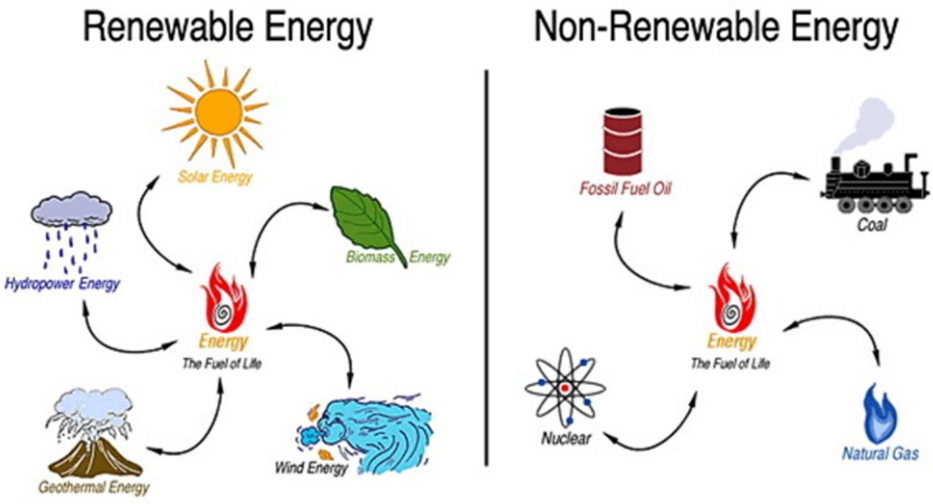
Design and Renewable Energy
Focus on Energy



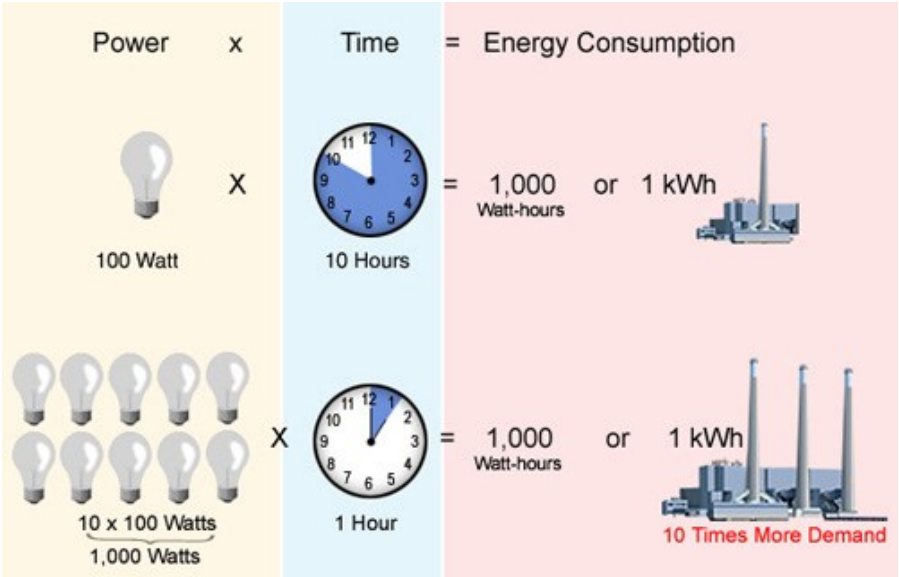
Primary, secondary and end-use energy

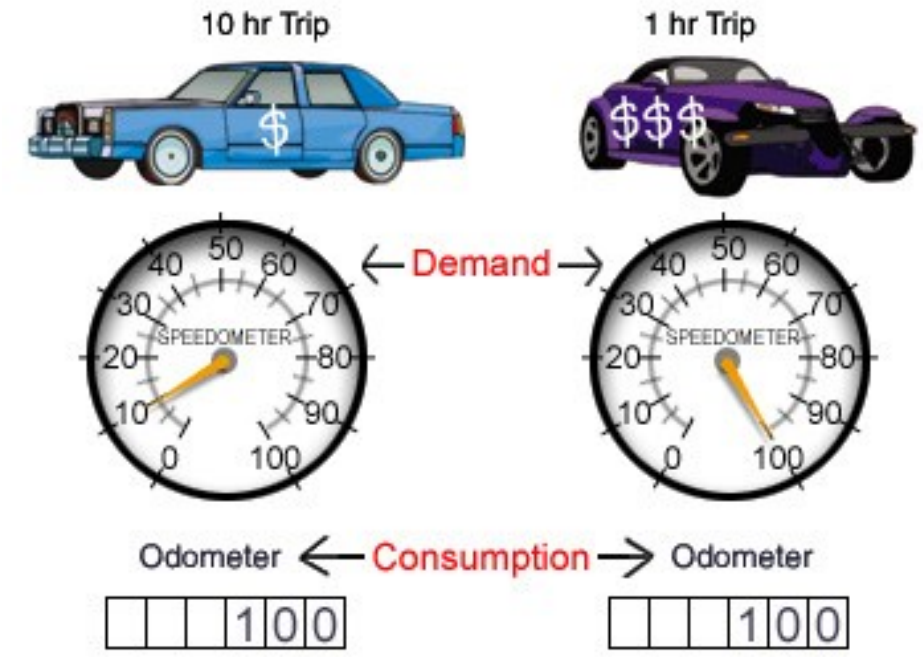
- Primary energy refers to the energy embodied in the natural resources that has not undergone any form of artificial conversion or transformation. Availability of primary energy is location dependent. Examples of primary energy sources are coal, crude oil, sunlight and uranium.

- Secondary energy refers to the energy obtained from the transformation of primary energy sources. It is also known as derived energy. Availability of secondary energy is capital dependent and is less affected by the location of primary energy sources. Examples of secondary energy sources are electricity and fuel cells.

- End-use energy refers to the energy consumed by the final users. End-use energy consumption is usually assessed based on the consumption of primary and secondary energy by industries and sectors. Pattern of end-use energy is industry dependent and varies from one place to another.

Kw (Load, demand) and Kwh (consumption)





kWh is a measure of energy, whilst kW is a measure of power

$E_{(\text{kWh})} = P_{(\text{kW})} \times t_{(\text{hr})}$

So

kilowatt-hour = kilowatt × hour

or

kWh = kW × hr

Example

What is the energy consumption in watt-hour when the power consumption is 5 kilowatts for time duration of 3 hours?

***E* = 5kW × 3h = 15 kWh**

Other units for energy

- The kilowatt hour (kWh) is a unit of energy... The Calorie is a unit of energy... And the joule (J) is a unit of energy... And these aren't the only units of energy - there's the BTU, the therm, and plenty of obscure units that you're unlikely to have heard of.
- *Power is the **rate** at which energy is generated or used.*
- Joules per second (J/s) is a measure of power... The watt (W) is a measure of power... And the kilowatt (kW) is a measure of power too

The relationship between energy consumption (kWh) and time

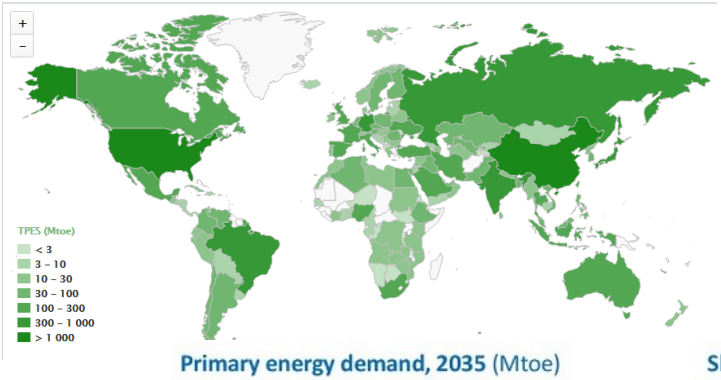
- A typical building uses more energy over long periods of time than it does over short periods of time:

On February 16th 2010 a building might have used 95 kWh.

Over the week starting April 12th 2010 it might have used 550 kWh.

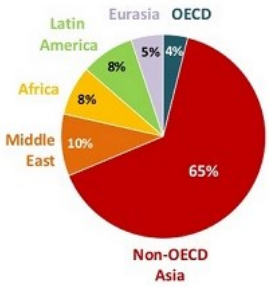
From January 1st 2009 to December 31st 2009 it might have used 31,250 kWh.

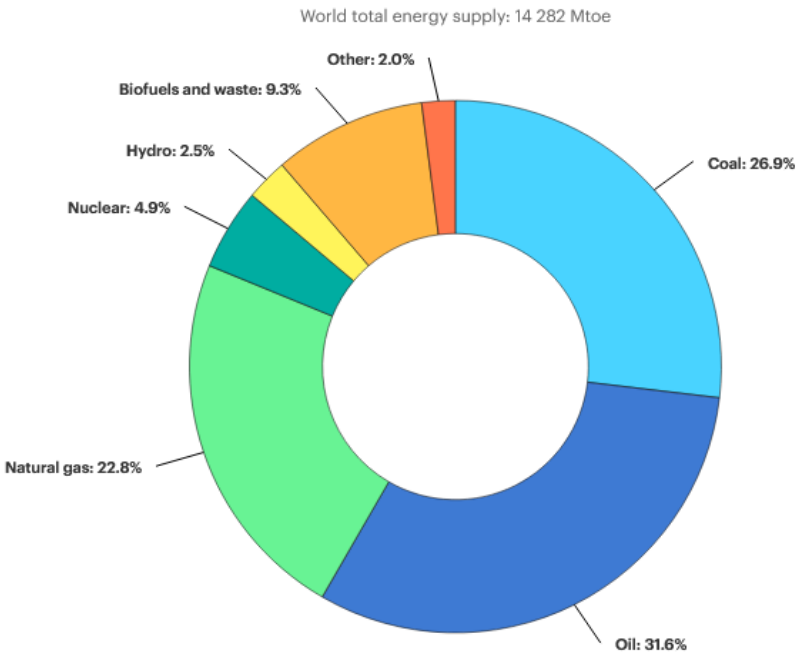
- However, we can't immediately compare the efficiency of the building over each of those periods. If a kWh figure covers a day, we can only compare it fairly with other kWh figures that cover a day. If a kWh figure covers a week, we can only fairly compare it with other kWh figures that cover a week.



Primary energy demand, 2035 (Mtoe)

Share of global growth 2012-2035





The case of Palestine

Figure E.1 – Primary Energy Consumption in PT in 2018

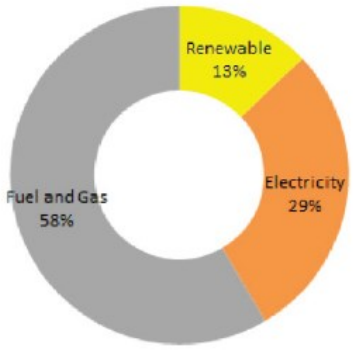
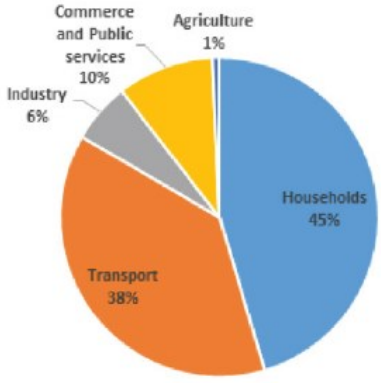
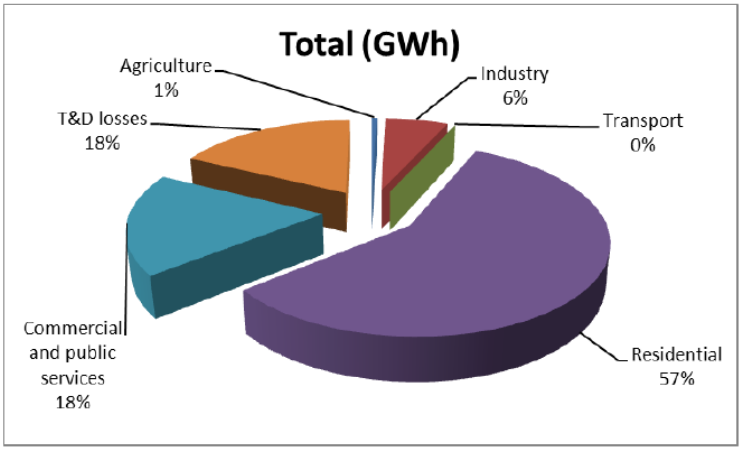
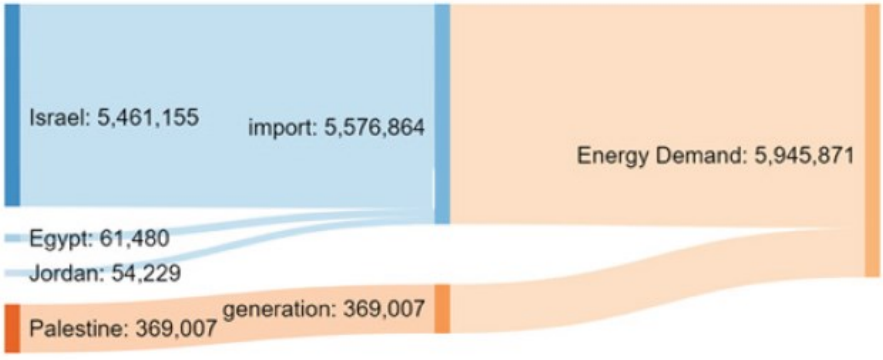


Figure E.2 – Final Energy Consumption in PT by sector in 2018





(Source: World Bank own elaboration based on data from Energy balance for Palestine - 2013



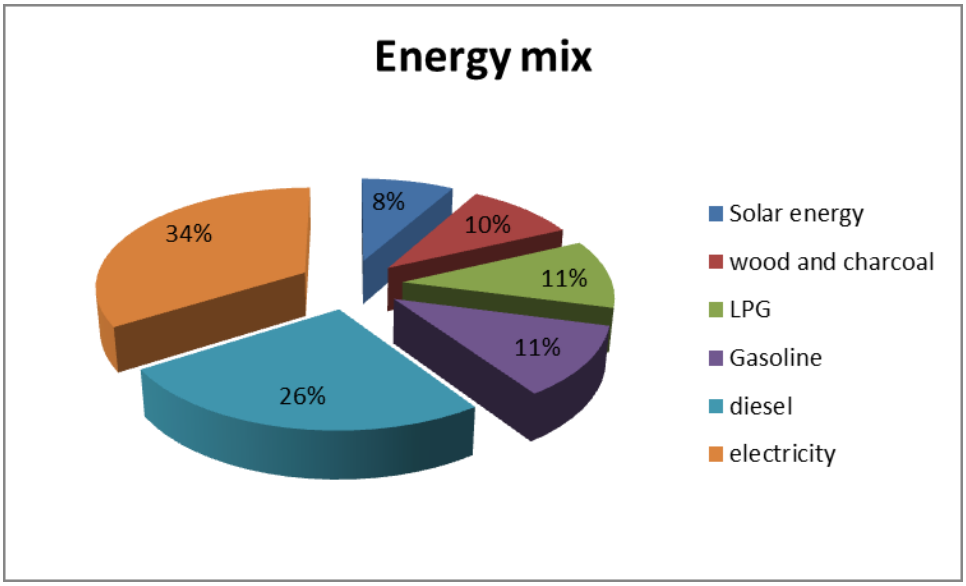
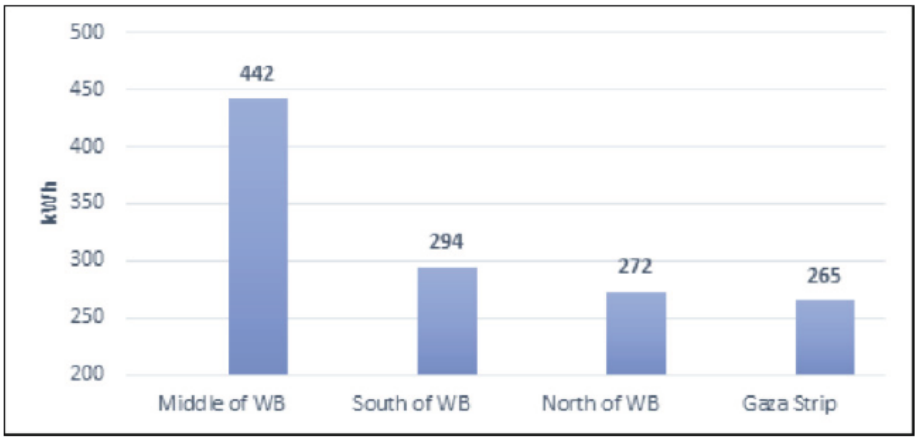


Figure 15 – Average Household Electricity Consumption in Households Using Electricity by Region, January 2015



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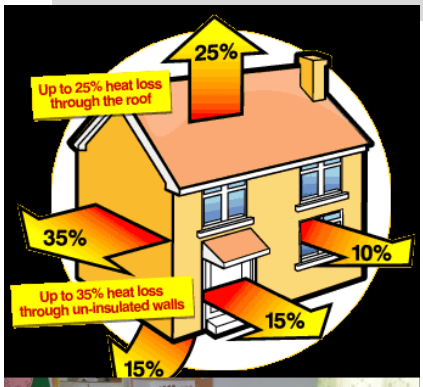


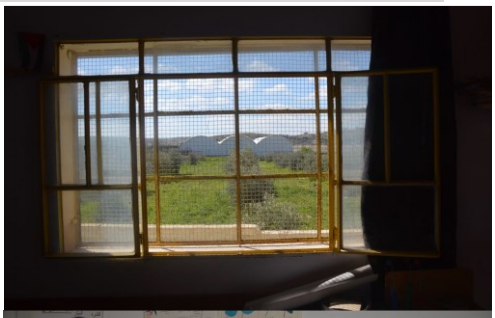
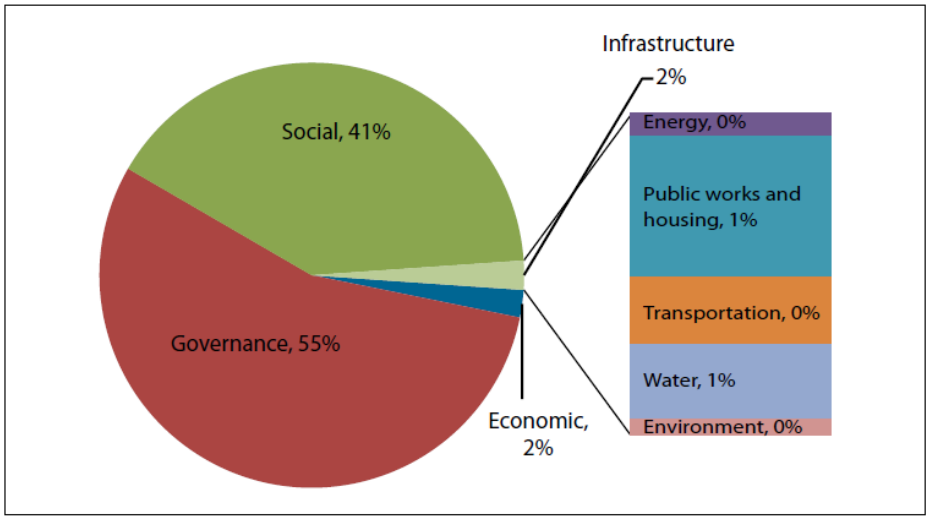


Figure 3- Financial distribution of national budget (2011) [33]



Coffee Maker	900-1200 watts
Microwave	750-1100 watts
Toaster	800-1400 watts
Dishwasher	1200-2400 watts
Washer	350-500 watts
Dryer	1800-5000 watts
Iron	100-1800 watts
Ceiling fan	65-175 watts
Space heater (40gal)	4500-5500 watts
Hair dryer	1200-1875 watts
Laptop	50 watts
Computer monitor	150 watts
Computer tower	120 watts
Television 19"-36"	65-133 watts
Television 53"-61"	170 watts

Calculating your consumption

Calculate Watt-hours Per Day

Device Wattage (watts) x Hours Used Per Day = Watt-hours (Wh) per Day

Example: A 125-watt television used three hours per day
125 watts x 3 hours = 375 Wh/Day

Convert Watt-Hours to Kilowatts

Device Usage (Wh) / 1000 (Wh/kWh) = Device Usage in kWh

Example: A television using 375 Wh of electricity per day
375 / 1000 = 0.375 kWh

Find Your Usage Over a Month

Daily Usage (kWh) x 30 (Days) = Approximate Monthly Usage (kWh/Month)

Example: A television using 0.375 kWh of electricity per day
0.375 kWh x 30 Days = 11.25 kWh/Month

Figure Out the Cost

Monthly Usage (kWh) x Electric Rate ($/kWh) = Approximate Cost per Month

Example: A television using 11.25 kWh/Month with an electric rate of $0.10/kWh
11.25 kWh x $0.10 = $1.13/Month