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Faculty of Graduate Studies

ANALYSIS OF PALESTINE ENERGY POLICY PROGRESS ON ACHIEVING SDG7

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Dedication

To whom I have always been blessed by God for being part of my life,

My dear father, the teacher, Mohammad Salim Abu Jafar,

My dear mother, teacher Etidal Abdul-Jabbar, Umm Jafar

My life partner and wife Riham Mamoun

My dear sister Liqa Mohammad

My children:

Ayman Salim

Mohammad Salim

Sally Salim

Anas Salim

My dear friends and colleagues

Acknowledgment

I would like to express my gratitude to my supervisor Dr. Adel Juaidi for his valuable guidance, valuable information, generous manners.

Deep thanks to all my teachers in An Najah National University

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

ANALYSIS OF PALESTINE ENERGY POLICY PROGRESS ON ACHIEVING SDG7

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: _____

Signature: _____

Date: _____

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ANALYSIS OF PALESTINE ENERGY POLICY PROGRESS ON ACHIEVING SDG7

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Abstract

Countries worldwide devote a great interest in energy policies due to their significant effect on the international budget and global environmental issues. Most importantly, Energy policies are directly reflected in the population's lifestyles, welfare, and behaviour. This thesis discusses the Palestinian accomplishment of fulfilling the seventh goal of the sustainable development goals (SDG 7). The UN's five targets for (SDG7) have been reviewed and evaluated, along with their associated indicators considering the following: Proportion of population with access to electricity, access to clean fuels for cooking, renewable energy share in the total final energy consumption, community awareness of the necessity of energy-saving devices, and the state's policies towards energy efficiency. According to the findings, Palestine has made significant progress toward achieving the first, third and fourth targets but has fallen short of accomplishing the second and fifth targets. Moreover, the political situation in Palestine is taken into consideration, and thus the resulting challenges posed by the Israeli occupation. Furthermore, the energy situation in terms of production and consumption, renewable energy, and energy policy are all carefully evaluated. To be more specific, further clarifications were provided for the political, economic, and social difficulties that Palestine confronts, such as population growth and its impact on energy consumption.

Chapter One

Introduction

1.1 Introduction

Developing an energy policy strategy is a top priority for all countries worldwide. Such approaches help make the most of a country's local resources, minimize the losses, secure energy generation with fair prices for the future, and reduce the environmental impact. In September 2015, the UN issued the Sustainable Development Goals (SDGs) to achieve 169 ambitious goals associated with the 17 SDGs by 2030. One hundred ninety-three countries agreed on the vital role of energy as a critical factor in obtaining the SDGs; accordingly, the UN considered SDG7) to Ensure access to affordable, reliable, sustainable and modern energy for all [43].

The three main targets of SDG7 by 2030: universal energy access, increasing the renewable energy (RE) share in global energy consumption, and increasing energy efficiency [43]. If the current energy status continues, the global scale report in 2018 anticipates failing in achieving SDG7 by 2030. For example, under the current situation, about 92% and 73% of the world population will enjoy clean cooking fuels and electricity [4], respectively, by 2030. Additionally, the RE percentage of final energy consumption is to be 21%, which could not be considered as an adequate increase from the base value of 18.3% [4].

In 2019, the percentage of residents who have access to electric power in Palestine reached 99.8 % [5], distributed as follows: 99.8 % of the West Bank and Gaza Strip residents are supplied with electricity, whether located in urban areas or refugee camps, while the percentage in rural areas was 99.7 % [5]. Previous results indicate that Palestine has achieved one of the goals of SDG7 [43]. Palestine consumes 100% of its fossil fuel demand through importing it from neighbouring countries [3], 87% of the consumed electrical energy is imported from the Israeli occupation state, and 8% from the Palestinian Electricity Company [3]. In comparison, the percentage of imported energy from Jordan and Egypt does not exceed 5%, knowing that the RE share does not exceed 11.7% of the total energy demand, implying that the Israeli occupation has complete control over energy security in Palestine [3].

Israel Electric Company (IEC) controls the supply of traditional energy (electricity). This monopoly leads to increasing prices, energy shortages, and the possibility of future energy crises [6]. The Palestinian energy supply faces numerous challenges due to its full reliance on Israel, which contributes to 100% of its fossil fuel imports and 90% of its electricity supply. Thus, increasing the electricity prices where the current cost of electrical energy starts from 0.4443 NIS/ kWh for residential consumers.

Throughout the Energy Authority, Palestine has worked to enhance the investment in the renewable energy sector by implementing renewable energy projects or by encouraging investment for the private sector at the residential or commercial level.

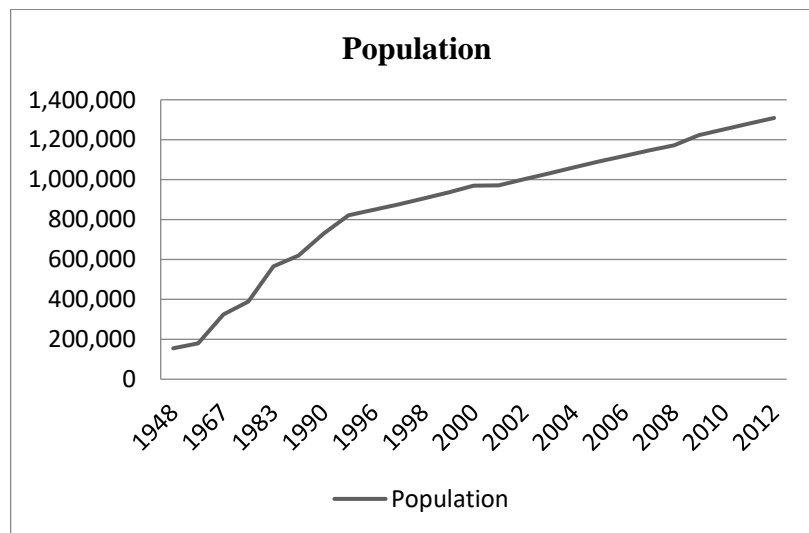
Overview of population sector in Palestine

Palestine witnessed many crises in the twentieth century due to the Israeli occupation of Palestine, which caused two major migrations; The first migration occurred after the Nakba War in 1948, and the second occurred after the Naksa War in 1967.

The following figure shows the number of Palestinians Since the beginning of the Israeli occupation until 2017 [35].

Figure 1

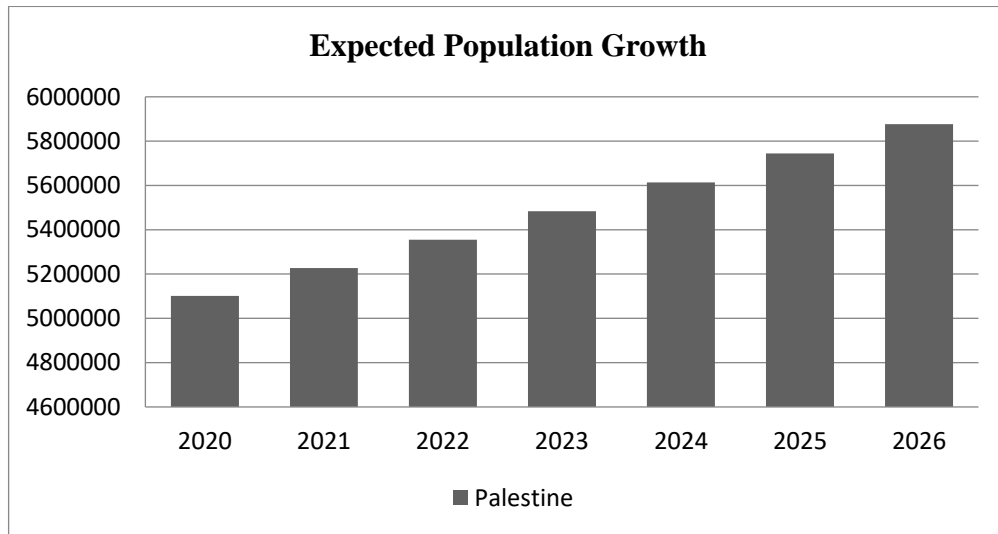
Population growth



The following figure depicts the estimated Palestinian population in Palestine since 2020, and the expected population growth for the years ahead, up to the year 2026 [35].

Figure 2

Expected Population growth in Palestine



1.2 Problem statement

The Palestinian government seeks to provide as many services as possible for its citizens, especially energy. The Palestinian energy demand is largely met by importing it from Israel and, the rest are from Egypt, Jordan, and Gaza power plants. Therefore, the focus of this thesis is on the energy policies that are required to achieve the United Nations' (SDG7) in Palestine.

1.3 Objective of the Study

The key objective is to link the energy policies in Palestine to SDG7, and demonstrate how they relate and affect each other. The objectives:

- To Review Energy Policies in Palestine and implementation of such policies.
- To assess the compatibility of energy policies in Palestine with the United Nations' (SDG7).
- Propose recommendations to improve the energy policies in Palestine in accordance with the United Nations' (SDG7).

1.4 Methodology

WP1: A literature review on energy policies for Palestine

T1: Palestine Policies for Electrical Sector, comprises:

Historically, Roles and Responsibilities, Organizational Structure

T2: Palestine Policies for Tariff, comprises:

Consumers Tariff, Type of Tariff, Low Power Factor Tariff

T3: Palestine Policies for Traditional Energy Sector, comprises:

Generation Sources, Palestine Imports

T4: Palestine Policies for Renewable Energy Sector, comprises:

Vision, Strategic Goal and Targets, Main Built Projects

T5: Palestine Policies for Transportation Sector

T6: Palestine Policies for Appliances and Energy Management

T7: Palestine Policies for Emissions

WP2: Studying the general energy challenges factors

T1: Studying political (Israeli occupation) factors, comprises:

Ports and Borders, Geographical Division, Energy Sector

T2: Studying economic factors, comprises:

Taxes, Finance

T3: Studying social factors, comprises:

Palestinian Camps

T4: Studying renewable Energy Challenges, comprises:

Sovereign Guarantees, Connecting Point, Political Risks

T5: Studying traditional energy challenges, comprises:

Fossil Fuel, Prices, Supply Security, Debts,

T6: Studying electrical energy challenges, comprises:

Generation Companies, Distribution Companies

WP3: Studying the energy Potential in Palestine

T1: Studying Electrical Energy in Palestine, comprises:

Consumers' Number, Tariff Classifications, Sales (GWH), Indicators of Service, Quality of Service, Financial Indicators,

T2: Studying Renewable Energy in Palestine, comprises:

Renewable Energy Data in 2020, Renewable Energy Data in the Last Three Years, Capacity Growth

T3: Studying Fossil Fuel in Palestine, comprises:

Petroleum Products, Consumption Sector

WP4: Analysing goal number seven of sustainable development

T1: Sustainable Development Goals (SDGs), comprises:

Definitions, Description, Revision

T2: Sustainable Development Goal Number 7 (SDG7), comprises:

Targets and Indicators Analysis, UN Recommendations

T3: Sustainable Development Goal Number 7 (SDG7) in Palestine, comprises:

Analysis of Palestinian Data According to SDG7

T4: Palestine VS Global for Achieving Goals, comprises:

comparison between Palestine and global in attaining SDG7

WP5: Development of a framework for fulfilling SDG7

T1: Conclusion

T2: Recommendations

1.5 Thesis Structure

- **Chapter One: Introduction**

This chapter outlines the importance of energy policy for Palestinian state, as well as the significance of the UN's SDG7 in achieving that policy.

Chapter Two: Literature review

This chapter represents a literature review on energy policy assessment for Palestine and countries with similar characteristics to Palestine.

- **Chapter Three: Energy Situation in Palestine: Potential and Challenges**

This chapter illustrates the challenges that face Palestine in general, as well as the obstacles posed by the Israeli occupation. Moreover, it addresses the renewable energy and traditional energy in Palestine and how they relate to the energy policies.

- **Chapter Four: Analysing the goal number seven of Sustainable Development**

This chapter represents the United Nations' Sustainable Development Goals as it focuses on goal number seven and its relevance to the energy policies in Palestine.

- **Chapter Five: Conclusion and Recommendation**

This chapter aims to determine the energy policies in Palestine and the potential developments, particularly in the next twenty years, highlighting how these policies align with the SDG7 to provide the best benefits to Palestinians.

Chapter Two

Literature Review

2 Literature review on energy policies assessment for Palestine

The Israel Electric Company (IEC) controls the supply of traditional energy (electricity), which led to increasing the prices, energy shortages, and the possibility of future energy crises [6]. The Palestinian energy supply faces numerous challenges as a result of their full reliance on Israel. It contributes to 100% of the Palestinian fossil fuel imports and 90% of electricity supply, resulting in high energy prices [7].

2.1 Vision

Building a comprehensive and integrated Palestinian national energy system capable of obtaining enough energy from different sources to meet the needs of comprehensive sustainable development at prices that represent the true cost of supply and consumption. [8], It is also of high efficiency, quality, and reliability that achieves the international quality specifications necessary for social development and economic progress so that the means employed to secure and supply energy needs are high-tech and compliant with international environmental standards [8].

2.2 Strategic Goals

Energy conservation in buildings can be achieved through the appropriate thermal design of the external elements of the building that make up the outer envelope and also by environment protection. These measures provide thermal comfort and a healthy atmosphere for the building occupants, increasing their work and production activity [8].

2.3 Palestine Policies for Electrical Sector

2.3.1 Historically

Since the foundation of the Palestinian National Authority, there has been a strong emphasis on energy and energy regulating policies, notably in the field of electricity. As a result, the Palestinian Energy Authority [8] was established as an independent and specialized energy authority.

Since its establishment, the Palestinian Energy Authority has gone through several stages of development, the most noticeable of which was the change of supervising authority in 2003, as it became directly subordinate to the Prime Minister rather than the Palestinian Authority's President [8]. Finally, in 2009, when Decree-Law No. 13 regarding the General Electricity Law was issued, the legal provisions of the Energy Authority Law concerning the electricity sector were cancelled.

The electricity sector is organized on three levels; First level: the political level, represented by the Palestinian Energy Authority, second level: the supervisory level represented by the Electricity Sector Regulatory Council, third level: the executive level represented by the electricity generation, transmission, and distribution companies.

Thus, the Energy Authority's powers and responsibilities are dedicated towards formulating policies, and handling international relations, programs, and plans for the electricity sector [8].

The energy sector in Palestine consists of the following sources: Traditional energy, Renewable energy, and Hydrocarbon sector (oil and gas derivatives).

The first and second sources are under the supervision of the Energy and Natural Resources Authority, while the Petroleum Authority supervises the hydrocarbon sector [8].

There are many laws, legislations, regulations and systems related to the management, operation and regulation of the energy sector in Palestine including [8]:

Decree-Law No. (12/1995): Concerning establishing the Energy Authority and defining its powers and responsibilities.

Decree-Law No. (13/2009) regarding the General Electricity Law; the primary law that organizes the electricity sector and defines Institutions operating in the sector, their structure, role, and responsibilities.

Decree-Law No. (14) on Renewable Energy and Energy Efficiency in Palestine for 2015. This law is concerned with encouraging the exploitation of RE sources. It also defines the responsibilities of the relevant institutions, including the Energy Authority, the Energy Research Centre, and the Electricity Sector Regulatory Council. It is also responsible for

specifying the required mechanisms to establish renewable power plants and thus their volumes and contracting mechanisms.

2.3.2 Roles and Responsibilities

1. Energy and Natural Resources Authority

The Energy and Natural Resources Authority is responsible for Setting general policies and rules related to the development of the energy sector and submitting them to the Council of Ministers for approval and preparing studies and legislation to enhance the exploitation of renewable energy resources. Take the approval of the Council of Ministers to contract with neighbouring countries to make electrical interconnections and exchange electrical energy.

Most importantly, this authority issues safety instructions that align with the standard specifications for power and electrical installations in cooperation with relevant authorities. It is also liable for granting licenses to establish, manage, operate and maintain electric power generation, transmission, distribution, and sale projects.

In order to ensure delivering the electrical energy properly to the consumer, the Energy and Natural Resources Authority sets the electric tariff, subscription fees, extension costs, insurances, and other services, then submits them to the Council of Ministers for approval [8].

2. Electricity Sector Regulatory Council

The electricity sector regulator council is responsible for monitoring the electrical energy generation, transmission, distribution, and sale activities, to ensure compliance with the approved laws, regulations, and systems. Where it also works on establishing controls that ensure legitimate competition in the activities of producing and distributing electric energy, so as to ensure the interests of the consumer.

Additionally, the council verifies that the cost of production, transmission and distribution of electrical energy to guarantee the interests of all parties involved in the electrical sector. He also ensures that distribution companies provide consumers with a high-quality technical and administrative services.

In order to ensure delivering the electrical energy properly to the consumer, the Council Proposes Recommendations to the Energy Authority regarding the electric tariff, subscription fees, allowance for the costs of extensions, insurance, and other services. Then, consult the relevant authorities to specify fair prices while considering the price deviation between different governorates. Finally, He asks the Energy Authority to accept, reject, renew, withdraw or assign licenses to generation and distribution companies [8].

3. Electricity distribution companies

Electricity distribution companies are responsible for purchasing energy from the Palestinian Electricity Transmission Company and distribute it to consumers according to the unified tariff approved by the Energy Authority [8]. Moreover, one of the main roles of these companies is to prepare distribution network development plans and submit them to the Electricity Sector Regulatory Council on a regular basis, provided that the companies are committed to complete the approved projects within the agreed time frame [8].

4. Palestinian Electricity Transmission Company

The Palestinian Electricity Transmission Company develops, manages, and maintains the electrical transmission systems in compliance with the legislation, besides the construction and maintenance of high voltage transformer stations. Moreover, it constructs new substations and expand the existing ones if necessary.

Furthermore, purchasing electrical energy from various sources and selling it to electricity distribution companies is liable to the Palestinian Electricity Transmission Company, besides managing the electrical connection points for local bodies not affiliated with the electricity distribution companies [8].

5. Palestinian Centre for Energy and Environmental Research

The Palestinian Centre for Energy and Environmental Research is responsible for supervising and assisting in developing studies linked to the use of renewable energy sources. Where it also supervises the implementation of the renewable energy sector strategy.

Consumers Tariff

The tariff explained in Table 1 is applied for all regions in Palestine, except for the Jordan Valley. Residential consumers, worship places, government educational institutions, and charities for prepaid one- and three-phase meters are also excluded. If this tariff cannot be applied, a new tariff will be compromised.

Table 1

Residential Consumers Tariff

Amount of Consumed Energy (kWh/ Month)	Region	Price NIS/ kWh
1 – 160	Palestine	0.4443
161 - 250	Palestine	0.4790
251 – 400	Palestine	0.5524
401 – 600	Palestine	0.5906
More than 600	Palestine	0.5630
Emergency	Palestine	0.4834
1 – 700	Jordan Valley	0.4156
More than 700	Jordan Valley	0.4592
Emergency	Jordan Valley	0.4403

The tariff explained in table 2 is applied for commercial consumers, low and medium voltage consumers, marble factories, water pumping, and agricultural consumers.

Table 2

Consumers Tariff

Amount of Consumed Energy (kWh/ Month)	Type	Price NIS/ kWh
Flat Tariff	Non-Repaid Commercial	0.6090
Flat Tariff	prepaid Commercial	0.5813
Less than 60000	Low Voltage	0.4960
Flat Tariff	Medium Voltage	0.4230
Flat Tariff	Marble Factories	0.5264
Flat Tariff	Water Pumping	0.4703
Flat Tariff	Agricultural	0.4500

Low Power Factor Tariff

- **Low Voltage Consumers**

The tariff shown in Table 3 applies when the power factor is less than 0.92.

Table 3*Low Voltage Power Factor Consumers Tariff*

Power Factor	Price (NIS)
0.92 - 0.8	0.1 % from the bill for 0.01 PF less than 0.92
0.79 – 0.70	0.125 % from the bill for 0.01 PF less than 0.92
Less than 0.69	0.15 % from the bill for 0.01 PF less than 0.92

- **Medium Voltage Consumers**

The tariff shown in Table 4 applies when the power factor is less than 0.90.

Table 4*Medium Voltage Power Factor Consumers Tariff*

Power Factor	Price (NIS)
0.90- 0.78	0.1 % from the bill for 0.01 PF less than 0.92
0.77 – 0.68	0.125 % from the bill for 0.01 PF less than 0.92
Less than 0.68	0.15 % from the bill for 0.01 PF less than 0.92

Minimum Cut-Off for Daily Consumption

The tariff shown in Table 5 applies on a daily basis when the energy consumption equals zero.

Table 5*Medium Voltage Cut-Off for Daily Consumption Tariff*

Tariff	Cost (NIS)
Residential consumers post paid	0.34
Residential consumers pre-paid	0.00
Commercial Consumers post paid	0.67
Commercial Consumers pre-paid	0.00
Industrial Consumers post -paid	1.00
Industrial Consumers pre-paid	0.00
Water Pumping	1.00
Agricultural	0.34

2.5 Palestine Policies for Traditional Energy Sector

The private sector plays an essential role in developing Palestine's energy sector by contributing to the construction of power plants, whether conventional or renewable. Furthermore, it assists in enhancing the production of the energy industry, which is a source of revenue for the state treasury [10].

Palestine depends mainly on Israel to secure its electrical energy and petroleum demand, while it imports only a small portion of the electrical energy from Jordan to supply the

areas of Jericho and the Jordan Valley. The same applies to Egypt. Palestine imports a small portion of the electrical energy to supply the Gaza Strip [10].

The difficult economic and political situations in Palestine are driving significant energy complications, where Palestine has been suffering from the Israeli occupation for more than seventy years, besides the internal Palestinian division for more than fifteen years. One of the main resulting complications is lacking an actual generation project in the Palestinian lands, where the only electrical generating station in Palestine is the Gaza Generating Station that shares only 11% of the electrical energy demand.

2.6 Palestine Policies for Renewable Energy Sector

The strategic vision of the energy authority aims to enhance the RE sector by increasing the dependency on RE resources, which implies having more than one source for securing Palestine's electrical demand.

Palestine issued its first law on renewable energy and energy efficiency in 2015, which aims to accomplish the following: Encouraging the exploitation of renewable energy sources and making the best use of their applications, aiming to increase the net RE share to the total energy and help to attain a reliable supply, in accordance with the renewable energy strategy. Moreover, it conserves energy through optimal use in various sectors and meets the requirements of sustainable development while protecting and preserving the environment. Furthermore, it encourages local manufacturing, high-efficient equipment and systems for RE applications, and approved mechanisms for implementing renewable energy projects.

The first law on energy supported the Palestinian initiative for solar energy for the residential sector for capacities of less than 5 kilowatts or less for a single system, subject to the distinctive tariff recommended by the Council and reviewed periodically. Additionally, this law seeks to expand the use of net metering systems for projects with capacities higher than 5 kilowatts in all sectors, provided that it does not exceed a certain percentage determined in the energy strategy. Finally, submitting bids or soliciting offers on a competitive basis in accordance with the relevant applicable laws for the establishment of power plants to sell those [10].

2.6.1 The strategic Goals

Palestine has defined its strategic goals, which are, sustainable use of renewable energy, energy independence, and security of energy supply, economic and social development [11].

2.6.2 The Target of Strategy

- 130 MW by the year 2020
- 500 MW by the year 2030

2.6.3 Implementation Mechanisms

Palestinian Solar Energy Initiative PSI, Net metering system, Direct Bidding, Competitive Bidding.

2.6.4 The Main Built Projects

- During the past few years, many RE projects were implemented [10]. Below are the most significant ones:

Table 6

PV system investments up to 2020

Project	Power (MW)	Location
Ajja Solar Project	2	Jenin
Maithalon	3	Jenin
Ya'bad Municipality	4	Jenin
Maslmani Co.	3	Tubas
CocaCola Factories in WB	2	Ramallah
Noor Jericho, PIF	7.5	Jericho
Hajla Solar Project	1.5	Jericho
Jayous Project	1	Qalqilya
Palestinian Initiative Program	5	-
Net Metering Projects	10	-

- Other RE initiatives are to be implemented in the near future; Table 7 lists the expected projects in the future [10]:

Table 7*The Expected Projects in the future*

Project	Power (MW)	Location
GIE/PADICO	7.3	Gaza
Noor Tubas, PIF	9	Tubas
Kafa'a Co. Solar Project	5	Tubas
Noor Jenin, PIF	3	Jenin
Bani Ne'em	30.5	Hebron
Askar	1	Nablus
Beit Forik	1	Nablus
Birzit University	1	Ramallah
Schools Project	35	-

All of these Project contribute to only 11.5% of the total electrical power in Palestine [10].

2.7 Palestine Policies for Industry Sector

Palestine has attempted to establish an industrial strategy that focuses on reducing reliance on conventional fuels while increasing reliance on renewable energy sources and improving energy efficiency [14]. As a result, the industry and services sectors were funded by the outstanding loan initiative for boosting energy efficiency projects in Palestine [14].

Loan initiative for energy efficiency projects

The Palestinian Energy Authority in 2012, with the support of the French Agency for Development (AFD), implemented a project to support and improve energy efficiency in in Palestine through energy audits [14].

The energy audit campaign, carried out by the Energy Efficiency Unit team at the Energy Authority, showed that the opportunity for private companies to save energy is significant. This can be achieved by developing a specific energy consumption behaviour by the employees. Moreover, investing in projects relevant to the companies' scope of work can be very beneficial. Such systems can be solar heating systems for water, pipes insulation, lighting control systems, or lighting replacement [14].

Since many companies in Palestine lack sufficient cash liquidity, The Energy Authority (with the support of the French Development Agency) granted a method to assist the private sector; both institutions aided in covering the bank interest on the loans taken out

by local banks. This initiative would support these companies in purchasing and installing energy-saving systems [14].

This initiative aims to support implementing energy efficiency projects in Palestine for the private sector (particularly in the industrial and service sectors) [14]. Consequently, reduce wastage in energy consumption and help local companies and institutions reduce energy consumption costs of all kinds [14].

Eligible beneficiaries are granted to the private sector “companies and organizations”, whether “industrial or service” companies, that have already benefited or wish to benefit from an energy efficiency audit or the implementation of an energy audit program [14]. Taking into account that the Energy Authority reviews the energy projects through the Energy Efficiency Unit for the benefit of the private sector free of charge (so far), where the can benefit for at least three years from industrial or service activities [14].

The Energy Authority is willing to support and cover energy efficiency projects, including:

Solar heating systems intended to supply hot water centrally or to heat water entering boilers, energy saving insulation such as insulation of pipes, furnaces, use of control systems, replacement of lighting systems, heat exchange projects to take advantage of waste heat in factories, and system replacement projects like replacing cooling systems or boilers with high-efficiency systems.

Financial support: The support provided will cover the interest amount on these loans (up to 5% flat rate, while the loan term is up to 5 years). If the interest on these loans is higher than 5% or the loan term is more than five years, the beneficiary will bear the difference in cost [14].

2.8 Palestine Policies for Residential/Building Sector

The Ministry of Local Government and the Engineers Association in Palestine originated the basis and standards for residential buildings by setting a code for modern buildings in Palestine in 2004. This code aims to [15]:

Energy conservation in buildings can be achieved through the appropriate thermal design of the external elements of the building that make up the outer envelope and also by

environment protection. These measures provide thermal comfort and a healthy atmosphere for the building occupants, increasing their work and production activity.

This code isn't mandatory on the following buildings and facilities that are used for human occupation purposes: Houses and residential buildings, schools and universities, hospitals, hotels and restaurants, public and government buildings, celebration halls and theaters, workshops and factories, shops, and commercial markets.

2.9 Palestine Policies for Appliances and Energy Management

Palestine started its development in the field of appliances and energy management by constructing a site to collect data that could be used to make decisions regarding the techniques and specifications of the imported appliances [16].

Since its inception in 2009, the Energy Efficiency site has housed various advanced and modern equipment specializing in energy audit and efficiency [16]. This laboratory services a range of sectors, including industrial, commercial, service, and residential [16].

As the electric demand is sharply increasing in Palestine in line with the rapid developments, an enormous burden is carried on the state and the customer. Therefore, establishing the energy efficiency laboratory evolved into one of the necessities and pressing issues at the national level [16].

2.10 Energy Efficiency program

The Energy Efficiency program is one of the strategic programs that PEA has developed with PEC and AFD to reduce Palestine authority expenses [17]. The main target of this program is to improve the efficiency in energy consumption [17], leading to saving a significant amount of money at the national level [17].

The following activities were defined in the National Study and Business Plan document [17]:

Improving the institutional building of EE team, describing the role of each party in EE program and the required regulations, suggesting an essential solution for providing incentive measures for the implementation of the EE programs, suggesting a solution for end-user behaviour, presenting the main output of studies in the analysed sectors and presenting the potential of saving, developing the revolving fund with Ministry of Finance (MoF) and starting the investments in the public sector, preparing the map road for suggested investments in the private sector [17].

2.11 Palestine Policies for Emissions

The Palestinian National Authority seeks to achieve sustainable development in Palestine by preserving and improving environmental quality. Moreover, it encourages environmentally sustainable economic and social growth [18].

2.11.1 Goals of the Policy

First, ensure an adequate standard of living while upholding people's social, cultural, and historical values. It is also essential to preserve the capacity of the natural environment to clean and sustain itself. Moreover, conserve biodiversity, landscapes, and the sustainable use of natural resources. Finally, avoid irreversible environmental damage and minimize reversible environmental damage caused by development activities [18].

2.12 Ways to align SDG7 screening with countries' policy

The results were analysed after reviewing energy-related laws and by evaluating these laws in achieving the energy SDG in Indonesia. Moreover, the applied policies' effectiveness was revised hierarchy, from government laws and presidential regulations. Finally, the results show that providing electricity to the remaining 1.1 million households living in remote areas is a significant challenge. However, Indonesia is still on track to achieve 100% residential electricity by 2030 as long as a sufficient budget is allocated annually. In contrast, the current policy that mostly focuses on gas for cooking will be less effective in reaching the remaining households who cook with solid biomass and live in poverty. Likewise, the current policy scenario does not support achieving the renewable energy target [59].

Another scientific paper aims to assess the application of compositional data analysis (CoDa) to follow up on the temporal trend indicators of the energy sector in the context of SDG7, with a case study for the most affected areas addressing the problem of electricity access, following CoDa methodology, we first use a log-ratio transformation to bring compositions to real space and then apply three multivariate methods: linear regression, generalized additive models and support vector machine, none of the seven countries studied will reach 100% access to electricity until the year 2030 [60].

On the other hand, the indicators of goal number 7.1 were discussed in a scientific paper for three countries to check if those indicators measure the goal; researchers suggested an alternative framework that simplifies and distinguishes two conceptually distinct aspects

of energy access—energy supply conditions and the status of household energy poverty [61].

Other researchers discussed energy security as a means of achieving SDG7, which is hampered by its reliance on imported fossil fuels, rising electricity prices, or the inability to access energy; researchers propose conducting a study on the state of art of off-grid energy systems for the two cases based on an extensive review of the literature [62].

Other Researchers discussed how Taiwan and other countries interacted with the obstacles of the United Nations Sustainable Development Goals regarding energy transition by using the legal appliance. In this regard, researchers discovered that the theory for achieving energy justice to prove that SDG7 is related with the concepts of energy management; due to the same concepts of “Fair Competition”, by the admission of “Energy Development and Poverty”, which links with “Environment Protection”. Furthermore, experts argue that the governments of Taiwan and Japan can enhance their environmental regulations to promote fair competition directly, allowing them to improve reliable electrical energy supply and thus move towards accomplishing the SDG7 and its indicators [63].

Further researchers looked into achieving SDG7 in Africa by investigating policies and strategies that can help accelerate Sub-Saharan Africa's progress toward universal energy access before 2030 through analysis of problems, research articles, laws, and project reports. The researchers found that electrical energy access to rural regions, as the case was in Vietnam, could successfully achieve SDG7[64].

According to some other scholars, many countries now lack a legal basis for adjusting policy actions. On this behalf, the researchers imply that the concept of a ‘right to energy’ can be used as a good foundation and justification for governments to address some energy issues such as energy injustice, energy poverty, and deficiencies in energy services and energy democracy, and most importantly, energy access hardships [65].

Other researchers have discussed how Jordan might attain the Sustainable Development Goals. With a low level of industrial development, a low population density, and a climate that seeks to reduce pollution quickly, the environment is not a significant concern for Jordan, except for the country's contribution to global environmental problems. Thus, it is not the driving force behind the rapid implementation of renewable energy; instead,

energy security and economic growth are among the main reasons for the state's efforts to promote renewable energy. Another reason for Jordan's utilization of renewable energy is its ability to use it to electrify the countryside in desert areas, which is a major government goal. Researchers recommended removing the price barrier in parallel with the development of the national renewable energy industry, as well as compiling and updating data on wind and solar energy sources and conducting technical-commercial studies regarding the use of solar panels in multi-family houses and small businesses [67].

Other researchers discovered that Jordan's energy sector is extremely vulnerable to regional conflicts. Because of the lack of diversity in energy suppliers, the effects of this sensitivity have become more severe. Therefore, Jordan must adopt policies to increase the share of domestic resources in its energy mix, expand and diversify its energy network, strengthen its strategic energy storage and construct interdependence relationships with energy suppliers [68].

Chapter Three

Energy Situation in Palestine: Potential and Challenges

3.1 Introduction

Energy security is currently one of Palestine's most significant difficulties, and it is often regarded as a major roadblock to achieving long-term political and economic independence. The Energy sector is mainly relying on electricity imports, particularly from Israel.

The majority of the electricity is obtained from the Israeli occupation state; approximately 87 % of the electrical demand is secured from Israel, and approximately 4% from Egypt and Jordan; the remaining 9% is produced locally in Gaza, and so are the fuels required for Gaza stations; thus, the entire energy sector is under the Israeli occupation control [3].

3.2 Political Implication

Energy in Palestine confronts many obstacles due to political (Israeli occupation), economic, and social factors. Each of these factors has an impact on the Palestinian government, preventing the energy sector from developing and becoming self-sufficient. As a result, the meaning of energy security, energy supply security, and diversification of energy sources in Palestine is a rudimentary concept that fails to capture reality. The Israeli occupation state applies many procedures to prohibit Palestine from fulfilling its rights, ensuring that Palestine always remains under its domination. The Israeli occupation is currently the most significant impediment facing Palestine; the primary obstacles posed by the Israeli procedures are geographical division, ports and borders, energy generation and supply, clearing, and tax returns. The Israeli occupation forces seized Palestine in two stages; the first stage occurred during the end of the British Mandate in 1948 and the second in 1967. Israel conquered Palestine completely after 1967. Following the signing of the peace agreement between the Israeli entity that controls all of the Palestinian land and the Palestine Liberation Organization, where two geographical regions belonged to the Palestinian Authority [54]. Palestine has two geographical regions separated from each other, West Bank and Gaza Strip; West Bank extends from the Jordan River in the East to the Israel border (green line) in the West, while Gaza Strip is located on the western side of Palestine on the Mediterranean Sea [3].

The Gaza Strip is considered an undivided block, whereas the West Bank is classified into 11 governorates that are separated from one another due to the enormous number of occupied Israeli settlements erected between these Palestinian governorates [1]. The Israeli occupation did not stop at dismembering the West Bank; instead, Israel tried to divide the Palestinian Authority's lands into three administrative A, B and C areas [52].

The map below represents Palestine from the beginning of the Israeli occupation to the present day.

Figure 4

Map of Palestine 2021



The Israeli occupation state controls all Palestinian ports and borders, making it an island state under the Israeli occupation. Palestine cannot import energy, whether electrical or fossil fuels, except through the Israeli occupation, owing to the Palestinian commitment

to Paris Economic Agreement, which was signed between the two countries. This agreement is considered one of Palestine's most significant economic barriers [19]. Another challenge confronting Palestine's energy sector, and one of the major difficulties, is Israel's control over the volume and quantity of fuel, as well as its prices, and when it is permitted to enter and when it is not, which seems to be the case in Gaza, where it has been suffering from a chronic electricity supply crisis for years. Considering C-class areas cannot be used for any energy-related or comparable initiatives, and because Israeli occupation controls all land, sea, and airports, the type of fuel used in energy production must be approved via the Israeli occupation. The Gaza Strip was close to completing the construction and development of its energy sector [20].

The Gaza Strip was close to completing the construction and development of its energy sector [20]. The Gaza Strip's first power plant, with a capacity of 140 MW and the capacity to be increased in stages according to requirement, was built by the Energy Authority in collaboration with our private sector. However, the Israeli occupation and its repeated aggression against it obstructed the plan to supply it with natural gases, forcing Palestine to operate the station with industrial fuel, and the Palestinian government now bears additional financial burdens.

Palestinian tax revenues withheld by the Israeli occupation state are subject to the Israeli government's political decision, as it engages in the most extreme form of political blackmail by refusing to transfer all of the funds, which has a significant impact on the investment in energy production projects or financing the fuel needed to operate the stations.

Note that the clearing funds and tax revenues account for approximately 68.4% of the monthly budget, implying that controlling them by Israeli occupation authorities entails controlling all Palestinian decision-making and stability [21].

The economic factor is one of the most pressing issues confronting Palestine, as it is primarily concerned with finance under poor economic conditions, including that the Palestinian economy is directly linked to the Israeli economy. Different countries' governments strive to accomplish more significant goals for their citizens that are compatible with their societies' long-term visions and with the most efficient use of natural and human resources [21]. As a result, the Palestinian National Authority has developed numerous developmental, economic, and social plans and initiatives in Palestinian areas since its formation in 1994 to address economic issues. The majority of

these plans were based on self-reliance, getting rid of the Palestinian economy's dependence on the Israeli economy, providing adequate infrastructure for the economic development process, addressing structural distortions in the Palestinian economic structure, addressing poverty and unemployment issues, and providing appropriate social services such as education, health, and housing [21].

These plans, however, collide with a number of intertwined internal and external challenges that impede Palestinian development activity, the most significant of which are [21]: The Israeli occupation, the internal political and administrative division, the decline of the general economic situation and the financial crisis [21]. The Israeli occupation is one of the most severe issues affecting Palestinian work, as it continues to impose a severe siege on the Gaza Strip and controls large areas of Palestinian land in the West Bank regions. Not to mention the series of repeated attacks on the Gaza Strip, which have caused significant material and non-material losses to the Palestinian economy [22]. In addition to controlling Palestinian capabilities, such as borders, agricultural land, natural resources, and airspace, the Israeli occupation cuts off Palestinian relationships and restricts their trade and mobility, consequently attaches the Palestinian economy to the Israeli economy [22]. Electric power generation projects take a lot of money, and Palestine can't afford to create them with its restricted budget. For example, the Jenin power plant project cost roughly \$620 million in 2016 with the participation of various funding agencies [23]:

Table 8

The Expected Project in the future

Company	Rate of Share %
The Palestinian Investment Fund	39.6
Palestine Development and Investment Company (PADICO)	20
Arab Bank Group	10
Palestinian Telecommunications Group (Paltel)	10
Palestinian Electricity Company	5
Arab Palestinian Investment Company (APIC)	4
Bank of Palestine	2.3
Gulf Metal Industries Company	2
The Palestinian Pension	1.3
Al-Quds Bank	1.1
Cairo Amman Bank	1.1
Palestine Real Estate Investment Company PRICO	0.7
National Insurance Company	0.7
Number of individual shareholders	2.2

Projects to generate electric power, such as the Jenin power plant, cost a lot of money and time, as the previous ratios reveal, and Palestine by itself cannot build such projects [22]. The exemption of Palestinian refugee camps from paying electricity and water bills is one of the most effective social factors that poses a significant challenge to Palestinian governments. At a difficult period in the Palestinian camps during the Al-Aqsa Intifada, the late leader Yasser Arafat decided to exclude the West Bank camps for Palestinian refugees from paying their water and energy bills [54]. Due to the late Palestinian leader's decision, all West Bank camps have continued not to pay the prices of water and electricity, placing a major setback on the Palestinian budget [54]. The greatest burden is the failure of successive Palestinian governments to reconsider this decision, which is tied firstly to the Palestinian leader Yasser Arafat and secondly to the political aspect of the Palestinian resistance that supports Palestinian camps as a mainstay [54]. When the late President Yasser Arafat agreed to pay the camps' electrical bills, this decision failed to distinguish between the camps. However, when it was put into effect, it included paying the power bill for the 19 camps in the occupied West Bank, but not for the eight camps in Gaza. The West Bank camps were excluded from the power charge from the time the decision was made until the 17th government suspended it, after which the next government decided to restart exempting the camps from the bill. Because of the energy exemptions, the West Bank's camps have become the destination for investments and housing since many camp residents have turned non-refugees, and the percentage of shops and industrial workshops in these camps has expanded. As a result of the free energy in the camps, consumption in these camps has increased above the national average, and the population's lifestyle has changed to rely on electric energy for heating instead of gas and wood, and electric energy was used for cooking instead of gas, and electric air conditioners were spread for cooling and heating purposes [54].

All previous practices led to the absence of energy conservation concept. On the contrary, energy was utilized irresponsibly and the resources were wasted easily, however, there are few exceptions for some citizens who, by their own choice, have prepaid meters installed in their houses [54].

3.3 Challenges for Energy

Since there are no waterfalls in Palestine, the direction is dependent on the energy of the sun, wind, and geothermal heat [24].

Since the mid-seventies of the last century, Palestinians have succeeded to some extent in exploiting solar energy, particularly in obtaining hot water; the solar heater has become an essential component in every Palestinian home; however, generating electricity with solar energy has remained a limited and was linked to research issues or the activities of donor bodies to help the population of deprived areas; there have been initial attempts to exploit wind energy, as well.

The most important challenges are [24]:

- The government's failure to provide sovereign guarantees to encourage investments in the energy sector [24]. The network's instability, as well as limits on renewable energy projects that can be connected to it, such as a limit of 6 MW in a single connecting point [24]. The Ministry of Finance does not support the “Priority Guarantee” funds sovereignty in risk coverage (due to Israeli practices). [24].
- Political risks and land classification issues, especially in Area C [24].
- Not permitting some companies to invest in renewable energy projects and not allowing all companies to contribute equally, as in the deal reached with the Palestinian Investment Fund on the one hand and the Ministry of Higher Education on the other to harness solar energy from school rooftops [24]. The presence of isolated, unconnected networks, as well as a large number of electrical distribution companies and local authorities distributing electricity. The lack abundance of Palestinian research and studies dealing with renewable energy issues, the absence of maps showing the movement of winds, seasonal sunlight locations, soil and climate characteristics, economic feasibility, lack of devices to carry out field measurements of heat distribution in the earth's layers, as well as the drilling tools necessary for work, and its high cost [24].

Despite the presence of batteries capable of charging and discharging the surplus, the cost of equipment and the high cost of storing surplus energy is due to the lack of mechanisms to connect it to the central network. The requirement for users to be trained in maintenance work [24]. Legislation and laws governing the alternative energy sector are ineffective. Four companies in the West Bank supply electricity to citizens, and they get their power from the Israeli Electric company. However, there is no unified policy or tariff between them, necessitating the existence of the national electricity company that supplies the sub-company's needs, but within a unified

policy based on a well-known and agreed-upon legislative and legal structure [24]. Natural and mineral resources are in short supply in Palestine. The Palestinians' greatest suffering, however, stems from the scarcity of traditional energy sources such as oil and gas, as well as their high prices, which are comparable to those in the world's most expensive cities; in addition, the Israeli authorities regulate the quantity and price of fuel, as well as when it is permitted and when it is prohibited [25].

- Fossil fuel sources and their apparent risks have been causing significant damage to human health and the environment. This harm can be seen most prominently through global warming, climate fluctuations, the widening of the ozone hole, and acid rain in more than one region, as well as the high prices of fossil fuels and the possibility of their depletion as a non-renewable resource, and most importantly, the risks of various diseases, which are caused by toxic and harmful gases issued by the combustion of fuel [25]. Palestine is also confronted with issues in the field of fossil fuels, or the so-called oil derivatives and the most important of which are the following [25]: Energy Supply Security

It is known that the Palestine's since its establishment import the oil through the Israeli occupation, which for political purposes can stop supplying oil to the Palestinian side, as happened with the Gaza Strip during the wars in the last years, whether this fuel was for electrical power plants or for the transportation sector to supply vehicles [25].

- Price of Oil
The Israeli occupation supplies petroleum to Palestine at a much higher price than the world market price [25]. It is still not satisfied with this level of extortion, and therefore imposes two types of taxes on gasoline as follows:

- a) The first tax is called the blue tax, which amounts to 2.7 shekels on fuel needed for electrical power generation and 3 shekels on fuel used for vehicles [26], [27].
- b) The second is called the value-added tax, which amounts to 16% [28].

Conversely, because the Palestinian government is the major recipient of tax funds, these actions benefit the Palestinian government. These revenues account for a significant portion of the Palestinian budget and are regarded as the second most important state resource (38 %),

resulting to an increase in the price of fuel to four times its real price [28].

Israel sets particular requirements for importing petroleum and forces Palestine to follow them, despite the fact that these requirements are identical to American and European requirements, preventing Palestine from importing lower-quality, lower-cost gasoline [25]. One of the most critical challenges facing the electric power sector is the Israeli occupation, which is a reference to all the following challenges [29]:

- Electrical energy Supply Security

The majority of electrical energy imports into Palestine are controlled by the Israeli occupation state, with the Israel Electricity Company supplying the West Bank through 237 connection points on the medium voltage system (22 kV and 33 kV) [29]. This means that any Palestinian area can have electricity connected or disconnected by the Israeli occupation company. In other words, energy supplies in the West Bank are unstable [29]. On the other hand, the Jordan National Electricity Company's electric power lines that fuel Jericho and the Jordan Valley pass through Israeli occupation-controlled sites, allowing the Israeli occupation state to control these lines [29]. The Gaza Strip is also under complete Israeli occupation control. This gives Israel the power to cut off electricity to the entire Gaza Strip by cutting off power lines from Egypt, thereby cutting off a significant portion of the power supply. Additionally, it can prohibit the export of feed fuel to the Gaza Generating Company, which imports all of its needs through the Karm Abu Salem crossing, preventing the generation company from producing electric power, where its reserve fuel for the generation company is not enough for more than a week [29]. As a result of importing the majority of the electric energy from the Israeli occupation, the price of electric energy is determined by the Israel Electricity Company, and the role of the Palestinian companies is limited to distributing energy and collecting money that ultimately belongs to the interest of the Israel Electric Company [29].

Note that the fuel used in the Gaza power plant is sold through the Israeli side, and therefore the cost of energy production through the Palestinian power plants will be higher than the purchase of electric power from the Israel Electric Company [29].

Note: In the next chapter, a detailed explanation of prices and cost will be provided.

Consumers refuse to pay their electricity bills for no apparent reason, causing electrical companies to be heavily indebted. For example, the Jerusalem Electricity Company has a debt of around 800 million shekels, of which 500 million shekels are owed to refugees in camps and 300 million shekels are owed to non-refugees, of which 100 million is owed to major consumers [31], [32]: Factory owners, stone saw operators, and merchants all owe hundreds of thousands of shekels in debt, while some of them owe more than 800,000. Some of them relocate their work to refugee camps to avoid paying for their electricity use [31] [32].

The judiciary's management of large consumer files is ultimately in the consumers' best interests. For example, when the electrical company disconnects those types of customers, the Palestinian judiciary provides urgent rulings to re-connect those customers [32]. Some of these consumers put guards on the transformers to prevent the company's employees from cutting the power, and others close the panels with rocks or chains so that the company cannot open them, and thus the series of electric current theft continues, either by stealing it directly or by not paying the bill, taking advantage of the Palestinian judiciary that is on their side [32].

In Palestine, energy consumption is split into two categories: electrical energy and transportation energy.

All forms of energy consumed in Palestine are imported through the Israeli occupation, and none of the energy is produced locally. While it may appear to non-professionals that there is little local production with no Israeli control over it, but in fact, the Israeli occupation actually has complete control over all forms of energy [10].

About 87% of the electrical energy consumed is imported from the Israeli occupation state and 8% from the Palestinian Electricity Company, while imported electricity from Jordan and Egypt accounts for less than 5% of total consumption [3]. This means that Palestine relies on the Israeli occupation for the majority of its energy consumption. While it may appear that the Palestinian electricity company produces a small fraction of the energy, implying that the Palestinian electricity company is self-sufficient in the production of energy, the truth is that the fuel required to operate the plant that generates electric power is imported from the Israeli occupation or with the consent of the Israeli occupation, the plant belonging to the Palestinian electricity company. As a result, the

Israeli occupying power has complete control over all traditional sources of electrical generation.

Interest in generating electricity from renewable energy sources and switching to renewable energy has grown for two main reasons: the first is a shortage of electric energy as a result of the high reliance on the Israeli occupation state in an attempt to achieve self-sufficiency, and the second is to obtain clean and reasonably priced energy [10].

All of the parts, equipment, and tools required to construct these plants, whether solar or wind turbine plants are provided by the Israeli occupation, implying that Israeli occupation will continue to dominate Palestinian energy. Because the transportation industry in Palestine is reliant on a variety of petroleum products, it is also under the jurisdiction of the Israeli occupation state, which imports all types of fuel [10].

3.4 Electrical Energy in Palestine

The Palestinian Energy Authority regulates and oversees all types of Palestinian electrical enterprises, including generation, transmission, and distribution [8].

a) Electrical generation companies in Palestine

- Jenin Electricity Power Generation Plant
- Palestinian Electricity Generating Company – Gaza

b) Electrical distribution companies in Palestine

- Jerusalem District Electricity Company (JDECO) [10].
- North Electricity Distribution Company (NEDCO) [10].
- Hebron Electricity Company (HEPCO) [10].
- Tubas Electricity Distribution Company (TEDCO) [10].
- South Electricity Company (SELCO) [10].
- Gaza Electricity Distribution Company (GEDCO) [10].

The Israel Electric Company supplies electricity to the West Bank through 237 medium voltage connection points (22kv & 33kv), Jericho and parts of the Jordan Valley are supplied through an electrical connection with Jordan [29], and the Gaza Strip is supplied by the Palestinian Electricity Company or through an electrical connection with Egypt [29].

3.4.1 Number of consumers - by distribution companies and tariff classifications

Figure 5 shows the percentage of consumers by distribution companies in 2020.

It is evident that the Jerusalem Electricity Company is the largest company in terms of consumers' number.

Figure 5

Percentage of Consumers

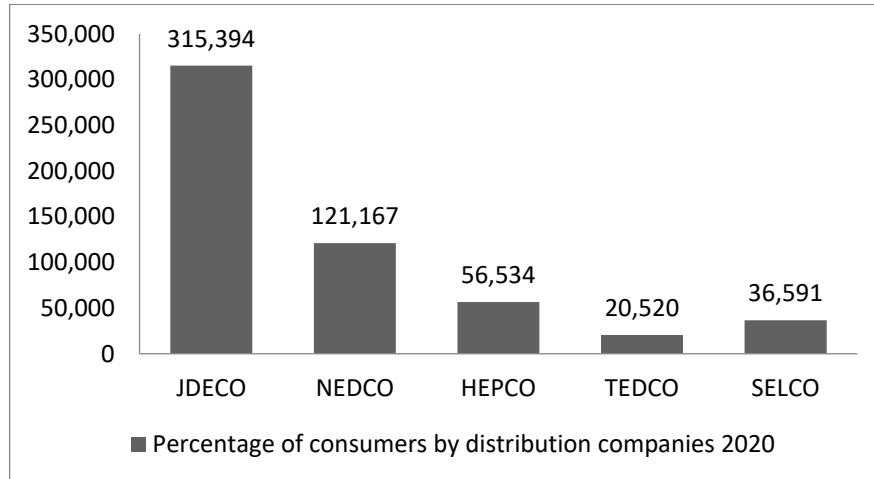
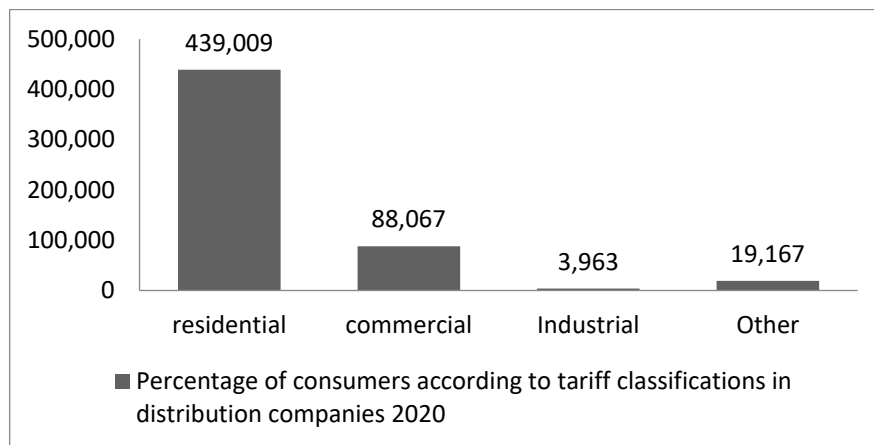


Figure 6 shows the percentage of consumers according to tariff classification for distribution companies in 2020.

It clearly illustrates that the residential sector is the largest, and the industrial sector is the smallest in Palestine.

Figure 6

Percentage of Consumers by Tariff Classifications



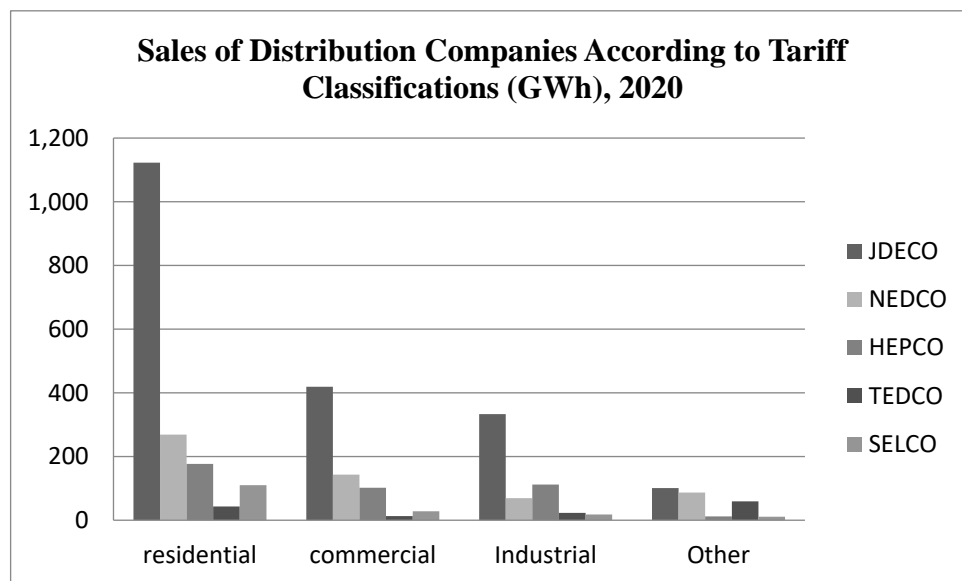
3.4.1 Electricity Sales - Distribution Companies by Tariff Classifications (GWh)

Figure 7 shows the sales of distribution companies according to tariff classifications in 2020.

Since Jerusalem Electricity Company is the largest in terms of consumers' number, its sales, as illustrated below, are the highest.

Figure 7

The Electricity Energy Sales Per Tariff



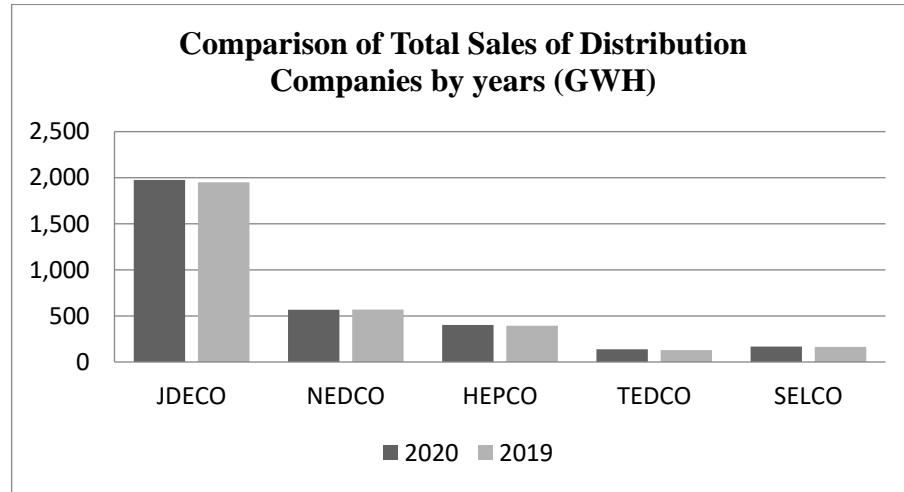
3.4.2 Comparison of sales (GWh)

Figure 8 shows the comparison between the total sales of distribution companies by 2019,2020.

The figure clearly illustrates that there is no substantial difference in sales between 2019 and 2020 for all companies.

Figure 8

Comparison of Total Sales Per Companies



3.4.3 Sources of electrical energy supply

The rate of purchases of electrical energy in west bank for the year 2020 is shown in table 9, indicating that Israel remains the primary supplier of electrical energy.

Table 9

Supply of Electrical Energy Percentage

Source Supply	Purchases
Israel	94%
Jordan	4%
Renewable energy	2%

3.4.4 Indicators of service continuity (outages)

These indicators are based on data from electrical power outages, which are classified according to the source of supply (mainly the Israeli company) [30]. The following sub-indicators are measured based on the measurement models for this indicator [30]:

- SAIDI System Outage Occurrence Index: This indicator measures the average outage duration for each subscriber in minutes during the year [30].
- SAIFI Frequency Index: This indicator measures the frequency of outages for each subscriber during the year [30].
- CAIDI Consumer Interruption Incidence Index: This indicator measures the average outage period for each subscriber in minutes during the year [30].

Figure 9

SAIDI Indicator Per Company

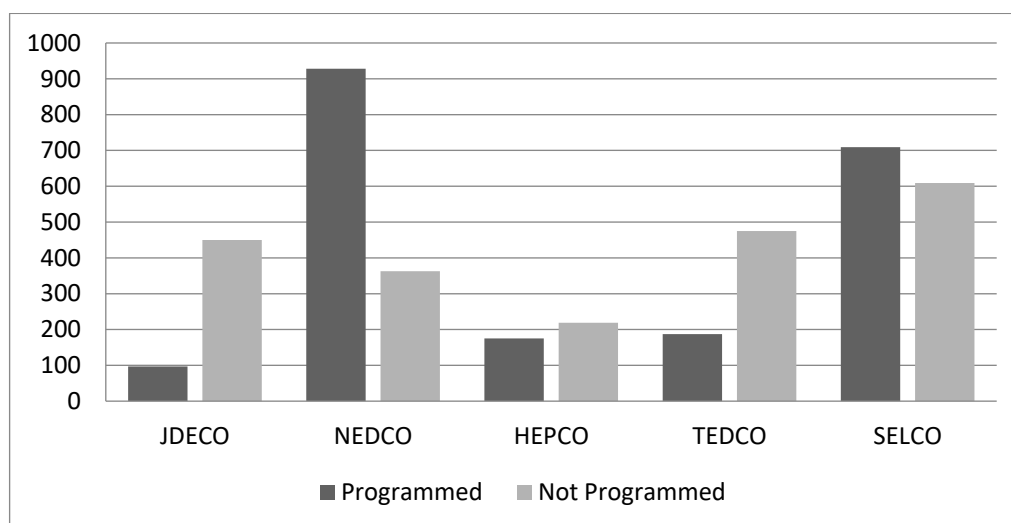
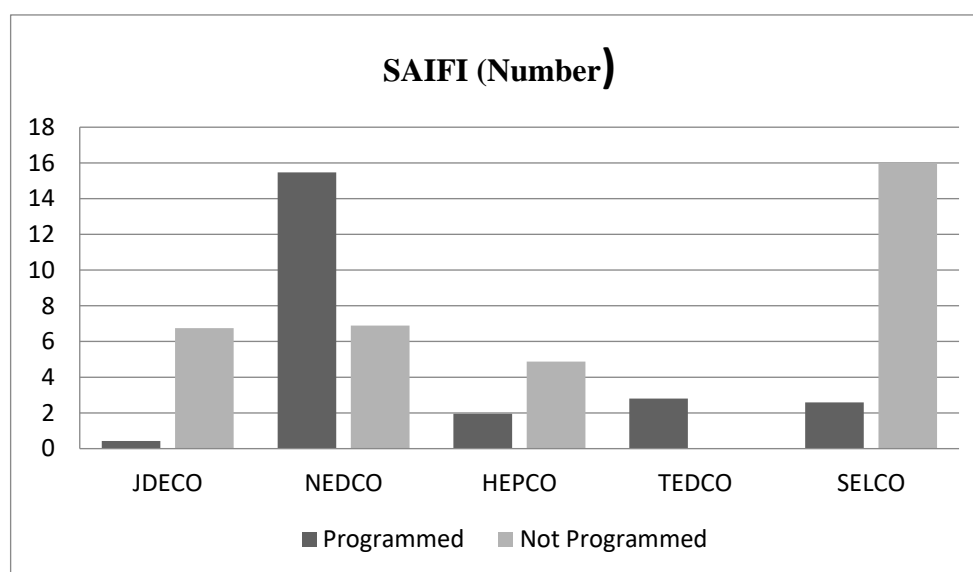


Figure 10

SAIFI Indicator Per Company



3.4.5 Quality of service indicators for consumers:

This indicator measures the number of complaints per 1000 subscribers, keeping in mind that these indicators only reflect complaints received by distribution firms and do not include complaints filed and followed up by the Regulatory Council.

Table 10 shows the number of complaints per company, which indicates that the number of complaints is small, knowing that the number of complaints has been almost constant for the last three years, except for the Hebron Electricity Company (HEPCO).

Table 10*Number of Complaints Per Company*

Indicators	Year	JDECO	NEDCO	HEPCO	TEDCO	SELCO
Number of complaints per 1000 subscribers	2020	1	3	24	4	2
	2019	1	2	13	5	2
	2018	1	2	4	5	3

3.4.6 Average time required to connect a new consumer

Table 1 in appendix A shows the number of days required to connect a new consumer for each company, which shows that companies' required time to deliver electricity has remained almost constant during the previous three years.

3.4.7 Financial indicators

Table 2 in appendix A shows that the collection rate for companies. This rate is continuously fluctuating because of the percentage of the Palestinian government's repayment of the debts incurred due to bearing the costs of electricity bills for the Palestinian camps.

Note that the percentage of losses is very high and, in some cases, it reaches 23%, which consequently leads to an increase in costs of electrical energy for the consumers.

As illustrated in Figure 1 in appendix B, the losses occurring on the electrical distribution networks are estimated in millions, leading to an increase in the accumulated debts of companies, as shown in Figure 2 in appendix B.

3.4.8 Percentage of population using electricity

Figure 3 in appendix B represents the percentage of Population using electricity in Palestine and particularly for west bank, Gaza strip, urban regions, rural regions and refugee camps. The figure shows that more than 99% of the population have electricity.

3.5 Renewable Energy in Palestine

This section contains renewable energy data in Palestine, focusing on the West Bank, based on the data released by the Palestinian Energy Authority on July 19, 2021, and the energy data released by the Palestinian Central Bureau of Statistics on February 2, 2021. This section also shows the capacity of the installed renewable energy projects

connected to the electricity network among all the West Bank distribution companies in the last three years.

3.5.1 Renewable energy Data in 2020

The figures show the RE data for all production projects connected with the electricity network for all distribution companies operating in the West Bank in 2020 can be seen as following.

Figure 4 in appendix B depicts the Palestinian solar energy effort in 2020, with TEDCO's renewable energy projects accounting for the largest share.

Figure 5 in appendix B represents net metering energy projects in 2020, revealing that JEDCO has the highest contribution in renewable energy projects.

Figure 6 in appendix B shows the productive energy projects in 2020 where JEDCO and TEDCO have the highest share of renewable energy projects. Productive RE projects in Palestine include projects linked to the Palestinian Electricity Distribution Companies, whose production is sold to distribution companies.

3.5.2 Renewable energy data in the last three years

Figure 7 in appendix B shows the capacity of RE projects connected through the electricity network for all distribution companies operating in the West Bank for the last three years.

Except for JEDCO, which is seeing sharp growth in RE projects, figure 35 shows that all other RE projects have slightly increased.

3.5.3 Capacity growth of renewable energy projects

The following table shows the capacity growth of RE projects between 2019/2020. Table 3 in appendix A shows the capacity growth percentage for RE projects, where NEDCO has the highest rate of growth.

3.6 Fossil Fuel in Palestine

Below are the fossil fuels data based on the data released by the Palestinian Central Bureau of Statistics on February 2, 2021.

3.6.1 Petroleum products

Figure 8 in appendix B depicts the use of petroleum products in Palestine during the previous ten years, demonstrating an increase in consumption due to population growth.

3.6.2 Petroleum products according to consumption sector

Figure 9 in appendix B shows the consumption of fossil fuels in Palestine according to the consumption type for the year 2019. It can be noted that the transportation sector consumes the most fossil fuels among all since Palestine is a non-industrial country.

Chapter Four

Analyzing the Goal Number Seven of Sustainable Development

4.1 Introduction:

The United Nations General Assembly works to establish goals for all countries around the world to achieve sustainable development. As a result, in 2015, the United Nations General Assembly established 17 goals as being important for achieving sustainable development [39].

All seventeen goals were included in a United Nations resolution called Agenda 2030, or the so-called 2030 Agenda [40], which strives to produce a better future for all while also being more sustainable. The United Nations General Assembly hopes to achieve these goals by the year 2030 [40].

As a result, the Sustainable Development Goals (SDGs) are wide and interlinked, the United Nations was able to define achievable goals for each goal in less than two years [41]. On 6/JULY/2017, all objectives were finished, along with all indicators that will be used to track progress toward reaching the goal [41].

The time required to set goals was calculated, between 2020 and 2030, and certain goals were left untimed, with no deadline set for their completion [42].

4.2 Sustainable Development Goals (SDGs):

The seventeen sustainable development goals, in order, are:

1. No Poverty
End poverty in all its forms everywhere.
2. Zero Hunger
End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3. Good Health and Well-being
Ensure healthy lives and promote well-being for all at all ages.
4. Quality Education
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

5. Gender Equality
Achieve gender equality and empower all women and girls.
6. Clean Water and Sanitation
Ensure availability and sustainable management of water and sanitation for all.
7. Affordable and Clean Energy
Ensure access to affordable, reliable, sustainable and modern energy for all.
8. Decent Work and Economic Growth
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Industry, Innovation and Infrastructure
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
10. Reducing Inequality
Reduce inequality within and among countries.
11. Sustainable Cities and Communities
Make cities and human settlements inclusive, safe, resilient and sustainable.
12. Responsible Consumption and Production
Ensure sustainable consumption and production patterns.
13. Climate Action
Take urgent action to combat climate change and its impacts.
14. Life Below Water
Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
15. Life on Land
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. Peace, Justice, and Strong Institutions
Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

17. Partnerships for the Goals.

Strengthen the means of implementation and revitalize the global partnership for sustainable development.

4.3 Sustainable Development Goal Number 7 (SDG7):

The Sustainable Development Goal Number 7 (SDG7) states that: "Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All" [43].

4.3.1 Description

Energy for sustainable development

The United Nations General Assembly established the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) in 2015, which include an energy-specific goal, SDG7, aiming for "affordable, dependable, sustainable, and modern energy for all." Both the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change [44] place energy at the centre. Providing everyone with inexpensive, dependable, sustainable, and contemporary energy will [44]:

- Open a new world of opportunities for billions of people through creating new economic opportunities and jobs.
- Empowered women, children and young.
- Better education and health.
- More sustainable, equitable and inclusive communities.
- Greater protections from, and resilience to, climate change.

4.3.2 Targets and Indicators

The SDG7 contains five targets that must be met by 2030, with six indicators used to track progress and success. The first three goals are "outcome targets," while the remaining goals relate to the means by which the goals will be met [45]. The targets are:

1. **Target 7.1:** Universal access to modern energy [46].

The indicators used to measure this target are:

- a) **Indicator 7.1.1:** Proportion of population with access to electricity [46].
- b) **Indicator 7.1.2:** Proportion of population with primary reliance on clean fuels and technology [46].

The indicator is calculated as the percentage of people who use clean fuels and technologies for cooking, heating and lighting divided by the total population who use any of these methods.

2. Target 7.2: Increase global percentage of renewable energy [46].

It has only one indicator:

- a) **Indicator 7.2.1:** is the "Renewable energy share in the total final energy consumption [46].

3. Target 7.3: Double the improvement in energy efficiency [46].

It has only one indicator:

- a) **Indicator 7.3.1:** is the "Energy intensity measured in terms of primary energy and GDP" [46].

To achieve the SDG 7.3 target, global primary energy intensity must drop from 5.6 MJ per USD in 2010 to 3.4 by 2030 [47].

Governments can boost this potential by enforcing required energy efficiency policies, offering targeted fiscal or financial incentives, leveraging market-based mechanisms, and disseminating high-quality energy efficiency information [48].

4. Target 7.A: To promote access to research, technologies and investments in clean energy [46].

"By 2030, enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technologies" [46].

It has one indicator:

- a) **Indicator 7.4.1:** is the "International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems [46].

5. Target 7.B: Expand and upgrade energy services for developing countries [46].

By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programs of support [46].

It has one indicator:

- a) **Indicator 7.5.1:** is the "Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services [46].

As of August 2020, there is no data available for this indicator [45]. It was reported in 2020 that Indicator 7.b.1 might be removed as it is identical with indicator 12.1.1 of SDG 12 [48].

4.3.3 Revision

SDG 7 was discussed in depth during the 2018 High-Level Political Forum under the subject "Transformation towards sustainable and resilient societies." The Member States, the UN system, and other intergovernmental organizations, Major Groups, and other accredited stakeholders staged energy-related side events on the margins of the HLPF [44].

The most prominent recommendations that have been adopted

The United Nations released a study in 2018 that included the essential facts and recommendations to help accomplish the seventh goal of the Sustainable Development Goals (SDG 7), and the following are the most prominent recommendations [44].

- a) Advancing SDG 7 implementation

The report concluded that the following methods [44] can be used to advance and continue working toward achieving the seventh goal of the Sustainable Development Goals:

- Make clean-cooking solutions a top political priority
- Close the electricity access gap
- Accelerate the pace of transition towards renewable energy
- Harness the potential of decentralized renewable energy solutions
- Scale up investments in energy efficiency across all sectors of the economy
- Double the financing for SDG 7 globally
- Scale up capacity-building and education
- Enhance innovation systems, including research, development, deployment and diffusion

- Invest in data collection systems and data analysis [44].
 - b) Strengthening interlink ages between SDG 7 and other SDGs
 - c) Addressing regional priorities
 - d) Accelerating transformation towards a sustainable, inclusive and equitable energy future.

4.4 Sustainable Development Goal Number 7 (SDG7) in Palestine:

Palestine is making significant progress in achieving the seventh goal of the United Nations Sustainable Development Goals (SDG7). As a result, the energy policies in place to accomplish the seventh goal of the Sustainable Development Goals will be evaluated in light of the UN's goals and the indicators that track Palestine's progress toward this goal [46].

This research focused on how to determine Palestine's position in relation to achieving the goal by first analysing data from the previous ten years for each indicator and determining whether Palestine is progressing or lagging, and then comparing Palestinian results with global results to determine Palestine's position in relation to the world.

4.4.1 Target 7.1

Universal access to modern energy [46].

The indicators used to measure the target are [46]:

Indicator 7.1.1: Proportion of population with access to electricity

Table 4 in appendix A represents the percentage of population using electricity [46].

Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technologies [46].

Table 5 in appendix A explains the percentage of clean energy used by Palestinian people [49].

Current global data collection focuses on the primary fuel used for cooking, categorized as solid or non-solid fuels, where solid fuels are considered polluting and non-modern, while non-solid fuels are considered clean. This single measure captures a good part of the lack of access to clean cooking fuels, but fails to collect data on type of device or

technology is used for cooking, and also fails to capture other polluting forms of energy use in the home such as those used for lighting and heating [46].

As seen in the previous data tables, Palestine has had significant success in connecting electrical energy to all categories of Palestinians, with a percentage of 99.9% of the population having access to electricity and 100% of the population using clean energy and technology [49]. As a result, the first and second Indicators for measuring the first goal have been met.

4.4.2 Target 7.2

Increase global percentage of renewable energy [46].

It has one indicator for measuring it:

Indicator 7.2.1: is the "Renewable energy share in the total final energy consumption"[46].

Table 6 in appendix A shows the percentage of RE share in total energy consumption.

As shown by the table 6 in appendix A, Palestine has had limited success in spreading renewable energy [33]. It should be noticed that the percentage of renewable energy in Palestine's total electrical energy consumption is decreasing [33], implying that Palestine failed to meet the objective based on the indicator used to assess it.

4.4.3 Target 7.3

Double the improvement in energy efficiency [46].

It has one indicator for measuring it:

Indicator 7.3.1: is the "Energy intensity measured in terms of primary energy and GDP" [46].

Table 7 in appendix A and figure 10 in appendix B show Palestine's country value and global value of purchasing power parity (PPP) in MJ per US\$ PPP 2017, and the GDP in USD Million, 2017 PPP which issued in 2018 [49].

Palestine clearly achieved the required level of energy efficiency (MJ per US\$ PPP 2017), as seen by its score of 2.9, which is lower than the global average of 4.8; on the other hand, the GDP (USD MILLION, 2017 PPP) is 2,900, which is lower than the previous year's [50].

Figure No. 11 in appendix B demonstrates that Palestine has experienced a considerable fall in yearly growth rate (GDP) over the last ten years, particularly in the year 2020 [50], implying that Palestine failed to meet the goal based on the indicator used to quantify it in the year 2020.

4.4.4 Target 7.A

To promote access to research, technologies and investments in clean energy [46].

It has one indicator for measuring it:

Indicator 7.4.1: is "International financial flows to developing countries in support of clean energy research and development as well as renewable energy production, including hybrid systems" [46].

International financial flows (USD million, 2018 PPP) are represented in the figure 12 in appendix B [49].

In terms of financial flows, Palestine is making apparent and demonstrable progress, despite the fact that these flows are not steady and are almost always increasing [49]. Based on the indicator used to measure it, Palestine can be regarded to have partly succeeded to achieve the goal.

4.4.5 Target 7.B

Expand and upgrade energy services for developing countries [46].

It has one indicator:

Indicator 7.5.1: is "energy efficiency investments as a proportion of GDP", as well as "the amount of foreign direct investment in financial transfers for infrastructure and technology to sustainable development services." [46.]

The international financial flows and compound annual growth rate of national energy intensity in Palestine from 2000 to 2018 are shown in the tables and figure 13 in appendix B below [46].

National Energy Intensity Compound Annual Growth Rate It can be observed from the data in figure 14 in appendix B that Palestine regressed in achieving the goal, particularly from 2015 to 2018, and as a result, Palestine failed to meet this goal [46].

4.5 Palestine VS Global for Achieving Goals

Palestine has fully succeeded in achieving the first goal, where 100% of its population have access to electricity. This accomplishment is attributed to the government's efforts in delivering energy to everyone through the establishment of new power stations, such examples are: Jenin Electricity Station, Gaza Power Station, the electrical connection between Jordan and Palestine feeding areas like Jericho city, as well as the electrical connection between Palestine and Egypt to feeding the Gaza Strip.

4.5.1 Target 7.1

Universal access to modern energy

Table 8 in appendix A and figures represent the access extent of electricity rate of Palestine compared to the world [41].

When comparing Palestinian outcomes to international results in order to assess Palestinian progress toward achieving the first goal, it is revealed that Palestine is making substantial progress in providing electric power to its citizens [49].

The Israeli generating sources supplying the Palestinian areas enable Palestine to achieve advanced results in attaining the first goal, knowing that the function of Palestinian distribution companies is limited to transmitting electricity to Palestinian consumers and collecting its fees.

4.5.1 Target 7.2

Increase global percentage of renewable energy [41].

Table 9 in appendix A and figures represent the renewable energy share in the total energy consumption (%) [49].

The percentage of RE share in Palestine is noticeably decreasing in some years due to population growth and improved life standards or increased energy consumption.

When comparing Palestine's results to global outcomes in fulfilling the second target, it's obvious that Palestine is making progress in the area of renewable energy contribution to total energy consumption [49].

4.5.3 Target 7.3

Double the improvement in energy efficiency [41].

The figure 15 in appendix B shows Palestine country value and global value of purchasing power parity (PPP) in MJ per US\$ PPP 2017, which was issued in 2018 [50].

Knowing that, in terms of the rate of gross domestic product, Palestine's results and scientific findings have achieved a remarkable decline after the year 2019. This decline is assessed by comparing Palestine's results to the global results for the third goal, where Palestine is slowing down in accordance with the global results to some extent due to the economic crisis that has affected everyone as a result of the Covid-19 virus's spread [50].

Table 10 in appendix A shows Palestine country value and global value of Energy intensity in MJ per USD 2017, which was issued in 2018 [50].

Israel offers over 300,000 jobs for Palestinians, increasing the GDP and, in turn, reducing the energy intensity. As a result, Palestine was able to achieve significant progress in meeting the third goal.

As indicated by the enormous number of power outages in Palestinian communities, Israel supplies the Palestinian side with an insufficient amount of energy to meet their demand, which also results in a decline in energy density.

4.5.4 Target 7.4

To promote access to research, technologies and investments in clean energy [41].

When comparing Palestine's results to the global results in achieving the fourth goal as seen in the figure 16 in appendix B shows, it is clear that the global results have made significant progress over Palestine's results in terms of financial flows related to financing

renewable energy projects, despite the fact that Palestine's results were several years ahead of the global results, owing to the political conditions in Palestine [49].

4.5.5 Target 7.5

Expand and upgrade energy services for developing countries the figure 17 in appendix B shows Palestine Compound Annual Growth Rate of National Energy Intensity [49], As of August 2020, there is no data available for this indicator [45], It was reported in 2020 that Indicator 7.b.1 might be removed as it is identical with indicator 12.1.1 of SDG 12 [48].

Compound Annual Growth Rate It can be observed from the data in figure 27 that Palestine regressed in achieving the goal, particularly from 2015 to 2018, and as a result, Palestine failed to meet this goal [49].

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

The following are concluded based on the energy policies applicable in Palestine to examine its suitability for achieving SDG7:

- The government's efforts to deliver energy to everyone through the establishment of new stations such as Jenin Electricity Station and Gaza Power Station, as well as the electrical connection between Palestine and Jordan feeding border areas like Jericho city, have resulted in complete success concerning the first goal, which is 100% access to electrical energy for the entire population.
- There is a minor decrease in the achievement of the second goal, as seen. Since 2012, the percentage of renewable energy has been decreasing until 2018, when it started to increase. Despite the continuous construction of renewable energy plants, this is due to population growth and improved life standards or increased energy consumption.
- In terms of reaching the third goal, Palestine is in a state of decline, since the annual GDP rate is always decreasing due to the occupation policies and lack of international funding. The annual GDP rate was decreased to 11 below zero (-11.45) in 2020 as a result of the emergence of the (COVID – 19) crisis, which badly impacted the economy in all countries around the world.

In terms of the fourth and fifth goals, Palestine suffers from fluctuations with foreign support based on the political situation, such as the commitment to continue Palestinian-Israeli negotiations, which is frequently used as a bargaining card by Palestinian governments.

5.2 Recommendations

Based on this study, the following recommendations are presented and arranged according to each target of the seventh goal of the sustainable development goals (SDG7).

5.2.1 Recommendations of the Target 7.1

Although Palestine achieves 100% success concerning the first goal, which is the universal access to modern energy, with a significant increase in the population, as was

shown in the fifth chapter, and in the light of the occupation state's control over generation sources in all its forms, as shown in the third unit, this percentage may be reduced in the future.

As a result, and based on the preceding, the following recommendations are made in order to maintain as much of this success as possible:

- Continuing to adopt current energy management policies.
- Searching for sources to generate electric power away from the control of the Israeli occupation to secure the electrical power supplies, through the following:
 - a) Building electrical power plants in Jordan to feed border areas such as Jordan Valley in particular and the West Bank in general. This provides an opportunity to purchase the fuel needed to operate the station without the control of the Israeli occupation at a lower price.
 - b) Building electrical power plants in Egypt to feed Gaza Strip provides an opportunity to purchase the fuel needed to operate the station without the control of the Israeli occupation at a lower price.
 - c) Small initiatives at the level of residences, residential buildings, and government buildings increase reliance on solar energy to generate electricity. This ensures that the occupational state does not control all electrical generation sources.
- Raise awareness of the population about the need for energy conservation, which helps to reduce the demand for electric energy.
- Collecting consumed electric energy cost from all population, particularly residents of refugee camps, by cancelling grants and not exempting them from electric energy prices, and as a result, electric energy consumption will decrease, guaranteeing a higher capacity of electric energy and ensuring that it is not interrupted during peak periods.
- Raise awareness among residents and contractors about the importance of building homes that meet the criteria of energy-efficient green buildings.

5.2.2 Recommendations of the Target 7.2

Since the share of renewable energy in total energy consumption in Palestine was declined, the following are proposed to fulfil the second goal:

- Encouraging the population to exploit solar energy through:
 - a) Install Impose politics, in which the installation of a solar water heater becomes a requirement for receiving electricity from Palestine Electric Company.
 - b) Develop policies to enforce installing renewable energy plants on school roofs, government buildings, and holy sites (mosques and churches).
 - c) Consumers who install solar cells should receive discounted electricity tariffs from electricity companies.
 - d) Encourage investment in renewable energy installations at the corporate level by providing low-interest loans.
 - e) Import taxes on renewable energy plant parts and equipment should be reduced.
- Imposing an energy policy that is required for all generation companies, requiring a certain percentage of electric energy to be generated by renewable energy plants.
- Impose additional fees to non-energy-efficient devices to encourage the utilization of appropriate lighting products (energy-saving lamps).

5.2.3 Recommendations of the Target 7.3

Double the improvement in energy efficiency.

- As a result of the emergence of the COVID-19 crisis, which has harmed all countries of the globe, Palestine is in a state of continual deterioration in terms of attaining the third target, particularly in 2020.

As a result, the following are proposed to help getting back on track to achieve the third goal: By boosting public awareness and advertising (via various media and through the implementation of awareness programs in schools, universities and government institutions) about the need to conserve energy rather than waste or overspend it, the following guidelines can be implemented:

- a) Impose additional fees to non-energy-efficient devices to encourage the utilization of appropriate lighting products (energy-saving lamps).
- b) Take advantage of natural lighting during the day instead of using electric lighting and clean windows to make the most of natural lighting.
- c) Clean lamps and chandeliers periodically.
- d) Light only the place where you are working and make sure it is turned off when you leave the place, or use smart devises.

- e) Paint the interior walls of rooms and offices in light colours that help diffusing the or by using a reflector.
 - f) Use the timer, solar cell to light the exterior fences so that they do not remain lit during the day.
 - g) Regular maintenance of the refrigerator.
 - h) Move the refrigerator away from the wall to increase ventilation for the cooling pipes.
 - i) Adjust the refrigerator temperature between (3-5) degrees Celsius and the freezer temperature (-18) degrees Celsius.
 - j) Keep the refrigerator away from any source of heat.
 - k) Use energy efficient appliances.
 - l) Spread the laundry under the sun instead of using an electric dryer.
 - m) Take advantage of the sun's heat by opening the curtains on sunny days.
 - n) Set the air conditioner thermostat at a temperature of 25 degrees Celsius in summer and 22 degrees Celsius in winter.
 - o) Install double-glazed and heat-reflecting windows to reduce heat transfer with the room.
 - p) Use solar water heaters instead of electric energy, and the solar mirrors must be cleaned of accumulated dust at least once a year.
 - q) Obliging municipalities to implement the Palestinian Building Code like the thermal insulation for buildings to save about 40% of the electrical energy consumed.
- Raise public knowledge about the importance of planned parenthood, which helps to lower demand for all types of energy, resulting in a rise in GDP.
 - Vocational education and training. Greater educational skills allow individuals to produce more goods and services, start businesses and earn higher incomes so that the country shifts from a state of consumption to a state of production. This leads to a higher GDP.
 - Increase educational and external financial scholarships for the residents of Palestine due to the presence of Arab and international sympathy resulting from the presence of Israeli occupation.

5.2.4 Recommendations of the Target 7. (A&B)

In terms of gaining international funds and aid, Palestine is making progress. As a result, it must continue to attain this goal by implementing the following recommendations:

- The current foreign policy should be maintained and strengthened.
- Seeking new funding sources from allied countries.
- Encouragement of renewable energy investments at the corporate and individual levels.
- Easing restrictions on building renewable energy plants.

List of Abbreviations and Symbols

Abbreviation	Meaning
AFD	French Agency for Development
APIC	Arab Palestinian Investment Company
CAIDI	Customer Average Interruption Duration Index
EE	Energy Efficient
GDP	Gross Domestic Product
GEDCO	Gaza Electricity Distribution Company
HEPCO	Hebron Electric Power Company
JDECO	Jerusalem District Electricity Company
kWh	Kilo Watt Hour
MoF	Ministry of Finance
MW	Mega Watt
NEDCO	Northern Electricity Distribution Company
NIS	Israeli New Shekel
PADICO	Palestine Development and Investment Company
Paltel	Palestinian Telecommunications Group
PCBS	Palestinian Central Bureau of Statistics
PEA	Palestinian Energy Authority
PEC	Palestinian Centre for Energy and Environmental Research
PPP	Purchasing Power Parity
PRICO	Palestine Real Estate Investment Company
PSI	Palestinian Solar Energy Initiative
RE	Renewable Energy
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SDG7	Sustainable Development Goal Number 7
SDGs	Sustainable Development Goals
SELCO	Southern Electricity Company
TEDCO	Tubas Electricity Distribution Company
UHF	Ultra-High Frequency

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Appendices

Appendix A: Tables

Table 1

Average Time Required to connect a new consumer

Indicators	Year	JDECO	NEDCO	HEPCO	TEDCO	SELCO
days to connect	2020	33	16	17	11	30
new consumer	2019	33	16	19	16	27
	2018	27	21	17	16	21

Table 2

Financial indicators Per Company

Indicators	Year	JDECO	NEDCO	HEPCO	TEDCO	SELCO
Direct consumer	2020	145	60	70	67	24
cash rate % to supplier	2019	95	59	66	74	47
	2018	82	78	87	78	74
Losses %	2020	23	21	19	18	22
	2019	23	19	20	18	21
	2018	23	18	21	18	21

Table 3

Capacity growth of renewable energy projects

Year	Jerusalem	North	Hebron	Tubas	Southern
2019/2020	37%	268%	26%	10%	177%

Table 4

Percentage of population using electricity

Year	Palestine	West Bank	Gaza Strip	Urban	Rural	Camp
2013	99.9	99.9	99.9	99.9	99.9	99.9
2014	99.9	99.9	99.9	99.8	100	99.8
2015	99.9	99.9	99.9	99.9	99.8	99.9
2016	99.9	99.9	99.9	100	99.8	100
2017	99.8	99.8	99.8	99.8	99.7	99.8
2018	99.9	99.9	99.9	99.9	99.9	99.9
2019	99.9	99.9	99.9	99.8	100	99.8

Table 5*Percentage of Renewable Energy for 10 Years*

Criteria	Percentage of Conduct %
ACCESS TO ELECTRICITY	100
ACCESS TO CLEAN COOKING	100

Table 6*Percentage of Renewable Energy for Ten Years*

Year	Share of renewable energy %
2014	13.8
2015	13.8
2016	13.6
2017	10.3
2018	10.7
2019	11.7

Table 7*Purchasing Power Parity (PPP)*

Indicator	Country Value	Global Average
(MJ per US\$ PPP 2017) 2018	2.9	4.8
GDP (USD MILLION, 2017 PPP) 2018	2,900.0	-

Table 8*Palestine VS World Electricity access rate %*

Year	Palestine	Global
2001	99	75
2003	99	77
2005	100	78
2007	98	80
2009	98	82
2011	100	82
2013	100	85
2015	100	87
2017	100	89
2019	100	90

Table 9*Palestine VS World RE in total energy consumption (%)*

Year	Palestine RE Share %	Global RE Share %
2010	14.1	16.4
2011	15.4	16.4
2012	12.2	16.7
2013	11.7	16.8
2014	10.8	16.9
2015	11	16.9
2016	12.3	17
2017	10.5	17.1
2018	12.7	17.1

Table 10*Palestine VS World Energy intensity*

Year	Palestine MJ per USD	Global MJ per USD
2012	2.6	5.4
2013	2.6	5.3
2014	3	5.2
2015	3	5
2016	3.1	4.9
2017	3	4.8
2018	2.9	4.8

Appendix B: Figures

Figure 1

Losses Cost Per Company

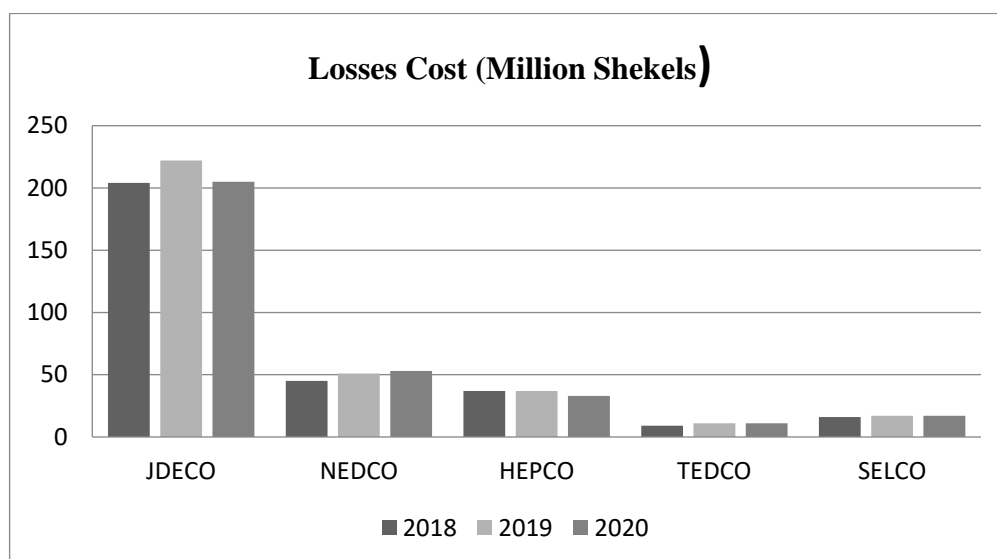


Figure 2

Cumulative Debt to Consumers Per Company

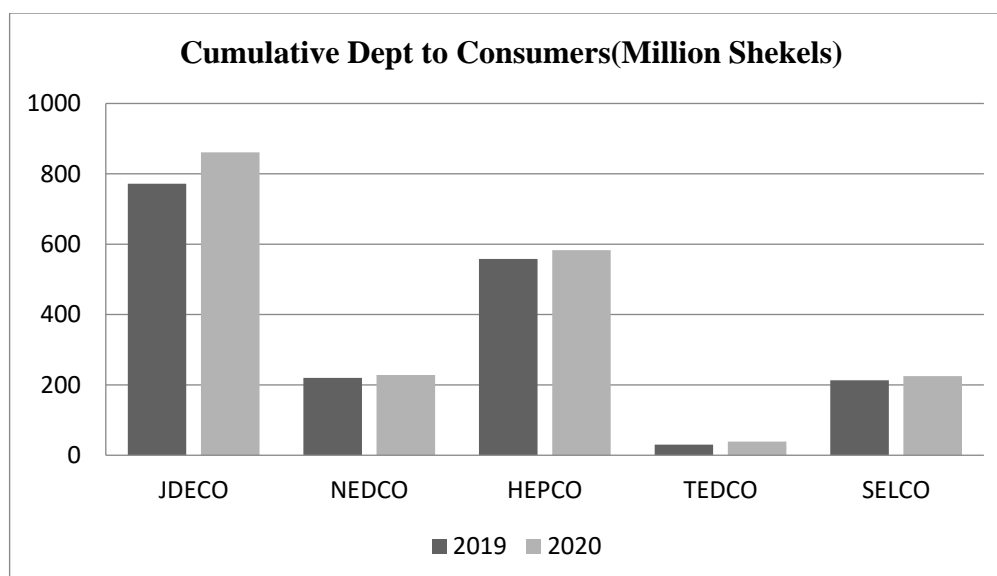


Figure 3

Percentage of population using electricity

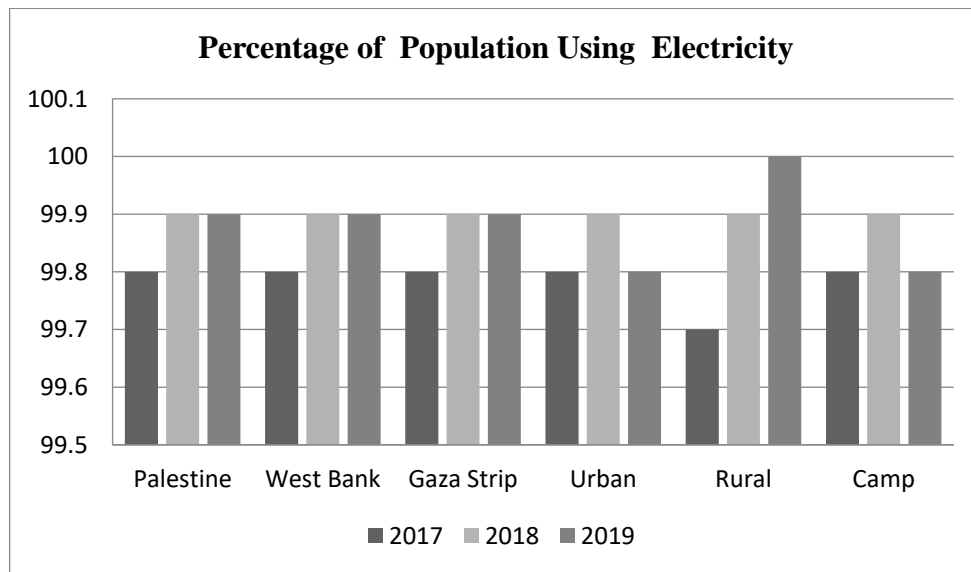


Figure 4

Palestinian Solar Energy Initiative Per Company

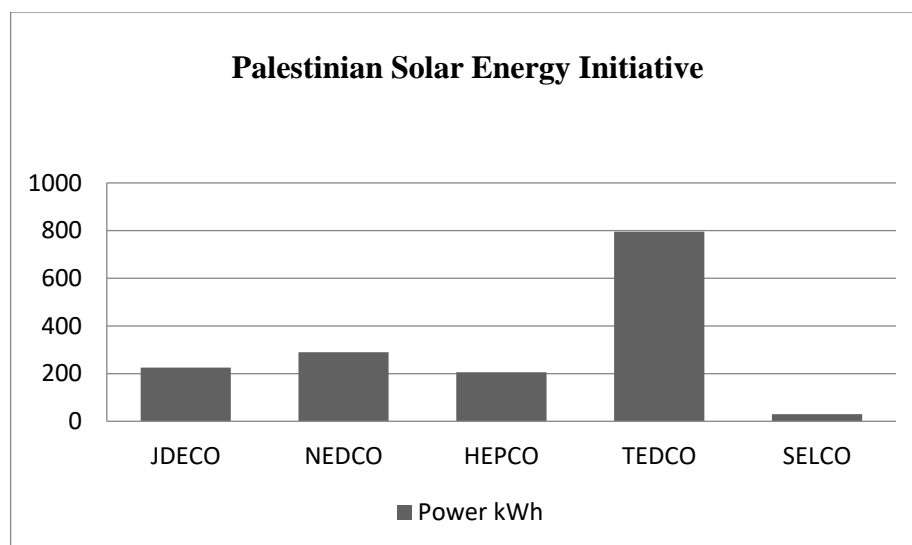


Figure 5

Net Metering Projects Per Company

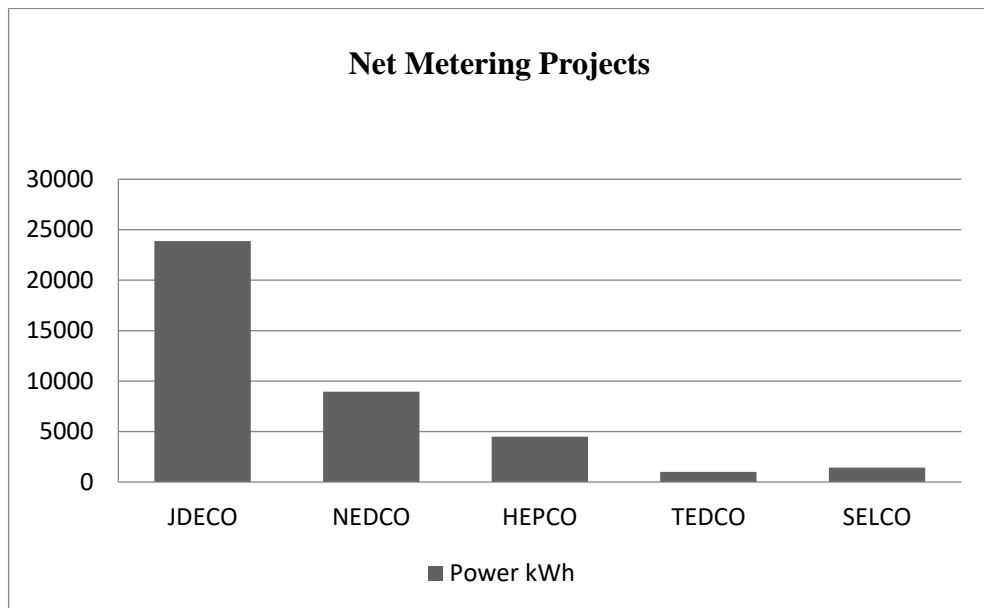


Figure 6

Productive Projects Per Company

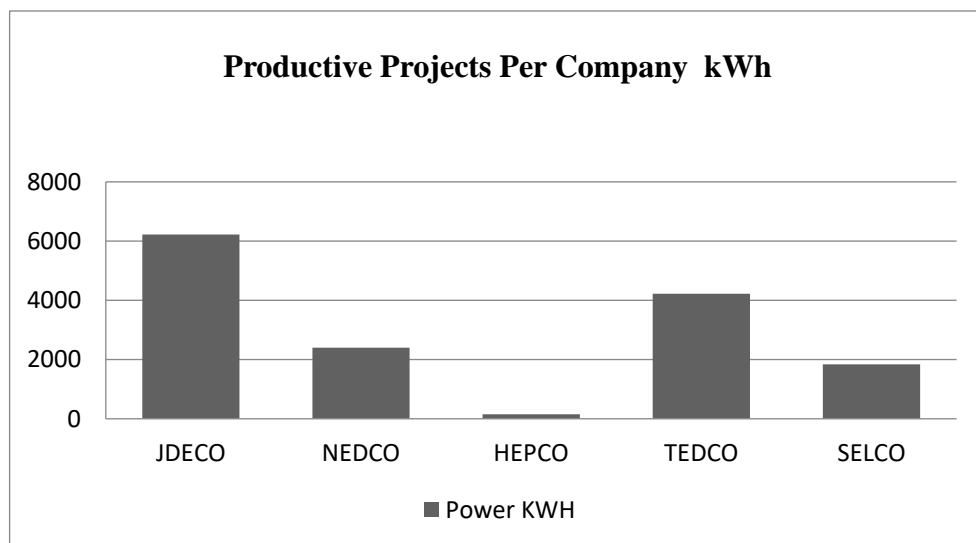


Figure 7

Total Renewable energy installed capacity Per Company

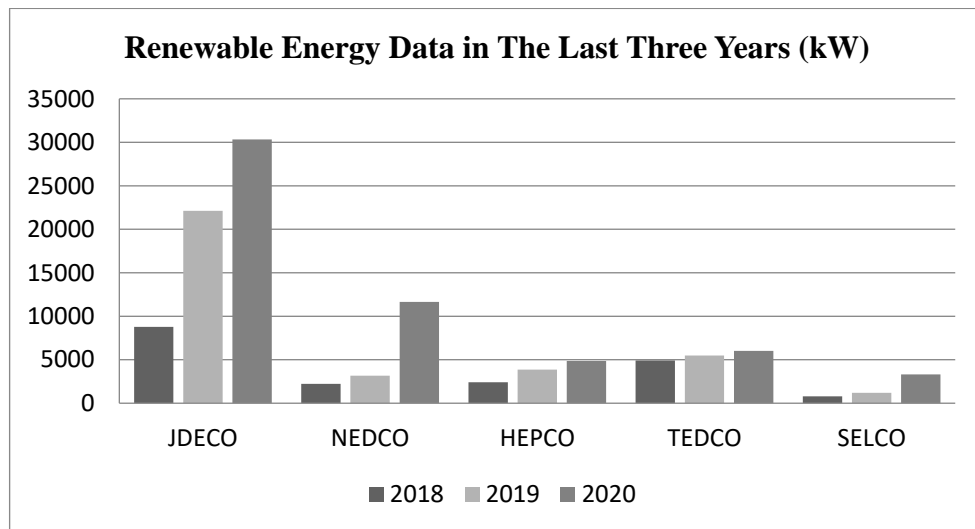


Figure 8

Petroleum products Consumption

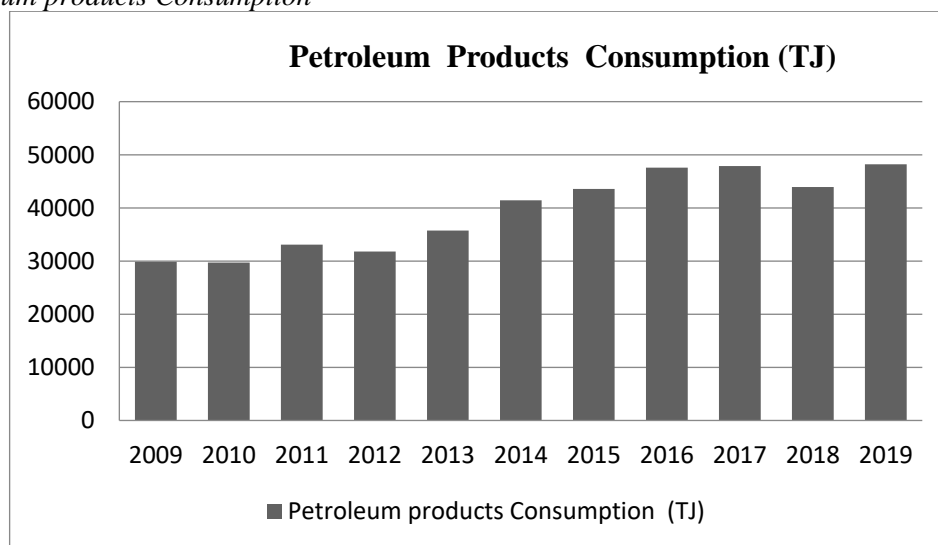


Figure 9

Total Consumption of Petroleum products 2019

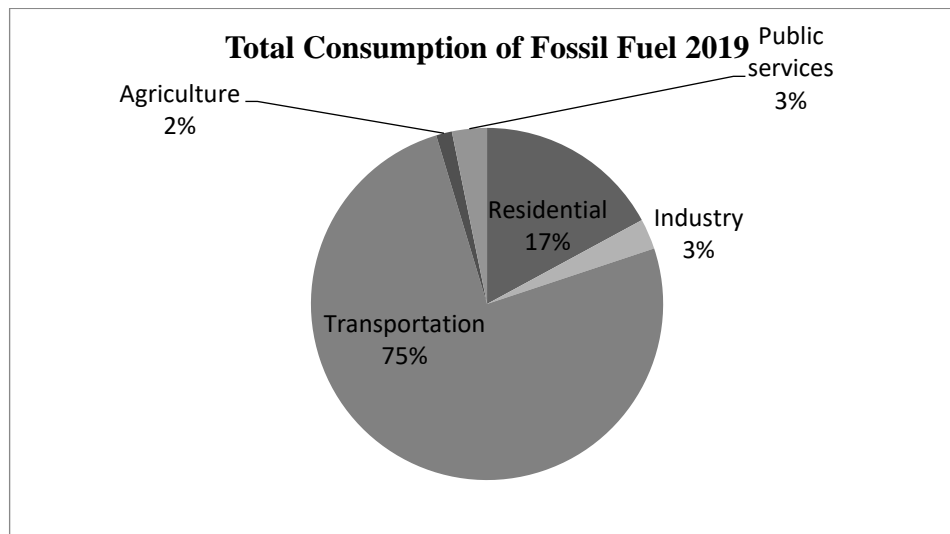


Figure 10

National Energy Intensity (MJ per 2017 USD) 1990-2018

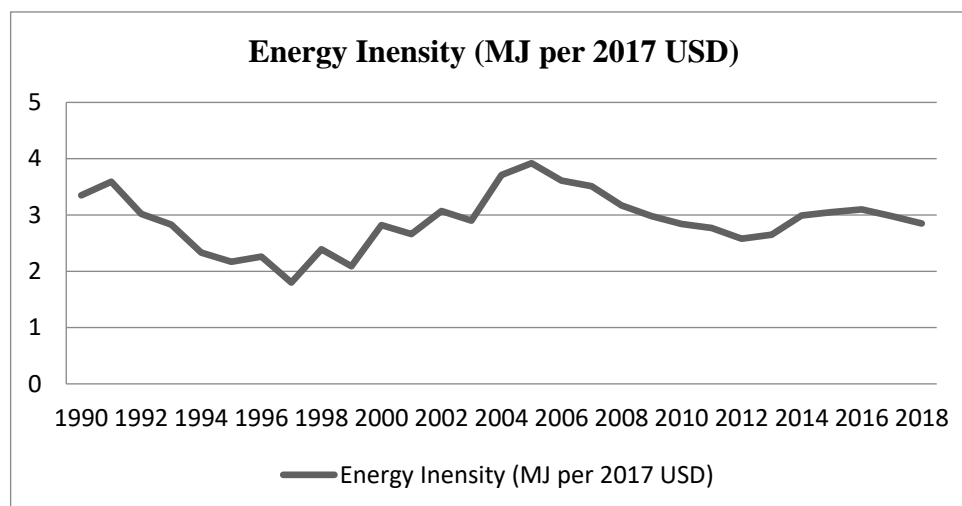


Figure 11

Palestine GDP Annual Growth %

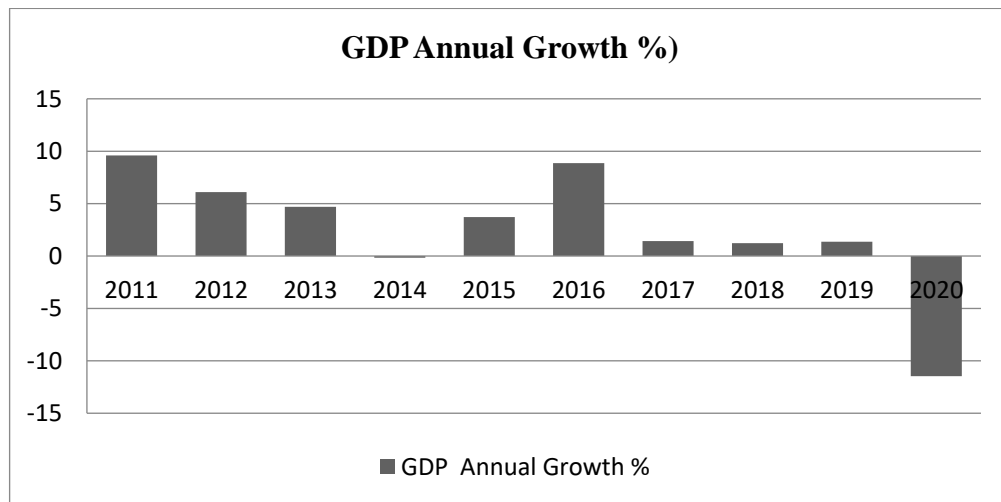


Figure 12

International Financial Flows to Palestine In Support of Clean and Renewable Energy (USD Million, 2018 PPP)

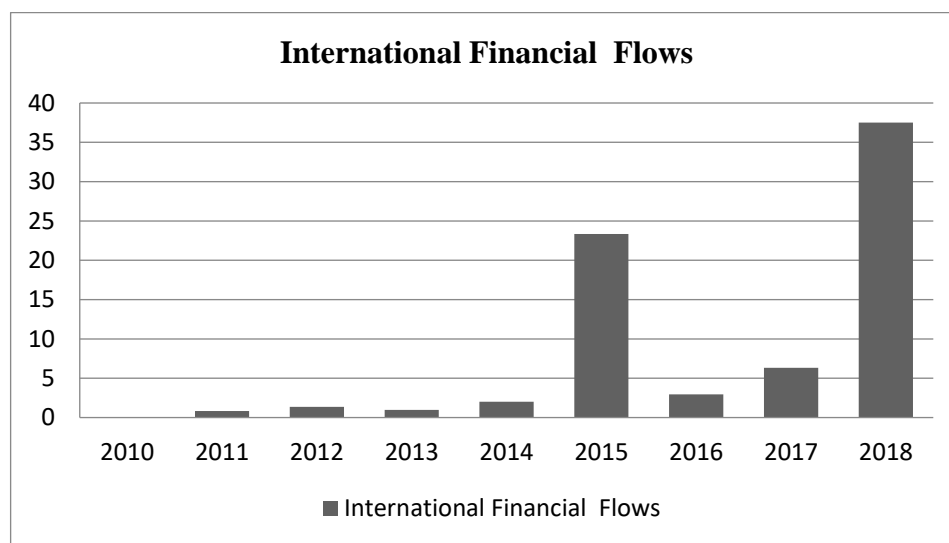


Figure 13

International Financial Flows To Palestine In Support Of Clean And Renewable Energy (USD Million, 2018 PPP)

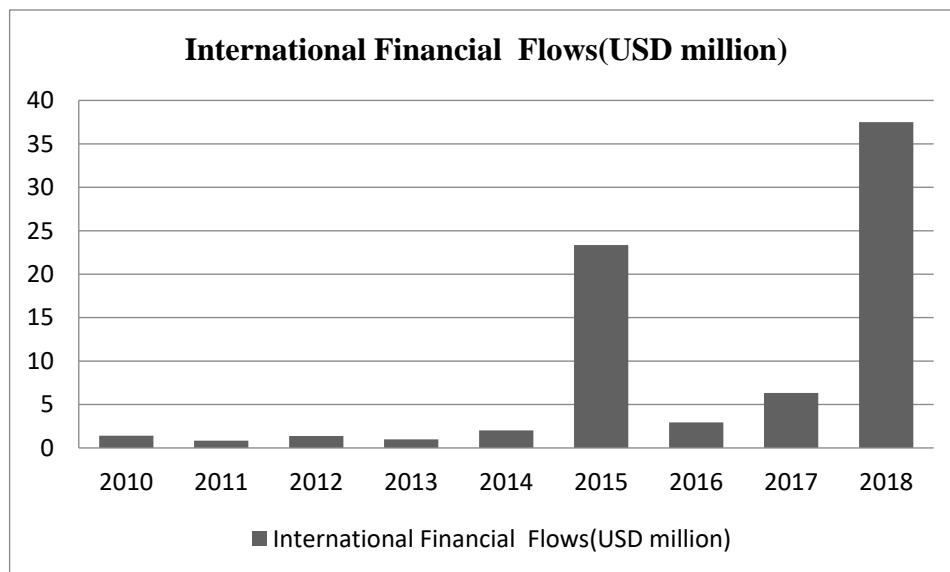


Figure 14

Compound Annual Growth Rate of National Energy Intensity

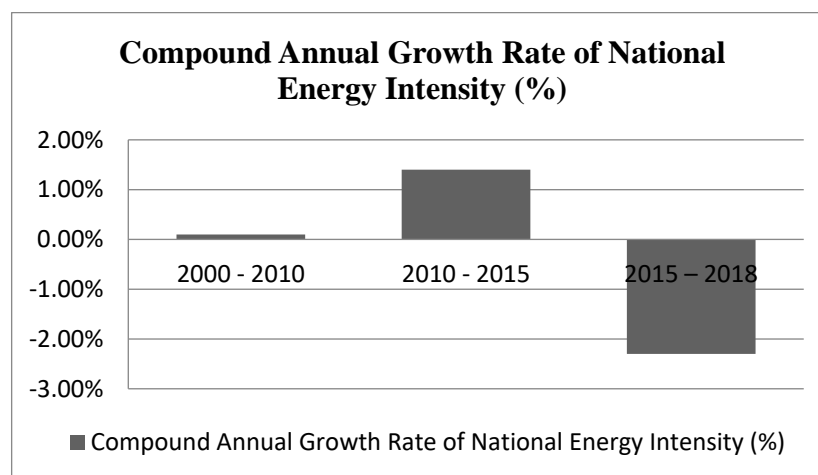


Figure 15

Palestine VS World Palestinian Annual GDP Rate %

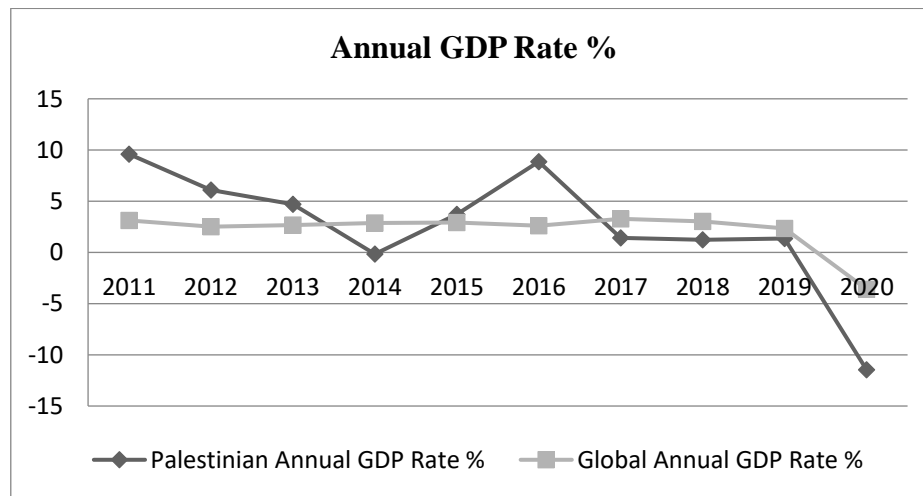


Figure 16

Palestine VS World International financial flows

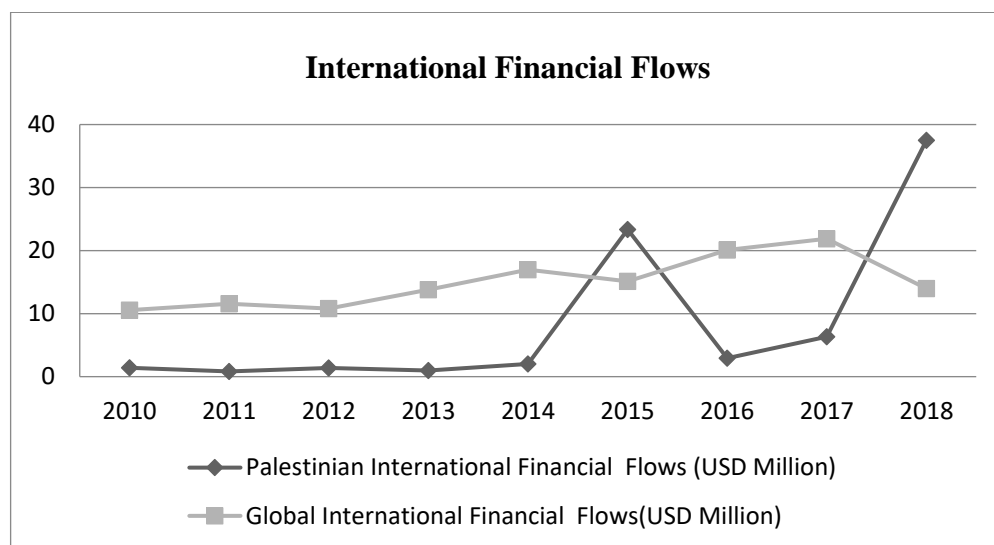
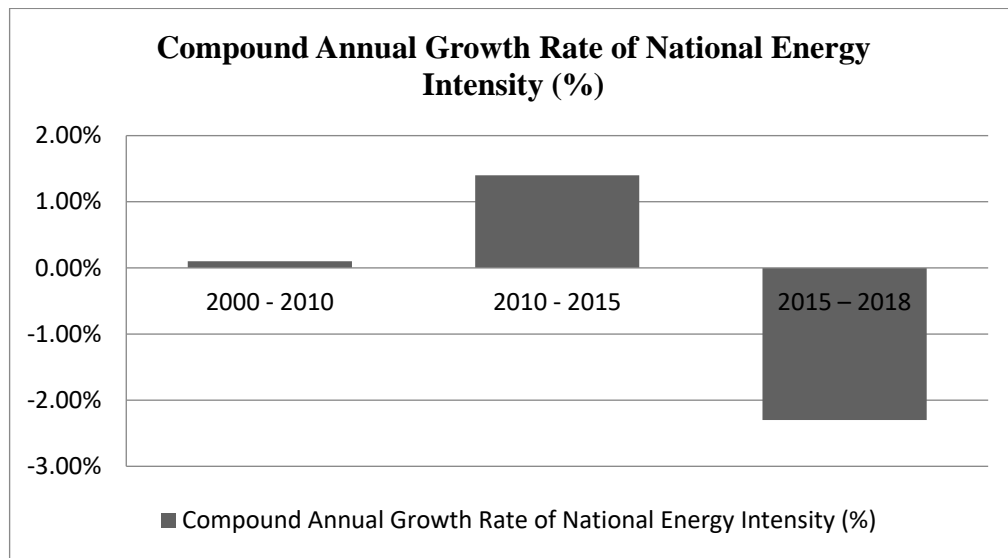


Figure 17

Compound Annual Growth Rate of National Energy Intensity





جامعة النجاح الوطنية

كلية الدراسات العليا

تحليل التقدم في سياسة الطاقة الفلسطينية في تحقيق الهدف السابع من أهداف التنمية المستدامة

إعداد

سليم محمد سليم داود

إشراف

د. عادل الجعدي

قدمت هذه الرسالة استكمالاً لمتطلبات الحصول على درجة الماجستير في هندسة الطاقة النظيفة وترشيد الاستهلاك، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس - فلسطين.

2022

تحليل التقدم في سياسة الطاقة الفلسطينية في تحقيق الهدف السابع من أهداف التنمية المستدامة

اعداد

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اشراف

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الملخص

تحتل سياسات الطاقة في دول العالم باهتمام كبير لأنها تشكل وزنًا كبيرًا في الميزانيات المالية للدول، ومن ناحية أخرى تؤثر الطاقة بشكل أساسي من خلال الانبعاثات الناتجة عن احتراق استخدام الطاقة على الغلاف الجوي وما ينتج عنها من أضرار بيئية مثل الاحتباس الحراري، وهذه السياسات تنعكس بشكل سريع ومباشر على حياة ورفاهية وسلوك السكان، وهو ما يتضح من خلال آرائهم السياسية.

تم في هذه الرسالة دراسة مدى نجاح دولة فلسطين في تحقيق الهدف السابع من أهداف التنمية المستدامة والأهداف الخمسة المنبثقة عنه. ووجد أن كل هدف له مؤشرات تستخدم لقياسه.

توضح الأهداف الخمسة المنبثقة عن الهدف السابع من أهداف التنمية المستدامة مدى وصول الطاقة الكهربائية إلى السكان، ومدى استخدام السكان للوقود النظيف للطهي، ونسبة مشاركة الطاقة المتجددة في المجموع النهائي لاستخدام الطاقة، و مدى وعي السكان بضرورة استخدام الأجهزة الموفرة للطاقة وسياسات الدولة تجاه كفاءة الطاقة.

تقدم هذه الرسالة تقييماً فنياً لمدى نجاح دولة فلسطين في تحقيق الهدف السابع من أهداف التنمية المستدامة والأهداف الخمسة المنبثقة عنه، بناءً على المؤشرات الخاصة التي أقرتها الأمم المتحدة.

وتبين من خلال الدراسة أن دولة فلسطين نجحت بشكل كبير في تحقيق الهدف الأول والثالث والرابع وفشلت في تحقيق الهدف الثاني والخامس، فيما نجحت بشكل مرضٍ في تحقيق الهدف الرابع.

من خلال هذه الرسالة تم تحديد الوضع السياسي لدولة فلسطين والمشاكل التي تعاني منها نتيجة الاحتلال الإسرائيلي ووضع الطاقة من حيث الإنتاج والاستهلاك والطاقة المتجددة وسياسة الطاقة للسنوات القادمة.

قدمت الرسالة إيضاحات حول التحديات التي تواجه دولة فلسطين، سواء كانت سياسية أو اقتصادية أو اجتماعية، مثل الزيادة السكانية وأثرها على استهلاك الطاقة.