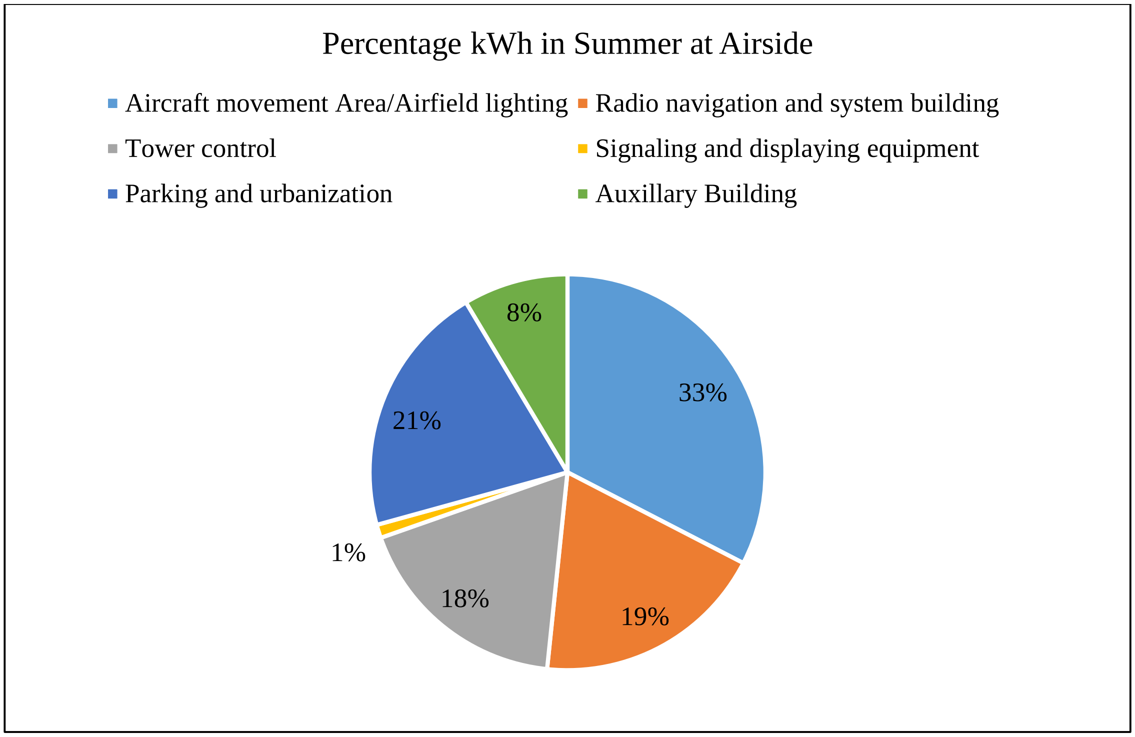

Figure 4. 9 : Percentage kWH in Summer at Airside

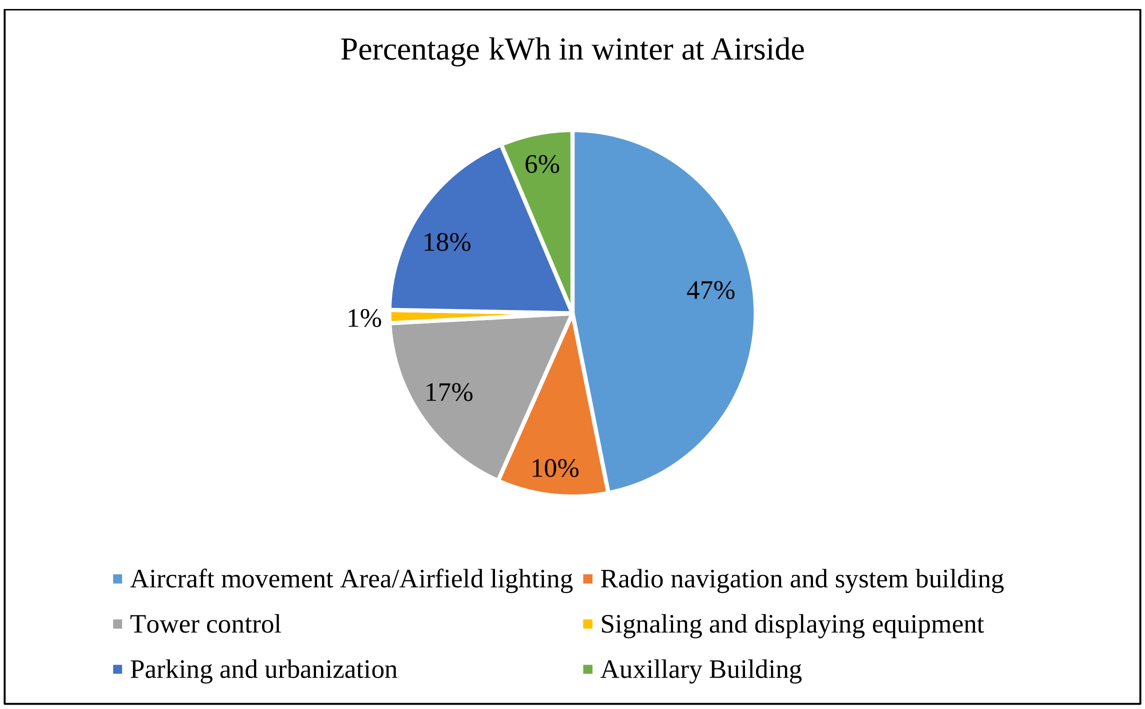

Figure 4. 10: Percentage kWH in Winter at Airside

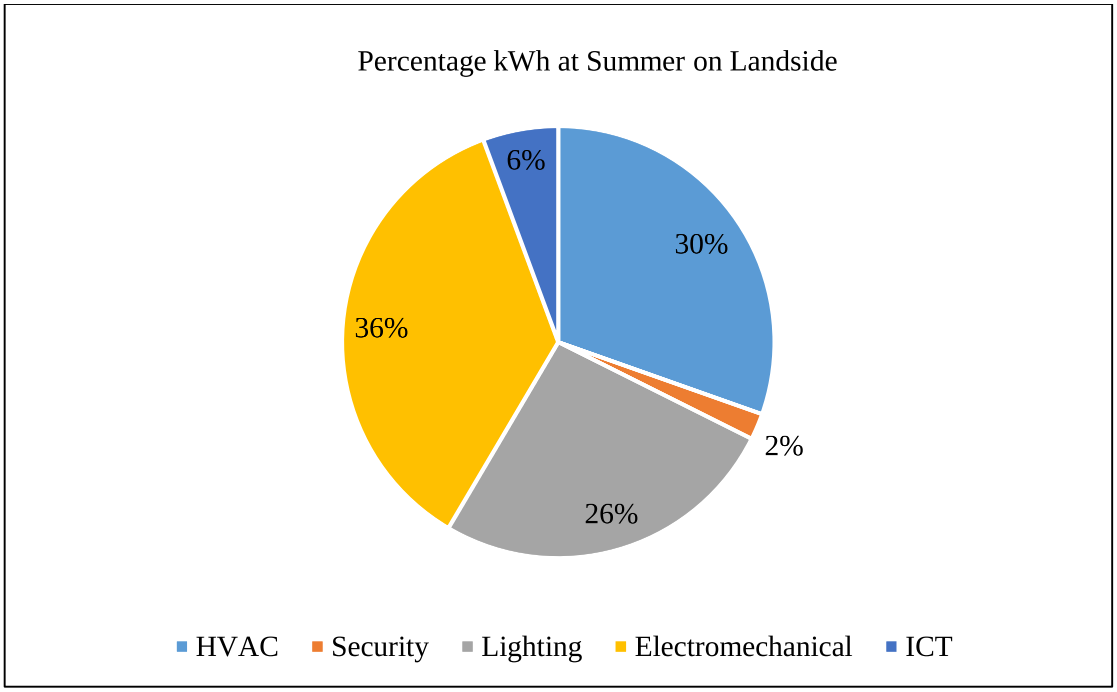

Figure 4. 11: Percentage kWh at summer at Landside

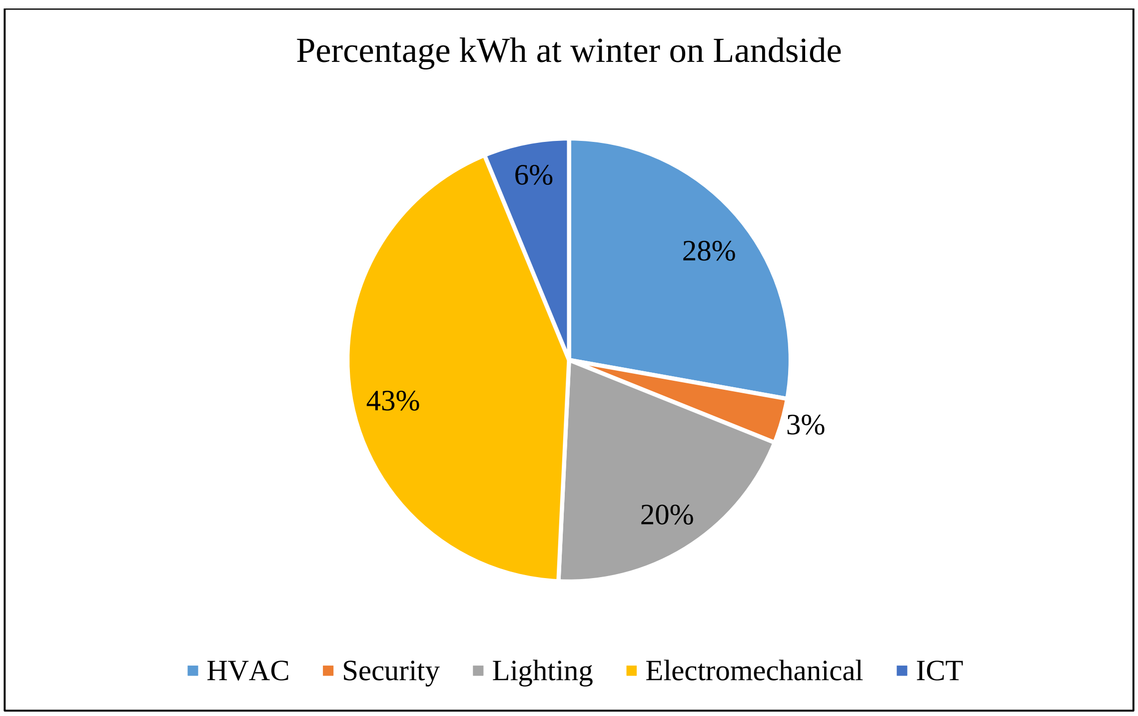

Figure 4. 12: Percentage kWh at winter at Landside

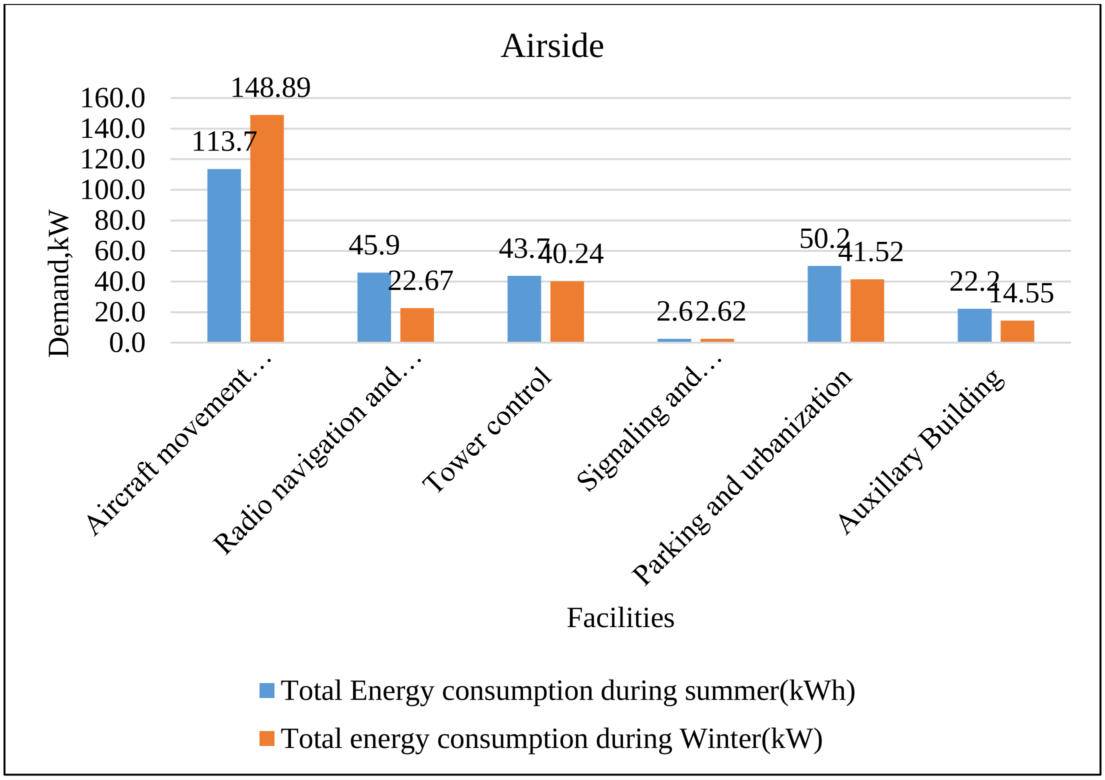

Figure 4. 13: Energy demand curve at Airside

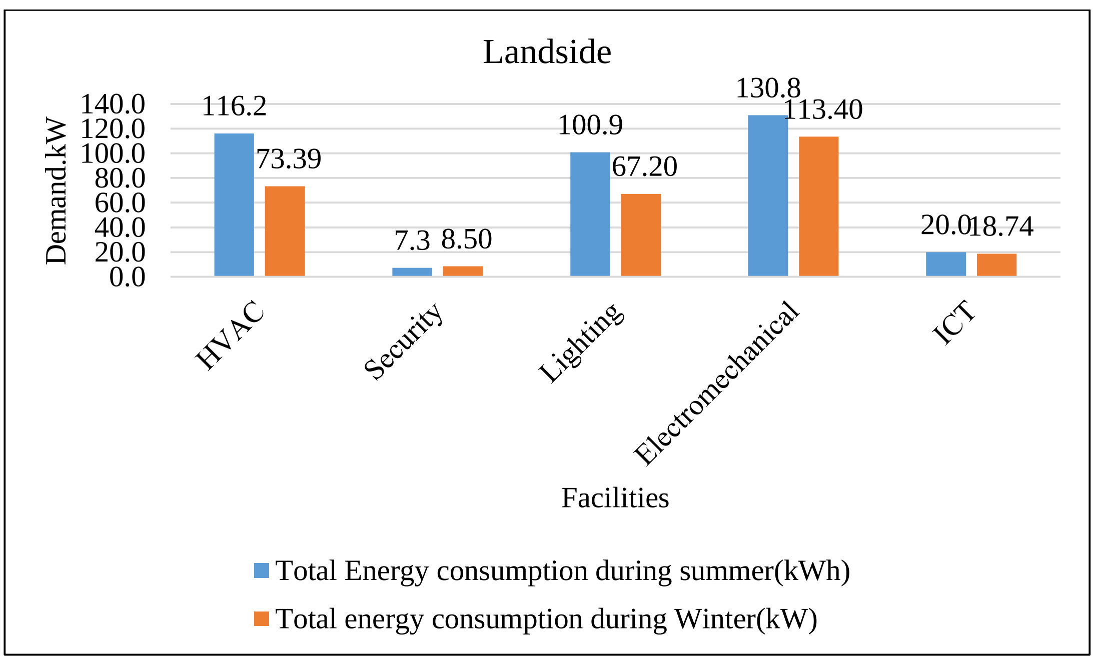

Figure 4. 14: Energy demand curve at Landside

4.3 Weekly Analysis:

The electric load profile presented in Figure 4.15 and Figure 4.16 represents the quarter-hourly power demand curves for summer and winter of the airport during one week. It has been plotted with the power demand data collected by the power analyzer located at the electrical panel board that supplies electricity to the entire airport between 15 July 2019 - 21 July 2019. This figure clearly indicates that weekly electric load profiles follow a similar curve shape for every day of the week, not showing differences between working and non-working days, therefore representing the energy demand pattern previously commented. This is because an airport with programmed regular flights operates in the same manner on working and non-working days, on the contrary to what might happen in the analysis for office buildings, schools or shopping malls. In fact, the energy demand patterns depend strongly on the season, as will be seen next, but very weakly on the day of the week. The morning peak load for the winter is 57.15kw during 8.00am to 9.00 am in the morning and 66.15kw during the evening peak load demand for 5.0pm to 6.0 pm during evening period for the summer and that for the winter is 52.95kW and 52.53Kw.

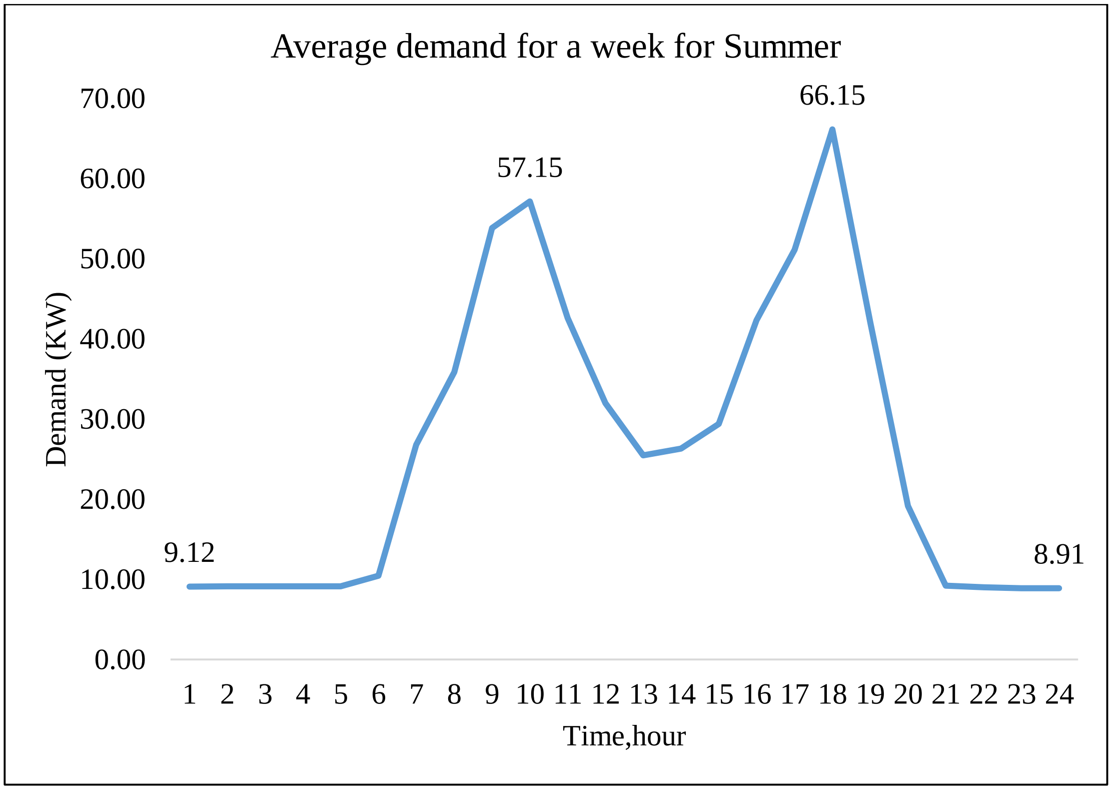

Figure 4. 15: Average weekly energy demand curve at summer

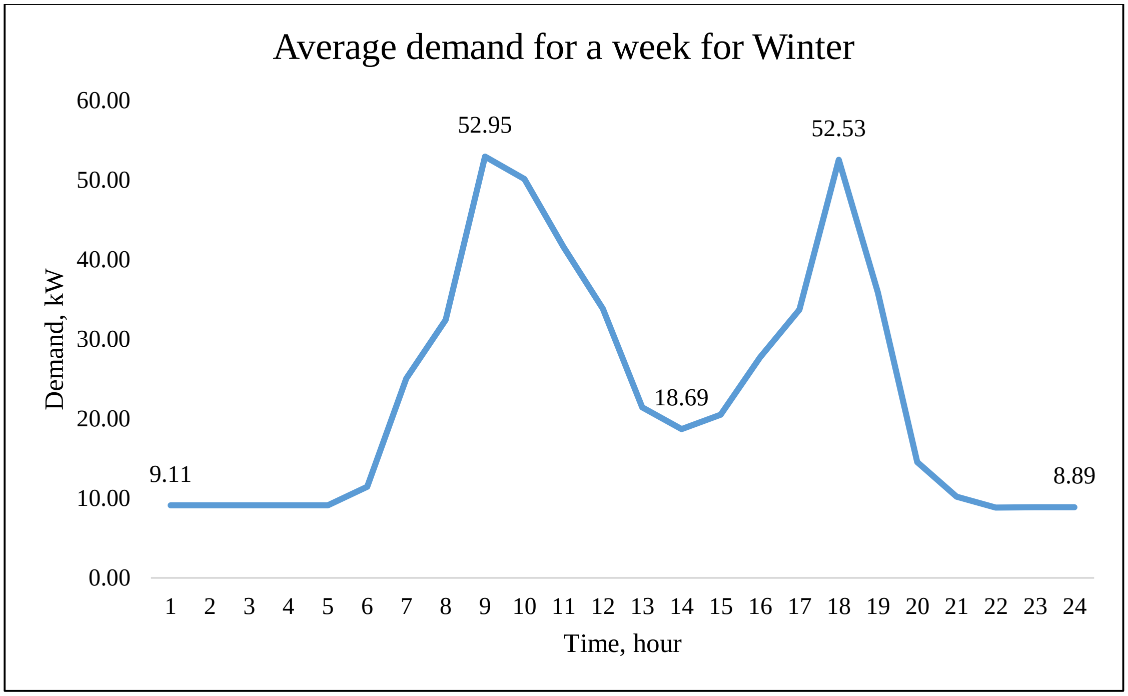

Figure 4. 16: Average weekly energy demand curve at winter

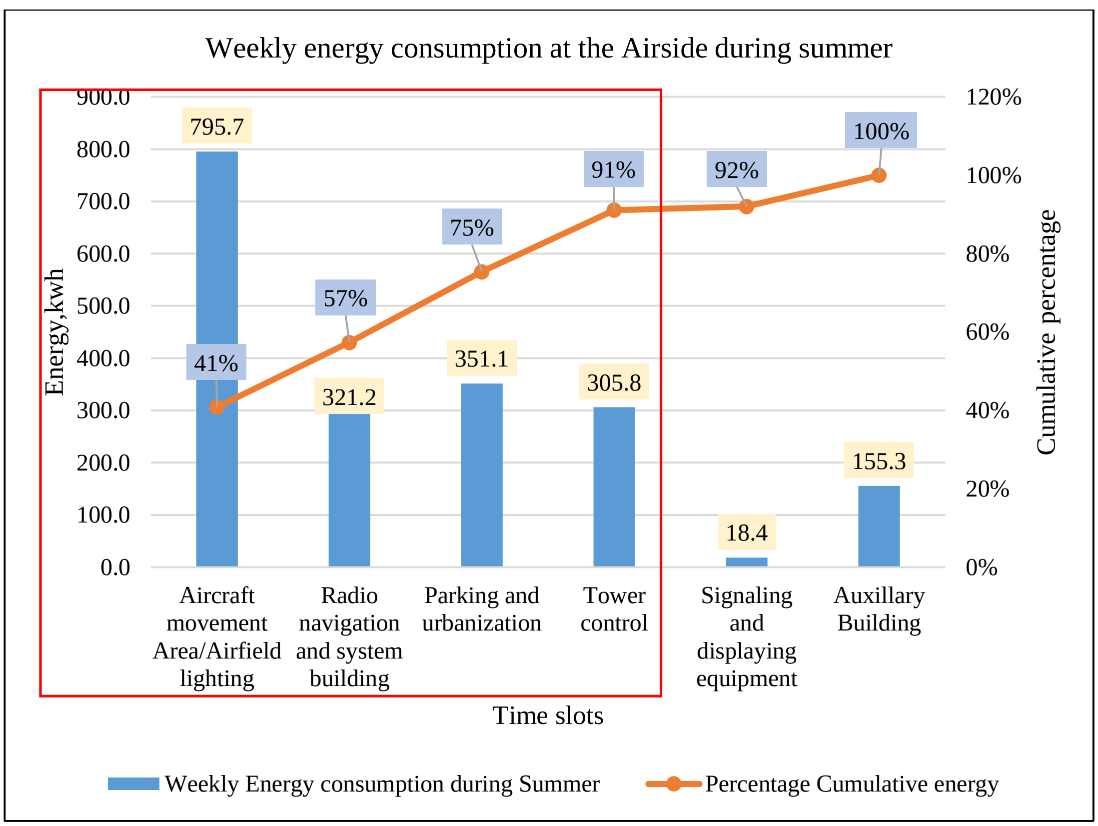

Figure 4. 17: Weekly energy consumption at Airside

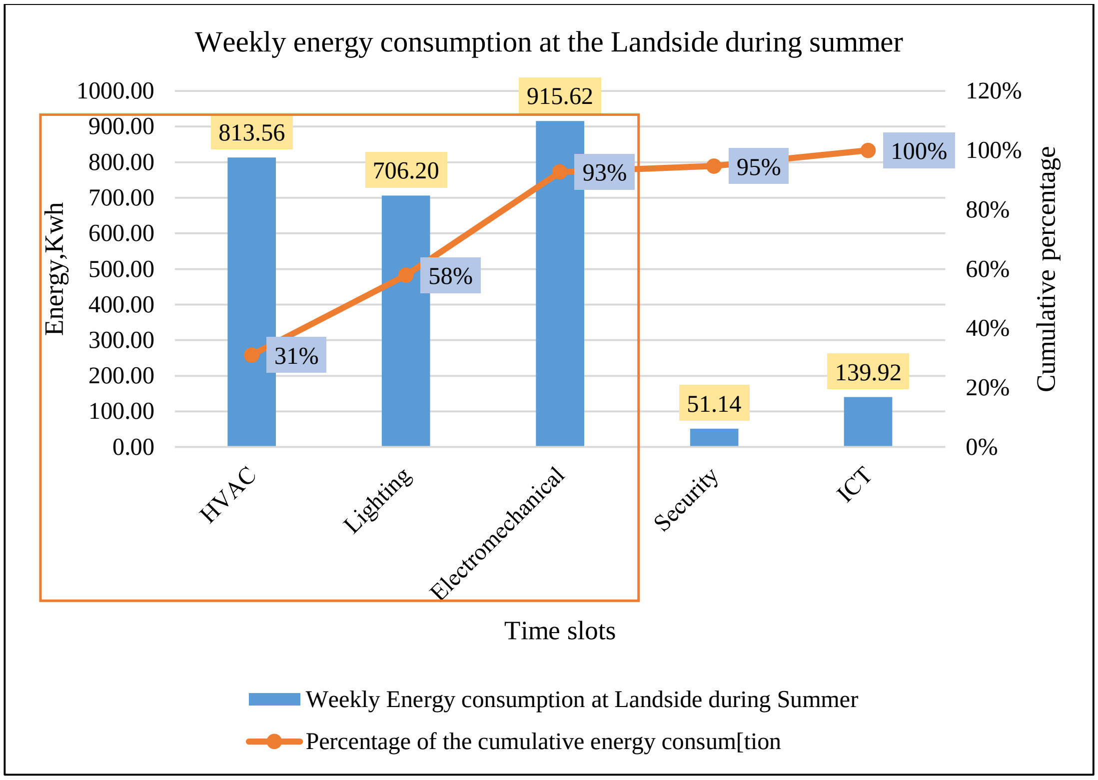

Figure 4. 18: Weekly energy consumption at Landside

4.4 Monthly Analysis:

Energy demand pattern presented previously is strongly influenced by the season of the year. While a similar curve shape is seen every day, as previously explained, the power demand varies seasonally for the hours in which the airport is open. This is principally due to the operation of HVAC and lighting systems, and is illustrated in Figures 4.20 and 4.22. This figure represents the average quarter-hourly power demand curve of the airport for each season and is based on the power demand data collected by the power analyzer located at the electrical panel board that supplies electricity to the entire airport.

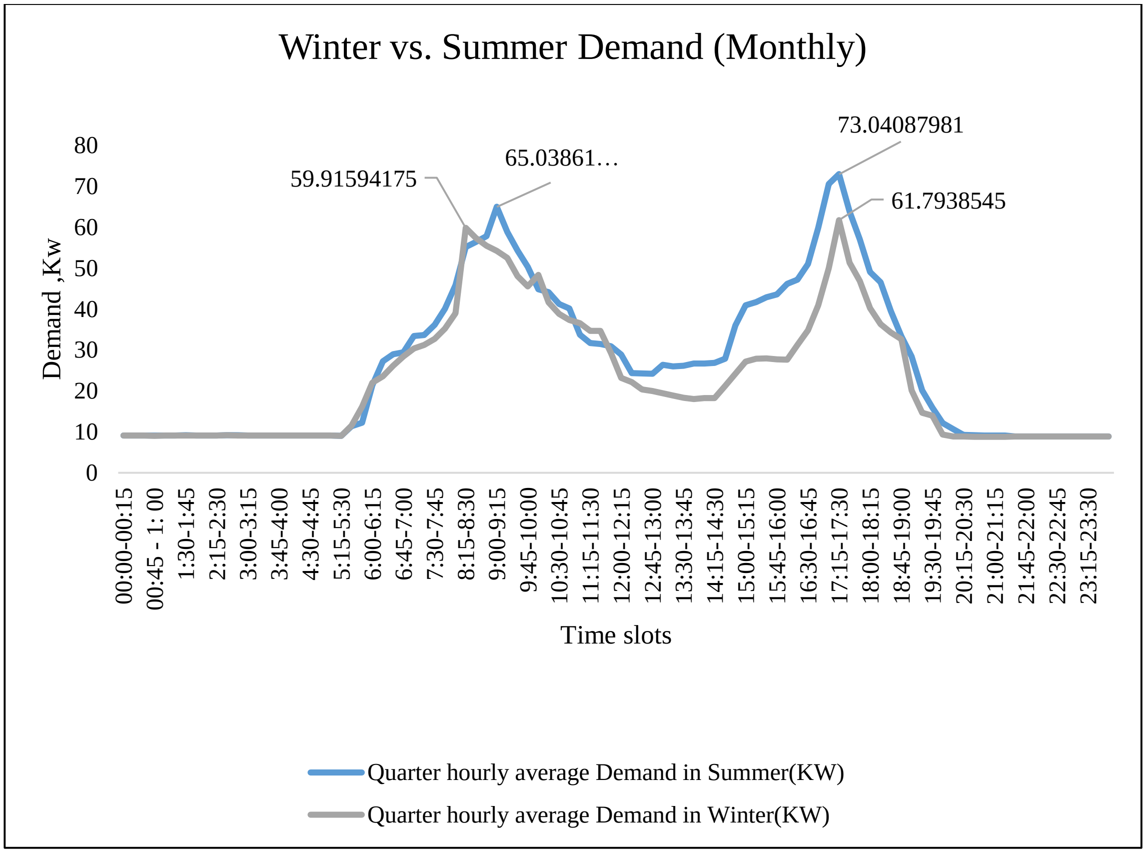

Figure 4. 19: Winter vs. summer energy Demand Curve

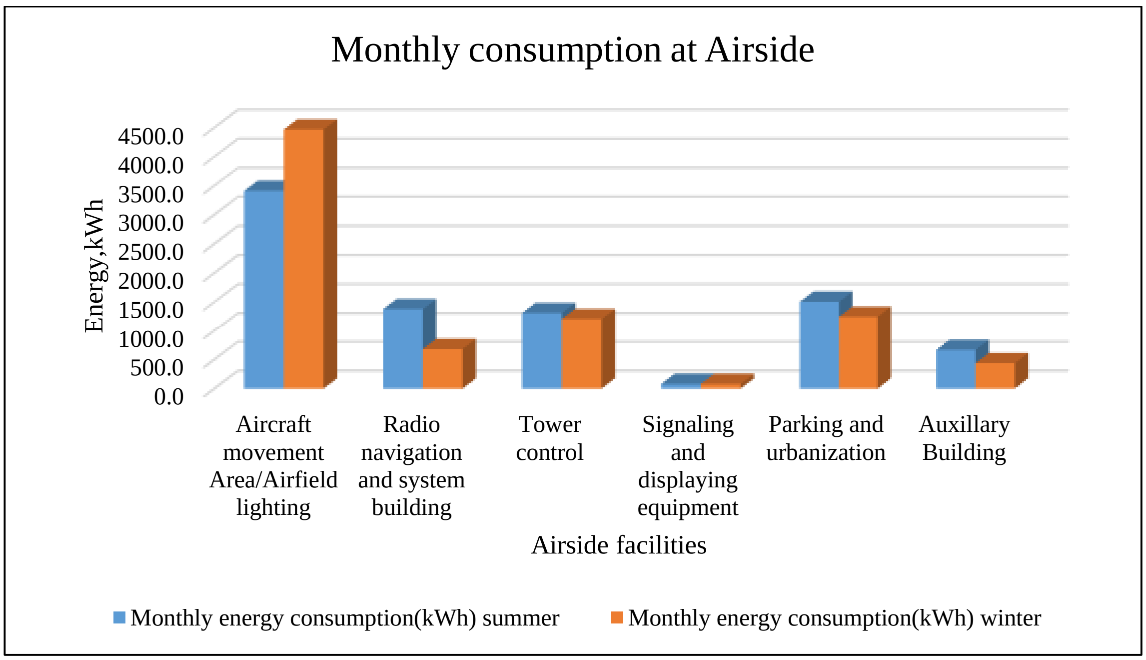

Figure 4. 20: Monthly energy consumption at Airside

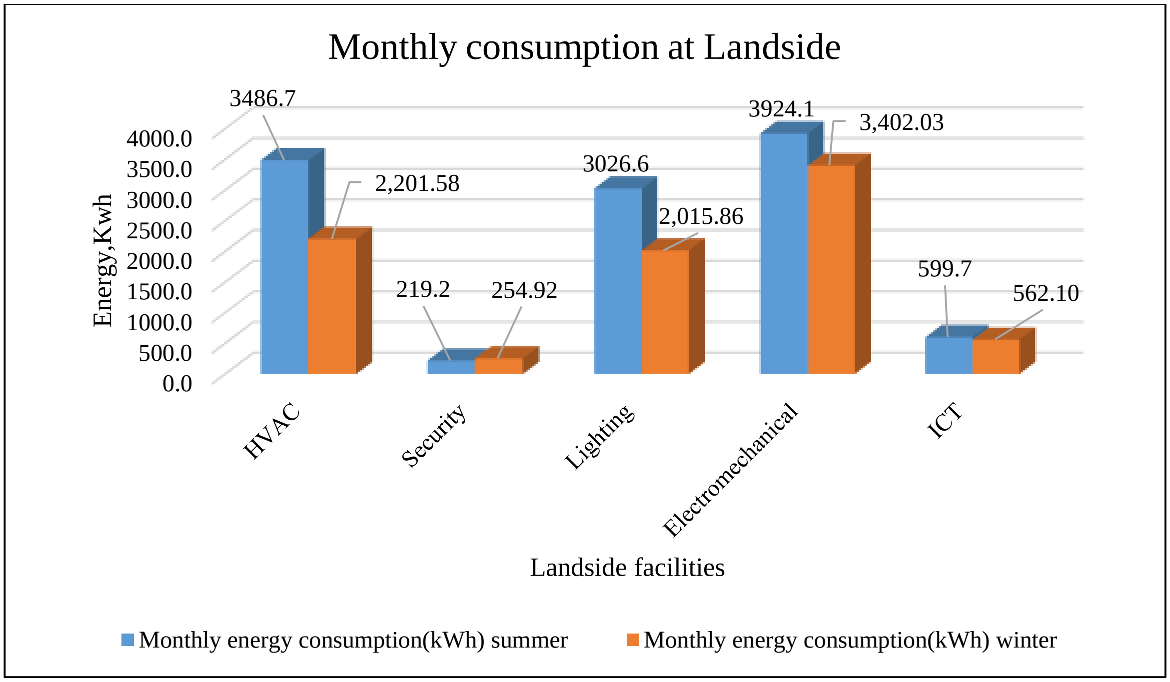

Figure 4. 21: Monthly energy consumption at Landside

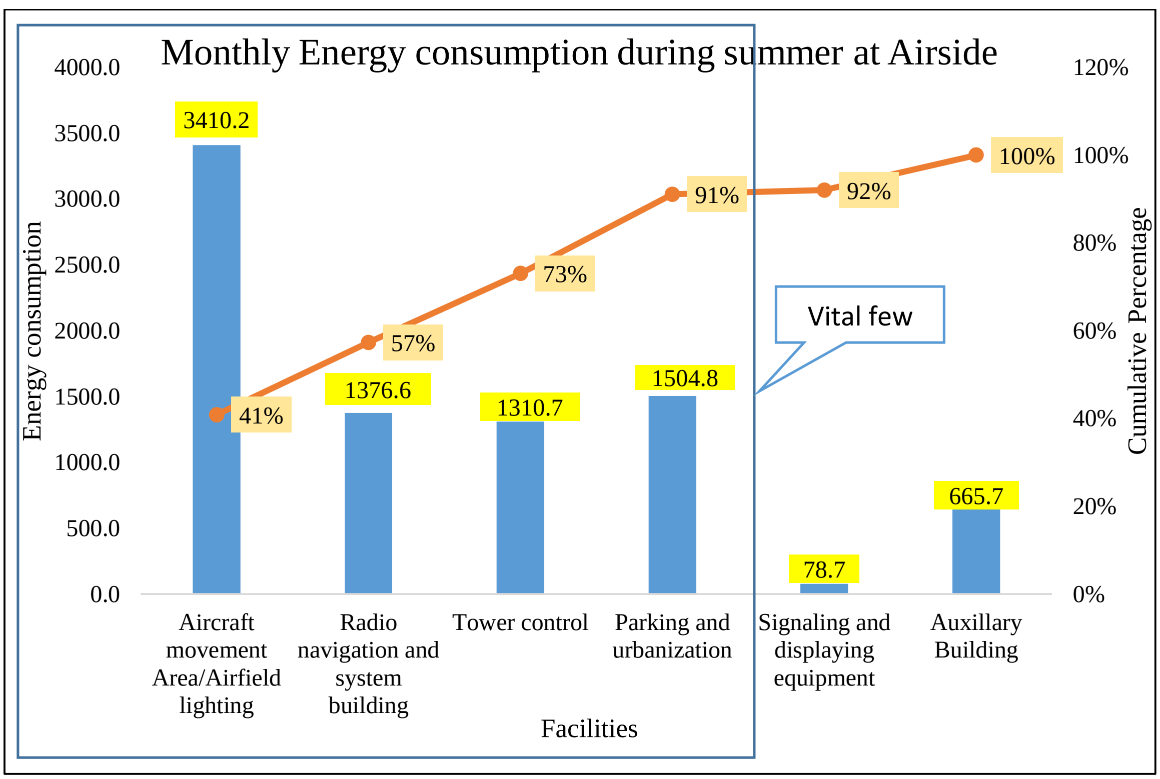

Figure 4. 22: Monthly Energy consumption pareto chart at Airside

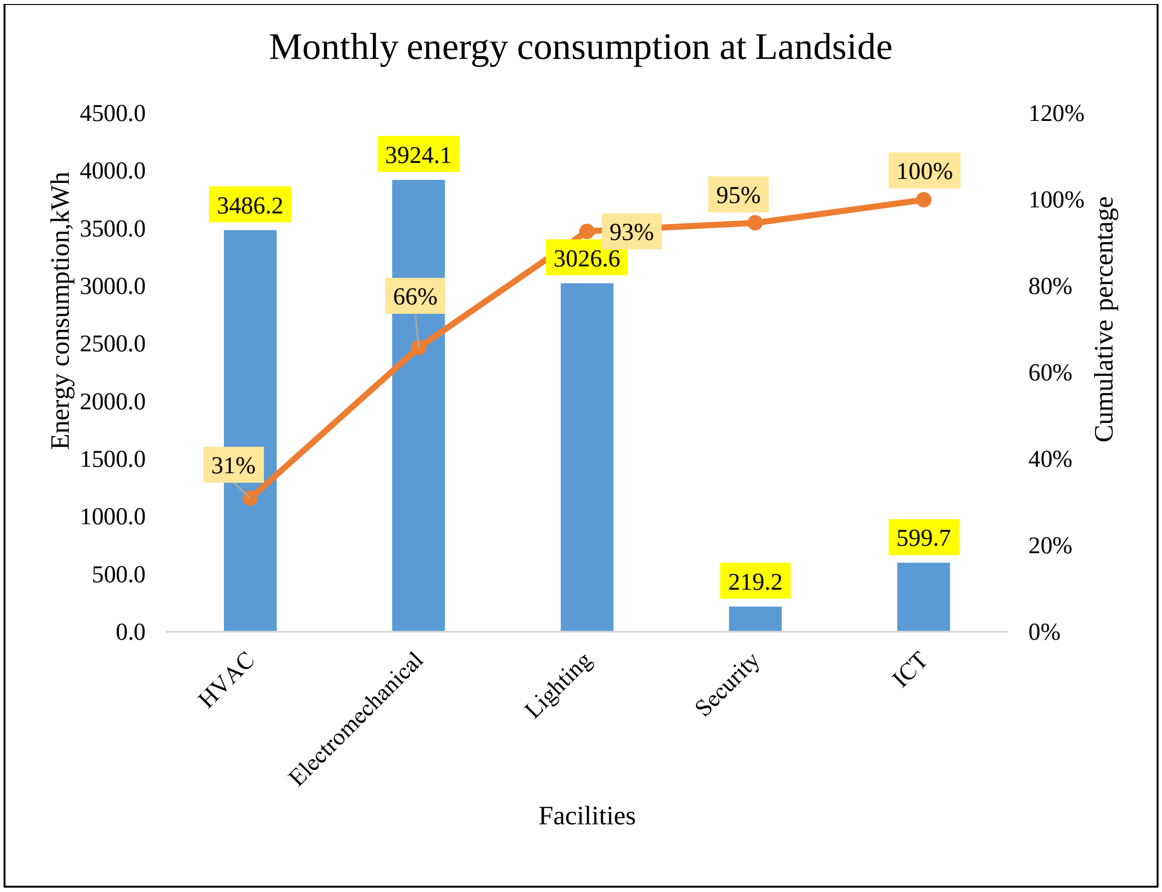

Figure 4. 23: Pareto chart for monthly energy consumption at Landside

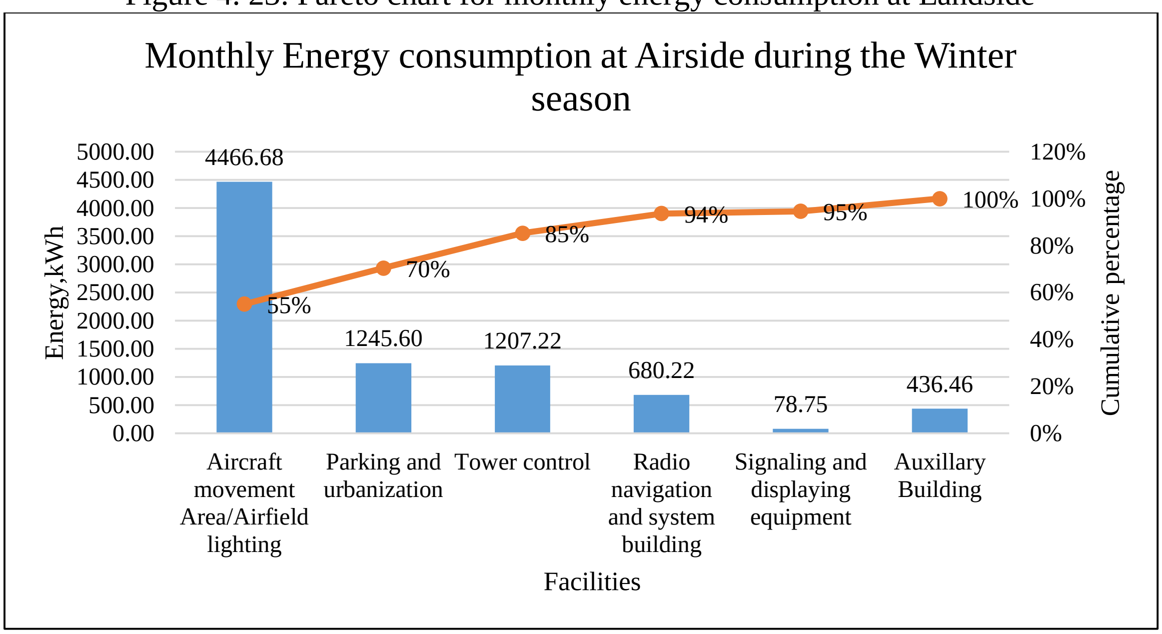

Figure 4. 24: Pareto chart for the monthly energy consumption at airside during winter season

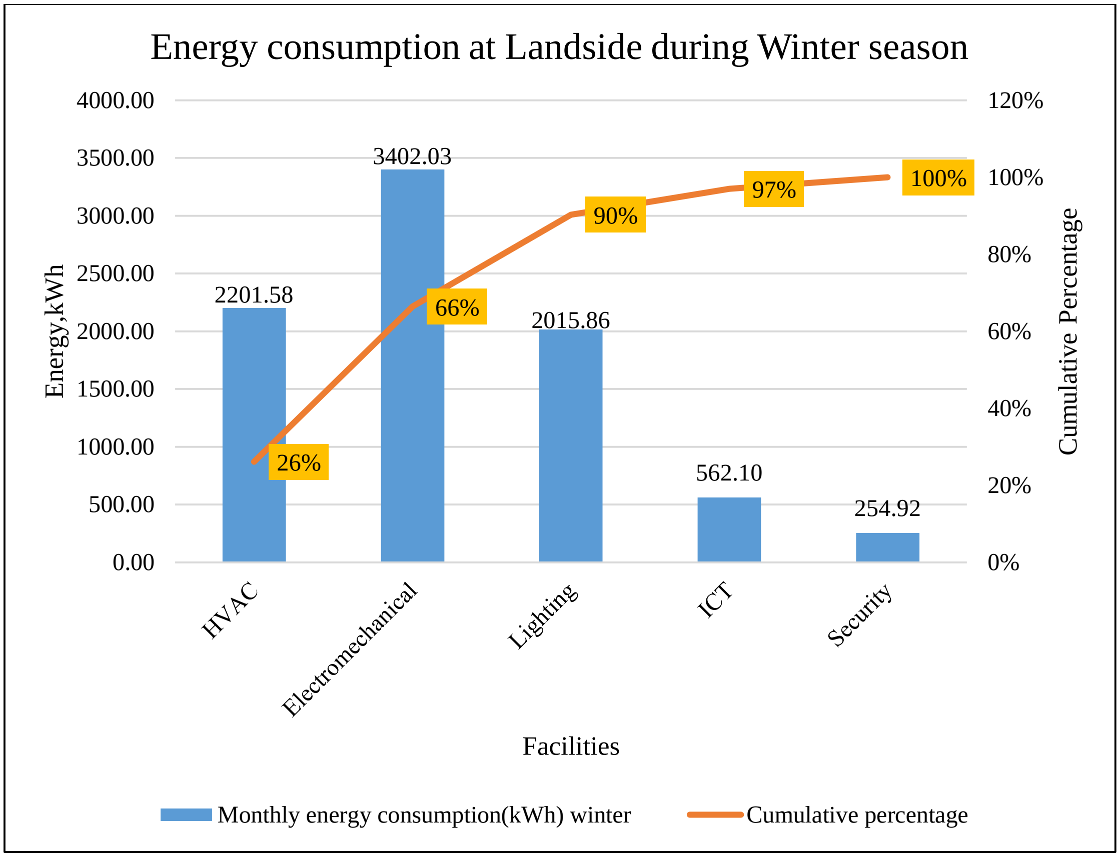

Figure 4. 25: Energy consumption at Landside during winter season

Related to HVAC systems, a big difference exists in the energy demand during the period the airport is open between summer and winter. As can be seen in Figure 4.19, in winter this energy demand stabilizes at approximately 15kw, while in winter and summer this energy demand stabilizes around 22 kW. This difference in energy demand averages about 7kw is principally due to the lower need for HVAC systems during the seasons winter as compare to the summer season because Dhangadhi is located at very toroid condition that cooling load is always high as compare to the heating loads so, HVAC systems represent a very important part of total energy demand.

After the calculation of winter and summer average energy consumption pattern and with the NEA tariff rate for the different season, The total energy tariff for the summer and winter and the demand charges are Rs 2,52,886, NPR.227955.1 and demand charge is NPR.24000 respectively.

4.5 Annual analysis:

As a consequence of the energy demand patterns presented previously, annual energy consumption by hour is higher in the period from 6 a.m. to 9 a.m., the morning start-up hours, due to the large number of electric loads that are started-up at the opening of the airport, and between 5 p.m. and 7 p.m., the main hours of the evening setback period, due to the switching-on of lighting and airfield lighting. In Figure 4.21 and 4.22, which represents the facility wise energy consumption during the entire year for the entire airport, and is based on the energy consumption data collected by the power analyzer located at the electrical panel board that supplies electricity to the entire airport during the year 2020/2021.

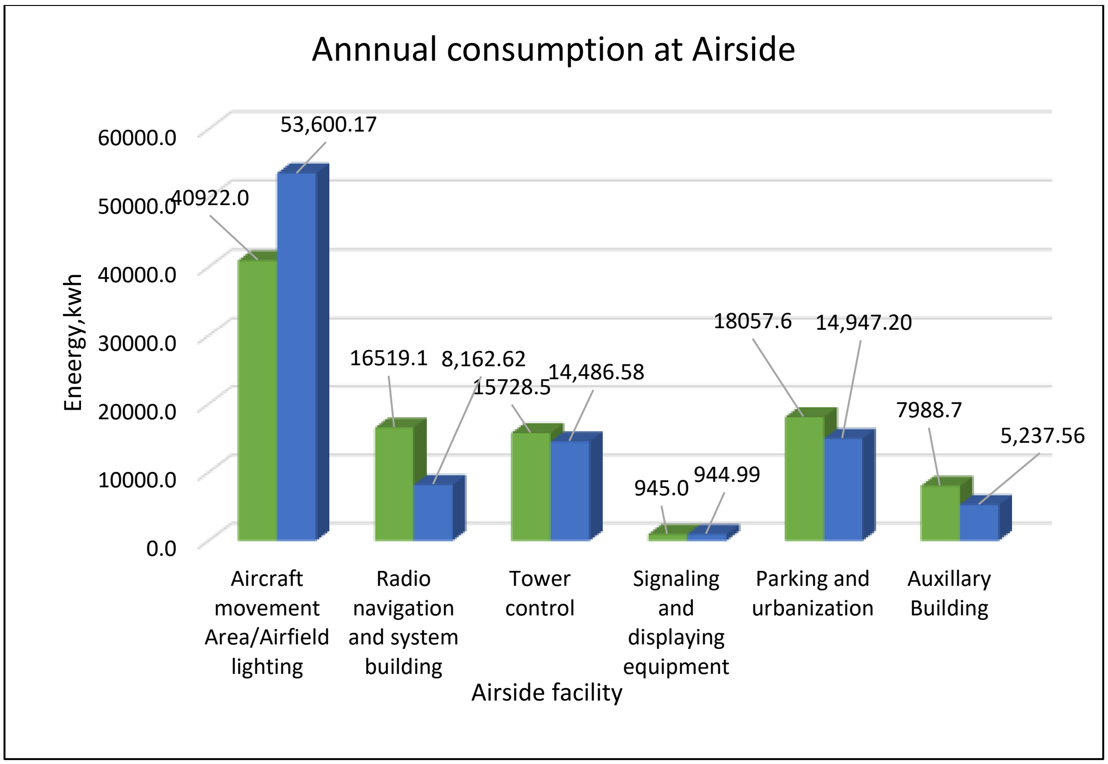

Figure 4. 26: Annual Energy consumption at Airside

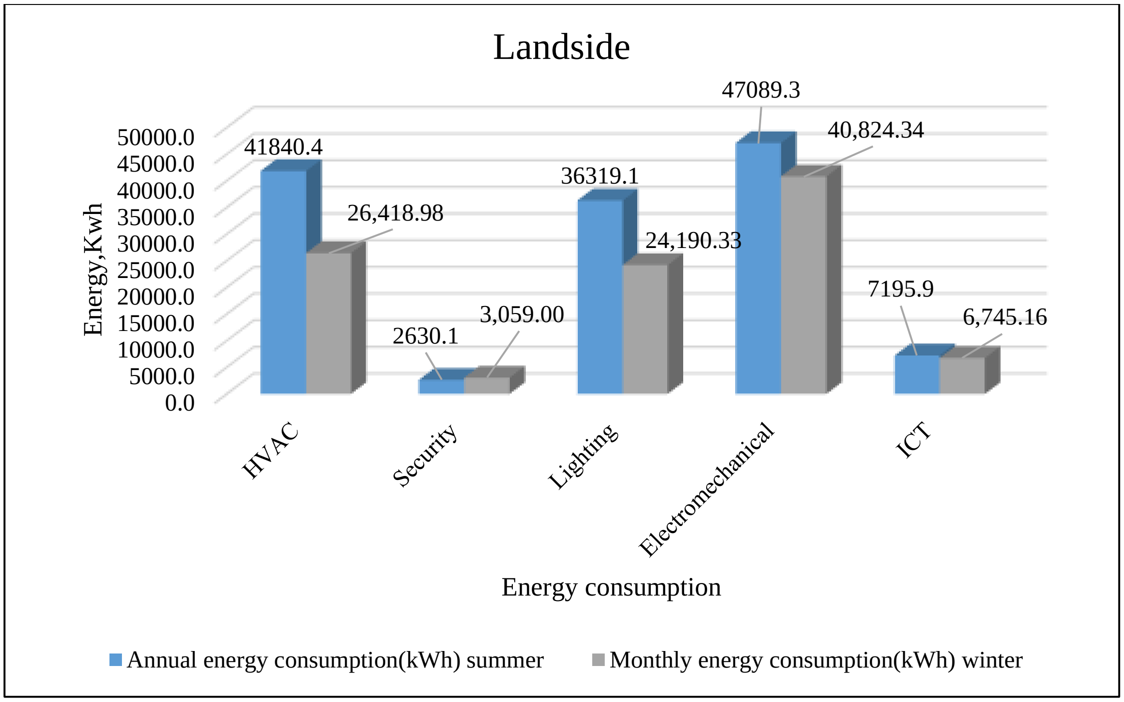

Figure 4. 27: Monthly energy consumption at Landside

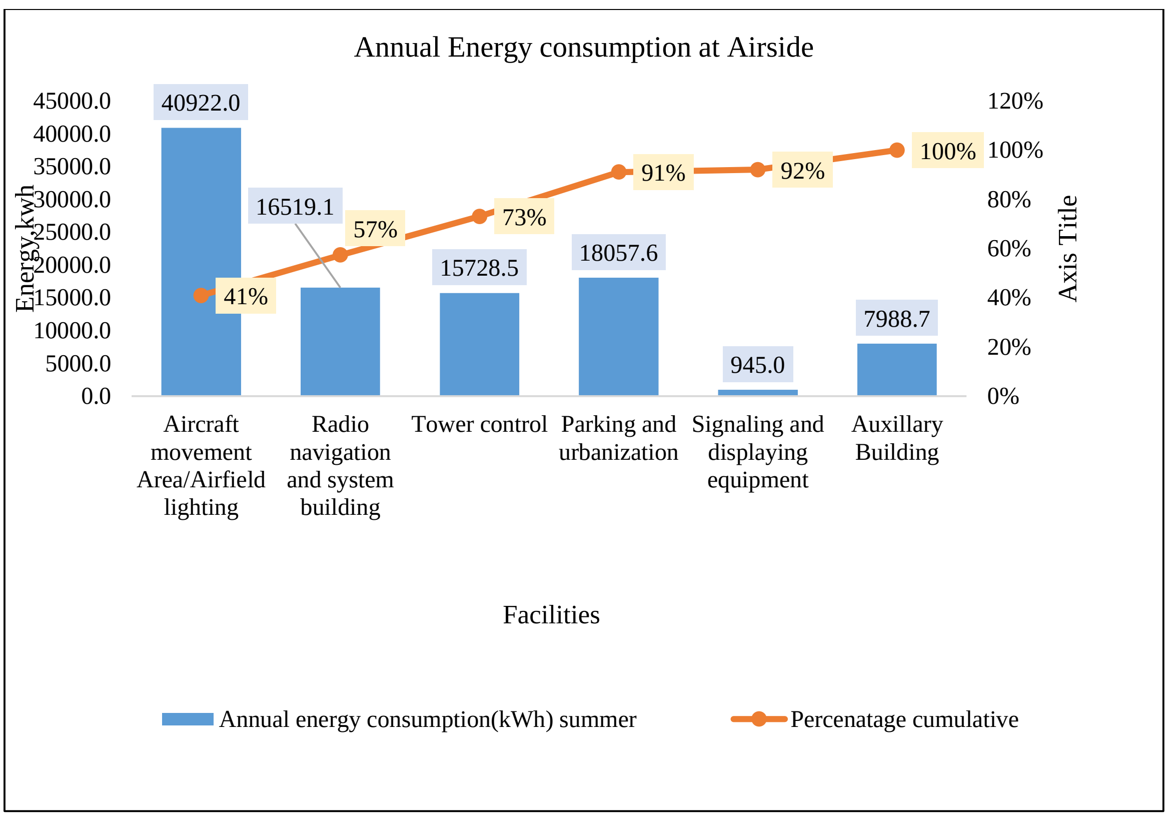

Figure 4. 28: Annual Energy Consumption at Airside

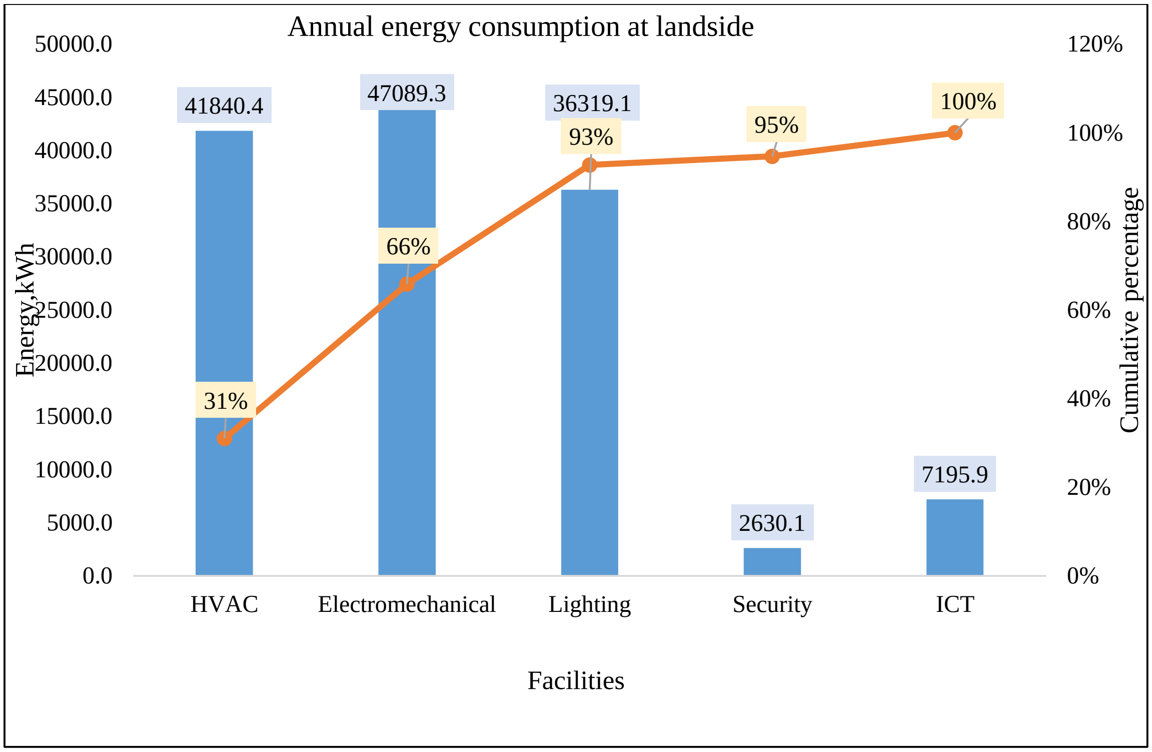

Figure 4. 29: Annual energy consumption at Landside

Considering the summer and winter energy consumption, throughout the year the average annual energy consumption by the different facilities are shown in the Table.4.5

Table 4. 5: The annual energy consumption by the different facilities.

Areas	Annual energy consumption(kWh)	Cumulative sum	Percentage cumulative
Electromechanical	45001.0	45001.0	24%
HVAC	36699.9	81700.9	19%
Lighting	32276.2	113977.1	17%
Aircraft movement Area/Airfield lighting	27,281.75	141258.8	14%
Signaling and displaying equipment	12,038.58	153297.4	6%
Radio navigation and system building	11,012.87	164310.3	6%
Tower control	10,485.81	174796.1	6%
Auxiliary Building	5,325.87	180121.9	3%
ICT	7045.6	187167.6	4%
Security	2773.1	189940.7	1%
Parking and urbanization	630.00	190570.7	0.3%

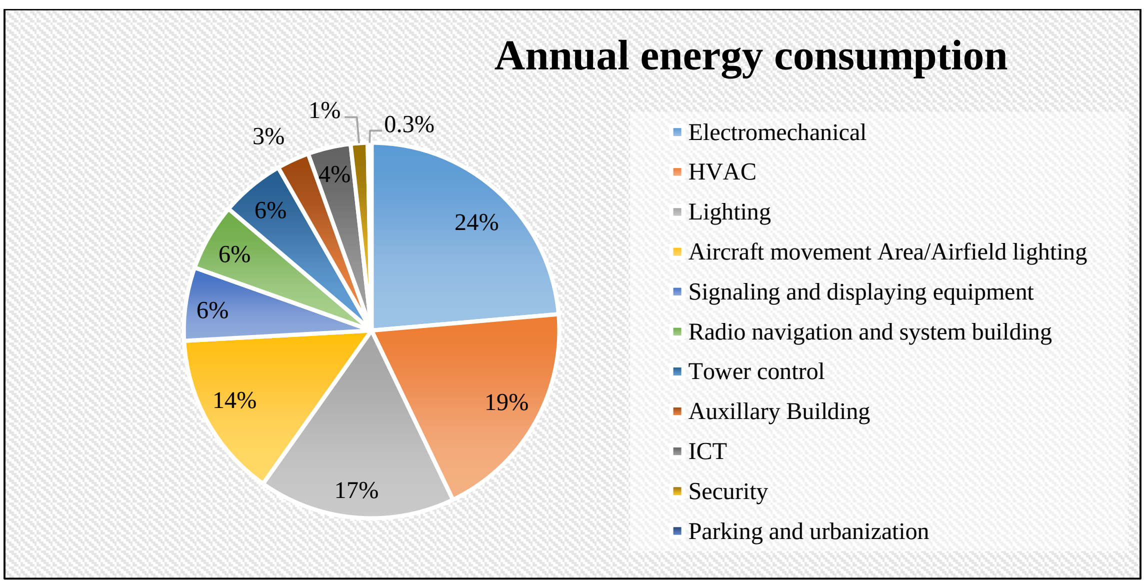

Figure 4. 30: Overall Annual Energy consumption

Total annual energy consumption during the winter and summer season is 190570.7 kWh. The major energy consumption areas are Electromechanical, HVAC, and Lighting and Aircraft movement areas. Which consumes the 90 percent of the total energy consumption as shown in the Fig 4.27. The types of loads related to the major energy consumption areas are Opening and the variable loads such as Water pumps and the inverter system for battery and the online ups for the electromechanical loads. And the Variable Airfield lighting, HVAC systems, General Lighting Systems, plays vital role in the energy consumption areas. And the total Electricity cost for the whole year is NPR.2934915.982.

4.6. Average Energy consumption influenced by the external influencer:

The average energy consumption is influenced by the different external factors. The HVAC and the cooling load depends upon the external temperature and the relation between the energy consumption and temperature during the summer and winter varied because the winter HVAC loads depend on the heating load but that for the summer season is related to the cooling load and the loading pattern varies in its own ways. The relation between the cooling load and the heating load is given by the regression analysis and the curve fittings.

4.6.1. Summer energy consumption vs. temperature:

The average daily energy consumption data and the temperature are shown below in the table below.

Table 4. 6: Hourly average energy consumption data vs. temperature during summer

Hour	Average demand for an hour for Summer day(kW)	Temperature at summer day(Per degree)
1	9.12	26
2	9.15	26
3	9.16	26
4	9.15	26
5	9.15	26
6	10.46	26
7	26.81	26
8	35.86	27
9	53.86	28
10	57.15	28
11	42.63	29
12	32.00	31
13	25.47	32
14	26.34	34
15	29.41	33
16	42.33	33
17	51.12	33
18	66.15	33
19	42.16	31
20	19.19	28
21	9.23	28
22	9.01	27
23	8.91	27
24	8.91	27

Table 4. 7: average daily energy consumption and the temperature.

	Coefficients	Standard Error	t -Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-85.434	31.594	-2.7	0.012	-150.9	-19.91	-150.95	-19.912
X1 Variable 1	3.897	1.092	3.5	0.001	1.63	6.16	1.63	6.162

The above result shows that the regression equation for the relation between the energy consumption data and the temperature is **Energy at summer = (-85.43) + 3.8974 X1.**

4.6.2. Winter energy consumption vs. Temperature:

The average daily energy consumption data and the temperature are shown below in the table below.

Table 4. 8: Average demand vs. Temperature for winter

Hour	Average hourly demand for Summer day(kW)	Temperature at summer day(per degree)
00:00	9.13	13
03:00	9.91	12
06:00	36.81	12
09:00	41.85	16
12:00	20.22	21
18:00	37.98	27
21:00	20.22	16
24:00	8.87	12

The regression analysis between the average daily consumption curve and the temperature is shown in the table below.

Table 4. 9: The regression analysis between the average daily energy consumption and the temperature for summer.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	3.5736	15.6962	0.2	0.82	-34.83	41.980	-34.83	41.980
X Variable 1	1.2124	0.92915	1.3	0.23	-1.061	3.4859	-1.061	3.485

This above table shows that the relation between the energy consumption and the temperature is shown by the equation Energy consumption at **winter = 3.573683 + 1.212 X1.**

4.7. Cost saving opportunities

4.7.1. Power factor improvement:

On the energy monitoring and the recording data the current existing power factor was the 0.75. This power factor is very low so that there may be arising many issues such as the kva demand increases which in turn increases kva costs. Also there may be issue of energy loss due to low power factor and also the current flow through the power cable increases so that the power cable sizing should increase. There is the possibility of increase the existing power factor so that these losses and the cost saving can be achieved through decrease in the increased demand charges.

In case of Dhangadhi airport, the active power is 142.355kW and the monthly demand charges is 2880 and the annual cost of capacitor per kvar is 127.385. Thus the most economical power factor is 0.999,which is shown by the MATLAB Simulation .Thus the financial analysis of the capacitor bank for the payback period are shown in table below.

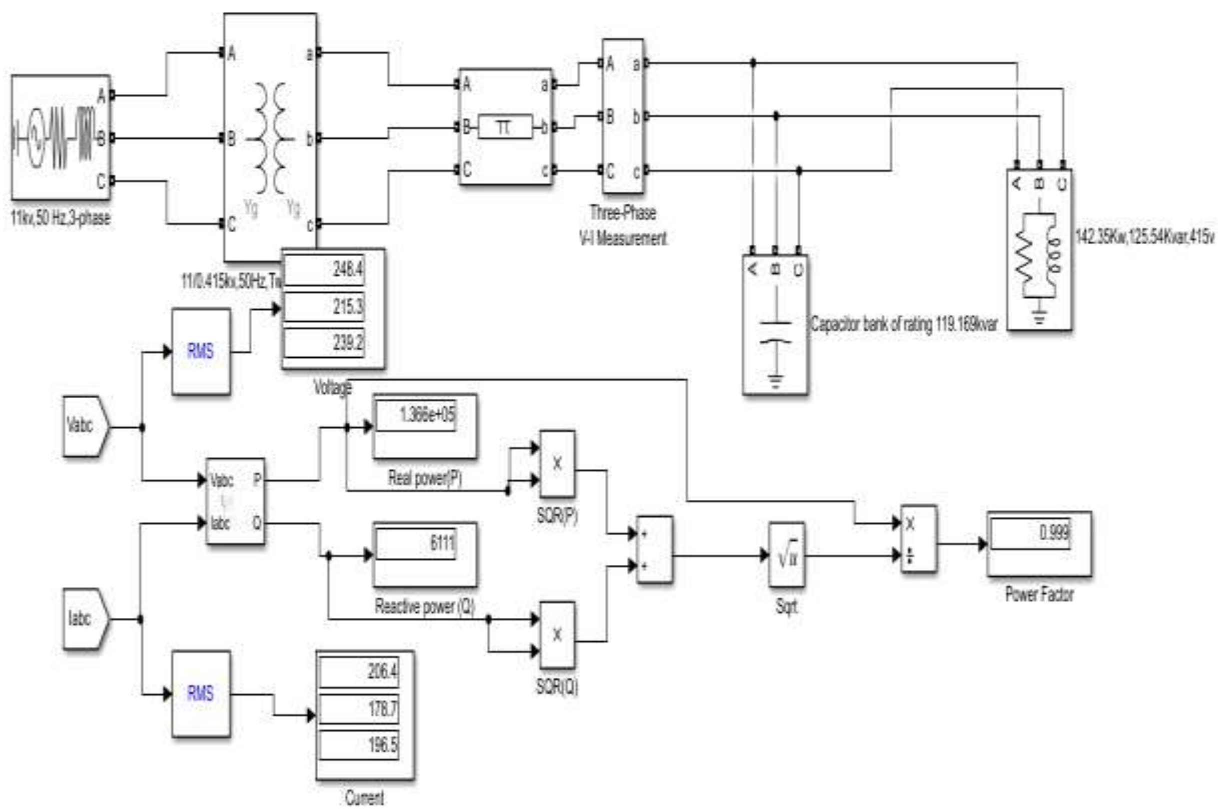

Figure 4. 31: Most economical power factor improvement model

Table 4. 10: Cash flow diagram for the Financial Analysis

Cash Flow Diagram For Power Factor Improvement								
Year	Capital Investment(Npr.)	Return (Npr.)	Depreciation	Repair & Maintenance	Depreciated value	Net Cash Flow(Npr)	Present Value of Each Net Cash Flow (NPV)	Cumulative cash flow
0	-151897	0.0	0.0	0.0		-151897	-151897	-151897
1	0	136259	-37974	-6813	-113922	91471	83156	-68740
2	0	136259	-28480	-8175	-85442	99602	82316	13575
3	0	136259	-21360	-9538	-64081	105360	79158	92734
4	0	136259	-16020	-10900	-48061	109338	74679	167413
5	0	136259	-12015	-12263	-36045	111980	69531	236945
6	0	136259	-9011	-13625	-27034	113621	64136	301081
7	0	136259	-6758	-13625	-20275	115874	59462	360543
8	0	136259	-5069	-13625	-15206	117564	54844	415388
9	0	136259	-3801	-13625	-11405	118831	50396	465784

Net present value	$465784.31
IRR	50%
Discounted payback period (Years)	2.83

After the power factor improvement the saving per month will be Rs 11354.93.

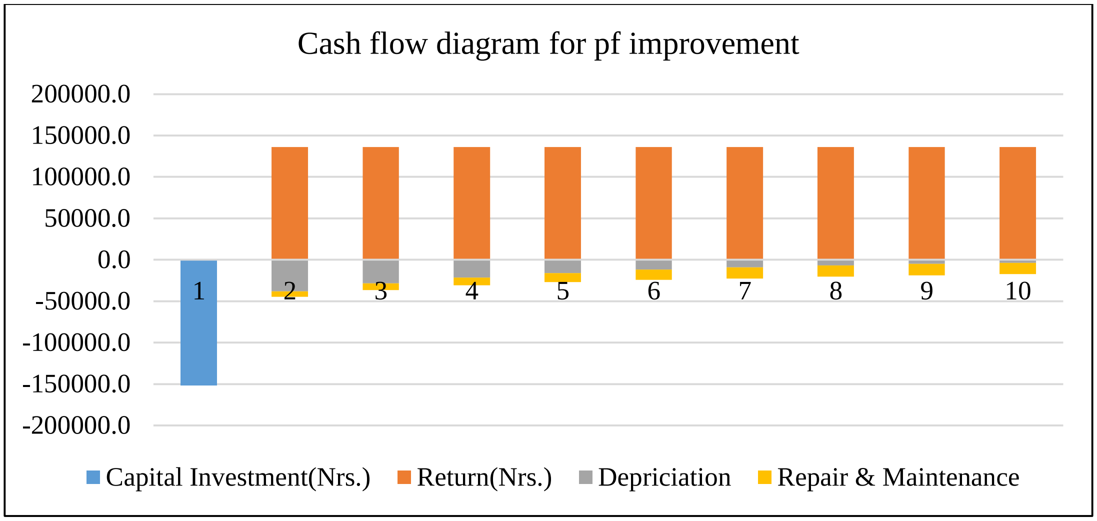

Figure 4. 32: cash flow diagram for the power factor improvement

The financial analysis for the capacitor bank replacement shows that the discounted payback period is 2.83 years. And the internal rate of return is 50% which shows that the project is feasible for the application.

4.7.2. Time Alteration of the shift able loads:

Among the all electrical charges in the Dhangadhi airport, there are many electrical loads that can be shift able and non-shift able. Shift able loads are the type of loads that can be shifted from the peak hour to the non-peak hour without hampering the airport operations whereas the shift able loads are such loads there consumption time cannot be compromised because it directly affects the airport operations. Thus there may be the possibility of saving cost by shifting the loading of the shift able loads from the peak hour to the non-peak hour or to the low consumption area of the existing curve so that the load factor of the energy curve increases and the curve becomes more flat and the efficient operation can be achieved. The shift able loads are tabulated in the table 4.11.

Table 4. 11: Shift able loads category

Shift able loads	Quantity	Rating(watt)	Total rating(Watt)
Water dispenser	10	90	900
Air compressor1	1	2700	2700
Air compressor2	1	2236	2236
Electric kettle	4	1000	4000
Three phase water pump	1	3728.5	3728.5
Water pump	7	745.7	5219.9
Inverter 1	1	1600	1600
Inverter 2	1	1600	1600
Inverter 3	1	1400	1400
Vacuum cleaner	1	1500	1500
Laptop	5	50	250
VHF/UHF charger	2	25	50
Total			25.184kW (17.69 %)

In case of the Dhangadhi airport the shift able load are listed on the consult with the energy manager of the airport without compromising the air operations and the passengers comfort.

After the categorization of the shift able loads it is found that the shift able load is 17.69 % of the total loads. So the shift able loads are significant such that if it is shifted to the peak hour to the off peak hour and the consumption curve become more flat such that the load factor and the peak clipping of the loads can be achieved so the demand charge decreases and the cost saving can be achieved. This shifting optimization have done in the MATLAB software using the MATLAB optimizer using the code generation for the shifting process.

The optimization model for the time alteration of the shift able loads are as follows.

Objective function: min $\sum$ ($P_h \times L_{max}$)

Subject to:

$X_h(new)=X_h(old)$

$X_{a,h}$= Energy consumption of the appliances a at h^{th} hours

System Load at h^{th} hour (L_h)= $\sum_{H=h}(Xa)$

All assigned as a binary variables (0 or 1)

- TOD tariff at h^{th} hour =[P_h]
- Peak load(L_{max})= max(L_h)
- Average Load(L_{avg})= $\frac{1}{H}\sum L_h$
- Φ_a= Starting time of appliance a
- Ψ_a= Ending time of appliance a
- H= 96 slots
- h= no of time slots

The existing curve and the demand curve after the optimization are shown in the figure 4.31.

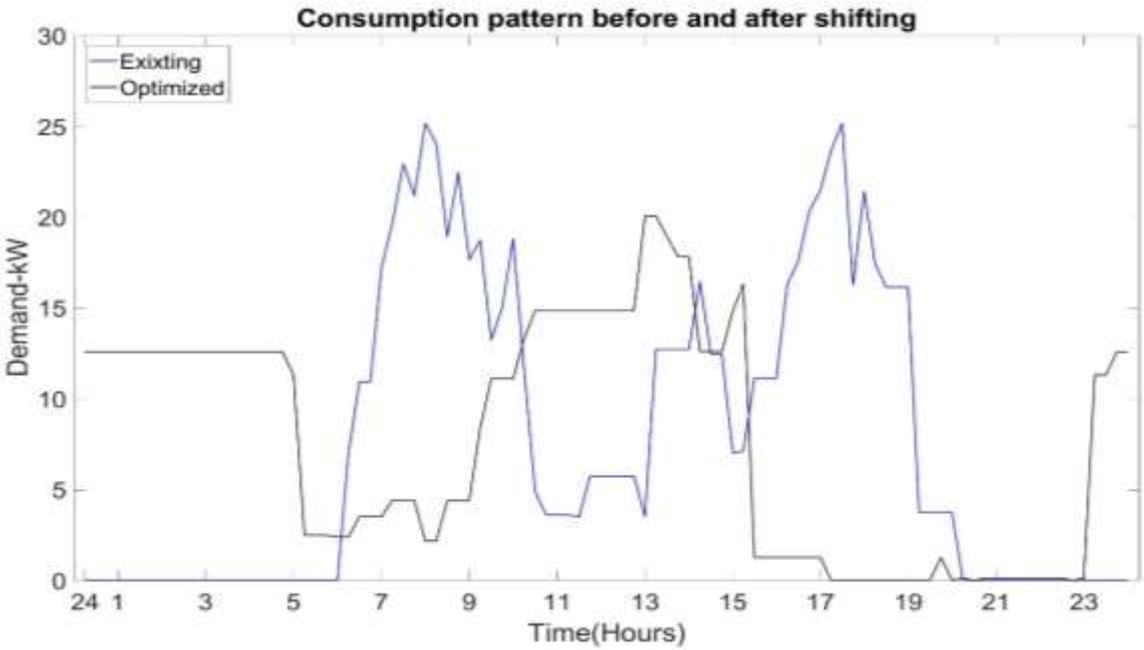

Figure 4. 33: Existing Shift able Vs. Optimized Consumption Curves

This curve shows that the demand response of the shift able load decreases during the peak hour and the these loads are shifted to the low consumption area of the curves that is during the night period and the during the day time where the demand is minimum and the whole consumption curves becomes more flat and the peak shaving can be achieved.

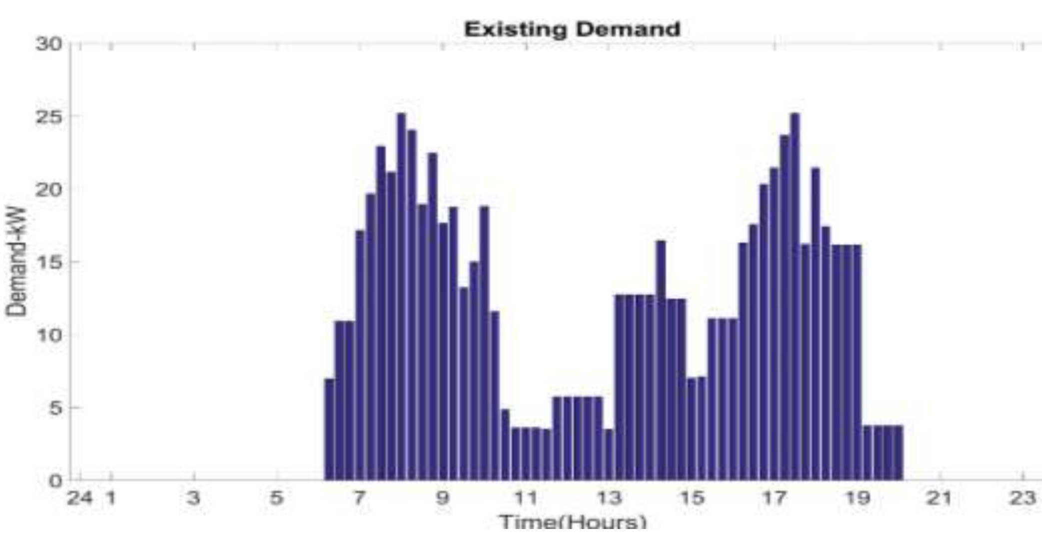

Figure 4. 34: Existing demand of the shift able load

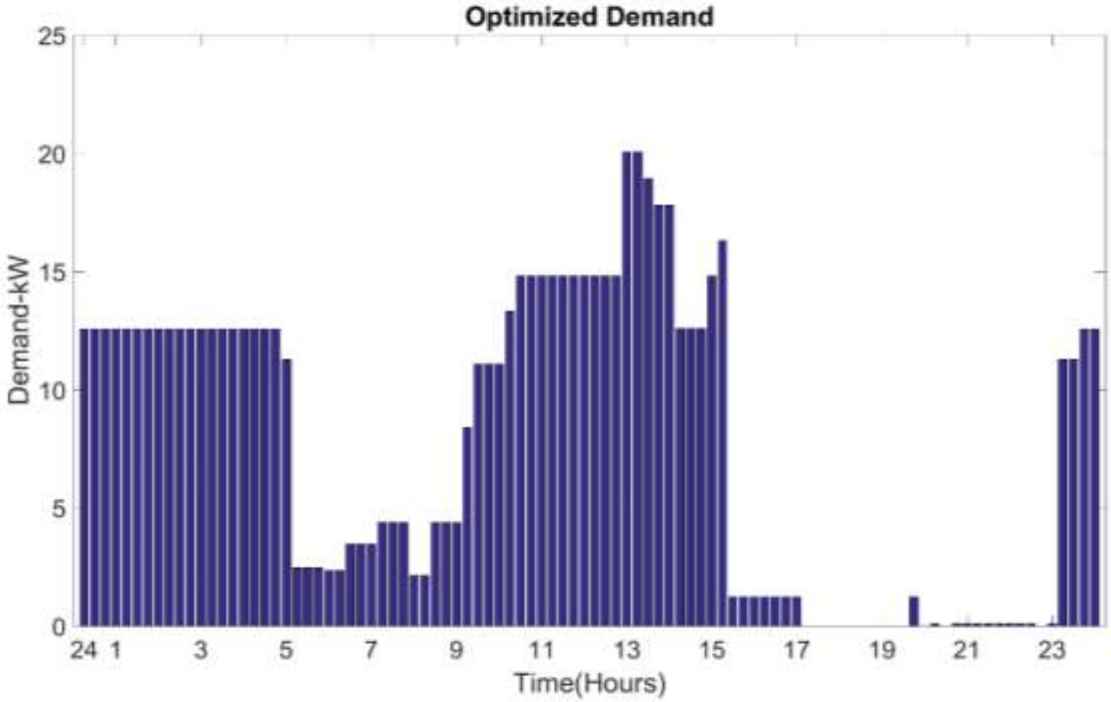

Figure 4. 35: Optimized demand of the shift able load

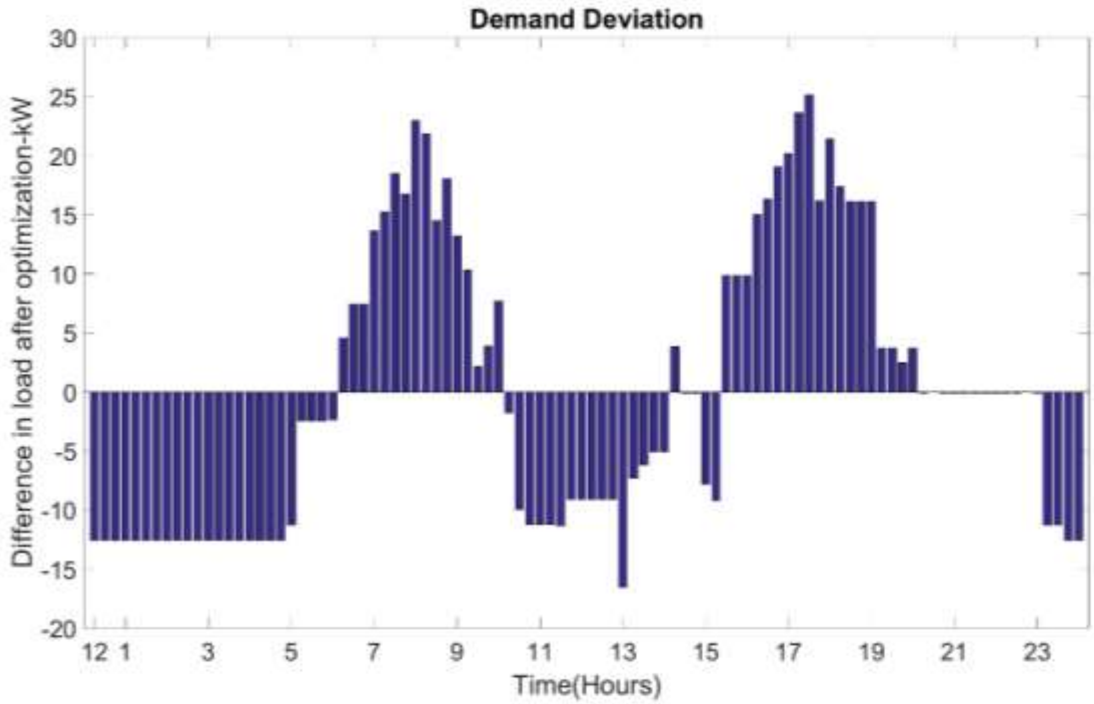

Figure 4. 36: Demand variation of the existing and optimized loads

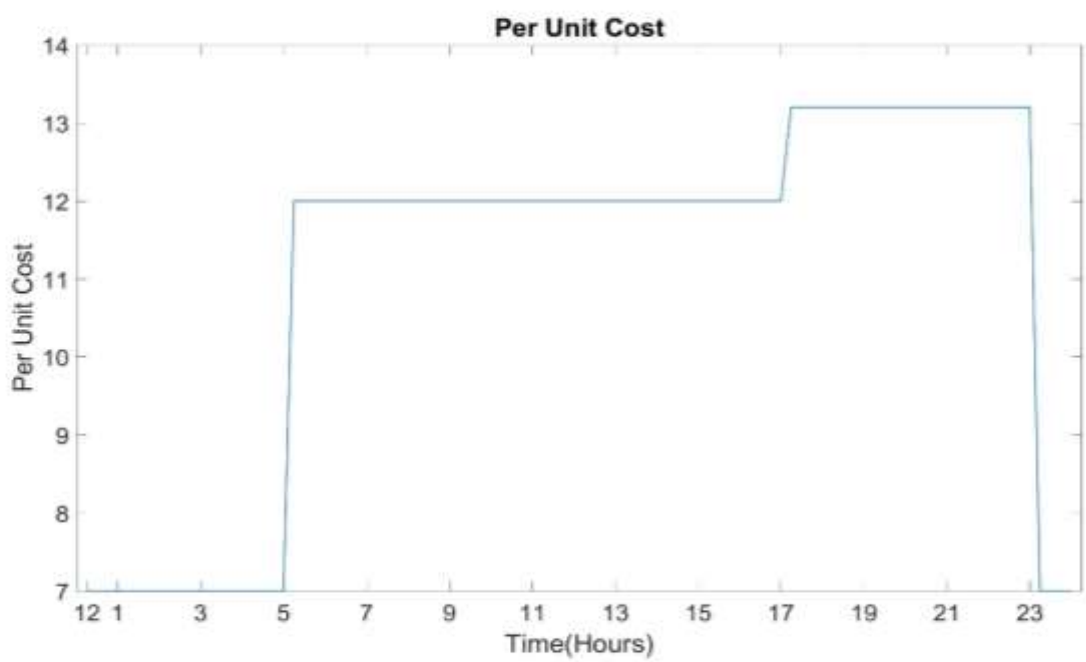

Figure 4. 37: Per unit cost of energy (Source: NEA)

From the above existing and the optimized curves the cost saving of the optimized curves is NPR.90450 and the previous existing monthly cost is 103100. Thus the saving per month is 12650 and the annual saving is NPR.151800 to the shifting of the shift able load to the non-peak hours.

4.7.3. Cost saving by the Replacement with Star rated HVAC, LED Lights and Star rated Fan:

The Currently existing loads at the Dhangadhi airports are conventional types, so that the power consumption by these appliances are high. Due to the development of modern more advanced technology the development of more efficient technology and the less power consumption devices such as the HVAC, LED lights, and the star rated ceiling fan are available Energy consumption and ultimately the cost saving can be achieved. There are some relative comparison such that Conventional appliances can be replaced with the low rating high efficient devices which can provide the similar features as in the conventional devices.

Table 4. 12: Relative comparison of halogen light with LED light

Halogen Light Bulb Wattage	LED Equivalent Wattage
100 Watt	12 Watt
75 Watt	11 Watt
60 Watt	8 Watt
50 Watt	6 Watt
30 Watt	4 Watt

Table 4. 13: Relative comparison of Fluorescent light with LED light

Fluorescent Tube Light Wattage	LED Equivalent Wattage
70 Watt	24 Watt
58 Watt	22 Watt
35 Watt	18 Watt
20 Watt	9 Watt

Table 4. 14: Relative comparison of Sodium light wattage with LED light

Sodium Light Bulb Wattage	LED Equivalent Wattage
250 Watt	100 Watt
150 Watt	60 Watt
70 Watt	30 Watt

Source: (LEDHUT, 2018)

After the replacement of the conventional type Appliances with the new more efficient devices the energy consumption and the peak load could be reduced.

Table 4. 15: Existing and the improved system monthly energy consumption during summer

Summer	kW	kWh consumption monthly
Load of the existing system	91.03	13908.48
Load of the Improved System	72.7	10338.75

Table 4. 16: Existing and the improved system monthly energy consumption during winter

Winter	kW	kWh consumption monthly
Load of the existing system	85.6	10702.74
Load of the Improved System	62.8	7519.38

With the existing system and the improved system, the monthly energy consumption during the winter and summer season are shown above in the Table 4.16 and Table 4.17. These table clearly shows that there is energy saving between the existing and the improved system. After these saving in the energy, the total annual cost saving after the improved system implementation is shown in the Table 4.18. This shows that the total annual energy cost saving during the summer and winter season be NPR. 495334.

Table 4. 17: Annual Cost saving by the Improved System Appliances

Total Cost Saving		
Total annual Energy saving during Summer	From Baisakh to the Mangsir	NPR. 337244
Total annual Energy saving during Winter	From Poush to the Chaitra	NPR. 158090
Total Annual Energy saving	NPR. 495334	

But with considering the initial investment cost for the replacement of the existing systems with the more efficient systems, the initial investment cost is NPR.13877780 which is shown on the appendix so it takes more than 15 years for the payback and IRR is negative. So, the financial analysis shows that the replacement of the existing system with the more efficient system is negative.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1. Conclusions:

The existing energy system of the Dhangadhi airport has been analyzed and basically the energy consumption by the different areas wise and the facility wise has been analyzed. In this analysis, the average quarterly data has taken for the two season that is summer and winter because loading pattern of the two season has been slight different because of the Heating and the cooling loads and also the NEA TOD tariff structures are different for Summer and Winter seasons. The daily, weekly, monthly and the annually total energy consumption are 643.06 kWh, 3892.98 kWh, 19602 kWh, 235235.61 kWh respectively for the summer season and that for the winter season are 553.58 kWh, 16551.41 kWh, 198616.92 kWh respectively. From this current existing curve it is found that the major energy consumption area are the Aircraft movement areas, Electromechanical and Lighting. The aircraft movement area covers the runway light which are the non-shift able loads. And Electromechanical consists of HVAC which are major loads for the airport facilities. From the current existing energy consumption and the demand curve it is found that there are various categories of loads such as the night loads, opening loads, Peak loads, constant loads, variable loads and the fixed loads. With the nature of these loads and their consumption behavior the current existing curves has been plotted.

The whole loads are categorized into shift able and non-shift able loads where shift able loads can be shifted to the non-peak period or low consumption areas so that the Peak Demand shaving opportunities can be achieved. Also from the power monitoring and the recording devices, Average power factor of the Airport is found to be 0.75, and after the placement of the capacitor bank of suitable size, it is seen that significant amount of NPR.11354.93 per month can be saved after the enhancement of the power factor of the systems. The most economical power factor would be 0.99.

Another energy saving and the cost saving opportunities could be the replacement of the existing systems with the more efficient appliances. After the implementation of the inverter type AC with current existing HVAC system, LED lights in replacement with the Fluorescent tube light, Sodium vapor lights and the Halogen Lights and the star rated ceiling fan with respect to the conventional more power consuming appliances. After these improvement in the system appliances annual energy cost saving with respect to the summer and winter could be NPR. 495334. The annual energy consumption and the energy cost saving can be reduced by 24.19% and 16.75% But due to huge initial investment cost of NPR. 1, 38, 77,780 for the replacement of the existing systems and the financial analysis shows that the payback period after the replacement is more than 15 years and NPV is also negative which shows that this approach for cost saving is not feasible. The financial analysis is attached in the Appendix K.

5.2. Recommendations:

- For this research work, only the Electrical energy consumption that are supplied by the NEA are taken into account for the analysis, It is recommended to analyze the whole energy system including the Distributed Generation such as Diesel generator, Solar supply to increase the reliability of the supply System.
- For the Continuous monitoring and control of the Airfield lighting at the Dhangadhi Airport, the ALCMS (Airfield lighting control and monitoring system) systems are recommended.
- For the effective automation of the Energy system at the Dhangadhi airport, the SCADA (Supervisory Control and Data Acquisition) system and BEMS (Building Energy Management System) is recommended.
- The external factors influence as the contingencies in the operation of the airport can be analyzed using different approaches so that more actual consumption pattern can be determined.
- The cost saving approach for the replacement of the existing system with the more efficient system is infeasible in case of Dhangadhi airport but it is recommended that with the completion of the useful period of the existing systems comparative study has to be done for the new investment for the existing system and improved systems.
- The energy modeling at Dhangadhi airport can be done by using the energy plus or Leap software with considering the multi energy sources.

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APPENDICES

Appendix A: Energy consumption at Dhangadhi Airport during summer season.

Appliances/time	AC1 at tower(ROWA)	AC2 at tower(AUX)	AC3 at tower(Hisence)	AC at account room(Hisence)	AC at Electromechanical room(ROWA)	AC at Fire room	AC1 at CCR room(Panasonic Old	AC2 at CCR room(Panasonic Old	AC1 at VIP Room(new)	AC2 at VIP Room(old	AC1 at Departure room(old)	AC2 at Departure room(Hisence)	AC3 at Departure room(Hisence)	AC4 at Departure room(Hisence)	AC5 at Departure room(Old)	AC6 at Departure room(Old US)	AC at airport chief office	AC1 At guest house	AC2 At guest house	AC1 at WFP office	AC at WFP office	Cooler	Public Announce System	Hold baggage-ray machine	Refrigerator	Walk through metal	Ceiling Fan	Table Fan	Runway edge light	Turning pad light	Runway Threshold/ End light	Runway PAPI light(09/27)	Approach Light (27 side)	Taxiway light	Apron flood light	RTIL light	Beacon light	Console power supply	Halogen lamp	VOR/DME	Fire vehicle battery
Items	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	2	2	80	10	60	12	12	24	17	22	8	4	2	1	8	1	1
total capacity(ton)	2	2	1	1.5	1.5	1	2	2	1.5	1.5	1.5	2	2	1.5	1.5	1.5	1	1.5	1	0.5	0.5	500	400	2000	80	55	60	60	55	45	1200	200	65	45	260	2000	1000	1700	1000	5500	200
Rating	2155	2215	988	1555	1555	988	2315	2315	1555	1555	1555	2115	2115	1555	1720	1555	988	1555	1000	455	455	2000	400	2000	160	110	4800	600	3300	540	1200	4800	1105	990	2080	8000	2000	1700	8000	5500	200
Stand by powers	4.741	4.873	2.1736	3.421	3.421	2.1736	5.093	5.093	3.421	3.421	3.421	4.653	4.653	3.421	3.784	3.421	2.1736	3.421	2.2	1.001	1.001	0	11.72	58.8	1.92	2.64	0	0	0	0	0	0	0	0	0	0	0	168.3	0	12.65	0.46
Total Rating(watt)	2159.741	2219.873	990.1736	1558.421	1558.421	990.1736	2320.093	2320.093	1558.421	1558.421	1558.421	2119.653	2119.653	1558.421	1723.784	1558.421	990.1736	1558.421	1002.2	456.001	456.001	2000	411.72	2058.8	161.92	112.64	4800	600	3300	540	1200	4800	1105	990	2080	8000	2000	1868.3	8000	5512.65	200.46
Types of loads	Opening/Variable	Opening/Variable	Opening/Variable	Variable	Variable	Variable	Fixed	Fixed	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Opening/Variable	Opening/Variable	Variable	Variable	fixed/opening /variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Opening/Variable/fixed	opening	Opening/Variable/fixed	fixed
00:00 - 00:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
00:15 - 00: 30	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
00:30 - 00: 45	0	0	0	0	0	0	0	0.265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
00:45 - 1: 00	0	0	0	0	0	0	0	0.245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
1:00 - 1: 15	0	0	0	0	0	0	0	0.269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
1:15-1:30	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
1:30-1:45	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
1:45-2:00	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0

2:00-2:15	0	0	0	0	0	0	0	0.264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
2:15-2:30	0	0	0	0	0	0	0	0.254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
2:30-2:45	0	0	0	0	0	0	0	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
2:45-3:00	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
3:00-3:15	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
3:15-3:30	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
3:30-3:45	0	0	0	0	0	0	0	0.265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
3:45-4:00	0	0	0	0	0	0	0	0.254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
4:00-4:15	0	0	0	0	0	0	0	0.249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
4:15-4:30	0	0	0	0	0	0	0	0.264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
4:30-4:45	0	0	0	0	0	0	0	0.274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
4:45-5:00	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
5:00-5:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
5:15-5:30	0	0	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
5:30-5:45	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
5:45-6:00	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
6:00-6:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
6:15-6:30	0.4	0	0.35	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.5	0	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
6:30-6:45	0.55	0	0.45	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	1	0.5	0	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
6:45-7:00	0.7	0	0.46	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.5	0	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
7:00-7:15	0.8	0	0.52		0.4	0.35	0	0.482	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.5	0.5	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
7:15-7:30	0.85	0	0.56		0.55	0.4	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.1	0.5	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
7:30-7:45	0.85	0	0.65		0.6	0.5	0	0.498	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.5	0.5	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
7:45-8:00	0.5	0	0.58		0.6	0.52	0	0.492	0	0	0.32	0.35	0.35	0.32	0	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.6	0.5	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
8:00-8:15	0.6	0	0.57	0.6	0.65	0.56	0	0.48	0.4	0.4	0.38	0.38	0.38	0.38	0.4	0	0	0	0	0	0	0.2	1	0.1	0.1	1	0.65	0.5	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0
8:15-8:30	0.55	0	0.58	0.6	0.68	0.57	0	0.47	0.45	0.43	0.37	0.4	0.4	0.37	0.43	0	0	0	0	0	0	0.2	1	0.1	0.1	1	0.7	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
8:30-8:45	0.7	0	0.6	0.55	0.7	0.58	0	0.482	0.47	0.44	0.45	0.42	0.42	0.45	0.44	0	0	0	0	0	0	0.2	1	0.1	0.1	1	0.75	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
8:45-9:00	0.85	0	0.62	0.7	0.75	0.59	0	0.462	0.5	0.55	0.47	0.43	0.43	0.47	0.55	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.77	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1

9:00-9:15	0.95	0	0.75	0.9	0.85	0.7	0	0.65	0.7	0.7	0.6	0.8	0.75	0.53	0.65	0	0	0	0	0	0	0.2	0	0.5	0.5	1	0.8	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
9:15-9:30	0.8	0	0.52	0.6	0.55	0.5	0	0.49	0.58	0.6	0.55	0.5	0.5	0.55	0.6	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.5	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
9:30-9:45	0.423	0	0.56	0.4	0.53	0.45	0	0.36	0.53	0.5	0.51	0.51	0.51	0.51	0.5	0	0	0	0	0	0	0.2	0	0.1	0.1	1	0.4	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
9:45-10:00	0.35	0	0.5	0.38	0.52	0.43	0	0.37	0.52	0.51	0.5	0.49	0.49	0.5	0.51	0.1	0	0	0	0	0	0.2	0	0.1	0.1	1	0.1	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
10:00-10:15	0.333	0	0.511	0.38	0.5	0.42	0	0.39	0.48	0.45	0.51	0.46	0.46	0.51	0.5	0.1	1	0	0	0	0	0.2	0	0.1	0.1	1	0.1	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
10:15-10:30	0.362	0	0.5231	0	0.4	0.4	0	0.461	0.48	0.45	0.51	0.46	0.46	0.51	0.5	0.1	1	0	0	0	0	0.2	0	0.1	0.1	1	0.1	0.5	1	1	1	1	1	0	0	0	0	1	0	0.3	1
10:30-10:45	0.363	0	0.4	0	0.3	0.38	0	0.472	0.3	0.25	0.3	0.28	0.28	0.3	0.3	0.1	1	0	0	0	0	0.2	0	0.1	0.1	1	0.1	0.4	1	1	1	1	1	0	0	0	0	1	0	0.3	1
10:45-11:00	0.365	0	0.35	0	0.2	0.38	0	0.481	0.3	0.25	0.3	0.28	0.28	0.3	0.3	0.1	0.5	0	0	0	0	0.2	0	0.1	0.1	0	0.1	0.3	1	1	1	1	1	0	0	0	0	1	0	0.3	1
11:00-11:15	0.375	0	0.332	0	0.1	0.4	0	0.4612	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.1	0	0.1	0.1	0	0	0.25	1	1	1	1	1	0	0	0	0	1	0	0.3	1
11:15-11:30	0.363	0	0.325	0	0	0.4	0	0.452	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.1	0	0.1	0.1	0	0	0.2	1	1	1	1	1	0	0	0	0	1	0	0.3	1
11:30-11:45	0.362	0	0.32	0	0	0.36	0	0.4621	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.1	0	0.1	0.1	0	0	0.2	1	1	1	1	1	0	0	0	0	1	0	0.3	1
11:45-12:00	0.3125	0	0.3636	0	0	0.34	0	0.4321	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.1	0	0.1	0.1	0	0	0.2	1	1	1	1	1	0	0	0	0	1	0	0.3	0
12:00-12:15	0.3045	0	0.5	0	0	0.33	0	0.431	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.1	0	0.1	0.1	0	0	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
12:15-12:30	0.462	0	0.45	0	0.4	0.35	0	0.521	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
12:30-12:45	0.652	0	0.35	0	0.45	0.33	0	0.35	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
12:45-13:00	0.55	0	0.3	0	0.55	0.34	0	0.34	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
13:00-13:15	0	0	0.29	0	0.58	0.35	0	0.36	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
13:15-13:30	0	0	0	0	0.6	0.36	0	0.35	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
13:30-13:45	0	0	0	0	0.62	0.35	0	0.36	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
13:45-14:00	0	0	0	0.35	0.63	0.36	0	0.354	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
14:00-14:15	0	0	0	0.4	0.55	0.4	0	0.34	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
14:15-14:30	0	0	0	0.43	0.58	0.41	0	0.324	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0

14:30 - 14:45	0	0	0	0.49	0.57	0.42	0	0.48	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
14:45 - 15:00	0	0	0	0.58	0.58	0.43	0	0.532	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	1	0.1	1	0.2	0.2	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
15:00 - 15:15	0	0	0.35	0.55	0.55	0.45	0	0.512	0.36	0.35	0.33	0.35	0.35	0.33	0.35	0	0.1	0	0	0	0	0.1	1	1	0.1	1	0.2	0.5	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
15:15 - 15:30	0	0	0.38	0.56	0.52	0.44	0	0.45	0.4	0.41	0.38	0.38	0.38	0.38	0.41	0	0.1	0	0	0	0	0.1	1	0.1	0.1	1	0.2	0.5	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
15:30 - 15:45	0	0	0.42	0.58	0.55	0.42	0	0.45	0.42	0.43	0.4	0.39	0.39	0.4	0.43	0	0.1	0	0	0	0	0.1	0	0.1	0.1	1	0.2	0.5	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
15:45 - 16:00	0	0	0.45	0.54	0.53	0.43	0	0.47	0.41	0.42	0.41	0.41	0.41	0.41	0.42	0	0.1	0	0	0	0	0.1	0	0.1	0.1	1	0.2	0.5	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
16:00 - 16:15	0.36	0	0.48	0.54	0.54	0.44	0	0.45	0.43	0.45	0.45	0.46	0.46	0.45	0.45	0	0.1	0	0	0	0	0.1	0	0.1	0.1	1	0.2	0.5	1	1	1	1	1	0	0	0	0	0.25	0	0.3	0
16:15 - 16:30	0.45	0	0.5	0.52	0.52	0.445	0	0.42	0.45	0.47	0.48	0.49	0.49	0.48	0.47	0	0.1	0	0	0	0	0.1	0	0	0.1	0.5	0.2	0.5	0.51	0.51	0.51	0.51	0.51	0.3	0.3	0.3	0.3	0.4	0.15	0.3	0
16:30 - 16:45	0.5	0	0.51	0.53	0.54	0.452	0	0.46	0.44	0.45	0.5	0.5	0.5	0.5	0.45	0	0.25	0	0	0	0	0.1	0	0	0.1	0.5	0.2	0.5	0.4	0.4	0.65	0.3	0.3	0.3	0.3	0.3	0.3	0.51	0.15	0.3	0
16:45 - 17:00	0.55	0	0.55	0.48	0.6	0.52	0	0.5	0.45	0.5	0.55	0.55	0.52	0.55	0.55	0	0.3	0	0	0	0	0	0	0	0.1	0.6	0.2	0.5	0.5	0.6	0.65	0.4	0.4	0.4	0.4	0.4	0.4	0.53	0.2	0.3	0
17:00 - 17:15	0.6	0	0.6	0	0.65	0.58	0	0.55	0.5	0.52	0.6	0.6	0.54	0.56	0.58	0	0.4	0	0	0	0	0	0	0	0.1	0.6	0.2	0.5	0.6	0.65	0.65	0.5	0.5	0.5	0.5	0.5	0.5	0.54	0.4	0.3	0
17:15 - 17:30	0.8	0	0.7	0	0.7	0.65	0	0.6	0.55	0.6	0.65	0.65	0.7	0.6	0.68	0	0.55	0	0	0	0	0	0	0	0.1	1	0.7	0.75	0.6	0.7	0.65	0.55	0.6	0.65	0.65	0.65	0.65	0.68	0.8	0.3	0
17:30 - 17:45	0.7	0	0.68	0	0.66	0.64	0	0.55	0.5	0.56	0.62	0.58	0.62	0.6	0.62	0	0.4	0	0	0	0	0	0	0	0.1	0.8	0.5	0.7	0.4	0.5	0.55	0.32	0.51	0.55	0.55	0.55	0.55	0.58	0.5	0.3	0
17:45 - 18:00	0.76	0	0.66	0	0.65	0.62	0	0.54	0.52	0.55	0.61	0.55	0.6	0.58	0.6	0	0.38	0	0	0	0	0	0	0	0.1	0.7	0.5	0.6	0.38	0.41	0.48	0.33	0.5	0.5	0.5	0.5	0.5	0.51	0.38	0.3	0
18:00 - 18:15	0.78	0	0.65	0	0.68	0.56	0	0.48	0.53	0.5	0.63	0.57	0.57	0.56	0.59	0	0.37	0	0	0	0	0	0	0	0.1	0.5	0.5	0.5	0.3	0.38	0.4	0	0.49	0.25	0.25	0.25	0.25	0.41	0.33	0.3	0
18:15 - 18:30	0.95	0	0.7	0	0.75	0.68	0	0.512	0.6	0.45	0.65	0.6	0.55	0.55	0.58	0	0.1	0	0	0	0	0	0	0	0.1	0.5	0.5	0	0.29	0.37	0.39	0	0.48	0.24	0.24	0.24	0.24	0.4	0.35	0.3	0
18:30 - 18:45	0.812	0	0.55	0	0.6	0.55	0	0.49	0.55	0.44	0.63	0.55	0.54	0.54	0.6	0	0.1	0	0	0	0	0	0	0	0.1	0.5	0.5	0	0.28	0.36	0.38	0	0.45	0.22	0.22	0.22	0.22	0.38	0.32	0.3	0
18:45 - 19:00	0.5	0	0.45	0	0.48	0.49	0	0.44	0.54	0.42	0.56	0.53	0.53	0.52	0.55	0	0.1	0	0	0	0	0	0	0	0.1	0	0	0	0.27	0.35	0.37	0	0.425	0.21	0.21	0.21	0.21	0.35	0.3	0.3	0
19:00 - 19:15	0.4	0	0.35	0	0.38	0.35	0	0.35	0.3	0.3	0.4	0.35	0.35	0.3	0.25	0	0.1	0	0	0	0	0	0	0	0.1	0	0	0	0.2	0.25	0.3	0	0.25	0.18	0.18	0.18	0.18	0.33	0.4	0.3	0

19:15 - 19:30	0.2	0	0.15	0	0.2	0.2	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0.2	0	0.2	0.16	0.16	0.16	0.16	0.3	0.4	0.3	0
19:30 - 19:45	0.2	0	0.1	0	0.2	0.2	0	1.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
19:45 - 20:00	0.1	0	0.1	0	0.1	0.1	0	0.135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
20:00 - 20:15	0.1	0	0.1	0	0.1	0.1	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
20:15 - 20:30	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
20:30 - 20:45	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
20:45 - 21:00	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
21:00 - 21:15	0	0	0	0	0	0	0	0.132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
21:15 - 21:30	0	0	0	0	0	0	0	0.142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
21:30 - 21:45	0	0	0	0	0	0	0	0.152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
21:45 - 22:00	0	0	0	0	0	0	0	0.153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
22:00 - 22:15	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
22:15 - 22:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
22:30 - 22:45	0	0	0	0	0	0	0	0.165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
22:45 - 23:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
23:00 - 23:15	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
23:15 - 23:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
23:30 - 23:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0
23:45 - 00:00	0	0	0	0	0	0	0	0.164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0

Appliances/time	Generator battery	De fridge	AMHS Printer	TV	Photocopy machine	Fax	Printer	Online UPS	Desktop computer(radio navigation)	Desktop computer	sodium vapour light	Battery ups	Flourescent tube	Water despenser	Air compressor1	Air compressor2	Electric kettle	3-phase water pump	Water pump	Invertor1(Shree air)	Invertor2(Buddha air)	Invertor3(Airort chief Quarter)	Vacuum cleaner	Laptop	VHF/UHF Charger	LED bulbs	CCTV camera	Router	Flight information monitor	AC1 at auxillary building	AC2 at auxillary building	AC1 at radio navigation	AC2 at radio navigation	others	Quarter Hourly Demand	Energy Consumption
Items	1	1	1	4	2	1	3	1	2	2	8	2	140	10	1	1	4	1	7	1	1	1	1	5	2	50	1	4	3	1	1	1	1	1		
total capacity (ton)	200	150	400	50	400	150	134	5000	250	250	1000	50	60	90	2700	2236	1000	3728.5	745.7	1600	1600	1400	1500	50	25	36	90	25	170	2	1.5	1	1	2650.2		
Rating	200	150	400	200	800	150	400	5000	500	500	8000	100	8400	900	2700	2236	4000	3728.5	5219.9	1600	1600	1400	1500	250	50	1800	90	100	510	2115	1555	901	901	2650.2		
Stand by powers	0.46	3.45		0	18.4	3.45	9.2	115	11.5	11.5	0	2.3	0	26.46	64.8	53.664	0	0	0	38.4	38.4	33.6	0	6	1.2	0	2.16	2.4	14.994	4.653	3.421	1.9822	1.9822	0		
Total Rating(watt)	200.46	153.45	400	200	818.4	153.45	409.2	5115	511.5	511.5	8000	102.3	8400	926.46	2764.8	2289.7	4000	3728.5	5219.9	1638.4	1638.4	1433.6	1500	256	51.2	1800	92.16	102.4	524.99	2119.7	1558.4	902.98	902.98	2650.2		
Types of loads	fixed	opening/fixed	opening/variable	opening/Variable	opening/variable	opening/variable	opening/variable	fixed	Opening/variable	Opening/variable	opening	fixed	variable	opening/variable	opening/variable	opening/variable	variable/fixed	Opening/Variable	Opening/Variable	Fixed	Fixed	Fixed	opening/variable	opening/variable	opening/variable/fixed	variable	fixed	fixed	opening	opening	opening	fixed	fixed			
00:00-00:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.11	2.28
00:15 - 00: 30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.28
00:30 - 00: 45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.15	2.29
00:45 - 1: 00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.10	2.28
1:00 - 1: 15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
1:15-1:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.11	2.28
1:30-1:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.18	2.30
1:45-2:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
2:00-2:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.29
2:15-2:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.12	2.28
2:30-2:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.20	2.30
2:45-3:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.18	2.30

3:00-3:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
3:15-3:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
3:30-3:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.15	2.29
3:45-4:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.12	2.28
4:00-4:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.11	2.28
4:15-4:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.29
4:30-4:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.17	2.29
4:45-5:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
5:00-5:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.11	2.28
5:15-5:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.09	2.27
5:30-5:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0.2	11.37	2.84
5:45-6:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0.5	0.5	0.2	12.25	3.06
6:00-6:15	0	0.25	0.4	0.4	0	0	0	0.05	0.4	0.4	0	1	1	0	0	0		0	0	0.5	0.5	0.5	0	1	1	0.2	1	1	0	0	0	0.5	0.5	0.2	21.41	5.35
6:15-6:30	0	0.35	0.5	0.5	0	0	0	0.1	0.4	0.4	0	1	1	1	0	0		0	0	0.5	0.5	0.5	0.3	1	1	0.5	1	1	0	0	0	0.5	0.5	0.2	27.32	6.83
6:30-6:45	0	0.34	0.5	0.5	0	0	0	0.12	0.4	0.4	0	1	1	1	0	0		0	0	0.5	0.5	0.5	0.4	1	1	0.8	1	1	0	0	0	0.5	0.5	0.2	29.04	7.26
6:45-7:00	0	0.35	0.5	0.5	0	0	0	0.15	0.4	0.4	0	1	1	1	0	0		0	0	0.5	0.5	0.5	0.5	1	1	0.4	1	1	0	0	0	0.5	0.5	0.2	29.47	7.37
7:00-7:15	0	0.32	0.5	0.5	0	0	0	0.17	0.4	0.4	0	0.5	1	1	0.2	0.15		0.3	0.1	0.5	0.5	0.5	0.5	1	1	0.2	1	1	0	0	0	0.5	0.5	0.2	33.43	8.36
7:15-7:30	0	0.4	0.5	0.5	0	0	1	0.19	0.4	0.4	0	0.5	1	1	0.3	0.3		0.4	0.12	0.5	0.5	0.5	0.6	1	1	0.15	1	1	0	0	0	0.5	0.5	0.2	33.66	8.42
7:30-7:45	0	0.324	0.5	0.5	0	0	1	0.2	0.4	0.4	0	0.5	1	1	0.4	0.22		0.42	0.15	0.5	0.5	0.5	0.65	1	1	0.12	1	1	0	0	0	0.5	0.5	0.2	36.23	9.06
7:45-8:00	0	0.35	0.5	0.5	0	0	1	0.22	0.4	0.4	0	0.5	1	1	0.5	0.25	0.2	0.5	0.18	0.5	0.5	0.5	0.7	1	1	0.1	1	1	0	0	0	0.5	0.5	0.2	40.12	10.03
8:00-8:15	0	0.33	0.5	0.5	0	0	1	0.25	0.4	0.4	0	0.5	1	1	0.6	0.3	0.3	0.52	0.2	0.5	0.5	0.5	0.8	1	1	0	1	1	1	0	0	0.5	0.5	0.2	45.87	11.47
8:15-8:30	0	0.34	0.5	0.5	0	0	1	0.27	0.4	0.4	0	0.5	1	1	0.7	0.32	0.35	0.55	0.22	0.5	0.5	0.5	0.85	1	1	0	1	1	1	0	0	0.5	0.5	0.2	55.21	13.80
8:30-8:45	1	0.35	0.5	0.5	0	0	1	0.28	0.4	0.4	0	0.5	1	1	0.8	0.35	0.4	0.58	0.25	0.5	0.5	0.5	1	1	1	0	1	1	1	0	0			0.2	56.50	14.12
8:45-9:00	1	0.34	0.5	0.5	0	0	1	0.3	0.4	0.4	0	0.5	1	1	0.9	0.4	0.5	0.6	0.27	0.5	0.5	0.5	1	1	1	0	1	1	1	0	0	0	0	0	57.85	14.46
9:00-9:15	1	0.35	0.5	0.5	0	0	1	0.31	0.4	0.4	0	0.5	1	0	1	0.7	1	0.62	0.3	0.5	0.5	0.5	1	1	1	0	1	1	1	0	0	0	0	0	65.04	16.26
9:15-9:30	1	0.33	0.5	0.5	0	0	1	0.29	0.4	0.4	0	0.5	1	0	0.8	0.6	1	0.55	0.2	0.5	0.5	0.5	1	1	1	0	1	1	1	0	1	0	0	0	58.90	14.73
9:30-9:45	1	0.32	0.5	0.5	0	0	1	0.28	0.4	0.4	0	0.5	1	0	0.6	0.5	1	0.48	0	0.5	0.5	0.5	1	1	1	0	1	1	1	0	1	0	0	0	54.32	13.58

9:45-10:00	1	0.31	0.5	0.5	0	0	1	0.25	0.4	0.4	0	0.5	1	0.5	0.5	0	1	0.35	0	0.5	0.5	0.5	0.5	1	1	0	1	1	1	0	1	0	0	0	50.33	12.58
10:00-10:15	1	0.32	0.5	0.5	0.5	0.4	1	0.22	0.4	0.4	0	0.5	0.5	0.5	0.4	0	0	0.35	0	0.5	0.5	0.5	0.4	1	1	0	1	1	1	1	1	0	0	0	44.85	11.21
10:15-10:30	1	0.34	0.5	0.5	0.5	0.4	1	0.2	0.4	0.4	0	0.5	0.5	0.5	0.4	0	0	0.35	0	0.5	0.5	0.5	0.38	1	1	0	1	1	1	1	1	0	0	0	44.19	11.05
10:30-10:45	1	0.33	0.5	0.5	0.5	0.4	1	0.18	0.4	0.4	0	0.5	0.5	0.5	0.4	0	0	0.35	0	0.5	0.5	0.5	0.3	1	1	0	1	1	1	1	1	0	0	0	41.28	10.32
10:45-11:00	1	0.3	0.5	0.5	0.5	0.4	1	0.17	0.4	0.4	0	0.5	0.5	0.5	0.4	0	0	0.35	0	0.5	0.5	0.5	0.2	1	1	0	1	1	1	1	1	0	0	0	40.23	10.06
11:00-11:15	1	0.31	0.5	0.5	0.5	0.4	1	0.16	0.4	0.4	0	0.5	0.35	0.25	0.3	0	0	0.2	0	0.5	0.5	0.5	0.2	1	1	0	1	1	0	1	1	0	0	0	33.76	8.44
11:15-11:30	1	0.3	0.5	0.5	0.5	0.4	1	0.15	0.4	0.4	0	0.5	0.35	0.25	0.3	0	0	0.2	0	0.5	0.5	0.5	0.1	1	1	0	1	1	0	1	0	0	0	0	31.76	7.94
11:30-11:45	1	0.32	0.5	0.5	0.5	0.4	1	0.14	0.4	0.4	0	0.5	0.35	0.25	0.3	0	0	0.2	0	0.5	0.5	0.5	0	1	1	0	1	1	0	1	0	0	0	0	31.54	7.89
11:45-12:00	0	0.312	0.5	0.5	0.5	0.4	1	0.13	0.4	0.4	0	0.5	0.35	0.25	0.3	0	0	0.2	0	0.5	0.5	0.5	0	1	1	0	1	1	0	1	0	0	0	0	30.93	7.73
12:00-12:15	0	0.325	0.5	0.5	0.5	0.4	1	0.13	0.4	0.4	0	0.5	0.35	0.25	0.3	0	0	0	0	0.5	0.5	0.5	0	1	1	0	1	1	0	1	0	0	0	0	28.89	7.22
12:15-12:30	0	0.33	0.5	0.5	0.5	0.4	1	0.12	0.4	0.4	0	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	24.42	6.11
12:30-12:45	0	0.35	0.5	0.5	0.5	0.4	1	0.11	0.4	0.4	0	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	24.34	6.09
12:45-13:00	0	0.32	0.5	0.5	0.5	0.4	1	0.11	0.4	0.4	0	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	24.21	6.05
13:00-13:15	0	0.33	0.5	0.5	0.5	0.4	0	0.1	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	26.39	6.60
13:15-13:30	0	0.31	0.5	0.5	0.5	0	0	0.1	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	26.05	6.51
13:30-13:45	0	0.312	0.5	0.5	0.5	0	0	0.11	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	26.15	6.54
13:45-14:00	0	0.321	0.5	0.5	0.5	0	0	0.12	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	26.76	6.69
14:00-14:15	0	0.312	0.5	0.5	0.5	0	0	0.13	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	26.77	6.69
14:15-14:30	0	0.341	0.5	0.5	0.5	0	0	0.14	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0	0	26.89	6.72
14:30-14:45	0	0.332	0.5	0.5	0.5	0.4	0	0.15	0.4	0.4	0	0.5	0	0	0	0	0	1	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0.5	0	27.90	6.98
14:45-15:00	0	0.321	0.5	0.5	0.5	0.4	0	0.17	0.4	0.4	0	0.5	1	1	0	0	0	0	0	0.5	0.5	0.5	0	1	1	0	1	1	0	0	0	0	0.5	0	36.06	9.02
15:00-15:15	0	0.341	0.5	0.5	0.5	0.4	0	0.18	0.4	0.4	0	0.5	1	1	0	0	0	0	0	0.5	0.5	0.5	0	1	1	0	1	1	1	0	0	0.5	0.5	0	40.96	10.24
15:15-15:30	0	0.4	0.5	0.5	0.5	0.4	1	0.35	0.4	0.4	0	0.5	1	1	0	0	0.25	0	0	0.5	0.5	0.5	0	1	1	0	1	1	1	0	0	0.5	0.5	0	41.78	10.44
15:30-15:45	0	0.45	0.5	0.5	0.5	0.4	1	0.4	0.4	0.4	0	0.5	1	1	0	0	0.5	0	0	0.5	0.5	0.5	0	1	1	0	1	1	1	0	0	0.5	0.5	0	42.93	10.73
15:45-16:00	0	0.46	0.5	0.5	0.5	0.4	1	0.45	0.4	0.4	0	0.5	1	1	0	0	0.6	0	0	0.5	0.5	0.5	0	1	1	0	1	1	1	0	0	0.5	0.5	0	43.65	10.91
16:00-16:15	0	0.47	0.5	0.5	0.5	0.4	1	0.4	0.4	0.4	0.1	0.5	1	1	0	0	0.8	0	0	0.5	0.5	0.5	0	1	1	0	1	1	1	0	0	0.5	0.5	0	46.24	11.56
16:15-16:30	0	0.47	0.5	0.5	0.5	0.4	1	0.4	0.4	0.4	0.1	0.5	1	1	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	1	1	1	0	0	0.5	0.5	0	47.23	11.81

16:30-16:45	0	0.4	0.5	0.5	0.5	0.4	1	0.41	0.4	0.4	0.1	0.5	1	1	0.2	0.3	1	0.5	0.1	0.5	0.5	0.5	1	1	1	0	1	1	1	0	0		0.5	0	51.09	12.77
16:45-17:00	0	0.45	0	0	0	0.4	1	0.4	0.4	0.4	0.3	0.5	1	1	0.3	0.4	1	1	0.5	0.5	0.5	0.5	1	1	1	0	1	1	1	0	0	0	0.5	0	59.92	14.98
17:00-17:15	0	48	0	0	0	0.4	1	0.4	0.4	0.4	0.3	0.5	1	1	0.35	0.5	1	1	0.5	0.5	0.5	0.5	1	1	1	0	1	1	0	0	0	0	0	0	70.64	17.66
17:15-17:30	0	0.5	0	0	0	0.4	1	0.4	0.4	0.4	0.3	0.5	1	1	0.4	0.4	1	1	0.4	0.5	0.5	0.5	1	1	1	0	1	1	0	0	0	0	0	0	73.04	18.26
17:30-17:45	0	0.32	0	0	1	0.4	1	0.3	0.4	0.4	0.3	0.5	1	1	0.45	0.45	1	0.8	0.25	0.5	0.5	0.5	1	1	1	0	1	1	0	0	0	0	0	0	63.87	15.97
17:45-18:00	0	0.35	0	0	1	0.4	1	0.28	0.4	0.4	0.3	0.5	1	0	0.3	0.5	0	1	0.23	0.5	0.5	0.5	1	1	1	0	1	1	0	0	0	0	0	0	57.06	14.27
18:00-18:15	0	0.324	0	0	1	0.4	1	0.25	0.4	0.4	0.3	0.5	1	0	0.2	0.1	0	1	0	0.5	0.5	0.5	1	1	1	0.4	1	1	0	0	0	0	0	0	49.10	12.27
18:15-18:30	0	0.412	0	0	1	0.4	1	0.22	0.4	0.4	0.3	0.5	1	0	0	0	0	1	0	0.1	0.1	0.1	1	1	1	0.5	1	1	0	0	0	0	0	0	46.62	11.66
18:30-18:45	0	0.325	0	0	0	0	0	0.21	0.4	0.4	0.3	0.4	0.5	0	0	0	0	1	0	0.1	0.1	0.1	1	1	1	0.6	1	1	0	0	0	0	0	0	39.52	9.88
18:45-19:00	0	0	0	0	0	0	0	0.2	0	0	0.3	0.3	0.35	0	0	0	0	1	0	0.1	0.1	0.1	1	1	1	0.6	1	1	0	0	0	0	0	0	33.39	8.35
19:00-19:15	0	0	0	0	0	0	0	0.18	0	0	0.3	0	0.4	0	0	0	0	0.5	0	0.1	0.1	0.1	1	1	1	0.65	1	1	0	0	0	0	0	0	28.46	7.11
19:15-19:30	0	0	0	0	0	0	0	0.2	0	0	0.3	0	0.4	0	0	0	0	0.5	0	0.1	0.1	0.1	0	1	1	0.68	1	1	0	0	0	0	0	0	20.15	5.04
19:30-19:45	0	0	0	0	0	0	0	0.14	0	0	0.3	0	0.3	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0.35	1	1	0	0	0	0	0	0	15.93	3.98
19:45-20:00	0	0	0	0	0	0	0	0.13	0	0	0.3	0	0.2	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0.3	1	1	0	0	0	0	0	0	12.20	3.05
20:00-20:15	0	0	0	0	0	0	0	0.1	0	0	0.3	0	0.1	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	10.72	2.68
20:15-20:30	0	0	0	0	0	0	0	0.1	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.29	2.32
20:30-20:45	0	0	0	0	0	0	0	0.09	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.21	2.30
20:45-21:00	0	0	0	0	0	0	0	0.08	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.12	2.28
21:00-21:15	0	0	0	0	0	0	0	0.08	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.15	2.29
21:15-21:30	0	0	0	0	0	0	0	0.07	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	9.12	2.28
21:30-21:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.88	2.22
21:45-22:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.89	2.22
22:00-22:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.93	2.23
22:15-22:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.90	2.23
22:30-22:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.91	2.23
22:45-23:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.88	2.22
23:00-23:15	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.90	2.23

23:15-23:30	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.90	2.23
23:30-23:45	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.93	2.23
23:45-00:00	0	0	0	0	0	0	0	0.02	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1	1	0	1	1	0	0	0	0	0	0	8.91	2.23
																															Max demand, kW				73.04	
																															Total daily energy ,kWh					643.064

Appendix B: Energy consumption at Dhangadhi Airport during the winter season.

Appliances/time	Ac1 at tower(ROWA)	Ac2 at tower(AUX)	Ac3 at tower(Hisence)	AC at account room(Hisence)	AC at Electromechanical room(ROWA)	AC at Fire room	AC1 at CCR room(Panasonic Old type)	AC2 at CCR room(Panasonic Old type)	AC1 at VIP Room(new)	AC2 at VIP Room(old panasonic)	AC1 at Departure room(old)	AC2 at Departure room(Hisence)	AC3 at Departure room(Hisence)	AC4 at Departure room(Hisence)	AC5 at Departure room(Old)	AC6 at Departure room(Old US)	AC at airport chief office	AC1 At guest house	AC2 At guest house	AC1 at WFP office	AC at WFP office	Cooler	Public Announce System	Hold baggage,x-ray machine	Refrigirator	Walk through metal detector	Ceiling Fan	Table Fan
Items	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	2	2	80	10
total capacity(ton)	2	2	1	1.5	1.5	1	2	2	1.5	1.5	1.5	2	2	1.5	1.5	1.5	1	1.5	1	0.5	0.5	500	400	2000	80	55	60	60
Rating	1800	1800	800	1325	1325	800	1900	1900	1325	1325	1325	1800	1800	1325	1500	1250	800	1325	825	350	350	2000	400	2000	160	110	4800	600
Stand by powers	3.96	3.96	1.76	2.915	2.915	1.76	4.18	4.18	2.915	2.915	2.915	3.96	3.96	2.915	3.3	2.75	1.76	2.915	1.815	0.77	0.77	0	11.72	58.8	1.92	2.64	0	0
Total Rating(watt)	1803.96	1803.96	801.76	1327.915	1327.915	801.76	1904.18	1904.18	1327.915	1327.915	1327.915	1803.96	1803.96	1327.915	1503.3	1252.75	801.76	1327.915	826.815	350.77	350.77	2000	411.72	2058.8	161.92	112.64	4800	600
Types of loads	Opening/Variable	Opening/Variable	Opening/Variable	Variable	Variable	Variable	Fixed	Fixed	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Opening/Variable	Opening/Variable	Variable	Variable	fixed/opening/variable	Variable
00:00-00:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
00:15 - 00: 30	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
00:30 - 00: 45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
00:45 - 1: 00	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
1:00 - 1: 15	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
1:15-1:30	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
1:30-1:45	0	0	0	0	0	0	0	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
1:45-2:00	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
2:00-2:15	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
2:15-2:30	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
2:30-2:45	0	0	0	0	0	0	0	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0

2:45-3:00	0	0	0	0	0	0	0	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
3:00-3:15	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
3:15-3:30	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
3:30-3:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
3:45-4:00	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
4:00-4:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
4:15-4:30	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
4:30-4:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
4:45-5:00	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
5:00-5:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
5:15-5:30	0	0	0	0	0	0	0	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
5:30-5:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
5:45-6:00	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
6:00-6:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0
6:15-6:30	0.4	0	0.35	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1		0.1	0
6:30-6:45	0.55	0	0.45	0	0	0	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.1	1	0.1	0
6:45-7:00	0.7	0	0.46	0	0	0	0	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.2	0.1	1	0.1	0
7:00-7:15	0.8	0	0.52	0	0.4	0.35	0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.3	0.1	1	0.1	0.1
7:15-7:30	0.6	0	0.56	0	0.55	0.4	0	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.4	0.1	1	0	0.1
7:30-7:45	0.4	0	0.57	0	0.58	0.45	0	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.45	0.1	1	0	0.1
7:45-8:00	0.5	0	0.58	0	0.6	0.52	0	0.49	0.00	0.00	0.32	0.35	0.35	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.48	0.1	1	0	0.1
8:00-8:15	0.6	0	0.575	0.35	0.65	0.56	0	0.48	0.40	0.4	0.38	0.38	0.38	0.38	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0	1	0.5	0.1	1	0	0
8:15-8:30	0.55	0	0.7	0.6	0.7	0.65	0	0.55	0.55	0.55	0.5	0.45	0.45	0.45	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0	1	0.6	0.1	1	0	0
8:30-8:45	0.7	0	0.6	0.55	0.7	0.58	0	0.48	0.47	0.44	0.45	0.42	0.42	0.45	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0	1	0.7	0.1	1	0	0
8:45-9:00	0.85	0	0.62	0.7	0.75	0.59	0	0.46	0.50	0.55	0.47	0.43	0.43	0.47	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0.1	1	0	0
9:00-9:15	0.95	0	0.65	0.8	0.85	0.6	0	0.51	0.61	0.65	0.58	0.52	0.52	0.58	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0.1	1	0	0
9:15-9:30	0.8	0	0.52	0.6	0.55	0.5	0	0.49	0.58	0.6	0.55	0.5	0.5	0.55	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0.1	1	0	0
9:30-9:45	0.5	0	0.56	0.4	0.53	0.45	0	0.36	0.53	0.5	0.51	0.51	0.51	0.51	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0.1	1	0	0
9:45-10:00	0.4	0	0.5	0.38	0.52	0.43	0	0.34	0.52	0.48	0.5	0.49	0.49	0.5	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0.1	1	0	0
10:00-10:15	0.333	0	0.511	0.38	0.5	0.42	0	0.39	0.48	0.45	0.51	0.46	0.46	0.51	0.45	0.00	1	0.00	0.00	0.00	0.00	0	0	0.1	0.1	1	0	0
10:15-10:30	0.362	0	0.523	0.36	0.3	0.4	0	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.00	0.00	0.00	0.00	0.00	0	0.1	0.1	1	0	0
10:30-10:45	0.363	0	0.364	0.35	0.2	0.38	0	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.00	0.00	0.00	0.00	0.00	0	0.1	0.1	1	0	0
10:45-11:00	0.365	0	0.33	0.1	0.1	0.38	0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0	0

11:00-11:15	0.375	0	0.332	0	0	0.4	0	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0	0
11:15-11:30	0.363	0	0.325	0	0	0.4	0	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0	0
11:30-11:45	0.362	0	0.32	0	0	0.36	0	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0	0
11:45-12:00	0.313	0	0.364	0	0	0.34	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0	0
12:00-12:15	0.305	0	0.5	0	0	0.33	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0	0
12:15-12:30	0.462	0	0.45	0	0.4	0.35	0	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
12:30-12:45	0.652	0	0.35	0	0.45	0.33	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
12:45-13:00	0.55	0	0.3	0	0.45	0.34	0	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
13:00-13:15	0.3	0	0.29	0.2	0.44	0.35	0	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.6	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
13:15-13:30	0.2	0	0.25	0.25	0.43	0.36	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
13:30-13:45	0.1	0	0.22	0.26	0.44	0.35	0	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
13:45-14:00	0.1	0	0.2	0.35	0.45	0.36	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
14:00-14:15	0.1	0	0.1	0.4	0.43	0.4	0	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
14:15-14:30	0.1	0	0.1	0.43	0.44	0.41	0	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
14:30-14:45	0.1	0	0.1	0.49	0.45	0.42	0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	0.00	0.00	0.00	0.00	0.00	0	0	0.1	0	0.1	0
14:45-15:00	0.1	0	0.1	0.58	0.46	0.43	0	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	0.00	0.00	0.00	0.00	0.00	0	0.1	0.1	1	0.1	0
15:00-15:15	0.1	0	0.35	0.55	0.47	0.45	0	0.54	0.36	0.35	0.33	0.35	0.35	0.33	0.35	0.00	0.3	0.00	0.00	0.00	0.00	0.00	1	0.2	0.1	1	0.1	0.5
15:15-15:30	0.2	0	0.38	0.56	0.49	0.44	0	0.55	0.40	0.41	0.38	0.38	0.38	0.38	0.41	0.00	0.28	0.00	0.00	0.00	0.00	0.00	1	0.3	0.1	1	0.1	0.5
15:30-15:45	0.25	0	0.42	0.58	0.5	0.46	0	0.56	0.42	0.43	0.4	0.39	0.39	0.4	0.42	0.00	0.22	0.00	0.00	0.00	0.00	0.00	1	0.45	0.1	1	0	0.5
15:45-16:00	0.28	0	0.45	0.59	0.5	0.47	0	0.58	0.44	0.45	0.41	0.41	0.41	0.44	0.43	0.00	0.23	0.00	0.00	0.00	0.00	0.00	1	0.5	0.1	1	0	0.5
16:00-16:15	0.36	0	0.48	0.6	0.51	0.48	0	0.59	0.45	0.46	0.45	0.46	0.46	0.45	0.45	0.00	0.24	0.00	0.00	0.00	0.00	0.00	1	0.6	0.1	1	0	0.5
16:15-16:30	0.45	0	0.5	0.62	0.52	0.49	0	0.60	0.46	0.47	0.48	0.49	0.49	0.48	0.47	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0	0.7	0.1	0.5	0	0.5
16:30-16:45	0.5	0	0.51	0.63	0.54	0.5	0	0.61	0.47	0.49	0.5	0.5	0.5	0.5	0.5	0.00	0.3	0.00	0.00	0.00	0.00	0.14	0	0.8	0.1	0.5	0	0.5
16:45-17:00	0.55	0	0.55	0.5	0.55	0.46	0	0.62	0.48	0.46	0.55	0.52	0.52	0.55	0.5	0.00	0.27	0.00	0.00	0.00	0.00	0.15	0	0.9	0.1	0.5	0	0.5
17:00-17:15	0.65	0	0.6	0	0.58	0.47	0	0.63	0.50	0.47	0.56	0.54	0.54	0.56	0.52	0.00	0.3	0.00	0.00	0.00	0.00	0.2	0	0	0.1	0.5	0	0.5
17:15-17:30	0.8	0	0.7	0	0.7	0.6	0	0.70	0.60	0.65	0.6	0.6	0.6	0.65	0.65	0.00	0.55	0.00	0.00	0.00	0.00	0.35	0	0	0.1	0.5	0	0.5
17:30-17:45	0.72	0	0.65	0	0.7	0.55	0	0.66	0.53	0.56	0.62	0.54	0.54	0.62	0.56	0.00	0.45	0.00	0.00	0.00	0.00	0.22	0	0	0.1	0.5	0	0.5
17:45-18:00	0.76	0	0.64	0	0.65	0.56	0	0.60	0.50	0.58	0.61	0.55	0.55	0.61	0.58	0.00	0.45	0.00	0.00	0.00	0.00	0.2	0	0	0.1	0.5	0	0.5
18:00-18:15	0.5	0	0.55	0	0.6	0.5	0	0.48	0.48	0.45	0.55	0.57	0.57	0.63	0.59	0.00	0.37	0.00	0.00	0.00	0.00	0.18	0	0	0.1	0.5	0	0.5
18:15-18:30	0.45	0	0.5	0	0.55	0.45	0	0.45	0.45	0.4	0.45	0.6	0.6	0.65	0.65	0.00	0.1	0.00	0.00	0.00	0.00	0	0	0	0.1	0.5	0	0
18:30-18:45	0.4	0	0.45	0	0.52	0.44	0	0.42	0.42	0.35	0.35	0.55	0.55	0.63	0.6	0.00	0.1	0.00	0.00	0.00	0.00	0	0	0	0.1	0.5	0	0
18:45-19:00	0.35	0	0.4	0	0.48	0.4	0	0.35	0.40	0.3	0.56	0.53	0.53	0.56	0.55	0.00	0.1	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
19:00-19:15	0.3	0	0	0	0	0	0	0.30	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0

19:15-19:30	0	0	0	0	0	0	0	0.10	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
19:30-19:45	0	0	0	0	0	0	0	1.12	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
19:45-20:00	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
20:00-20:15	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
20:15-20:30	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
20:30-20:45	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
20:45-21:00	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
21:00-21:15	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
21:15-21:30	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
21:30-21:45	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
21:45-22:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
22:00-22:15	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
22:15-22:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
22:30-22:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
22:45-23:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
23:00-23:15	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
23:15-23:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
23:30-23:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0
23:45-00:00	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.1	0	0	0

Appliances/time	Runway edge light	Turning pad light	Runway Threshold/End light	Runway PAPI light(09/27)	Approach Light (27 side)	Taxiway light	Apron flood light	RTIL light	Beacon light	Console power supply	Halogen lamp	VOR/DME	Fire vehicle battery	Generator battery	De fridge	AMHS Printer	TV	Photocopy machine	Fax	Printer	Online UPS	Desktop computer	sodium vapour light
Items	60	12	12	24	17	22	8	4	2	1	8	1	1	1	1	1	4	2	1	3	1	4	8
total capacity(ton)	55	45	1200	200	65	45	260	2000	1000	1700	1000	5500	200	200	150	400	50	400	150	134	5000	250	1000
Rating	3300	540	1200	4800	1105	990	2080	8000	2000	1700	8000	5500	200	200	150	400	200	800	150	400	5000	1000	8000
Stand by powers	0	0	0	0	0	0	0	0	0	168.3	0	12.65	0.46	0.46	3.45		0	18.4	3.45	9.2	115	98	0
Total Rating(watt)	3300	540	1200	4800	1105	990	2080	8000	2000	1868.3	8000	5512.65	200.46	200.46	153.45	400	200	818.4	153.45	409.2	5115	1098	8000
Types of loads	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Opening/Variable/fixed	opening	Opening/Variable	fixed	fixed	opening/fixed	opening/variable	opening/Variable	opening/variable	opening/variable	opening/variable	fixed	Opening/variable	opening
00:00-00:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3
00:15 - 00:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3
00:30 - 00:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3
00:45 - 1:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3
1:00 - 1:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3
1:15 - 1:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3

Appliances/time	Battery ups	Flourescent tube	Water despenser	Air compressor1	Air compressor2	Electric heater	3-phase water pump	Water pump	Invertor1(Shree air)	Invertor2(Buddha air)	Invertor3(Airort chief Quarter)	Vacuum cleaner	Laptop	VHF/UHF Charger	LED bulbs	CCTV camera	Router	Flight information	AC1 at auxillary	AC2 at auxillary	AC1 at radio	AC2 at radio	others	Quarter hourly Demand	Energy Consumption
Items	2	140	10	1	1	4	1	7	1	1	1	1	5	2	50	1	4	3	1	1	1	1	1		
total capacity(ton)	50	60	90	2700	2236	1000	3728.5	745.7	1600	1600	1400	1500	50	25	36	90	25	170	2	1.5	1	1	2650.22		
Rating	100	8400	900	2700	2236	4000	3728.5	5219.9	1600	1600	1400	1500	250	50	1800	90	100	510	1800	1800	900	900	2650.2		
Stand by powers	2.3	0	26.46	64.8	53.664	0	0	0	38.4	38.4	33.6	0	6	1.2	0	2.16	2.4	14.994	3.96	3.96	1.98	1.98	0		
Total Rating(watt)	102.3	8400	926.46	2764.8	2289.664	4000	3728.5	5219.9	1638.4	1638.4	1433.6	1500	256	51.2	1800	92.16	102.4	524.994	1803.96	1803.96	901.98	901.98	2650.22		
Types of loads	fixed	variable	opening/variable	opening/variable	opening/variable	variable/fixed	Opening/Variable	Opening/Variable	Fixed	Fixed	Fixed	opening/variable	opening/variable	opening/variable	variable	fixed	fixed	opening	opening	opening	fixed	fixed			
00:00-00:15	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.10	2.28
00:15 - 00:30	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.12	2.28
00:30 - 00:45	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.13	2.28
00:45 - 1:00	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.09	2.27
1:00 - 1:15	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.28
1:15 - 1:30	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.10	2.28

1:30 - 1:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
1:45 - 2:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.28
2:00 - 2:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.13	2.28
2:15 - 2:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.11	2.28
2:30 - 2:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.18	2.29
2:45 - 3:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.16	2.29
3:00 - 3:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.28
3:15 - 3:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.28
3:30 - 3:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.13	2.28
3:45 - 4:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.11	2.28
4:00 - 4:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.10	2.27
4:15 - 4:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.13	2.28
4:30 - 4:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.15	2.29
4:45 - 5:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.14	2.28
5:00 - 5:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.10	2.28
5:15 - 5:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0	0	9.08	2.27
5:30 - 5:45	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0	0.2	0.2	11.53	2.88
5:45 - 6:00	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0.5	0	0	0	0		0	0.12	0.11	0.13	0	1	1	0	1	1	0	0	0	0.5	0.2	0.2	16.16	4.04
6:00 - 6:15	0	0	0	0	0	0	0	0	0	1	0.4	0.3	0	0	0.25	0.4	0.4	0	0	0	0.02	0.4	0.3	1	0.5	1	0	0	0.1	0.5	0	0.45	0.48	0.42	0	1	1	0.2	1	1	0	0	0	0.5	0.2	0.2	22.08	5.52
6:15 - 6:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.35	0.5	0.5	0	0	0	0.02	0.4	0.3	1	0.5	1	1	0	0.2	0.8	0	0.45	0.48	0.42	0	1	1	0.5	1	1	0	0	0	0.5	0.2	0.2	23.64	5.91
6:30 - 6:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.34	0.5	0.5	0	0	0	0.02	0.4	0.3	1	0.5	1	1	0	0.3	1	0	0.45	0.48	0.42	0	1	1	0.8	1	1	0	0	0	0.5	0.2	0.2	26.15	6.54

6:45 - 7:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.35	0.5	0.5	0	0	0	0.4	0.4		1	0.5	1	1	1	0.4	1	0	0.45	0.48	0.42	0	1	1	0.4	1	1	0	0	0	0.5	0.2	0.2	28.44	7.11
7:00 - 7:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.32	0.5	0.5	0	0	0	0.4	0.4		0.5	0.5	1	1	1	0.5	1	0.1	0.45	0.48	0.42	0	1	1	0.2	1	1	0	0	0	0.5	0.2	0.2	30.41	7.60
7:15 - 7:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.4	0.5	0.5	0	0	1	0.4	0.4		0.5	0.5	1	1	1	0.6	0.7	0.12	0.45	0.48	0.42	1	1	1	0.15	1	1	0	0	0	0.5	0.2	0.2	31.23	7.81
7:30 - 7:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.32	0.5	0.5	0	0	1	0.4	0.4		0.5	0.5	1	1	1	0.7	1	0.15	0.45	0.48	0.42	1	1	1	0.12	1	1	0	0	0	0.5	0.2	0.2	32.73	8.18
7:45 - 8:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.35	0.5	0.5	0	0	1	0.4	0.4		0.5	0.5	1	1	1	0.75	1	0.18	0.45	0.48	0.42	1	1	1	0.1	1	1	0	0	0	0.5	0.2	0.2	35.29	8.82
8:00 - 8:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.33	0.5	0.5	0	0	1	0.4	0.4		0.5	0.5	1	1	1	0.8	1	0.2	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0.5	0.2	0.2	38.98	9.75
8:15 - 8:30	0	0	0	1	1	1	1	1	1	1	0	0	1	0	0.55	0.5	0.5	0	0	1	0.4	0.4	0	0.5	0.5	1	1	1	0.85	1	0.22	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0		0.2	0.2	59.92	14.98
8:30 - 8:45	0	0	0	1	1	1	1	1	1	1	0	0	1	1	0.5	0.5	0.5	0	0	1	0.4	0.4	0	0.5	0.5	1	1	0	0.8	1	0.25	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0		0.2	0.2	57.40	14.35
8:45 - 9:00	0	0	0	1	1	1	1	1	1	1	0	0	1	1	0.4	0.5	0.5	0	0	1	0.4	0.4	0	0.5	0.5	1	1	0	0.65	1	0.27	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0	0	0	55.50	13.87
9:00 - 9:15	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.35	0.5	0.5	0	0	1	0.4	0.4	0	0.5	0.5		0	0	0.5	0	0.3	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0	0	0	54.28	13.57
9:15 - 9:30	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.33	0.5	0.5	0	0	1	0.4	0.4	0	0.5	0.5		0	0	0.5	0	0.2	0.45	0.48	0.42	0	1	1	0	1	1	1	0	1	0	0	0	52.57	13.14
9:30 - 9:45	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.32	0.5	0.5	0	0	1	0.02	0.4	0	0.5	0.5		0	0	0.5	0	0	0.45	0.48	0.42	0	1	1	0	1	1	1	0	1	0	0	0	48.07	12.02
9:45 - 10:00	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.28	0.5	0.5	0	0	1	0.02	0.4	0	0.5	0.5			0		0	0	0.45	0.48	0.42	0	1	1	0	1	1	1	0	1	0	0	0	45.58	11.39
10:00-10:15	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.32	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0.5	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	1	1	1	0	0	0	48.39	12.10
10:15-10:30	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.34	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0.3	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	1	1	1	0	0	0	41.67	10.42
10:30-10:45	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.33	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	1	1	1	0	0	0	38.88	9.72
10:45-11:00	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.3	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	1	1	1	0	0	0	37.37	9.34
11:00-11:15	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.31	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	1	1	0	0	0	36.58	9.14
11:15-	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.3	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	1	0	0	0	0	34.73	8.68

11:30																																																
11:30-11:45	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0.32	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	1	0	0	0	0	34.71	8.68
11:45-12:00	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0	0	0.8	0.8	0.3	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	1	0	0	0	0	29.32	7.33
12:00-12:15	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.25	0	0	0	0	0.33	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	1	0	0	0	0	23.18	5.80
12:15-12:30	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.25	0	0	0	0	0.33	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	1	0	0	0	0	22.22	5.56
12:30-12:45	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.25	0	0	0	0	0.35	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	20.41	5.10
12:45-13:00	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.28	0	0	0	0	0.34	0.51	0.51	0.55	0.45	1	0.03	0.5	0	0.6	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	19.97	4.99
13:00-13:15	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.25	0	0	0	0	0.33	0.5	0.5	0.5	0.4	1	0.05	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	19.44	4.86
13:15-13:30	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.25	0	0	0	0	0.31	0.5	0.5	0.5	0.3	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	18.94	4.74
13:30-13:45	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.25	0	0	0	0	0.31	0.5	0.5	0.5	0.25	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	18.37	4.59
13:45-14:00	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.25	0	0	0	0	0.32	0.5	0.5	0.5	0.24	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	18.02	4.50
14:00-14:15	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.25	0	0	0	0	0.31	0.5	0.5	0.5	0.23	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	1	1	1	0	1	1	0	0	0	0	0	0	18.30	4.58
14:15-14:30	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.25	0	0	0	0	0.34	0.5	0.5	0.5	0.22	1	0.02	0.4	0	0.5	0	0	0	0	0	0	0	0.45	0.48	0.42	1	1	1	0	1	1	0	0	0	0	0	0	18.30	4.57
14:30-14:45	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.25	0	0	0	0	0.33	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0	0	0	1	0	0	0	0.45	0.48	0.42	1	1	1	0	1	1	0	0	0	0.5	0	0	21.22	5.31
14:45-15:00	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.25	0	0	0	0	0.32	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0		1	1	0		0	0.45	0.48	0.42	1	1	1	0	1	1	0	0	0	0.5	0	0	24.22	6.06
15:00-15:15	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0	0	0	0.34	0.5	0.5	0.5	0.4	1	0.02	0.4	0	0.5	0		1	1	0		0	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0.5	0	0	27.24	6.81

15:15-15:30	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.3	0	0	0	0	0.38	0.55	0.54	0.51	0.48	1	0.03	0.42	0	0.5	0		1	1	0		0	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0.5	0	0	27.89	6.97
15:30-15:45	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.33	0	0	0	0	0.4	0.58	0.55	0.55	0.55	1	0.04	0.45	0	0.55	0		1	1	0		0	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0.5	0	0	27.96	6.99
15:45-16:00	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.28	0	0	0	0	0.33	0.59	0.56	0.54	0.53	1	0.02	0.46	0	0.58	0		1	1	0		0	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0.5	0	0	27.77	6.94
16:00-16:15	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.29	0	0	0	0	0.35	0.6	0.58	0.55	0.54	1	0.03	0.48	0	0.6	0	1	1	1			0	0.45	0.48	0.42	0	1	1	0	1	1	1	0	0	0.5	0	0	27.69	6.92
16:15-16:30	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.4	0	0	0	0	0.36	0	0	0.58	0.58	1	0.05	0.49	0	0.65	0	1	1	1		1	0	0.45	0.48	0.42	0	1	1	0	1	1	1	0	0	0.5	0	0	31.27	7.82
16:30-16:45	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.51	0	0	0	0	0.4	0	0	0.57	0.6	1	0.06	0.5	0	0.7	0.1	1	1	1		1	0.1	0.45	0.48	0.42	1	1	1	0	1	1	1	0	0	0.5	0	0	34.88	8.72
16:45-17:00	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.53	0	0	0	0	0.45	0	0	0.6	0.4	1	0.02	0.51	0.3	0.7	0.3	1	1	1	0.4	1	0.5	0.45	0.48	0.42		1	1	0	1	1	1	0	0	0.5	0	0	40.94	10.24
17:00-17:15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.54	0.3	0	0	0	0.41	0	0	0	0.4	1	0.02	0.4	0.3	0.7	0.7	1	1	0	0.5	1	0.5	0.45	0.48	0.42	0	1	1	0	1	1	0	0	0	0	0	0	50.02	12.50
17:15-17:30	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.62	0.5	0	0	0	0.5	0	0	0	0.45	1	0.02	0.5	0.5	0.8	0.8	1	1	0	0.65	1	0.4	0.45	0.48	0.42	1	1	1	0.7	1	1	0	0	0	0	0	0	61.79	15.45
17:30-17:45	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.58	0.35	0	0	0	0.36	0	0	0	0.35	1	0.02	0.45	0.45	0.6	0.8	1	1	0	0.4	0	0.4	0.45	0.48	0.42	1	1	1	0.4	1	1	0	0	0	0	0	0	51.36	12.84
17:45-18:00	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.51	0.31	0	0	0	0.33	0	0	0	0.3	1	0.02	0.4	0.3	0.5	0.7	1	1	0	0.33	0	0.4	0.45	0.48	0.42	1	1	1	0.4	1	1	0	0	0	0	0	0	46.95	11.74
18:00-18:15	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.41	0.33	0	0	0	0.32	0	0	0	0.25	1	0.02	0.4	0.3	0.5	0.7	1	0	0	0.3	0	0	0.45	0.48	0.42	0	1	1	0.4	1	1	0	0	0	0	0	0	40.25	10.06
18:15-18:30	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.4	0.35	0	0	0	0.41	0	0	0	0.2	1	0.02	0.4	0.3	0.5	0.7	1	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.5	1	1	0	0	0	0	0	0	36.34	9.08
18:30-18:45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.38	0.32	0	0	0	0.33	0	0	0	0	0	0.02	0.4	0.3	0.5	0.7	1	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.6	1	1	0	0	0	0	0	0	34.31	8.58
18:45-19:00	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.35	0.3	0	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0.7	1	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.7	1	1	0	0	0	0	0	0	32.68	8.17
19:00-	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0.7	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.65	1	1	0	0	0	0	0	0	20.13	5.03

19:15																																																
19:15-19:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0.5	1	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.45	1	1	0	0	0	0	0	0	14.70	3.68
19:30-19:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0.3		0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.4	1	1	0	0	0	0	0	0	13.95	3.49
19:45-20:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0.3	1	1	0	0	0	0	0	0	9.37	2.34
20:00-20:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.88	2.22
20:15-20:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.86	2.22
20:30-20:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.84	2.21
20:45-21:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.81	2.20
21:00-21:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.83	2.21
21:15-21:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.85	2.21
21:30-21:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.87	2.22
21:45-22:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.87	2.22
22:00-22:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.90	2.23
22:15-22:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.88	2.22
22:30-22:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.89	2.22
22:45-23:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.86	2.22

23:00-23:15	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.88	2.22
23:15-23:30	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.88	2.22
23:30-23:45	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.90	2.23
23:45-00:00	0	0	0	0	0	0	0	0	0	0.1	0.4	0.3	0	0	0	0	0	0	0	0	0.02	0	0.3	0	0	0	0	0	0	0	0	0.1	0.11	0.12	0	1	1	0	1	1	0	0	0	0	0	0	8.89	2.22
																																														Maximum Demand	61.79	
																																														Total Daily Demand		553.59

Appendix C: Area wise energy consumption of the different facilities at Dhangadhi Airport (Airside and Landside)

Energy Inventory by Areas																
Airsides	Items	Items	Individualtotal capacity (ton)	Rating	Total Rating(watt)	Daily energy consumption during summer	Total Kwh in Summer	Daily energy consumption during Winter	Total Kwh Winter	Percentage KWh @ Summer @Airside	Percentage KWh @winter @Airsides	Total Percentage Kwh @ Summer	Total percentage Kwh @ Winter	Total demand(Kw)	Overall Percentage KW	Percentage KW@ airside
Aircraft movement Area/Airfield lighting	Runway edge light	60	55	3300	3300	**30.30**	**113.67**	**18.5039**	**148.89**	**40.86**	**55.04**	**17.40**	**26.99**	24.015	16.68	43.37
	Turning pad light	12	45	540	540	**5.06**		**3.02792**								
	Runway Threshold/ End light	12	100	1200	1200	**11.45**		**6.7287**								
	Runway PAPI light(09/27)	24	200	4800	4800	**41.89**		**30.5148**								
	Approach Light (27 side)	17	65	1105	1105	**10.39**		**7.02476**								
	Taxiway light	22	45	990	990	**1.10**		**6.29368**								
	Apron flood light	8	260	2080	2080	**2.32**		**13.2231**								
	RTIL light	4	2000	8000	8000	**8.92**		**50.858**								
	Beacon light	2	1000	2000	2000	**2.23**		**12.7145**								
Radio navigation and system building	VHF/UHF/HF Charger	2	50	100	100	**1.23**	**45.89**	**1.2288**	**22.67**	**16.49**	**8.38**	**7.02**	**4.11**	7.402	5.14	13.37
	VOR/DME	1	5500	5500	5500	**39.69**		**18.6052**								
	Acl (ROWA)	2	901	1802	1802	**4.97**		**2.83995**								
Tower control	Console supply	1	1700	1700	1700	**18.76**	**43.69**	**18.5475**	**40.24**	**15.70**	**14.88**	**6.69**	**7.29**	7.208	5.85	15.20
	HVAC	3	1500	4500	4500	**18.28**		**14.7779**								
	Led lamps	3	36	108	108	**0.18**		**0.21519**								
	AMHS printer	1	400	400	400	**2.14**		**2.073**								
	ICT(desktop)	2	250	500	500	**2.61**		**2.90421**								
	Other equipment	7	172.84	1209.88	1209.88	**1.72**		**1.72264**								
Signaling and displaying equipment	Flight display monitor	3	170	510	510	**2.62**	**2.62**	**2.62497**	2.62	0.94	0.97	**0.40**	**0.48**	0.51	0.35	0.92
Parking and urbanization	Halogen street bulbs	8	1000	8000	8000	**50.16**	**50.16**	**41.52**	**41.52**	**18.03**	**15.35**	**7.68**	**7.53**	8	5.56	14.45
Auxiliary Building	Fluorecent lamps	20	80	1600	1600	**11.10**	**22.19**	**5.1**	**14.55**	**7.98**	**5.38**	**3.40**	**2.64**	26.99	4.88	12.70
	Led lamps	15	40	600	600	**0.88**		**1.07595**								
	Ceiling fans	10	60	600	600	**2.32**		**0.255**								
	HVAC	2	2115	4230	4230	**7.89**		**8.11782**								
		241	**Total cor**	55374.88	**55374.9**	**Total**	**278.22**		**270.50**							100
						Percentage	a									

	Landsides	Items	btotal cap	Rating	ating(watt)					Percentage KWh @ Summer @Landside	Percentage KWh @winter @ Landside	Total Percentage Kwh @ Summer	Total percentage Kwh @ Winter	Total demand(Kw)	Overall Percentage KW	Percentage KW@ Landside
		AC at account room(Hisence)	1	1.5	1555	6.12		4.36884								
		AC at Electromechanical room(ROWA)	1	1.5	1555	9.93		7.36329								
		AC at Fire room	1	1	988	5.69		4.27138								
		AC1 at CCR room(Panasonic Old type)	1	2	2315	0.00		0								
		AC2 at CCR room(Panasonic Old type)	1	2	2315	19.55		16.4666								
		AC1 at VIP Room(new)	1	1.5	1555	5.95		4.05014								
		AC2 at VIP Room(old panasonic)	1	1.5	1555	5.82		4.06674								
		AC1 at Departure room(old)	1	1.5	1555	6.32		4.28917								
		AC2 at Departure room(Hisence)	1	2	2115	8.41		5.79071								
		AC3 at Departure room(Hisence)	1	2	2115	8.38		5.80424								
		AC4 at Departure room(Hisence)	1	1.5	1555	6.08		4.46843								
	HVAC	AC5 at Departure room(Old)	1	1.5	1720	6.83	116.22	4.93082	73.39	30.98	26.10	17.79	13.30	34.016	23.63	38.39
		AC6 at Departure room(Old US)	1	1.5	1555	0.82		0								
		AC at airport chief office	1	1	988	2.17		2.70193								
		AC1 At guest house	1	1.5	1555	0.00		0								
		AC2 At guest house	1	1	1000	0.00		0								
		AC1 at WFP office	1	0.5	455	0.00		0								
		AC2 at WFP office	1	0.5	455	0.00		0								
		De fridge	1	150	150	2.51		0.68515								
		Cooler	4	500	2000	2.30		0.92								
		Ceiling Fan	70	60	4200	16.24		1.785								
		Refrigirator	2	80	160	0.40		0.38861								
		Table Fan	10	60	600	2.70		1.035								
		Public Announce System	1	400	400	1.65		0.82344								
Terminal Building	Security	CCTV camera	1	90	90	2.21	7.31	2.21184	8.50	1.95	3.02	1.12	1.54	2.6	1.81	2.93
		Hold baggage,x-ray machine	1	2000	2000	2.62		4.67348								
		Walk through metal detector	2	55	110	0.82		0.78848								
		Sodium vapour lamp	8	1000	8000	32.40		34.3								
	Lighting	Flourescent tube	120	80	9600	66.60	100.89	30.6	67.20	26.89	23.89	15.44	12.18	19.4	13.47	21.90
		LED bulbs	32	40	1800	1.89		2.29536								
		Fire vehicle battery charger	1	200	200	0.70		0.7417								
		Generator battery charger	1	200	200	0.65		0.69159								
		Air compressor1	1	2700	2700	8.71		16.5888								
		Air compressor2	1	2236	2236	3.86		9.73107								
		Water Pump	7	745.7	5219.9	5.18		5.59834								
		Invertor1(Shree air)	1	1600	1600	11.96		11.1534								
	Electromechanical	Invertor2(Buddha air)	1	1600	1400	11.96	130.80	11.7514	113.40	34.86	40.33	20.02	20.55	30.1844	20.96	34.07
		Invertor3(Airort chief Quarter)	1	1400	1400	10.47		9.48326								
		Vacuum cleaner	1	1500	1500	8.77		7.5								
		Online UPS	1	5000	5000	17.10		7.98579								
		Battery ups	2	50	100	0.71		0.74116								
		Water despenser	10	90	900	6.20		5.79038								
		Electric kettle	4	1000	4000	20.90		10.73								
		3-phase water pump	1	3728.5	3728.5	23.65		14.914								
		Laptop	5	250	250	6.14		6.144								
		TV	4	50	200	1.07		1.032								
		Photocopy machine	2	400	800	3.58		2.95647								
	ICT	Fax	1	150	150	0.45	19.99	0.51099	18.74	5.33	6.66	3.06	3.40	2.4	1.67	2.71
		Printer	3	134	400	3.68		4.6035								
		Router	4	25	100	2.46		2.4576								
		computer	2	250	500	2.61		1.032								
		Total number of electric charges	303	Total Landside power	88600.4		375.21		281.22						100	100
				Total installed loads	143975		653.43		551.71							

Appendix D: The MATLAB codes for the MOSEK optimizer for the time shifting optimization.

```
%Code:Bishal Dumre
%{
Dhangadhi Airport Load Shifting Scheduling for DSM
%}

clc;clear all; close all;

A=12;H=96;

Load_Data=xlsread('dhangadhi_new.xlsx');

C=Load_Data(1:end,1:H);
C(isnan(C))=0;
D=Load_Data(1:end,H+1);
D(isnan(D))=0;


for i=1:A
X_all(i,:)=C(i,1:H)*D(i);
end

U=sum(C,2); %Each user's applainces running for hours

Z=sum(sum(X_all,1),3)/1000; %Hourly kW system Load
PAR=max(Z)/mean(Z);         % Peak to Average Ratio
LF=1/PAR;                   % Load Factor
u1=7*ones(1,20);     % Per unit cost of (12PM to 5AM)
u2=12*ones(1,48);        % Per unit cost of (5AM to 5PM)
u3=13.20*ones(1,24);        % Per unit cost of (5PM to 11PM)
u4=7*ones(1,4);          % Per unit cost of (11PM to 12AM)
u=[u1,u2,u3,u4];            % For 24 Hour/ 96 time Slot
Cost=30*(sum(Z.*u)*0.25)+240*150;       % divided by 4



%__________________optimization______________________
cvx_begin
    binary variables X(A,H);

    for i=1:A
    X_opt(i,:)=X(i,1:H)*D(i);
    end

 Z_=sum(sum(X_opt,3))/1000;%optimized system demand at Hth hour
 Cost_=(sum(Z_.*u)*0.25)*30+(240*150);
  U_opt=sum(X,2);
```

```
 minimize(Cost_);


subject to

U_opt==U;
X(1,1:20)==0;      %No Water dispenser from 12PM to 11AM
X(1,80:96)==0;   %No Water dispenser from 4PM to 12PM

X(2:3,80:96)==0;
X(2:3,1:24)==0;

X(4,1:24)==0;
X(4,88:96)==0;

X(5:6,22:40)==0;    % NO Water pump from 5AM to 11PM
X(5:6,64:88)==0;

X(7:9,32:40)==0;    % NO Water pump from 5AM to 11PM
X(7:9,68:76)==0;

X(10,1:20)==0;
X(10,80:96)==0;

X(11,1:20)==0;
X(11,80:96)==0;

X(12,24:80)==0;


cvx_end

 Z_opt=sum(sum(X_opt,1),3)/1000;
 PAR_opt=max(Z_opt)/mean(Z_opt);
 LF_=1/PAR_opt;

 Zd=Z-Z_opt;



 xlswrite('dhangadhi_opt',X_opt);
 xlswrite('dhangadhi_opt_binary',X);

 %____________Plot______________________________________%
figure(1)
set(groot,'defaultLineLineWidth',1.2);
plot(Z,'color','b');
hold on
plot(Z_opt,'color','k');
hold on;
```

```
    xlabel('Time(Hours)');
    ylabel('Demand-kW');
    legend({'Exixting','Optimized'},'Location','northwest');
    set(gca,'FontSize',24);
    xlim([0 96+1]);
    set(gca,'XTick',[1 4 12 20 28 36 44 52 60 68 76 84 92 ]);

set(gca,'xticklabel',({'24','1','3','5','7','9','11','13','15','17',
'19','21','23',}));
    set(gcf, 'PaperUnits', 'centimeters');
    set(gcf, 'PaperPosition', [0 0 45 25]);
    title('Consumption pattern before and after shifting');
    saveas(gcf,' Dhangadhi_Demand comparison.jpg');
    grid on;

figure(2)
set(groot,'defaultLineLineWidth',1.2);
bar(Z);

    xlabel('Time(Hours)');
    ylabel('Demand-kW');

    set(gca,'FontSize',24);
    xlim([0 96+1]);
    set(gca,'XTick',[1 4 12 20 28 36 44 52 60 68 76 84 92 ]);

set(gca,'xticklabel',({'24','1','3','5','7','9','11','13','15','17',
'19','21','23',}));
    set(gcf, 'PaperUnits', 'centimeters');
    set(gcf, 'PaperPosition', [0 0 45 25]);
    title('Existing Demand');
    saveas(gcf,' Dhangadhi_Existing Demand.jpg');
    grid on;

    figure(3)
set(groot,'defaultLineLineWidth',1.2);
bar(Z_opt);

    xlabel('Time(Hours)');
    ylabel('Demand-kW');

    set(gca,'FontSize',24);
    xlim([0 96+1]);
    set(gca,'XTick',[1 4 12 20 28 36 44 52 60 68 76 84 92 ]);

set(gca,'xticklabel',({'24','1','3','5','7','9','11','13','15','17',
'19','21','23',}));
    set(gcf, 'PaperUnits', 'centimeters');
    set(gcf, 'PaperPosition', [0 0 45 25]);
    title('Optimized Demand');
    saveas(gcf,' Dhangadhi_Optimized Demand.jpg');
```

```
    grid on;

  figure(4)
bar(Zd);
    xlabel('Time(Hours)');
    ylabel('Difference in load after optimization-kW');
    set(gca,'FontSize',24);
    xlim([0 96+1]);
    set(gca,'XTick',[1 4 12 20 28 36 44 52 60 68 76 84 92 ]);

set(gca,'xticklabel',({'12','1','3','5','7','9','11','13','15','17',
'19','21','23',}));
    set(gcf, 'PaperUnits', 'centimeters');
    set(gcf, 'PaperPosition', [0 0 45 25]);
    title('Demand Deviation');
    saveas(gcf,'Dhangadhi_Demand variation.jpg');
    grid on;

      figure(5)
plot(u);
    xlabel('Time(Hours)');
    ylabel('Per Unit Cost');
    set(gca,'FontSize',24);
    xlim([0 96+1]);
    set(gca,'XTick',[1 4 12 20 28 36 44 52 60 68 76 84 92 ]);

set(gca,'xticklabel',({'12','1','3','5','7','9','11','13','15','17',
'19','21','23',}));
    set(gcf, 'PaperUnits', 'centimeters');
    set(gcf, 'PaperPosition', [0 0 45 25]);
    title('Per Unit Cost');
    saveas(gcf,'Dhangadhi_Per Unit Cost.jpg');
    grid on;
```

Appendix E: The solver report of the optimization of the shift able loads.

```
Calling Mosek 9.1.9: 1152 variables, 437 equality constraints

------------------------------------------------------------


MOSEK Version 9.1.9 (Build date: 2019-11-21 11:34:40)

Copyright (c) MOSEK ApS, Denmark. WWW: mosek.com

Platform: Windows/64-X86


Problem

  Name                   :

  Objective sense        : min

  Type                   : LO (linear optimization problem)

  Constraints            : 437

  Cones                  : 0

  Scalar variables       : 1152

  Matrix variables       : 0

  Integer variables      : 1152


Optimizer started.

Mixed integer optimizer started.

Threads used: 2

Presolve started.

Presolve terminated. Time = 0.02

Presolved problem: 715 variables, 12 constraints, 715 non-zeros

Presolved problem: 0 general integer, 715 binary, 0 continuous

Clique table size: 0
```

BRANCHES RELAXS ACT_NDS DEPTH BEST_INT_OBJ
BEST_RELAX_OBJ REL_GAP(%) TIME

0 0 1 0 5.6897173050e+04 NA
NA 0.1

0 1 1 0 5.4444600000e+04
5.4444600000e+04 0.00e+00 0.1

An optimal solution satisfying the relative gap tolerance of 1.00e-02(%) has been located.

The relative gap is 0.00e+00(%).

An optimal solution satisfying the absolute gap tolerance of 0.00e+00 has been located.

The absolute gap is 0.00e+00.

Objective of best integer solution: 5.444460000000e+04

Best objective bound : 5.444460000000e+04

Construct solution objective : Not employed

User objective cut value : Not employed

Number of cuts generated : 0

Number of branches : 0

Number of relaxations solved : 1

Number of interior point iterations: 0

Number of simplex iterations : 0

Time spend presolving the root : 0.02

Time spend optimizing the root : 0.03

Mixed integer optimizer terminated. Time: 0.14

```
Optimizer terminated. Time: 0.22


Integer solution solution summary
  Problem status  : PRIMAL_FEASIBLE
  Solution status : INTEGER_OPTIMAL
  Primal.  obj: 5.4444600000e+04    nrm: 5e+01    Viol.  con: 0e+00
var: 0e+00    itg: 0e+00
Optimizer summary
  Optimizer                 -                        time: 0.22
    Interior-point          - iterations : 0         time: 0.00
      Basis identification  -                        time: 0.00
        Primal              - iterations : 0         time: 0.00
        Dual                - iterations : 0         time: 0.00
        Clean primal        - iterations : 0         time: 0.00
        Clean dual          - iterations : 0         time: 0.00
    Simplex                 -                        time: 0.00
      Primal simplex        - iterations : 0         time: 0.00
      Dual simplex          - iterations : 0         time: 0.00
    Mixed integer           - relaxations: 1         time: 0.14

------------------------------------------------------------
Status: Solved
Optimal value (cvx_optval): +90444.6
```

Appendix F: NEA Tariff Rates for Noncommercial TOD meter

३. टाइम अफ डे (Time of day) विद्युत महशुल

३.१. वैशाखदेखि मंसिरसम्मको विद्युत महशुल दर

क्र.सं	उपभोक्ता वर्ग	डिमान्ड शुल्क (रू. प्रति के.भि.ए. प्रति महिना)	इनर्जी शुल्क (रू. प्रति कि.वा.घण्टा) पिक समय (साँझ ५:०० बजे देखि राति ११:०० बजेसम्म)	इनर्जी शुल्क (रू. प्रति कि.वा.घण्टा) अफ पिक समय (राति ११:०० बजे देखि बिहान ५:०० बजेसम्म)	इनर्जी शुल्क (रू. प्रति कि.वा.घण्टा) अन्य समय (बिहान ५:०० बजे देखि साँझ ५:०० बजे सम्म)
अ.	माथिल्लो भोल्टेज				
१	औद्योगिक (१३२ के.भी)	२३०।००	१०।००	४।६५	८।२०
२	औद्योगिक (६६ के.भी)	२४०।००	१०।१०	४।७५	८।३०
आ.	मझौला भोल्टेज (३३ के.भि)				
१	औद्योगिक	२५०।००	१०।२०	५।२५	८।४०
२	व्यापारिक	३१५।००	१२।३०	६।७५	१०।८०
३	गैर व्यापारिक	२४०।००	१३।२०	७।००	१२।००
४	सिंचाई		६।३०	३।१५	४।७०
५	खानेपानी				
	क) सामुदायिक खानेपानी		६।२०	३।१०	४।६०
	ख) अन्य खानेपानी	१५०।००	१०।२०	५।२५	८।४०
७	यातायात				
	क) चार्जिङ स्टेशन	२३०।००	७।००	३।७०	५।५०
	ख) अन्य यातायात	२५५।००	९।३५	३।७०	८।४०
८	सडक बत्ति	८०।००	८।४०	३।५०	४।२०
इ.	मझौला भोल्टेज (११ के.भि.)				

Appendix G: Total Calculated Annual Cost at Dhangadhi Airport

Time slots	Daily energy consumption during Summer	Daily energy curve during the Winter season	Tariff rate for summer	Cost of energy during summer	Tariff rate for winter	Cost of energy during winter
00:00-00:15	2.278	2.275	7	15.946	12	27.30
00:15 - 00: 30	2.284	2.280	7	15.986	12	27.36
00:30 - 00: 45	2.287	2.282	7	16.007	12	27.39
00:45 - 1: 00	2.275	2.273	7	15.926	12	27.27
1:00 - 1: 15	2.289	2.284	7	16.023	12	27.41
1:15-1:30	2.278	2.275	7	15.946	12	27.30
1:30-1:45	2.295	2.289	7	16.068	12	27.47
1:45-2:00	2.290	2.285	7	16.027	12	27.41
2:00-2:15	2.286	2.282	7	16.003	12	27.38
2:15-2:30	2.280	2.277	7	15.962	12	27.32
2:30-2:45	2.301	2.294	7	16.108	12	27.53
2:45-3:00	2.295	2.289	7	16.068	12	27.47
3:00-3:15	2.290	2.285	7	16.027	12	27.41
3:15-3:30	2.290	2.285	7	16.027	12	27.41
3:30-3:45	2.287	2.282	7	16.007	12	27.39
3:45-4:00	2.280	2.277	7	15.962	12	27.32
4:00-4:15	2.277	2.275	7	15.942	12	27.29
4:15-4:30	2.286	2.282	7	16.003	12	27.38
4:30-4:45	2.292	2.286	7	16.043	12	27.44
4:45-5:00	2.290	2.285	7	16.027	12	27.41
5:00-5:15	2.278	2.275	12	27.336	12	27.30
5:15-5:30	2.272	2.270	12	27.266	12	27.24
5:30-5:45	2.842	2.883	12	34.110	12	34.59
5:45-6:00	3.062	4.041	12	36.749	12	48.49
6:00-6:15	5.353	5.519	12	64.242	12	66.23
6:15-6:30	6.830	5.910	12	81.955	12	70.92
6:30-6:45	7.259	6.537	12	87.109	12	78.44
6:45-7:00	7.368	7.110	12	88.413	12	85.33
7:00-7:15	8.358	7.603	12	100.290	12	91.23
7:15-7:30	8.416	7.808	12	100.991	12	93.70
7:30-7:45	9.058	8.184	12	108.690	12	98.20
7:45-8:00	10.029	8.823	12	120.352	12	105.88
8:00-8:15	11.468	9.745	12	137.611	12	116.94
8:15-8:30	13.803	14.979	12	165.635	12	179.75
8:30-8:45	14.124	14.351	12	169.486	12	172.21
8:45-9:00	14.463	13.874	12	173.555	12	166.49
9:00-9:15	16.260	13.570	12	195.116	12	162.85

9:15-9:30	14.725	13.143	12	176.703	12	157.71
9:30-9:45	13.581	12.018	12	162.973	12	144.22
9:45-10:00	12.583	11.394	12	151.000	12	136.73
10:00-10:15	11.211	12.097	12	134.537	12	145.16
10:15-10:30	11.047	10.418	12	132.564	12	125.02
10:30-10:45	10.320	9.721	12	123.839	12	116.65
10:45-11:00	10.056	9.342	12	120.678	12	112.11
11:00-11:15	8.441	9.144	12	101.289	12	109.73
11:15-11:30	7.940	8.682	12	95.286	12	104.18
11:30-11:45	7.885	8.678	12	94.622	12	104.14
11:45-12:00	7.734	7.331	12	92.803	12	87.97
12:00-12:15	7.224	5.795	12	86.684	12	69.54
12:15-12:30	6.105	5.556	12	73.261	12	66.67
12:30-12:45	6.086	5.102	12	73.035	12	61.23
12:45-13:00	6.053	4.994	12	72.639	12	59.92
13:00-13:15	6.597	4.861	12	79.164	12	58.33
13:15-13:30	6.514	4.736	12	78.163	12	56.83
13:30-13:45	6.538	4.592	12	78.450	12	55.10
13:45-14:00	6.690	4.504	12	80.279	12	54.05
14:00-14:15	6.692	4.576	12	80.310	12	54.91
14:15-14:30	6.723	4.574	12	80.675	12	54.89
14:30-14:45	6.976	5.305	12	83.712	12	63.66
14:45-15:00	9.015	6.055	12	108.182	12	72.67
15:00-15:15	10.239	6.810	12	122.868	12	81.72
15:15-15:30	10.444	6.972	12	125.334	12	83.67
15:30-15:45	10.732	6.991	12	128.787	12	83.89
15:45-16:00	10.912	6.942	12	130.939	12	83.30
16:00-16:15	11.561	6.922	12	138.734	12	83.06
16:15-16:30	11.806	7.817	12	141.676	12	93.80
16:30-16:45	12.772	8.721	12	153.263	12	104.65
16:45-17:00	14.980	10.236	12	179.759	12	122.83
17:00-17:15	17.661	12.505	13.2	233.128	13.2	165.06
17:15-17:30	18.260	15.448	13.2	241.035	13.2	203.92
17:30-17:45	15.966	12.840	13.2	210.756	13.2	169.48
17:45-18:00	14.266	11.737	13.2	188.314	13.2	154.93
18:00-18:15	12.274	10.062	13.2	162.021	13.2	132.81
18:15-18:30	11.656	9.085	13.2	153.854	13.2	119.92
18:30-18:45	9.881	8.578	13.2	130.427	13.2	113.23
18:45-19:00	8.347	8.169	13.2	110.186	13.2	107.83
19:00-19:15	7.115	5.033	13.2	93.915	13.2	66.43
19:15-19:30	5.037	3.676	13.2	66.491	13.2	48.52
19:30-19:45	3.984	3.487	13.2	52.585	13.2	46.03
19:45-20:00	3.049	2.344	13.2	40.252	13.2	30.93
20:00-20:15	2.681	2.220	13.2	35.383	13.2	29.31
20:15-20:30	2.322	2.216	13.2	30.654	13.2	29.25
20:30-20:45	2.304	2.211	13.2	30.409	13.2	29.18
20:45-21:00	2.279	2.201	13.2	30.087	13.2	29.06
21:00-21:15	2.286	2.207	13.2	30.179	13.2	29.13

21:15-21:30	2.279	2.212	13.2	30.086	13.2	29.20
21:30-21:45	2.221	2.217	13.2	29.319	13.2	29.26
21:45-22:00	2.222	2.217	13.2	29.327	13.2	29.27
22:00-22:15	2.232	2.225	13.2	29.457	13.2	29.37
22:15-22:30	2.226	2.220	13.2	29.380	13.2	29.31
22:30-22:45	2.229	2.223	13.2	29.419	13.2	29.34
22:45-23:00	2.220	2.216	13.2	29.304	13.2	29.25
23:00-23:15	2.226	2.220	7	15.580	12	26.64
23:15-23:30	2.226	2.220	7	15.580	12	26.64
23:30-23:45	2.232	2.225	7	15.621	12	26.70
23:45-00:00	2.23	2.22	7	15.597	12	26.67
			Daily energy cost	7629.56		6798.50
			Monthly energy	228886.95		203955.10
			Kva demand charges	24000		24000
			Total energy charges for each month	252886.95		227955.10
			Total Annual Electricity cost	NPR. 2934916		

Appendix H: Total Electric charges at the Dhangadhi Airport

Appliances/time	Items	Total capacity(ton)	Rating	Stand by powers	Total Rating(watt)	Types of loads
AC1 at tower(ROWA)	1	2	2155	4.741	2159.741	Opening/Variable
AC2 at tower(AUX)	1	2	2215	4.873	2219.873	Opening/Variable
AC3 at tower (Hisence)	1	1	988	2.1736	990.1736	Opening/Variable
AC at account room (Hisence)	1	1.5	1555	3.421	1558.421	Variable
AC at Electromechanical room(ROWA)	1	1.5	1555	3.421	1558.421	Variable
AC at Fire room	1	1	988	2.1736	990.1736	Variable
AC1 at CCR room(Panasonic Old type)	1	2	2315	5.093	2320.093	Fixed
AC2 at CCR room(Panasonic Old type)	1	2	2315	5.093	2320.093	Fixed
AC1 at VIP Room(new)	1	1.5	1555	3.421	1558.421	Variable
AC2 at VIP Room(old panasonic)	1	1.5	1555	3.421	1558.421	Variable
AC1 at Departure room(old)	1	1.5	1555	3.421	1558.421	Variable
AC2 at Departure room(Hisence)	1	2	2115	4.653	2119.653	Variable
AC3 at Departure room(Hisence)	1	2	2115	4.653	2119.653	Variable
AC4 at Departure room(Hisence)	1	1.5	1555	3.421	1558.421	Variable
AC5 at Departure room(Old)	1	1.5	1720	3.784	1723.784	Variable
AC6 at Departure room(Old US)	1	1.5	1555	3.421	1558.421	Variable
AC at airport chief office	1	1	988	2.1736	990.1736	Variable
AC1 At guest house	1	1.5	1555	3.421	1558.421	Variable
AC2 At guest house	1	1	1000	2.2	1002.2	Variable
AC1 at WFP office	1	0.5	455	1.001	456.001	Variable
AC at WFP office	1	0.5	455	1.001	456.001	Variable
Cooler	4	500	2000	0	2000	Variable
Public Announce System	1	400	400	11.72	411.72	Opening/Variable
Hold baggage-ray machine	1	2000	2000	58.8	2058.8	Opening/Variable
Refrigerator	2	80	160	1.92	161.92	Variable
Walk through metal detector	2	55	110	2.64	112.64	Variable
Ceiling Fan	80	60	4800	0	4800	fixed/opening /variable
Table Fan	10	60	600	0	600	Variable
Runway edge light	60	55	3300	0	3300	Variable
Turning pad light	12	45	540	0	540	Variable
Runway Threshold/ End light	12	1200	1200	0	1200	Variable
Runway PAPI light(09/27)	24	200	4800	0	4800	Variable
Approach Light (27 side)	17	65	1105	0	1105	Variable
Taxiway light	22	45	990	0	990	Variable
Apron flood light	8	260	2080	0	2080	Variable
RTIL light	4	2000	8000	0	8000	Variable
Beacon light	2	1000	2000	0	2000	Variable

Console power supply	1	1700	1700	168.3	1868.3	Opening/Variable/fixed
Halogen lamp	8	1000	8000	0	8000	opening
VOR/DME	1	5500	5500	12.65	5512.65	Opening/Variable/fixed
Fire vehicle battery charger	1	200	200	0.46	200.46	fixed
Generator battery charger	1	200	200	0.46	200.46	fixed
De fridge	1	150	150	3.45	153.45	opening/fixed
AMHS Printer	1	400	400		400	opening/variable
TV	4	50	200	0	200	opening/Variable
Photocopy machine	2	400	800	18.4	818.4	opening/variable
Fax	1	150	150	3.45	153.45	opening/variable
Printer	3	134	400	9.2	409.2	opening/variable
Online UPS	1	5000	5000	115	5115	fixed
Desktop computer	4	250	1000	98	1098	Opening/variable
sodium vapor light	8	1000	8000	0	8000	opening
Battery ups	2	50	100	2.3	102.3	fixed
Fluorescent tube	140	60	8400	0	8400	variable
Water dispenser	10	90	900	26.46	926.46	opening/fixed
Air compressor1	1	2700	2700	64.8	2764.8	opening/variable
Air compressor2	1	2236	2236	53.664	2289.664	opening/variable
Electric kettle	4	1000	4000	0	4000	variable/fixed
3-phase water pump	1	3728.5	3728.5	0	3728.5	Opening/Variable
Water pump	7	745.7	5219.9	0	5219.9	Opening/Variable
Invertor1(Shree air)	1	1600	1600	38.4	1638.4	Fixed
Invertor2(Buddha air)	1	1600	1600	38.4	1638.4	Fixed
Invertor3(Airport chief Quarter)	1	1400	1400	33.6	1433.6	Fixed
Vacuum cleaner	1	1500	1500	0	1500	opening/variable
Laptop	5	50	250	6	256	opening/variable
VHF/UHF Charger	2	25	50	1.2	51.2	opening/variable/fixed
LED bulbs	50	36	1800	0	1800	variable
CCTV camera	1	90	90	2.16	92.16	fixed
Router	4	25	100	2.4	102.4	fixed
Flight information monitor	3	170	510	14.994	524.994	opening
AC1 at auxiliary building	1	2	2115	4.653	2119.653	opening
AC2 at auxiliary building	1	1.5	1555	3.421	1558.421	opening
AC1 at radio navigation	1	1	901	1.9822	902.9822	fixed
AC2 at radio navigation	1	1	901	1.9822	902.9822	fixed
Others	1	2650.22	2650.22	0	2650.22	fixed/opening /variable
Total Electric charges	559	Total installed capacity of different electric charges(KW)	142.3556		143.2274672	

Appendix I: Existing and the improved appliances power consumption During Summer season

Appliances/time	Items	total capacity(ton)	Rating(Current)	Stand by powers	Total Rating(watt)	Capacity (ton)	Rating(improved)(Three star AC)	Standby Power	Total Rating(watt)(Three star AC, Star rated fan and LED Lights)
Ac1 at tower(ROWA)	1	2	2155	4.741	2159.741	2	1930	4.246	1934.246
Ac2 at tower(AUX)	1	2	2215	4.873	2219.873	2	1930	4.246	1934.246
Ac3 at tower(Hisence)	1	1	988	2.174	990.1736	1	980	2.156	982.156
AC at account	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC at	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC at Fire room	1	1	988	2.174	990.1736	1	980	2.156	982.156
AC1 at CCR	1	2	2315	5.093	2320.093	2	1930	4.246	1934.246
AC2 at CCR room(Panasonic	1	2	2315	5.093	2320.093	2	1930	4.246	1934.246
AC1 at VIP	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC2 at VIP	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC1 at Departure	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC2 at Departure	1	2	2115	4.653	2119.653	2	1930	4.246	1934.246
AC3 at Departure	1	2	2115	4.653	2119.653	2	1930	4.246	1934.246
AC4 at Departure	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC5 at Departure	1	1.5	1720	3.784	1723.784	1.5	1600	3.52	1603.52
AC6 at Departure	1	1.5	1555	3.421	1558.421	1.5	1600	3.52	1603.52
AC at airport chief	1	1	988	2.174	990.1736	1	988	2.1736	990.1736
AC1 At guest house	1	1.5	1555	3.421	1558.421	1.5	1630	3.586	1633.586
AC2 At guest house	1	1	1000	2.2	1002.2	1	980	2.156	982.156
AC1 at WFP office	1	0.5	455	1.001	456.001	0.5	455	1.001	456.001
AC at WFP office	1	0.5	455	1.001	456.001	0.5	455	1.001	456.001
Ceiling Fan	80	60	4800	0	4800	45	3600	0	3600
Runway edge light	60	55	3300	0	3300	26	1560	0	1560
Turning pad light	12	45	540	0	540	12	144	0	144
Runway Threshold/	12	1200	1200	0	1200	25	300	0	300
Runway PAPI	24	200	4800	0	4800	200	4800	0	4800
Approach Light (27	17	65	1105	0	1105	25	425	0	425
Taxiway light	22	45	990	0	990	12	264	0	264
Apron flood light	8	260	2080	0	2080	260	2080	0	2080
RTIL light	4	2000	8000	0	8000	2000	8000	0	8000
Beacon light	2	1000	2000	0	2000	1000	2000	0	2000
Halogen lamp	8	1000	8000	0	8000	1000	8000	0	8000
sodium vapour light	8	1000	8000	0	8000	250	2000	0	2000
Flourescent tube	140	60	8400	0	8400	22	3080	0	3080
AC1 at auxillary	1	2	2115	4.653	2119.653	2	1930	4.246	1934.246
AC2 at auxillary	1	1.5	1555	3.421	1558.421	1.5	1630	3.586	1633.586
AC1 at radio	1	1	901	1.982	902.9822	1	980	2.156	982.156
AC2 at radio	1	1	901	1.982	902.9822	1	980	2.156	982.156
Total Electric charges	422	Total installed	90.951		91.034019				Quarterly Demand(Current)
									Quarterly Demand(Improved)
									Kwh energy consumption at each 15min basis(Current)
									Kwh energy consumption at each
									Energy saving during each 15 min(After
									Tariff rate(KWH)

00:00-00:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.38	7.483562	2.345006	1.870890375	0.474115	7
00:15 - 00: 30	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.403	7.502904	2.350806	1.87572599	0.47508	7
00:30 - 00: 45	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.415	7.512575	2.353706	1.878143798	0.475562	7
00:45 - 1: 00	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.368	7.47389	2.342106	1.868472568	0.473633	7
1:00 - 1: 15	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.424	7.520312	2.356026	1.880078044	0.475948	7
1:15-1:30	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.38	7.483562	2.345006	1.870890375	0.474115	7
1:30-1:45	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.45	7.541589	2.362407	1.88539722	0.477009	7
1:45-2:00	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.426	7.522246	2.356606	1.880561605	0.476045	7
2:00-2:15	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.413	7.510641	2.353126	1.877660236	0.475466	7
2:15-2:30	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.389	7.491298	2.347326	1.872824621	0.474501	7
2:30-2:45	0	0	0	0	0	0	0	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.473	7.560931	2.368207	1.890232835	0.477974	7
2:45-3:00	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.45	7.541589	2.362407	1.88539722	0.477009	7
3:00-3:15	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.426	7.522246	2.356606	1.880561605	0.476045	7
3:15-3:30	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.426	7.522246	2.356606	1.880561605	0.476045	7
3:30-3:45	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.415	7.512575	2.353706	1.878143798	0.475562	7

3:45-4:00	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.389	7.491298	2.347326	1.872824621	0.474501	7
4:00-4:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.378	7.481627	2.344426	1.870406814	0.474019	7
4:15-4:30	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.413	7.510641	2.353126	1.877660236	0.475466	7
4:30-4:45	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.436	7.529983	2.358926	1.882495851	0.476431	7
4:45-5:00	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.426	7.522246	2.356606	1.880561605	0.476045	7
5:00-5:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.38	7.483562	2.345006	1.870890375	0.474115	12
5:15-5:30	0	0	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.357	7.464219	2.339206	1.86605476	0.473151	12
5:30-5:45	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.426	7.522246	2.356606	1.880561605	0.476045	12
5:45-6:00	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0.5	0.5	10.31	8.48506	2.576552	2.12126499	0.455287	12
6:00-6:15	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	16.28	10.94572	4.070751	2.736429375	1.334322	12
6:15-6:30	0.4	0	0.35	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	19.94	13.90186	4.984966	3.475463855	1.509502	12
6:30-6:45	0.55	0	0.45	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	20.55	14.44495	5.137113	3.6112369	1.525876	12
6:45-7:00	0.7	0	0.46	0	0	0	0	0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	21	14.84162	5.249579	3.71040459	1.539175	12
7:00-7:15	0.8	0	0.52		0.4	0.35	0	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	22.43	16.23774	5.60847	4.059435773	1.549034	12
7:15-7:30	0.85	0	0.56		0.55	0.4	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	20.99	15.25819	5.246627	3.814548465	1.432078	12

7:30-7:45	0.85	0	0.65		0.6	0.5	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	23.17	16.96111	5.79198	4.240277752	1.551702	12
7:45-8:00	0.5	0	0.58		0.6	0.52	0	0.49	0	0	0.32	0.35	0.35	0.32	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	25.31	18.96364	6.327432	4.740909158	1.586523	12
8:00-8:15	0.6	0	0.58	0.6	0.65	0.56	0	0.48	0.40	0.4	0.38	0.38	0.38	0.38	0.4	0	0	0	0	0	0	0.65	0	0	0	0	0	0	0	0	0	0.8	0	1	0	0	0.5	0.5	29.04	22.62321	7.258983	5.655803725	1.603179	12
8:15-8:30	0.55	0	0.58	0.65	0.68	0.57	0	0.47	0.45	0.43	0.37	0.4	0.4	0.37	0.43	0	0	0	0	0	0	0.7	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0.5	0.5	34.06	23.88086	8.514819	5.97021518	2.544603	12
8:30-8:45	0.7	0	0.6	0.55	0.7	0.58	0	0.48	0.47	0.44	0.45	0.42	0.42	0.45	0.44	0	0	0	0	0	0	0.75	1	1	1	1	1	0	0	0	0	0	0	1	0	0			34.05	23.69131	8.512813	5.922827373	2.589985	12
8:45-9:00	0.85	0	0.62	0.7	0.75	0.59	0	0.46	0.50	0.55	0.47	0.43	0.43	0.47	0.55	0	0	0	0	0	0	0.77	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	35.28	24.86864	8.819681	6.217158968	2.602522	12
9:00-9:15	0.95	0	0.75	0.9	0.85	0.7	0	0.65	0.70	0.7	0.6	0.8	0.75	0.53	0.65	0	0	0	0	0	0	0.8	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	39.26	28.61135	9.814132	7.152838675	2.661294	12
9:15-9:30	0.8	0	0.52	0.6	0.55	0.5	0	0.49	0.58	0.6	0.55	0.5	0.5	0.55	0.6	0	0	0	0	0	0	0.5	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	35.68	25.63599	8.919336	6.408998515	2.510337	12
9:30-9:45	0.42	0	0.56	0.4	0.53	0.45	0	0.36	0.53	0.5	0.51	0.51	0.51	0.51	0.5	0	0	0	0	0	0	0.4	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	33.24	23.44226	8.310083	5.860564675	2.449519	12
9:45-10:00	0.35	0	0.5	0.38	0.52	0.43	0	0.37	0.52	0.51	0.5	0.49	0.49	0.5	0.51	0.1	0	0	0	0	0	0.1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	31.6	22.18067	7.899258	5.54516752	2.35409	12
10:00-10:15	0.33	0	0.51	0.38	0.5	0.42	0	0.39	0.48	0.45	0.51	0.46	0.46	0.51	0.5	0.1	1	0	0	0	0	0.1	1	1	1	1	1	0	0	0	0	0	0	0.5	1	1	0	0	30.22	23.27943	7.554319	5.819858154	1.734461	12
10:15-10:30	0.36	0	0.52	0	0.4	0.4	0	0.46	0.48	0.45	0.51	0.46	0.46	0.51	0.5	0.1	1	0	0	0	0	0.1	1	1	1	1	1	0	0	0	0	0	0	0.5	1	1	0	0	29.69	22.69541	7.422193	5.673852145	1.74834	12
10:30-10:45	0.36	0	0.4	0	0.3	0.38	0	0.47	0.30	0.25	0.3	0.28	0.28	0.3	0.3	0.1	1	0	0	0	0	0.1	1	1	1	1	1	0	0	0	0	0	0	0.5	1	1	0	0	27.06	20.11787	6.766087	5.029468113	1.736618	12
10:45-11:00	0.37	0	0.35	0	0.2	0.38	0	0.48	0.30	0.25	0.3	0.28	0.28	0.3	0.3	0.1	0.5	0	0	0	0	0.1	1	1	1	1	1	0	0	0	0	0	0	0.5	1	1	0	0	26.39	19.4346	6.597277	4.858650639	1.738627	12
11:00-11:15	0.38	0	0.33	0	0.1	0.4	0	0.46	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0.35	1	1	0	0	21.8	15.81952	5.449547	3.954879314	1.494668	12

11:15-11:30	0.36	0	0.33	0	0	0.4	0	0.45	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0.35	1	0	0	0	20.03	13.9777	5.007433	3.494424538	1.513009	12
11:30-11:45	0.36	0	0.32	0	0	0.36	0	0.46	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0.35	1	0	0	0	20.01	13.9511	5.001612	3.487775692	1.513837	12
11:45-12:00	0.31	0	0.36	0	0	0.34	0	0.43	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0.35	1	0	0	0	19.85	13.82054	4.963336	3.455136202	1.5082	12
12:00-12:15	0.3	0	0.5	0	0	0.33	0	0.43	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0.35	1	0	0	0	19.96	13.92705	4.989659	3.481762993	1.507896	12
12:15-12:30	0.46	0	0.45	0	0.4	0.35	0	0.52	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	17	12.72548	4.250403	3.181368795	1.069034	12
12:30-12:45	0.65	0	0.35	0	0.45	0.33	0	0.35	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	16.97	12.72454	4.243582	3.181135783	1.062446	12
12:45-13:00	0.55	0	0.3	0	0.55	0.34	0	0.34	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	16.85	12.62897	4.211767	3.157243335	1.054524	12
13:00-13:15	0	0	0.29	0	0.58	0.35	0	0.36	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	15.75	11.65193	3.938091	2.91298214	1.025109	12
13:15-13:30	0	0	0	0	0.6	0.36	0	0.35	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	15.48	11.38965	3.870771	2.847413205	1.023358	12
13:30-13:45	0	0	0	0	0.62	0.35	0	0.36	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	15.53	11.43124	3.881888	2.85781103	1.024077	12
13:45-14:00	0	0	0	0.35	0.63	0.36	0	0.35	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	16.08	12.00673	4.021141	3.001681851	1.019459	12
14:00-14:15	0	0	0	0.4	0.55	0.4	0	0.34	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	16.04	11.97083	4.011234	2.99270715	1.018527	12
14:15-14:30	0	0	0	0.43	0.58	0.41	0	0.32	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	16.11	12.04591	4.027806	3.011478356	1.016327	12
14:30-14:45	0	0	0	0.49	0.57	0.42	0	0.48	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0.5	17.01	12.92873	4.253118	3.23218284	1.020935	12
14:45-15:00	0	0	0	0.58	0.58	0.43	0	0.53	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0.5	25.7	16.27949	6.424715	4.069871428	2.354844	12

15:00-15:15	0	0	0.35	0.555	0.555	0.45	0	0.51	0.336	0.335	0.333	0.335	0.335	0.333	0.335	0	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0.5	0.5	29.22	19.76213	7.305852	4.940532678	2.365319	12
15:15-15:30	0	0	0.38	0.556	0.552	0.44	0	0.45	0.40	0.41	0.38	0.38	0.38	0.38	0.41	0	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0.5	0.5	29.61	20.16275	7.402622	5.040687535	2.361934	12
15:30-15:45	0	0	0.42	0.558	0.555	0.42	0	0.45	0.42	0.43	0.4	0.39	0.39	0.4	0.43	0	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0.5	0.5	29.91	20.46161	7.477439	5.115401545	2.362037	12
15:45-16:00	0	0	0.45	0.554	0.553	0.43	0	0.47	0.41	0.42	0.41	0.41	0.41	0.41	0.42	0	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0.5	0.5	29.97	20.5047	7.492451	5.126175195	2.366276	12
16:00-16:15	0.36	0	0.48	0.554	0.554	0.44	0	0.45	0.43	0.45	0.45	0.46	0.46	0.45	0.45	0	0.1	0	0	0	0	0.2	1	1	1	1	1	0	0	0	0	0	0.1	1	0	0	0.5	0.5	32.02	21.86765	8.005594	5.466913415	2.53868	12
16:15-16:30	0.45	0	0.5	0.552	0.552	0.45	0	0.42	0.45	0.47	0.48	0.49	0.49	0.48	0.47	0	0.1	0	0	0	0	0.2	0.51	0.51	0.51	0.51	0.51	0.3	0.3	0.3	0.3	0.3	0.1	1	0	0	0.5	0.5	33.39	24.81359	8.346253	6.20339717	2.142856	12
16:30-16:45	0.5	0	0.51	0.553	0.554	0.45	0	0.46	0.44	0.45	0.5	0.5	0.5	0.5	0.45	0	0.25	0	0	0	0	0.2	0.4	0.4	0.65	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	1	0	0		0.5	31.88	23.48988	7.968869	5.872470208	2.096399	12
16:45-17:00	0.55	0	0.55	0.48	0.6	0.52	0	0.50	0.45	0.5	0.55	0.55	0.52	0.55	0.55	0	0.3	0	0	0	0	0.2	0.5	0.6	0.65	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	1	0	0	0	0.5	37.55	27.52959	9.388475	6.882239803	2.506077	12
17:00-17:15	0.6	0	0.6	0	0.65	0.58	0	0.55	0.50	0.52	0.6	0.6	0.54	0.56	0.58	0	0.4	0	0	0	0	0.2	0.6	0.65	0.65	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.3	1	0	0	0	0	42.72	32.26154	10.68035	8.065385015	2.614965	13.2
17:15-17:30	0.8	0	0.7	0	0.7	0.65	0	0.60	0.55	0.6	0.65	0.65	0.7	0.6	0.68	0	0.55	0	0	0	0	0.7	0.6	0.7	0.65	0.55	0.6	0.65	0.65	0.65	0.65	1.6	0.3	1	0	0	0	0	55.76	44.40139	13.94062	11.10034705	2.840275	13.2
17:30-17:45	0.7	0	0.68	0	0.66	0.64	0	0.55	0.50	0.56	0.62	0.58	0.62	0.6	0.62	0	0.4	0	0	0	0	0.5	0.4	0.5	0.55	0.32	0.51	0.55	0.55	0.55	0.55	1	0.3	1	0	0	0	0	45.42	35.0229	11.35578	8.755724815	2.600052	13.2
17:45-18:00	0.76	0	0.66	0	0.65	0.62	0	0.54	0.52	0.55	0.61	0.55	0.6	0.58	0.6	0	0.38	0	0	0	0	0.5	0.38	0.41	0.48	0.33	0.5	0.5	0.5	0.5	0.5	0.76	0.3	1	0	0	0	0	42.55	32.32502	10.63693	8.081255887	2.555674	13.2
18:00-18:15	0.78	0	0.65	0	0.68	0.56	0	0.48	0.53	0.5	0.63	0.57	0.57	0.56	0.59	0	0.37	0	0	0	0	0.5	0.3	0.38	0.4	0	0.49	0.25	0.25	0.25	0.25	0.66	0.3	1	0	0	0	0	36.28	26.49022	9.069931	6.622554548	2.447377	13.2
18:15-18:30	0.95	0	0.7	0	0.75	0.68	0	0.51	0.60	0.45	0.65	0.6	0.55	0.55	0.58	0	0.1	0	0	0	0	0.5	0.29	0.37	0.39	0	0.48	0.24	0.24	0.24	0.24	0.7	0.3	1	0	0	0	0	36.91	27.11648	9.227439	6.779121198	2.448318	13.2

18:30-18:45	0.81	0	0.55	0	0.6	0.55	0	0.49	0.55	0.44	0.63	0.55	0.54	0.54	0.6	0	0.1	0	0	0	0	0.5	0.28	0.36	0.38	0	0.45	0.22	0.22	0.22	0.22	0.64	0.3	0.5	0	0	0	0	30.79	23.7635	7.697937	5.940875648	1.757061	13.2
18:45-19:00	0.5	0	0.45	0	0.48	0.49	0	0.44	0.54	0.42	0.56	0.53	0.53	0.52	0.55	0	0.1	0	0	0	0	0	0.27	0.35	0.37	0	0.43	0.21	0.21	0.21	0.21	0.6	0.3	0.35	0	0	0	0	25.13	19.64701	6.282738	4.91175185	1.370986	13.2
19:00-19:15	0.4	0	0.35	0	0.38	0.35	0	0.35	0.3	0.3	0.4	0.35	0.35	0.3	0.25	0	0.1	0	0	0	0	0	0.2	0.25	0.3	0	0.25	0.18	0.18	0.18	0.18	0.8	0.3	0.4	0	0	0	0	22.94	17.68415	5.736192	4.421036715	1.315155	13.2
19:15-19:30	0.2	0	0.15	0	0.2	0.2	0	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.2	0.16	0.16	0.16	0.16	0.8	0.3	0.4	0	0	0	0	16.03	11.59677	4.008601	2.8991931	1.109408	13.2
19:30-19:45	0.2	0	0.1	0	0.2	0.2	0	1.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0.3	0	0	0	0	14.96	11.09256	3.739797	2.77313888	0.966658	13.2
19:45-20:00	0.1	0	0.1	0	0.1	0.1	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0.2	0	0	0	0	11.36	8.427331	2.840766	2.106832753	0.733933	13.2
20:00-20:15	0.1	0	0.1	0	0.1	0.1	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0.1	0	0	0	0	10.58	8.167687	2.645266	2.04192179	0.603345	13.2
20:15-20:30	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.148	7.290137	2.287003	1.822534225	0.464469	13.2
20:30-20:45	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.125	7.270794	2.281203	1.81769861	0.463505	13.2
20:45-21:00	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.078	7.23211	2.269603	1.80802738	0.461575	13.2
21:00-21:15	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.106	7.25532	2.276563	1.813830118	0.462733	13.2
21:15-21:30	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.129	7.274663	2.282363	1.818665733	0.463698	13.2

21:30-21:45	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.153	7.294005	2.288164	1.823501348	0.464662	13.2
21:45-22:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.155	7.29594	2.288744	1.82398491	0.464759	13.2
22:00-22:15	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.194	7.328822	2.298604	1.832205455	0.466398	13.2
22:15-22:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.171	7.309479	2.292804	1.82736984	0.465434	13.2
22:30-22:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.183	7.319151	2.295704	1.829787648	0.465916	13.2
22:45-23:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.148	7.290137	2.287003	1.822534225	0.464469	13.2
23:00-23:15	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.171	7.309479	2.292804	1.82736984	0.465434	7
23:15-23:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.171	7.309479	2.292804	1.82736984	0.465434	7
23:30-23:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.194	7.328822	2.298604	1.832205455	0.466398	7
23:45-00:00	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.3	0	0	0	0	0	9.18	7.317216	2.295124	1.829304086	0.46582	7
																																		Daily Cost savings									1405.185	
																																		Montly (KWH)Cost savings									42155.55	
																																		Total summer energy consumption(From Baisakh to Mangsir)									337244.4	

Appendix J: Existing and the improved appliances power consumption During Winter season

Appliances/time	Items	total capacity(to	Rating	Stand by powers	Total Rating(watt	Capacity	Rating	Standby power	Total power
Ac1 at tower(ROWA)	1	2	1800	3.96	1804	2	1765	4	1769
Ac2 at tower(AUX)	1	2	1800	3.96	1804	2	1765	4	1769
Ac3 at tower(Hisence)	1	1	800	1.76	802	1	950	2	952
AC at account room(Hisence)	1	1.5	1325	2.915	1328	2	1365	3	1368
AC at Electromechanical room(ROWA)	1	1.5	1325	2.915	1328	2	1365	3	1368
AC at Fire room	1	1	800	1.76	802	1	950	2	952
AC1 at CCR room(Panasonic Old type)	1	2	1900	4.18	1904	2	1765	4	1769
AC2 at CCR room(Panasonic Old type)	1	2	1900	4.18	1904	2	1765	4	1769
AC1 at VIP Room(new)	1	1.5	1325	2.915	1328	2	1365	3	1368
AC2 at VIP Room(old panasonic)	1	1.5	1325	2.915	1328	2	1365	3	1368
AC1 at Departure room(old)	1	1.5	1325	2.915	1328	2	1365	3	1368
AC2 at Departure room(Hisence)	1	2	1800	3.96	1804	2	1765	4	1769
AC3 at Departure room(Hisence)	1	2	1800	3.96	1804	2	1765	4	1769
AC4 at Departure room(Hisence)	1	1.5	1325	2.915	1328	2	1365	3	1368
AC5 at Departure room(Old)	1	1.5	1500	3.3	1503	2	1365	3	1368
AC6 at Departure room(Old US)	1	1.5	1250	2.75	1253	2	1365	3	1368
AC at airport chief office	1	1	800	1.76	802	1	950	2	952
AC1 At guest house	1	1.5	1325	2.915	1328	2	1365	3	1368
AC2 At guest house	1	1	825	1.815	827	1	950	2	952
AC1 at WFP office	1	0.5	350	0.77	351	1	400	1	401
AC at WFP office	1	0.5	350	0.77	351	1	400	1	401
Ceiling Fan	80	60	4800	0	4800	45	3600	0	3600
Runway edge light	60	55	3300	0	3300	25	1500	0	1500
Turning pad light	12	45	540	0	540	12	144	0	144
Runway Threshold/ End light	12	1200	1200	0	1200	25	300	0	300
Runway PAPI light(09/27)	24	200	4800	0	4800	200	4800	0	4800
Approach Light (27 side)	17	65	1105	0	1105	25	425	0	425
Taxiway light	22	45	990	0	990	12	264	0	264
Apron flood light	8	260	2080	0	2080	260	2080	0	2080
RTIL light	4	2000	8000	0	8000	2000	8000	0	8000
Beacon light	2	1000	2000	0	2000	1000	2000	0	2000
Halogen lamp	8	1000	8000	0	8000	250	2000	0	2000
sodium vapour light	8	1000	8000	0	8000	250	2000	0	2000
Flourescent tube	140	60	8400	0	8400	22	3080	0	3080
AC1 at auxillary building	1	2	1800	3.96	1804	2	1765	4	1769
AC2 at auxillary building	1	1.5	1800	3.96	1804	2	1365	3	1368
AC1 at radio navigation	1	1	900	1.98	902	1	950	2	952
AC2 at radio navigation	1	1	900	1.98	902	1	950	2	952
Total Electric charges	422	Total installed	85.565		85.63617			Total	62.76951

Types of loads	Opening/Variable	Opening/Variable	Opening/Variable	Variable	Variable	Variable	Fixed	Fixed	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	fixed/opening /variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	opening	opening	variable	opening	opening	Variable/fixed	Variable/fixed	Quarterly Demand(Existing)	Quarterly Demand(Improved)	Kwh energy consumption at each 15min	Kwh energy consumption at each 15min	Energy saving during each 15 min(After Improvement)	Tariff rate(KWH)
00:00-00:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.08	1.84	1.52	0.46	1.06	12.00
00:15 - 00:30	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.10	1.86	1.52	0.46	1.06	12.00
00:30 - 00:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.10	1.87	1.53	0.47	1.06	12.00
00:45 - 1:00	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.07	1.83	1.52	0.46	1.06	12.00
1:00 - 1:15	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.11	1.88	1.53	0.47	1.06	12.00
1:15 - 1:30	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.08	1.84	1.52	0.46	1.06	12.00
1:30 - 1:45	0	0	0	0	0	0	0	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.13	1.90	1.53	0.47	1.06	12.00
1:45 - 2:00	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.11	1.88	1.53	0.47	1.06	12.00
2:00 - 2:15	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.10	1.87	1.53	0.47	1.06	12.00
2:15 - 2:30	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.08	1.85	1.52	0.46	1.06	12.00
2:30 - 2:45	0	0	0	0	0	0	0	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.15	1.91	1.54	0.48	1.06	12.00
2:45 - 3:00	0	0	0	0	0	0	0	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.13	1.90	1.53	0.47	1.06	12.00
3:00 - 3:15	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.11	1.88	1.53	0.47	1.06	12.00
3:15 - 3:30	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.11	1.88	1.53	0.47	1.06	12.00
3:30 - 3:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.10	1.87	1.53	0.47	1.06	12.00
3:45 - 4:00	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.08	1.85	1.52	0.46	1.06	12.00

4:00 - 4:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.07	1.84	1.52	0.46	1.06	12.00
4:15 - 4:30	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.10	1.87	1.53	0.47	1.06	12.00
4:30 - 4:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.12	1.88	1.53	0.47	1.06	12.00
4:45 - 5:00	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.11	1.88	1.53	0.47	1.06	12.00
5:00 - 5:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.08	1.84	1.52	0.46	1.06	12.00
5:15 - 5:30	0	0	0	0	0	0	0	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	6.06	1.82	1.51	0.46	1.06	12.00
5:30 - 5:45	0	0	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0.2	6.29	2.07	1.57	0.52	1.06	12.00
5:45 - 6:00	0	0	0	0	0	0	0	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0.5	0	0	0.5	0.2	10.93	4.07	2.73	1.02	1.72	12.00
6:00 - 6:15	0	0	0	0	0	0	0	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0.5	0	0	0.5	0.2	10.91	4.05	2.73	1.01	1.71	12.00
6:15 - 6:30	0.4	0	0.35	0	0	0	0	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0	0	0	0	0	0	0	0	0.3	0.5	0	0	0.5	0.2	9.23	4.68	2.31	1.17	1.14	12.00
6:30 - 6:45	0.55	0	0.45	0	0	0	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0	0	0	0	0	0	0	0	0.3	0.5	0	0	0.5	0.2	9.73	5.19	2.43	1.30	1.14	12.00
6:45 - 7:00	0.7	0	0.46	0	0	0	0	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0	0	0	0	0	0	0	0		0.5	0	0	0.5	0.2	7.70	4.95	1.93	1.24	0.69	12.00
7:00 - 7:15	0.8	0	0.52	0	0.4	0.35	0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0	0	0	0	0	0	0	0	0	0		0.5	0	0	0.5	0.2	8.90	6.21	2.23	1.55	0.67	12.00
7:15 - 7:30	0.6	0	0.56	0	0.55	0.4	0	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0		0.5	0	0	0.5	0.2	8.30	5.76	2.07	1.44	0.64	12.00
7:30 - 7:45	0.4	0	0.57	0	0.58	0.45	0	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0		0.5	0	0	0.5	0.2	8.09	5.56	2.02	1.39	0.63	12.00
7:45 - 8:00	0.5	0	0.58	0	0.6	0.52	0	0.49	0.00	0.00	0.32	0.35	0.35	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0		0.5	0	0	0.5	0.2	10.46	7.94	2.62	1.99	0.63	12.00
8:00 - 8:15	0.6	0	0.575	0.35	0.65	0.56	0	0.48	0.40	0.4	0.38	0.38	0.38	0.38	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0		0.5	0	0	0.5	0.2	13.11	10.59	3.28	2.65	0.63	12.00
8:15 - 8:30	0.55	0	0.7	0.6	0.7	0.65	0	0.55	0.55	0.55	0.5	0.45	0.45	0.45	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0				1	1	1	1	1	1	0	0	0.5	0	0		0.2	33.30	29.39	8.33	7.35	0.98	12.00
8:30 - 8:45	0.7	0	0.6	0.55	0.7	0.58	0	0.48	0.47	0.44	0.45	0.42	0.42	0.45	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0				1	1	1	1	1	1	0	0	0.5	0	0		0.2	32.72	28.79	8.18	7.20	0.98	12.00
8:45 - 9:00	0.85	0	0.62	0.7	0.75	0.59	0	0.46	0.50	0.55	0.47	0.43	0.43	0.47	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0				1	1	1	1	1	1	0	0	0.5	0	0	0	0	33.50	29.56	8.38	7.39	0.99	12.00
9:00 - 9:15	0.95	0	0.65	0.8	0.85	0.6	0	0.51	0.61	0.65	0.58	0.52	0.52	0.58	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0.5	0	0	0	0	40.16	33.12	10.04	8.28	1.76	12.00

9:15 - 9:30	0.8	0	0.52	0.6	0.55	0.5	0	0.49	0.58	0.6	0.55	0.5	0.5	0.55	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0.5	0	1	0	0	40.47	32.96	10.12	8.24	1.88	12.00
9:30 - 9:45	0.5	0	0.56	0.4	0.53	0.45	0	0.36	0.53	0.5	0.51	0.51	0.51	0.51	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0.5	0	1	0	0	38.97	31.47	9.74	7.87	1.87	12.00
9:45 - 10:00	0.4	0	0.5	0.38	0.52	0.43	0	0.34	0.52	0.48	0.5	0.49	0.49	0.5	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0.5	0	1	0	0	38.47	30.97	9.62	7.74	1.88	12.00
10:00-10:15	0.333	0	0.511	0.38	0.5	0.42	0	0.39	0.48	0.45	0.51	0.46	0.46	0.51	0.45	0.00	1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0.5	1	1	0	0	40.81	33.42	10.20	8.36	1.85	12.00
10:15-10:30	0.362	0	0.5231	0.36	0.3	0.4	0	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0.3	1	1	0	0	34.09	27.76	8.52	6.94	1.58	12.00
10:30-10:45	0.363	0	0.3636	0.35	0.2	0.38	0	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	31.30	26.54	7.83	6.63	1.19	12.00
10:45-11:00	0.365	0	0.33	0.1	0.1	0.38	0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	30.11	25.19	7.53	6.30	1.23	12.00
11:00-11:15	0.375	0	0.332	0	0	0.4	0	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	29.84	24.92	7.46	6.23	1.23	12.00
11:15-11:30	0.363	0	0.325	0	0	0.4	0	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	28.00	23.51	7.00	5.88	1.12	12.00
11:30-11:45	0.362	0	0.32	0	0	0.36	0	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	27.98	23.48	6.99	5.87	1.12	12.00
11:45-12:00	0.3125	0	0.3636	0	0	0.34	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	0.00	0.00	0.00	0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0	0	0	1	0	0	0	23.05	19.46	5.76	4.87	0.90	12.00
12:00-12:15	0.3045	0	0.5	0	0	0.33	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0	0	0	1	0	0	0	18.25	15.57	4.56	3.89	0.67	12.00
12:15-12:30	0.462	0	0.45	0	0.4	0.35	0	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	1	0	0	0	17.29	14.93	4.32	3.73	0.59	12.00
12:30-12:45	0.652	0	0.35	0	0.45	0.33	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	15.47	13.15	3.87	3.29	0.58	12.00
12:45-13:00	0.55	0	0.3	0	0.45	0.34	0	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0	0	0	0	0	0	0	14.76	12.53	3.69	3.13	0.56	12.00
13:00-13:15	0.3	0	0.29	0.2	0.44	0.35	0	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.6	0.00	0.00	0.00	0.00	0.1	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0	0	0	0	0	0	0	14.36	12.36	3.59	3.09	0.50	12.00

13:15-13:30	0.2	0	0.25	0.25	0.43	0.36	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	0.00	0.00	0.00	0.00	0.1	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0	0	0	0	0	0	0	14.03	12.10	3.51	3.02	0.48	12.00
13:30-13:45	0.1	0	0.22	0.26	0.44	0.35	0	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	0.00	0.00	0.00	0.00	0.1	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0	0	0	0	0	0	0	13.46	11.63	3.37	2.91	0.46	12.00
13:45-14:00	0.1	0	0.2	0.35	0.45	0.36	0	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0	0	0	0	0	0	0	13.11	11.38	3.28	2.84	0.43	12.00
14:00-14:15	0.1	0	0.1	0.4	0.43	0.4	0	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.1	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0	0	0	0	0	0	0	11.90	10.39	2.97	2.60	0.38	12.00
14:15-14:30	0.1	0	0.1	0.43	0.44	0.41	0	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	0.00	0.00	0.00	0.00	0.1	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0	0	0	0	0	0	0	11.89	10.38	2.97	2.59	0.38	12.00
14:30-14:45	0.1	0	0.1	0.49	0.45	0.42	0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	0.00	0.00	0.00	0.00	0.1	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0	0	0	0	0	0.5	0	12.50	10.95	3.12	2.74	0.39	12.00
14:45-15:00	0.1	0	0.1	0.58	0.46	0.43	0	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	0.00	0.00	0.00	0.00	0.1	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0	0	0	0	0	0.5	0	12.42	10.90	3.10	2.72	0.38	12.00
15:00-15:15	0.1	0	0.35	0.55	0.47	0.45	0	0.54	0.36	0.35	0.33	0.35	0.35	0.33	0.35	0.00	0.3	0.00	0.00	0.00	0.00	0.1	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0	0	0	0	0.5	0	13.99	12.88	3.50	3.22	0.28	12.00
15:15-15:30	0.2	0	0.38	0.56	0.49	0.44	0	0.55	0.40	0.41	0.38	0.38	0.38	0.38	0.41	0.00	0.28	0.00	0.00	0.00	0.00	0.1	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0	0	0	0	0	0.5	0	14.21	13.19	3.55	3.30	0.26	12.00
15:30-15:45	0.25	0	0.42	0.58	0.5	0.46	0	0.56	0.42	0.43	0.4	0.39	0.39	0.4	0.42	0.00	0.22	0.00	0.00	0.00	0.00	0	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0	0	0	0	0	0.5	0	13.80	12.94	3.45	3.23	0.21	12.00
15:45-16:00	0.28	0	0.45	0.59	0.5	0.47	0	0.58	0.44	0.45	0.41	0.41	0.41	0.44	0.43	0.00	0.23	0.00	0.00	0.00	0.00	0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0	0	0	0	0	0.5	0	13.67	12.90	3.42	3.23	0.19	12.00
16:00-16:15	0.36	0	0.48	0.6	0.51	0.48	0	0.59	0.45	0.46	0.45	0.46	0.46	0.45	0.45	0.00	0.24	0.00	0.00	0.00	0.00	0	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0	0	0	0	0	0.5	0	13.84	13.15	3.46	3.29	0.17	12.00
16:15-16:30	0.45	0	0.5	0.62	0.52	0.49	0	0.60	0.46	0.47	0.48	0.49	0.49	0.48	0.47	0.00	0.25	0.00	0.00	0.00	0.00	0	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0	0	0	0	0	0.5	0	13.96	13.33	3.49	3.33	0.16	12.00
16:30-16:45	0.5	0	0.51	0.63	0.54	0.5	0	0.61	0.47	0.49	0.5	0.5	0.5	0.5	0.5	0.00	0.3	0.00	0.00	0.00	0.00	0	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0	0	0.1	0	0	0.5	0	14.79	13.71	3.70	3.43	0.27	12.00
16:45-17:00	0.55	0	0.55	0.5	0.55	0.46	0	0.62	0.48	0.46	0.55	0.52	0.52	0.55	0.5	0.00	0.27	0.00	0.00	0.00	0.00	0	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0	0.3	0.3	0	0	0.5	0	18.59	14.71	4.65	3.68	0.97	12.00
17:00-	0.65	0	0.6	0	0.58	0.47	0	0.63	0.50	0.47	0.56	0.54	0.54	0.56	0.52	0.00	0.3	0.00	0.00	0.00	0.00	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.7	0	0	0	0	32.43	22.96	8.11	5.74	2.37	12.00

17:15																																												
17:15-17:30	0.8	0	0.7	0	0.7	0.6	0	0.70	0.60	0.65	0.6	0.6	0.6	0.65	0.65	0.00	0.55	0.00	0.00	0.00	0.00	0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.8	0	0	0	0	40.78	27.98	10.19	6.99	3.20	13.20
17:30-17:45	0.72	0	0.65	0	0.7	0.55	0	0.66	0.53	0.56	0.62	0.54	0.54	0.62	0.56	0.00	0.45	0.00	0.00	0.00	0.00	0	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.35	0.45	0.8	0	0	0	0	36.06	24.85	9.01	6.21	2.80	13.20
17:45-18:00	0.76	0	0.64	0	0.65	0.56	0	0.60	0.50	0.58	0.61	0.55	0.55	0.61	0.58	0.00	0.45	0.00	0.00	0.00	0.00	0	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.31	0.3	0.7	0	0	0	0	32.18	22.91	8.04	5.73	2.32	13.20
18:00-18:15	0.5	0	0.55	0	0.6	0.5	0	0.48	0.48	0.45	0.55	0.57	0.57	0.63	0.59	0.00	0.37	0.00	0.00	0.00	0.00	0	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.33	0.3	0.7	0	0	0	0	32.18	22.59	8.05	5.65	2.40	13.20
18:15-18:30	0.45	0	0.5	0	0.55	0.45	0	0.45	0.45	0.4	0.45	0.6	0.6	0.65	0.65	0.00	0.1	0.00	0.00	0.00	0.00	0	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.35	0.3	0.7	0	0	0	0	31.58	21.85	7.89	5.46	2.43	13.20
18:30-18:45	0.4	0	0.45	0	0.52	0.44	0	0.42	0.42	0.35	0.35	0.55	0.55	0.63	0.6	0.00	0.1	0.00	0.00	0.00	0.00	0	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.32	0.3	0.7	0	0	0	0	29.86	20.44	7.47	5.11	2.36	13.20
18:45-19:00	0.35	0	0.4	0	0.48	0.4	0	0.35	0.40	0.3	0.56	0.53	0.53	0.56	0.55	0.00	0.1	0.00	0.00	0.00	0.00	0	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.3	0.3	0.7	0	0	0	0	28.70	19.52	7.17	4.88	2.30	13.20
19:00-19:15	0.3	0	0	0	0	0	0	0.30	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0.7	0	0	0	0	15.98	7.99	4.00	2.00	2.00	13.20
19:15-19:30	0	0	0	0	0	0	0	0.10	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0.5	0	0	0	0	9.99	3.12	2.50	0.78	1.72	13.20
19:30-19:45	0	0	0	0	0	0	0	1.12	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0.3	0	0	0	0	10.25	4.31	2.56	1.08	1.49	13.20
19:45-20:00	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.86	1.64	1.46	0.41	1.05	13.20
20:00-20:15	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.90	1.68	1.48	0.42	1.06	13.20
20:15-20:30	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.89	1.67	1.47	0.42	1.06	13.20
20:30-20:45	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.87	1.65	1.47	0.41	1.05	13.20
20:45-21:00	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.83	1.61	1.46	0.40	1.05	13.20

21:00-21:15	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.85	1.63	1.46	0.41	1.05	13.20
21:15-21:30	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.87	1.65	1.47	0.41	1.05	13.20
21:30-21:45	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.89	1.67	1.47	0.42	1.06	13.20
21:45-22:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.89	1.67	1.47	0.42	1.06	13.20
22:00-22:15	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.92	1.70	1.48	0.43	1.06	13.20
22:15-22:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.90	1.68	1.48	0.42	1.06	13.20
22:30-22:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.91	1.69	1.48	0.42	1.06	13.20
22:45-23:00	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.89	1.67	1.47	0.42	1.06	13.20
23:00-23:15	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.90	1.68	1.48	0.42	1.06	12.00
23:15-23:30	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.90	1.68	1.48	0.42	1.06	12.00
23:30-23:45	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.92	1.70	1.48	0.43	1.06	12.00
23:45-00:00	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	5.91	1.69	1.48	0.42	1.06	12.00
																																		Daily Cost savings								1317.4	
																																		Montly Cost savings								39522.4	
																																		Total summer Cost saving(Poush to Chaitra)								158089.9	

Appendix K: Cash flow diagram for replacement of existing system with efficient system

Cash Flow Diagram For replacement of the existing system with the efficient system							
Year	Capital Investment (NNPR.)	Return (NNPR.)	Depreciation	Depreciated value	Net Cash Flow (NNPR.)	Present Value of Each Net Cash Flow NNPR.	Cumulative cash flow
0	-13877780	0	0		-13877780	-13877780	-13877780
1	0	495334	-3469445	-10408335	-13382446	-12165860	-26043640
2	0	495334	-2602083.75	-7806251.25	-9913001	-8192562.81	-34236203
3	0	495334	-1951562.81	-5854688.44	-7310917.25	-5492800.338	-39729003
4	0	495334	-1463672.11	-4391016.33	-5359354.438	-3660511.193	-43389514
5	0	495334	-1097754.08	-3293262.25	-3895682.328	-2418912.225	-45808427
6	0	495334	-823315.562	-2469946.68	-2797928.246	-1579357.553	-47387784
7	0	495334	-617486.671	-1852460.01	-1974612.685	-1013288.529	-48401073
8	0	495334	-463115.003	-1389345.01	-1357126.013	-633109.3011	-49034182
9	0	495334	-347336.253	-1042008.76	-894011.0101	-379147.9402	-49413330
10	0	495334	-260502.189	-781506.568	-546674.7576	-210766.7843	-49624097
11	0	495334	-195376.642	-586129.926	-286172.5682	-100301.7393	-49724398
12	0	495334	-146532.482	-439597.445	-90795.92612	-28930.38019	-49753329
13	0	495334	-109899.361	-329698.083	55736.55541	16144.89475	-49737184
14	0	495334	-82424.5209	-247273.563	165635.9166	43617.11366	-49693567
15	0	495334	-61818.39	-185455.172	248060.4374	59383.69648	-49634183
16	0	495334	-46363.79	-139091.379	309878.8281	67438.66155	-49566744
17	0	495334	-34772.844	-104318.534	356242.6	70480.70341	-49496264
18	0	495334	-26079.633	-78238.9007	391015.4658	70327.56851	-49425936
19	0	495334	-19559.725	-58679.1755	417095.0993	68198.38168	-49357738
20	0	495334	-14669.793	-44009.3816	436654.8245	64905.95731	-49292832
21	0	495334	-11002.3454	-33007.0362	451324.6184	60987.75336	-49231844
22	0	495334	-8251.75905	-24755.2772	462326.9638	56795.00598	-49175049
23	0	495334	-6188.81929	-18566.4579	470578.7228	52553.36486	-49122496

Cash Flow Diagram For replacement of the existing system with the efficient system							
Year	Capital Investment (NNPR.)	Return (NNPR.)	Depreciation	Depreciated value	Net Cash Flow (NNPR.)	Present Value of Each Net Cash Flow NNPR.	Cumulative cash flow
24	0	495334	-4641.61447	-13924.8434	476767.5421	48404.10982	-49074092
25	0	495334	-3481.21085	-10443.6326	481409.1566	44432.13864	-49029659
26	0	495334	-2610.90814	-7832.72441	484890.3674	40684.94588	-48988974
27	0	495334	-1958.1811	-5874.54331	487501.2756	37185.46847	-48951789
28	0	495334	-1468.63583	-4405.90748	489459.4567	33940.75817	-48917848
29	0	495334	-1101.47687	-3304.43061	490928.0925	30947.81663	-48886900
30	0	495334	-826.107653	-2478.32296	492029.5694	28197.5028	-48858703
31	0	495334	-619.58074	-1858.74222	492855.677	25677.13258	-48833026
Interest rate	10%				NPV	-48833025.82	Negative
IRR rate	Negative						
Discounted payback period	negative						

Appendix L: Originality report

Bishal Dumre

ORIGINALITY REPORT

14%

SIMILARITY INDEX

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