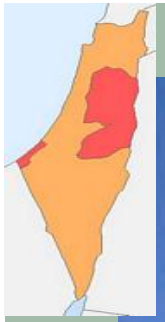

Refrigeration: The case of the electric sector in Palestine

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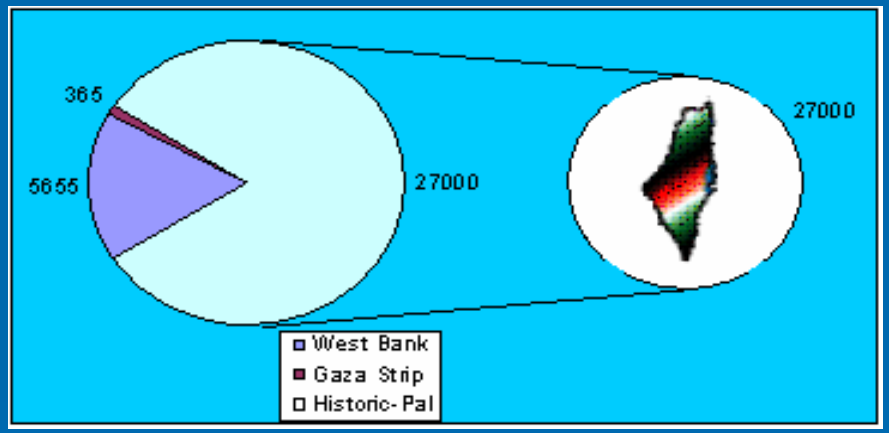
Financing: Program PEACE, Université de Genève

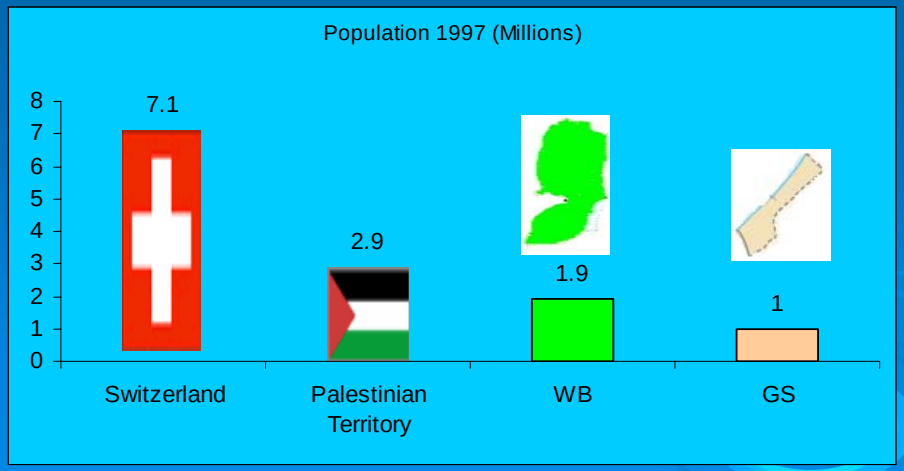
Background

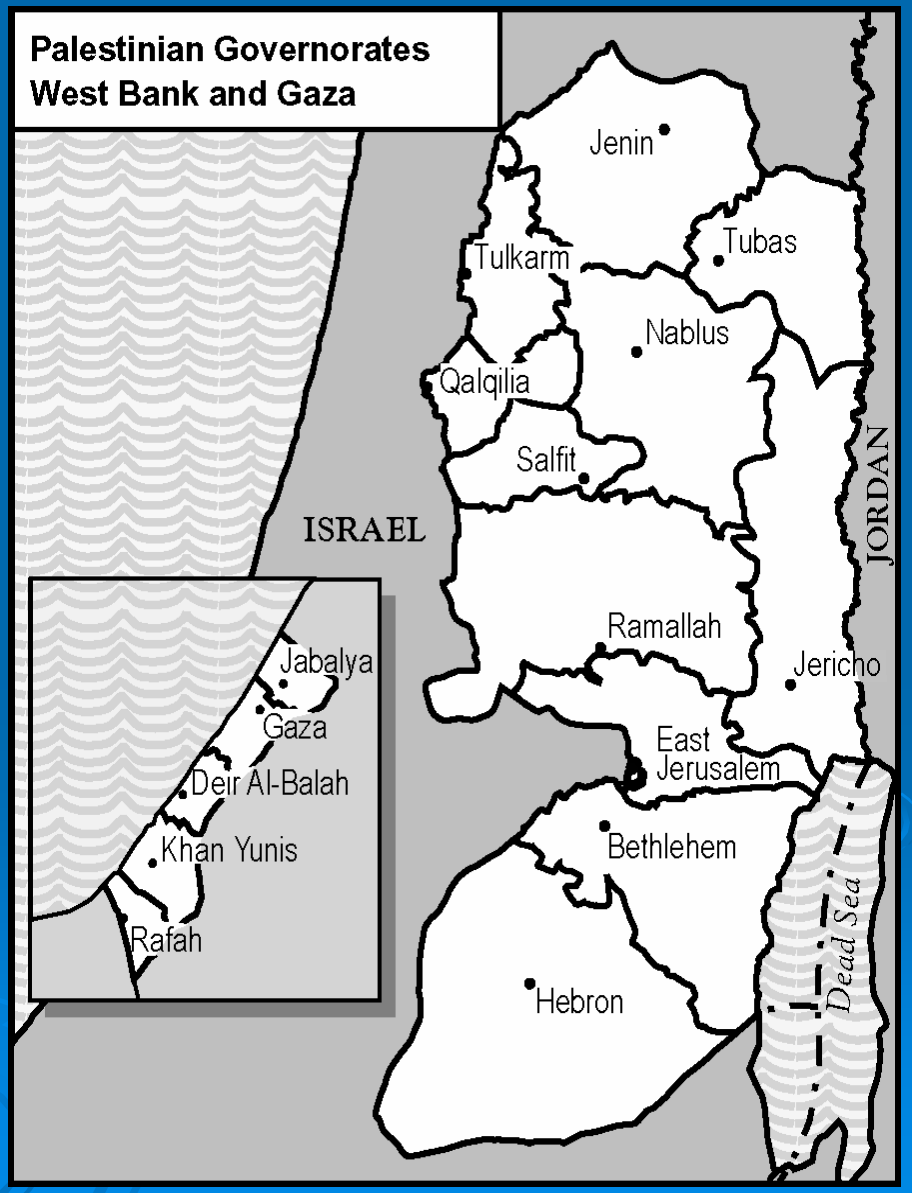
Out of the 27 000 Km² of the historic map of Palestine, Palestinian Territories measure: 6020 Km2 (22%)

West Bank (Cisjordanie) with 11 governorates: 5655 km2 (94%), 2 million habitants

Gaza Strip (Bande de Gaza) with 5 governorates: 365 km2 (6%), 1.3 million habitants

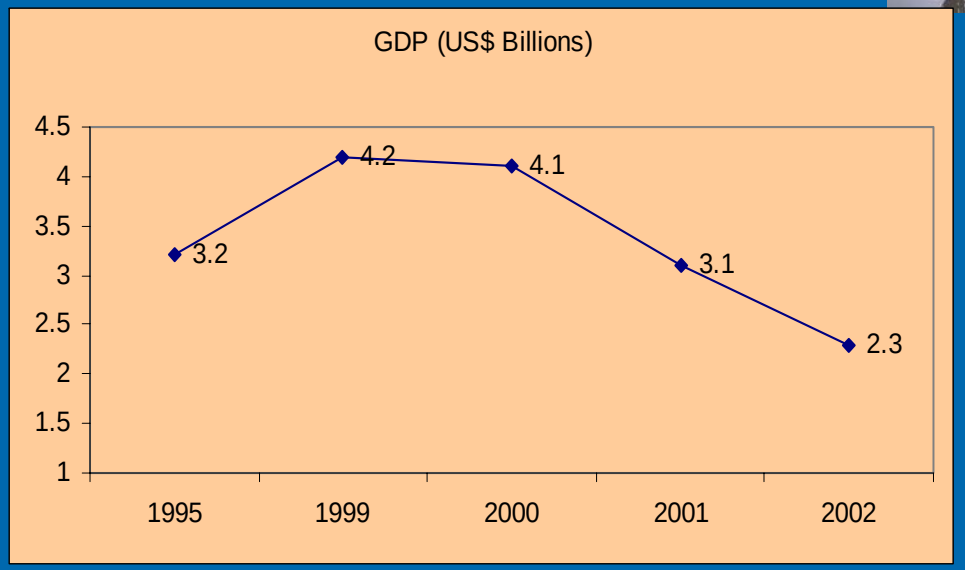


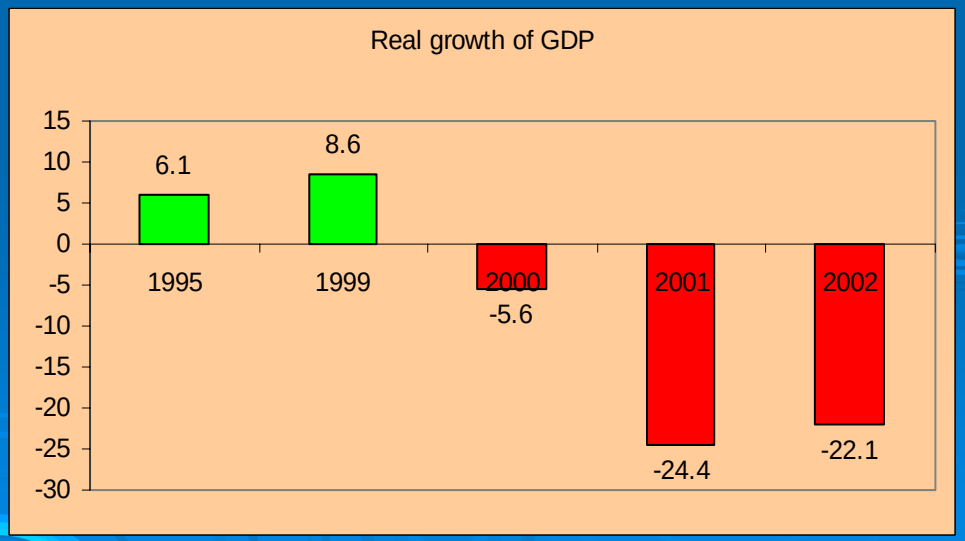




Palestinian economy

- GDP ≈ $4 Billion (1999)
- 30% of the labour force work in services, against 15% in industry
- A very distorted economy (Ex. dependence upon one major trade partner, disappearance of small industries).
- High vulnerability to political shocks.

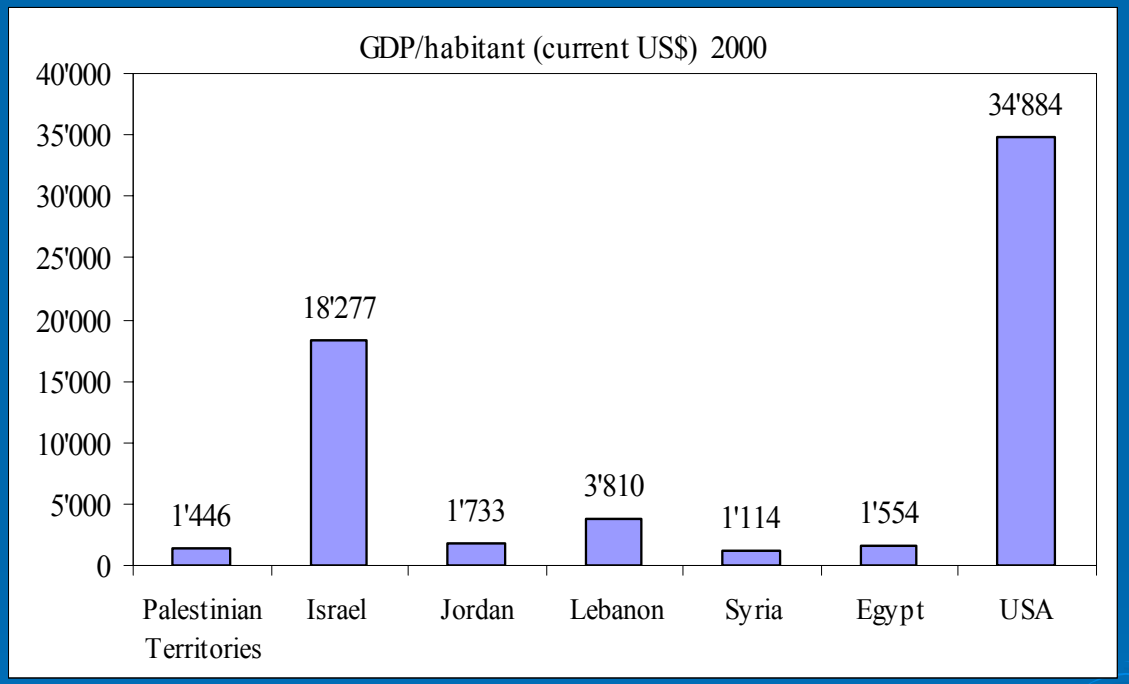




PCBS, National account statistics. www.pcbs.gov.ps.

Palestinian economy (GDP/habitant)

- GDP/habitant ≈ $1400 (1999)
- Against nearly 18 000/habitant in Israel (10 times superior).



Sources: PCBS, statistical abstract of Palestine no. "4", November, 2003 . www.pcbs.gov.ps. Central Bureau of Statistics of Israel. Statistical Abstract of Israel 2004. USA census depat. http://www.census.gov/, Dpt of commerce US, http://www.bea.gov/ , World Bank http://devdata.worldbank.org/. Middle east dierctor http://www.middleeastdirectory.com/.

General energy situation

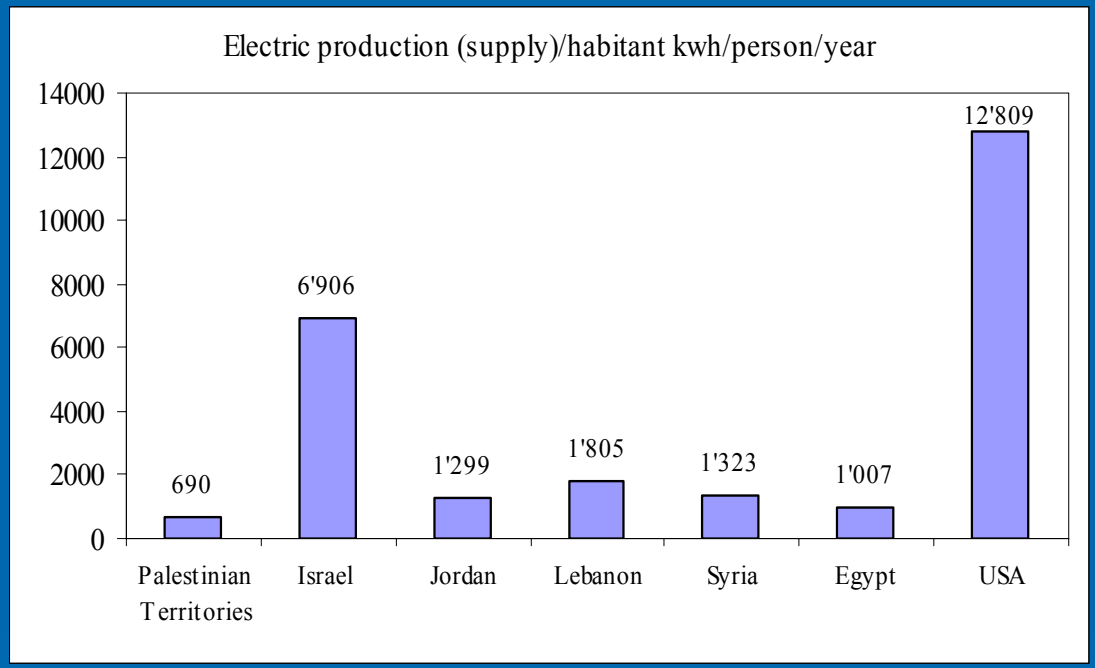
- Neglected infrastructure half a century.
- Electricity provided by IEC (monopole).
- Petroleum products monopolised by Paz Oil co. and Naphtha Israel Petroleum, (Therefore political weapon).

Energetic resources

- December 2000: British Gas (BG) successfully completed drilling a gas well offshore of Gaza.
- Possible reserves estimated at nearly 39.6 Billion m^3.
- BG has a 25-year contract to explore for gas and set up a gas network.
- Gaza power station and other industrial, transport and household consumption estimated at nearly 419 Million m^3/year.
- **Solar** insolation in Palestine has annual average of 5.4 kWh/m2. day.

Electricity production and supply

- 690 kWh/person, 2000 supplied by IEC except for Palestine Elect. Co at Gaza with 140 MW production capacity.
- Against 6906 kWh/person in Israel (10 times as superior).
- And 1299 kWh/person in Jordan (twice as superior)



source: Eearth Trends http://earthtrends.wri.org/ and National Master http://www.nationmaster.com/, energy statistics. Solar med net http://www.solarmed.net/profile_palestinian.htm, ministry of energy and mineral resources, general indicators, http://www.memr.gov.jo/estatics/general%20inidcators.2.htm, **Energy** Information Administration, http://www.eia.doe.gov/emeu/cabs/egypt.html, World Energy http://www.worldenergy.org/wec-geis/publications/reports/current_cls/ClsELEC.asp

Power Map

(Actual or planned projects)

Power station

Oil refineries

Planned project for electric cooperation.

Planned nuclear power station at horizon 2012.

Wind farm (actual or planned)

Solar farm (actual or planned)

Gas well.

Map source:
http://www.cia.gov/cia/publications/factbook/geos/is.html.

Electricity network

West Bank

161 KV O/HL

161 KV O/HL

161 KV O/HL

Main IEC Feeders supply to West Bank Map source: (Data source: Palestinian Energy Centre, 1995). (Map source: Geography about Library, CIA).http://geography.about.com/library/cia/blcwestbank.htm

Gaza Strip

3. Gaza El-Bahar

2. Jabalya, Beit Lahya, Gaza/Al-Naser

1. Beit Hanon, Jabalya

4. Gaza El-Shaaf

5. Gaza - Bagdad

6. Gaza – El-Quba

7. El-Breige, Al-Nusairat, Al-Magazi, Al-Zawaida, Deir El-Balah

To Israeli settlements

8. Al-Qara, Beni-Suhaila, Abesan Kabera, Abasan Sagira, Khuzaa, Khanyunis

9. Rafah

Palestinian Energy Research Centre - Jerusalem, Ministry of planning and International Cooperation Directorate General of Energy Planning, Electrical Energy Status in Gaza Strip, analytical study, Technical department – Electrical Branch, Gaza – January, 1995.
Map Source: http://www.mideastweb.org/mgaza.htm.

Organisation of Electric sector in the Palestinian Territories

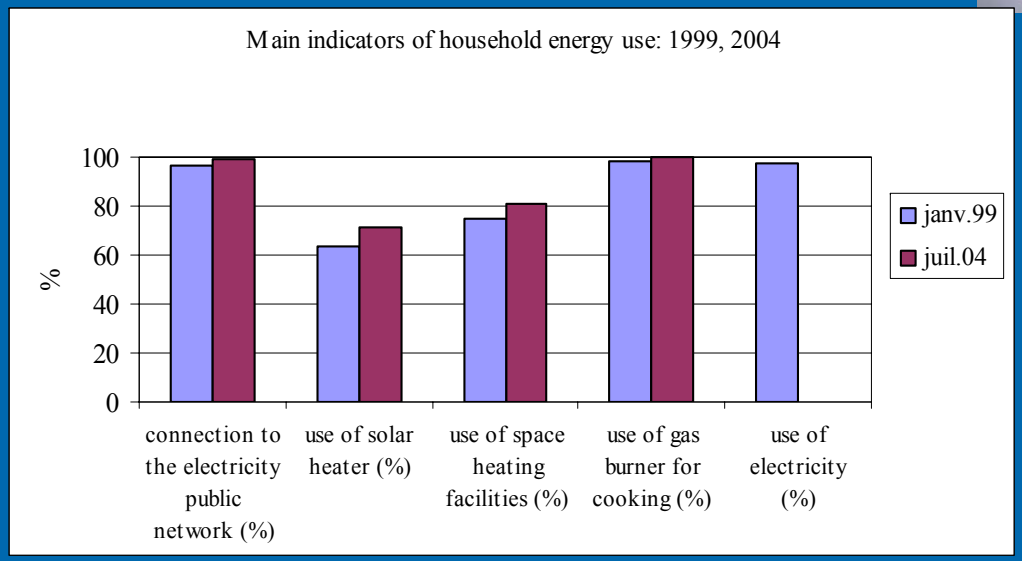
- Municipalities as distribution utilities.
- Collect the electric bill from the final consumers.
- Palestinian Energy Authority as regulator (in zones under their control).
- The Jerusalem District Electricity Company (JEDCO) in East Jerusalem and some Palestinian agglomerations around Jerusalem.
- After the Oslo agreement, three distribution companies contemplated:
- 1. Gaza Electric Utility (GEU) ,
- 2. South Electric Company (SELCO),
- 3. North Electricity Utility (NEU).
- The only significant production is in Gaza Strip after the establishment of the Gaza Power Plant with a capacity of 140 MW.

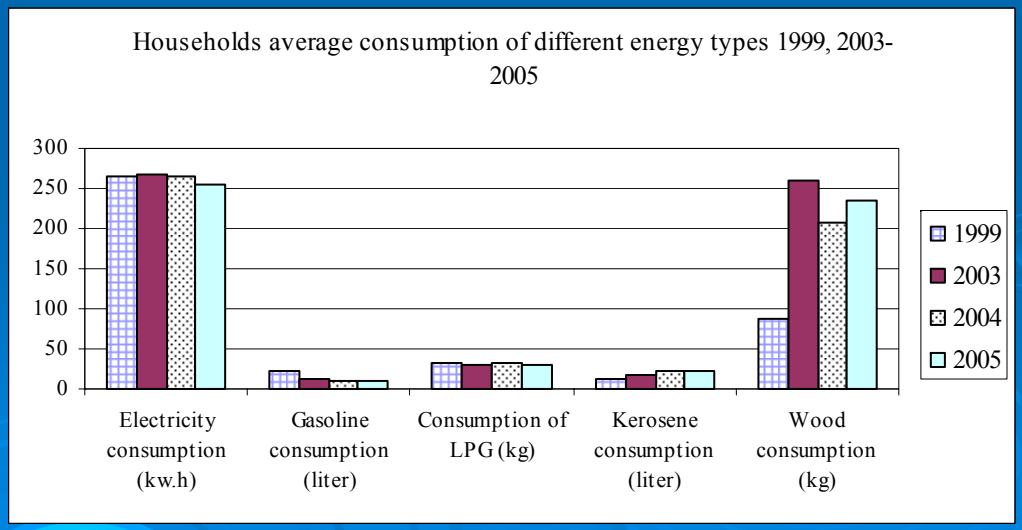
Israel energetic policy in the Palestinian Territories

- Service priority given to the Israeli customer first, resulting in a low voltage at the end of feeder lines.
- IEC supply a limited amount of electrical energy for the Palestinian Territories. In order for the municipalities to increase their electric demand, they have to pay a lot of extra money as fees to the IEC. Otherwise, people who need such a demand increase have to finance such need.
- The generation and transmission costs are very high, while it may be less expensive through a national production.

Socio-economic aspects

- **Water heating (LPG, Electricity)**
- **Lighting (Electricity)**
- **Heating (Gas, kerosene, wood, electricity)**
- **Air conditioning (Electricity)**
- **Cooking (LPG)**
- **Bread-baking (LPG, electricity, wood)**
- Remarkable increase in wood consumption during the *Intifada*.

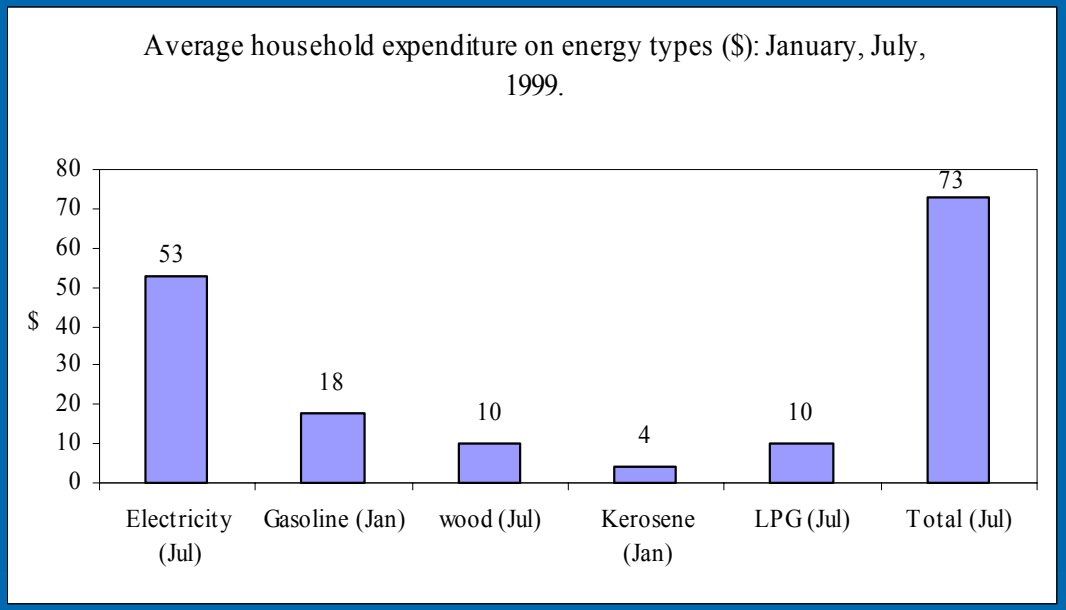




Source: PCBS, Area statistics, Natural resource statistics, energy statistics, household energy. www.pcbs.gov.ps.

Average household expenditure on energy types, January 1999, 2003-2005

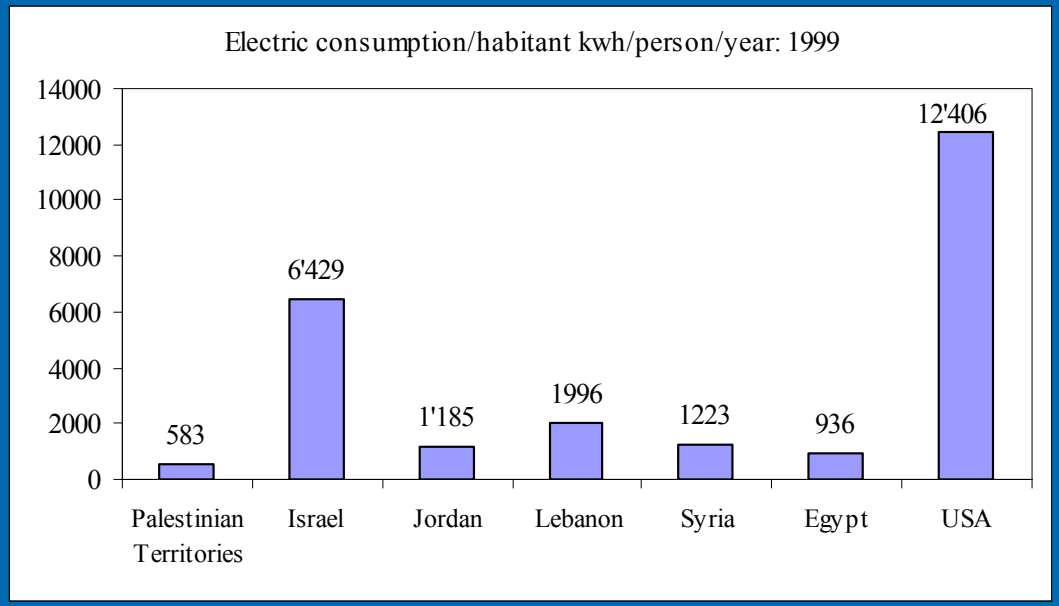
- Expenditure on different energy types: $73 (10% of consumption budget), of which, $53 for electricity.



Source: PCBS, Area statistics, Natural resource statistics, energy statistics, household energy. www.pcbs.gov.ps.

Electricity consumption

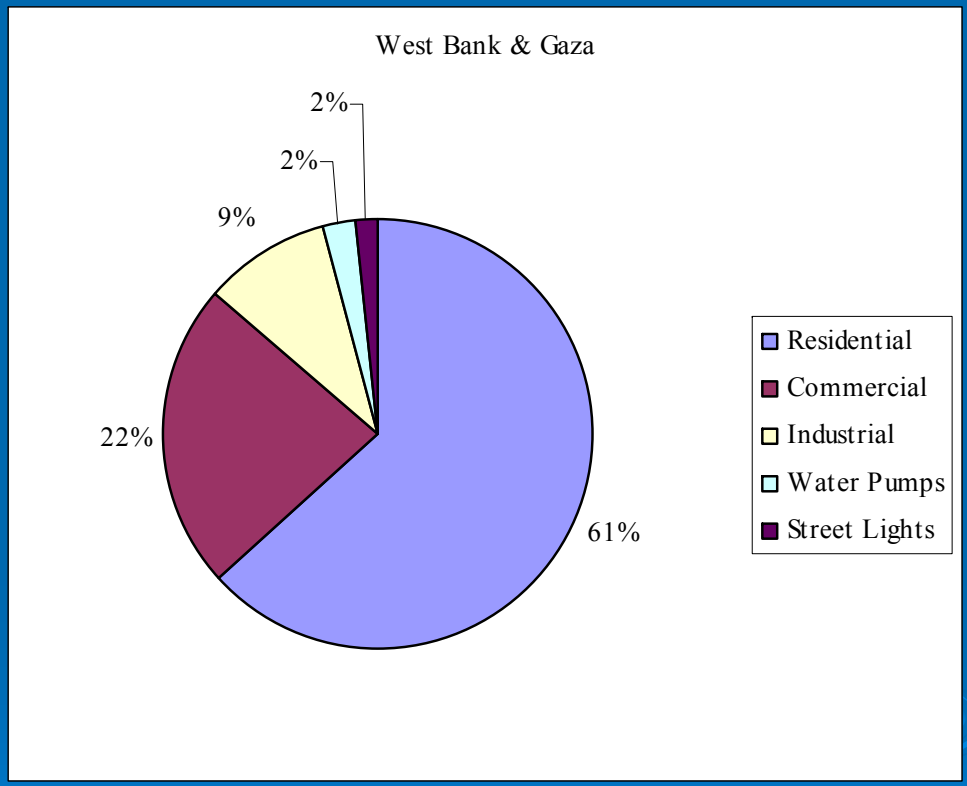
- **583 kWh/capita consumption (lowest in the region).**
- Vs 6,429 kWh/capita for Israel (11 times as superior).
- And 1,185 kWh/capita for Jordan (twice as superior).
- **Explanations for low consumption include:**
  1. Insufficient capacity of power sources.
  2. High prices of electricity.
  3. Inadequate quality of electrical energy (deteriorated grid).



Sources: PCBS, PCBS, statistical abstract of Palestine no. "4", November, 2003. Ramallah - Palestine. 1997 is the base year in US$ million. Data are for 2000. Eearth Trend http://earthtrends.wri.org/, Energy statistics.

Electricity consumption by all sectors

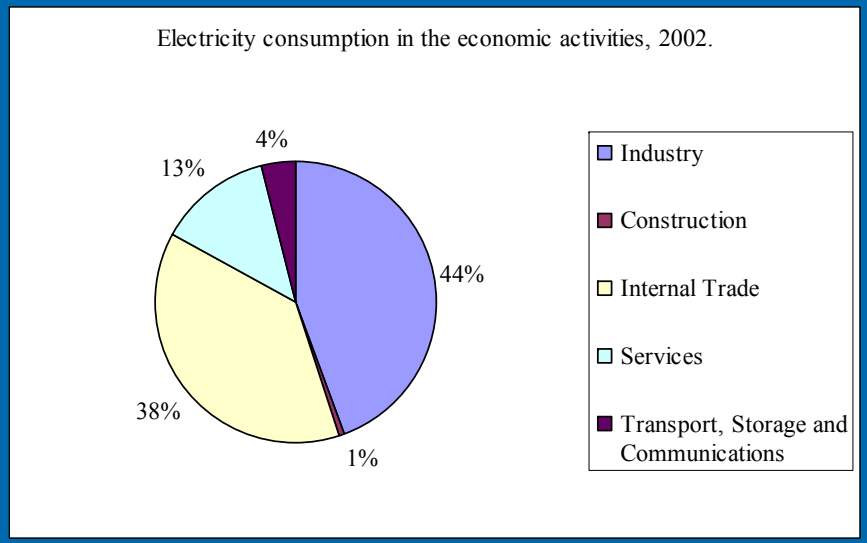
- **Main consumers of electricity:**
  residential (61%).
  Commercial (22%).
  industrial (9%).

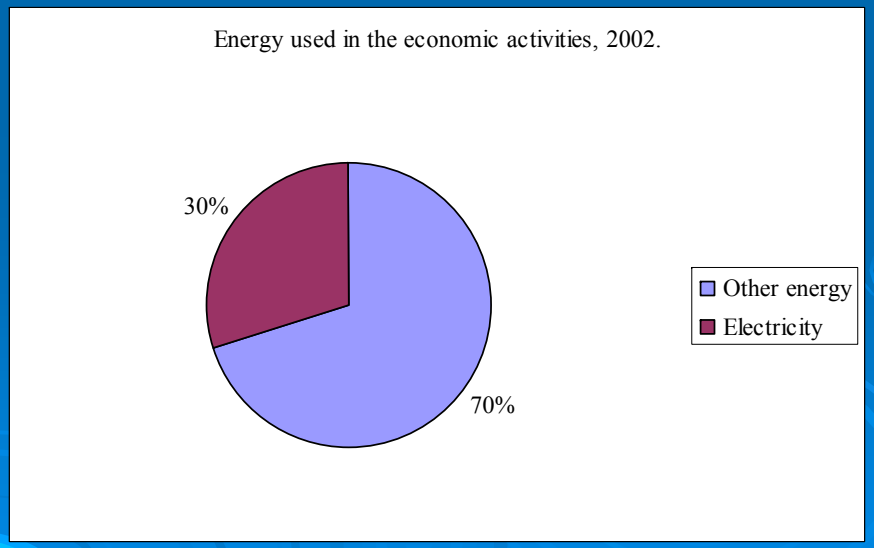


Source: Palestinian Ministry of Energy and Natural Resource.

Electricity consumption by economic activities

- Industrial sector and internal trade consume more than 80% of the total energy.
- 1/3 of energy used in economic activities comes from electricity.

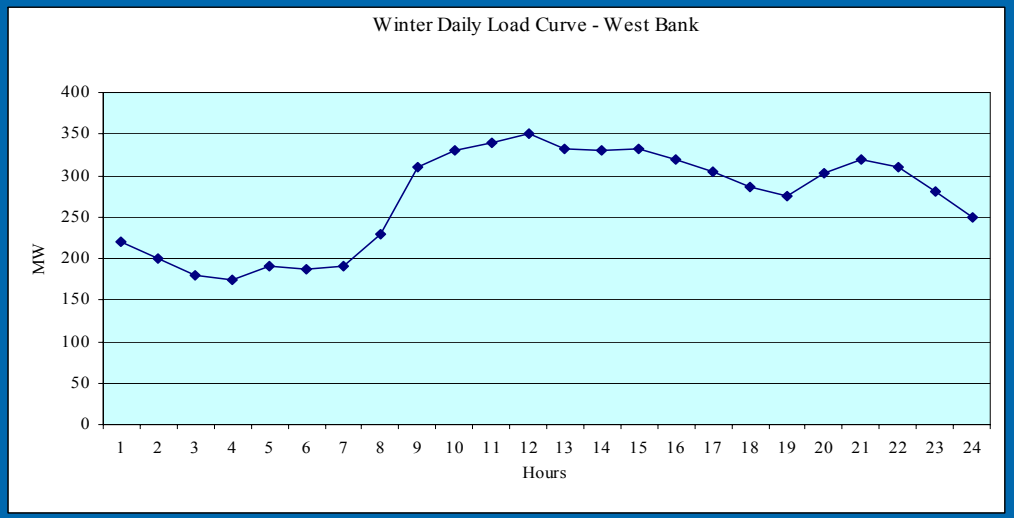


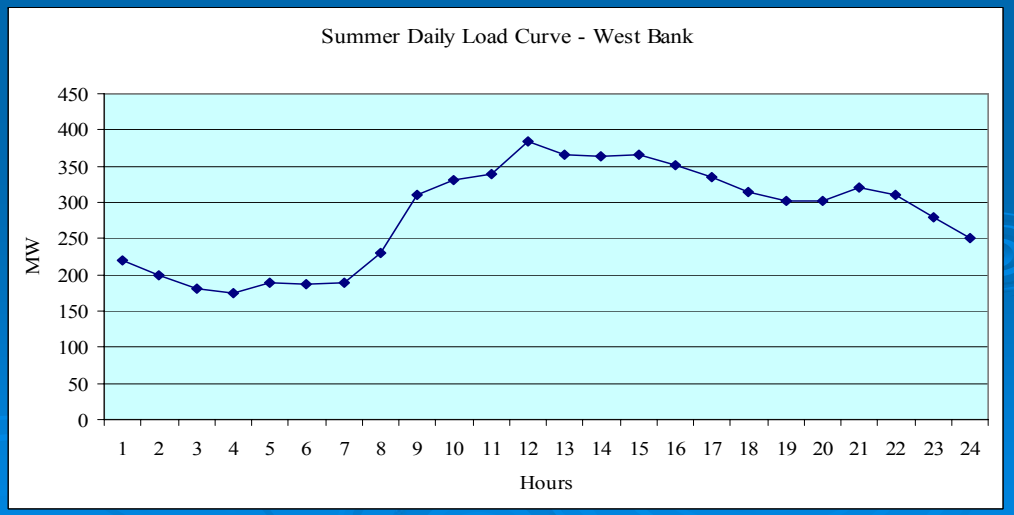


Source: PCBS, Area statistics, natural resource statistics, energy statistics. www.pcbs.gov.ps.

Electricity daily load curves

- The maximum demand in winter time between **12h to 19h.**
- The maximum demand in summer time between **12h to 19h (10% more than winter time)** due to air conditionning and cooling loads

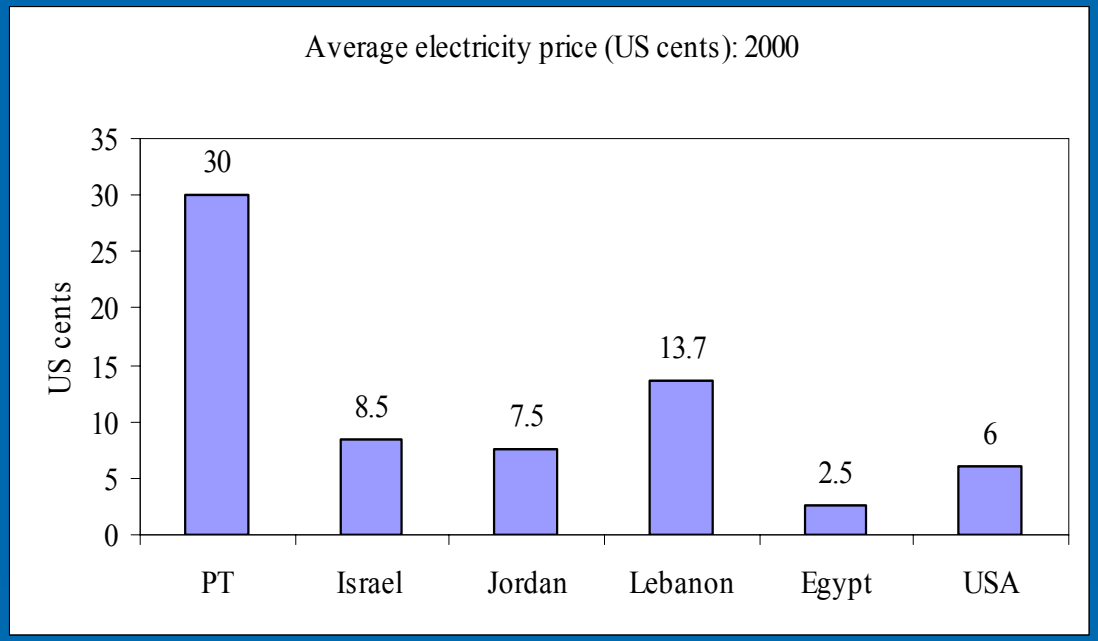




Source: Palestinian Energy Research Centre PEC) – Nablus, Palestine.

Electricity prices

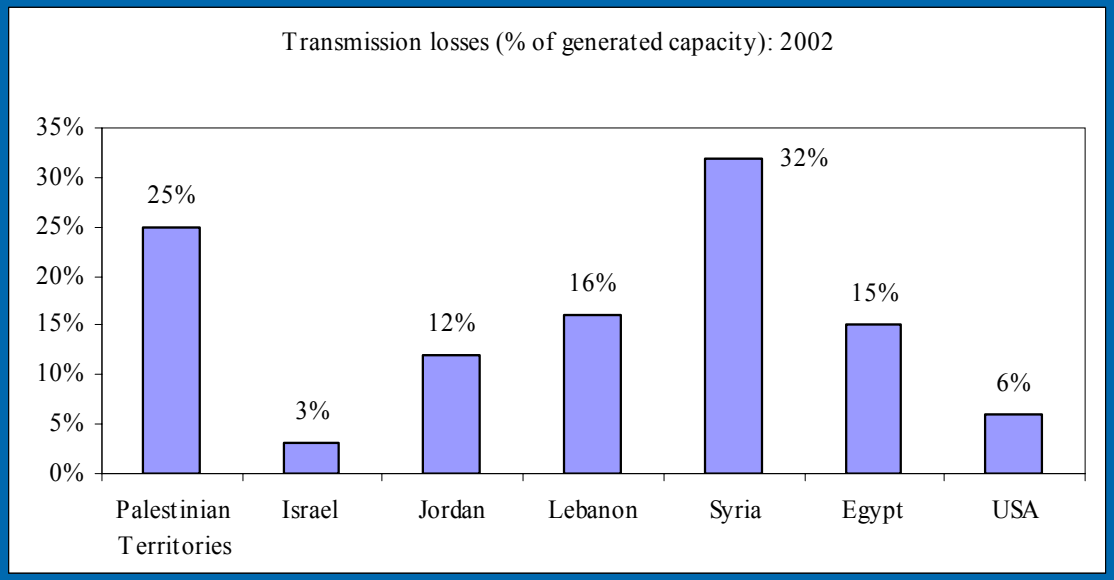
- Average price: $0.30/kwh
- 3 times higher than in Israel and Jordan.
- 5 times higher than in the USA.



World Energy, http://www.worldenergy.org/, Palnet, http://www.palnet.com/~eigr/menr/cost.htm, solar Buzz, http://www.solarbuzz.com/Solarpricesworld.htm, Energy Information Administration http://www.eia.doe.gov/emeu/cabs/,
Central Bank of Jordan, http://www.cbj.gov.jo/
Palestinian energy research centre (PEC), 1995. The present status of electricity services in the west bank.

Transmission losses

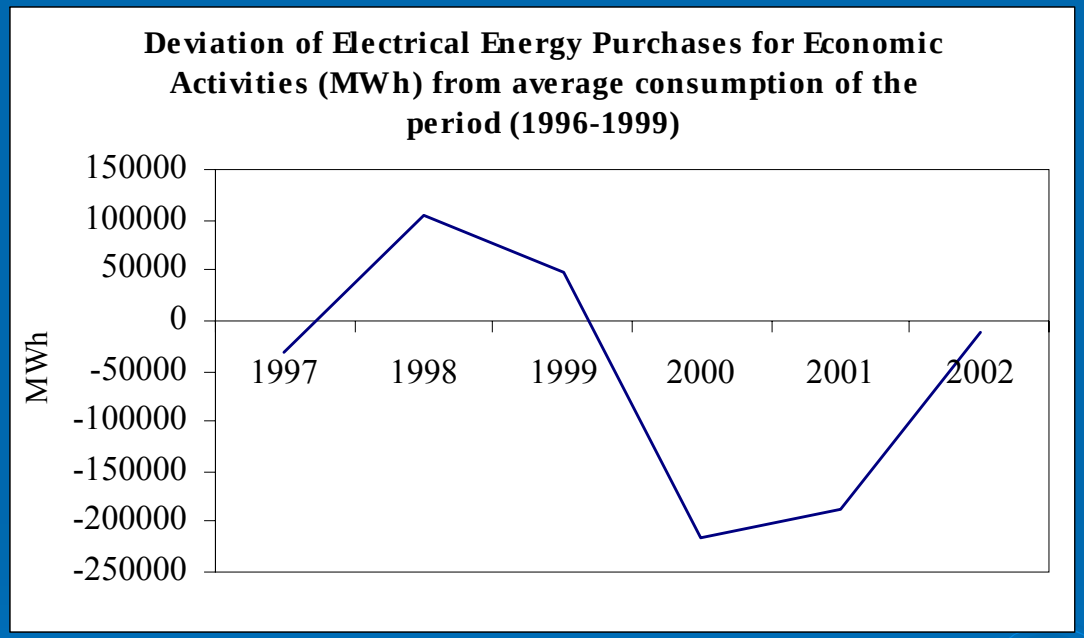
- **Losses:** 25% of electricity injected.
- key source of **technical loss**: low power factors.
- Sources of **non - technical losses**: illegal ways of accessing the network (theft).
- Unpaid bills.



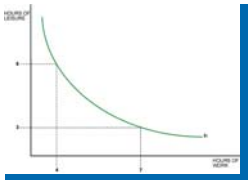
World Energy, http://www.worldenergy.org/, Palnet, http://www.palnet.com/~eigr/menr/cost.htm, solar Buzz, http://www.solarbuzz.com/Solarpricesworld.htm, Energy Information Administration http://www.eia.doe.gov/emeu/cabs/,
Central Bank of Jordan, http://www.cbj.gov.jo/
Palestinian energy research centre (PEC), 1995. The present status of electricity services in the west bank.

Conflict and electricity consumption

- **For economic activities**: the level of energy purchases is superior to the average in the period with "no conflict" after the peace agreement, and inferior during the second *Intifada*.
- However, we can observe a recovery trend.



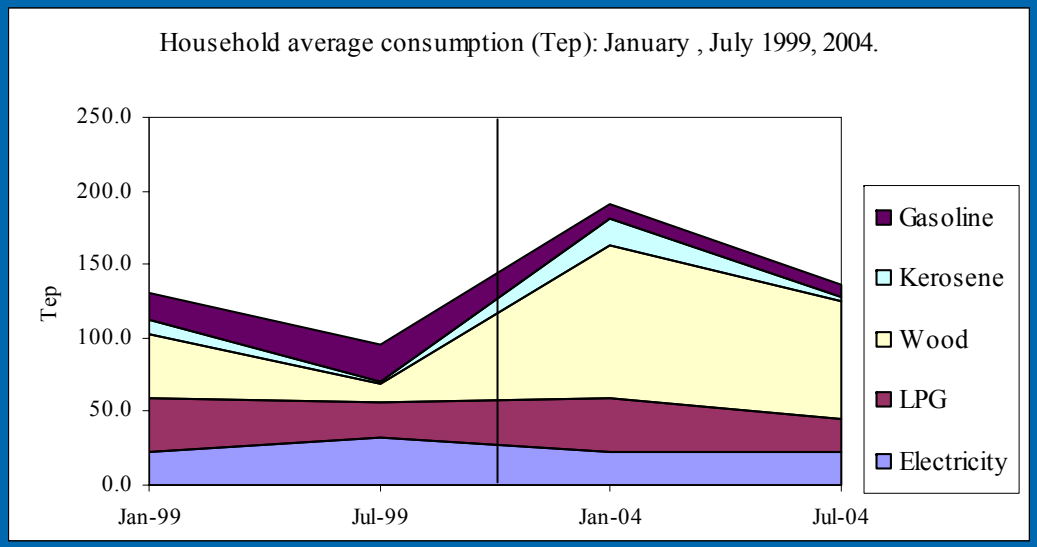
Source: Palestinian Energy and Natural Resources Authority. Energy consumption statistics. www.menr.org.

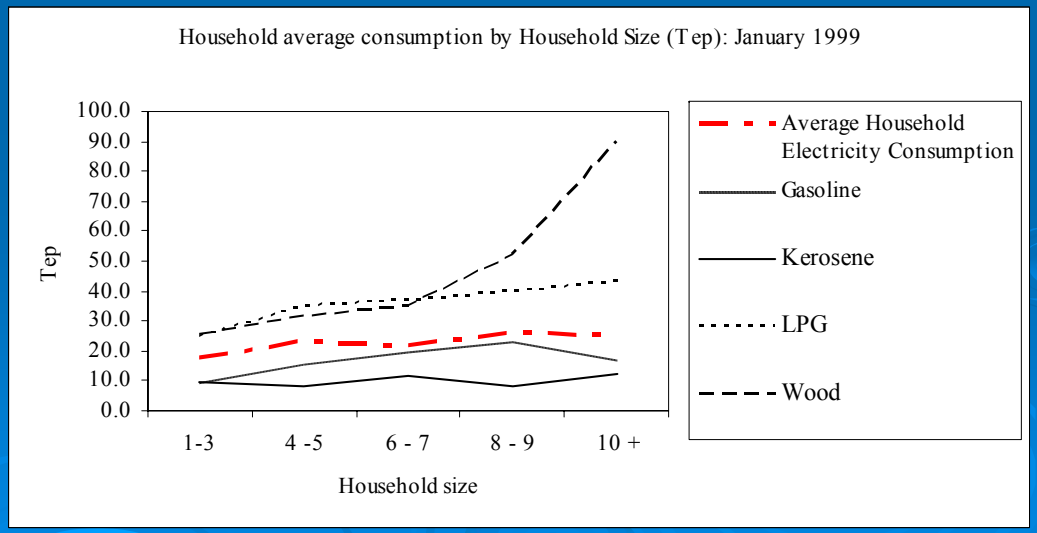


Substitution effect

- Substitution effect:

1. More consumption of wood during the current *Intifada*
2. Wood consumption increases with family size
3. LPG can be considered a substitute for electricity for certain uses.





Source: PCBS, Area statistics, natural resource statistics, energy statistics. www.pcbs.gov.ps

Electricity problems and priorities

Problems

- Very deficient network (high transmission losses).
- Electricity services limited in quantity and quality.
- Lack of investment in the electric sector.
- High prices.

Priorities

- Rehabilitation and development of electricity system.
- A detailed survey will be indispensable to estimate the real needs in the sector.
- Independent local production.
- Scenario building

Cooling and refrigeration

Household acquisition of durable Goods

Available durable goods	Year				
	1997	2000	2001	2002	2004
Private Car	20.4	21.6	22.8	20.2	26.4
Television	84.6	94.0	94.2	92.7	93.2
Video	13.3	17.8	18.8	11.4	20.1
Refrigerator	**80.4**	**92.3**	**92.8**	**90.9**	**92.9**
Cooking Stove	96.9	98.8	99.3	98.9	98.7
Washing machine	73.2	87.5	86.8	85.8	89.6
Solar Boiler	61.2	68.7	74.7	74.3	72.6

PCBS, 2006. Living conditions survey, www.pcbs.org .

- (Our analysis of the availability of durable goods shows) Stagnation or decrease in the acquisition of electrical devices between 2001 and 2002 (*Intifada* period).

Percentage of households using air conditioning facilities by conditioning facility and region, July, 2005

Region	Space Conditioning Facility		
	Electrical conditioner	Fixed fan	Mobile fan
West Bank - North	3.0	44.7	80.7
West Bank - Middle	**12.3**	**36.4**	**82.4**
West Bank - South	1.3	13.2	91.7
Total West Bank	5.5	33.6	84.2
Total Gaza Strip	0.2	71.9	76.3
Palestinian Territory	**3.5**	**47.9**	**81.2**

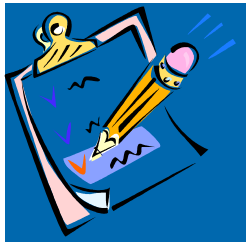
PCBS, 2006. Area statistics, natural resources, energy statistics, household energy. www.pcbs.org .

Refrigerators

- Forms the largest load in the residential sector as consumption represents **30 - 40%** of the electricity bill of a household.
- High percentage of the Palestinian households use inefficient **second hand refrigerators** (10-15 years old) due to their low initial cost.
- Audit results of the PEC (Palestine Energy Centre) show that the consumption of these old refrigerators is about **1.5 -3 times higher** than the same new types.

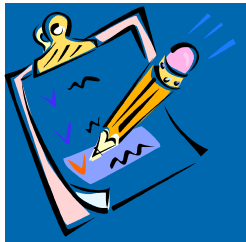
Energy conservation

- Palestinian Energy Research Centre (PEC) effectuated an audit of modern energy-efficient cooling technologies in residential and industrial sectors, as well as in public utilities.
- Total conservation potential in these sectors is around **15%** of the total energy consumption.
- The associated costs of the investment in this field are relatively low and correspond to a pay back period varying in the range from 6 to 36 months.



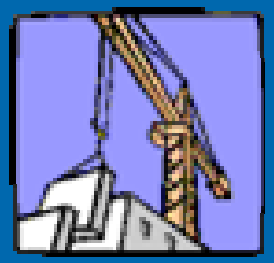
Conclusions

- **The level of electric services provided by the IEC is inadequate:**
- Constituting a handicap for the industrial sector.
- A high economic loss
- And an obstacle for the development of the country.
- **The end of collective punishment policies and a well functioning economy are key factors for healthy electricity services.**



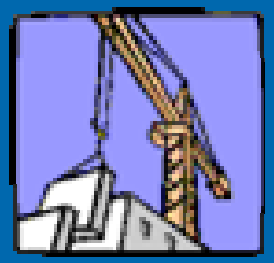
Conclusions

- Palestinian electricity consumption appears to be inelastic.
- The Palestinian electric sector shows a high vulnerability to political shocks.
- Modern energy-efficient cooling technologies are needed for the national energy policy.



Actions

- Application of international law and the basic human rights in Palestine.
- Rural electrification.
- Promotion of renewable energy (ex: R&D projects, investment in renewables).
- Energy conservation through the promotion of modern energy-efficient cooling technologies (ex: loans for young families).



Actions

- Creation and enforcement of an energy label for refrigerators to help the consumer select an energy saving model .
- Performance of electrical surveys, audits and power measurements.
- Creation of independent power plants in the West Bank. This will increase the efficiency, experience and knowledge of workers in the electricity field
- Scenario building.

Thank you, Merci, Danke

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