

Sub-theme: Statistics for Evidence-Based Policy-Making

Energy Data to Develop the Energy Sector Case Study – Palestine

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Abstract

The reliable and timely monitoring of the supply and use of energy is fundamental for decision making. In Palestine, additional attention is warranted for energy data due to scarce natural resources, the high cost of energy and high population density. Palestine imports most of its energy needs despite of the proven gas reserves in Gaza strip and oil in the West bank which couldn't be utilized according to the Israeli restrictions. The Palestinian Energy Authority started 4 years ago in adopting an energy auditing and renewable energy plans mainly in the industry and services sectors where these sectors consumed less than 9% from the total energy consumption in Palestine.

Data Sources for this paper are the Energy Balance which is prepared by the Palestinian Central Bureau of statistics (PCBS) depending on the related statistics produced by PCBS (energy, economic sectors and environmental statistics), the Ministry of Energy Authority (MEA) and the General Petroleum Corporation (GPC). Several procedures were applied to ensure appropriate quality control for the survey and the administrative data sources.

Although 14% of the consumed energy in Palestine came from renewable energy sources and mostly from the solar water heaters and biomass, only less than 0.1% came from Photo Voltaic (PV) in 2014. Around 34% of the Palestinian households used fuel wood and olive cake for energy purposes and mostly in primitive inefficient ways . More than 97% of Gaza Strip household have less than 16 hours of electricity service a day due to the Israeli siege.

This paper illustrates the energy situation in Palestine, gives some recommendations for the policy makers to reduce energy imports from Israel, increase the share of the renewable energy and where should we focus to meet the new SDGS.

Key words: Energy, renewable energy, energy auditing, SDGs, PV.

1. Introduction

As the economy of the Palestine continues to develop, the Palestinian people find themselves in dire need of an efficient and economical source of energy that can meet their energy requirements. Despite the moderate global energy prices, Palestinians are paying much higher than neighboring countries for all fuel types and electricity; moreover, Palestine experiences one of the world's highest population growth rates, and this has led to tremendous energy demand in Palestine in recent years.

Palestine imports most of its energy needs and is completely dependent on Israeli for supply, with the absence of controlling its borders, the military control on most of the Palestinian land and with the forced fragmentation of the country into two distinct geographical zones (the West Bank and Gaza Strip) by Israel, Palestine is in dire need of alternative energy and efficient urban planning.

In Palestine two main bodies are responsible for the energy sector, the Energy Authority which operates the electricity and the renewable energy, the other body is the General Petroleum Corporation which follows the Ministry of Finance and operates the petroleum products.

Solar energy can be a major contributor to the future Palestinian energy supply, with its high potential in the area. Palestine receives about 3,000 hours of sunshine per year and has an average solar radiation of 5.4 kWh/m². Being an agricultural society, Palestine utilizes appreciable amount of wood, animal manure and crop wastes.

2. The current situation of energy

2.1 Energy Production

As primary production Palestine produces only some renewable energy types, the main types are solar energy, wood and olive cake as shows in (Figure 1)

Palestine has proven reserves of natural gas in Gaza Strip in two locations, the reserves are estimated to be around 1.1 trillion cubic feet, The gas was discovered in 2000 and still not utilized until now due to the political situation. Palestine also has some oil and gas reserves in the West Bank where these reserves utilized and stolen by Israel. [1]

2.2 Energy Imports

As the energy balance of Palestine 2014 (table 1), Palestine imports all of its petroleum needs from Israel only, 68.6% of the total energy imports are from petroleum products while the imports from electricity constituted 31.1%, the imports from wood and charcoal reached 0.3% in year 2014 as shown in (figure 2).

2.2.1 Petroleum Products

Palestine has no refinery, thus all fuels are imported refined, and up today all fuels are imported from Israel, although Palestine can import such fuels from other countries but due to the limitations of the fuel imports according to the agreement between Palestine and Israel it becomes difficult to import from other countries reminded that Palestine has no control with the boundaries with neighbor countries mainly Jordan.

The prices of the petroleum products in Palestine are very high compared to the neighboring countries, it reached 1.38 US dollar per liter of diesel and 1.56 US dollar per liter of gasoline as in 2015.

(table 1) shows The main fuels used in Palestine are the diesel, gasoline, liquefied petroleum gas (LPG), kerosene, lubricants, bitumen and fuel oil, it shows also that Palestine doesn't produce any petroleum products despite of the proven reserves of the natural gas in Gaza Strip, and in the presence of some oil well in the West Bank that are utilized by Israel.

All petroleum products are bought from Israel through the ministry of Finance under its main body for the petroleum products the General Petroleum Corporation.

2.2.2 Electricity

In 2014 Palestine imported around 90% of its electricity needs, 95% from the imports are from Israel, 4% from Egypt and only 1% from Jordan as shown in (figure 3).

In Palestine production and distribution of electricity are run by the private sector with many companies work in this field. There is only one Electricity plant and located in Gaza Strip, this plant has an installed capacity of 140 MW and runs on diesel until today, it runs mostly on 60 MW only, due to the shortage of fuel that is imported from Israel. In 2014 only 2000 MWh were produced from the Photovoltaic systems.

Around 99.9% of the Palestinian households are connected to electric network according to the household energy survey 2015, but this doesn't give the full picture of the real situation of electricity especially for Gaza Strip, that when we look at the number of hours of electricity service (table 2) we notice that 81% of Gaza Strip households have less than 8 hours of electricity service a day, and around 18.4% have electricity service between 8-16 hours a day and only 0.6% of the households have electricity service for more than 16 hours. [2]

2.3 Renewable Energy

It's any energy source that is naturally replenished, and the types and applications available in Palestine are:

Solar Thermal: Palestine started using solar water heaters from a long time ago, around 57% of the Palestinian households have solar heaters as in January 2015, distributed as 63% in the West Bank and 44% in Gaza Strip, (figure 4) shows the time series of the percentage of households in Palestine that use solar water heaters, 2001-2015.

Although a high percentage of the Palestinian households use solar heaters, this percentage decreased from 72.5 to 56.5 from the year 2001 to 2015 especially in Gaza Strip because of the siege by Israel, in the West bank its recognized that some high buildings doesn't use solar heaters (mostly hired apartments) and some other households use electricity for water heating and many of these households do not pay their electricity bills, in Israel its compulsory for households to use solar heaters in all new buildings which is not the case in Palestine, reminded that the payback period is only 2-3 years for these heaters and their life time reaches 25 years.

When comparing using solar heaters between Palestine and neighboring countries we notice a big difference even of the similar weather conditions, in Israel and Cyprus the households using solar heater reached around 90%, in Palestine 57% while in Jordan it doesn't exceed 15% as in year 2015 (figure 5). [3]

Estimates show that if an increase of only 5% in solar heaters will save more than 30 thousand MWh, and save around 6 million dollars and rejects 9000 tons of CO₂ emissions.

Photovoltaic

This type of renewable energy is still not utilized well although of the 300 sunny days a year in Palestine. Jericho governorate is the leader in this type with about 3 MW installed capacity, followed by Tubas Governorate with 1.8 MW installed capacity, the total installed capacity in Palestine reached by mid 2016 to 13 MW which represents less than 1.5% of the total available installed capacity, where in Jordan the total installed capacity reached 145 MW which represents around 3.5% of the net installed capacity by mid 2016, so Palestine leads Jordan

in solar Water heaters while Jordan leads in photovoltaic, this comes out with a big question to the government and the private sector.

The Palestinian Authority did not accomplish more than 20% of its strategy for the PV from 2012-2015 which was proposed to be around 15MW, unfortunately most of the implemented projects were individual ones. [4] [5]

In Palestine there are many small projects implemented in households and in some establishments through the Palestinian energy Authority in implementing a 5 KW capacity for 1000 households, unfortunately this project did not proceed as proposed and no more than 250 systems out of the 1000 proposed by the Energy Authority were implemented, going back to the energy balance of Palestine we could recognize that only 2000 MWh were produced by photovoltaic in 2014 which represents less than 0.6% of the available electric energy.

The prices of PV systems still relatively high and maybe it's the main obstacle for such systems to grow, and the Palestinian Energy Authority has ambitious plans to develop this sector in the future through a 140 MW proposed project in the near future.

Investors talk about many obstacles face the growth of this energy type and mainly in the laws put by the government such as the investor has to donate of 25% of the production surplus to the transmission companies, another thing that these projects require big funds and banks in Palestine asks for a big interest rate unlike the case in Jordan.

Geothermal

The earth naturally absorbs 50% of the sun's energy and stores it as clean renewable energy, thus the temperature in the earth remains constant throughout the entire year. In Palestine and Jordan, for example, the temperature in the earth is at a constant 17 degrees Celsius throughout the entire year. In the winter, the 17 degrees constant ground temperature is warmer than the 4 degrees outside air, thus by pumping water into a system of pipe installed deep in the earth, we can absorb heat from the warmer ground, channel it to an electrically powered geothermal heat pump, which takes the heat, compresses it and outputs it to the building at 45C°. In the summer the same exact system is simply reversed. The 17 degrees constant temperature in the ground is now cooler than the 36 C° outside hot air, thus we take the buildings heat, returning chilled water to the building, and reject the buildings heat down to the cooler earth. [6]

Even this method approved high efficiency, only few projects used it In Palestine, the reasons might be the high price of installing such a system and also the variation of the oil prices which affect the payback period, especially now a days with a very low oil prices.

Wood & Charcoal

Around 33.9% of the Palestinian households used wood for energy purposes, 29% in the west Bank and 43.3% in Gaza Strip as in January 2015 as shown in (table 3), 29.7% of the Palestinian households who are baking used wood as a main fuel, 29.2% of the Palestinian households who are heating space used wood as a main fuel for space heating where 8% of the households who are heating water used wood as a main fuel for water heating as in January 2015. Most of the use of wood occurs in an open fire manner or stoves that are not tested for their efficiency. [2]

Charcoal is used in some household activities such as barbecue and sometimes for space heating, it's used also in shisha for smoking in some coffee shops.

Wood and charcoal were not mentioned in the General Energy Strategy in Palestine at all even they constructed around 8% of the total energy consumption in 2014.

Olive cake

A solid waste resulting from olive era, Palestinian households use this kind of fuel for heating and baking, some economic facilities use it also for heating. The production of Palestine from this solid fuel ranges between 10-70 thousand tons per year according to the olive harvest.

Biofuels

Biodiesel and biogas are produced in small quantities in Palestine, there is one factory licensed in Palestine for biodiesel, where the used oil turned into biodiesel, the production of the facility is estimated at 5,000 liters per day.

Biogas is produced in some small applications in Palestine and used for cooking, one plant is producing biogas that used to produce 340 kW of electricity in Hebron. [4]

2.4 Energy Consumption

Going back again to the energy balance (table 1) and for the consumption part we recognize the following:

- Transport: The consumption of the transport sector accounts for half of the total consumption (49%).
- Household: The consumption of this sector contributes around 38% of the total consumption.
- Commerce & public services: The consumption of this sector contributes around 8% of the total consumption.
- Industry: The consumption of this sector contributes around 4% of the total consumption.
- Agriculture /Forestry / Fishing: The consumption of this sector contributes around 1% of the total consumption.

The largest consuming sectors are the transport and the household sectors with around 87% of the total consumption.

2.5 SDGs-Goal 7:

2.5.1 Affordable and clean energy

Target 2 of the seventh goal of the SDGs states that By 2030, ensure universal access to affordable, reliable and modern energy services.

Much work is needed to meet this target, although almost all households are connected to the electric network, the supply is not reliable and it is also not affordable in cost knowing that the prices of electricity reaches 0.16 US Dollars/kWh which is very high compared to the neighboring countries.

Wood is used widely for energy purposes in Palestine mainly in households, It is well known that reliance on such energy types for cooking and heating is associated with high levels of household (indoor) air pollution. The use of inefficient fuels for cooking alone is estimated to cause over 4 million deaths annually, mainly among women and children. This is more than TB, HIV and malaria combined Given the importance of clean and safe household energy use as a human development issue, universal access to energy among the technical practitioner community is currently taken to mean access to both electricity and clean fuels and technologies for cooking, heating and lighting. For this reason, clean cooking forms part of the universal access objective under the UN Secretary General's Sustainable Energy for All initiative. [7]

2.1 of the Palestinian households use kerosene for energy purposes and mainly for space heating where this act is discouraged by WHO. Existing evidence shows that household use of kerosene can lead to levels of particulate matter and other pollutants that exceed WHO guidelines. As well, the risk of burns, fires and poisoning, associated with the use of kerosene in developing countries is a cause for concern. [8]

2.5.2 Share of renewable energy

Target 2 of the seventh goal of the SDGs states that By 2030, increase substantially the share of renewable energy in the global energy mix.

Referring to the energy balance of Palestine 2014 (table 1), it is recognized that the total consumed renewable energy reached 9176 terajoule which represents around 14% of the total final energy consumption, this percentage could be increased by utilizing the huge potential of the solar heaters and PV systems.

2.5.3 Energy Efficiency

Target 3 of the seventh goal of the SDGs states that By 2030, double the global rate of improvement in energy efficiency.

The government and through the Palestinian Energy Authority started an energy auditing program in 2012, the auditing was done mainly for the industrial and commercial & services sectors, the number of establishments went through this program were 230, and the total savings reached around 25 GWh according to the Palestinian Energy Authority, this quantity composes only less than 0.5% when compared with the total electricity consumption.

On the other hand when comparing the consumption of these sectors with other sectors and with the total consumption we notice that the total consumption of these sectors represents 4% and 8% respectively, while the transport sector which consumes around 49% of the total consumption, and also the household sector which also consumes around 38% of the total consumption were almost out of such auditing.

2.5.4 Investment on modern energy

Data is not available for this target, but it seems evident that attention has to be taken through the high potential of renewable and by focusing on the efficiency of the energy facilities used especially at household and in the transport sectors.

Recommendations:

- Accelerating the restructuring of the energy sector to put all energy types under one energy authority (oil, electricity & renewable energy).
- Increase the number of solar heaters by making its installation mandatory like other countries.
- Adopting clean fuels and technologies for all main household energy use, and by adopting advanced combustion heating facilities and cooking stoves.
- Promote and encourage investment in renewable energy to attract investors to this important sector.
- Doing energy auditing for the transport sector, there should be more tax on high fuel consuming cars.
- Doing energy auditing for the household sector, replace of old light with light-emitting diode lights.

References

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[6] MENA Geothermal- Geothermal Cooling and Heating Systems
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[7] United Nations Statistics Division, Metadata for Goal 7, Ensure access to affordable, reliable, sustainable and modern energy for all, March 2016

[8] *WHO guidelines for indoor air quality: Household fuel combustion*. (2014). Geneva: World Health Organization 2014

Tables

Table 1: Energy Balance of Palestine in Terajoul, 2014

Flows	Total	Energy Products										
		Solar Energy	Wood and Charcoal	Olive Cake	Bitumen	Oils and Lubricants	LPG	Fuel Oil	Kerosene	Gasoline	Diesel	Electricity
1.1 Primary production	11,730.84	5,300.88	5,693.01	726.15	-	-	-	-	-	-	-	10.80
1.2 Imports	57,028.83	-	153.13	-	670.74	117.14	7,010.47	121.00	40.76	8,781.31	22,367.21	17,767.07
1.3 Exports	-59.08	-	-46.46	-	-	-12.62	-	-	-	-	-	-
1.4 Stock change	2,346.95	-	-	-	-	-	-	-	-	476.45	1,870.50	-
1.Total energy supply	71,047.54	5,300.88	5,799.68	726.15	670.74	104.52	7,010.47	121.00	40.76	9,257.76	24,237.71	17,777.87
2. Statistical differences	-3,590.20	-	-	-	-	-	-	-	-	-	-3,590.20	-
3.Transformation	-2,110.73	-	-	-	-	-	-	-	-	-334.54	-2,987.90	1,211.71
3.1 Electricity plants	-2,110.73	-	-	-	-	-	-	-	-	-334.54	-2,987.90	1,211.71
4. Losses	5,057.28	2,650.44	-	-	-	-	-	-	0.11	67.53	60.45	2,278.75
5. Final consumption	67,469.73	2,650.44	5,799.68	726.15	670.74	104.52	7,010.47	121.00	40.65	8,855.69	24,779.56	16,710.83
5.1. Final energy consumption	66,694.47	2,650.44	5,799.68	726.15	-	-	7,010.47	121.00	40.65	8,855.69	24,779.56	16,710.83
5.1.1 By industry	2,824.75	-	81.27	167.50	-	-	333.84	60.50	0.07	5.05	277.92	1,898.60
5.1.2 By transport	32,506.36	-	-	-	-	-	189.20	-	-	8,690.50	23,626.66	-
5.1.2.1 Road	32,506.36	-	-	-	-	-	189.20	-	-	8,690.50	23,626.66	-
5.1.3 By household and other sectors	31,363.36	2,650.44	5,718.41	558.65	-	-	6,487.43	60.50	40.58	160.14	874.98	14,812.23
5.1.3.1 Households	25,605.35	2,650.44	5,619.58	558.65	-	-	5,915.29	-	38.22	-	190.79	10,632.38
5.1.3.2 Agriculture	682.45	-	-	-	-	-	113.66	-	1.11	135.29	299.35	133.04
5.1.3.3 Commerce & public services	5,075.56	-	98.83	-	-	-	458.48	60.50	1.25	24.85	384.84	4,046.81
5.2 Non energy use	775.26	-	-	-	670.74	104.52	-	-	-	-	-	-

(-): Null

Notes:

1. In all accounts related to charcoal and wood, a unified calorific value was used for each of the charcoal and wood based on the weight of each type in the balance, and the calorific value for both was considered to be 15.61 gigajoules/ton
2. The efficiency of the solar water heater was considered to be 45% and the consumed energy is half of the produces quantity.
3. The technical losses in electricity in the Palestinian Territory are considered to be 12% based on the Palestinian Energy Authority.

Table 2: Percentage Distribution of Households by Region and Number of Hours of Electricity Service, July 2015

Region	Number of Hours of Electricity Service				
	Total	Hours 24	17-23 Hours	8-16 Hours	Less than 8 Hours
Palestine	100	52.5	11.6	7.5	28.4
West Bank	100	79.5	17.6	1.9	1.0
Gaza Strip	100	0.6	0.0	18.4	81.0

Table 3: Percentage of Households that Used Energy by Region, and Energy Type, January 2015

Region	Energy Type						
	Diesel	Gasoline	Kerosene	LPG	Solar Energy	Wood	Electricity
Palestine	8.3	17.1	2.6	97.3	56.5	33.9	99.9
West Bank	11.1	19.1	2.3	99.6	63.1	29.0	99.9
North of West Bank	10.2	16.9	2.1	99.7	65.8	29.7	100
Middle of West Bank	10.8	23.9	2.1	99.7	62.9	19.4	100
South of West Bank	12.5	17.4	2.7	99.4	60.2	36.7	99.6
Gaza Strip	2.9	13.5	3.1	93.0	43.8	43.3	99.9

Figures

Figure 1: Energy Produced in Palestine by type of Energy, 2015 (Tera Joule)

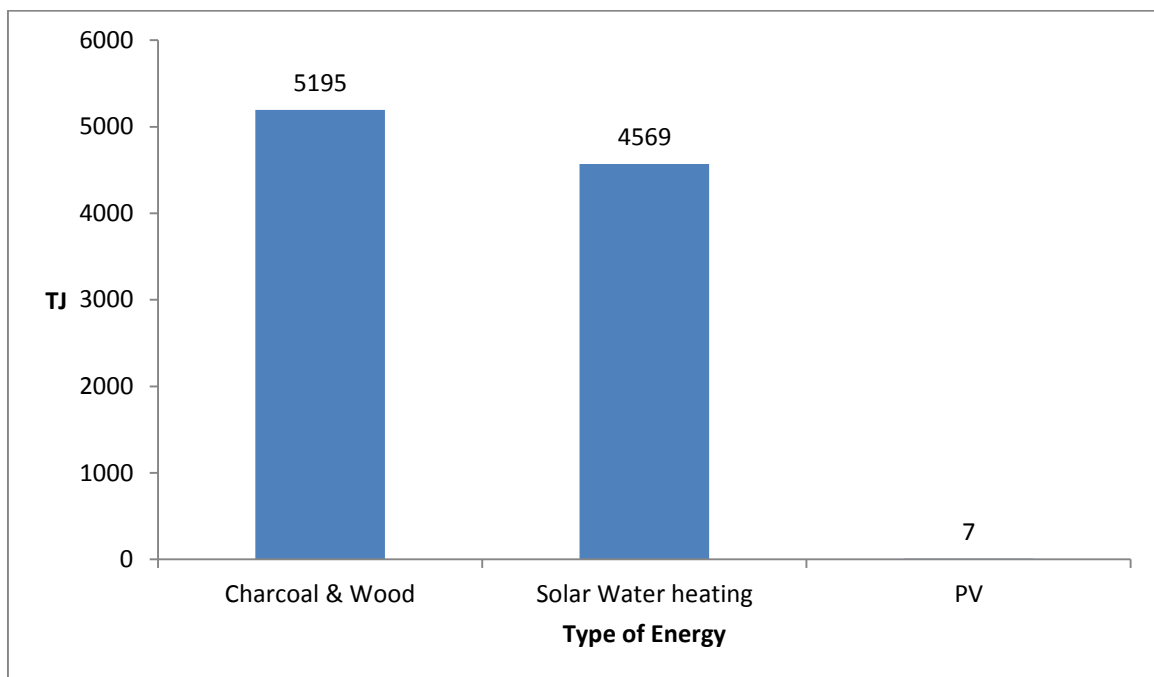
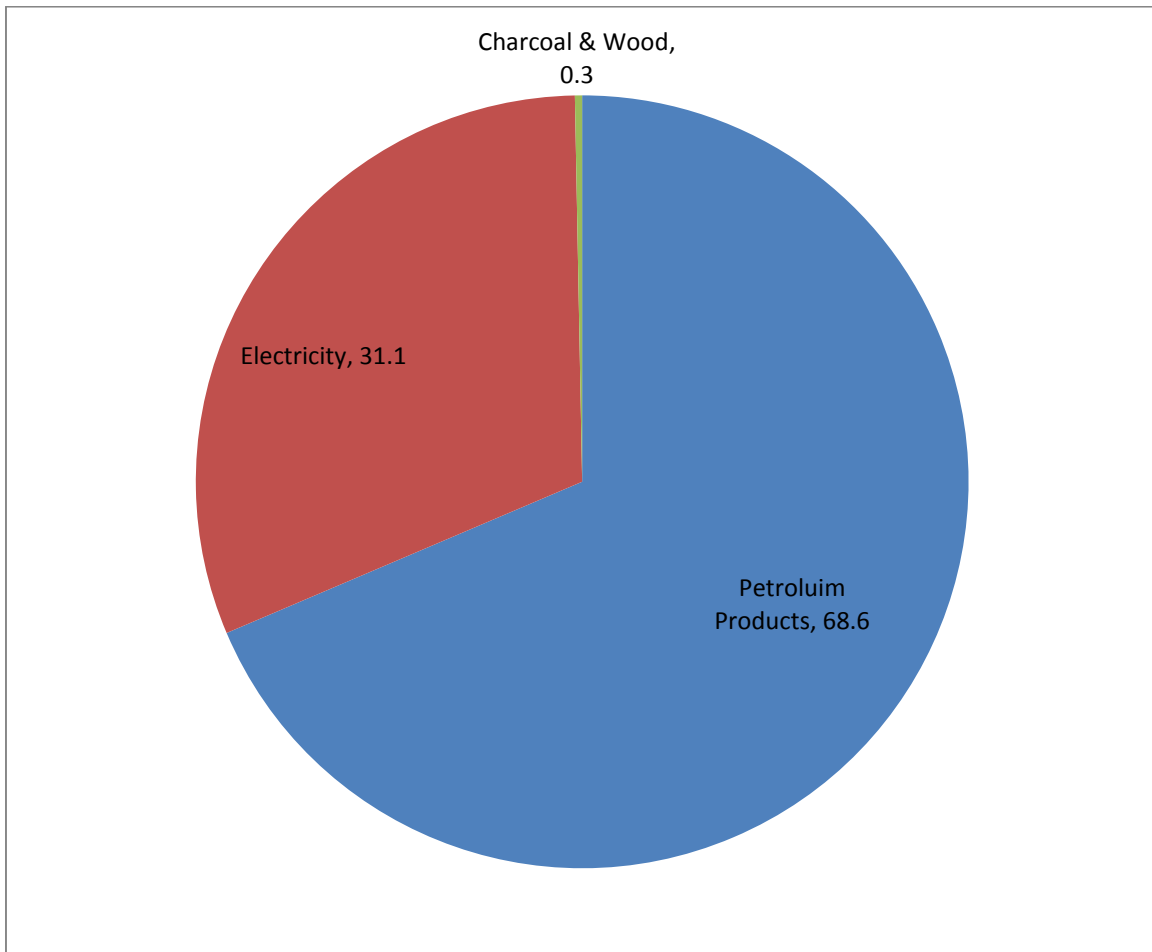


Figure 2: Percentage Distribution of energy imports, 2014



**Figure 3: Imports of Electricity in Palestine by Source, 2014
(MWh)**

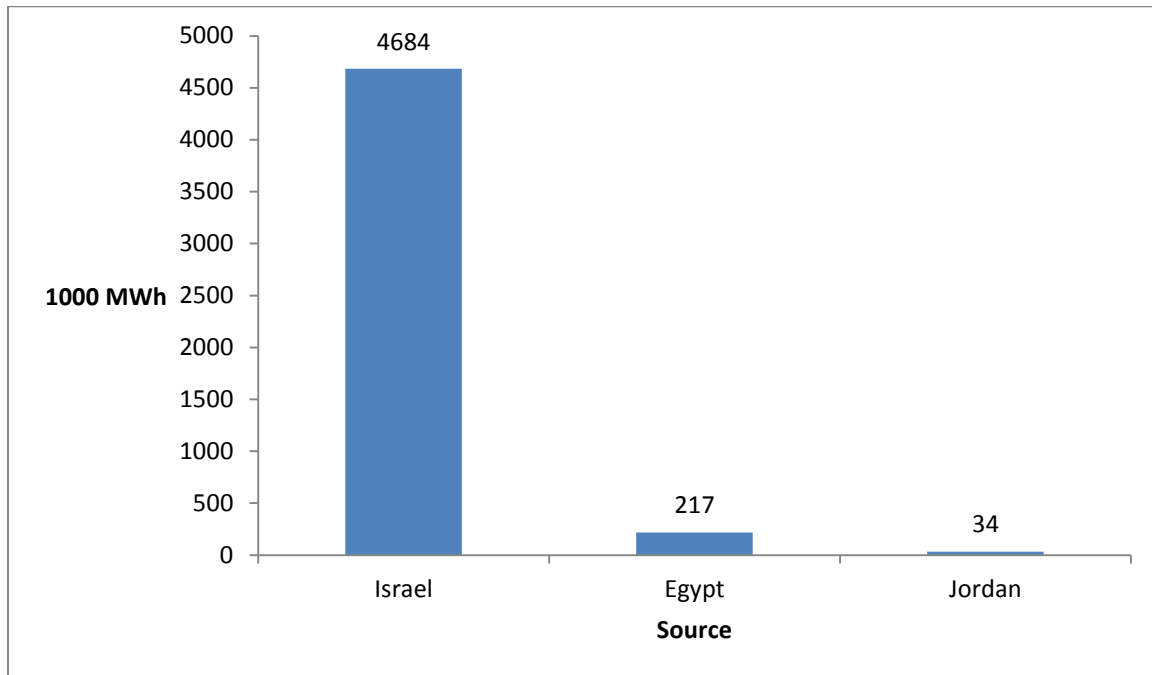


Figure 4: percentage of households in Palestine that use Solar Water Heaters, 2001-2015

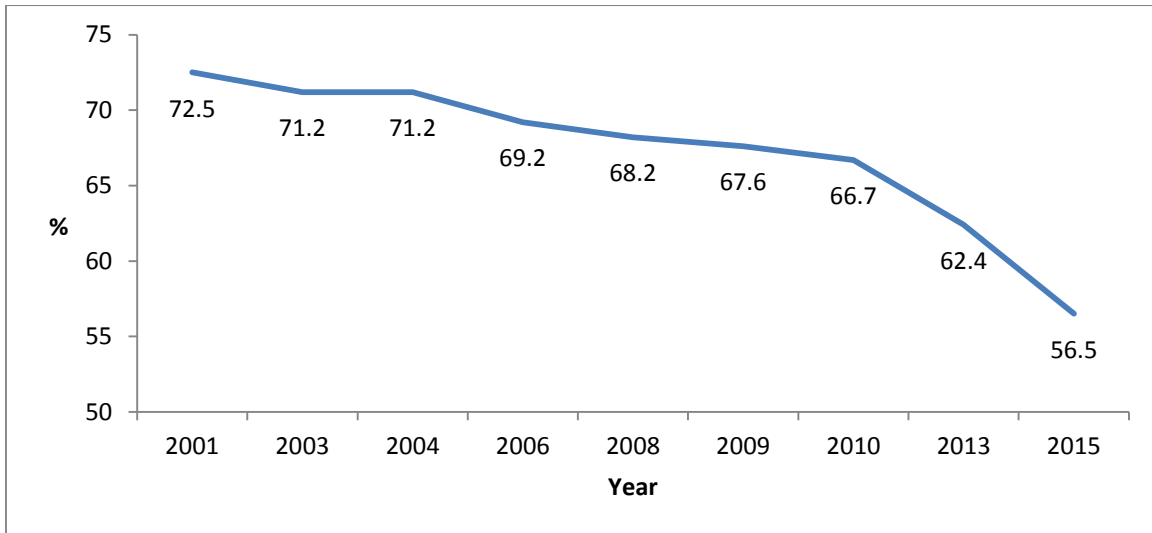


Figure 5: percentage of households that use Solar Water Heaters, 2015

