T.C.

ISTANBUL AYDIN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

PLANNING OF POWER SYSTEM WITH RENEWABLE ENERGY SYSTEM IN TYRE CITY IN LEBANON

M.Sc. THESIS

ELHASSAN ELDALKAM

Department of Electrical & Electronic Engineering

Electrical and Electronics Engineering Program

September 2019

T.C.
ISTANBUL AYDIN UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY

PLANNING OF POWER SYSTEM WITH RENEWABLE ENERGY SYSTEM IN TYRE CITY IN LEBANON

M.Sc. THESIS

ELHASSAN ELDALKAM
(Y.1713.300008)

Department of Electrical & Electronic Engineering

Electrical and Electronics Engineering Program

Advisor: Prof. Dr. MEHMET EMİN TACER

September 2019

T.C.
İSTANBUL AYDIN ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ MÜDÜRLÜĞÜ

YÜKSEK LİSANS TEZ ONAY FORMU

Enstitümüz Elektrik-Elektronik Mühendisliği Anabilim Dalı Elektrik-Elektronik Mühendisliği (İngilizce) Tezli Yüksek Lisans Programı Y1713.300018 numaralı öğrencisi **El Hassan EL DALKAM** 'in **"Desıgn Of Smart Power Grıd Renewable Energy System"** adlı tez çalışması Enstitümüz Yönetim Kurulunun 03.11.2019 tarih ve 2019/21 sayılı kararıyla oluşturulan jüri tarafından oybirliği/oyçokluğu ile Tezli Yüksek Lisans tezi 11.11.2019 tarihinde kabul edilmiştir.

	Unvan	**Adı Soyadı**	**Üniversite**	**İmza**
		ASIL ÜYELER		
Danışman	Prof. Dr.	Mehmet Emin TACER	İstanbul Aydın Üniversitesi	
1. Üye	Prof. Dr.	Murtaza FARSADI	İstanbul Aydın Üniversitesi	
2. Üye	Dr. Öğr. Üyesi	Gürkan SOYKAN	Bahçeşehir Üniversitesi	
		YEDEK ÜYELER		
1. Üye	Prof. Dr.	Nedim TUTKUN	İstanbul Aydın Üniversitesi	
2. Üye	Dr. Öğr. Üyesi	Nezihe YILDIRAN	Bahçeşehir Üniversitesi	

ONAY

Prof. Dr. Ragıp Kutay KARACA
Enstitü Müdürü

DECLARATION

I hereby declare that all information in this thesis document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results, which are not original to this thesis.

ELHASSAN FATHI ELDALKAM

FOREWORD

In the beginning I would like to thank my mother and father, My Ideals who raised me to be the good person I'm today, for being patient, loving and supporting through it all. I hope one day I can return some of what they gave me, everything I have accomplished is because of them.

I would like to express my gratitude to my advisor **prof. Dr. MEHMET EMİN TACER** for his guidance and encouragement, the suggestions and comments during the making of this thesis. I'm truly grateful for working with him all this time.

Finally, I would like to thank my friends for always believing in me and **encouraging me from day one.**

September , 2019 **ELHASSAN ELDALKAM**
(Electric and Electronic Engineer)

TABLE OF CONTENT

Page

ABBREVIATIONS

REr	: Renewable energy resources
SG	: Smart grid
SGs	: Smart grid system
WT	: Wind turbine
PV	: Photovoltaic
SP	: Solar panel
BC	: Before Christ
AC	: Alternating current
DC	: Direct Current
MW	: Mega watt
M$	: Million Dollar
GWh	: Gega watt hours
SED	: Smart electricity devices
Ps	:Polycrystalline Silicon
MS	: Monocrystalline Silicon
TF	: Thin Film
IPCC	: Intergovernmental Panel on Climate Change

LIST OF FIGURES

Page

LIST OF TABLES

Page

PLANNING OF POWER SYSTEM WITH RENEWABLE ENERGY SYSTEM IN TYRE CITY IN LEBANON

ABSTRACT

The world is fast becoming a global village due to the increasing daily requirement of energy by all populations across the world while the earth in its form cannot change. The need for energy and its related services to satisfy human social and economic development, welfare and health are increasing.

In Lebanon as a small country but it definitely depends on fossil fuel to generate electricity so expensive electricity bills could decrease economic and lead to be poor. This thesis I am going to study how could place a power system with a renewable energy system in TYRE city in south Lebanon in order to decrease consumption of fossil fuel.

This thesis I will study the geographical area of TYRE city and I will make a statistical study about population and bill payment.

Also in this thesis, I will use MATLAB as a simulation software to get the best results about wind turbine energy.

Finally, the result obtained will be compared to the standard and general survey that has been done in Canada in order to draw a conclusion and getting the best result

Kay Word: *Lebanon, Tyree, Wind energy, landlocked country, energy power, power plant, renewable energy, energy supply, energy efficiency.*

LÜBNAN'DA TYRE ŞEHRİNDE YENİLENEBİLİR ENERJİ SİSTEMİ İLE GÜÇ SİSTEMİNİN PLANLANMASI

ÖZET

Dünya, dünyadaki tüm popülasyonlar tarafından artan günlük enerji gereksinimi nedeniyle dünya çapında hızlı bir şekilde küresel bir köye dönüşürken, şeklindeki dünya değişemez. İnsanın sosyal ve ekonomik gelişimini, refahını ve sağlığını tatmin etmek için enerjiye ve ilgili hizmetlere olan ihtiyaç artmaktadır.
Lübnan'da küçük bir ülke olarak ancak elektrik üretmek için kesinlikle fosil yakıtlara bağlı olduğundan, pahalı elektrik faturaları ekonomik olarak düşebilir ve fakir olabilir.
Bu tez, fosil yakıt tüketimini azaltmak için Lübnan'ın güneyindeki TYRE kentinde yenilenebilir enerji sistemine sahip bir enerji sisteminin nasıl yerleştirilebileceğini çalışacağım.
Bu tezde TYRE şehrinin coğrafi alanını çalışacağım ve nüfus ve fatura ödemeleri hakkında istatistiksel bir çalışma yapacağım.
Bu tezde ayrıca rüzgar türbini enerjisi konusunda en iyi sonuçları almak için MATLAB'ı bir simülasyon yazılımı olarak kullanacağım.
Son olarak, elde edilen bilgiler , bir sonuç çıkarmak ve en iyi sonucu almak için Kanada’da yapılan standart ve genel araştırmalarla karşılaştırılacaktır.

Anahtar Kelimeler: *Lübnan, Tyree, Rüzgar enerjisi, kara ülkesi, enerji gücü, enerji santrali, yenilenebilir enerji, enerji arzı, enerji verimliliği.*

1. INTRODUCTION

1.1 Purpose of this thesis

I have been living in Lebanon for more than 18 years. The area of Lebanon is about 10452 square kilometers. This area is spread over 7 governorates, including the southern governorate, which contains the city I live with. This city is called TYREE and it is divided into 10 villages.

Lebanon depends entirely on fossil fuels for generating electricity, as is the case in the high cost of living and high prices, especially fuel prices such as gasoline and diesel.

Before starting this thesis, I visited a lot through country to see if there was any use of renewable energies, but I was disappointed that I did not find the slightest use of REr. Hence the idea in my mind of how to make unended energies instead of fuels. I started visiting the distributors of electricity companies and got the information I want including the cost of electricity annually.

I suggested that my research be on the complete elimination of fossil fuels and started using renewable energies from my city.

After that I decided that the aim of my thesis is to decrease usage of fossil fuels slowly and e the environmental bad effect as well increasing in economy pollution caused by power generators.

1.2 Literature Review

The economic literature on renewable energy is extensive, but many areas of economics must be included to discuss issues related to the use, development and consequences of renewable energy technologies (Bergmann, 2006). Renewable energy technologies – winter power, hydroelectric plants power and applications of solar thermal– are economically viable and emulator. Sectoral competitiveness of other realities of renewable energy, particularly biomass energy, depends, between another factors, on increasing demand and production levels achieve the economies of scale required for sectoral competitiveness. These forms of renewable energy are not competitive under current market conditions so far. They need a market-friendly regulatory mechanism to understand the basic economy of scale. In addition, renewable energy sources are a critical component in many small economies. There is an important relationship between renewable energy resources and growth. Increases population growth and then squeezes limited resources, reducing per capita growth. Changes in the structure of production, technological progress and the switch between mixed renewable energy sources can lead to dependence on natural resources for economic growth Either diminishing the relative cost of renewable energy for fossil powers, or by expanding the request for power produced from renewable sources, such approach measures will give expanded returns by distinguishing more proficient shapes of power era utilizing renewable vitality sources)investigated the relationship between renewable energy consumption and economic growth by using long-term equilibrium with panel data. In other words, renewable energy plays an important role in sustainable energy development, with four experiments exploring the relationship between energy consumption and economic growth. First, energy labor and capital consumption in the production process play an important role in economic growth. Second, energy policies, especially demand management policies, are important for economic growth. Thereafter, feedback supported by the relationship consider both directions between energy utilization and financial development. Finally, these relationships back the nonpartisanship speculation. Total energy supply from renewable sources increases over time and governments should support the development and adoption of renewable energy technologies.[30]

There are many estimates for the future renewable energy market, such as the EU's goal of using renewable energy in 2007 to reach 20% of the EU's total energy needs by 2020. Economically, renewable energy technologies are expensive, so renewable energy policy is essential to Investment promotion (Popp et al., 2010). According to the International (IEA), there are five types of renewable economic instruments: problems, hardware costs, site costs, production over time – capital (Hammonds, 2002). SADORSKY (2009) evaluates two experimental models of renewable energy consumption and revenues for a range of emerging economies. If real per capita income increases, it will have a significant impact on renewable energy consumption per capita. Differently, on the other hand, there is a positive relationship between income and renewable energy consumption. Emerging economies are growing rapidly. For example, a 1% increase in income (real per capita GDP) increases renewable energy consumption per capita in emerging economies by between 3.39% and 3.45% in the long run. SADORSKY (2009) used panel co-integration techniques to explore / determine the relationship between renewable energy consumption and income to create an experimental model.[29]

1.2.1 Energy and civilization

Technological Energy plays a central part in the social and Financial development of society. Fossil-fuel based technologies have fully contributed to the lives, and we note that these developments are very expensive the main cause of environmental pollution is fossil fuel sources, which leads to collapse. They have drastically depleted environmental aspects[4]

Using and consuming of high amount of fossil fuels causes phenomenon, which is the increases the earth planet's temperature called global warming. This phenomenon is very dangerous and had a great impact on the environmental destruction. for example the spreading of mercury and other chemicals pollute the rivers and seas, which lead to fish killing and affect negatively on the marine life in general .Additionally the extra use of the fossil fuel doubles the public health cost, due to the increase of diseases: in which the medical bills that are paid by the governments due to the environment pollution by this fuels exceeded the limits, such as the asthma, and black lung diseases in coal miners.

This fuel has a great importance internationally due to its uses all over the world, which led to political conflicts between countries, also the extra consumption of, open many horizons to looking for new renewable , safe, environment friendly recourses for these fuels in order to preserve the continuous of life on this planet.

2. ELECTRICITY GENERATION

1) What is electrical power

2) Electricity generation methods

    i) Natural gas

    ii) Petroleum products

    iii) Nuclear fission

    iv) Hydropower

    v) Wind energy

    vi) Solar energy

2.1 What is electrical power?

Electric is a type of energy generated by the flow of electrical charges. Electric energy may be either kinetic energy or motor energy, but it is usually motor energy, the energy put away by the relative positions of charged particles or electric areas. The movement of charged particles is called a wire or the center of another current or electricity.

2.2 Electricity generation methods

Michael Faraday is a scientist, his studying was specialized in the domain of electromagnetic and electrochemistry. From his discoveries: he showed for the world that when a piece of magnet enters a coil of wire this generates electric current in this wire, on the base of this discovery, the generator had been discovered in which it is used in converting all types of energy into electrical one. The contact between the magnet and the electricity form generally the function and role of the generator. One from the roles of this generator is the converting of kinetic (mechanical) energy into electrical one or others different forms of energy that are present in our life.[13]

The most important methods of producing electricity are:

i) Natural gas

Where natural gas is burned inside a combustion chamber, then passed directly through turbines, which in turn spin to produce electricity.

ii) Petroleum products

Oil derivatives are used to heat water and produce water vapor that passes directly through turbines to produce electricity.

Nuclear fission: is a physical process in which it depends on heating the water in order to produce high amount of steams to use in generating the turbines. The heat or high temperature, change the water into water vapor (steam), and the last operates the turbines, which produce electricity. All of this takes place in the nuclear power plants in which the reactor in; has nuclear fuel nucleus.

iii) Hydropower

Hydropower: From the name of this process (hydro power) it depends on the strength of the water flowing in order to operate the turbines that are connected to the generator. In the hydroelectric system which depends on water to generate electricity you can find two main kinds , the first one which works by the accumulation of water in tanks that formed due to the dams , the water flowing in the tubes makes pressure on the blades of the turbine to functionate the generator. The second system from hydroelectric systems, is the using of the power of river water flowing in order to press on the turbines and generate electricity, (this is called the river runoff).

iv) Wind energy

Wind energy is used to rotate windmills connected to power generation turbines, just like the flow of the river.

v) Solar energy

Solar cells or photovoltaic voltages do not use a generator; they are themselves generated. These cells benefit from the ability of light to cause current flow. A series of cells are connected and the current flows from the board when sunlight falls on it.[9]

2.3 Renewable energy resources

Table 2.1: advantages and disadvantages of renewable energy resources

Advantages	Disadvantage's
Permanent energy: Renewable energy is an untenable and continuous source.	You need large and spacious land.
Environmental benefits: Renewable energy has very few negative impacts on the environment, if any	You need big capital at first.
Economic benefits: The cost of renewable energy is low in the long run, saving a high amount of money that can be used for other benefits.	Does not provide large and enough amounts of energy.

Can a country rely entirely on renewable energy?

Renewable energy has achieved many economic objectives, perhaps the most important being one of the means of protecting the environment, which led many countries to pay attention to the development of this source of energy, and set it as a goal to achieve it, and therefore the option of moving towards the production of renewable energy by non-conventional sources inevitably in light of the success of many experiments Global. The importance of renewable energy lies in its emergence as an area in the 21st century for economic and environmental reasons, and in the importance of obtaining sustainable and clean energy as a guarantee for the present and future security. Thus, experiments have emerged that are trying to make the use of this renewable energy for long periods easier than before, to reduce dependence on non-renewable energy, which destroys the environment if they are used.[3]

3. SMART GRID

In this article I will discuss the importance in which ICT (information and communication technology) is used, as I will try to give an diagram of the SG.

The smart grid is often a power grid depend on the digital technology used to provide consumers with power via digital communication. This framework permits observing, examination, control and communication to move forward effectiveness, reduce power consumption and cost, and maximize transparency and reliability in the power supply chain. The Smart Grid was introduced to overcome the weaknesses of traditional electrical networks using Smart Grid Meters or Smart Meter.[2]

Due to the extreme development in the world, and the technology spreading in all countries, also the smart networks using in all domains, even in each house by many devices like phones and others, most of the governmental institution started to use and depends on the smart networks which facilitate and accelerate their work in a more accurate and precise way, especially the network in the power generation and distribution institutions.[7]

In the domain of electricity and its distribution to all homes, companies, centers...etc there is the smart grid technology which is the use of the developed smart networks by the electricity government institutions, in order to distribute the electricity and everything related to.: such as the management of electricity consuming, the costs, the communication system between the supplier, employees and the consumers, the way of working, analysis of its work , and the controlling of many smart network devices .

All of this has been controlled by this type of systems (the smart grid network or technology). It is important and necessary to provide easy integration and services to the consumers , it permits the communication between the supplier and the consumers through devices in order to manage as mentioned previously the cost reducing, the energy saving and the whole electricity distribution to all home4s and companies.

Nowadays the internet networks can be found in each home which this make the work and the results of the smart grid systems easier and more practical especially in businesses, Retail, hospitals, universities and multinational corporations.

Generally the consumers become able to know everything and all data related to the consumption level of electricity, the costs and the prices of the energy, and the compensation between the consumption and the demands by managing of the services.

3.1 Lebanon and smart Grid

After reviewing the file of the electricity of Lebanon, it became clear to us that there is no smart grid passing inside it. Unfortunately, the electricity of Lebanon is a little bad, especially the total lack of the use of renewable energies and smart devices.

In addition, most towns in Lebanon have electricity from the top through the roofs, which reflects negatively on the external appearance of the country. We also note that there is no underground tunnels for electric wires except in the capital Beirut.

Lebanon relies on human control of the movement of electricity so that there are differential regulators that are unorganized and not modern, which require a manpower throughout the day to monitor and control.[6]

The electricity situation in Lebanon must be improved by starting to use renewable energies such as wind and sun, in addition to providing a smart grid to control it. In the past, Lebanon used Turkish authorities to boost electricity in Lebanon.Turkish authorities sent a ship called Fatima, which is working to provide Lebanon with electricity and after several days stopped working due to the amount of energy consumed That exceeded all limits.

3.2 Summary about electricity usage in Lebanon

The cumulative electricity deficit during the 26 years (from 1992 to the end of 2017) amounted to 36 billion US dollars, representing about 45% of the total public debt which reached 79.5 billion dollars by the end of December 2017. In contrast, Transfers from the Banque du Lebanon to cover the electricity deficit of $ 1,295 billion in 2017, accounting for 2.4% of GDP or 6.8% if the estimated annual interest of $ 2.4 billion resulting from accumulated deficit is added.[8]

The budget for 2018 shows a deficit of $ 1.4 billion if the government agrees to buy 850 megawatts to secure the bulk of the current shortfall. The solution to the electricity problem in the mid-nineties, reducing the size of public debt to 43 billion dollars by the end of 2017, and provide a huge cost to citizens beyond the $ 17 billion (currently estimated between 1.1 and 1.2 billion dollars) paid to private generators In addition to the damage and environmental problems, and to achieve additional growth of the national economy at the rate of 1 to 1.5% per year according to the World Bank report, and the reduction of the ratio of public debt to GDP to 80% instead of about 147% for 2017.

About the current situation of electricity, the average annual demand for energy is estimated at 2350 megawatts, while the total amount of electricity produced and purchased is 2,300 megawatts, of which 13% is lost in transportation and distribution. The distribution of 2000 megawatts to residents in Lebanon (including displaced persons and Palestinian refugees) 18% of which are stolen by Syrian refugees. Lebanon needs energy during the peak hours of next August at 3450 megawatts, meaning that Lebanon needs to produce an additional 1666 megawatts before unloading technical waste in transport and distribution, to cover the need of the market.[19]

The construction of additional power plants capable of covering this quantity (1666 megawatts) takes at least three years. During this period, the only solution to cover the deficit is to buy electricity from any source at the best prices and as quickly as possible. In addition, there is no obvious financial or technical advantages to the proposal of one of the political parties to install generators on land with a production capacity smaller than the current plants, because its effects are negative to the environment, and requires a complex infrastructure, especially in terms of transport of fuel. As the market grows gradually over the coming years at about 3% per annum, the demand for energy during the peak hours in 2023 reaches 4,153 megawatts according to the Master Plan prepared with the French Electricity Corporation. It is supposed to add production capacity to cope with this increase through sustainable energy. The total cost of electricity consumption in Lebanon exceeds $ 3.35 billion, of which the Treasury accounts for an annual deficit of about 39%. The Electricity Corporation receives about 26%. The citizen pays private generators about 35%, or $ 2.05 billion annually. It is proposed to purchase 850 megawatts at a cost of about 700 million dollars annually, in order to ensure the need for consumption immediately, and almost completely in the least ten months of the year and can cover most of the growing need during the remaining two months using renewable energy and rationalization of consumption. The cost of purchasing power from the vessels is currently about 12.5 cents / kWh, about one cent less than the cost of production from the plants. Thus, the purchase of the additional 850 megawatts reduces the total electricity bill by about 190 million dollars in 2018, and 250 million dollars during the year Next, the tariff can be considered to become the total bill on the citizen after the insurance of electricity 22 hours / 24, 2100 million dollars, and the value of deficit coverage on the Treasury to 1000 million dollars, the cost of electricity bill on the total citizens and the state $ 3100 million instead of the current number of 3350 million dollars.[21]

3.3 Transmission in Lebanon

The electrical power plants and stations in Lebanon has transition network system for electricity in which there are three classes from the high voltage power lines which are the,66 , 150, and the last one is the 220 kV. Additionally, there are 58 main power substations which have role of converting the high voltage into medium one. Nowadays this network has 1615km lines distributed between the overhead lines (1336 km), and the underground cables (279 km), of different voltages used for the transmission and distribution.[21]

[Fig. 3] below show the transmission line in most of Lebanon province

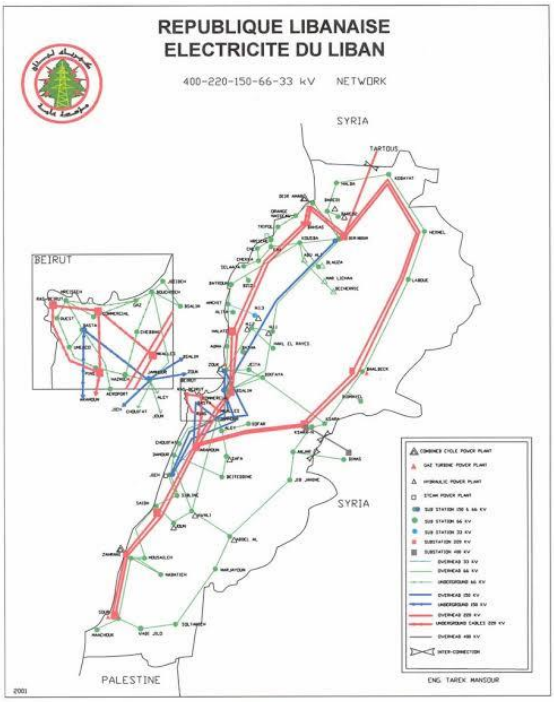


Figure 3.1: Transmission in Lebanon[21]

Table 3.1: shows some problem in Transmission operation. [21]

SIMPLE	**DIFFICULT**
High technical losses (-1 5%) There's a critical number of transformers (-- 1 1%) that are drawing nearer the conclusion of their normal life [AZOROM 2007]	Improvement of transmission arrange disturbance/fault examination is critically required to supply a benchmark for prioritizing organize change and surveying current and future organize execution
No computerized companywide administration data frameworks exist to help staff within the control of costs, stock database, blame examination, blackout administration, upkeep programs or work issue and announcing	Total the 220-kV line which, on the off chance that completed would increment solidness, decrease the specialized misfortunes by more than 1% and increment the transmission capability of the framework

Table 3.1: (con) shows some problem in Transmission operation. [21]

SIMPLE	**DIFFICULT**
Implementation of the 220-kV tension line network has not completed yet	Establish management control and information systems to help the transmission staff in their work
HV porcelain lines and glass HV insulin have negative natural impacts	Many FIV lines require replacement [AZOROM 2007]
Numerous of the FIV transformers are working at tall stack components which result in a need of standby capacity	Allotment of a sufficient budget for the Transmission Directorate in arrange to upgrade its monetary independency, at slightest for the obtainment of low-cost materials
Stack shedding happens all through the year, primarily amid the day, and much less amid the night	
No financial independency within the Directorate to ensure good functionality	Climatic contaminations propel the substitution of HV porcelain lines and glass HV insulin in composite sorts over the systems
Frequent delays to work programs are caused by materials procurement difficulties	

Problems Recommendations

High technical losses (~15%)

There is a significant number of transformers (~11%) that are approaching the end of them average life [AZOROM 2007]

No computerized companywide management information systems exist to assist staff in the control of costs, inventory database, fault analysis, outage management, maintenance programs or work issue and reporting

Implementation of the 220-kV tension line network has not completed yet

HV porcelain lines and glass HV insulators have negative environmental effects

Many of the HV transformers are operating at high load factors which result in a lack of standby capacity

Load shedding occurs throughout the year, mainly during the day, and much less during the night

No financial independency within the Directorate to ensure good functionality

Frequent delays to work programs are caused by materials procurement difficulties

Development of transmission network disturbance/fault analysis is urgently required to provide a benchmark for prioritizing network improvement and assessing current and future network performance

Establish management control and information systems to help the transmission staff in them work

Complete the 220-kV line which, if completed would increase stability, reduce the technical losses by more than 1% and increase the transmission capability of the system [MEW

2010]

Many HV lines require replacement

[AZOROM 2007]

Atmospheric pollutions motivate the

replacement of HV porcelain lines and glass

HV insulators with composite types across the

networks

Allocation of an enough budget for the

Transmission Directorate in order to enhance

its financial independency, at least for the

procurement of low-cost material

3.4 Distribution:

he physical interface between EDL transmission and distribution networks is at the cable end box of the

outgoing medium voltage (MV) cubicles from the main transmission stations. The distribution networks

are supplied primarily at 11 kV, 15 kV and 20 kV, with some additional networks at 5.5 kV and 33 kV.

The nominal low voltage (LV) is 380/220 volts

Between the transmission and the distribution network there are a physical interface, which is the cable at the end box of outgoing MV (Medium Voltage) which produced at the main transmission station, usually the distribution networks basically supplied at 11 KV , 15 KV and 20 KV , and some extra networks at 5.5 KV and 33 KV . The nominal LV (Low Voltage) is 380/220 V [Fig. 2].

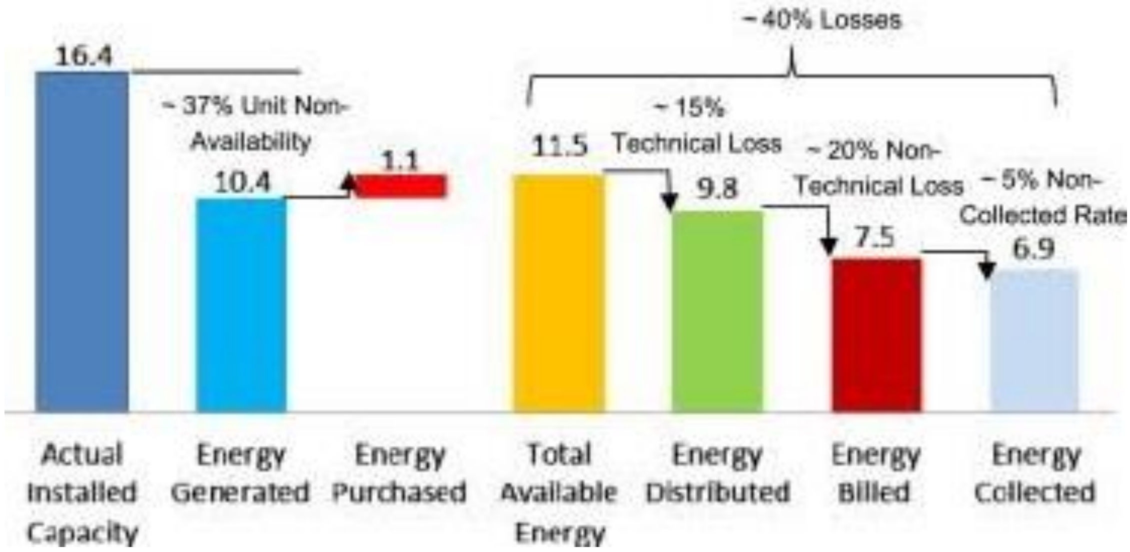


Figure 3.2: Distribution in Lebanon [23]

The problem is given in the following,

Table 3.2: Problem in Distribution operation [22]

Simple	Difficult
The presence of undetected number of electrical consumption bills (-5% in 2009 [MEW 2010])	Minimize the unpaid consumption of electricity
High non-technical losses (— 20%)	Providing a modem and a well organized billing and metering system
There is no well studied system for the keeping up of the MV/LV substation assets and the dealing with the problems is on a "action-reaction" basis	minimize the electricity theft , wasting and the outlawed connections by applying of the penal law No. 632
The age profile of MV/LV transformers shows that 37% of the transformer found are over the average life expectancy (20 years) and exceeded their life span.	Permanent checking up, Evaluation, watching and review of the whole setup and machines and evaluating the organizing degree and transformer and other appliances condition, also encourage the arrangement of a efficient arranged upkeep programs.
The suffering of the difficult overloading problems on the Lebanese capital area MV networks	Providing of information gathering systems for the operations and maintenance areas.
The presence of many employees who reject to use the suitable endorsed devices (e.g. earthling sets) and to wear special costume for protection against and dangerous. (E.g. Security Protective caps).	Presentation of dispersion organize coherence examination is direly required to supply a benchmark for prioritizing organize change and evaluating future arrange execution
Law number of qualified and expertise contractor workmanship	Explaining the mechanism of work by doing many, continuous workshop for the employees and the managers also, depending on specific predetermined plans.
The absence of financial self-reliance and self sufficient within the Directorate to get better functionality	Staring supportive actions like the inspecting and recording defects, fault monitoring, etc...

Table 2.3: (con) Problem in Distribution operation [22]

Simple	Difficult
The dissemination transport armada is old and ineffectively kept up, coming about in a tall level of vehicle breakdown. In a few cases, the accessible vehicles were unsuitable for the required work Appliances and equipment's are with law number and inadequate for the required work Shortage in the number of employees forms critical problems.	Actualizing Geographic Data Frameworks for Power of Lebanon (GISEL) [Assi 2007] that would give EDL with the specific devices for gathering, checking, and administration and subsequently lowering the amount of the non-technical misfortunes and help the Dissemination employees group in their work
Lack of developed , No computerized companywide administration data frameworks which is presence to support staff responsible for the control of costs, stock databases, blame examination, blackout administration, support programs or work issue and announcing	Conserving and improving in quantity and quality the capacities of the distribution network Rejection of many employees to use the correct pretested and permitted tools (e.g. earthing sets) and to wear protective costume with its protective accessories (e.g. Safety Helmets).
Visit delays to work programs are caused by materials acquirement challenges	Unsatisfactorily low-cost endorsement levels inside the Directorate result in delays in advancing work
Substations are old without permanent improvement and developing and assets for substitution are a main obstacle.	

3.5 Wind Turbine

History:

People have been using wind energy for thousands of years

About 5,000 years ago, man used winds to drive boats through the sails of the Nile and the water pumps of 200 BC were very primitive and very simple to use in China, as well as woven blades windmills to grind grain in the Middle East And the Persians

It seems to us that ways of using wind power are spreading all over the world By the 11th century, people in the Middle East used windmills and windmills largely to produce food. Traders and crusaders brought wind technology to Europe and then drained lakes and swamps in the Nile and Rhine rivers. Wind technology was eventually transferred by migrants to the Western Hemisphere. American colonists used windmills to pump water, grind grain, and cut wood in timber factories. In the western United States, homeowners installed several wind pumps while resettling in the country

At the end of the nineteenth century and at the beginning of the twentieth century they used little generators turbine that began to spread widely. We also recall that the construction of electrical lines to facilitate the spread of power to all areas that are rules in the thirties also began to using small turbines operating by wind.[25]

However, wind pumps should be used to provide water for livestock on some farms. Wind turbines are re-invading the world to provide electricity and ease of transport in rural areas

What are wind turbines and how it works?

Wind energy is characterized as the method of changing over wind vitality to another form of vitality that's easy to utilize, regularly electric, utilizing turbines. The full wind control generation for 2006 was 74,223 MW, proportionate to 1% of the worldwide utilize of power, the extent of generation to utilization was around 20% in Denmark, 9% in Spain and 7% in Germany. Hence, world wind power generation has quadrupled between 2000 and 2006. Winds that turn turbines are changed over by turning the latter's revolution into power by generators. Researchers utilize their past encounter to convert the wind development into a physical development. The use of wind energy started at the starting of history. The pharaohs utilized it to function water crafts within the Nile Stream, and the Chinese utilized it through windmills to pump groundwater.

Wind energy is utilized as wind areas for nearby control lattices. And within the form of little turbine in order supply power to provincial home or farther range area. Wind energy is secure as well as a part of the renewable energy family, an natural vitality that does not create hurtful poisons. After worldwide warming and contamination, the world is turning to renewable sources of vitality as elective sources of vitality and to decreasing the utilize of fossil fills. For these reasons, mechanical advance looks for to diminish the fetched of renewable vitality to grow its spread.

3.6 Parts of wind turbine[14]

- **Anemometer:**

Measures the wind speed and transmits wind speed data to the controller.

- **Blades:**

Lifts and rotates when wind is blown over them, causing the rotor to spin. Most turbines have either two or three blades.

- **Brake:**

Stops the rotor mechanically, electrically, or using pressurized water, in crises.

- **Controller:**

Begins up the machine at wind speeds of almost 8 to 16 miles per hour (mph) and close off the machine at around 55 mph. Turbines don't work at wind speeds over around 55 mph since they may be harmed by the tall winds.

- **Gear box:**

Interfaces the low-speed shaft to the high-speed shaft and increments the rotational speeds from around 30-60 revolutions per miniature (rpm), to around 1,000-1,800 rpm; typically the rotational speed required by most generators to produce power. The equip box could be a exorbitant (and overwhelming) portion of the wind turbine and engineers are investigating "direct-drive" generators that work at lower rotational speeds and do not require adapt boxes.

- **Generator:**

Produces sixty cycle alternative current power; it is as a rule an off the shelf inductions generators.

- **High speed shaft:**

Play a rule to push up generator (driving).

- **Low speed shaft:**

Make the low speed shaft about 30-60 RPM.

- **Nacelle:**

Sits on the tower and contains the adapt box, moo- and high-speed shafts, generator, controller, and brake. A few nacelles are huge sufficient for a helicopter to arrive on.

- **Pitch:**

Turns (or pitches) edges out of the wind to control the rotor speed, and to keep the rotor from turning in winds that are as well tall or as well moo to create power.

- **Rotor:**

Blades and hub together form the rotor.

- **Tower:**

Made from tubular steel (appeared here), concrete, or steel grid. Bolsters the structure of the turbine. Since wind speed increments with stature, taller towers empower turbines to capture more vitality and create more power.

- **Wind direction:**

Decides the plan of the turbine. Upwind turbines—like the one appeared here face into the wind whereas downwind turbines confront absent.

- **Wind vane:**

Measures wind course and communicates with the yaw drive to arrange the turbine appropriately about the wind.

- **Yaw drive:**

Orients upwind turbines to keep them confronting the wind when the course changes. Downwind turbines do not require a yaw drive since the wind physically blows the rotor absent from it.

- **Yaw motor:**

Powers yaw drive.

3.6.1 Wind Turbine Generators

wind turbine change the mechanic rotation process into usable electric energy. They are somewhat unusual turbines as they have been compared to other generating units that are usually connected to power grids.

One of the most important reasons is the work of the generator next to an energy source, which works to provide mechanical energy sometimes change, which is called torque

Humans should be aware of the basics of electricity, electromagnetism and phase as well as alternating current. If an overvoltage or hertz is observed, it will seem strange to us.[26]

3.6.2 Generating Voltage (tension)

On major, very big wind turbines (over 100-150 kW) the voltage (pressure) produced by the turbine is as a rule 690 V three-phase substituting current (AC).

According to the standards in the required and detected country electrical grid, the process of raising the voltage between 10,000 and 30,000 volts has done by sending the current to the wind turbine by using a transformer.[26]

Mostly, in most of the countries in the world, the large producers will supply the 50 Hz wind turbine models for the electrical networks, and 60 Hz models in America electrical networks.

Cooling System

During the work of the generator, permanent cooling up should take place. This cooling process can be done by putting the generator in a channel using a big fan for cooling. Different producers use water for cooling the generators. The last type of generator may be built more compactly, which gives a few electrical proficiency preferences, but they require a radiator within the nacelle to urge freed of the warm from the fluid cooling System.[26]

Starting and Stopping the Generator

On the off chance that you associated (or disengaged) a huge wind turbine generator to the network by flicking an standard switch, you'd be very likely to harm both the generator, the gearbox and the current within the network within the neighborhood.

Design Choices in Generators and Grid Connection

Wind turbine can be set up with synchronous or a synchronous generators, also with various shapes coordination or pathway framework association of the generator.

There are two network associations the direct one and the indirect one, in the direct one the generator is connected clearly and precisely to the (ordinarily 3-phase) rotating current grid.

The second one of network association which is the indirect one suggest that the current from the turbine go through many steps and over series of electric devices which change the electrical current to correlate that of the grid. Also to be notified that with an asynchronous generator this takes place spontaneously.

The solar cells or th sun light absorbed cells have semi- conductive chemical materials (like the silicon, indium, phosphide, and indium copper selenide), this alters the sun strength and fore from in to electrical force, also from these cells properties they have in their structure anti- reflective layer to diminish the reflected sun rays and accumulate most of.[26]

The anti – reflective layer composed from silicon oxide, or tantalum, or titanium, as a round top coat of these cells, or a vacuum statement strategy. Directly under the reflective layer there are three basic layers: the upper holding layer , the middle permeable layer and the last one which is th3e back layer, it is on the cell surface and composed from a piece of monocriystalline precious stones, also a trivalent components like boron, the contact layer which is negatively charged formed from pure silicon , additionally it has a little bit of pollutions to the pentavalent atoms like phosphorous, as result both layers exchange power to and from panel.

4. PHOTOVOLTAIC CELL

History

Solar cells are one of the most important inventions that have emerged in the modern era, which enable humans to secure a good part of their daily energy needs by converting solar energy into electrical energy, either straightforwardly or in a roundabout way.

The topic of solar cells dates to 1839 when the French scientist EDMUND BECORIL discovered it if an electrode was exposed to light and immersed in a conductive solution producing an electric current, then in 1941 the American inventor Russell O'HALL produced the first solar cell made of silicon

Solar cells are usually made of chemically treated silicon, and layers of this material and other materials and electrical conductors are arranged in a special engineering system. If this cell is exposed to normal light or sunlight, it releases electrons that travel through electrical wires and are used to operate one of the electrical appliances are inviting in lighting the electric lamp.

Photovoltaic cells have been used in many aspects of daily life and have been exploited to produce the necessary electrical power for the operation of satellites in space and the operation of spacecraft launched to detect planets and cosmic objects.

These panels are an perfect source to the electrical production because they do not cause environmental damage and do not produce toxic chemical residues and gases. Research on their development and exploitation has been supported extensively in various fields and around the world.

But the cost of producing high solar cells has become the most important obstacles to the expansion of exploitation, and therefore scientists have realized that the biggest challenge is to increase the conversion capacity of solar cells, the ability to convert solar energy to electricity and reduce the cost of production, and some studies indicate that the level has been achieved Good for the required conversion ratio of 32.3% of the solar energy entering the electric current, and many researchers believe that a conversion rate can reach up to 40%.

Such an increase in the conversion capacity of solar cells will result in a reduction in the size of these cells and increase the amount of electricity resulting from them and thus reduce the cost of production, which in turn will play an important role in reducing global warming and combating environmental pollution, which became the first threat to humanity in time Currently[28]

4.1 Solar cells and their uses

It could be a gadget that changes over light vitality specifically into electrical energy through the photoelectric impact. It is additionally called photovoltaic cells. Sun powered cells are a fundamental vitality supplier where they don't require chemical responses or fuel to create electricity. Unlike generators, they don't have any parts moving. Sun powered cells may be within the frame of little arrangements called sun powered cell boards that are utilized in homes to supplant conventional vitality sources.[10]

They are moreover utilized in numerous inaccessible areas where conventional vitality sources are troublesome to supply. Sun powered cells may be huge bunches called clusters), Comprising of a few thousand person cells, are utilized to change over daylight into electrical vitality for dispersion to mechanical, private and commercial gathering zones by central control stations. Sun oriented cells are too utilized to supply control to most vehicles and hardware Such as disciple space stations and satellites, because it does not expend fuel since it is stable, as they don't require steady support, moreover utilized within the fabricate of electronic diversions, computers, portable phones, radios, and other gadgets. Sun based cells contain semi-conductive materials (such as silicon, indium phosphide, and indium copper selenide), which change over sun oriented photovoltaic vitality into electrical vitality and contain an anti-reflective layer to decrease light misfortune. regularly, the anti-reflective layer Silicon oxide, tantalum, or titanium, shaped on the surface of the cell by circular coating or vacuum sedimentation method. Beneath the anti-reflective layer there are three primary layers: the upper holding layer, the retentive layer, and the back layer. The cell contains two positive and negative electrical layers, the positive

(positive) contact layer, which is found on the cell surface and comprises of a cut taken from monocrystalline precious stones furthermore a few pollutions from a trivalent component such as boron, the negative electrical contact layer comprising of silicon Unadulterated and include a few pollutions to the pentavalent component such as phosphorus, and both layers work together to exchange power to and from the sun based cell.[11]

4.2 Installation of Solar Cells

Sun based cells contain semi-conductive materials (such as silicon, indium phosphide, and indium copper selenide), which alter over the sun arranged imperativeness of the sun into electrical imperativeness and contain essentially an anti-reflective layer to diminish light mishap. The anti-reflective layer customarily comprises of silicon oxide, or tantalum, or titanium, formed on the surface of the cell by circular coating or vacuum explanation procedure. Underneath the anti-reflective layer there are three crucial layers: the upper holding layer, the porous layer, and the back layer. The cell contains two positive and negative electrical layers, the positive (positive) contact layer, which is found on the cell surface and comprises of a cut taken from monocrystalline jewels moreover many contaminations from a trivalent component such as boron, the negative electrical contact layer comprising of silicon Unadulterated and incorporate a couple of contaminations to The pentavalent component such as phosphorus, and both layers work together to trade control to and from board.[28]

4.3 Solar Cells Mechanism

The solar radiation drops to a solar cell, the anti reflective layers enhances its transition to the next banes by efficiently recording the falling light.

[fig. 3] show the mechanism of solar panel and how its work

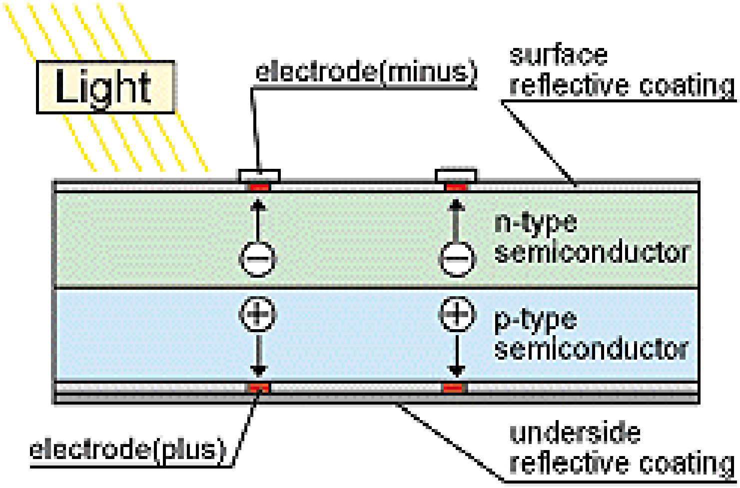


Figure 4.1: Solar Mechanism [32]

When the adverse chip is subjected to the sun, the photons ' power travels to the electrons in the valence area so that they can migrate to the adverse on contrary, the positive hole are transmitted to the + chip's coupling area, leading in a potential distinction between two interfacing. An electrical conductor can connect the two surfaces to

achieve electrical current in the electrical circuit. -ve to the +ve interface within an electrical circuits, so we must change over energy into electrical energy. So should be worth noticing outside circuit cell get opened, the cell produces a current of 0.07 amps and a voltage contrast of 0.6 volts, hence creating an electric control of 0.04 watts (depending on the connection: Power = current).

e are going require a matrix of hundreds of associated sun based cells separately and parallel, so that the associated cells individually decide the whole of generator voltage differentials, whereas the lattice cells speak to the parallel of the current voltage, and the square meter of the network creates I=4A And electric capacity by 48 watts, and to function a pump should require 4 networks of each m2 region, and contains five thousands sun based cell associated arrangement .[32]

4.4 Evolution of solar cells

In 1839, Becker studied the effect of light on some metals, solutions, and the properties of the resulting electricity. He observed the photovoltaic effect. In 1877, Adam and Smith demonstrated the concept of the optical transport carrier for the first time. In 1883, the first solar cell of selenium was installed. As quantum mechanics theories developed, scientists were able to interpret the phenomena associated with photovoltaic electricity. The optical sensitivity the histogram shown in [fig. 4]

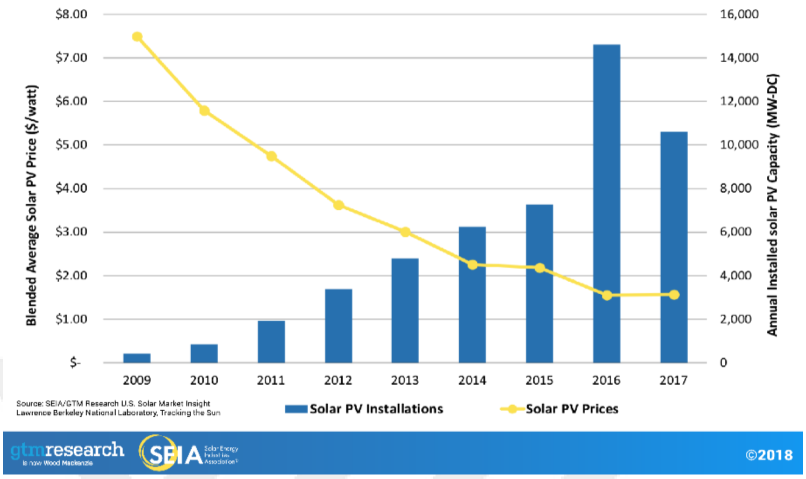


Figure 4.2: Solar Cell evolution[33]

Of materials such as silicon, copper oxide, lead sulfate and thallium sulfur were explained. Manufacturing the first solar cell consisting of With the efficiency

of work less than 1%, and in the mid-fifties was made solar battery efficiency of 6%, and was invented solar cells thin films made of cadmium supplied, copper supplied, and with the expansion of research development in the physical sciences and the study of photovoltaic exchanges, The solar cell industry has improved its efficiency and reduced its cost. The amount of energy produced by cells has increased from milli Watt to kilowatt. The evolution of solar cells has increased in the 1970s and 1980s because of the development of micro- (PV) was one of the most ambitious scientific methods by which electricity could be generated from renewable sources of energy in nature (solar energy). As energy consumption increased, solar cell complexes (matrices) were created, which contributed significantly to reducing the cost of solar energy. Reasonably energy consumption and production reached tens of megawatts.[33]

4.4.1 Solar cell in Lebanon

Many countries in the Middle East have started to rely on solar energy to support their electricity sector, considering the high prices of non-renewable energies and the manipulation of oil prices.

Lebanon is still lagging, despite having ample solar wealth, extending most of the year.

Renewable energies are the energies that are obtained through energy currents that are repeated in nature automatically and periodically, and thus, unlike non-renewable energies often found in a rigid stock in the earth cannot be utilized only after human intervention to remove them from it.

Lebanon's renewable energies are solar, wind, water, biomass, wave, and geothermal. All of the Earth's energy sources originated from solar energy.

The use of solar thermal energy has been known for thousands of years in hot areas. Solar energy has been used to heat water and dry some crops to keep them from being damaged.

In our time, research and experiments are based on trying to exploit the energy of the sun in the production of electric energy and in heating homes, air conditioning, smelting metals and other necessary applications. Solar energy reaches the Earth with light or radiant energy. In sunny days, when the sun is perpendicular, its radiation energy reaches the outer surface of the Earth at a rate of 1 kW / m 2, which is a plentiful source if it can be assembled and exploited for many human needs.

There are major ways to exploit solar energy, the first by collecting its heat for direct exploitation in cooling and heating, the second by capturing the heat of the sun to produce steam for the operation of an electric generator, and the third by using sunlight to generate electricity in practice.[12]

Lebanon is characterized by a suitable geographical situation to benefit from solar energy, it is in the northern hemisphere, where the amount of energy directly through the photovoltaic cells to the square meter per day ranging from 14 to 30 MJ.

Heating of domestic use water does not necessarily require the conversion of electrical energy into thermal energy and can be done using solar collectors with tubular absorbent surface made of galvanized steel or copper with an absorbent plate of steel and aluminum. Most of these devices operate in an open circuit based on the principle of thermal fatigue. In the Arab world, Jordan and Syria are the most used and productive countries for these devices. In Lebanon, the private sector is still young, and the number and potential of private companies is still very limited, while the number of imported companies is also low and prices are discouraging. You can't inevitably Market insurance.

The problem lies in the absence of encouraging policies and the lack of interest by the state or EDL, although studies conducted at the American University of Beirut indicate that there is economic feasibility at the level of the citizen and the network, as the solar heater can provide hot water 50 ° C for 8-10 months per year. In conclusion, we note that the price of a solar heater in Lebanon with a capacity of 200 liters ranges between 600 and 1000 US dollars. The production of electricity by photovoltaic cells has proven to be of utmost importance and economic viability in small applications even in cases where power can be obtained from the public grid or from diesel stations. Globally, photovoltaic-based solar devices have flourished. Manufacturers of these devices have gone from selling 3,000 kW in 1980 to 60,000 kW in 1992, with many applications, such as outdoor lighting, telephone sets, electrofusion and small cooling machines. Street advertisers can work well on solar energy, partly because they are sometimes unwilling to connect to the public grid at relatively high voltages, or unable to pass power grids over certain grounds for various reasons. As for prices, the price of electricity production by photovoltaic cells fell to US $ 0.30 per kWh in 1993. The cost of construction is estimated at US $ 450 per m2 of cells. International attention is being paid to the development and improvement of solar devices. The United States is making a significant effort. Achieving widespread use of renewable energies requires a strategy that allows citizens to acquire this technology at a reasonable price, which must often be subsidized by the government or facilitated by private institutions. Supporting renewable energies in the early stages may be a policy to familiarize the consumer with the advantages of these energies and make them accept them. Consequently, the results of this policy will prompt the private sector to start local or assembly industries for imported parts.[16]

In any case, it is logical that support starts from some ministries, such as the Ministry of Water and Electricity Resources and the Ministry of Environment, to avoid the risk of pollution and rationalization of consumption and thus reduce the expenses resulting from all of this. The support of the state through its institutions for all the rings that contribute to the creation of renewable energies from the factory to the consumer will undoubtedly play a distinctive role in making these energies contribute more to the security needs of the Lebanese society. An economic development project of this size requires a set of studies and procedures to identify the opportunities and cost of this type of energy production in Lebanon. It is not yet proven that reliance on the sun to produce electricity is less costly or sustainable than production by oil derivatives that have been associated with fluctuations in oil prices in the past four years. Some believe that production from renewable energy is unsustainable and requires high investments with low and long-term returns. In addition, there is no technical capability in Lebanon. Earlier, the Lebanese Center for Energy Conservation implemented the project of replacing the electric water heater with solar heater through the Lebanese Electricity Establishment in the Bekaa, Beirut and South Lebanon, funded by the Swedish Development Office. The Lebanese Wind Power has conducted experiments to generate electricity from the air in Akkar Plain. From the International Finance Corporation. According to the Center's data, electricity savings of $ 1.413 billion could be achieved in 15 years and 14,433 tons of CO2 emissions were saved. It installed 11 joint solar heaters and 88 individual heaters, saving $ 564,915. Individuals have $ 29,448 a year, or an average of $ 28 a month, with an investment cost of between $ 1,000 and $ 1,500 for solar panels and a water pump. The process of converting solar energy into electricity for homes and institutions was not limited. The Ramses project, which aims to solve the problems of high fuel prices globally in the agriculture sector, has made the bulldozers and agricultural machinery work on solar energy. The project, which was prepared by the European Union with the participation of many from Lebanon and abroad, was carried out in the Monastery of Mar Sarkis and Bacchus in the Lebanese town of Achkout surrounded by agricultural lands, where the cultivation of grapes and olives, and a cattle farm. Thus, the first tractor running on solar energy, its generator runs on batteries charged from solar energy, and enables the tractor to work for six hours without interruption, and has an alarm to charge the batteries shortly before discharging. In addition, the factory in the monastery was provided with electricity from solar energy, in a way that would enable it to give energy for three consecutive days despite power cuts or even the absence of the sun altogether. Technically, it captures light from solar energy and converts it through several processes into energy equal to the electricity we normally use. With regard to the issue of completely eliminating state electricity, or generators, this remains at the disposal of customers who may not cancel their subscription to state electricity, if the batteries are discharged and there is not enough solar power. In Switzerland, some use solar power in the morning, and state electricity in the evening, and this system is connected to the state grid. Others are also storing and selling solar energy to the state, making them a dual benefit. Elsewhere, there is a special system for areas without electricity, such as rugged valleys and high mountains. The Hashemite Kingdom of Jordan is the primary nation within the Center East to enact the utilize of sun based vitality and the make, generation and improvement of solar heaters, which utilize up to 40% of the full private houses, and introduced yearly approximately 15,000 gadgets agreeing to official measurements, in expansion to utilize in Healing centers, schools, lodgings and swimming pool warming, and in numerous mechanical, benefit and agrarian applications, where a sun powered radiator is introduced, which is reasonable for all applications of distinctive sizes as an free and lasting framework or as an assistant framework for central warming frameworks and water warming frameworks. Hey. In China, solar power is not only used to generate electricity. For example, it uses it to heat meals on flights, where the latter provides a reduction in the cost of services to airlines. Saudi Arabia has come a long way in the use of solar energy in the production of electricity, as well as the use of this energy in the desalination of sea water, where it joins the countries of Jordan and Syria, which are the two most powerful countries in the use of solar energy in the Middle East. There are additional reasons to doubt the conversion of electricity production from fuel to solar energy, as this requires the exploitation of large areas of real estate that may not be available in Lebanon at low cost. Will the plains of Akkar, the Bekaa and Marjayoun be planted with solar panels? This will be at the expense of the agricultural sector and its workers.[5]

4.5 TYRE city applications

In this chapter, geometric placement and the number of buildings and population are given in Fig.5. The statistical situation also is given Table 5.

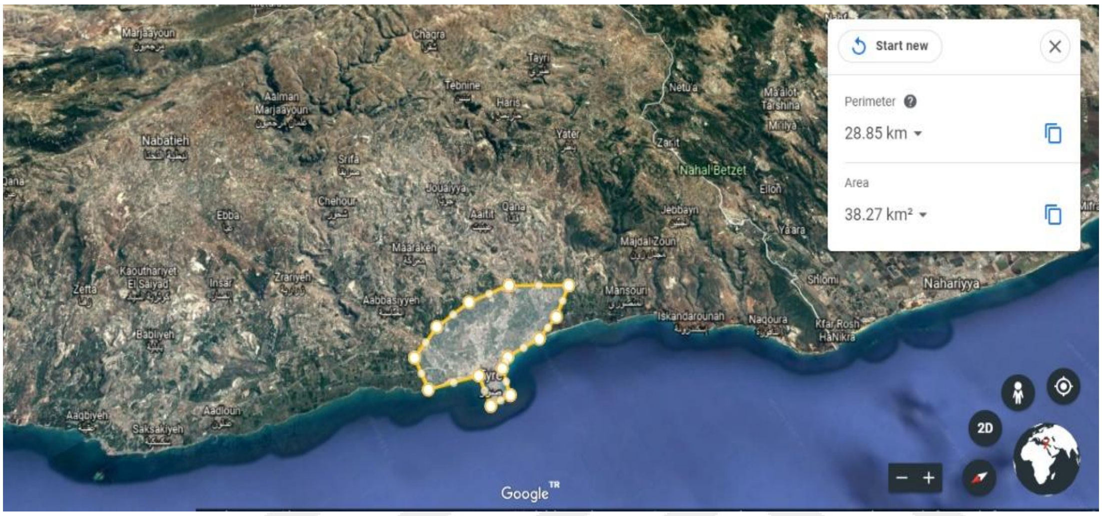


Figure 4.3: map view of TYRE city

The statistical information and date about Tyre city is listed in table 4 and Fig. 6 is a histogram illustrates the usage of electricity in last five year in Lebanon

Table 4.1: Statistical study abut TYRE city .[5]

District	Population	Approximation building	Approximation Work shop	Area per km
City center	135204	5000	39	4
MARAKA	20000	1000	5	2.8
RAS AL AIN	11500	400	2	1
ABASIA	54000	1800	11	3.3
MSAKEN	31000	1200	-	1.8
RCAMP	16000	650	4	2
BORJ SHAMALE	39000	1400	17	4.4
KANA	14000	400	4	2
HOSH	9000	270	1	3.8
BORJ RAHAL	18000	700	22	6
Total	347704	12820	105	31.1
Available area Result	7.17 km			

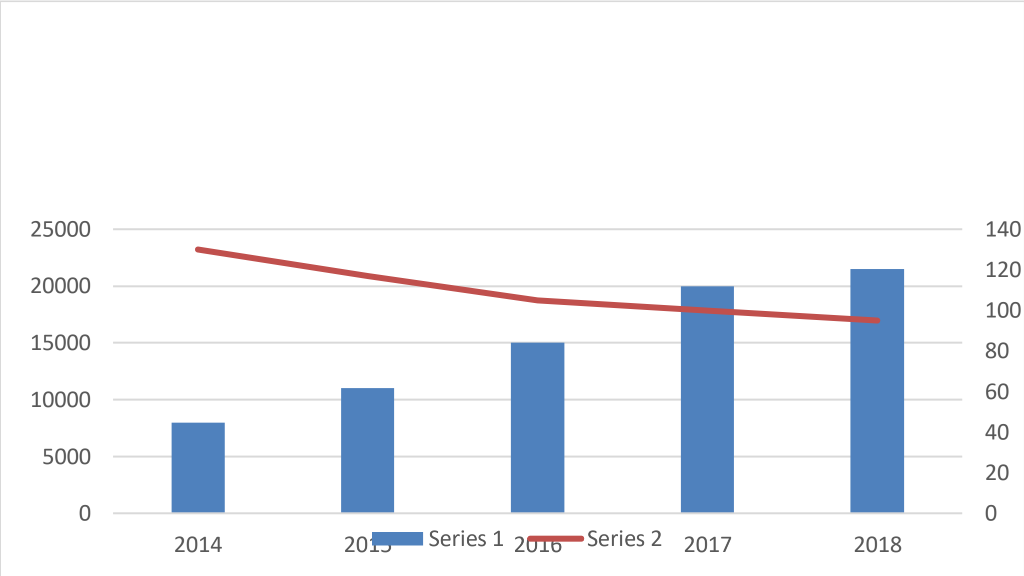


Figure 4.4: Usage of electricity in last 5 years .[5]

Based on the result in table 1.1 there is about 7.17 Km available for work.

4.5.1 Figure 1: Analysis

The above figure illustrate the usage of electricity in last five year the blue histogram show that or confirm that electricity consumption increased progressively this is due to increasing in population as well increasing in the number of building this phenomenon provide us several information in using of fusel fuel especially in Lebanon because they are depending hundred percent on generator that working on diesel so in this research I'll do the best to decrees in using of fusing fuel so we will have god atmosphere in addition to save huge amount of money.

Orange yellow line refer to increase in capacity of electric by GW/hrs. (curve from right to left) the maximum usage rate in last year its approximately about 22500 GW/hrs.

One of the Generator used there:

-500 KVA

-3 phase – 500 A

-1 KVA proceed 1.5 Amp

-1500 rpm

-1 hr. need 95-liter fuel

-95-liter cost 85,000 LBP (55$)

-2240 – 220 V

-Volvo type

-60,000 $ price

-weight = 6 ton + Muffler

-24 V to start

-VFD

Figure 4.5: Motor used in TYREE

Some Calculation:

Three phase Amps = (kVA x 1000)/Volts x 1.73

500*100=500,000

500,000/220*1373 = 1313 AMP

24 Hrs. working = 24 * 55$ = 1320 $ per day

This 500 KVA motor supply about 700 home in winter may be in summer session we need to supply these homes about 800 KVA this due to increasing in electricity consumption in summer (heavy load like AC). 700 m aluminum cable used to transfer power from generator station after that simple cupper cable used from stations to home (load). The given motor need repairing for some devices and material inside such as air filters should be changed every 1000 Hrs. as well water every 300 Hrs. work, changing oil takes place every 150 Hrs. repaired should take seriously to save generator life.

In order to supply a small town which is no more than 2 Km2 we need at least 4 motor like given motor that means we need about 1320$ * 4 = 5280$ per day its very high value this why renewable energy resources are important and make life easy simple and safe from atmospheric pollution.

How much the customer pays for electricity bill?

To have accurate answer I filled a survey (questionnaire) about electricity consumption for some houses and workshop.

Sample about Questionnaire

5. QUESTİONNAİRE ABOUT ENERGY CONSUMPTİON İN HOUSEHOLD AND WORKSHOP

1- **Where is your home**?

Province	TYR
District	Rcamp
Region	Rcamp

2- How large is your home / workshop?

oSmall home /workshop	100 M^2
oMedium home /workshop	150 M^2 – 250 M^2
oLarge home / workshop	250 M^2 - 350 M^2
oMansion/ workshop	350 M^2 – 500 M^2
oNkandla/ workshop	> 500 M^2

3- number of bed rooms 5

4- Number of occupants 3

5- Number of heavy Machine 8

6- Approximate working of heavy machines hrs./month. 300 Hrs. / month

7- Does house separator diminish the power utilization?

1) Yes 2) No

8- What type of coping mechanism you are using against electricity load shedding?

1) UPS 2) Rechargeable fans and lamps 3) Generators

4) Solar energy panels 5) Wind energy turbines

9- If you are using a UPS, then please answer the questions from “a” to “c”:

a) What was the installation cost of UPS including battery? Please specify.

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,300,,,,,,,,,,,,,,,,,,,,,,,

b) For how many hours the UPS provides the backup facility.

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,8 Hrs,,,,,,,,,,,,,,,,,,,,

c) What is the normal life of UPS? Please specify.

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,1 year ,,,,,,,,,,,,,,,,,,,,,,,

10- If you are using rechargeable fans, then please answer the questions from “d” to “e”.

d) What was the cost of rechargeable fans?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,60,,,,,,,,,,,,,,,,,,,,,,,,,,,

e) What is the normal life of rechargeable fans?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,8 month ,,,,,,,,,,,,,,,,,,,,,,,,,,

11- If you are using generators, the please answer the questions from “f” to “o”.

f) What type of generator you are using? Volvo

1) Run by Petrol 2) Run by diesel 3) Run by gas

g) What is the maximum power potential of the generator?

,,

h) What was the price of generator?

………………popular use…………………….

i) When did you buy generator?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

j) For how many hours, you are using generator in winter.

,,,,,,,,,,,,,,,,,,,,,,,,,,8 Hrs,,,,,,,,,,,,,,,,,,,,,,,

k) For how many hours you are using your generator in summer.

,,,,,,,,,,,,,,,,,,,,,,,,,,14 Hrs,,,,,,,,,,,,,,,,,,,,

l) If you are using a petrol generator, how many liters of oil are consumed in one hour?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

m) If you are using a diesel generator, how many liters of diesel are consumed in one hour?

,,,,,,,,,,,,,,,,,,,,,,,,,,95 L,,,,,,,,,,,,,,,,,,,

n) If you are using a gas generator, how many kilo grams of gas are consumed in one hour?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,

o) What are the environmental threats of generators?

1) Generate Smoke 2) Generate noise 3) Both

12. If you have installed solar energy system, please answer the questions from "p" to "s".

p) What is the power capacity of solar energy system?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

q) What was the installation cost of solar energy panels?

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

r) What is the normal life of solar energy system?

s) What are the natural benefits of utilizing sun based energy?

1) Does not produce smoke 2) Does not make commotion 3) Both

13. which month you get the most amount of electricity.

Summer

14. Month to month power utilization in units for the past 12 months

6th ,2018………..120$………………… 7th , 2018………..120$…………………
8th , 2018…………..120$…………… 9th , 2018……..90$……………..
10th , 2018…………..90$………….. 11th , 2018…………70$……………
12th , 2018………..65$………….... 1st , 2019………..60$………………
2nd , 2019 ………..50$……………3rd , 2019………..45$………………
4th , 2019………..60$……………… 5th , 2019………..65$…………………

Summer Autumn Winter Spring

5.1 Statistical study I

in oreder to calcalute the bil payment in homes belwo table 5 show the payment of homes according to their area

Table 5.1: A statistical study about RCAMP district:

	No of home	**Bill in season / $**					
		Winter	Spring	Summer	Autumn	Annual per home	Total
<150	500	90	75	120	100	385	192500
150<x<250	1700	175	170	360	250	955	1623500
250<x<350	600	210	180	500	350	1240	744000
>500	4	1200	1000	2500	1800	6500	26000
Total	2804	1675	1425	3480	2500		**2586000**

500 * 385 =192500$
1700 * 955 = 1623500$
600 * 1240 = 744000$
2 * 6500 = 26000$(this is not home it’s a workshop)

Add all together :
192500 + 1623500 + 744000 + 26000 = **2586000 $**

We have in RCAMP about 650 Buildings

Average Payment= 2586000 / 650 = 3978.4

thıs value wıll used lıke an average ın order to fınd the total payments ın all district as a result, we must compare the total payment with cost of fuel used among 1 year

in section 6.2.2 we’ve calculated for one single day its about 1320$ so easily multiply by 365 we have

1320$ * 365 = 471800$ generator cost in one year for fuel.

Taking a ratio: **2586000 / 471800** = 5.4

the owner of this generator gains about 5 and half multiple of customer total payment.

Calculating for the region selected above

Assume the Camp payments is the average for the 10 districts, so we have

District building * **Average Cost / 650 =3978.4 * No of building (1)**

To find the annual payments per district by using the equation (1) and the results are given in Table 5.2.

Table 5.2: Total Bill Calculations

District	No of Buildings	Ratio	Result
CITY CENTER	5000	3978.4 *5000	$19.89*10^6$
MARAKA	1000	3978.4 *1000	$3.9*10^6$
RAS AL AIN	400	3978.4 *400	$1.5*10^6$
ABASIA	1800	3978.4 *1800	$7.1*10^6$
MSAKEN	1200	3978.4 *1200	$4.7*10^6$
RCAMP	*650*		*2.586*
BORJ SHAMALE	1400	3978.4 *1400	$5.56*10^6$
KANA	400	3978.4 *400	$1.5*10^6$
HOSH	270	3978.4 *270	$1.07*10^6$
BORJ RAHAL	700	3978.4 *700	$2.78*10^6$
		Total	$\mathbf{50.586*10^6}$

<u>*Verifying the Result*</u>

We have about 12820 building as total payment,

12820 * 3978.4 ≈ 51

The result above is matching to the result obtained in table 6

The mentioned region paying annually about 51M$

Savıng money in Lebanon:

Saving is the art of deducting a sum of money and keeping it away from the hands to take advantage of it at the time of need. This helps the person to find financial security that helps him to arrange his affairs and adjust his financial situation if he needs to. The importance of saving has increased as it helps to overcome crises and difficult times. It is the first line of defense in emergencies.. Saving is different from investing. When you save, you keep your savings for the future. When you invest, you want your savings to grow over time. While investment can help you achieve your long-term goals, saving is a tool to meet your short-term needs and save you your emergency expenses.

Figure 5.1: is histogram show the number of building in Lebanon province according to usage of electricity.

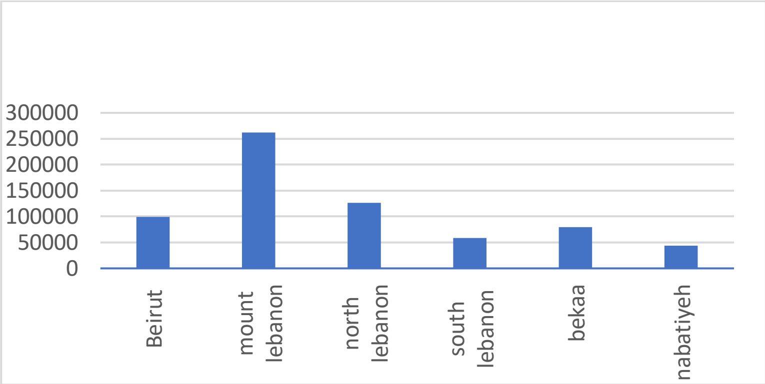


Figure 5.1: Number of buildings for Lebanon province.[19]

5.1.1 Comparison between world use and TYRE province

In Fig. 7.2 and 7.3 is a comparison according to the usage of kWh in TYRE district and global use

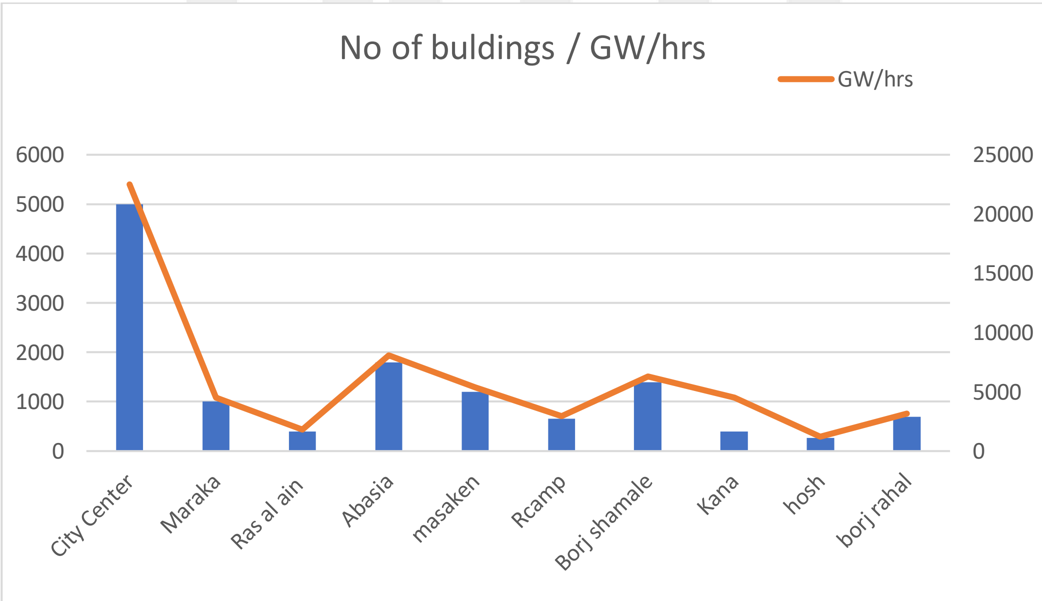


Figure 5.2: Electricity consumption (GW/hr) in TYRE City

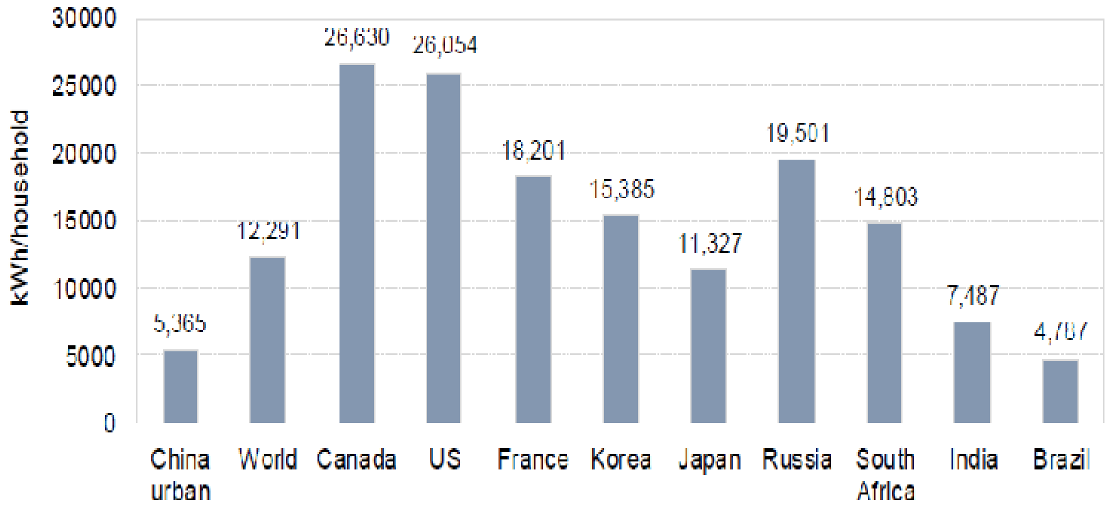


Figure 5.3: Global Electricity consumption (Kw/hr)

5.1.2 Comparison between Canada home and TYRE home 27

In order to see the differences between Canada home and TYRE home Table 6.1 and 6.2

Shows the number of electrical devices in sampled home in Canada and in TYRE is listed in the

Table 5.3: Number of electrical devices found in homes in Canada

No of home Sampled	Average Number of devices count									
	Lamps	Refrig.	Freezer	Dish washer	Wine cellar	Home enter	Office and comm.	Other common	Supp. space cond.	Other misc. and seasonal
720	56.4	1.39	0.61	0.68	0.05	9.4	9.7	11.4	2.1	0.6

Table 5.4: Number of electrical devices found in homes in TYRE

No of home Sampled	Average Number of devices count									
	Lamps	Refrig.	Freezer	Dish washer	Wine cellar	Home enter	Office and comm.	Other common	Supp. space cond.	Other misc. and seasonal
500	39.26	0.96	0.42	0.47	0.034	6.52	6.73	7.91	1.45	0.41

The calculation of bills payment per month according to the district of TYRE is shown in the table 6.3 and Histogram in fig. 7.5

Table 5.5: One-month Bill in TYRE

District	No of Buildings	1000 kWh
CITY CENTER	5000	331,5$
MARAKA	1000	325$
RAS AL AIN	400	312.5$
ABASIA	1800	328$
MSAKEN	1200	326$
RCAMP	650	76$
BORJ SHAMALE	1400	330&
KANA	400	312.5
HOSH	270	330
BORJ RAHAL	700	330.95

The below figures show one-month bill payment in Canada home according to statistical survey done ın Canada

	7 kW (7.8 kVA) 1,000 kWh
Regina SK	$ 162.07
Saskatoon SK	$ 162.07
Halifax NS	$ 155.21
Saint John NB	$ 154.92
Moncton NB	$ 153.40
Ottawa, ON	$ 151.77
Vancouver BC	$ 130.17
Calgary AB	$ 120.88
St. John's NL	$ 116.63
Edmonton AB	$ 113.45
Montreal QC	$ 110.13
Winnipeg MB	**$ 104.49**

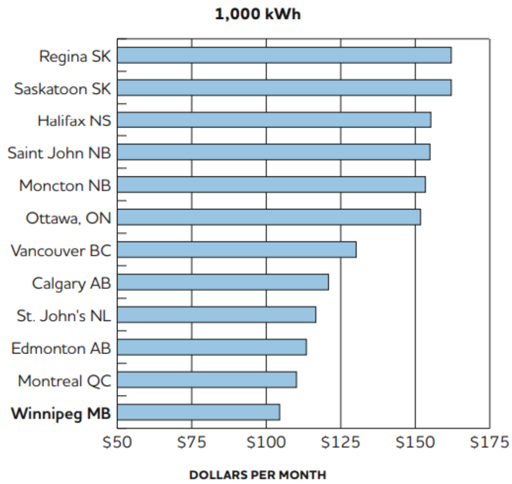


Figure 5.4: One-month bill in Canada cities.[29]

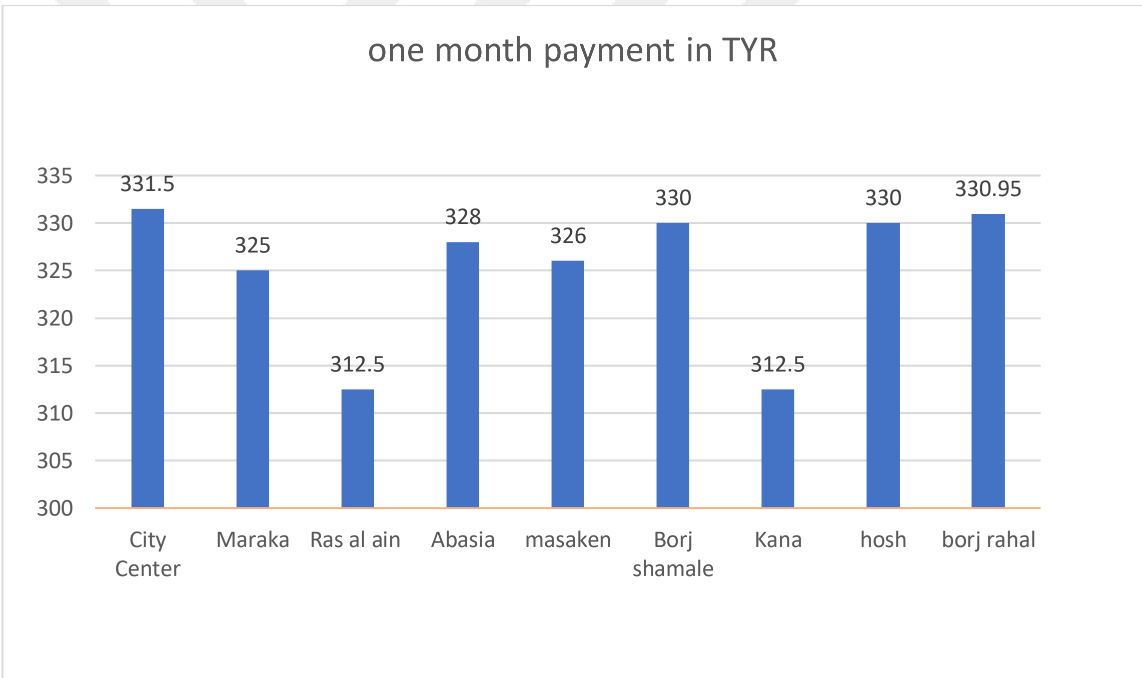


Figure 5.5: Electricity bill one-month histogram

By referring to the results we conclude that the bill payment in Canada is less than Lebanon because they are using renewable energy resources while in Lebanon, they weren't

5.2 How smart electricity devices save money? (SED)

Smart home

Replacing old appliances and replacing them with new "smart" technologies and systems can be a good step by opening the door to saving a large amount of money on facilities. Each different family and will require a unique look to the needs and uses of these potential technologies. Each solution is not listed here, each family will benefit both. For example, small homes that do not use too much electricity may not benefit from installing solar panels like a big house. The bright future looks to conserve energy and smart devices market entry for consumers at an increasing rate. [Fig. 8]

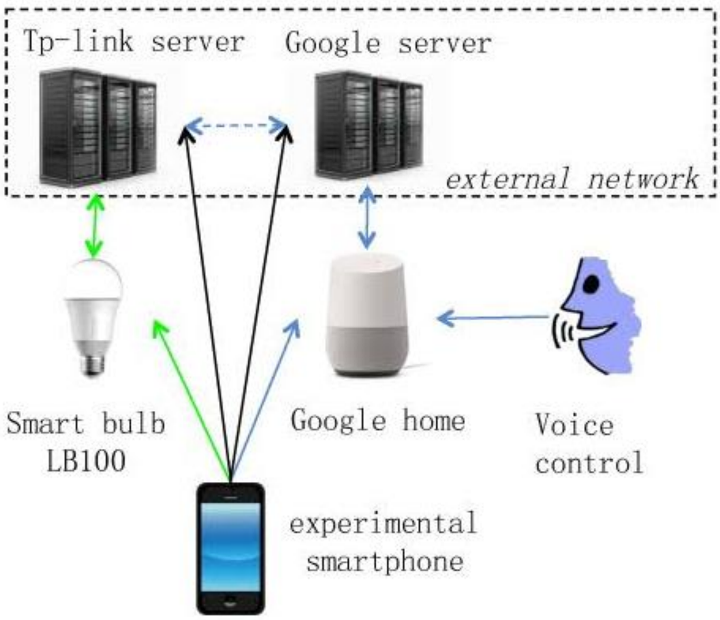


Figure 5.6:: Smart home. [27]

Smart heat

Contributing a couple of hundred dollars on a heat regulator who can instruct himself perfect way the most perfect way to manage temperature control at home could be a exceptionally great venture. There's a indoor regulator within the showcase that gets a parcel of acknowledgment for its capacities and benefits for keen clients, nicknamed Settle. This small gadget will turn on domestic temperature settings on your possess and can offer assistance spare cash on vitality bills. Learn after you wake [Fig. 5.7]

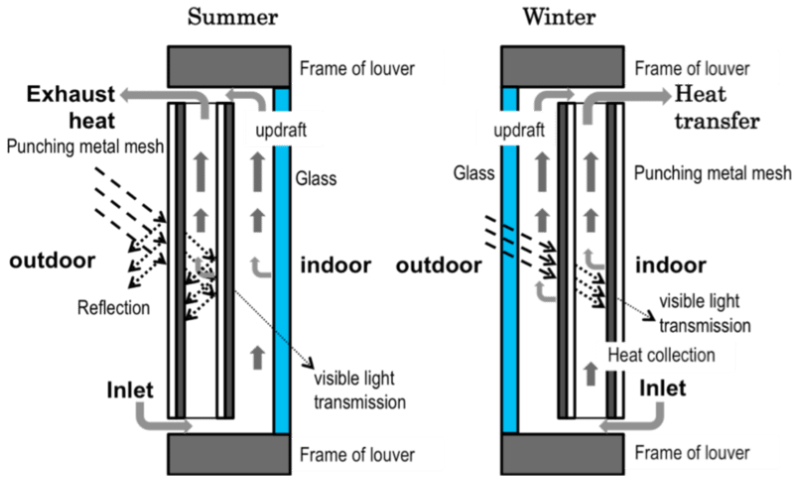


Figure 5.7: Smart heat [17]

We'll moreover learn once you go to work, go domestic from work, and can moreover feel at domestic and alter the temperature appropriately. Settle has built-in temperature adjusters to the perfect setting regardless of whether you're at home or at domestic. In case you're not fulfilled with how to form the warm controller consequently, you'll control it utilizing your smartphone from anyplace. All these little alterations will spare you cash. 50% of the normal homeowner's charge goes to warming and cooling. Settle will too consequently alter itself depending on the climate since it is associated to a Wi-Fi arrange and confirmed desires.

Light Ignition Sensors

The establishment of light sensors to quench or turn on lights can spare cash. As any father knows, no matter how numerous times you remind your children to turn off lights that don't appear to keep in mind. The common assess of the sum of cash misplaced each year on the lights cleared out within the ranges of hundreds of dollars. In the event that the light remains 100 watts for 10 hours, it employments 1000 watts of power, or 1 kWh. A speedy see at the power charge will uncover how much you spend per kilowatt-hour.[14]

Waste water

Clearly to all people that wasting water through long showers is fearfully for the used bills and disastrous for the environment. Also there is wasting in the power that heating the water in these bathrooms, and don't overcome the squandered energy of the old water radiators and non-insulated channels. As a result, the tendency for property holders to updating or develop the old water radiator to their unused water heater without a tank to save cash on used bills. Sometime recently you choose to go without a tank you ought to contact an master to consider your needs.[fig. 10]

Figure 5.8: Waste water mechanism.[17]

The reality of the case is that it truly depends on the domestic, the utilize of water, the cost of gas within the range. Indeed, in case water radiators are upgraded, it is still conceivable to squander cash by using excessive water in case you are doing not alter terrible showering propensities. Some of the time, the best gadgets can essentially help us by reminding us to halt water. For 10 dollars [17]

you can buy a simple product on the market called Water Pebble. It is a small device that you put on your feet in the bathroom.

At the beginning of the shower. The person will notice a green light, after that the light will changed gradually into yellow, at the end and after spending a certain time the a red surrounded by a pattern of different colors will appear to detect the end of the shower. It traces and calculates the time had spent in the toilet at the middle of the primary use and each customer uses it in order to decrease the time by seven.

Then, when we reach to a brief and an adjusted time for a shower, the client presses the reset button. This invention may help in saving over 300$ per year on wasted water and energy. In this case you may save over 12,000 gallons of

water yearly. It’s not a difficult step and action for everyone to save cash with a just 10$ device.

Collecting result:

After all calculations done above now, we need wind turbine that can supply all district in selected region so first we have to know how much we need for KVA wind turbine that can generate enough energy. [14]

5.3 Starting to insert wind turbine

Map view wind turbine available area is given in the below Fig.

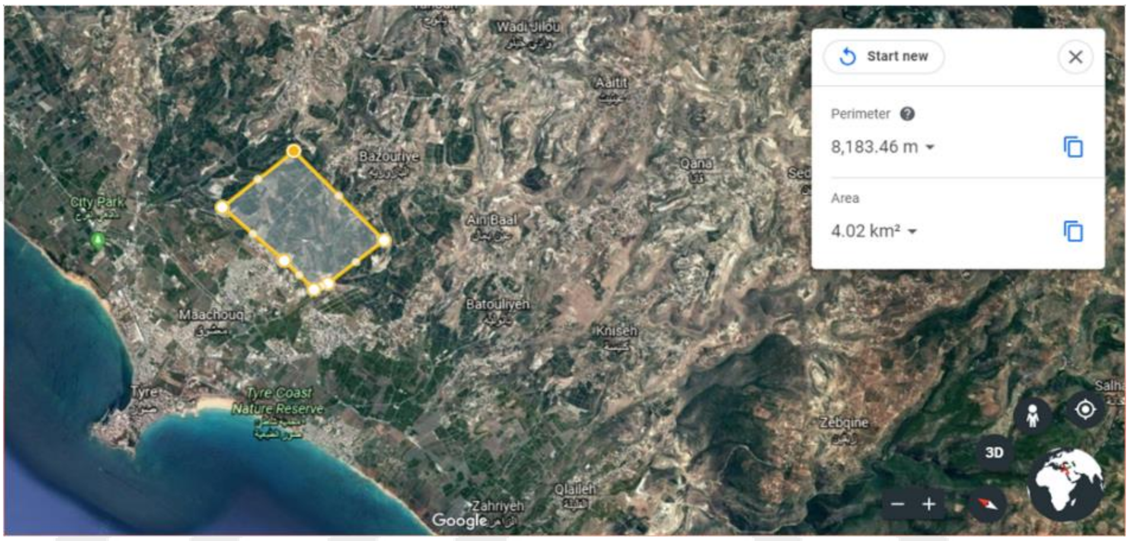


Figure 5.9: Map view wind turbine available area

5.4 Problem Statement

With the information that it is of basic financial significance to know the control and so vitality created by different types of wind turbine in several conditions, in this model we are going calculate the rotational motor control delivered in a wind turbine at its evaluated wind speed. Usually the least wind speed at which a wind turbine produces its evaluated control.

5.4.1 Mathematical Model

The symbols and definitions, which are used in the Mathematical model, is given in the Table **7.**

Table 5.6: Mathematical model use to identıfy the equation of power

E	KINETIC ENERGY (J)	ρ	DENSITY (kg/m^3)

m	MASS (kg)	**A**	SWEPT AREA (m^2)
v	SPEED WIND (m/s)	**C_P**	POWER COEFFICIENT
P	POWER (W)	**r**	RADIUS (m)
dm/dt	MASS FLOW RATE (kg/s)	**x**	DISTANCE (m)
DE/dt	ENERGY FLOW RATE (J/s)	**t**	time (s)

Assume we have a constant acceleration, the kinetic energy of an object with mass m and velocity v is equal to the work done W . [1]

$E = W = Fs$ (Kinetic Energy (J) Fs force)

Apply Newton's Law, so we have : $F = ma$ then $E = mas$ (1)

third equation of motion: $V^2 = U^2 + 2as$ wind turbine start with zero velocity then U^2 set to be 0

therefore $a = V^2/2s$

refer to Eq.1 , the kinetic energy of a mass in motions is:

$$E = 0.5mv^2 \quad \textbf{(5.1)}$$

The power in the wind is given by the rate of change of energy:

$$P = DE/dt = 0.5\, v^2 \, \frac{dm}{dt} \quad \textbf{(5.2)}$$

$\frac{dx}{dt} = v$

$\frac{Dm}{dt} = \boldsymbol{\rho A v}\, \frac{dx}{dt}$ -------- $\frac{dm}{dt}\, \boldsymbol{\rho A v}$

Use Eq.1.2

$$P = 0.5\, \boldsymbol{\rho A v^3} \quad \textbf{(5.3)}$$

Albert Betz who is a German physicist derived a conclusion that there is not any wind turbine can alter an amount exceeded the ratio of 17/27(59.3%) of the dynamic energy into mechanical (kinetic) energy rotating the rotor. These days this law is called the Betz's .law. Hypothetically the extreme control proficiency of wind turbine is 0.59(not more than 59% of the energy carried by the4 wind can be released by the turbine). Its name is "power coefficient" , which is defined as : Cpmax=0.59

Moreover, wind turbines cannot work at this greatest level. Each type of turbines has its specific Cp also depends on the wind speed surrounding the turbine and it works in. when the strengthening of the all prerequisites of the wind turbine – quality and hardness in specific- the authentic limitation are under the Betz limit with ranged value between 0.35-0.45in the best planned wind turbines. Over time they take in consideration the other factors in calculating the total wind turbine framework, eg. The gearbox, orientation, generator … etc. It was 10-30% of the power of the wind which changed into utilizable power. Hence, the power coefficient needs to be factored in equation (1.3) and the extractable power from the wind is given by:[1]

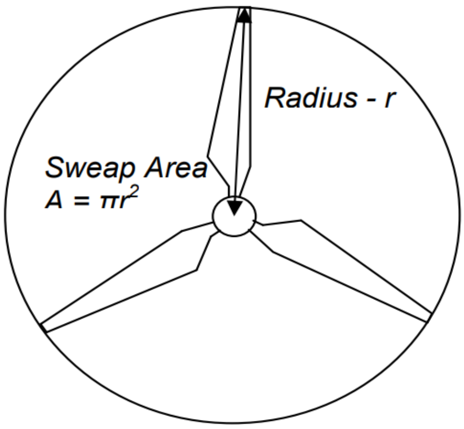


Figure 5.10: turbine circle[1]

$$P_{avail}=0.5\boldsymbol{\rho A v^3 C_P} \tag{5.4}$$

Swept Area

$$A = \pi r^2 \tag{5.5}$$

Calculations with Given Data [1]

Blade length, l = 52 m

Wind speed, v = 12 m/sec

Air density, ρ = 1.23 kg/m3

Power Coefficient, Cp = 0.4

Inserting the value for blade length as the radius of the swept area into equation we have:

I = r = 52 m

$A = \pi r^2$

$$= \pi * 52^2 = 8495 \text{ m}^2 \quad \textbf{(5.6)}$$

power converted from the wind

$$P_{avail}=0.5\boldsymbol{\rho A v^3 C_P} \quad \textbf{(5.7)}$$

$$= 0.5 * 1.23 * 8495 * 12^3 * 0.4 \quad = 3.6 \text{ MW}$$

5.4.1.1 Data Simulation (MATLAB)

A) Coding:

```
clc;
clear all;
ro=1.22;%density
R=20;%Raduis
A=pi*R^2;%Area
V=2; %velocty
w=0:0.1:10; %wide range
B=0;
for j=1:7
L=w.*R./V;
Li=((B.^3+1).*(L+0.08.*B))./((B.^3+1)-(0.035.*(L+0.08.*B)));
Cp=0.5176.*((((116./Li)-(0.6.*B)-5).*exp(-21./Li))+0.0068*L);
Pm=0.5.*Cp.*ro.*A.*V.^3;
i=4;
```

```
dP=0;
dP_old=0;
while sign(dP*dP_old)>=0
dP=Pm(1,i)-Pm(1,i-1);
dP_old=Pm(1,i-1)-Pm(1,i-2);
if dP>0
if (w(1,i)-w(1,i-1))>0
i=i+1;
else
i=i-1;
end
en?
if dP<0
if (w(1,i)-w(1,i-1))>0
i=i-1;
else
i=i+1;
end
end
end
V=V+2;
Pmpp=Pm(1,i);
wm=w(1,i);
MPP(j,2)=Pmpp;
MPP(j,1)=wm;
plot(w,Pm,'linewidth',1.5)d
```

```
ylim([0 1200000])
hold on
plot (wm,Pmpp,'ro','linewidth',2)
xlabel('Turbine Speed')
ylabel('Mechanical Power')
title('Max Power Point Turbine')
hold on
if j==7
line(MPP(:,1),MPP(:,2),'linewidth',1.3) end
```

B) Fig. 12.1 Shows the output result of MATLAB code

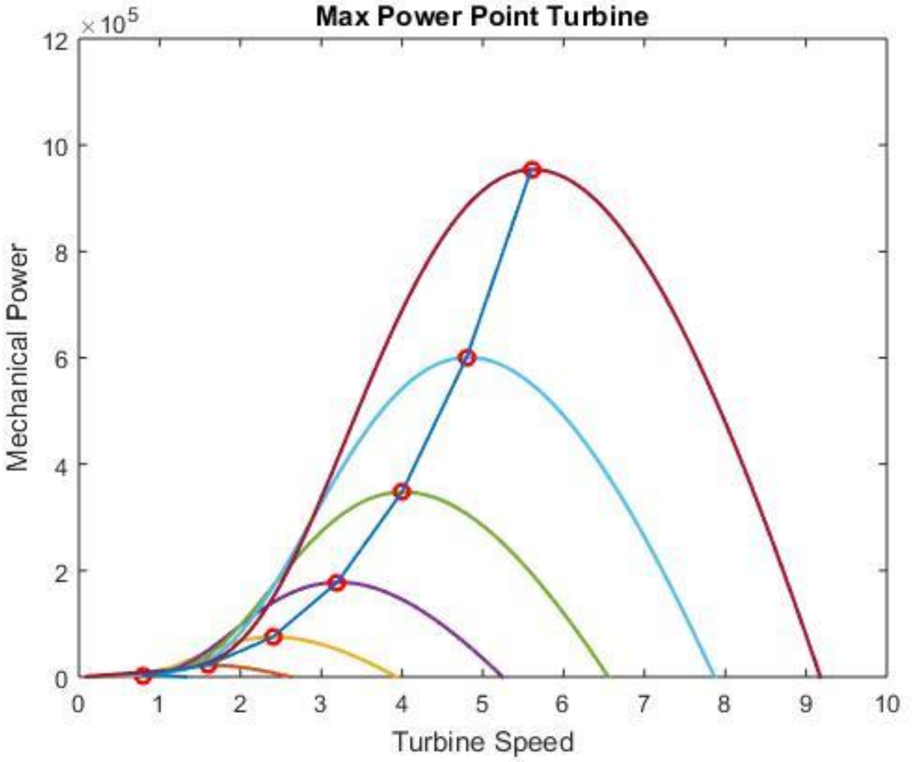


Figure 5.11: Maximum Power Point Turbine

The figures below show more explanation about MATLAB result

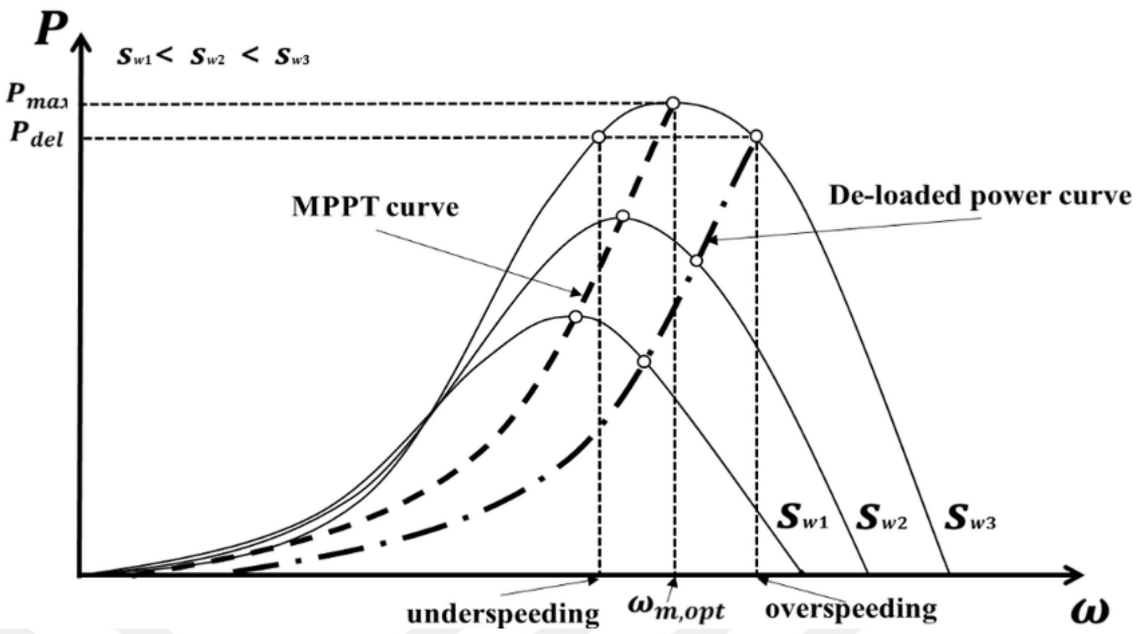


Figure 5.12: De-loaded power curve

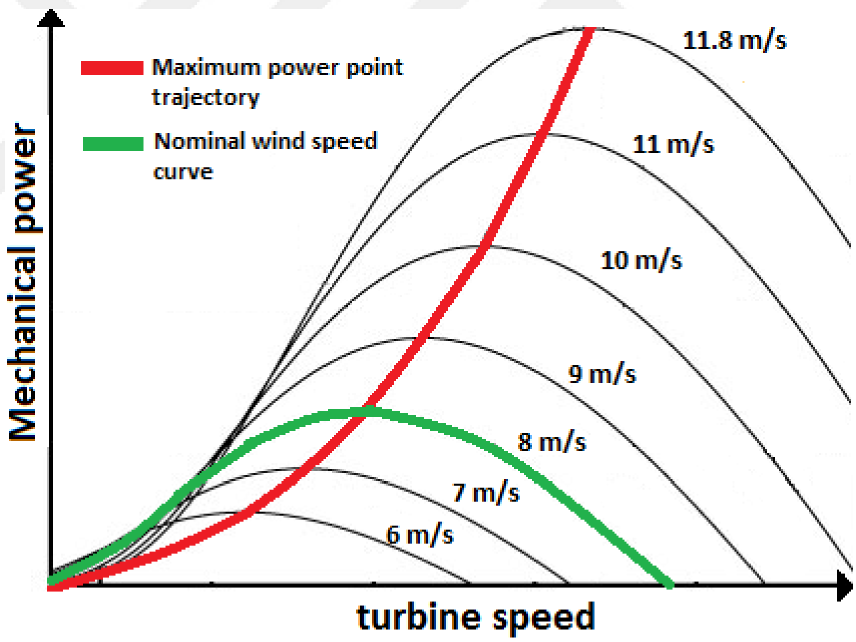


Figure 5.13: Turbine speed

5.4.2 Conclusion

This esteem is ordinarily characterized by the turbine creators, but it is imperative to get it relation between these variables and to utilize the condition to calculate the control at wind speeds other than the evaluated wind speed.

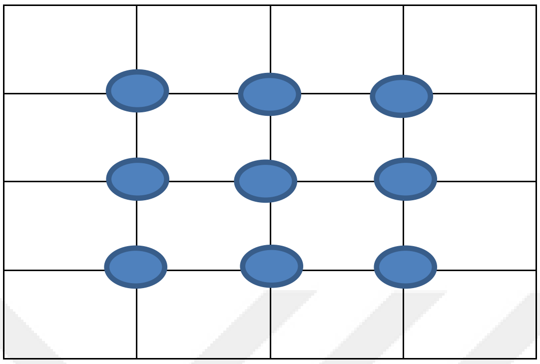


Figure 5.14: Wind Turbine Area Design

5.4.3 Area between turbine (risk area)

Suppose that the available area for wind turbine is about 4 m^2 length 2m and width 2m so area easily 2*2 according to the figure 9 there is about 9 spots that represent wind turbines position

The risk area should be 500m long if we take each 2 squares about 1 unit, so half square represents 500 m between each wind turbine vertically and horizontally there is 500m also between outside area there is 500 m in this case the plugging of turbines are safe.

5.4.4 Is 9 turbines enough or Not

According to calculation done above we need like an average about 2800kva for each town so for 10 town its will be 28000 KVA

28000kva * 0.8 =22400kw

22.4MW

Each turbine supply about 3.6 MW we have 9 turbines

3.6 * 9 =35.1 MW

35.1 – 22.4 = 12.7 MW (excess energy)

1.3 m$ cost for 1 MW

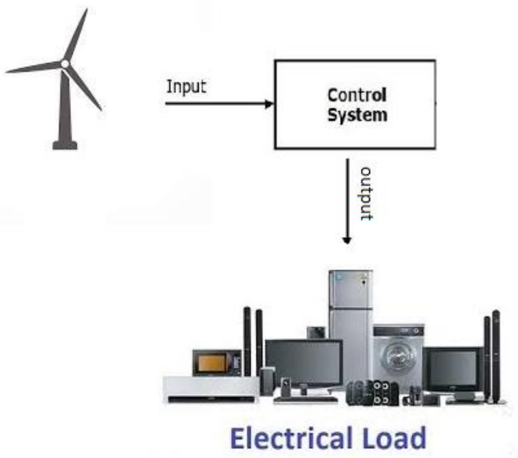
We need 22.4MW its about 29.12M$

Totally with loses and resistance reach 35.1MW approximately 45.36 m$

5.5 Connection turbine through system:

After inserting wind turbines in specific places, we notice there is about 12.7 MW for free this excess energy should be used in transmission line as we know transmission line has resistance and impedance may absorbed few energies on other hand wind turbine truly will connected through a smart grid system this system will control our work briefly. Next step discus how we would use solar cell in our project.

Figure 5.15: Wind turbine connection



Photovoltaics cell

What is the average solar panel size and weight?

The average size of solar panels used to stabilize solar energy on the surface is about

65 inches by 39 inches, or 5.4 feet by 3.25 feet. There's a few distinction between the brand and the brand, and in case you're introducing a large-scale sun based board framework (such as a stockroom or city lobby), your boards will be more than 6 feet long. Each sun oriented board comprises of person PV sun oriented cells. The PV cells come in a standard measure of 156 mm by 156 mm, with a length of around 6 inches and a width of 6 inches. Most sun oriented boards for sun oriented establishments on the surface comprise of 60 sun oriented cells,

whereas the standard for commercial sun oriented establishments is 72 cells (and can reach 98 or more cells).

Solar panel size and weight, residential and commercial panels [table 8]

Table 5.7: Panel Size [15]

FEATURE	RESIDENTIAL PANELS	COMMERCIAL PANELS
Solar Cells number	60	72
Avge. Length (inch)	65	78
Avge. Width (inch)	39	39
Avge. Depth (inch)	1.5 - 2	1.5 - 2

Figure 5.16: Schema of PV Size [15]

5.6 Types of solar panels:

Monocrystalline Silicon

The monocrystalline boards have a uniform appearance which demonstrates the immaculateness of silicon crystals. Monobloc cells are silicon ingots cut into strips. And you'll be able see that the letters of the cells are not bordering and this gives the single plates their unmistakable appearance as shown within the picture. These panels are the foremost costly species Gives productivity up to 22.5% within the research facility, but commercially conveyed cells in 2017 their productivity to not more than 17.5% Its rack life is 25 a long time or more.[9]

Figure 5.17: Monocrystalline PV type.[9]

Polycrystalline Silicon

The distinction between them and monochrome is exceptionally clear in terms of shape within the two pictures, where the cells are squares. Characterized by a lower cost compared to monocytes. Its proficiency is around 16.9% Its rack life is 25 a Its as it were drawback that does not matter to numerous but in some cases considers is that its appearance isn't as stylish as within the case of the wonderful blue streamlined appearance of monocrystalline sun based panels.[9]

Figure 5.18: Polycrystalline PV.[9]

Thin Film

This kind of solar panels is papery and smooth; it is clear in front of all with its idea and trendy in which it is the top of the projects under studying, searching, and development due its streamlined and thickness.

It is muli –useable, in which it may be used in surfaces of boats and transport vehicles , but from the cons of these solar panels that the most expensive kinds of can stay for a life span not exceed 15 years.[20]

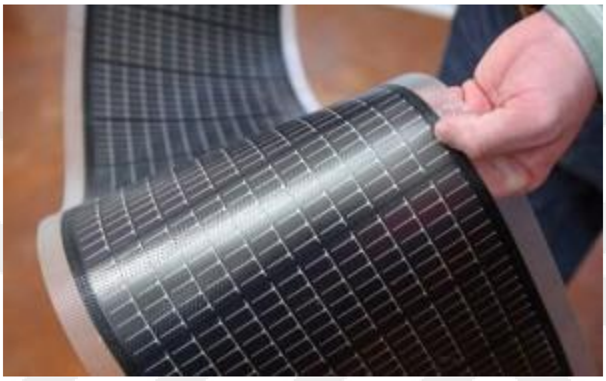


Figure 5.19: Thin PV type.[20]

5.6.1 What is the best type: Mono or Poly panels?

Generate identical electricity! When comparing the output of 100 watts of Mono cells with 100 watts of Poly cells, we find that the generation of electricity is equal. The attempt to differentiate between the productivity of cell types of equal capacity is funny and very naive. Because simply if the factory found the productivity of the cell when the test is more than 100 watts and to be like 105 will be written by 105 immediately to increase his profits and does not give this difference to the consumer free!! If it is not true to the myth that Mono panels produce electricity more identical panel sizes and space saving is very simple when you buy a 250-265 W Poly solar panel from any dealer you will find an area of 99 * 164 cm and when looking for a 270-280 Mono panel Wat Any Place in the world you will find that the area of 99 * 164 cm also !!!! Once again, we challenge anyone who can come to us with a solar panel different from these numbers and the two types are manufactured in identical sizes so that there are standard fixing systems suitable for all models. And the development that occurs over time increases the capacity of the board while maintaining these standard sizes, for example, we find that when the manufacture of cells and a newer model size of the board becomes 97 * 160 instead of 99 * 264. But we find that the size remains constant with evolution, but the ability of modern models 285 watts instead of 250 watts Two years ago, space saving between Mono and Poly comes from commercially abundant panel capabilities on the market. Currently Mono panels are 280 watts in size 99 * 165, while maximum watts in poly panels at the same size = 265 watts. 280-265 / 265 [24]

5.7 Solar Panel Centralizing:

A) Solar Angle Calculator

This solar angle calculator tells you the optimum angle to get the best out of your system. To induce the most excellent out of solar cell, we would like to have to make them facing sun. as an ideal point changes all through a year, by taking into consideration area and season and this calculator appears the distinction in sun stature on a month-by-month premise. We know that sun from shining till growing down is changing in direction so we must know what the best angle is should be placed in order to get long time rays.[34]

Figure 5.20: Solar Angle.[34]

İn this situation I will use online software could be capable to detect angle figure 15 illustrate the best angle may use in specific area where solar panel should be inserted.

Easley type on google solar angle calculate in first box we will choose Lebanon country in second box we will chose TYREE After that the angles will generate automatically as shown in figure 15. This is the best angle may centralize during the whole year 12 month from January until December. This angle generated according to 4 seasons in winter angle is 34 degree the sun in winter has less shining due to winter climate domination while in summer that will be the best time and longest one so in this season, we have full fill in sun

In fig. 20 we can see how to use software in order to get best angle for solar panel during all month in year

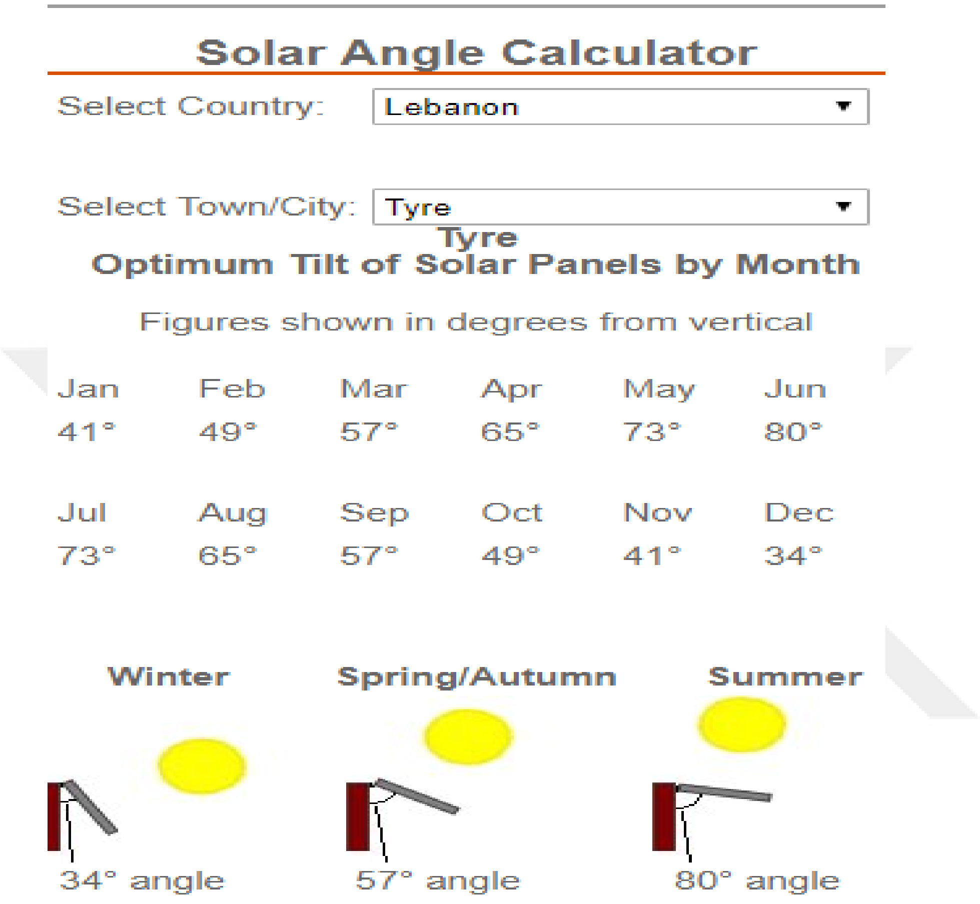


Figure 5.21: Software used. [34]

Solar panel connected through system:

The solar panel deeply connected to the battery through smart grid. In its function the smart grid will send this energy to store in battery. Big battery is attached to the system in order to receive all power sending by solar panel. As we know solar panel generate electricity lower than wind turbine this situation is not bad because the energy stored in battery will use when we need it.

There is a transmission line connect from solar panel to system as well transmission line founded from system to battery as shown in figure below.

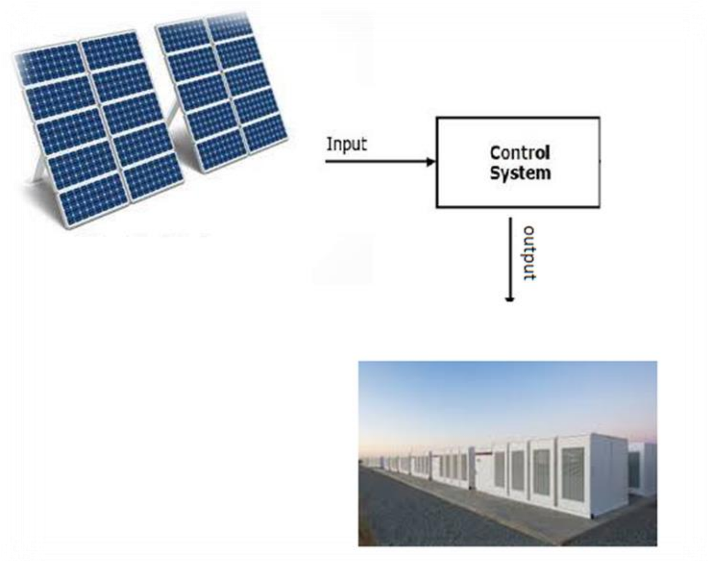


Figure 5.22: Panel Connection

The control system should have a mechanism to get back electricity from battery and supply the loads this mechanism is called inverter that discussed in coming chapters

B) Solar panel inserting:

Figure 16 shows the available area is 1.32 km^2 know how much we can put solar panel in that area? According to table 5 solar panel size is 78 inch length and 39 inch width converting to meter length will be 2m and width 1m. Ignoring the volume Then the area of solar panel 2*1= $2m^2$

$1.32km^2 = 1320000m^2$ let us say 0.32 will use it to be a little space between panels therefore we can use 1000000 m^2 for solar panel.

(it is Not important how much we have solar panel since all these energies will stored and may using later in worst case)The energy generated in solar panel will be directly stored in battery the energy may use in case of less energy in wind turbine generation we can supply the area with energy stored by solar panel in battery

This figure below shows the available area where we can put solar panel

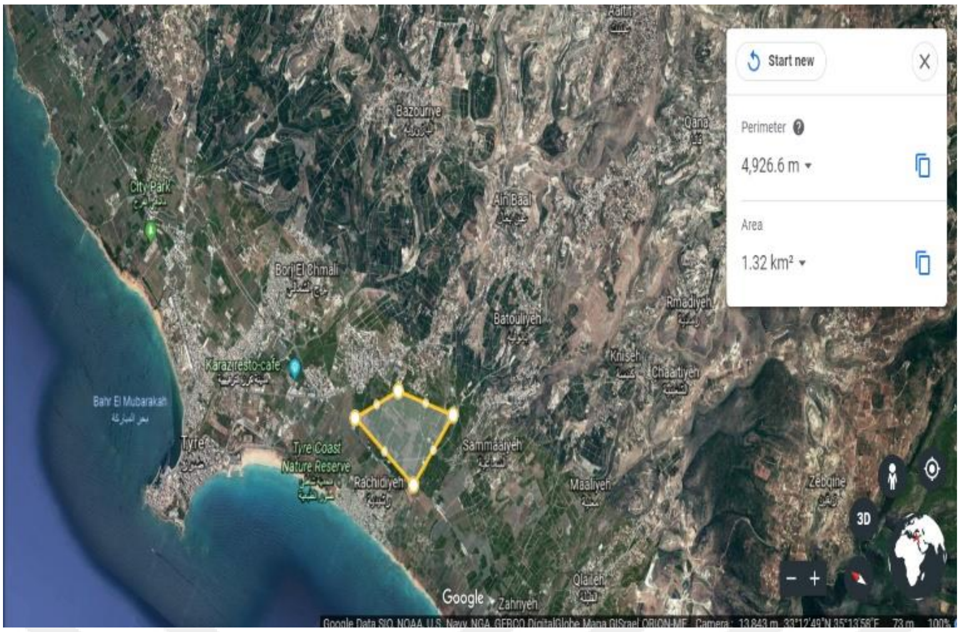


Figure 5.23::Map View PV Area

Beirut, Lebanon — Sunrise, Sunset, and Daylength, September 2019

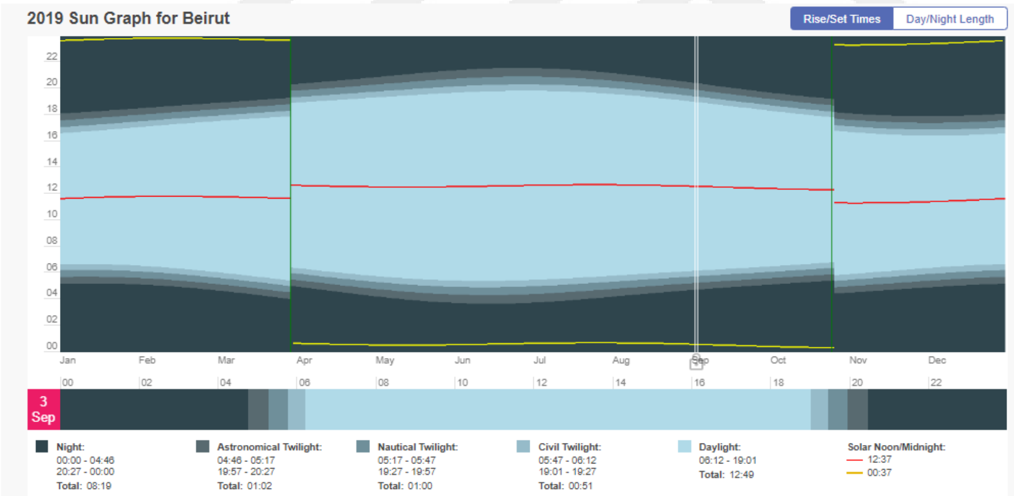


Figure 5.24: Lebanon Sun Shine .[21]

Day night length

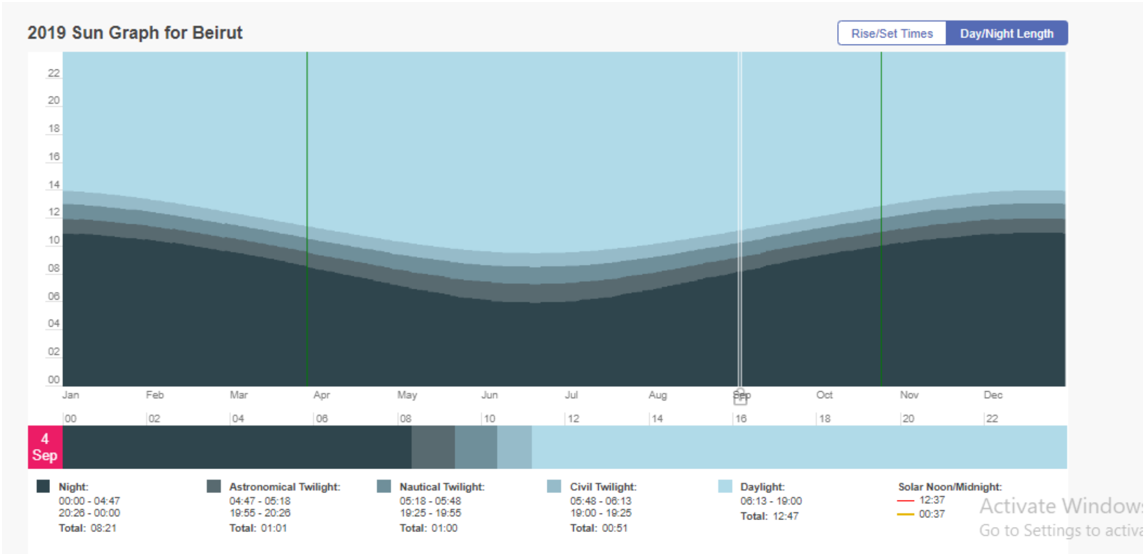


Figure 5.25::Lebanon Day Light [21]

Solar panel cost

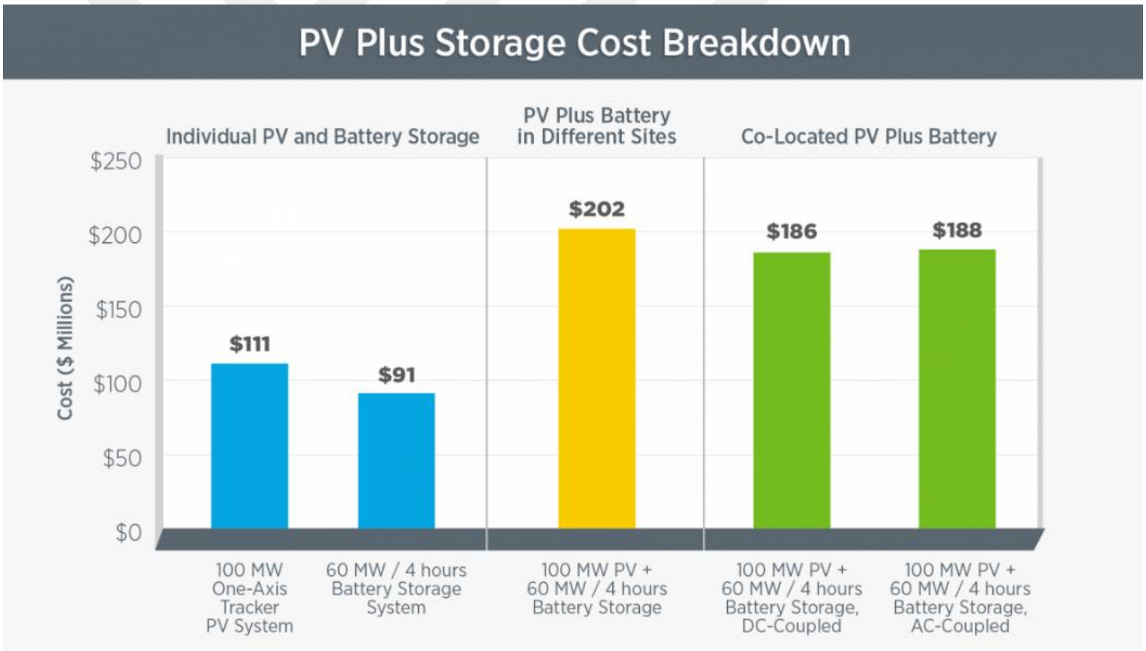


Figure 5.26: PV cost.[20]

Importance of battery:

Superhero battery it is a huge battery use to store energy incase of excess this battery allow to get back AC or DC voltage. This article is the primary in an arrangement examining what battery energy capacity is, how it works, and how it can assist you in your domestic or trade.

Figure 5.27: Battery storage.[18]

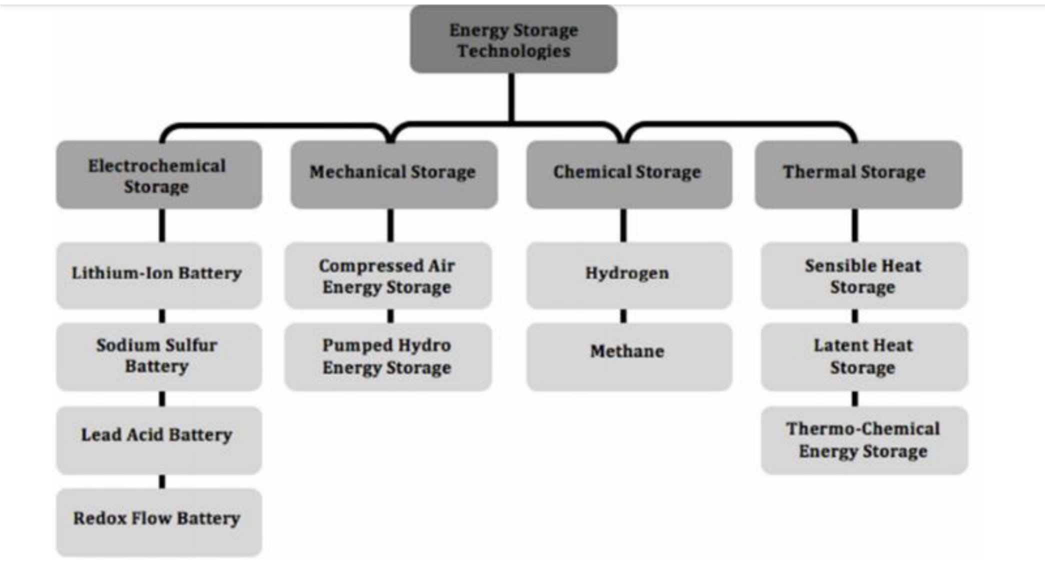


Figure 5.28: Schematic illustration of the four categories and associated EST. [18]

Save more than just power with battery storage:

Sun based battery capacity works by putting away abundance sun powered generation amid the day for utilize at night. Usually more fetched compelling than offering it back to your retailer amid the day at a cheaper rate. On a time of utilize tax, you'll moreover buy lattice control amid cheaper periods, lessening how much you buy amid top periods. Battery systems can also be designed to supply control in an blackout. There are several diverse sorts of capacity frameworks like Crossover inverter, AC Coupled and DC Coupled arrangements. [18]

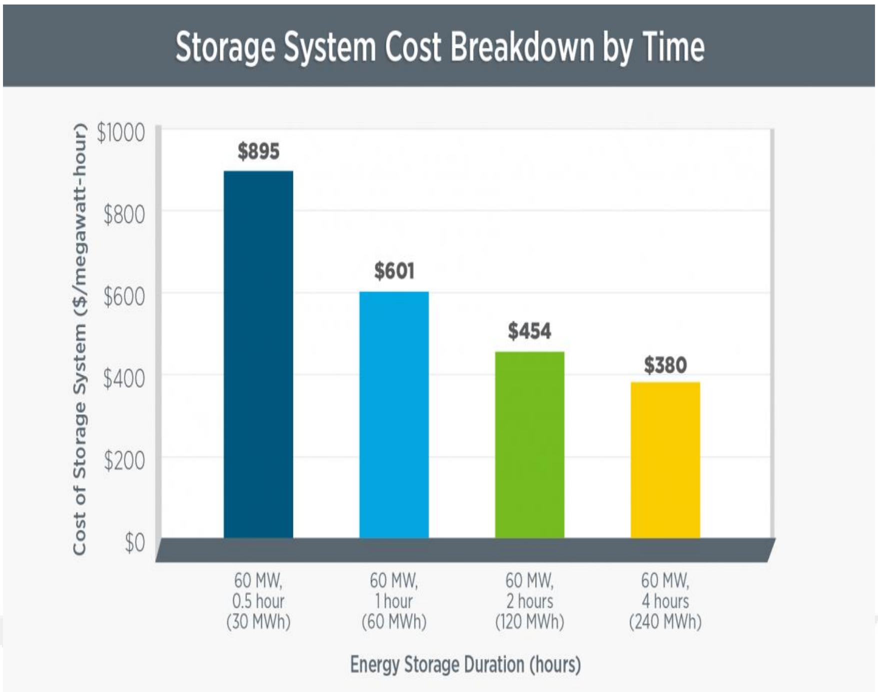


Figure 5.29: Storage system cost .[18]

5.7.1 Hybrid Inverters

- Hybrid inverters are reason built for solar and batteries, giving noteworthy focal points. Crossover inverters are the finest DC and AC arrangements,
- Sometime recently changing over we will store control within the battery it is to AC, sparing on superfluous future changes.
- As is it too AC coupled, you'll still consolidate highlights like battery reinforcement and putting away control amid cheaper times
- All the checking is additionally done from one unit, so you do not get to stress around isolated

oMonitoring bundles for both your capacity and sun-oriented systems.

oWe are presently seeing increasingly of these units as they an awesome fit for inhabitants looking to consolidate sun based and storage.

The framework costs extend from $380 per kWh for those that can give power for 4 hours to $895 per kWh for 30-minute frameworks.[29]

Hybrid inverter placing and connection

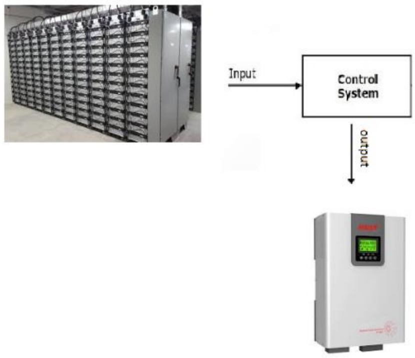


Figure 5.30: inverter connection

5.7.2 Storage capacity

Storage capacity is the sum of vitality extricated from a control plant vitality capacity framework; as a rule measured in joules or kilowatt-hours and their products, it may be given in number of hours of power generation at control plant nameplate capacity; when capacity is of essential sort (i.e., warm or pumped-water), yield is sourced as it were with the control plant inserted capacity framework.[18]

5.8 Simple summaries for work done above:

- Town chosen
- Energy consumption have been calculated
- Knowing how much paying in single one year
- How to decrease energy consumption
- Start using renewable energy
- Wind turbine calculation
- Win turbines area placed
- Wind turbine money cost
- Wind turbine get position
- Photovoltaic cell types
- Choosing best type

- ➢ Battery storage
- ➢ Type of energy storage
- ➢ Inverting method
- ➢ Hybrid inverting

Every calculation needed and data using above is done know how we connect all together to start supply town by energy?

5.8.1 Collecting system:

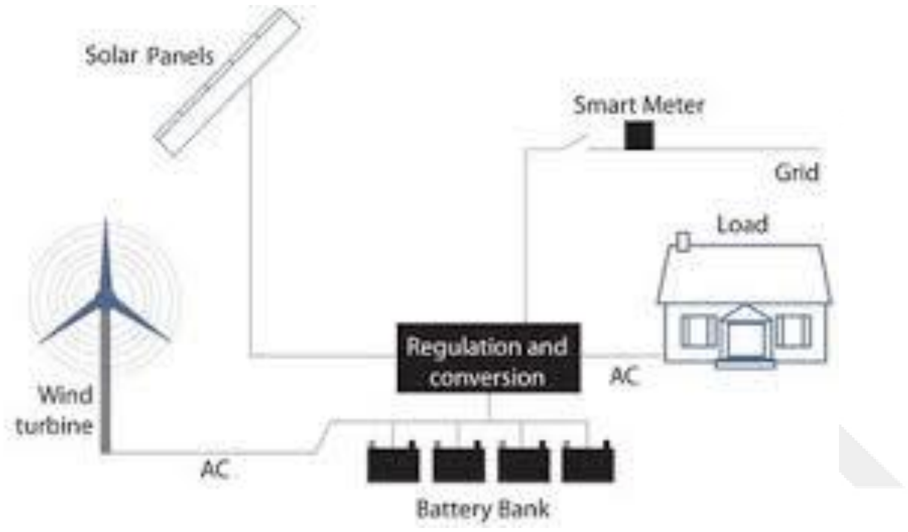


Figure 5.31: Collecting System

Wind turbine, solar panel, battery is connected to the load through smart grid system.

Smart grid system will detect automatically where power is need and directly will supply it even from wind turbine or batteries system is smart that mean all power coming inside it will dissipated to the load progressively and without any error or mistake if the system detect an error he will work shortly to solve the facing problem never forget system has an alarm may inform human being that responsible to monitor the process of electricity distribution

If we had ask how system will deal with DC current we can justify this word by hybrid inverter that have been placed inside the system. Now our system is going to be ready in few steps.

6. SMART GRID SYSTEM:

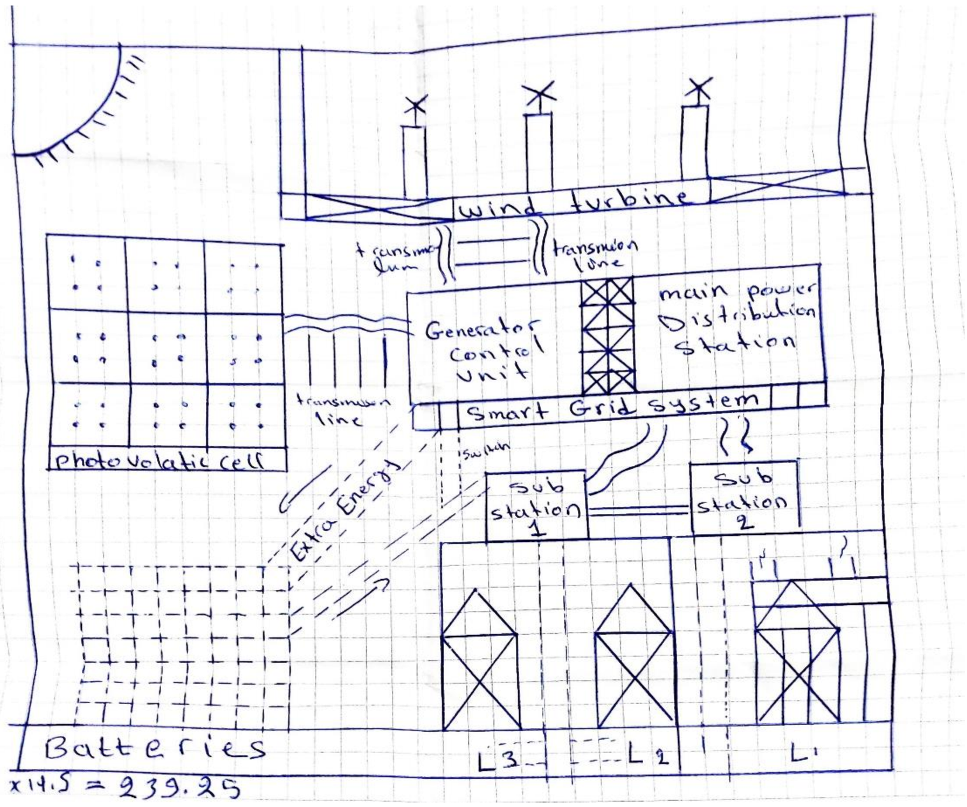


Figure 6.1: System

This system will control every unit starting from turbine till loads.

In this system we have:

- *wind turbine*
- *Photovoltaic cell*
- *Batteries*
- *Loads*
- *Transmission line*
- *Stations*
- *Substation*

- *Grid system*
- *Main controller*

6.1 How system work?

Smart grid system in first stage consist of generator control unit and main power distribution stations.

Wind turbines are connected to the system by transmission line as well photovoltaic cell also connected to system through transmission line, energy get in know the energy needed will pass through main power distribution station this station or main station will dissipate energy to substation that really connected by transmission line.

Substation 1 will supply simple loads such as houses on contrary substation 2 will supply the huge loads such as manufacturing and workshop that need more and more energy on other hand these two-station connected, may this connection used if some problem gets up in order to have more choices.

6.2 Dealing with extra energy

Undoubtedly there is excess energy from all sources This energy can be stored in batteries by means of transmission lines. On the other hand, the batteries are connected to the smart grid in both cases.

When it is noticed that there is a shortage of energy, the system will accelerate the supply of loads by recovering the energy stored inside the batteries by a Hybrid Inverter.

Taking into consideration we may face technical problem in system, or some devices stop working indeed the smart grid system will start automatically to solve that problem in case that problem is software problem.[17]

6.3 MATLAB Simulation

A) 1st Input: Identifying Torque

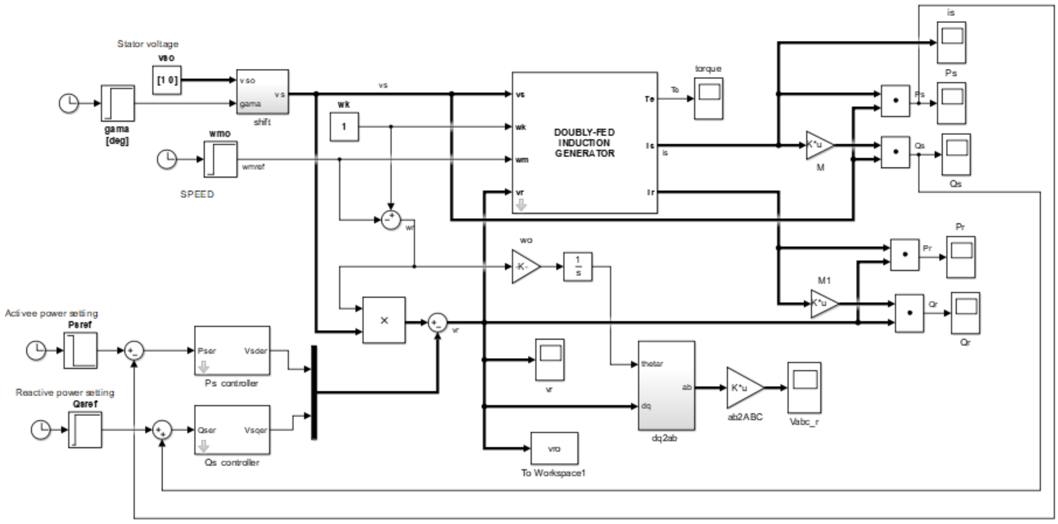


Figure 6.2: Matlab simulation to identify turbine torque

$$d\omega r/dt=2Pa/(J\ \omega r) \qquad \textbf{(6.1)}$$

where J is the moment of inertia due to the rotating mass and Pa is the rotor accelerate mechanical power. The angular velocity of the rotor is considered in the region $0.7\omega \leq \omega r \leq 1.3\omega$ for the case study. The doubly fed induction generator equations, using the motor convention, are the following

$$d\ \lambda ds\ /dt = uds-Rsids+\ \omega\lambda qs \qquad \textbf{(6.2)}$$

$$d\ \lambda qs\ /dt = uqs-Rsiqs+\ \omega\lambda ds \qquad \textbf{(6.3)}$$

$$d\ \lambda dr/dt = udr-Rridr+s\omega\lambda qr \qquad \textbf{(6.4)}$$

$$d\ \lambda qr/dt = uqr-Rriqr-s\omega\lambda dr \qquad \textbf{(6.5)}$$

The stator electric values are indicated by the subscript s and the rotor electric values are indicated by the subscript r. u is a voltage, R is a resistance, i is a current, λ is a flux linkage. ω is the stator electrical frequency and s is the rotor slip. The flux linkages are given by

$$\lambda ds= Lsids +M\ idr \qquad \textbf{(6.6)}$$

$$\lambda qs= Lsiqs +M\ iqr \qquad \textbf{(6.7)}$$

$$\lambda dr= Lridr +M\ ids \qquad \textbf{(6.8)}$$

$$\lambda qr= Lriqr +M\ iqs \qquad \textbf{(6.9)}$$

Ls , Lr and M are respectively the stator and the rotor leakage inductance and the mutual inductance between the stator and the rotor. The stator and rotor active and reactive are given by

$$Ps=3/2(udsids +uqsiqs) \quad \textbf{(6.10)}$$

$$Pr=3/2(udridr +uqriqr) \quad \textbf{(6.11)}$$

$$Qr=3/2(udriqr -uqridr) \quad \textbf{(6.12)}$$

$$Qs=3/2(udsiqs -uqsids) \quad \textbf{(6.13)}$$

The rotor accelerate mechanical power, the rotor electric power and the stator electric power

$$Pa=PS-Pm-Pr \quad \textbf{(6.14)}$$

$$Pr=Pm[s/(1-s)] \quad \textbf{(6.15)}$$

$$Ps=Pm[1/(1-s)] \quad \textbf{(6.16)}$$

Output : This result shows the curve of torque and stator current**:**

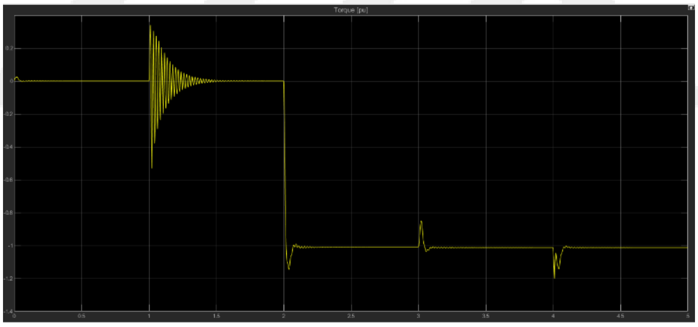


Figure 6.3: Torque

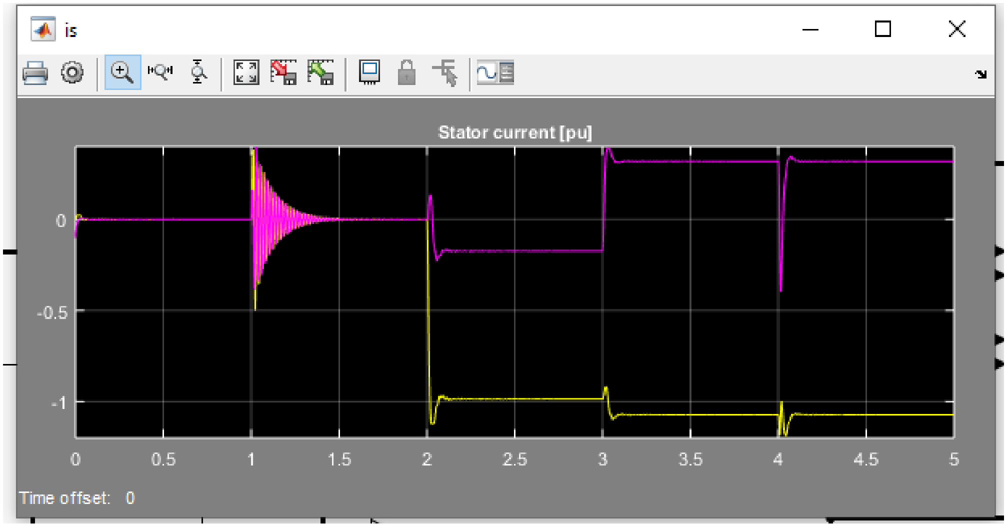


Figure 6.4: Stator Current Fluctuation

B) 2nd Input

This simulation allow us to get wind turbine mode its consist of subsystems connecting together to have the main system.

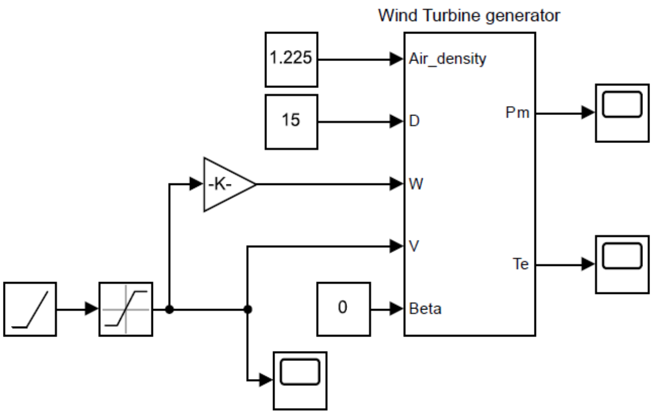


Figure 6.5: Turbine Generator

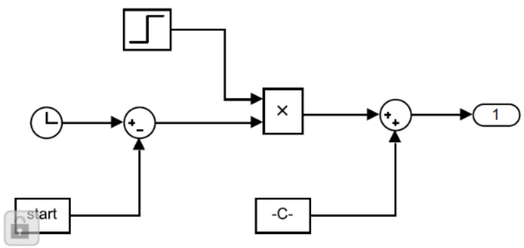


Figure 6.6: Wind turbine mod/Ramp

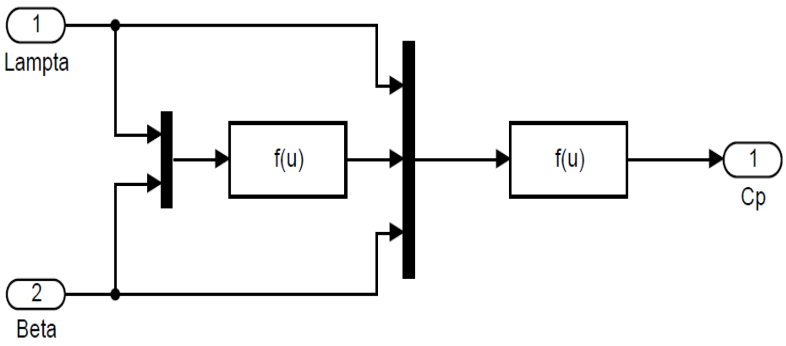


Figure 6.7:power coefficient

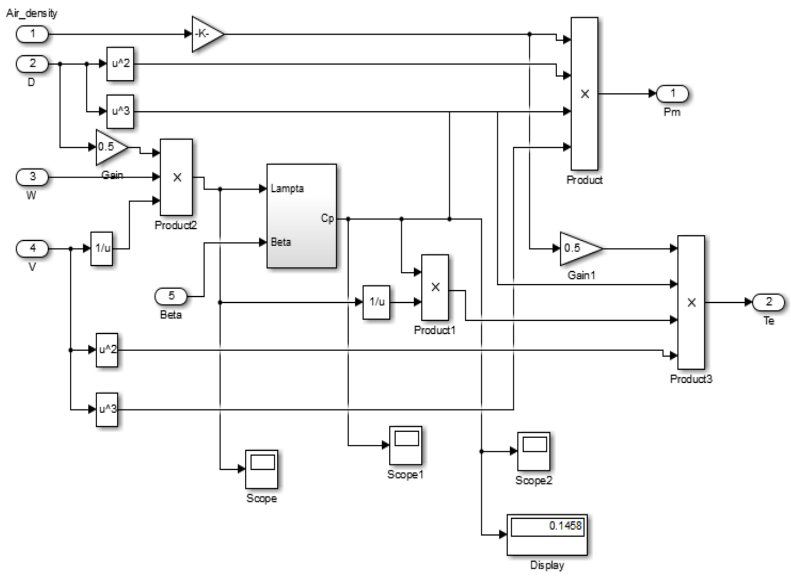


Figure 6.8: Wind turbine mod / Wind Turbine generator

The turbine model is based on the following ,the mechanical Power of the turbine :

$$Pm=\frac{1}{8} * \rho*\pi*D^2*v^3*c_p(\beta, \lambda) \qquad \textbf{(6.17)}$$

λ is the tip speed ratio, β is the pitch angle of rotor blades, ω m is the mechanical angular speed.

Where ρ is the air density, D is the diameter of the blades, v is the wind speed, p c is the power coefficient, we consider it given by

$$C_p(\beta, \lambda)=0.73(\frac{15}{\lambda} - 0.002\beta - 13.2)*e^{-18.4\lambda} \tag{6.18}$$

$$\lambda= \frac{1}{\frac{1}{(\lambda+0.08\beta)}-\frac{1}{(\beta3+1)}}$$

$$\lambda=\frac{D*\omega r}{2v} \tag{6.19}$$

Output:

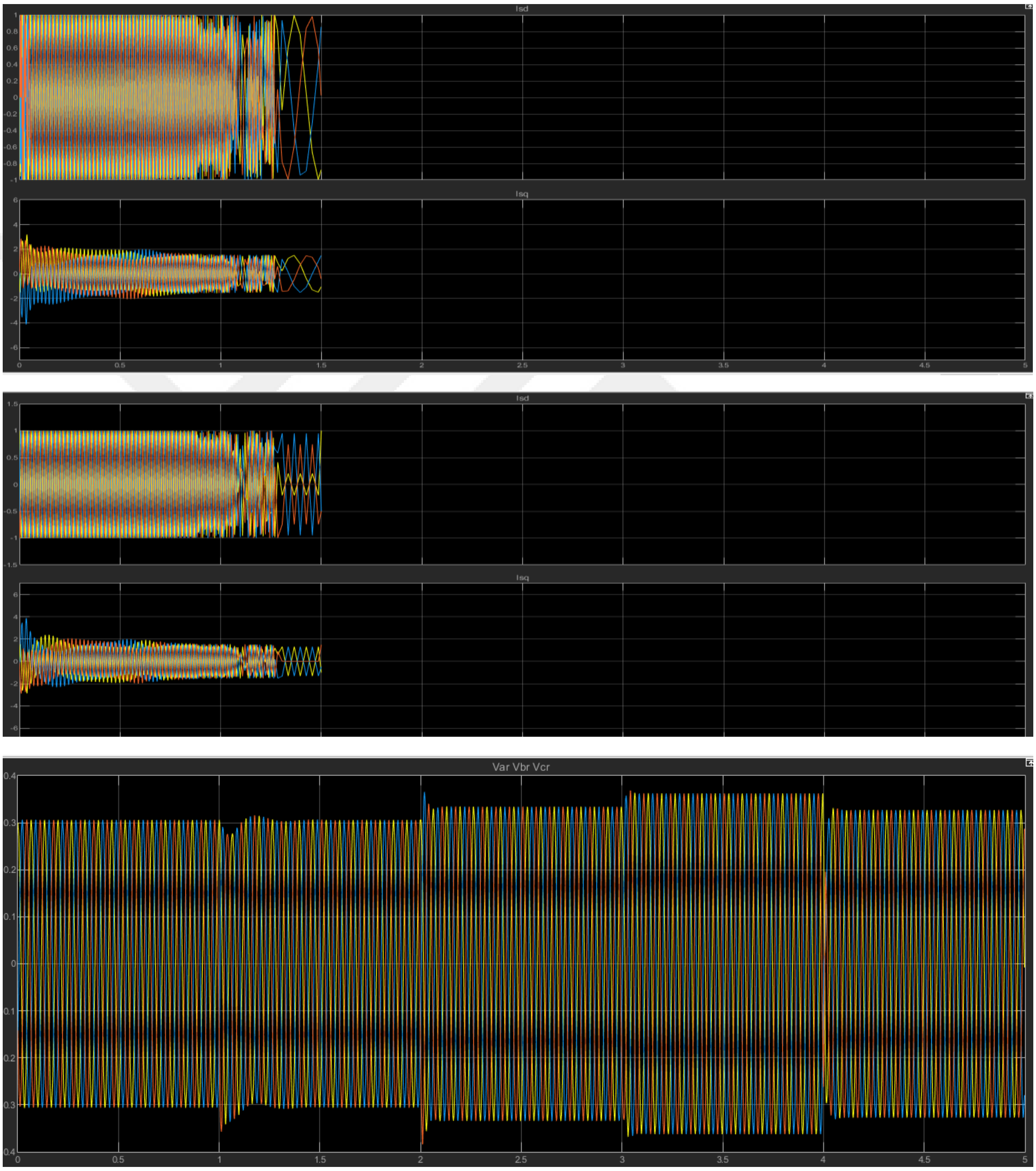


Figure 6.9: Mechanical speed

6.4 MATLAB Glossary:

Atomic Subsystem. A subsystem treated as a unit by an implementation of the design

documented in this report. The implementation computes the outputs of all the blocks in the atomic subsystem before computing the next block in the parent system's block execution order (sorted list).

Block Diagram. A Simulink block diagram represents a set of simultaneous equations that relate a system or subsystem's inputs to its outputs as a function of time. Each block in the diagram represents an equation of the form y = f(t, x, u) where t is the current time, u is a block input, y is a block output, and x is a system state (see the Simulink documentation for information on the functions represented by the various types of blocks that make up the diagram). Lines connecting the blocks represent dependencies among the blocks, i.e., inputs whose current values are the outputs of other blocks. An implementation of a design described in this document computes a

root or atomic system's outputs at each time step by computing the outputs of the blocks in an order determined by block input/output dependencies.

Block Parameter. A variable that determines the output of a block along with its inputs, for example, the gain parameter of a Gain block.

Block Execution Order. The order in which Simulink evaluates blocks during simulation of a model. The block execution order determined by Simulink ensures that a block executes only after all blocks on whose outputs it depends are executed.

Checksum. A number that indicates whether different versions of a model or atomic subsystem differ functionally or only cosmetically. Different checksums for different versions of the same model or subsystem indicate that the versions differ functionally.

Design Variable. A symbolic (MATLAB) variable or expression used as the value of a block parameter. Design variables allow the behavior of the model to be altered by altering the value of the design variable.

Signal. A block output, so-called because block outputs typically vary with time.

Virtual Subsystem. A subsystem that is purely graphical, i.e., is intended to reduce the visual complexity of the block diagram of which it is a subsystem. An implementation of the design treats the blocks in the subsystem as part of the first nonvirtual ancestor of the virtual subsystem

(see Atomic Subsystem).

6.5 MATLAB Report Overview

This report describes the design of the windturbinemod system. The report was generated automatically from a Simulink model used to validate the design. It contains the following sections:

Model Version. Specifies information about the version of the model from which this design description was generated. Includes the model checksum, a number that indicates whether different versions of the model differ functionally or only cosmetically. Different checksums for different versions indicate that the versions differ functionally.

Root System. Describes the design's root system.

Subsystems. Describes each of the design's subsystems.

Design Variables. Describes system design variables, i.e., MATLAB variables and expressions used as block parameter values.

System Model Configuration. Lists the configuration parameters, e.g., start and stop time, of the model used to simulate the system described by this report.

Requirements. Shows design requirements associated with elements of the design model. This section appears only if the design model contains requirements links.

Glossary. Defines Simulink terms used in this report.

Root System Description

This section describes a design's root system. It contains the following sections:

Diagram. Simulink block diagram that represents the algorithm used to compute the root system's outputs.

Description. Description of the root system. This section appears only if the model's root system has a Documentation property or a Doc block.

Interface. Name, data type, width, and other properties of the root system's input and output signals. The number of the block port that outputs the signal appears in angle brackets appended to the signal name. This section appears only if the root system has input or output ports.

Blocks. This section has two subsections:

Parameters. Describes key parameters of blocks in the root system. This section also includes graphical and/or tabular representations of lookup table data used by lookup table blocks, i.e., blocks that use lookup tables to compute their outputs.

Block Execution Order. Order in which blocks must be executed at each time step in order to ensure that each block's inputs are available when it executes.

State Charts. Describes state charts used in the root system. This section appears only if the root system contains State flow blocks.

Subsystem Descriptions

This section describes a design's subsystems. Each subsystem description contains the following sections:

Diagram. Simulink block diagram that graphically represents the algorithm used to compute the subsystem's outputs.

Description. Description of the subsystem. This section appears only if the subsystem has a Documentation property or contains a Doc block.

Interface. Name, data type, width, and other properties of the subsystem's input and output signals. The number of the block port that outputs the signal appears in angle brackets appended to the signal name. This section appears only if the subsystem is atomic and has input or output ports.

Blocks. Blocks that this subsystem contains. This section has two subsections:

• **Parameters.** Key parameters of blocks in the subsystem. This section also includes graphical and/or tabular representations of lookup table data used by lookup table blocks, blocks that use lookup tables to compute their outputs.

• **Block Execution Order.** Order in which the subsystem's blocks must be executed at each time step in order to ensure that each block's inputs are available when the block executes .This section appears only if the subsystem is atomic. Note: in Acrobat(PDF) reports, the number in square brackets next to the block name is a hyperlink to the block parameter table. The number has no model significance.

State Charts. Describes state charts used in the subsystem. This section appears only if the root system contains Stateflow blocks.

State Chart Descriptions

This section describes the state machines used by Stateflow blocks to compute their outputs, i.e., Stateflow blocks. Each state machine description contains the following sections:

Chart. Diagram representing the state machine.

States. Describes the state machine's states. Each state description includes the state's diagram and diagrams and/or descriptions of graphical functions, Simulink functions, truth tables, and MATLAB functions parented by the state.

44 Chapter 8. About this Report

Transitions. Transitions between the state machine's states. Each transition description specifies the values of key transition properties. Appears only if a transition has properties that do not appear on the chart.

Junctions. Transition junctions. Each junction description specifies the values of key junction properties. Appears only if a junction has properties that do not appear on the chart.

Events. Events that trigger state transitions. Each event description specifies the values of key event properties.

Data. Data types and other properties of the State flow block's inputs, outputs, and other state machine data.

Targets. Executable implementations of the state machine used to compute the outputs of the corresponding State flow block.

MATLAB Supporting Functions. List of functions invoked by MATLAB functions defined in the chart.

7. RESULT

7.1 Future of Country

In the earlier sections we've calculated bill payments by home. The smallest home paying about 385 dollar per month in contrary the biggest one paid about 6500 per month that would be workshop or manufacturing the total payments was $50.586*10^6$ dollar per year for whole city or bounded region. After inserting turbines, solar panel and battery connected through grid system we will pay nothing per month because the using of fossil fuel is ignored. Without paying money for power and energy it makes no sense so a little payment should be collected by government or turbines owners this payment will be helpful for repairing wind turbine since bad effects could be occur also wind turbines need to monitor 1 time per month at least. The annual payments coms to wind turbine price that allow to go ahead and build turbines through all Lebanon.

By saving this amount of money annually the economy will be raised and improved by the time all these results and money saving will be reflect positively to people living there.

Using smart electronic devices that have been explained in section 5.2 also revels more advantages to the country city center will grow up government will start to build more and more stations of REr.

In the future may be water turbine will used since Lebanon country contains a river this river passing through all Lebanon its make sense to thing about new idea to reduce generators that works on diesel.

After building this station the education will encourage students to get more information about using renewable energy resources and providing needed material for those want to study power engineering to increase in economy.

7.2 Short comparison

The Table below summaries the result by comparing before using rer and after:

Table 7.1: Short Comparison before And after

Befor using REr	After using REr
Payment for fuel	No payment just for repairing
Environmental pollution	There is no any pollutions
Acoustic noise	Fare places less Acoustic noise
Water, soil could be polluted by fuel	No fuel to effect
Uneconomical	Economical
Finite	Infinite
Unhealthy	Healthy
Undeveloped	Available to develop
Dependent of money	Independent
Bad view	Nice view
Effect on climate	Dose not effect on climate
Bade ozone layer	Good for ozone layer
Increase global warming	No global warming
Huge material	Could made by simple material

8. CONCLUSION

The renewable energy is critically beneficial increasingly over the world. According to this thesis , regarding the financial problem, Lebanon directed to the renewable energy in which it costed it too much , and the states this project costed it about $51 million .

After comparing the result between Canada homes and TYRE homes we can find in Canada he less payment on electricity bills is due to usage of renewable energy resources such as wind turbine while in TYRE city the energy is very expensive that the reason why we did this planning n order to decrease electricity bill by using renewable energy resources our project for planning power system depending on renewable energy resource benefits TYRE and Lebanon in all direction such as economic, health, environment, and so on.

Generally, the renewable energy provides approximately 20% of the power consumed around the world

Most researches in sciences and innovations deal closely with the renewable energy and its effect, role, and significance. Concurring to the report of the (IPCC) in 2011, renewable sources possessed around 13 percent of the world's energy in 2008 and it is in continuous increasing. Also, in the last four decades the renewable energy formed 80% of the whole world energy. Moreover, the combination of the types of renewable energy to gather makes a great difference in the world.

Due to many studies, but 2050 the estimated geothermal energy forms 3% of the worldwide power, also 5% of the worldwide warm request, while the hydropower form 30% from the world power supply, and the wind form approximately an increasing 20% finally the sun energy supply around 15 %.

Obviously, especially in the last decades the renewable energy stared to formulate a basic stone to the continuity of the life and environment in this planet. İt has significance role in saving the environment, due to its positive effect on the degree of pollution in which in its turn decrease the pollution and confirmation in all its types. Moreover, it decreases the level of global warming, also minimizes the diseases and let people live a healthy life free from anything disturbs this life.

App A: MATLAB key

RTPrefix error
ConsistencyChecking none
ArrayBoundsChecking none
SignalInfNanChecking none
StringTruncationChecking error
SignalRangeChecking none
ReadBeforeWriteMsg UseLocalSettings
WriteAfterWriteMsg UseLocalSettings
WriteAfterReadMsg UseLocalSettings
AlgebraicLoopMsg warning
ArtificialAlgebraicLoopMsg warning
SaveWithDisabledLinksMsg warning
SaveWithParameterizedLinksMsg none
CheckSSInitialOutputMsg on
UnderspecifiedInitializationDetection Classic
MergeDetectMultiDrivingBlocksExec none
CheckExecutionContextRuntimeOutputMsg off
SignalResolutionControl TryResolveAllWithWarning
BlockPriorityViolationMsg warning
MinStepSizeMsg warning
TimeAdjustmentMsg none
MaxConsecutiveZCsMsg error
MaskedZcDiagnostic warning
IgnoredZcDiagnostic warning
SolverPrmCheckMsg warning
InheritedTsInSrcMsg warning
MultiTaskDSMMsg warning
MultiTaskCondExecSysMsg none
MultiTaskRateTransMsg error
SingleTaskRateTransMsg none
TasksWithSamePriorityMsg warning
SigSpecEnsureSampleTimeMsg warning
CheckMatrixSingularityMsg none
IntegerOverflowMsg warning
Int32ToFloatConvMsg warning
ParameterDowncastMsg error
ParameterOverflowMsg error
ParameterUnderflowMsg none
ParameterPrecisionLossMsg warning
ParameterTunabilityLossMsg warning
FixptConstUnderflowMsg none
FixptConstOverflowMsg none
FixptConstPrecisionLossMsg none
UnderSpecifiedDataTypeMsg none
UnnecessaryDatatypeConvMsg none
VectorMatrixConversionMsg none
InvalidFcnCallConnMsg error
FcnCallInpInsideContextMsg warning
SignalLabelMismatchMsg none
UnconnectedInputMsg warning
UnconnectedOutputMsg warning
UnconnectedLineMsg warning
UseOnlyExistingSharedCode error
SFcnCompatibilityMsg none
FrameProcessingCompatibilityMsg error
UniqueDataStoreMsg none
BusObjectLabelMismatch warning
RootOutportRequireBusObject warning
AssertControl UseLocalSettings
EnableOverflowDetection off
AllowSymbolicDim on
ModelReferenceIOMsg none
ModelReferenceVersionMismatchMessage none
ModelReferenceIOMismatchMessage none
ModelReferenceCSMismatchMessage none
ModelReferenceSimTargetVerbose off
UnknownTsInhSupMsg warning
ModelReferenceDataLoggingMessage warning
ModelReferenceSymbolNameMessage warning
ModelReferenceExtraNoncontSigs error
StateNameClashWarn warning

SimStateInterfaceChecksumMismatchMsg warning
SimStateOlderReleaseMsg error
InitInArrayFormatMsg warning
StrictBusMsg ErrorLevel1
BusNameAdapt WarnAndRepair
NonBusSignalsTreatedAsBus none
SFUnusedDataAndEventsDiag warning
SFUnexpectedBacktrackingDiag warning
SFInvalidInputDataAccessInChartInitDiag warning
SFNoUnconditionalDefaultTransitionDiag warning
SFTransitionOutsideNaturalParentDiag warning
SFUnconditionalTransitionShadowingDiag warning
SFUnreachableExecutionPathDiag warning
SFUndirectedBroadcastEventsDiag warning
SFTransitionActionBeforeConditionDiag warning
SFOutputUsedAsStateInMooreChartDiag error
SFTemporalDelaySmallerThanSampleTimeDiag warning
SFUnconditionalPathOutOfParentDiag warning
SFSelfTransitionDiag warning
SFExecutionAtInitializationDiag none
SFMachineParentedDataDiag warning
SFUnreachableStateOrJunctionDiag warning
SFDanglingTransitionDiag warning
IntegerSaturationMsg warning
AllowedUnitSystems all
UnitsInconsistencyMsg warning
Property Value
Name Hardware Implementation
Description
Components
ProdBitPerChar 8
ProdBitPerShort 16
ProdBitPerInt 32
ProdBitPerLong 32
ProdBitPerLongLong 64
ProdBitPerFloat 32
ProdBitPerDouble 64
ProdBitPerPointer 32
ProdBitPerSizeT 32
ProdBitPerPtrDiffT 32
ProdLargestAtomicInteger Char
ProdLargestAtomicFloat None
ProdIntDivRoundTo Undefined
ProdEndianess Unspecified
ProdWordSize 32
ProdShiftRightIntArith on
ProdLongLongMode off
ProdHWDeviceType 32-bit Generic
TargetBitPerChar 8
TargetBitPerShort 16
TargetBitPerInt 32
TargetBitPerLong 32
TargetBitPerLongLong 64
TargetBitPerFloat 32
TargetBitPerDouble 64
TargetBitPerPointer 32
TargetBitPerSizeT 32
TargetBitPerPtrDiffT 32
TargetLargestAtomicInteger Char
TargetLargestAtomicFloat None
TargetShiftRightIntArith on
TargetLongLongMode off
TargetIntDivRoundTo Undefined
TargetEndianess Unspecified
TargetWordSize 32
TargetPreprocMaxBitsSint 32
TargetPreprocMaxBitsUint 32
TargetHWDeviceType Specified
TargetUnknown off
DenormalBehavior Default
ProdEqTarget on
UseEmbeddedCoderFeatures on
UseSimulinkCoderFeatures on
Name Model Referencing
Description
Components
UpdateModelReferenceTargets IfOutOfDateOrStructuralChange
SkipRefExpFcnMdlSchedulingOrderCheck off
EnableRefExpFcnMdlSchedulingChecks on
CheckModelReferenceTargetMessage error
SFSimEnableDebug off

SFSimOverflowDetect
ion on
SFSimEcho on
SimBlas on
SimCtrlC on
SimExtrinsic on
SimIntegrity on
SimUseLocalCustomC
ode off
SimParseCustomCode
on
SimAnalyzeCustomCo
de off
SimBuildMode
sf_incremental_build
SimDataInitializer
SimGenImportedType
Defs off
CompileTimeRecursio
nLimit 50
EnableRuntimeRecursi
on on
MATLABDynamicMe
mAlloc on
MATLABDynamicMe
mAllocThreshold
65536
CustomSymbolStrEM
XArray nothing
CustomSymbolStrEM
XArrayFcn nothing
EnableParallelModelR
eferenceBuilds off
ParallelModelReferenc
eErrorOnInvalidPool
on
ParallelModelReferenc
eMATLABWorkerInit
None
ModelReferenceNumI
nstancesAllowed Multi
PropagateVarSize Infer
from blocks in model
ModelDependencies
ModelReferencePassR
ootInputsByReference
on
ModelReferenceMinAl
gLoopOccurrences off

PropagateSignalLabels
OutOfModel off
Name Code
Generation
SystemTargetFile
grt.tlc
HardwareBoard None
TLCOptions
CodeGenDirectory
GenCodeOnly off
MakeCommand
make_rtw
GenerateMakefile on
PackageGeneratedCod
eAndArtifacts off
PackageName
TemplateMakefile
grt_default_tmf
PostCodeGenComman
d
Description
GenerateReport off
SaveLog off
RTWVerbose on
RetainRTWFile off
ProfileTLC off
TLCDebug off
TLCCoverage off
TLCAssert off
ProcessScriptMode
Default
ConfigurationMode
Optimized
ProcessScript
ConfigurationScript
ConfigAtBuild off
RTWUseLocalCustom
Code off
RTWUseSimCustomC
ode off
SILDebugging off
TargetLang C
IncludeERTFirstTime
off
GenerateTraceInfo off
GenerateTraceReport
off
CombineOutputUpdate
Fcns off

CombineSignalStateStr
ucts off
GroupInternalDataByF
unction off
SuppressErrorStatus
off
ERTFirstTimeComplia
nt off
IncludeFileDelimiter
Auto
ERTCustomFileBanne
rs off
SupportAbsoluteTime
on
LogVarNameModifier
rt_
MatFileLogging on
MultiInstanceERTCod
e off
CodeInterfacePackagin
g Nonreusable function
PurelyIntegerCode off
SupportNonFinite on
SupportComplex on
SupportContinuousTi
me on
SupportNonInlinedSFc
ns on
RemoveDisableFunc
off
RemoveResetFunc off
SupportVariableSizeSi
gnals off
ParenthesesLevel
Nominal
CastingMode Nominal
PreserveStateflowLoca
lDataDimensions off
GenerateClassInterface
off
ModelStepFunctionPro
totypeControlComplia
nt off
CPPClassGenComplia
nt on
GRTInterface on
GenerateAllocFcn off
UseToolchainInfoCom
pliant on

GenerateSharedConstants on
LUTObjectStructOrderExplicitValues
Size,Breakpoints,Table
LUTObjectStructOrderEvenSpacing
Size,Breakpoints,Table
ArrayLayout Column-major
UnsupportedSFcnMsg error
ERTHeaderFileRootName RE
ERTSourceFileRootName RE
ERTDataFileRootName $R_data
ExtMode off
GenerateTraceReportSl off
GenerateTraceReportSf off
GenerateTraceReportEml off
GenerateCodeInfo off
GenerateWebview off
GenerateCodeMetricsReport off
GenerateCodeReplacementReport off
RTWCompilerOptimization off
CovBoundaryAbsTol 1.0000e-05
CovBoundaryRelTol 0.0100
CovUseTimeInterval off
CovStartTime 0
CovStopTime 0
CovMetricStructuralLevel Decision
CovMetricLookupTable off
CovMetricSignalRange off
CovMetricSignalSize off

REFERENCESS

[1] Wind Turbine Power Calculations RWE power renewables Mechanical and Electrical Engineering Power Industry

[2] http://www.gantechs.com/2018/09/what-is-smart-grid-.html

[3] Doetsch, Christian (November 6, 2014). "Electric Storage Devices – "Definition" of Storage Capacity, Power, Efficiency" (PDF). www.iea-eces.org. Archived from the original(PDF) on February 13, 2017. Retrieved February 13, 2017.

[4] https://mitpress.mit.edu/books/energy-and-civilization

[5] https://www.thenational.ae/world/mena/lebanon-minister-hopeful-about-plan-for-24-7-electricity-by-next-year-1.848562

[6] https://en.wikipedia.org/wiki/Smart_grid

[7] Lundin, Barbara (January 24, 2012). "Honeywell builds on smart grid success in England". Fierce Smart Grid. Retrieved March 7, 2012.

[8] https://www.reuters.com/article/us-lebanon-economy-electricity/fixing-lebanons-ruinous-electricity-crisis-idUSKCN1RA24Z

[9] https://www.greenmatch.co.uk/blog/2014/08/5-advantages-and-5-disadvantages-of-solar-energy

[10] https://en.wikipedia.org/wiki/Solar_panel

[11] https://www.fortum.com/about-us/our-company/our-energy-production/solar-power-unlimited-source-

[12] https://www.executive-magazine.com/economics-policy/lebanons-electricity-crisis

[13] https://www.horizoncurriculum.com/supportmaterial/parts-of-a-wind-turbine/

[14] John, J.S. (2017-06-29). "The Case for Utilities to Bundle Their Energy Businesses—Before They're Cannibalized". /www.greentechmedia.com. Retrieved 8 October 2018.

[15] https://news.energysage.com/average-solar-panel-size-weight/

[16] http://datagenetics.com/blog/june12017/index.html

[17] Packing Some Power: Energy Technology: Better ways of storing energy are needed if electricity systems are to become cleaner and more efficient, The Economist, March 3, 2012

[18] https://en.wikipedia.org/wiki/Energy_storage

[19. Article (PDF Available) in Energy Procedia 19:310-320 · May 2012

[20] https://photovoltaic-software.com/principle-ressources/how-calculate-solar-energy-power-pv-systems

[21]https://en.annahar.com/article/850746-analysis-electricity-in-lebanon-understanding-the-real-problem

[22] Energy Procedia 19 (2012) 310 – 320

[23] http://www.edl.gov.lb/page.php?pid=1&lang=en

[24] Dalton, G. J., Lockington D.A., Baldock, T. E 2008b. Feasibility analysis of stand-alone energy supply options for a large hotel. Renewable Energy, 33(7): 1457-1490. doi:10.1016/j.renene.2007.09.014

[25]https://www.siemensgamesa.com/en-int/explore/journal/socioeconomic-report-wind-energy-2019?gclid=CjwKCAjwxt_tBRAXEiwAENY8he7O0_0_kGesPh9L7jvG86W1arMYuyRO7c6L31ct3CY1SmWzRP93RRoCUI4QAvD_BwE

[26] https://en.wikipedia.org › wiki › Wind_turbine

[27] Deng, S.-M., Burnett, J. 2000. A study of energy performance of hotel buildings in Hong Kong. Energy and Buildings, 31(1): 7–12. doi:10.1016/S0378-7788(98)00067-X

[28] https://en.wikipedia.org › wiki › Solar_cell

[29]https://www.mustpower.com/category/power-inverter/?gclid=CjwKCAjwxt_tBRAXEiwAENY8hbtow5GHPW5D5GpHmEIzDxdqQhuLbt6LnT-fHkbvz82JrLiuW5Tf2xoCb1EQAvD_BwE

[30] Fink, A. 1998. Conducting, Research Literature Reviews: From the Internet to the Paper. Thousand Oaks: Sage.

[31] https://greenliving.lovetoknow.com › Efficiency_of_Wind_Energy

[**32**] http://www.kewsolar.co.uk/techinfo/panels.aspx

[33] SOLAR CELLS AND THEIR APPLICATIONS Second Edition Edited by LEWIS FRAAS LARRY PARTAIN

[34] http://www.solarelectricityhandbook.com/solar-angle-calculator.html

RESUME

Name : ELHASSAN ELDALKAM

Place and Date of Birth : LEBANON TYREE 16/09/1993

E-Mail: hassan.dalkam@gmail.com

Education :

• Bachelor : 2013-2017 , AL-Near east University,

Electric and Electronic Engineering .

• Master : 2017-2019, Istanbul Aydin University, Electric and Electronic

Engineering.

CERTİFİCATES:

• Electronic devices Repairing

• Matlab And Multisim Circuit Designer

• Power Distribution