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SOLAR ENERGY UTILIZATION IN ISTANBUL'S FOUR AND FIVE-STAR HOTELS

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Master`s Thesis

Supervisor

Asst. Prof. Dr. Ayça Kurnaz TÜRKBEN

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The thesis titled SOLAR ENERGY UTILIZATION IN ISTANBUL'S FOUR AND FIVE-STAR HOTELS prepared by AHMED ABDULKADHIM AZAWI and submitted on 17/08/2022 has been **accepted unanimously** for the degree of Master of Science in Electrical and Computer Engineering

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Ahmed Abdulkadhim AZAWI

Signature

DEDICATION

I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving parents, whose words of encouragement and push for tenacity ring in my ears.

PREFACE

I begin by thanking Allah Almighty in the first place, then I thank my supervisor Asst. Prof. Dr. Ayça kurnaz TURKBEN for helping me to prepare this research and linking me to the necessary references and sources at any of the stages it went through.

ABSTRACT

SOLAR ENERGY UTILIZATION IN ISTANBUL'S FOUR AND FIVE-STAR HOTELS

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Introduce One of the most prevalent and suitable renewable energy sources employed in the energy sector is solar energy. It is also the one that is most economical. Solar energy, also known simply as solar energy, is a technology that makes use of sunshine to supply power for a range of functions. Solar energy has been used for thousands of years in a wide range of technologies, particularly in places where no other energy source is accessible, like isolated areas in space, and is still employed today in numerous applications. The following solar energy system types should be recognized. Some of the accessible system categories include photobiological systems, chemical systems, photovoltaic systems, thermal systems.

Keywords: Thermal System, Solar Energy, Pollution

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ABBREVIATIONS

AI	:	Artificial Intelligence
FSK	:	Frequency Shift Keying
IoT	:	Internet of Things
PAN	:	Personal Area Network
OFDM	:	Orthogonal Frequency Division Multiplexing
TDMA	:	Time Division Multiple Access

LIST OF SYMBOLS

μ	:	Electron mobility
λ	:	Wavelength
ω	:	Angular frequency

1 INTRODUCTION

1.1 INTRODUCTION

In recent decades, however, as this industry has expanded, it has placed increasing demand on the planet's natural resources [1, 2]. The tourism sector has been a significant contribution to economic growth in developing countries while also transporting millions of people across the world [3] [4].

Ecotourism is one of the most often discussed subjects in the tourism business today, and with good reason. The term "ecotourism," according to Alexander [1], is defined as "tourism that is more nature-oriented and environmentally orientated." According to Wall [2], ecotourism may be defined as "going to generally undisturbed or uncontaminated natural areas with the intentional aim of learning, appreciating, and enjoying the beauty."

Ecotourism is becoming increasingly popular among tourists all around the world, showing a growing need for environmentally friendly vacation choices in the travel industry. To put it another way, hotels are becoming more environmentally friendly, and those that label their enterprises "green hotels" place a strong emphasis on the effective use of non-renewable resources as well as the correct use of available renewable resources. [1]

Solar energy is a very effective and acceptable renewable energy source for the hotel industry. It is also quite inexpensive. Solar power or solar energy is the term used to describe the process of acquiring operational energy from the sun's light. Solar power has been used in a variety of technologies for centuries in regions where alternative energy sources are sparse, such as isolated areas or outer space. Listed below are the several types of solar energy systems identified by Raoufirad [4]. These system types include: photobiological systems that are both active and passive in nature; photochemical systems that are both active and passive in nature; solar thermal systems; and photovoltaic systems that have both active and passive components.

Barriers to the operation and maintenance of solar energy systems occur in accordance with the obstacles and problems associated with the acceptance of new technologies. These barriers exist

for the usage of solar energy systems. Researchers have discovered a number of impediments to solar energy adoption, including a lack of government support policies, a lack of consumer knowledge, high solar energy costs, difficulties in constructing an energy system, inadequate financing choices, and a lack of industry standards [5]. The absence of stakeholders in energy decision-making, as well as the public's negative impression of renewable energy, are significant obstacles.

The goal of this study is to investigate the present barriers that prevent the use of solar energy in Iran's hotel and tourism industries from becoming successful. As a temporary measure, the article will focus on some of the most prevalent and broad barriers to the widespread use of solar energy across the world.

1.2 BACKGROUND

Solar energy is one of the most ideal and beneficial energy sources for the tourist business since it is clean, modern, and renewable. "Photo biologic Systems, Chemical Systems, Photovoltaic, Thermal Systems, and Active & Passive Systems" [6] are only few of the ways in which solar energy may be collected. Solar energy systems, both active and passive, could be used in the hotel industry to harness the sun's energy for use in the establishments' hot water systems. These systems could be integrated into new buildings or retrofitted onto existing ones to provide the establishments with clean, safe, and reliable hot water.

In many countries, including Iran, the usage of solar energy systems is still in its infancy, much like any other new product that is still in its infancy. As a result, current solar energy systems, whether used for household or industrial purposes, present a number of sophisticated and challenging installation and operating issues. As a result of this, At the federal level, there are recurring obstacles to the use of solar energy, and this has a direct and indirect influence on the tourism industry [7].

Margolis and Zubby [8] compiled a list of the most often Some non-technical obstacles to the adoption of solar energy and other EE/ER technologies based on nineteen recent research. For instance, a lack of government policy that encourages stakeholder and community participation

in energy choices, a lack of information and consumer awareness, a lack of adequate codes and standards, the high cost of solar energy production in comparison to current energies, the difficulty of overcoming established energy systems, inadequate financing options, a lack of workforce skills and training, and a failure to a As Doner [9] points out, there are also a number of other major challenges that need to be overcome, including technological and institutional ones.

1.3 OBJECTIVE

a. In Istanbul's most renowned four- and five-star hotels, researchers are investigating the managerial and organizational challenges that prevent the use of solar energy from being more widely implemented.

b. Examining the financial barriers that prevent the use of solar energy in Istanbul's leading 4- and 5-star hotels from being implemented.

c. Investigating the cultural obstacles that prevent major four- and five-star hotels in Istanbul from implementing solar energy.

d. Researchers are exploring the technological challenges to the use of solar energy in some of Istanbul's most famous four- and five-star hotels, according to the Turkish Daily News.

e. Fifth, despite Istanbul's geographical challenges, researchers are looking at the usage of solar energy in the city's biggest four- and five-star hotels.

1.4 PROBLEM STATEMENT

Researchers have found the importance of solar energy in today's society through studies and research on the usage of solar energy in hotels, which they conducted. Using this sort of energy, researchers determined that it may assist the hotel industry in a variety of ways, including environmental and economic benefits, among other things.

1.5 SIGNIFICANCE

Turkey's large supply of solar energy may be of particular use to high-rise hotels and other structures, such as those in the country's capital, Ankara. Since fossil fuel prices have recently declined, it has become evident that resorting to alternative energy sources such as solar and wind turbines is a must. This research is an attempt to bring the subject of solar energy into the conversation about hotels and tourists, which has been largely ignored.

1.6 OUTLINE

This thesis will be organized as follow:

a. Introduction: This chapter represented an overview of the main objectives of the research, statement of problems, aims and objectives of the study.

b. Literature review: This chapter presented a background about.

c. Methodology: This chapter 3 investigates the interviews, and the survey will be organized for different group of people.

d. Results and analysis: Results will be shown and analyse in this chapter.

e. Conclusion: This chapter summarized the problems.

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2 LITERETURE REVIEW

2.1 INTRODUCTION

By Garud [10], it has been emphasized that "energy" is a significant agent in wealth production as well as a critical aspect in economic growth. Natural resource scarcity and environmental concerns have stressed the necessity for innovative, environmentally friendly energy supply solutions that utilize renewable energy sources." Additionally, in his document, Pigram [11] emphasizes the importance of energy conservation and recommends that developing countries prioritize renewable energy sources in their energy policy discussions. He also suggests that the tourism sector is a significant energy consumer., should be involved in these discussions and should be on the lookout for ways to adapt to changing energy needs.

Tourist hotels have significant and expensive energy requirements because of their heavy reliance on heating and cooling systems that rely on limited non-renewable and fossil-fuel-based resources to operate. As a result, the locals and their surroundings will be adversely affected in their own right. As a result, tourism and hotel companies are held liable for these types of difficulties.

Among the many various forms of renewable energy sources available, solar radiation, wind turbines, waves, hydroelectric facilities, as well as tidal and geothermal sources, are the most commonly employed. The other so-called renewable energy sources, according to Pigram [11], cannot be utilized in are not readily available at the stage of tourism development due to the tourism sector, with the exception of "direct solar energy and maybe restricted use of wind energy."

Solar energy is one of the most suitable and beneficial renewable, clean, and contemporary energy sources for the tourism industry. Solar energy can be obtained in a variety of ways, including "Photo biologic Systems, Chemical Systems, Photovoltaic Systems, Thermal Systems, and Active & Passive Systems" [4], and can be used in a variety of applications. Examples include the use of photovoltaic systems in hotel lighting systems, and the installation of hot water solar systems, either active or passive, during new hotel construction or hotel

restoration to capture solar energy and transform it into the safe, dependable energy that hotels need to run.

When it comes to adopting solar energy systems, a large portion of the world's population, including Iran, is still in the initial stage of the process. New solar energy systems, whether for residential or commercial usage, present a variety of issues and hurdles that must be navigated through. This, in and of itself, provides common hurdles to the use of solar energy at the national level and has an influence on both the direct and indirect incorporation of clean energies into tourist attractions and industrial settings, both directly and indirectly.

Margolis and Zubby [5], who reviewed 19 papers, identified the most often cited barriers to the widespread adoption of solar energy and other EE/ER technologies as outlined in their most current findings. The issues they mention as roadblocks include insufficient government policies, a lack of information and consumer awareness, a lack of adequate codes and standards, and the high costs associated with solar energy production in comparison to current energy sources. They also mention the difficulty in overtaking established energy systems, inadequate financing options, a lack of workforce skills and training, as well as a failure to account for all costs. Furthermore, as Doner [9] points out, there are more general barriers to overcome, such as those related to technology, institutional structure, and financial resources.

Istanbul, which is situated in an optimal geographic location on the planet, has an abundance of sunlight that is perfect for solar energy generation. Approximately 2,800 hours of sunshine are received in Istanbul 's central region each year, which has an average radiation intensity of 19.23 MJ/m2/day (=5.3 kWh/m2/day), according to a German Iranian study conducted in 2005. Aside from air pollution and carbon emissions, other environmental challenges in Istanbul have arisen in recent years. Regardless of Istanbul 's abundant natural resources, there are a number of social, economic, industrial, and development issues that must be addressed in the implementation and localization of renewable energy in the country, and appropriate steps must be taken to alleviate these issues in order for renewable energy to be successful.

2.2 ENERGY SAVING

It is a primary state priority, as well as a crucial growth direction for all enterprises in the state. As the absence of a sustainable source of energy has become increasingly common [12], there has been an increase in public concern about energy saving. There are many different techniques to conserve energy, but there is no practical and consistent approach for quantifying the impact of any type of energy-saving technology now available. Many works of literature deal with economic aspects [13] and/or specific difficulties in a particular place [14], both of which are common topics.

In light of the wide disparity in the energy base values of the two organizations, comparing the percentage of energy loss reduction [15] is futile because the proportions do not accurately reflect the actual reduction in energy loss. To evaluate energy consumption, the GDP created per unit of traditional coal usage is an important indicator to consider. This looks to be a bad decision when it comes to evaluating energy savings. This is due to the fact that, despite the fact that no energy is lost, the economic benefits received by using the same amount of energy in different enterprises are substantially different.

According to Pigram [11], it has been possible for human culture to progress through the use of animate energy (given by living beings) as well as inanimate energy (supplied by non-living objects). Due to growing concerns over the long-term sustainability of reserves, increased focus on renewable energy sources, and the need for energy conservation, the tourism industry, which consumes a substantial amount of energy, is also anticipated to consider these options.

Despite appearances, the heating and cooling systems in tourist accommodations may have extremely high and expensive energy requirements. There are several ways to save energy, ranging from passive solar heating to properly insulating your home; these strategies can reduce or eliminate the need for expensive heating and cooling systems [1]. There are a variety of renewable energy sources that could be used to develop new forms of energy and repurpose squandered natural resources, including solar radiation, wind, waves, hydropower, biomass, geothermal heat, and gravitational (tidal) power. Solar radiation, wind, waves, and hydropower

are just a few of the renewable energy sources that could be used. According to Pigram [11], certain sources of energy are more easily accessible by people than others, whilst others are more difficult. In the case of "direct solar energy" and "wind energy," for example, they are regarded reliable sources of alternative energy, although biomass and hydropower are less accessible in the current status of the tourism industry. In addition, he claims that the most prevalent and rapidly expanding source of renewable energy in the tourism sector is solar water heating. They have previously been employed for pool heating, despite the fact that a backup system is usually required in most cases. Passive solar heating systems are extensively utilized in households, and they may be easily adapted for use in hotels as well. The increased requirement for low temperature room heating in tourism operations has resulted in the incorporation of passive solar heating into contemporary integrated energy-efficient design strategies. Growing numbers of people are turning to renewable energy sources in order to lessen their dependency on fossil-fuel based energy sources while simultaneously saving money. Renewable energy sources include solar, wind, and biomass.

According to Alexander [1], Since hotels all over the world are realizing the potential to implement energy-efficient projects in their space cooling and heating systems, energy efficiency and energy conservation are becoming more and more frequent in the hotel business. The Hyatt Regency International Hotel in New Zealand, which considered the fact that most guests frequently left applications and heating and cooling systems running while they were out of their rooms and developed a system to link energy use with room occupancy, is one instance of a novel idea that has succeeded. All devices, with the exception of the refrigerator, alarm clocks, and other needs, are now switched off as soon as a guest leaves the room. Despite the fact that the project required a $16,000 investment, there was a 14-month repayment term, and the resulting annual savings were $14,000. As an illustration, the Sheraton Auckland Hotel discovered that daily bed linen washing accounted for 35% of total energy consumption during the laundry process, whereas drying accounted for 65% of total energy consumption throughout the laundry process. The temperature of the hotel's washing machine was decreased temperatures range from 85 to 65 degrees Celsius. without the need for any further effort on the part of the hotel staff. These modifications saved the company $2,000 in the first three months

alone, while the linens were as clean as they had been previously. The use of washing detergents has been decreased, and the pollution of the hotel's wastewater has been reduced as a consequence of the energy conservation efforts of this project, in addition to other benefits. It can also be beneficial to allow hotel guests to choose between having their bedding cleaned every day or every other day in order to conserve both water and electricity.

2.3 CLEAN ENERGY AND RENEWABLE ENERGY

It is when we speak about "clean energy" that we are referring to renewable energy sources such as solar active and passive systems that do not contaminate the environment or emit greenhouse gases into the atmosphere. According to a broad definition, such energies are needed "in order to deal with both the lowered environmental imprint and the increasing worldwide demand for energy while also meeting the requirement for energy independence."

Furthermore, people all around the world are now regularly utilizing the term "green" in their everyday conversations. In today's society, the term "green" is commonly used to represent a style of living that is environmentally conscious and thoughtful of other people. It's the same whether it comes to green power or green energy, for that matter. Energy sources that are widely acknowledged as being low in pollution and so beneficial to the environment are frequently referred to as "green" in their names. By reducing pollution's harmful effects on our environment, we can decrease or even halt the rate at which our world heats in the future. Using green energy can help us do both. As a result, the reduction of environmental effects and the reduction of harmful emissions are the two most significant benefits of green energy.

The fields of cogeneration, heating, and electricity are among the most often investigated when it comes to green energy. Green energy has the potential to considerably reduce the environmental impact of traditional energy usage when combined with other energy sources. Customers can buy green energy and use it effectively in their efforts to lead more ecologically conscious lives. As a way of proving their dedication to ecologically friendly activities, an increasing number of businesses are getting "green certifications" or "renewable energy certificates," which record their use of clean, renewable energy. More than 35 million

households in Europe are currently using green certificates to prove their use of clean energy, according to statistics provided by the ifpaenergyconference.com. As long as they don't exhaust the world's finite reserves of fossil fuels, all types of clean and green energy are considered renewable. Tidal power, wave power, solar power, wind power, and geothermal energy are all examples of renewable and ecologically beneficial energy sources to consider.

2.3.1 Wind Power

Initial sources of wind energy are the incident solar radiation and the absorbed solar radiation by the earth. Convection is the process through which energy from the Earth's surface is transferred to air molecules, which in turn propels them and causes wind to blow. Warm air rising from the equator in the northern hemisphere produces a northerly wind to blow at ground level in the northern hemisphere. This is the most common method to describe the direction of the wind. Solar electricity is converted into wind energy at a rate of around 0.5 percent of the entire amount of electricity generated [16].

There are many different types of wind:

There are several forms of planet-wide circulations. These include geostrophic winds, thermal winds, gradient winds, and katabatic/anabatic winds.

Even if the Earth were to remain stationary, Near the equator, there would be more convective air movement as a result of the increased sun radiation intensity, where the sun's rays are concentrated at their greatest intensity. A result of the earth's rotation, the wind appears to be blowing more quickly towards the direction of the east, and this apparent force is referred to as the Coriolis force. Coriolis force:

The energy generation of a wind turbine is controlled by the form of the machine as well as the speed of the wind. In the context of wind energy, wind capacity refers to the maximum rated power that a turbine can produce on an average day. The total wind capacity of a country or region is therefore equal to the sum of the present turbines' capabilities. In the United States,

wind resources and the placement of wind power facilities make it clear that there is a great deal of potential for wind energy.

Wind is one of the variables that determine how life acts on Earth, and it has a significant impact. We may go back in time to the beginning of time to see how people used wind, and by extension, wind energy, to complete chores and activities for the benefit of themselves and others. Wind energy for beneficial uses was first harnessed by the ancient Greeks, who were pioneers in this field. The creation of Egyptian sail boats, It caused the wind's kinetic energy to be converted into the boat's kinetic energy, allowed for the first time in human history for the wind itself to be employed to accomplish labor for the first time. According to historical records, Persians were the first to construct structures specifically meant to collect wind energy, which dates back to the era 500-900AD. During that historical period, granary labor was performed with the assistance of windmill structures. Beyond this point in time, windmills took a long time to make major advancements, and horizontal windmills that used air lift to power various farming and granary activities were not established until the European Medieval Ages. It was introduced with the expansion of US colonies in the late 1800s and was used for irrigation and farming operations that were similar to those of the Halladay Windmill. It was the research with wind conducted by the US Wind Engine Company, and later by the Aermotor Company, which recorded up to 5,000 tests with wind, that launched the commercialization of windmills in rural areas in the United States. After being widely acknowledged as a source of renewable energy, wind became a well-known case study to examine.

When windmill technology and electric technology were both developing at the same time in the late nineteenth century, it seemed inevitable that a way of producing electricity from wind power would be created. Cleveland, Ohio, made history in 1888 when it became the first city in the United States to install a windmill that produced electricity. Inside the windmill, a step-up gearbox connected to a direct current motor was installed so that the rotation of the blades could generate usable electrical frequencies. In the early twentieth century, as a consequence of advancements in Windmill technology, wind energy was also employed for pumping and other hydraulic operations, such as water purification. Wind energy research and development

continued during World War II, with turbines such as Grandpa's Knob being constructed. The turbine featured just two blades, rather than the usual three blades (which we will differentiate between at later stages of the report). It wasn't until 1979 that wind turbines were capable of generating 1 megawatt of electricity (MW).

Because of current government incentives that encourage the use of green technology to address global warming and pollution, there is an increase in the demand for green power production technologies. Because of its long history (in comparison to other green technologies) and low intermittent nature (in comparison to other green technologies), wind technology remains one of the most promising future sources of electricity generation, even in the face of competition from other green technologies such as solar, hydroelectric, and nuclear power (when placed in the correct regions).

Wind technology is thriving in developed countries such as the United States, and sophisticated control systems are being developed to "squeeze out" as much energy as possible from the wind. Due to advancements in material and structural research and development, wind turbines are getting more inexpensive, while the overall height of wind turbines is increasing. According to the Energy Information Administration, wind turbines generated 11 percent of renewable energy in the United States in 2010, and that figure is predicted to climb to 15 percent by 2016.

During the last several decades, there has been a major advancement in the technology of renewable energy. from high-priced, unreliable gimmicks that, without hefty government subsidies, would be unable to completely replace fossil fuels.

The majority of industrialized economies throughout the world are gradually shifting their reliance on the type of energy source that is increasing at the highest rate. Chinese wind energy is already generating 486 gigatonnes (GW) of power alone, despite the fact that the country has one of the world's highest carbon footprints. Wind energy is becoming more affordable than traditional power producers (which rely on fossil fuels), and the number of wind turbines being installed is increasing at an exponentially faster rate. Today's biggest wind turbines have blade

spreads of 80 meters and a tower height of 178 meters, allowing them to gather ever-increasing amounts of power from the wind, as seen in the graph below (Figure).

In addition to the wind's drag and lift components, the turbine is susceptible to two more major wind force components. In the field of wind energy, a divergence in technology led in the development of two fundamental types of turbines: vertical and horizontal.

The difference between the two basic types of turbines is illustrated in the picture below, which is a graphical illustration of the difference. It is vital to understand the benefits and downsides of the two primary types of wind turbines in order to make informed decisions. Despite the fact that vertical axis turbines, due to their capacity to operate more readily with air drag, have been termed a probable future technology, they still have a long way to go before they can realize their full capabilities. Because the vertical axis of the turbine comprises a high number of revolutions, it is necessary to adequately secure the tower. Second, due to the fact that the generator is mounted on the tower, it must be properly secured. It is possible that using guy wires to keep the tower from tilting is not the best method. Aside from that, because thrust bearings transfer stress in the z-direction, they also transfer weight load, and as a result, they may break at larger loads. The inability of vertical axis turbines to be erected at higher altitudes results in them being less efficient than horizontal axis turbines in most instances. The possibility of lower bending stresses and simpler maintenance due to the fact that the electric-producing equipment is placed closer to the ground are both possibilities.

The fact that its plane of action is constantly in the direction of the wind means that it does not require steering in order to face it in the proper direction. Vertical windmills are more likely than horizontal windmills to be put in residential areas, owing to their smaller size and the fact that they may function at lower elevations than their horizontal counterparts. In contrast, horizontal wind turbines have a bigger influence on the electrical grid.

Horizontal axis turbines may create additional forward momentum on their blades by taking use of the lift given by the air, which is particularly useful at higher altitudes. It is possible that a single wind turbine in some wind farms may generate up to 7.9 GW of power, which represents

a huge increase over the previous generation's 100-150 m structures (Gansu, China). Control is essential in order for these structures to work at their expected and ideal efficiency levels, a job that is becoming increasingly attainable with today's technological advancements. The HAWT's primary disadvantages, on the other hand, are the challenges associated with its installation and the negative influence it has on noise and visibility. They are big, imposing structures that create a great deal of noise and cover a broad area; as a result, they are frequently found in windy locations.

The material utilized to construct these turbines, as well as the form of their structure, were both carefully researched in order to minimize fatigue and buckling problems.

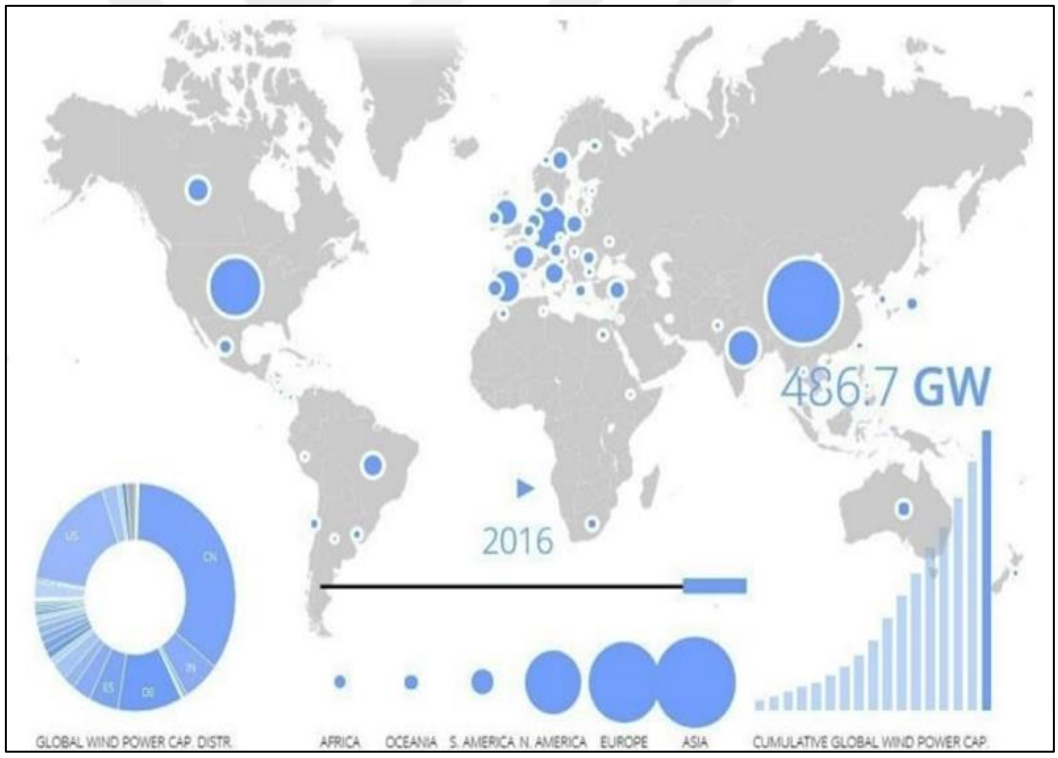

Figure 2.1: Worldwide distribution.

Figure 2.2: Wind energy types.

2.3.2 Tidal Power

Tidal power is a kind of hydro renewable energy that might be utilized to replace conventional power generation in some circumstances. According to Wright [16], tidal energy is "the power of electricity generation produced by harnessing the energy inherent in moving water mass due to tides and converting it into electricity." There are two different but related sources of tidal energy: "kinetic energy of currents between ebbing and surging tides," as well as "potential energy from the difference in height between high and low tides."

2.3.3 Wave Power

Wave power can be classified as a hydroelectric renewable energy source, if the right conditions are met. According to Wright, wave power is the collection of energy from ocean surface waves and the use of that energy to perform beneficial labor such as electricity generation, desalination,

and the pumping of water into reservoirs. Wave power is also used in the production of renewable energy such as wind and solar energy [17]. Due to the fact that tidal power fluctuates throughout the day, wave power and tidal power cannot be directly compared. Wave power looks to be a more dependable source of energy than wind power, which has a limited number of test locations and is unable to keep up with the global demand for electricity and power.

2.3.4 Geothermal Power

Because of the widespread use of hot springs, geothermal energy has been used as a source of energy since the beginning of the twentieth century; nevertheless, relying on it as a source of electricity is a relatively new concept. Clean-energy-idea.com [18] states that harnessing geothermal energy to create electricity is a very effective approach to generate clean and renewable energy. Geothermal energy is a renewable source of energy that is quite inexpensive. Although this is true, the location of the equipment required to extract geothermal energy and the efficient growth of the plant required to do so present difficulties that might cause the process to be delayed. Another downside of this form of electricity production system is the fact that huge amounts of power can only be generated in a restricted number of locations. When it comes to geothermal energy, the majority of the world's population lives in areas where it cannot be exploited to create sufficient amounts of electricity. So, in 2007, the amount of electricity generated by geothermal sources fell to less than 1 percent of total global electricity generation.

2.4 WASTE MANAGEMENT

As Pigram [11] points out, reducing pollutants through pollution and waste management may be an efficient but expensive method of lowering pollution levels. A solution to the complex problems of pollution management will be impossible for any one group to devise if the efforts of other crafts and experts are not enlisted in the endeavor. Additionally, he contends that the sheer number of most tourist activities is not usually the root cause of a specific pollution problem; instead, they may be a source of liquid or gaseous substances that are potentially detrimental to human health and the environment. There are several ways in which human activity has a negative impact on our environment. Sewage discharges into bodies of water,

emissions from heating and refrigeration equipment, and the release of dangerous substances into the environment through the sewage or drainage system are among the most harmful environmental effects. In this study, it was discovered that by phasing out hazardous materials like chlorine bleach in swimming pools, leaded gasoline, and toxic cleaning products, and replacing them with more environmentally friendly alternatives, as well as putting in place proper waste treatment and filtering systems, the use of hazardous materials can be reduced to a reasonable minimum.

In the words of Pigram [11], trash created by tourism can be "solid or gaseous in nature, and may consist of by-products, contaminated debris," "split and dated material," "used packaging and containers," "kitchen and garden waste," as well as "outdated equipment." In waste management, every component is focused at preventing and reducing waste; rejecting certain items and recycling others, as well as enforcing waste treatment and garbage disposal, are all part of the process. Environmental concerns such as material conservation and recycling, together with the proper disposal of hazardous waste, are among the most important challenges facing the tourism industry today. The first step in separating waste streams from tourism operations and processes is to establish a distinction between the two stories. Since a result, it is critical to identify and treat the principal rubbish sources, as visitors will undoubtedly be adversely impacted and become more concerned about the existence of visible waste items as a result of the situation. It is simply the first step in recognizing waste resources; the next step is to limit the consumption of the sources of that pollution. [16] There are several methods for reducing waste and saving money, including the use of refillable containers and purchasing in bulk. As an additional recommendation, he suggests that tourism activities be assessed to determine whether the prospect of reprocessing, recycling, and treatment of wastes may be realized for both environmental and economic benefits. By reusing things, it is possible to minimize consumption as well as waste streams. As Pigram explains in his book [11], this is the "process of extracting resources from waste and transforming them into useful items."

It is critical for tourist firms to adhere to recycling plans and programs since it is more essential to consumers and visitors than just minimizing trash in the first place. A few examples of

methods that tourism enterprises may assist lessen their environmental impact include composting organic waste, building composting toilets for human waste, and using grey water on gardens. Waste separation and a proper recycling infrastructure are both essential for successful and effective waste management and recycling [11].

2.5 SOLAR ENERGY

Solar power or, as it is more often known, solar energy harvesting (solar energy) is the process of obtaining useful energy from the sun's light. Where there are no other accessible energy sources, such as in isolated places or on the surface of the moon, solar energy has risen to become the dominant source of energy. Along with heat (hot water, heating of buildings, cooking), solar energy may also be used for power generation (photovoltaics, heat engines), desalination of seawater, and the lifespan of plants, among other applications.

The fact is that the sun supplies nourishment for all sources of energy, including nuclear. Plants, animals, decaying plants, and fossil fuels such as coal, oil, and natural gas are all examples of energy drift, as are fossil fuels such as coal, oil, and natural gas. Fossil fuels are, in reality, the product of millions of years of sunlight being trapped in the Earth's crust, resulting in the formation of carbon dioxide. In addition, solar energy is a very ecologically beneficial means of generating electricity that is becoming increasingly popular. There are no emissions from solar panels or direct application methods into the atmosphere. Passive construction, photovoltaics, solar water heating, and other direct applications at the residential scale diminish power generation from traditional sources and the environmental problems that come with it [3].

2.6 HISTORY OF SOLAR ENERGY

A great number of ancient civilizations dared the sun and its solar energy, and they paid close attention to the phenomenon. Throughout history, it has been a fundamental topic in the majority of religions and heavenly conceptions throughout the planet. Iranians, Egyptians (Ra, the sun deity), and other people who worshipped the sun at the time of Abraham's arrival in the Holy Koran are among the earliest sun worshippers recorded in history.

It was Arashmidos who first used solar energy to power warships in 212 BC, Thus the development of the solar sail may be regarded as one of the most remarkable episodes in the history of humanity's scientific advancement. With the use of a mobile platform, Arashmidos was able to position square small mirrors close to each other, directing sunlight towards the opposing ships and causing them to catch fire. However, even if these tales are not totally factual, they may nonetheless suggest that the development of diverse systems for harnessing solar energy has a long history in human culture and cannot be overlooked at all [19].

During the Renaissance period, which lasted from the 14th through the 17th century, a number of instruments were developed by harnessing the power of the sun. Salmon de Kai, a Frenchman, was responsible for the conception and construction of one of the most famous inventions of the Renaissance. An example of a solar water pump motor that produced its own electricity. Solar energy was used to heat the air in a solar motor, and he was able to effectively pump water with the help of the engine. His solar motor was simple, but it was of such quality that it was still in use 200 years after it was built. It is important to note that solar instrument construction during the Renaissance was impracticable and of limited benefit [20], as was the case with many other technologies of the time.

In the nineteenth century, solar energy was also utilized. Sterling made significant changes and structural alterations to the piston air motors during this period in the early 1800s in order for them to be able to function on solar energy. The following century saw the development of a broad range of solar motors, which were eventually put to use in printing presses and other manufacturing operations. It was also possible to utilize solar motors to power other equipment, like electric lights. Following that, the following solar-powered devices were created:

a. An inventor from France named Able Pager created a solar-powered printing machine for the Taban newspaper in 1880.

b. In 1871, Charner Villon constructed a huge solar water distillation factory in Las Salinas Chemistry to give drinkable water to mine employees in order to keep them working.

c. Cairo's 50-kilowatt power plant, built in 1907.

d. In 1931, Dr. Bruno Lunch developed a solar-powered battery.

e. A solar cooker dating back to 1950.

Solar energy also had an impact on aviation and space research, resulting in the development of one of the most important roles ever performed in the space industry through the use of solar energy to power communications satellites, which is considered to be one of the most important roles ever performed in the space industry. Inventor Hermann Oberth, one of the early pioneers of satellite transmission, came up with the concept as far back as 1920. During World War II, Piers from the Bell Laboratories was the first to bring Arthur Clarke's satellite communication idea to fruition [20]. The use of communications satellites, also known as COMSATs, is a crucial part of contemporary life, since they allow for immediate connectivity between people and things all over the globe. These spacecrafts are powered only by solar-powered batteries. Solar energy may be used on the ground as well as in space, according to NASA. Several spacecraft on their way to the moon or other planets utilized radios powered by sunlight to broadcast various messages and pieces of information back to Earth, allowing humans to harness the energy that might be the source of all of the energy on the planet [20].

Flat collectors might be considered one of the most significant technological breakthroughs of the nineteenth century. Although focused collectors were used to capture light before to the eighteenth century, flat collectors were popular throughout that time period. Collectors of this type were less difficult to construct than focusing collectors, and they do not require clear sky to function [19]. Solar water heaters were also installed in southern California between 1920 and 1930, and some of them are still in service now, according to historical records. In Japan, solar water heaters were used in swimming pools as early as World War II, when the technology was originally developed. The fact that gas water heaters for swimming pools were so expensive to install prompted them to try to convert this into a profitable business enterprise.

During World War II, the provision of drinking water for soldiers who had to be rescued by lifeboats was a serious concern. Dr. Maria Telenker was working on small distillation apparatus made of plastic at the time, which could be transported in lifeboats. A little quantity of saltwater

was placed in a plastic bag that could be separated from the device, which sat on the surface of the water and floated in the water. Eventually, the United States Department of Agriculture became aware of this device, and bigger replicas were manufactured and placed into operation in Florida [21].

At a time when the distillation devices of World War II were still fresh in people's minds in 1952, the American Commission of Supplies published a paper outlining the advantages of utilizing solar energy for home heating and forecasted that 13 million solar-heated homes would be constructed by 1975. The reduction of 30 percent in the quantity of fuel required to heat these dwellings resulted in a significant reduction in the amount of fuel consumed. As a result of this optimistic vision, various organizations and people from the private sector have begun to construct solar-powered homes. Instances include the MIT Home in Massachusetts, the Georg Boeuf Houses in Colorado, and an Arizona house [19], to name a few examples.

It was a century ago that the first individuals who used solar energy to cook began to experiment with the technology. By the mid-1950s, cooking in the sunshine had been rigorously studied and confirmed to be both cost-effective and safe, and the practice had become widespread. Cookers that run on sunlight are made of wood, plastic, and other metals, and on sunny days, they may create up to 500 watts of power each hour. The use of solar energy in suburban excursions and travel is more convenient and cost-effective since no fuel is necessary; in addition, it is safer in terms of fire prevention in forests and arbor sites because there will be no painful discomfort caused by the sun.

In the twentieth century, because of the widespread availability of affordable fossil fuels, fossil fuels surpassed all other sources of energy for human civilization as the dominant source of power. Following the recent energy crisis and the economic, technical, environmental, and other problems caused by the use of fossil fuels, it has been suggested that solar energy, as well as scientific and technical studies for using this energy instead of fossil fuels and other finite and expensive energies that are harmful to the environment, be investigated. A short time later, the significant successes of previous generations were once again taken into consideration in order

to create systems for utilizing solar energy, and efforts were made to complete them as well as to provide fresh approaches to the problem [20].

2.7 DIFFERENT TYPES OF SOLAR SYSTEM

There are three main types of solar power systems that may be used to create energy. Among them:

a. On-grid solar systems.

b. Off-grid solar systems.

c. Hybrid solar power systems.

2.7.1 On-Grid Solar

The on-grid solar system, also known as grid-tied or grid-fed solar, is comprised of solar panels, an inverter, a meter, and a connection to the utility grid. DC electricity is the type of power produced by solar cells. AC is used to power the vast majority of the appliances on the market (AC). An inverter is a device that transforms direct electricity into alternating current, which is then routed via an electric meter and supplied to other devices.

In the event that there is excess power generated by the solar system, it is returned to the grid and paid as feed-in traffic (Fit).

Electricity from the grid can be used throughout the night or when the solar power system is not producing enough energy to meet the needs of the household.

There is a disadvantage to using on-grid solar power:

It is a disadvantage of using on-grid solar because it does not allow for the storage of energy for immediate use in the event of adverse weather or a failure of the electrical system.

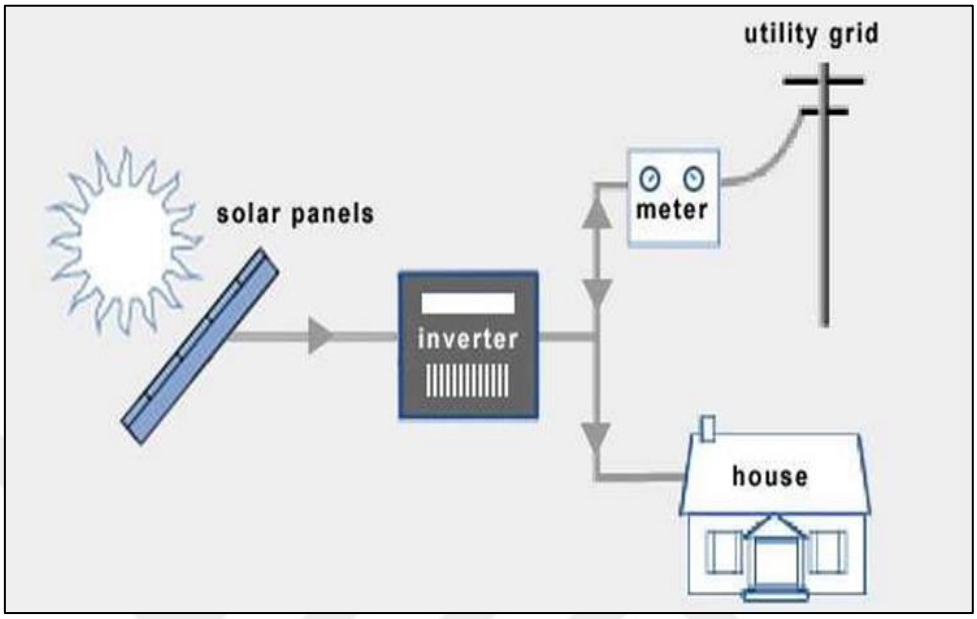

Figure 2.3: ON-GRID solar system.

2.7.2 Off-Grid Solar

An off-grid solar power system, also known as a stand-alone power system, is one that uses battery storage to generate electricity.

Because off-grid solar power requires so little electricity from the grid, it is ideal for remote locations. An inverter and a battery bank are all included in the system, which may be reinforced with a generator in the event of an emergency.

The operation of off-grid solar power systems is explained.

Solar cells turn the light emitted by the sun into energy, while an inverter converts the direct current produced by the solar cells into alternating current.

A battery backup is utilized in the case that solar power is unavailable, and any excess electricity is stored in the batteries. Batteries are also used to store excess electricity generated throughout the day.

In contrast, when the need for electricity is great and neither the solar panels nor the batteries are able to match the demand, it becomes difficult to meet those demands. People who live in remote areas with no connection to the electricity grid would profit the most from this system, as would be expected.

Because of this, a hybrid solar power system may be utilized to address the shortcomings of both on-grid and off-grid solar power systems.

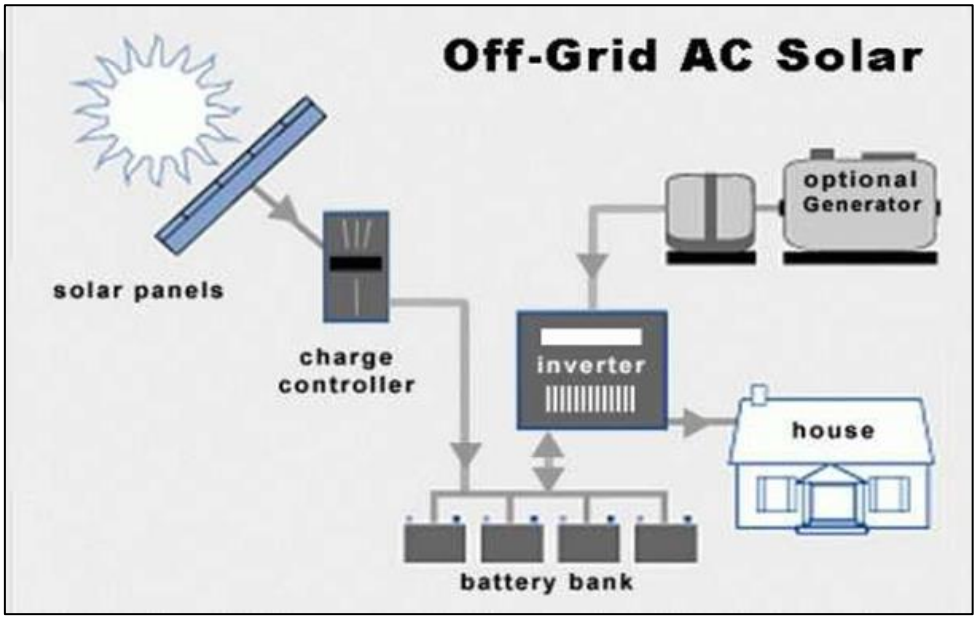

Figure 2.4: OFF-Grid AC Solar.

2.7.3 Hybrid Solar

A hybrid solar power system combines both on-grid and off-grid solar power systems into a single unit. Battery storage, which can subsequently be taken from the grid as needed, making this system more convenient to run while also lowering the total cost of ownership of electricity.

The functioning of a hybrid solar energy system is as follows:

At the end of the day, the sun's rays are converted into electricity. Batteries will be utilized to store any excess monies, creating a system that is similar to an off-grid system. In the same way

as on-grid solar generates excess electricity, battery-based solar generates surplus power that is sent back into the system.

When solar energy or the electrical grid are unavailable, batteries can be used to supply backup power for a short period of time. The electrical grid may also provide a continuous flow of electricity in the absence of solar power and with a low-capacity battery backup, allowing for the recharging and maintenance of the battery.

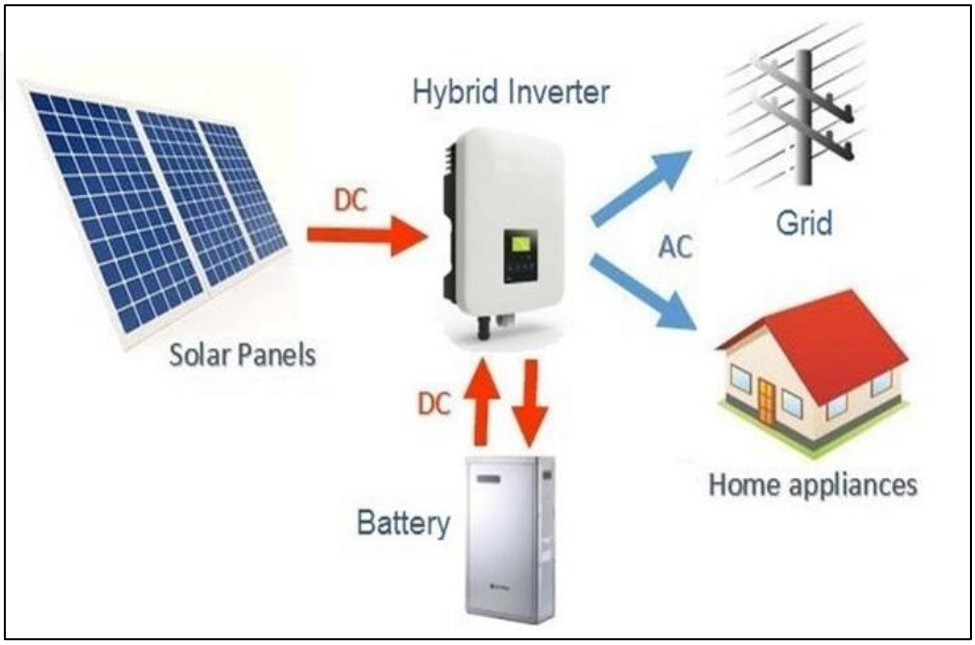

Figure 2.5: Hybrid Inverter.

2.8 ADVANTAGES AND DISADVANTAGES OF SOLAR ENERGY

According to Piri [3], solar energy customers encounter a variety of advantages and disadvantages, including the following:

2.8.1 The Advantages of Solar Energy

The following are the benefits to the economy:

a. Once the first investment in solar energy has been made, the generated solar energy is essentially free.

b. Because of the large amount of electricity you utilize, the payback time may be rather short.

c. Incentives and reimbursements from the government and utility companies help to balance off the initial investment.

d. You will save money since your electricity bill will be decreased or canceled.

e. Solar energy does not require the use of any fuel to be generated.

To put it another way, it is not influenced by changes in the supply and demand for fuels.

The use of solar energy provides environmental advantages since it is renewable, clean, and long-lasting.

a. Solar energy pollutes the atmosphere by emitting no carbon dioxide, nitrogen oxide, or mercury emissions, unlike other forms of energy.

b. Because solar energy does not contribute to global warming or other environmental challenges such as acid rain or pollution, it is considered to be environmentally friendly.

c. Semi-independent or entirely independent energy systems are described as follows:

d. It is feasible to use solar energy to balance the need for energy supplied by utilities. In the event of a power outage, it will not only allow you to keep your home or business functioning, but it will also allow you to save money on your utility bills.

e. The operation of a solar energy system is achievable even when the system is not connected to the grid.

f. Through the use of Solar Energy, we can reduce our reliance on foreign and centralized energy sources, which are susceptible to disruption due to natural disasters or global events.

Installation and maintenance of solar energy systems are minimal to non-existent. After the first installation, there are no more expenditures to be concerned about.

2.8.2 Disadvantages of Solar Energy

Solar panels may be expanded in the future as demand grows, and they are environmentally friendly because they are silent, have no moving parts, produce no bad odors, and do not require any fuel to function.

An examination of some of the disadvantages of solar energy:

a. The primary drawback of operating and establishing a solar energy system is the expense of doing so, which is mostly due to the high cost of semi-conductive materials used in the construction of solar panels.

b. The cost of solar energy is also expensive when compared to the cost of fossil fuels. As power disruptions grow more often, solar energy is becoming more competitive in terms of cost. To be successful, solar panels need to be deployed over a large area in order for them to be functional.

The installation of particular components can relieve this difficulty, which is compounded by the system's dependency on where the light shines to function properly. Cloud cover or pollution in the atmosphere may have an impact on the quantity of solar energy that can be created. A battery backup system and/or net metering, on the other hand, can help to alleviate this difficulty.

2.9 BARRIERS TO SOLAR ENERGY USE (ADOPTION)

It is common for a new technology to be accepted after it has been through a series of difficulties. Non-technical barriers to the use of solar energy and other EE/ER technologies are outlined by Margolis and Zubby [8] on the basis of 19 recent studies, and they include, among other things:

The use of EE/RE is not encouraged by government policy.

A dearth of awareness and understanding of energy efficiency and renewable energy (EE/RE) exists among the general public and consumers.

In comparison to traditional energy sources, solar and other EE/RE technologies are extremely expensive.

Breaking through established energy networks may be a challenging task.

The financing options available for EE/RE projects are insufficient.

a. A failure to take into account the whole range of costs and benefits associated with different energy sources.

b. The workforce is not receiving adequate training and education.

c. Inadequate connection and net-metering guidelines; insufficient standards, norms, and codes of practice; and insufficient funding.

d. The aesthetics of renewable energy systems are seen negatively by the general population.

Involvement of stakeholders and the general public in energy choices and EE/RE efforts is low or non-existent.

Doner [9], on the other hand, contends that the application of sustainable energy is impeded by three major obstacles: technological, economic, and institutional in nature. Major organizations are more likely than smaller businesses to adopt new technology as a consequence of their bigger size and greater capacity to spend in research and development, as well as their greater ability to do so.

The Clean Energy Group and Smart Power lay out the main marketing advantages of solar energy in recent research for the United Aria that are driving solar power development and awareness in various states. When it comes to increasing the number of solar power installations, cost, dependability, complexity, and market inertia are some of the most significant barriers that

must be addressed. In the study, it is suggested that states use these marketing tactics as a model for establishing their own marketing strategies to overcome hurdles to overcome obstacles to solar adoption from the perspectives of clean energy initiatives and solar marketers. Activities related to solar energy programs should contain the 4 pillars of product marketing, price, venue, and advertising, among others. States will be able to develop stronger customer-focused marketing strategies that will be more effective in achieving the solar objectives that they have set for themselves as a result of this knowledge.

2.10 SOLAR ENERGY IN ISTANBUL

When it comes to increasing output and improving the quality of life for their population, many modern countries are seeing a large rise in energy consumption as a result of their efforts to do so. In order to meet these increased demands, governments frequently resort to expanding supply bases without putting a strong emphasis on energy efficiency and sustainability. In response to climate change and the dwindling supply of fossil fuels, new alternative energy sources have evolved and are increasingly being reliant on to fulfill the world's expanding energy demands, as seen by the rise of solar and wind energy. There has never been a time when renewable energy sources have received as much attention as they do now, thanks to the present renewable energy push, which is primarily focused on alternative energy sources [23]. It is possible to minimize the world's dependency on polluting fossil fuels by increasing the usage of renewable energy sources such as solar and wind power. However, because of their high initial expenditures and dependency on the weather, they have several disadvantages. Commercial wind turbines, as well as smaller-scale wind turbines that may be utilized at home for personal power generation, can be found in a variety of locations across the world. Wind farms can range in size from a few kilowatts to many megawatts, depending on how they are connected to the power grid [24]. The use of renewable energy sources is becoming more popular in many countries with high average daily solar radiations [25], which range from 3 to 6 kWh/m2. "Stand-alone" diesel or hybrid generating systems are now the principal way of delivering electricity to residential areas in these nations, whether they are linked or isolated from the grid. The "stand-alone" hybrid systems are particularly frequent in rural locations

where there is no access to the power grid or a water supply. Denmark, India, Morocco, Bahrain, and Iran [26] are just a few examples of countries with rural communities, including the United States. When analyzing costs, component sizes, and other economic difficulties associated with a hybrid system, it is necessary to take environmental factors into account [27]. [28] The energy storage system for hybrid wind/photovoltaic (PV) systems, according to the study reported in this paper, must be able to deal with the unexpected patterns of wind and solar power. It is also possible that running and maintaining connected "stand-alone" diesel generators at low loads may be prohibitively expensive [29].

Turkey has witnessed a significant growth in the quantity of solar power it has installed over the past decade, and it is expected to continue on this path in the coming years.

When it comes to promoting renewable energy sources, one of the fundamental motives is a desire to cut the high cost of foreign energy imports, which has been a major cause of contention in the country for some time.

It began generating power from the sun in 2014, having a capacity of 40 megawatts at the time

(MW). This amount has now surpassed 7,816 megawatts, according to statistics acquired by the Ministry of Energy and Natural Resources.

As a consequence of the various support initiatives implemented by the Turkish government over the years, the country's installed solar power capacity climbed from 249 MW in 2015 to 833 MW the following year.

According to the statistics, the most significant rise happened in 2017, when the total capacity reached 3,421 MW, representing a 311 percent increase year on year.

In the year 2021 alone, 1,149 MW of new installed electricity capacity will be added.

By 2026, the International Energy Agency estimates that Turkey's renewable energy capacity will have more than doubled from its current level. (IEA).

The International Energy Agency (IEA) projects that the country's renewable capacity would rise by 53 percent over the next decade, with solar and wind power accounting for 80 percent of the increase.

According to Tolga All, the chairman of Turkey's Environmentalist Energy Association, there has been a "enormous" increase in the number of solar power installations in the country.

The environmental situation in Turkey is such that "there is no region within Turkey's borders where we cannot benefit from solar energy," everyone agreed, highlighting the importance of renewable energy sources in both the fight against climate change and the fight for energy independence in Turkey.

It is beneficial to everyone, whether they reside in Antalya or elsewhere in the Black Sea region.

There is no difference whether it is raining or gloomy in these places since we will still take advantage of the conditions, he added (AA).

"Germany, for instance, is located to our north. It does, however, have a significant installed capacity."

It was also highlighted the significance of the Paris Climate Agreement, which Turkey joined in October of this year, and which would be in effect from 2022 onwards.

Having argued for years that it should be classified as a developing country in order to get financial and technological help, it was the latest G-20 member to ratify the agreement.

"Our Parliament has accepted the Paris Global Agreement, which will aid in the battle against the climate disaster." When making investments in renewable energy, he believes that it is important to examine the communities' long-term climate action goals.

The fact that investors' top worry right now is electricity prices, along with recent legislative changes, has practically everyone interviewed for this piece predicting a significant increase in solar energy investment in the coming years.

3 RESEARCH METHODOLOGY

3.1 RESEARCH PURPOSE

This study's objective is to investigate the obstacles that prevent hotels in Istanbul's four- and five-star categories from making use of solar energy. The urgent need for study on renewable energy sources, which is also in line with current trends affecting developing countries all over the world, served as the impetus for doing this research in the first place.

3.2 RESEARCH APPROACH AND STRATEGY

Because of the many benefits associated with utilizing this strategy, the authors of this article decided to do research in order to supply a new source of energy to commercial establishments, including hotels.

3.3 DATA COLLECTION

The research used both primary and secondary sources to compile its findings. In secondary research, things like surveys and taking into account the expertise of experts are taken into consideration, but in primary research, things like books, the internet, and case studies are the major sources of information.

3.4 SAMPLE SELECTION

The researchers were looking for reputable hotels to collect data and replies from in order to make their findings more accurate. Researchers in Istanbul chose nine hotels ranging from four to five stars in order to conduct interviews with hotel staff members on the issue. When developing a questionnaire, main consideration was given to the following five aspects: In total, twenty-one questions were posed to the respondent. During the course of the interview, managers were required to give their responses to a number of questions. According to the findings, the utilization of solar electricity by certain hotels was shown to be fraught with a number of severe challenges.

3.5 DATA ANALYSIS

When analyzing the data, the researchers utilized version8 of the SPSS program. When it came time to present the findings, qualitative data analysis was followed by the creation of frequency tables, graphs, and a chart. You will learn every last detail in the fourth chapter.

3.6 SPSS SOFTWARE

The statistical data analysis software application known as SPSS is offered by IBM and is referred to as SPSS Statistics (Statistical Package for the Social Sciences).

Although it had its origins in the social sciences, SPSS is today utilized in many other data related fields as well. Research in the fields of medicine, education, and even marketing all use SPSS.

A diverse assortment of data sets might be analyzed with the assistance of SPSS. The results of scientific studies, server log files, Google Analytics, survey findings, and client databases are only some of the most prevalent types of sources. With SPSS, it is possible to do analyses and modifications on a wide range of data types as well as virtually every structured data format. The program supports the importation of data in a variety of forms, including downloadable spreadsheets and plain text files, amongst others.

SPSS not only performs descriptive and bivariate statistical analysis, but it also provides numerical result forecasts and projections for the purpose of classifying individuals. The package also includes data translation and graphing services, in addition to direct marketing options.

The open data is shown in a format similar to that of a spreadsheet in the primary window of the software. The metadata of the data file is displayed in its secondary variable view. This view demonstrates the variables and data entries that are contained inside the data file.

1968 marked the beginning of development on the software package that would later be sold to IBM in 2009. The software was once known as SPSS but has now been rebranded under the name IBM SPSS Statistics.

4 PRESENTATIONS OF FINDINGS

4.1 INTRODUCTION

In this chapter, the findings of research that was conducted using interviews and a questionnaire are presented in the form of tables and bar charts. All the question are asked in form of statement when the respond is between 0 for strongly disagree and 10 for strongly agree with scale of 1 step.

4.2 ORGANIZATIONAL FACTOR

4.2.1 Research Question 1

“The lack of policies and regulations had an effect over the implementation of solar energy systems in Istanbul hotels”. 60 % of the interviewers consider the impact of policies and regulations is not very important.

Table 4.1: policies.

Policies					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	2	9.5	9.5	9.5
	3.00	3	14.3	14.3	23.8
	4.00	12	57.1	57.1	81.0
	5.00	1	4.8	4.8	85.7
	6.00	1	4.8	4.8	90.5
	7.00	1	4.8	4.8	95.2
	9.00	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

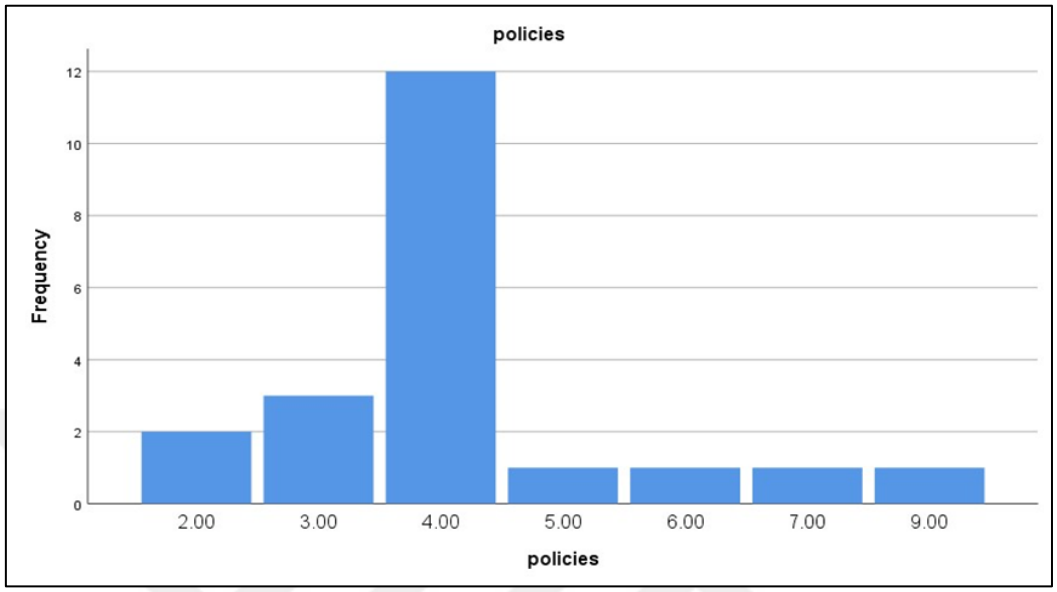

Figure 4.1: policies effect.

4.2.2 Research Question 2

"The lack of financial support from the government had an effect over the implementation of solar energy systems in Istanbul hotels". 60 % of the interviewers consider the impact of policies and regulations is very important.

Table 4.2: Government financial effect.

Government financial					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6.00	1	4.8	4.8	4.8
	7.00	4	19.0	19.0	23.8
	8.00	12	57.1	57.1	81.0
	9.00	3	14.3	14.3	95.2
	SA	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

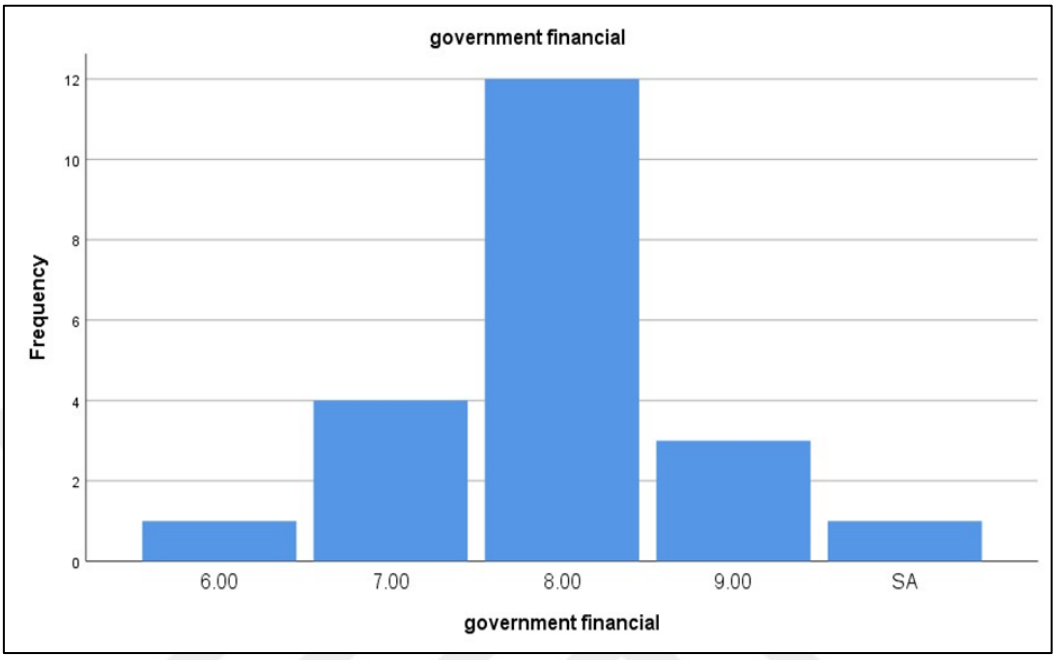

Figure 4.2: Government financial effect.

4.3 ECONOMIC FACTORS

4.3.1 Economical Question 1

"The high cost had an effect over the implementation of solar energy systems in Istanbul hotels". More than 70% of the population strongly agreed that the high cost of solar energy system implementation is an important factor will be taking the decision of switching the hotel to solar system energy.

Table 4.3: High cost of running effect.

High cost of running					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5.00	1	4.8	4.8	4.8
	6.00	1	4.8	4.8	9.5
	7.00	1	4.8	4.8	14.3
	8.00	1	4.8	4.8	19.0
	9.00	12	57.1	57.1	76.2
	SA	5	23.8	23.8	100.0
	Total	21	100.0	100.0	

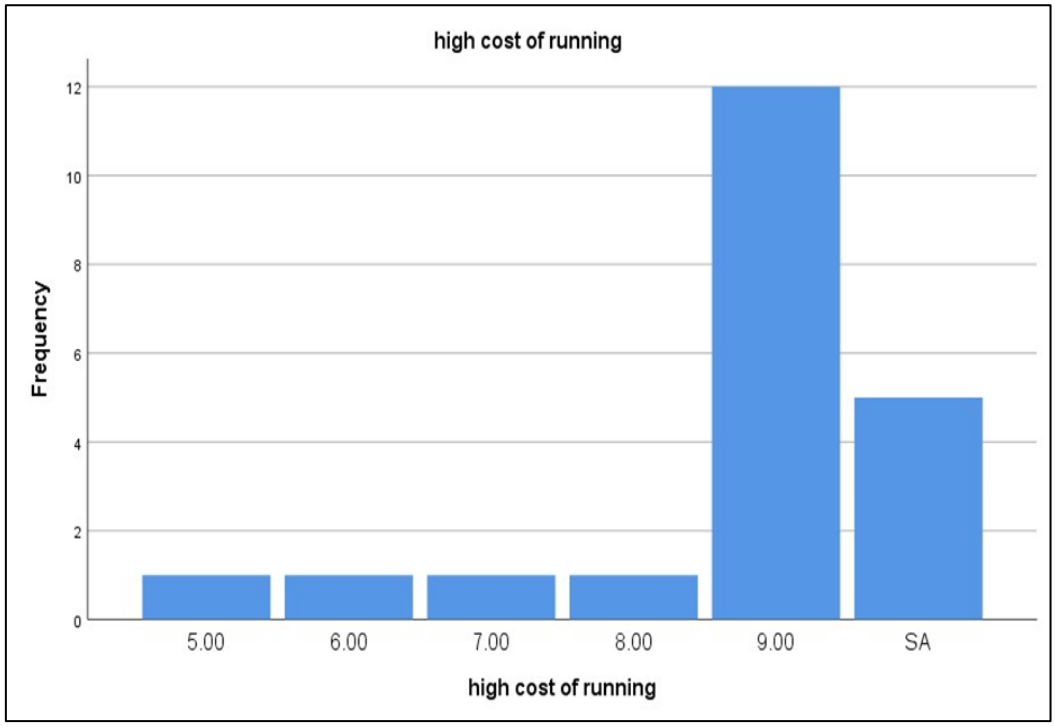

Figure 4.3: High cost of running effect.

4.3.2 Economical Question 2

“The high cost of maintenance had an effect over the implementation of solar energy systems in Istanbul hotels”. Most of interviews see the cost of maintenance is not very important.

Table 4.4: High-cost maintenance.

High-cost maintenance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	2	9.5	9.5	9.5
	3.00	2	9.5	9.5	19.0
	4.00	1	4.8	4.8	23.8
	5.00	11	52.4	52.4	76.2
	6.00	1	4.8	4.8	81.0
	7.00	1	4.8	4.8	85.7
	8.00	1	4.8	4.8	90.5
	9.00	2	9.5	9.5	100.0
	Total	21	100.0	100.0	

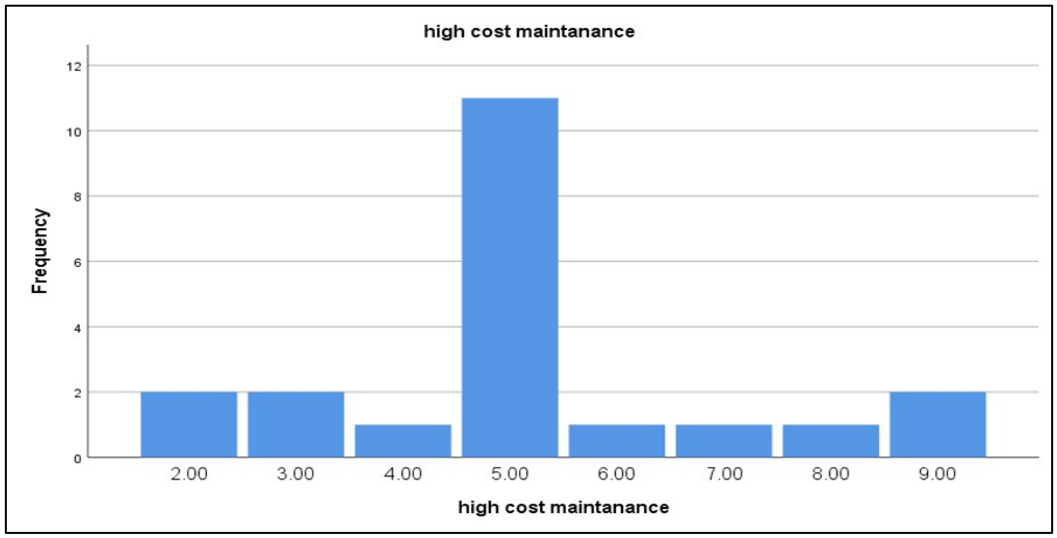

Figure 4.4: High-cost maintenance Effect.

4.3.3 Economical Question 3

"Cheap price of the fossil had an effect over the implementation of solar energy systems in Istanbul hotels". Most of interviews see the price of fossil is not a big deal as a factor for the implementation of solar energy systems.

Table 4.5: Price of fossil effect.

Price of fossil					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	2	9.5	9.5	9.5
	3.00	3	14.3	14.3	23.8
	4.00	9	42.9	42.9	66.7
	5.00	2	9.5	9.5	76.2
	6.00	2	9.5	9.5	85.7
	7.00	1	4.8	4.8	90.5
	8.00	1	4.8	4.8	95.2
	9.00	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

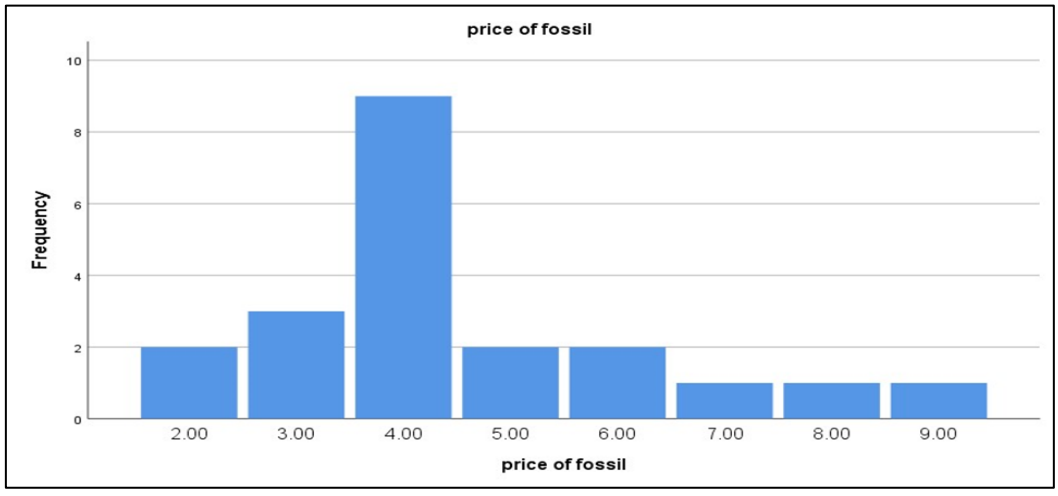

Figure 4.5: Price of fossil effect.

4.3.4 Economical Question 4

"The long duration of investment had an effect over the implementation of solar energy systems in Istanbul hotels". Apparently more than 70% of the interviewers consider this factor very important.

Table 4.6: Long duration payback effect.

Long duration payback					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5.00	1	4.8	4.8	4.8
	7.00	2	9.5	9.5	14.3
	8.00	2	9.5	9.5	23.8
	9.00	10	47.6	47.6	71.4
	SA	6	28.6	28.6	100.0
	Total	21	100.0	100.0	

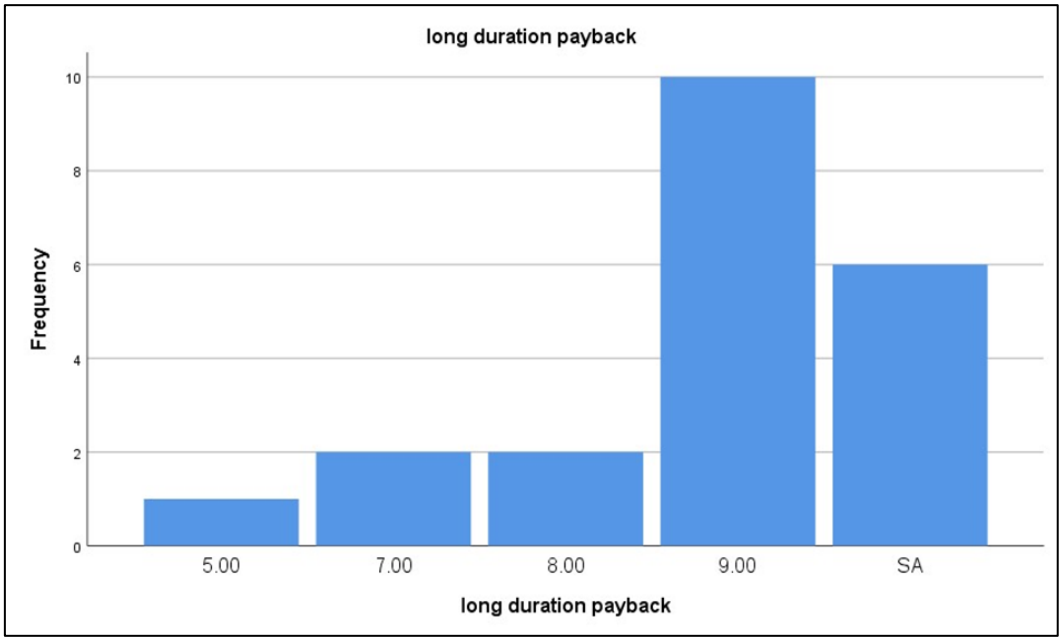

Figure 4.6: Long duration payback effect.

4.4 CULTURAL FACTORS

4.4.1 Cultural Question 1

"The government lack of awareness had an effect over the implementation of solar energy systems in Istanbul hotels". The awareness of government is a fair factor for the implementation of solar system in hotel in most of the interviewer's opinion.

Table 4.7: Government awareness.

Government awareness					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3.00	1	4.8	4.8	4.8
	4.00	1	4.8	4.8	9.5
	5.00	3	14.3	14.3	23.8
	6.00	11	52.4	52.4	76.2
	7.00	3	14.3	14.3	90.5
	8.00	1	4.8	4.8	95.2
	9.00	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

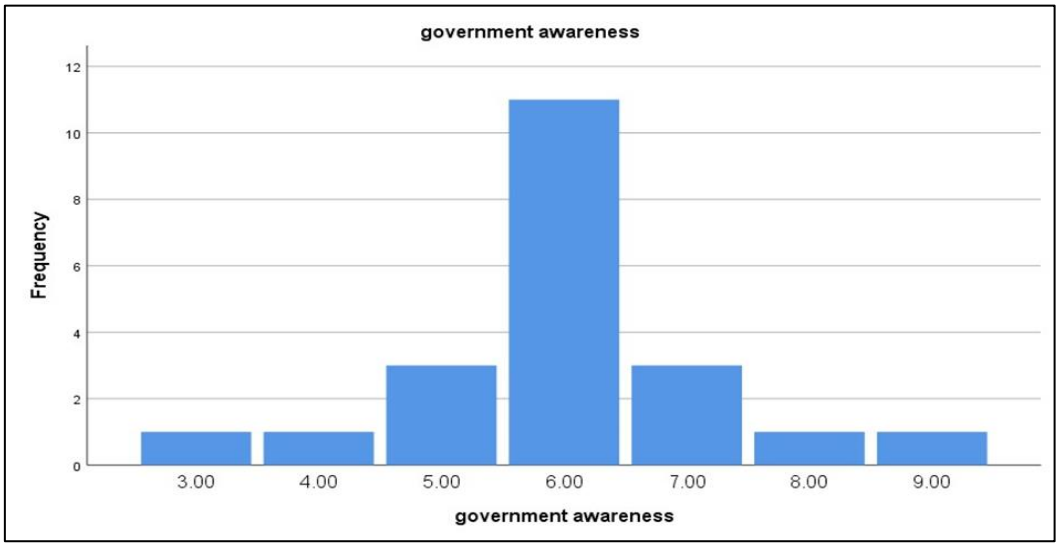

Figure 4.7: Government awareness.

4.4.2 Cultural Question 2

"The hotel's managers lack awareness had an effect over the implementation of solar energy systems in Istanbul hotels". More than 85% of population agreed that the importance of the personal awareness very high.

Table 4.8: Personal awareness.

Personal awareness					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6.00	2	9.5	9.5	9.5
	7.00	1	4.8	4.8	14.3
	8.00	2	9.5	9.5	23.8
	9.00	11	52.4	52.4	76.2
	SA	5	23.8	23.8	100.0
	Total	21	100.0	100.0	

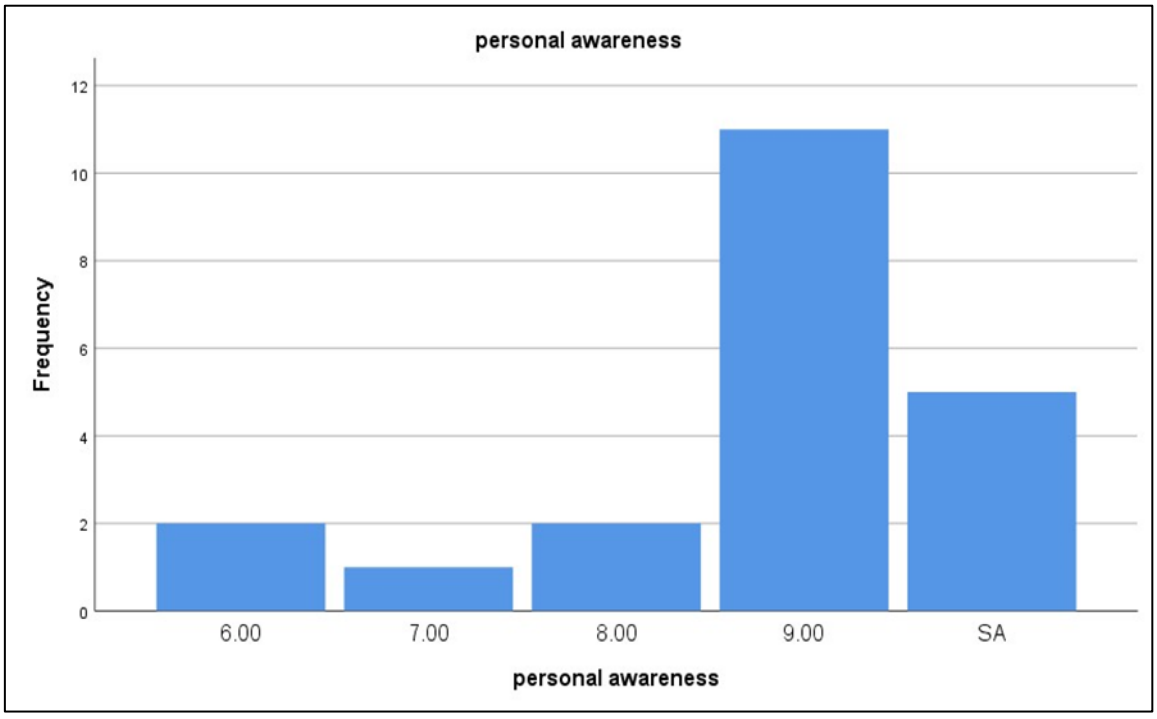

Figure 4.8: Personal awareness.

4.4.3 Cultural Question 3

"The customer lack of awareness had an effect over the implementation of solar energy systems in Istanbul hotels". The employee awareness is not very important factor for most of the interviewers.

Table 4.9: Employee awareness.

Employee awareness					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	4.8	4.8	4.8
	3.00	1	4.8	4.8	9.5
	4.00	2	9.5	9.5	19.0
	5.00	9	42.9	42.9	61.9
	6.00	4	19.0	19.0	81.0
	7.00	2	9.5	9.5	90.5
	8.00	1	4.8	4.8	95.2
	9.00	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

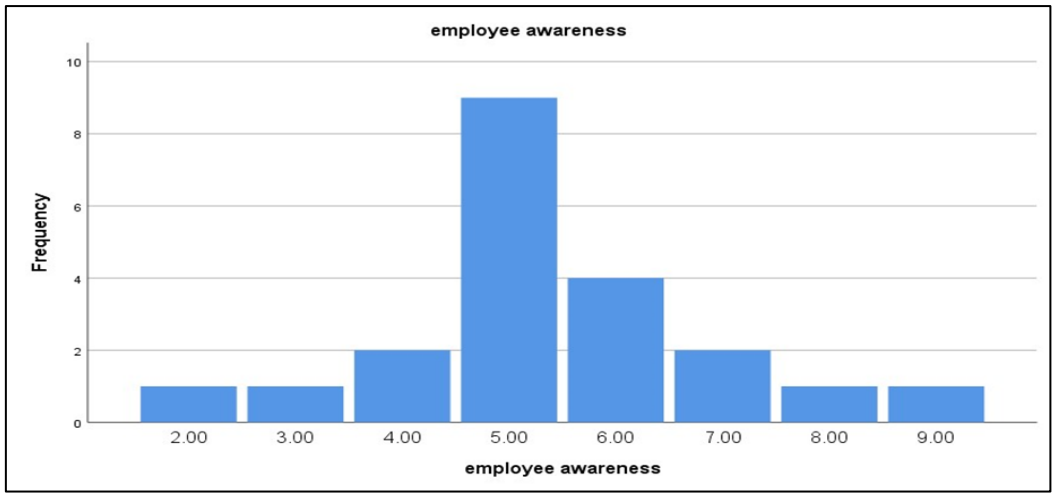

Figure 4.9: Employee awareness.

4.4.4 Cultural Question 4

“The employee lack of awareness had an effect over the implementation of solar energy systems in Istanbul hotels”.

Table 4.10: Customer awareness.

Customer awareness					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	1	4.8	4.8	4.8
	2.00	1	4.8	4.8	9.5
	3.00	3	14.3	14.3	23.8
	4.00	8	38.1	38.1	61.9
	5.00	2	9.5	9.5	71.4
	6.00	2	9.5	9.5	81.0
	7.00	1	4.8	4.8	85.7
	8.00	1	4.8	4.8	90.5
	9.00	2	9.5	9.5	100.0
	Total	21	100.0	100.0	

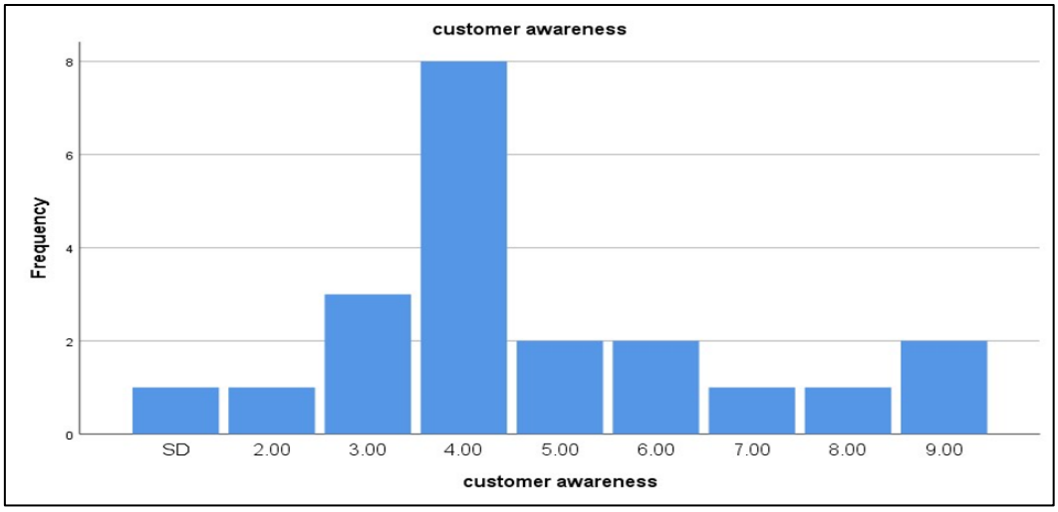

Figure 4.10: Customer awareness.

4.4.5 Cultural Question 5

“The government resistance to change had an effect over the implementation of solar energy systems in Istanbul hotels”.

Table 4.11: Resistance of G change.

Resistance of G change					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	10	47.6	47.6	47.6
	2.00	11	52.4	52.4	100.0
	Total	21	100.0	100.0	

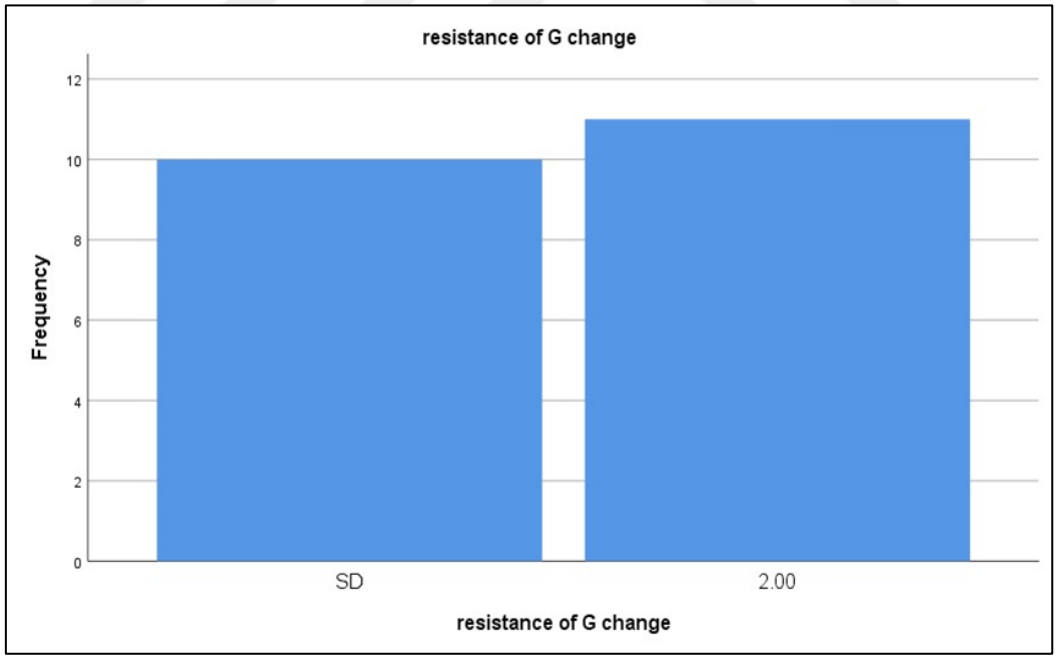

Figure 4.11: Resistance of G change.

4.5 TECHNOLOGICAL FACTORS

4.5.1 Technological Question 1

"The complexity of solar systems had an effect over the implementation of solar energy systems in Istanbul hotels".

Table 4.12: Complexity of solar system.

Complexity of solar system					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.00	2	9.5	9.5	9.5
	5.00	2	9.5	9.5	19.0
	6.00	3	14.3	14.3	33.3
	7.00	6	28.6	28.6	61.9
	8.00	3	14.3	14.3	76.2
	9.00	2	9.5	9.5	85.7
	SA	3	14.3	14.3	100.0
	Total	21	100.0	100.0	

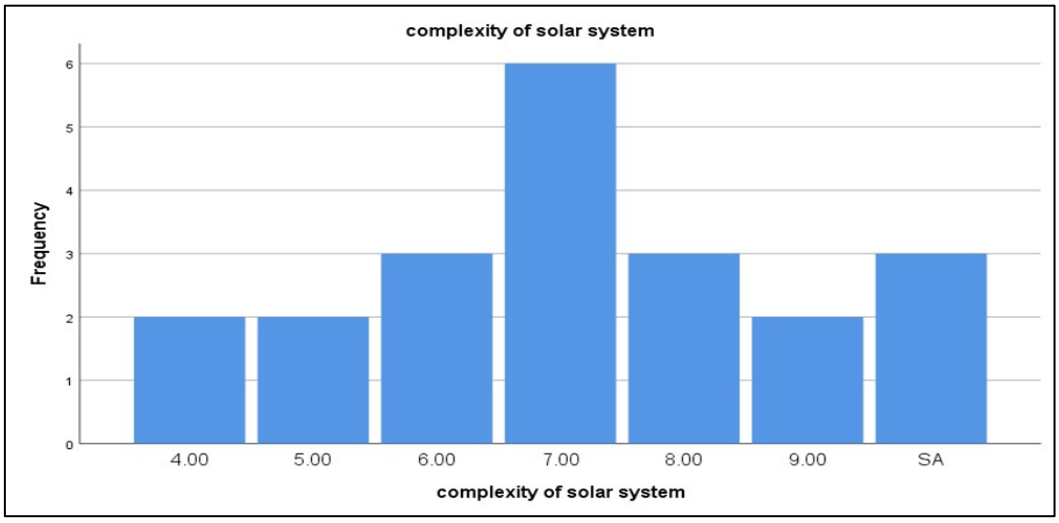

Figure 4.12: Complexity of solar system.

4.5.2 Technological Question 2

“The difficulty of replacing the current energy had an effect over the implementation of solar energy systems in Istanbul hotels.”

Table 4.13: Difficulty replacing current systems.

Difficulty replacing current syste s					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5.00	2	9.5	9.5	9.5
	8.00	13	61.9	61.9	71.4
	9.00	5	23.8	23.8	95.2
	SA	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

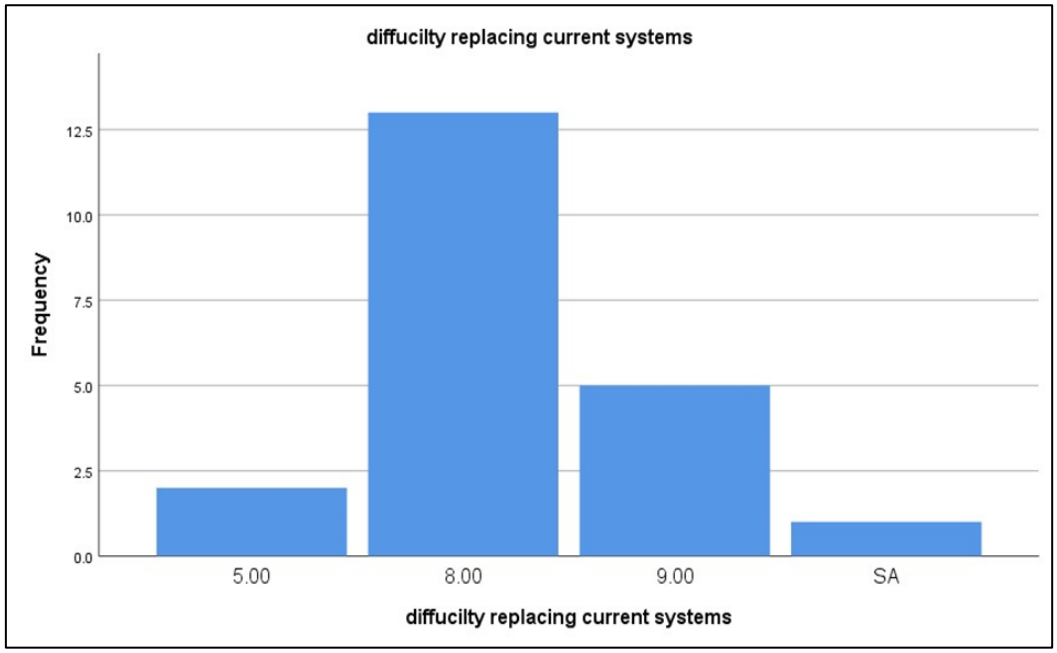

Figure 4.13: Difficulty replacing current systems.

4.5.3 Technological Question 3

"The area needed for system implementation had an effect over the implementation of solar energy systems in Istanbul hotels."

Table 4.14: Area needed.

Area needed					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.00	3	14.3	14.3	14.3
	5.00	1	4.8	4.8	19.0
	8.00	1	4.8	4.8	23.8
	9.00	10	47.6	47.6	71.4
	SA	6	28.6	28.6	100.0
	Total	21	100.0	100.0	

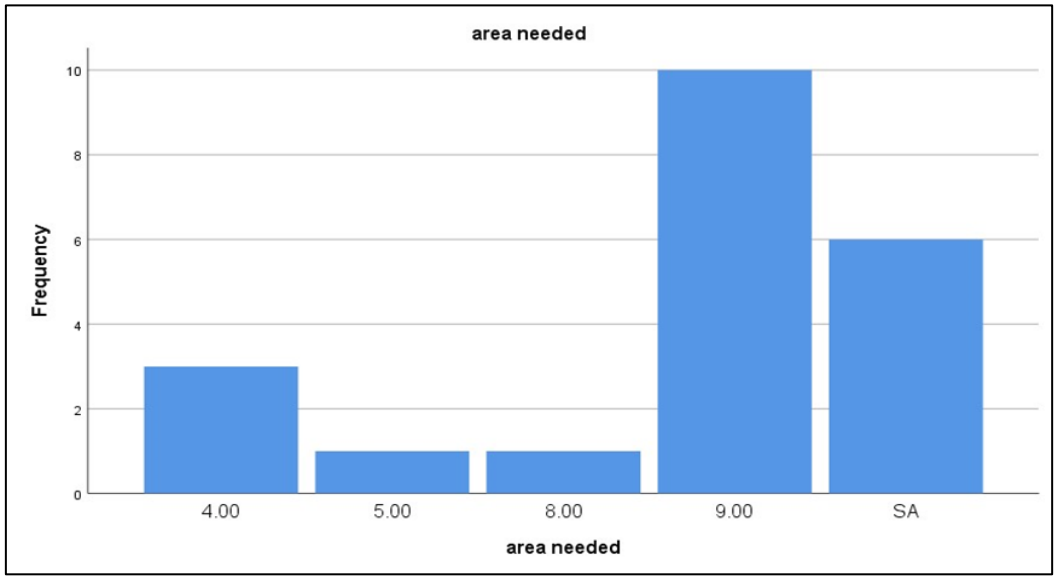

Figure 4.14: Area needed.

4.5.4 Technological Question 4

“The regular maintenance had an effect over the implementation of solar energy systems in Istanbul hotels.”

Table 4.15: Regular maintenance.

Regular maintenance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5.00	1	4.8	4.8	4.8
	6.00	1	4.8	4.8	9.5
	7.00	3	14.3	14.3	23.8
	8.00	9	42.9	42.9	66.7
	9.00	3	14.3	14.3	81.0
	SA	4	19.0	19.0	100.0
	Total	21	100.0	100.0	

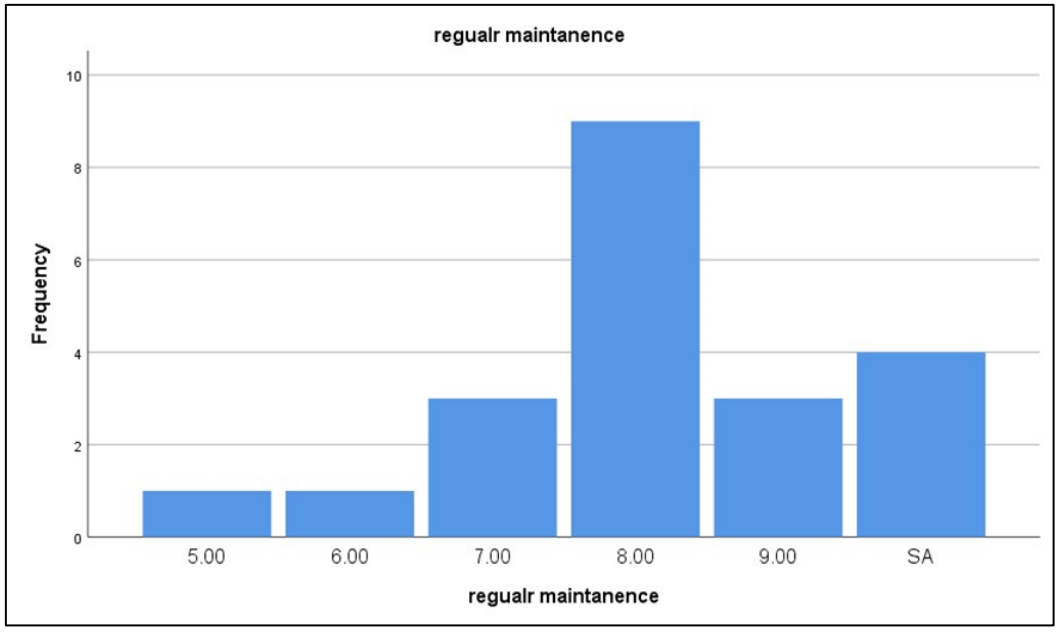

Figure 4.15: Regular maintenance.

4.5.5 Technological Question 5

“The low assurance had an effect over the implementation of solar energy systems in Istanbul hotels.”

Table 4.16: Low assurance.

Low assurance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3.00	1	4.8	4.8	4.8
	4.00	2	9.5	9.5	14.3
	5.00	1	4.8	4.8	19.0
	6.00	9	42.9	42.9	61.9
	7.00	2	9.5	9.5	71.4
	8.00	1	4.8	4.8	76.2
	9.00	2	9.5	9.5	85.7
	SA	3	14.3	14.3	100.0
	Total	21	100.0	100.0	

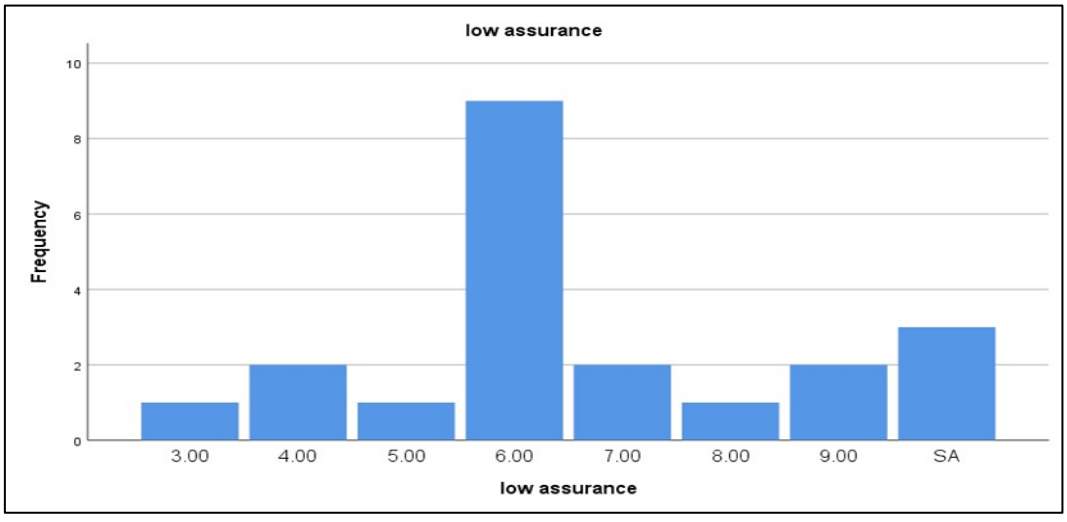

Figure 4.16: Low assurance.

4.5.6 Technological Question 6

“The lack of system technology production had an effect over the implementation of solar energy systems in Istanbul hotels”.

Table 4.17: Lack of system production.

Lack of system production					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6.00	2	9.5	9.5	9.5
	7.00	1	4.8	4.8	14.3
	8.00	2	9.5	9.5	23.8
	9.00	9	42.9	42.9	66.7
	SA	7	33.3	33.3	100.0
	Total	21	100.0	100.0	

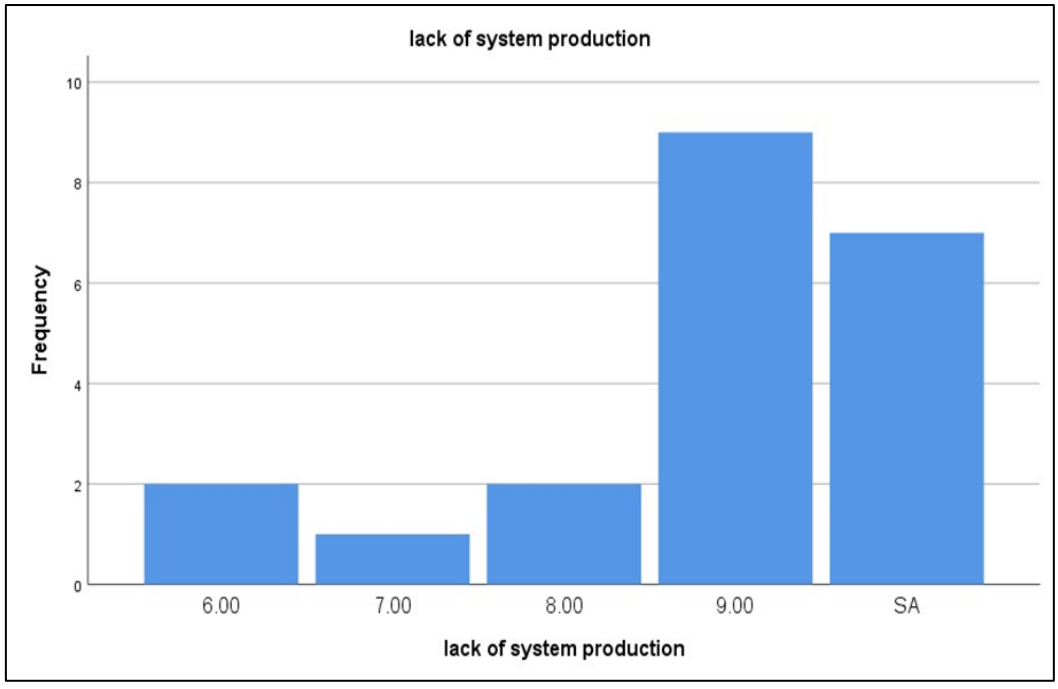

Figure 4.17: Lack of system production.

4.6 GEOGRAPHICAL FACTORS

“The effect overheats and decreasing sunlight effects the implementation of solar energy systems in Istanbul hotels”.

Table 4.18: Effect overheat and sunlight.

Effect overheats and sunlight					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	1	4.8	4.8	4.8
	2.00	4	19.0	19.0	23.8
	3.00	11	52.4	52.4	76.2
	4.00	3	14.3	14.3	90.5
	5.00	1	4.8	4.8	95.2
	7.00	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

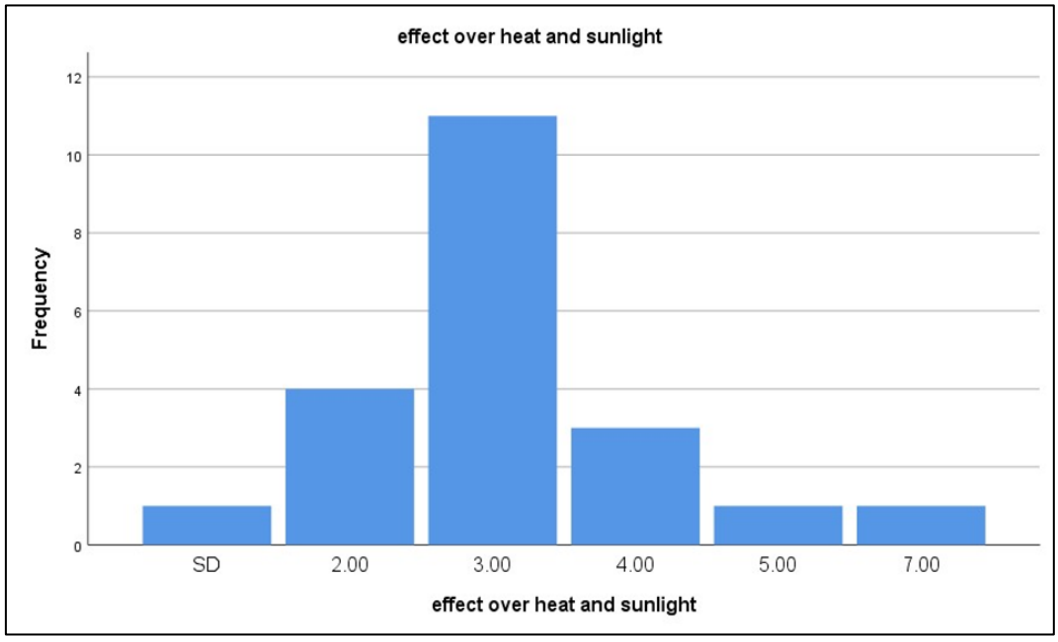

Figure 4.18: Effect overheat and sunlight.

4.7 SUMMARY

The usage of renewable solar energy at some of Istanbul's most prestigious four- and five-star hotels served as the primary subject of this inquiry. In the course of this study, the researchers' primary focus was on identifying the specific challenges that are most frequently encountered by hotels in Turkey when they are attempting to employ solar energy. Additionally, benefits of solar energy as a sustainable energy source and environmentally friendly form of energy that is ideally suited to Turkey's geographical location were discussed. The following research questions were asked in order to try to determine why such a small amount of solar power is being utilized in Istanbul's four- and five-star hotels:

How can the large four- and five-star hotels in Istanbul overcome the managerial and organizational barriers that prevent them from using solar energy?

Utilizing solar power in Istanbul's distinguished 4- and 5-star hotels presents a number of difficult financial obstacles.

Is there a cultural barrier to overcome in order to use solar electricity at some of Istanbul's most prominent hotels?

What are some of the technological obstacles that must be overcome before the most renowned hotels in Istanbul can switch to using solar power?

Because of the city's topography, the most renowned four- and five-star hotels in Istanbul are unable to utilize solar energy effectively.

The researchers were able to identify the most significant and significant barriers to the utilization of solar energy in the target hotels as a consequence of conducting interviews with hotel management. Because of this, these obstacles have been classified into the following categories.

4.8 FINDINGS

What kinds of challenges do the most famous four- and five-star hotels in Istanbul face when it comes to adopting solar energy?

Researchers found that one of the most major barriers to the usage of solar energy is the administrative and organizational challenges involved in doing so. This was determined through interviews with industry professionals. The support structure and policies put in place by the government were deemed to be ineffectual when the results of the interviews were tallied. In addition, the lack of financial support from the government is a significant barrier to the expansion of environmentally friendly energy use.

What kind of financial hurdles must the most renowned hotels in Istanbul overcome in order to switch to solar power?

Another factor that has been demonstrated to play a role in determining whether or not hotel rooms make use of solar energy is the cost of doing so. According to the findings, hotel businesses are unable to implement this system as quickly as other types of energy due to the high running expenses associated with it. The expenses associated with maintenance are not nearly as high as the costs associated with operation; nonetheless, in other instances, respondents were ignorant of the costs and lacked appropriate information about the matter at hand.

The most renowned four- and five-star hotels in Istanbul confront cultural obstacles when it comes to the implementation of solar energy.

According to the findings, cultural aspects constitute a barrier to the utilization of solar energy; hence, it is imperative that culturalization be taken into consideration as a vital component. The majority of respondents stressed how important a role the government plays in the process of culturalization.

Even with all of Istanbul's stringent construction regulations, is it even viable to use solar energy in the city's most luxurious hotels?

Because it is challenging to compare this new technology to previous types of energy systems in Iran, Hotel management lack sufficient knowledge of the system's complexity, advantages, and disadvantages. This is one of the primary obstacles on the way.

Because of the city's topography, the most renowned 4- and 5-star hotels in Istanbul are unable to utilize solar energy effectively.

Only three of the persons who were questioned for this study properly recognized the geographical problem as a barrier to adopting solar energy, despite the fact that the majority of those who were interviewed did not have sufficient knowledge about the issue to accurately identify it as such.

4.9 DISCUSSION

According to the findings of the research, the most essential aspects are managerial and organizational considerations. It is abundantly clear that this component is essential to the utilization of solar energy, and the findings of this research corroborate those of earlier research [8] which showed that the absence of government support policies has a detrimental effect on the utilization of solar energy, particularly in developing countries. Researchers that participated in this study came to the conclusion that public financial aid for the use of solar energy has a significant role. [8] They contend that encourages and refunds from governments balance the initial cost of installing solar panels.

Consideration must also be given to the influence that economics have on the amount of solar energy that is consumed. According to the findings of this research project, the high cost of installation is the most significant barrier to the widespread adoption of solar power in Istanbul's four- and five-star hotels. When it comes to the second aspect of the economy, interviewers have a hard time estimating how much it will cost to maintain solar energy plants. Utilization of solar energy is impeded by economic issues such as high costs associated with solar technology and an inability to account for all of the expenses and benefits associated with a system. In addition to this, it was said in [20] that a key disadvantage of a system is the basic operational expenses.

In addition, they said that the price of solar energy is considerably higher than the price of fuels made from fossil fuels. The same may be stated regarding the ways that hotels are now utilizing electrical power.

The third research question, which focuses on cultural aspects, shows that the lack of understanding of important 4- and 5-star hotel management about this new technology and the government's reluctance to change are crucial hurdles to the use of renewable solar energy in hotels.

According to the findings of previous research, the absence of government regulations and standards, as well as a lack of information distribution and consumer understanding, has also been proven to have a substantial influence on the use of solar energy. In addition, the results of this poll indicate that both customers and workers of hotels are uninformed of the positive aspects associated with the installation of solar systems in their respective businesses. According to [20], a lack of skilled workers and educational opportunities is a barrier to the usage of solar electricity. The respondents claim that staff members can be trained to utilize new technology, and that a lack of understanding is not a barrier to the use of solar energy in 4- and 5-star hotels.

The technological component is relevant as an effective problem that affects solar energy consumption because the complexity of solar systems and the difficulty of replacing solar energy systems for the present energy system illustrate the significance of the technological component. Lastly, there is a lack of solar technology in Turkey; similarly, to Doner [9], who mentioned that technical factors could be considered a barrier to the use of solar power, also [8] listed difficulties in overcoming established energy systems as an important obstacle to the use of solar systems as a barrier to the use of solar systems. The operating operations of solar systems demand a significant amount of space. In addition, [20] mentioned that one of the drawbacks of solar systems is that a significant amount of land is necessary for the installation of solar panels in order to attain an adequate level of effectiveness.

The final obstacle is the gap that separates them physically. According to the conclusions of a research study that was based on interviews with participants, the level of air pollution in

Istanbul may have an effect on the operation of solar systems. In spite of the fact that Turkey's air pollution is getting worse, none of the other research have shown evidence that this is a particularly major barrier. However, the production of solar energy is affected when there are clouds in the sky or when there is pollution in the air.

5 CONCLUSIONS

5.1 CONCLUSIONS

In order to investigate the challenges that come with using solar power, the researchers sent out questionnaires to several of Istanbul's most opulent hotels and kept those questionnaires up to date.

The questionnaire was divided into five sections, each of which was based on one of five different factors: managerial-organizational, economic, technical, cultural, and geographical. Various managerial and organizational factors pointed to the need for help from the government for hotels that adhere to certain standards, laws, and policies and have unique worries regarding their finances. The findings

According to the findings of an economic research, one of the most significant barriers to the widespread adoption of solar energy is the high operational expense associated with solar powered systems. The lack of familiarity on the part of management and the government with new technologies, such as current energy, is a barrier to the advancement of technology and technical challenges. Another significant barrier was the lack of solar technology, which prevented the creation of solar energy on a local level.

The fact that management was uninformed of the issue was also discovered through the analysis of questions pertaining to cultural characteristics. In the most major development, it would appear that authorities have constructed barriers to the utilization of solar energy. The next factor to take into account is Istanbul's haze, which is often seen as a barrier to the usage of solar energy. Unfortunately, the management of the hotels who took part in the research did not understand the significance of this idea and did not implement any of the most recent solar energy systems for their own facilities.

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