3.2.3 Past Power Demand of the Study Area

(1) Past Energy Consumption Record

The past energy consumption record of the whole country including those of the study area is presented in Table 3.2-3. The detailed sales record of the study area is presented in the Table 3.2-9.

The combined Damascus and Damascus Rural area is the largest energy consuming area in the country. The total energy consumption in the year 1997 including distribution losses is 2,519 GWh for Damascus and 2,734 GWh for Damascus Rural area. Among the consumption by distribution companies in Syria, this area consumed about 33.4% of total energy of the country in 1997.

The share of the study area in 66 kV sales is 1.1 % only for Damascus and 12.2 % for Damascus Rural in total 66 kV consumption.

(2) Past Record of Peak Load

The annual peak demand of the whole country is based on the NCC summation of generator output in the country, and that of the study area is based on the RCC summation of the supplying power at the 66 kV side of 230/66 kV substations. The 1997 peak loads of the whole country and the study area are compared in Table 3.2-10 below:

Table 3.2-10 Comparison of Recorded 1997 Peak Load

Area	Peak Load (MW)
Whole country	3,259
Damascus city	495
Damascus Rural area	468
Combined Damascus and Damascus Rural	912

(3) Annual Energy Sales to Consumers

Energy sales records of the study area for the period of 1990 to 1997 are also shown in the Table 3.2-9, in which the breakdown of energy sales for different voltage classes and various categories, distribution losses and load shedding is available.

In this table, the energy consumption by commercial sector is available only for 1993 to 1997, as the commercial consumption in 1990 to 1992 was included in the domestic sector.

An average growth rate of energy sales in the Damascus in a period of 1990 to 1997 was 5.4 %, while that in the latest four years of 1993 to 1997 was 13.8 %. As for Damascus Rural area, an average growth rate in a period of 1990 to 1997 was 10.4 % and that in a period of 1993 to 1997 was 24.4 %.

(4) Number of Consumers and Electrification

Numbers of consumers of all categories in the study area are shown in Table 3.2-11.

The household electrification has already reached almost 100% and no new electrification activities are required any more.

(5) Seasonal and Daily Load Pattern

Hourly energy consumption of the combined Damascus and Damascus Rural area for the year 1997 was recorded by the Regional Control Center, but data for each of Damascus and Damascus Rural are not available. The Team analyzed those data and found that the peak load of 898 MW was recorded on February 23, 1997 (Sunday) for the combined Damascus and Damascus Rural area. While the system peak load of whole Syria appeared on December 29, 1997. Normally the peak load in Syria is recorded at night in December due to large energy consumption by electric heaters. Even in the system of the Study area, on several days in December 1997 the daily peak loads exceeded 850 MW that is almost same as the annual peak load of the country.

Daily load curves of the combined Damascus and Damascus Rural area were prepared for a typical day in every four seasons as shown on Figs. 3.2-3 to 3.2-6, to understand load patterns in the study area.

Daily load curves of the feeders for typical economical, industrial and residential loads at 20 kV level including load factors are also shown on Figs.3.2-7 to 3.2-9.

Actual load duration curve of the Study area of the year 1997 is also prepared as shown on Fig. 3.2-10, based on the actual measurement of transformer loads in all substations but not including 66 kV consumers. The annual load factor for the year 1997 in the study area is estimated at 0.64 from this load duration curve.

(6) Energy Losses

The ratio of losses to the net energy delivered to PEDEEE is accounted at 28.3% for Damascus and 32.7% for Damascus rural areas, which are higher than the average loss factor of the whole Syria of 27.3% in 1997.

The breakdown of losses is estimated by PEDEEE as follows:

Table 3.2-12 Breakdown of Losses (Losses in %)

	1995	1996	1997
Damascus			
Total Losses	34.9	29.0	28.3
Technical Losses:	16.2	16.0	16.0
Non-technical Losses			
- Commercial losses	2.0	2.0	2.0
- Illegal consumption	16.7	11.0	10.3
Damascus Rural			
Total Losses	38.4	36.8	32.7
Technical Losses	17.0	16.5	16.5
Non-technical Losses:			
- Commercial losses	2.0	2.0	2.0
- Illegal consumption	19.4	18.3	14.2

(Source: Department of Planning and Statistics, PEDEEE)

It is considered that non-technical losses are around a half of the total losses. PEDEEE estimates that commercial losses are accounted for 2% which basically appropriate to inaccurate metering and meter reading and billing errors, while the remainder is by illegal consumption.

3.3 Power Tariff System

In Syria, consumers have to pay for all costs for installation of service wires to consumers and demand meters to be installed by distribution companies. Meter reading, billing and power charge collection from all 20 kV, 20/0.4 kV and 0.4 kV consumers are undertaken by the distribution companies every two months. PEDEEE is in charge of 66 kV consumers, and meter reading, billing and charge collection are performed every month.

The uniform power tariffs, same at any places, are applied all over the country. The present tariff system in Table 3.3-1 was enforced in 1991 and has not been amended till the present.

Tariffs in the parentheses in the table are those converted into US cents at the market exchange rate in 1998 (US$ 1.00 = SP 46).

There is no consumer classification for the voltage classes of 230 kV, 66 kV and 20kV. The 20/0.4 kV class has three consumer categories of agricultural, commercial and industrial. The 0.4 kV class has six consumer categories of industrial, commercial, government, street lighting, domestic and religious buildings, and domestic consumers are subdivided into five according to the consumption levels. The tariff is highest for the commercial category and marginally followed by the industrial category. The tariff of domestic consumers of small consumption group is extremely low and the tariff is free to religious buildings.

Table 3.3-1 Tariffs by Consumer Type

Voltage	Consumer	Phase	Fixed Charge (SP per 2 months)	Bi-monthly Consumption (kWh)	Rate (SP/ kWh)
230 kV		3	75	-	0.75 (1.63)
66 kV		3	75	-	0.80 (1.74)
20 kV level		3	75	-	0.90 (1.96)
20/0.4 kV	Agricultural use	3	75	-	0.80 (1.74)
	Industrial use	3	75	-	1.20 (2.61)
	Commercial use	3	75	-	1.25 (2.72)
0.4 kV	Industrial use	3	150	-	1.40 (3.04)
		1	50	-	1.40 (3.04)
	Commercial use	3	150	-	1.50 (3.26)
		1	50	-	1.50 (3.26)
	Government	3	150	-	0.75 (1.63)
		1	50	-	0.75 (1.63)
	Street lighting	3	100	-	0.75 (1.63)
		1	50	-	0.75 (1.63)
	Domestic	3	100	1 – 100	0.25 (0.54)
		3	100	101 – 200	0.35 (0.76)
		3	100	201 – 400	0.50 (1.09)
		3	100	401 – 600	0.75 (1.63)
		3	100	Above 601	1.50 (3.26)
		1	50	1 – 100	0.25 (0.54)
		1	50	101 – 200	0.35 (0.76)
		1	50	201 – 400	0.50 (1.09)
		1	50	401 – 600	0.75 (1.63)
		1	50	Above 601	1.50 (3.26)
	Religious bldg.	-	-	-	Free

The overall average tariffs, the total sales income divided by total sales energy, were SP 0.8186/kWh for the whole country, SP 0.9744/kWh for Damascus City and SP 0.8787/kWh for Damascus Rural in 1997.

The tariffs seem too low compared with those of other developing countries, and is lower than the actual cost of energy. The power supply activities are obliged to be operated with deficit. The actual tariffs are not based on cost and seem to be determined only by social factors.

Based on the present tariff system, the consumers are to pay for consumed energy at the contracted rate and fixed charge for the contracted category, after adding tax of 12.32% to the charge for total consumed energy. The full amount of tax collected by PEDEEE or a distribution company is to be transferred to the Ministry of Finance.

For example, assuming that a single-phase 0.4 kV domestic user consumed energy of 300 kWh in two months, the consumer should pay Syrian Pound 173.52 as below:

(Fixed Charge) + (Energy Payment) + (Tax)
= 50 + (100 x 0.25 + 100 x 0.35 + 100 x 0.50) + (100 x 0.25 + 100 x 0.35 + 100 x 0.50) x 0.1232
= 173.52

The exporting power rate to Lebanon is US$ 0.04 to 0.05 /kWh since 1995.

The tariffs for consumers above 400 V include three energy rates relating to consumption in times of day, high rate for Peak time consumption, low rate for Night and intermediate rate for Day. However, the Day rate is applied uniformly due to lack of metering arrangement for three classes. There are no kVA or reactive power related charges in the present tariff structure. Also there seems no regulation for capacitor installation, or preferential tariff system to high power factor consumers.

Promoting actions for the Demand Side Management (DSM) have not yet been taken in Syria. It is told that difficulty in modifying the present tariff system is one reason to prevent introduction of DSM. There is a plan to commence a study of DSM with financial assistance from the World Bank.

3.4 Power Generating Facilities

As seen in Tables 3.4-1 and 3.4-2, the installed capacity and available output of generating plants in the country increased remarkably after 1994.

The significant increase in generating capacity after 1994 was caused by the commissioning of the following new thermal generation plants.

1994 : Tishrin steam plant and Tishrin gas turbine plant, (656 MW)
1995 : Jandar combined cycle plant and Nasrieh gas turbine plant, (984 MW)
1996 : Zayzoun gas turbine plant, (384 MW) and
1997 : Aleppo steam plant, (1,000 MW)

The substantial increase in generating capacity after 1994, that was sufficient to meet the demand, and allowed the retirement of three (3) old steam sets with available output of 60 MW at the Qattineh power plant. Although periodical maintenance of power plants was not possible up to 1993 due to the shortage in supply capacity, proper maintenance of the existing power plants has become possible by the commissioning of new generation plants.

Table 3.4-1 Power Plants in Syria as of 1998

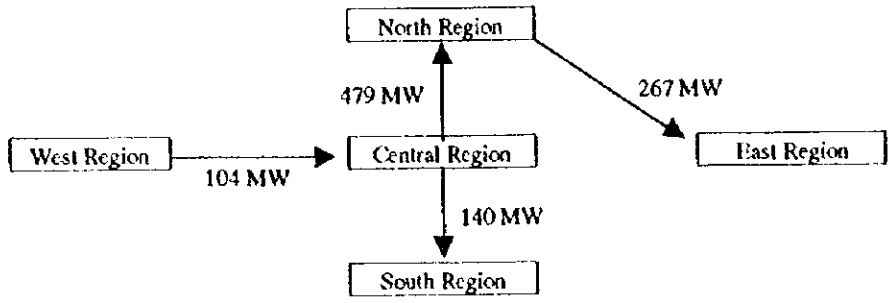
Type	Plant	Unit No.	Total Capacity (MW)		Fuel Type	Commissioning Year	Year for Retirement
			Installed	Available			
Hydro	Thawra	1-3	300	210	-	1974	2024
	Thawra	4-5	200	140	-	1976	2026
	Thawra	6-7	200	140	-	1977	2027
	Thawra	8	100	70	-	1978	2028
	Baath	1	25	16	-	1987	2037
	Baath	2-3	50	32	-	1988	2038
	Total	**11**	**875**	**608**			
Steam	Qattineh	3-5	90	60	HFO	1966	1994
	Qattineh	6	64	50	HFO	1981	2006
	Banias	1	170	125	HFO	1982	2008
	Banias	2	170	125	HFO	1983	2009
	Banias	3-4	340	340	HFO	1987	2014
	Mahardeh	1-2	300	240	HFO/NG	1986	2011
	Mahardeh	3-4	330	330	HFO/NG	1988	2013
	Homs Refinery	1-2	64	50	HFO/NG	1988	2013
	Homs Refinery	1-4	48	36	NG	1988	2013
	Tishrin Thermal	1	200	180	HFO/NG	1993	2018
	Tishrin Thermal	2	200	180	HFO/NG	1994	2019
	Jandar Combined	1-6	600	600	NG/DO	1995	2020
	Aleppo	1-5	1,000	1,000	HFO/NG	1997	2022
	Total	**30**	**3,576**	**3,316**			
Gas Turb.	Swedieh	1-3	105	90	NG	1988	2008
	Swedih	4-5	70	60	NG	1989	2009
	Tayem	1-3	105	90	NG	1990	2011
	Mahardeh	5	30	20	DO	1988	2003
	Banias	5	30	20	DO	1989	2004
	Tishrin Thermal	3-4	256	200	HFO/NG	1994	2019
	Nasrieh	1-3	384	300	HFO/NG	1995	2020
	Zayzoun	1-3	384	300	HFO/NG	1996	2021
	Total	**18**	**1,364**	**1,080**			
Grand Total		**59**	**5,815**	**5,004**			

(Source: Ministry of Electricity and PEDEEE)

Table 3.4-2 Installed Capacities and Available Output

Year	Installed Capacity (MW)	Available Output (MW)
1990	2,791	2,604
1991	2,791	2,604
1992	2,791	2,604
1993	2,991	2,784
1994	3,447	2,804
1995	4,431	3,704
1996	4,815	4,004
1997	5,815	5,004
Average Annual Growth Rate		
(1990-1997)	11.06 %	9.78 %
(1993-1997)	18.08 %	15.79 %

The central region is furnished with surplus generating capacity to export power to the other regions after meeting its own power demand. The interregional balance of power flow under the peak load in 1996 was analyzed by EDF in its Generation and Transmission Master Plan as shown below:



3.5 High Voltage (400/ 230 kV) Transmission System

The following information was provided by PEDEEE based on the Electricity Sector Support Program (ESSP) undertaken by EU.

3.5.1 System Configuration

Configuration of the present 400/ 230 kV transmission network is shown on the single line diagram of Fig. 3.5-1. The only one 400 kV line connects the Aleppo (F) and Jandar power plants with the Hama 2 and Adra 2 substations. 230 kV transmission lines interconnect five (5) regions forming a 230 kV network. In addition, the 230 kV network is extended from the Tartous substation to Lebanon and from the Sheikh Miskin substation to Jordan for international power interchange.

3.5.2 Existing Facilities and Their Performances

(1) Substations

As of the end of 1998, four 400/230 kV substations are in operation in the country with total transformer capacity of 1,500 MVA. As of the end of 1997, 37 numbers of 230/66 kV substations are in operation in the whole country, and their installed capacities are regionally summarized in Table 3.5-1. The transformer capacity of each substation is tabulated in Table 3.5-2.

Table 3.5-1 230/66 kV Substations at the end of 1997

Region	Installed Capacity (MVA)
South	1,680
Central	770
Coastal	650
North	1,520
East	750
Whole Country	5,370

Table 3.5-2 Existing 230/66 kV Substations in the Country (end-1997)

	Substation	Units Installed (MVA)	Installation (MVA)	Year Installed
(1)	**South Region**	**Total**	**1,680**	
	Dummar	2 x 80	160	1994
	Qaboon 1	3 x 40	120	1980
	Qaboon 2	3 x 70	210	1967/78
	Adra 2	2 x 70 + 1 x 80	220	1978/83
	Midan 2	3 x 70 + 1 x 80	290	1976/87
	Kisweh	2 x 125	250	1996
	Shekh Miskin	2 x 70	140	1979
	Fursan	2 x 125	250	1998
	Sweida	1 x 40	40	1998
(2)	**Central Region**	**Total**	**770**	
	Hama 1	2 x 70	140	1976
	Hama 2	1 x 80	80	1986
	Fairouzeh	1 x 70 + 1 x 80	150	1978/83
	Qattineh	2 x 70	140	1978
	Jandar P/S	2 x 80	160	1994
	Zayzoun	1 x 50	50	1996
	Mahardeh	1 x 50	50	1995
(3)	**Coastal Region**	**Total**	**650**	
	Latakia	3 x 70	210	1984
	Tartous	2 x 70	140	1978
	Baias	2 x 70	140	1976/87
	Skoubeen	2 x 80	160	1997
(4)	**North Region**	**Total**	**1,520**	
	Aleppo H	2 x 125	250	1988
	Aleppo B	2 x 125	250	1978
	Aleppo F	2 x 70	140	1977
	Aleppo G	2 x 80	160	
	Aleppo D	3 x 70	210	1976
	Idleb	1 x 70 + 1 x 80	150	1984
	Zayzoun	1 x 50	50	
	Maskaneh (0)	2 x 50	100	
	Maskaneh (1)	2 x 25	50	
	Maskaneh (e)	2 x 40	80	
	Maskaneh (w)	2 x 40	80	
(5)	**East Region**	**Total**	**750**	
	Raqqa	2 x 50	100	1976
	Hassakeh	3 x 50	150	1977
	Der Al Zor	2 x 80	160	1983
	Swedieh	2 x 50	100	1978
	Kamishli	2 x 80	160	1995
	Tayem	1 x 80	80	
	Whole Country		**5,370**	

(Source: PEEGT and amended by PEDEEE on Dec. 16, 1998)

Total installed capacity of the existing transformers can satisfy the present peak demand estimated at about 3,000 MW assuming the power factor of 0.8.

(2) Transformers

Total number of 230/66 kV transformers as of the end-1998 was 74 units. Unit capacities of the presently installed transformers are 40, 50, 70, 80 and 125 MVA. The standard number of units in one substation is two sets (24 substations out of 37), and except six substations with one unit installation, other seven substations are provided three or four units of transformer.

Unscheduled outages of transformers occurred 95 times in 1995, of which 22 were overload outages and 73 by other causes. 68 percent of overload outages occurred repeatedly at six particular substations only. Capacity addition is urgently required for these substations. Many of the other unscheduled 73 outages were actually resulted from system or protection mal-operations rather than transformer failures.

(3) Switchgear in Substations

The ESSP study classified that the number of scheduled outages of switchgear was 55 in total (less than two outages per substation per annum) in 1995 and unscheduled outages to be 22 (0.7 outage per substation per annum). Then, the study concluded that the number of outages was relatively small due to a reasonable reliability of used switchgear.

(4) Transmission Lines

Total length of 400 kV single-circuit overhead line between the Aleppo (F) and Adra substations is 322 km with two intermediate connections with the Hama 2 substation and Jandar power station. Most of the existing 230 kV lines are of single-circuit construction (some double circuit lines are constructed recently) with single conductors of approximately 4,000 km in total length and interconnect all the five power regions.

The average number of faults per 100 km line in one year of 1995 was 5.7 times, comprising 2.6 transient and 3.1 permanent faults. The transient faults caused by lightning strokes and insulation failures resulted in success of high-speed re-closure. The above fault rate is very high compared with the rate of normal lines in other countries, and many of transmission line faults are told to be caused by insulator contamination by salty dust and morning moisture. The insulation design is required to be reviewed and insulation is to be reinforced.

(5) National Load Dispatching

PEEGT supervises and controls the entire generation and transmission systems in the whole country from two (2) national system control centers; the National Control Center (NCC) in Damascus and the Emergency National Control Center (ENCC) in Aleppo.

Load dispatching facilities exist at the both of NCC and ENCC providing data for display on mimic diagram

board. The existing load dispatching facilities are largely unserviceable and the mimic board of NCC provides status indication of only five 230/66 kV substations. While, that of ENCC has not been used.

The control system and monitoring for status indication are processed manually, initiated by telephone communication using the existing PLC routes between NCC and substations. The present system relies upon operator's knowledge and experience, and there are no means of recording status of the system at any given moment.

Scheduling of circuit outages for programmed and emergency maintenance functions is authorized and initiated via NCC. Daily log sheets of both scheduled and unscheduled outages due to system faults are stored. However, these data are not transferred to a database for the purpose of producing record for fault statistics and analysis.

Regional Control Centers (RCC) for the 66/20 kV systems are operated under the control of NCC.

3.5.3 Protection Employed in the System

(1) Overhead Lines

The following relaying protection schemes are applied to typical 230 kV overhead lines. However, other types of relaying schemes are also employed in some sections.

- Main protection by multi-zone distance relays in the permissive under-reach scheme,
- Backup protection by overcurrent relays for short circuit and earth fault, and
- High-speed single-pole and three-pole autoreclose.

Standardization of the PEEGT's protection system to apply to all lines in the country is now in the process of formulation.

(2) 230/66 kV Transformers

According to PEEGT's specifications for transformers, the 230/66 kV transformers are to be provided with transformer differential protection, over-current protection, tank earth fault protection and Buchholtz protection.

(3) Bus Couplers and Busbars

Protection by over-current and earth fault definite time relays is applied to bus couplers. However, no protection is provided to 230 kV busbars.

(4) ESSP's Recommendations for Protection of the 230 kV System

The following are recommendations of ESSP to the protection system.

- Since the 230 kV line in Syria performs very important roles, the duplicate line protection scheme provided with two series of distance relays with different schemes is to be applied
- Duplicate busbar protection comprising main and check zones is to be used.
- Distance relays and associated directional earth fault scheme is to be implemented for lines as unit protection by the addition of protection signaling.
- Only minor modifications are required for transformer protection.
- Time delayed over-current and earth fault relays are to be provided for all bus coupler circuit breakers.
- Circuit breaker-fail protection is to be provided to all 230 kV circuit breakers

3.6 Distribution System

3.6.1 General

In Syria, the 66 kV network is managed by PEDEEE within the distribution category though its function is the transmission. Standard voltage of the MV distribution network in the country is 20 kV. However, 6.3 kV is also adopted partly for irrigation water pumps in rural areas. The standard LV distribution system is of 400/230 V 3-phase, 4-wire, and is called the 0.4 kV system.

Outline of the system is explained referring to the ESSP report and information from PEDEEE.

3.6.2 Existing 66 kV Network

(1) Summary of 66 kV Substations and Lines

Summary of the existing 66 kV substations and lines in the country by region as of 1997 are presented in Table 3.6-1.

Table 3.6-1 Existing 66 kV Substations and Lines in 1997 (incl. private S/S)

Region	66/20 kV & 66/6.3 kV Substations			66 kV Lines	
	Number of Substations	Total Number of Transformers (units)	Total Capacity (MVA)	Length of O/H Lines (cct-km)	Length of U/G Cables (cct-km)
South	41	87	1,810	737	79
Central	30	55	895	1,252	0
Coastal	18	38	750	382	7
North	33	64	1,293	656	0
East	29	34	552	1,520	0
Total	151	278	5,300	4,547	86

(Source: ESSP Report TD 004, Appendix D7 & D5 updated by PEDEEE on Dec. 15, 1998)

(2) Performances of Substations

All the existing 66/20 kV substations are manually operated according to instructions of RCC over telephone. Substation operators record switching operations and hourly reading of meters in log sheets, and those records are reported hourly and daily over telephone to the RCC concerned.

From the ESSP's analyses on records of each substation in 1995, the following were identified:

(a) About 10% of substations were facing with overloading of their transformers,

(b) At 12% of substations, their transformers reached their rated capacities in more than 85% of time in the year,

(c) Utilization factor of all the substations in the system was 65% against an ideal factor of within 50%, and

(d) More than 88% of substations could not satisfy the required level of supply reliability.

Further analyses to 20 selected substations identified causes of outages of transformers, switchgear and other equipment in substations.

(a) Shares of scheduled, unscheduled and emergency outages[3] were 8%, 68% and 24%, respectively.

(b) Respective average times to restore the outages were 2.36, 1.65 and 1.93 hours.

(c) Total 287 unscheduled outage comprised 66 from transformers, 79 from the 20 kV side, 5 from bay, 81 from overhead lines, and 56 from others.

(d) Transformer outages were assumed to be caused by operation of transformer protections like thermal overload.

(e) 20 kV side outages were caused by operation of 20 kV feeder protection, while bay outages were assumed to be operation of 66 kV switchgear protection.

(f) Overhead line outages were classified as non-scheduled outages of overhead lines connected to the substations.

(g) Other outages were non-classified outages resulting from system-related outages or equipment failures.

(3) Performances of 66 kV Lines

Similarly to substations, ESSP analyzed outages in 1995 for sampled 20 lines of 66 kV circuits (881.3 km).

(a) Number of outages in the sampled lines was 286: 6 of scheduled outages, 183 of unscheduled outages and 79 of emergency maintenance.

[3] "Emergency Outage" is an additional category that describes an unscheduled outage initiated by the operators as a precautionary measure when a potential fault situation has been observed.

(b) Unscheduled outages were classified into 26 due to substation faults, 117 from un-identified causes and 40 from other causes.

(c) Average time to restoration was 3.03 hours for scheduled outage, 11.77 hours for substation fault, 1.01 hours for un-identified outage, 3.18 hours for other causes, and 3.97 hours for emergency maintenance.

(d) Faults in substations resulted in tripping of overhead lines.

(e) Other outages included flashover faults caused by insulation break down due to insulator pollution, etc.

The line fault rate of the sampled lines except faults caused by substations was 17.7 per 100 km per year (outage due to un-identified and other causes: 157 divided by 881.3 km). This rate is deemed extraordinary high compared with those in normal utility. It is reported that about 70% of faults occurred early morning from the reasons that moisture combined with dust pollution on the insulators creates conditions for flashover to occur. Very little rainfall in the country might increase contamination on insulators and will need longer creepage distance of insulator sets (increase of number insulator discs in string or use of fog insulators) or use of special (with conductive glaze) insulator discs.

(4) System Protection

Functions of the protection relaying practice of the 66 kV network are same as those described in detail in Sub-clause 5.2.3.

ESSP recommended the following for the protection system.

- Distance protection to overhead lines and long cable circuits.
- Protection signaling (a simple time-stepped distance scheme) to enable high-speed unit protection of each line.
- To provide adjustors of the neutral compensation factor in vector terms to long distance cable circuits.
- To provide the conventional pilot wire protection to short distance cable circuits
- Separate overcurrent and earth fault relays to 66 kV feeders and interconnection circuits.
- Delayed three-phase autoreclosing to certain important overhead interconnecting lines.
- Use of overcurrent and earth fault time-delayed relays to bus-section circuit breakers.

3.6.3 Existing 20 kV Network

Summary of 20 kV facilities in the country are as shown in Table 3.6-2 below:

Table 3.6-2 20 kV Facilities in the Country

	Unit	1994	1995	1996	1997	Growth Rate
20 kV Lines	km	39,128	40,294	41,778	43,038	3.23%
20/0.4 kV Transformers	Nos.	25,466	26,613	27,641	29,060	4.50%

Although the power demand of the country is growing steadily, the expansion of 20 kV facilities has not been properly executed due to financial difficulties. The increase rate of 20 kV facilities in the above table is much lower than the growth rate of demand in the same period, 13.9%. Such delayed development of distribution facilities compared with the demand growth seems to be one of causes that have led to the present insufficiency in distribution facilities to satisfy the demand.

(1) Transformer Stations of 20/0.4 kV System

Technical particulars of transformer stations are same as those mentioned in Sub-clause 5.3.1.

Total number of 20/0.4 kV transformer stations are reported to be approximately 29,000 sites in 1997 by PEDEEE, however records for total capacity of transformers and others have not been available.

(2) 20 kV Lines

Technical particulars of 20 kV lines are similar to those mentioned in Sub-clause 5.3.2.

(3) Protection

Technical particulars of the protection system are similar to those mentioned in Sub-clause 5.3.3.

ESSP concluded that the existing protection arrangements are acceptable. However, the existing definite time relays are proposed to be replaced with inverse-time relays at the time of renovation of 66/20 kV substations.

3.6.4 Existing Low Voltage (LV) Network

(1) General

The LV network in Syria is entirely under control of the Distribution Company of each governorate. Therefore, data are localized and country-wide detailed information (loss, voltage drop, reliability, etc.) for LV network was not available, except data for the Damascus city and Damascus Rural governorates in the study area.

(2) Total Feeder Length and Number of Consumers

The recent records of LV feeder length and number of consumers in the country are given in the following table:

Table 3.6-3 Past Feeder Length and Number of Customers

	Unit	1994	1995	1996	1997	Growth Rate
0.4 kV Feeders	km	56,528	58,097	59,891	61,714	2.97 %
Number of Consumers	Nos.	2,431,371	2,580,053	2,739,906	2,827,830	5.16 %
Newly Electrified Villages	Villa.	7,765	7,988	8,227	8,443	2.83 %

(Source: PEDEEE – Table for "The Existing Distribution and Project up to 1997 and updated on December 16, 1998)

Total length of LV lines in the country in1997 was 61,700 km against 43,000 km of 20 kV lines and 29,000 units of 20/0.4 kV transformer.

3.6.5 Regional Control Centers (RCC)

PEDEEE has three RCCs at Damascus, Aleppo and Hama to control its 66/20 kV distribution networks in the country.

The existing load dispatching facilities were originally planned and installed in 1974 and subsequently extended in 1982. The system was based on an integrated hierarchical structure with substation data collected by remote terminal units (RTUs) for transmission to RCCs. Many of RTUs provided in 1982 were never commissioned, and the system extensions executed later have not been incorporated in the system. This system has already been out-of-dated and is not suitable to future use even though the system may be rehabilitated.

Currently, control and management of the power system are being performed with the help of telephone communication. This communications system is formulated with the PLC channels and PAX system, and interconnects RCCs with the National Control Center (NCC) of PEEGT in Damascus and other substations and power stations in the HV network. Many 66/20 kV substations are also served by this network and provided with direct communication with RCCs. Communication among substations is maintained through the public telephone or by manual relaying of messages between substations, or in some cases by VHF radio.

The following are information on the present system control provided to the Team by the General Director of the Damascus RCC.

(a) Each governorate (total 14 distribution companies) has a control substation to manage and control the 66 kV and 20 kV networks of the company. The control substation of the Damascus city is the Qaboon-1 substation and that of the Damascus Rural area is the Duma substation.

(b) Each control substation is to collect operation data (load, voltage, current, faults, etc.) from all

66/20 kV substations in the company.

(c) The collected data are reported to the related RCC by the control substations on hourly, daily, every 10 days, monthly and yearly basis.

(d) RCCs of Aleppo and Hama report the same including operation records of 230/66 kV substations in the region to the Damascus RCC. Thus, all operation records of 66 kV and 20 kV circuit breakers in the country are collected at the Damascus RCC.

(e) Operation instructions to substation are issued by RCC to all substations in the country through the control substations.

(f) The daily, 10 days, monthly and yearly reports compiled at the Damascus RCC are submitted to the Ministry of Electricity, PEDEEE head office and PEEGT.

(g) Report from substations and other RCCs and instructions of the Damascus RCC to the substations and other RCCs are made through the PLC, VHF radio or public telephone systems. The Damascus RCC is to communicate important system operation information immediately to NCC and PEEGT.

(h) The existing mimic board in the Damascus RCC has been out of order. PEDEEE is to provide the RCCs and all substations in the country with new SCADA system equipment with communication means by PLC transmission and/or optical system. The project is now (as of November 1998) in process of tender evaluation for procurement of the new system equipment. PEDEEE is expecting the new SCADA system is commissioned in 2002.

3.7 Financing Situation

3.7.1 Budget of PEDEEE

Yearly budget for the administration and investment for the distribution network, both for ongoing projects and new projects, is proposed in every fiscal year (starting at January 1 and ending at December 31) by PEDEEE to the State Planning Commission (SPC) through the Ministry of Electricity. Final approval is given by the Parliament. The following Table 3.7-1 is the 5-year investment plan (budget) of PEDEEE (1996-2000), which however has not been approved yet. The details are shown in Table 3.7-2.

According to PEDEEE's explanation, budgets for 1996 and 1997 were approved and spent as planned. The budgets include local expenditures, foreign expenditures locally financed, foreign expenditures financed by external sources. Amount financed by external sources is only 14% to 24% of each year's total budget. Majority of expenditures was financed by own funds.

In the recent three years, new projects are not planned, but carried-over projects from the previous 5-year investment program have been implemented. Budget for other projects comprise assistance services to distribution companies and others, building and store construction, procurement of cars and machines,

expenditures for study of renewable energy, etc.

Table 3.7-1 PEDEEE's 5-Year Investment Plan (Whole country) (unit: 1,000 SP)

Items	1996	1997	1998	1999	2000
(1) Replacement & Rehabilitation	-	-	-	-	-
(2) Carried-over Project					
66 kV Projects	893,513	1,992,500	2,280,250	2,108,615	2,108,615
20 kV and 0.4 kV Projects	887,078	1,104,866	1,772,100	1,947,800	2,044,600
Rural Projects	461,689	586,404	869,830	869,830	869,840
System Improvement	43,465	58,000	58,000	15,000	10,000
Other Projects	269,121	503,476	805,000	849,000	858,000
Subtotal	2,554,866	4,245,246	5,785,180	5,790,245	5,891,055
(3) New Projects	-	-	-		
66 kV Projects	-	-	-	-	-
20 kV and 0.4 kV Projects	-	-	-	900,000	900,000
Rural Projects	-	-	-	-	-
System Improvement	-	-	-	-	-
Other Projects	-	-	-	-	-
Subtotal	-	-	-	900,000	900,000
Total	2,554,866	4,245,246	5,785,180	6,690,245	6,791,055

(Source: Written information of PEDEEE)

3.7.2 Financial Status

Financial structure for revenues and expenditures of PEDEEE is outlined below.

(1) Purchase and Sales Tariffs

Contractually, PEDEEE purchases electricity from PEEGT and sells it to the 14 distribution companies. The Government yearly provides two kinds of budgets to PEDEEE, (i) investment budget for new investment and (ii) estimated budget for the existing facilities.

Those budgets include local and foreign currency portions. Revenues from the distribution companies are divided into two portions; (i) remittance to the government and (ii) deduction for own expenses (O & M cost and salary, etc.). Revenues and expenditures of PEEGT and PEDEEE should be managed to be balanced (plus/minus zero). No financial losses are allowed.

Sales tariff between PEEGT and PEDEEE was 0.6 SP/kWh in the years from 1994 to 1996 and increased to 0.6385 SP/kWh in 1997. While, sales tariff to 14 distribution companies is determined every year. The tariffs for Damascus Distribution Company were 0.65 SP/kWh for 1994 and 0.67 SP/kWh for 1995 and 1996. Those for the Damascus Rural Distribution Company were 0.62 SP/kWh for 1994 and 0.64 SP/kWh for 1995 and 1996. For 1997, the sales tariff for the distribution companies has not yet been decided.

Tariff for 66 kV customers is 0.8 SP/kWh. Retail tariffs to consumers are based on the tariff system mentioned in Clause 3.3.

The weighted average tariffs for all consumers were as follows:

Table 3.7-3 Weighted Average Tariffs (SP/kWh)

Year	Damascus City	Damascus Rural	All the Country
1995	0.9000	0.8500	0.8160
1996	0.9423	0.8550	0.8466
1997	0.9120	0.8251	-

(2) Financial Performance of PEDEEE

Balance sheets of 1994, one of PEDEEE and one of distribution companies were shown to the Team, although those balance sheets have not been yet finally approved. The provisional sheets for 1995 to 1997 have been in preparation by the financial department of PEDEEE and were presented to the Team for indicative purposes.

Financial performance of PEDEEE from 1994 second half (July 1 through December 31) to 1997 is summarized in the following table.

Table 3.7 - 4 Financial Performance of PEDEEE (unit: 1,000SP)

Year	Revenue	Total Expenditure	Expenditure (1)	Expenditure (2)	Profit	Sales (GWh)
1994 SH	6,755,487	2,226,213	1,685,606	580,607	4,489,274	
1995	8,872,734	14,913,627	13,488,982	1,424,645	-6,040,893	9,874
1996	11,287,004	17,057,848	14,375,084	2,682,764	-5,770,844	11,091
1997	12,052,660	17,498,410	14,409,205	3,089,205	-5,445,750	12,127

Expenditure (1) includes salary, wages, energy purchase costs, O&M costs, expenses for existing facilities and Expenditure (2) includes the investment costs for new projects. PEDEEE commenced its operation from the second half of 1994 when the former PEE was separated into PEEGT and PEDEEE. As seen from the above table, the financial performance of PEDEEE in 1995 through 1997 was in deficit, with the exception of the second half of 1994. The main reason of the deficit is considered to be low revenues due to low sales price of electricity. To fill the amount of the deficit, government subsidies have been given as additional loans. In every 3 to 4 years, these loans have been transferred to the capital of PEDEEE.

The balance sheet of 1994 second half was submitted to the Team and summarized in Table 3.7-5.

The PEDEEE's balance sheets for 1995, 1996 and 1997 have not been issued and were not available. Since the available information is not sufficient at the present stage, the analysis of the balance sheets and other

associated financial performance documents will be performed at the later stage of the study.

Table 3.7-5 Balance Sheets of PEDEEE and the Distribution Companies

(SP Million)

	PEDEEE	Damascus City	Damascus Rural	
	1994 SH	1995	1995	1996
Fixed assets				
Fixed assets	8,442.3	710.5	374.1	444.1
Work in progress	1,827.0	185.3	862.8	1,073.8
Goods in storage	5,384.7	374.8	275.7	306.0
Current assets				
Financial investment	0.08	0.08		
Debtors	7,242.0	1,292.5	2,365.3	2,379
Other	30,877.6	9,914.4	4,029.9	4,569.2
Available funds	1,356.8	27.9	90.0	201.9
Total	**55,130.4**	**12,756.4**	**7,997.7**	**8,974.0**
Equity and Liabilities				
Capital	8,344.2	790.0	485.0	458.0
Reserve	4,238.6	12.0		
Depreciation	2,970.0	391.8	133.3	153.3
Provision	52,242.7		129.6	130.5
Long term debt	13,120.2		0.225	0.225
Other liabilities	5,125.9	225.3	445.8	366.7
Current Liabilities	21,379.3	11,337.2	6,383.8	7,838.3
Total Equity and Liabilities	**55,130.4**	**12,756.4**	**7,997.7**	**8,947.0**

Alhough the Team requested PEDEEE and two distribution companies to provide the following information relating to the financial performance of PEDEEE and the two distribution companies for further review, the Team could not obtain these information during the study period, of which the preparation by the Government was still in progress.

- Balance sheets of PEDEEE for 1995, 1996, 1997 (actual) and 1998 and 1999 (forecasted)
- Balance sheets of Damascus City Company for 1996 and 1997 (actual) and 1998 and 1999 (forecasted)
- Balance sheets of Damascus Rural Company for 1997 (actual) and 1998 and 1999 (forecasted)
- Detailed breakdown of revenues and expenses in the income statements including energy sales, average tariff, energy revenue, other operating revenues (sales of facilities and watthour meters, etc.) O&M costs, salary and wages, electricity purchase (GWh x purchase unit price), taxes, etc. for 1995 to 1997 (actual) and 1998 and 1999 (forecasted) for the three organizations.

(3) Financial Performance of Damascus City and Rural Distribution Companies

Financial performance of Damascus City and Rural Distribution Companies from 1994 second half (July 1

through December 31) to 1997 are summarized in the following tables.

Table 3.7 - 6 Financial Performance of the Distribution Companies

1. Damascus City Distribution Company (unit: 1,000SP)

Year	Revenue	Total Expenditure	Expenditure (1)	Expenditure (2)	Profit	Sales (GWh)	Average Tariff
1994 SH	722,585	242,034	244,487	17,547	480,551		
1995	1,635,033	1,980,895	1,905,146	75,749	-345,862	1,491.5	0.9
1996	1,638,105	2,354,944	2,238,491	116,453	-716,839	1,410.9	0.9423
1997	1,790,660	2,540,862	2,359,538	181,342	-750,202	1,422.5	

2. Damascus Rural Distribution Company (unit: 1,000SP)

Year	Revenue	Total Expenditure	Expenditure (1)	Expenditure (2)	Profit	Sales (GWh)	Average Tariff
1994 SH	661,615	158,336	107,431	50,905	503,279		
1995	1,443,782	1,563,078	1,497,802	65,267	-119,296	1,251.9	0.85
1996	1,994,275	1,868,106	1,778,217	89,889	126,169	1,568.8	0.855
1997	2,616,025	2,158,867	2,067,503	91,364	457,158	1,833.7	

As seen from the above table, the financial performance of the Damascus City Company in 1995 through 1997 is in deficit, with the exception of second half of 1994. Similarly to the case of PEDEEE, the main reason of the deficit is considered to be low revenues because of low tariff of electricity. On the other hand, in the case of the Damascus Rural Company, the performances of 1996 and 1997 were in surplus although that of 1995 was in deficit. This matter will be discussed later.

Balance sheets of the Damascus City Company in 1995 and the Damascus Rural Company in 1995 and 1996 were submitted to the team as indicative purposes and summarized in Table 3.7-5. These balance sheets have not yet been approved by the government.

3.8 Environmental Considerations

Although the basic policy for protection of its environment was committed, establishments of environmental laws, regulations and legislation is delaying in Syria. Thus, the present situation for environmental protection is behind that of the developed countries. UNDP funded to a project "Strengthening National Capacity for Environmental Affairs in Syria". The project aims at building up the institutional and technical capacities of the General Commission for Environmental Affairs to enable it effectively to fulfil its functions and responsibilities according to its mandate. Additionally, the project will formulate a national strategy and an environmental action plan to address the country's pressing environmental concerns as well as promote the integration of environmental considerations into all development activities and the preparation of a sustainable development strategy.

Thus, there is, at present, no definite environmental law, regulation or legislation for development of distribution network in Syria. This was also confirmed by the Deputy Minister of Electricity.

However, the maximum environmental consideration should be taken in planning, designing and formulating the distribution network under the study.

3.9 Current Prices of Equipment and Materials for the Sector

The Team obtained the current average prices of equipment and materials for substations and lines for 66 kV and medium/low voltage levels.

Detailed prices as of the middle 1998 in Syrian market are shown in Table 3.9-1. All prices are based on international tender procurement for Syria. The following are general prices for 66/20 kV substations, 66 kV lines and 20 kV lines for general information.

Table 3.9-2 General Price Information (unit: US$)

Facility		Local Cost	Foreign Cost	Total
66/20 kV Substation	2 x 20 MVA	534,000	3,306,000	3,839,000
	2 x 30 MVA	589,000	3,501,000	4,090,000
66 kV Line	Per km	10,250	32,000	42,250
20 kV Overhead Line	Per km	4,230	5,500	9,730

All the prices for the cost estimate of the formulated plan and feasibility study in 1999 will be updated.

3.10 Study of Syrian Power System by Other International Institutions

The following studies have been and will be achieved under finance of the European Union (EU) as the Electricity Sector Support Program (ESSP) for Syria.

(1) Training Master Plan

This study aimed at establishment of a permanent training program for PEEGT and PEDEEE. The study was undertaken by ESB International (Ireland) during 1995 to 1997.

(2) Generation and Transmission Master Plan

The study was for formulation of the master plan on development of generation and transmission facilities in the whole Syria and undertaken by Electricite de France (EDF) over the period of 1995 to 1997. EDF completed following reports:

- Technical Report No. 0 : General Approach and Methodology
- Technical Report No. 1 : Load Forecast Study
- Technical Report No. 2 : Review of the Energy Potential in Syria
- Technical Report No. 3 : Generation Expansion
- Technical Report No. 4 : Transmission Expansion

(3) Transmission and Distribution Components

The study aimed at review of the transmission and distribution systems in the whole Syria, identification of the needs for improvement and recommendation of urgent actions to be taken. The study was executed by Merz & McLellan (UK) during 1996 to 1998.

(4) Operation and Control Components

The study was for recommendation on improvement of the PEEGT's and PEDEEE's O & M practices. The study was undertaken by Merz & McLellan (UK) during 1995 to 1996.

(5) Management Information System

The study was for specifying the future efficient management information system required for PEEGT and PEDEEE. The study was executed by Rust Kennedy & Donkin (UK).

(6) Distribution Master Plan

The study is for formulation of the master plan for improvement of the Syrian distribution systems including transfer of knowledge for self-preparation of the future distribution system to PEDEEE personnel. T.O.R for the study was approved by the authority of EU. The selection of consultant firm was in progress as of June 1999. The study is expected to start around September 1999.

(7) Energy Efficiency and DSM

UNDP/GEF (Global Environmental Facilities) will assist in examination of program for energy efficiency and DSM in Syria soon.

Table 3.2-6 Number of Low Voltage Customers by Region in 1996 (Detailed)

Category	South Region					Central Region		North Region		West Region		East Region			Total
	Damascus City	Damascus Rural	Daraa	Sweida	Qunaytra	Homs	Hama	Aleppo	Idleb	Tartous	Latakia	Raqqa	Hassakeh	Der Al Zor	
66kV															
Industry	2	5	0	0	0	6	9	12	0	5	2	2	3	1	47
20kV															
Industry	3	0	4	0	0	16	13	53	4	4	10	8	2	5	122
Agricult	0	74	4	0	0	16	13	53	5	3	10	8	2	5	193
Others	10	0	1	0	0	4	3	13	2	0	3	2	0	1	39
Sub-total	13	74	9	0	0	36	29	119	11	7	23	18	4	11	354
20/0.4kV															
Industry	79	2,460	69	0	26	261	405	1,191	52	195	119	80	481	0	5,418
Commerce	100	401	126	0	9	91	141	209	87	85	42	28	168	16	1,503
Agricult.	51	384	459	0	34	335	522	638	664	148	153	103	619	0	4,110
Others	1,328	0	240	0	10	102	158	0	121	3	47	31	188	282	2,510
Sub-total	1,558	3,245	894	0	79	789	1,226	2,038	924	431	361	242	1,456	298	13,541
0.4kV															
Domestic	302,082	299,320	86,174	53,670	7,882	205,721	169,623	516,126	136,638	117,147	136,065	72,169	123,660	83,344	2,309,621
Industry	1,983	2,454	1,879	1,236	18	8,961	2,456	5,320	3,097	4,986	3,483	77	2,908	500	39,358
Commerce	83,068	40,364	5,895	5,057	387	31,272	23,950	93,991	13,219	14,173	17,197	8,398	11,348	10,252	358,571
Govern.	2,605	1,676	1,335	609	380	2,499	2,275	4,855	1,580	1,608	1,005	1,128	2,162	1,138	24,855
Lighting	490	985	573	352	82	877	1,366	1,307	204	406	304	118	285	152	7,501
Sub-total	390,228	344,799	95,856	60,924	8,749	249,330	199,670	621,599	154,738	138,320	158,054	81,890	140,363	95,386	2,739,906
Summary															
66 kV	2	5	0	0	0	6	9	12	0	5	2	2	3	1	47
20 kV	13	74	9	0	0	36	29	119	11	7	23	18	4	11	354
20/0.4 kV	1,558	3,245	894	0	79	789	1,226	2,038	924	431	361	242	1,456	298	13,541
0.4 kV	390,228	344,799	95,856	60,924	8,749	249,330	199,670	621,599	154,738	138,320	158,054	81,890	140,363	95,386	2,739,906
Total	**391,801**	**348,123**	**96,759**	**60,924**	**8,828**	**250,161**	**200,934**	**623,768**	**155,673**	**138,763**	**158,440**	**82,152**	**141,826**	**95,696**	**2,753,848**

(Source: Table B.1 of ESSP TD 007 confirmed by PEDEEE in November 1998)

Table 3.2-9 Energy Sales Records from 1988 to 1997

Whole Syria (Energy in MWh)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Growth 93-97
Net Energy Ready to PEDEEE								14,144,000	15,300,306	16,616,000	
Motive Energy Sale											
66 kV			910,000	919,000	1,030,000	1,001,000	1,054,000	1,160,552	1,226,806	1,291,686	
20 kV			842,000	893,000	867,000	816,000	928,000	1,004,643	1,002,285	1,043,115	
20/0.4 kV			1,272,000	1,287,000	1,359,000	1,141,000	1,341,000	1,708,500	1,773,292	2,237,939	
0.4 kV			94,000	93,000	117,000	90,000	150,000	178,591	244,896	244,419	
Total for motive energy	0	0	3,118,000	3,192,000	3,373,000	3,048,000	3,483,000	4,052,286	4,247,279	4,817,159	12.12
Street Lighting			107,000	95,000	90,000	90,000	113,000	169,936	217,271	245,202	28.48
Domestic			3,533,000	3,676,000	3,651,000	3,433,000	4,166,000	4,701,183	5,450,021	5,633,380	13.18
Commercial			103,000	145,000	111,000	388,000	504,000	621,304	803,893	915,988	23.96
Public Office			193,000	154,000	165,000	150,000	215,000	226,386	216,839	231,548	11.46
PEDEEE Office			11,000	18,000	34,000	16,000	42,000	23,179	32,478	48,525	31.97
Religion Office			41,000	50,000	54,000	61,000	73,000	86,202	125,318	184,613	31.90
Total for Lighting Energy	0	0	3,988,000	4,138,000	4,105,000	4,138,000	5,113,000	5,828,190	6,845,820	7,259,256	15.09
Total Sale	0	0	7,106,000	7,330,000	7,478,000	7,186,000	8,596,000	9,880,476	11,093,099	12,076,415	13.86
Distribution Loss								4,263,524	4,207,267	4,539,585	
Percentage								30.14	27.50	27.32	
Growth Rate											Average
Commercial				40.78	-23.45	249.55	29.90	23.27	29.39	13.94	24.13
Industry				2.37	5.67	-9.64	14.27	16.34	4.81	13.42	12.21

Damascus (Energy in MWh)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Growth 93-97
Net Energy ready to Damascus			1,652,940	1,719,760	1,731,280	1,888,870	2,100,530	2,292,394	2,476,531	2,519,425	7.47
Motive Energy Sale											
66 kV				25,379	17,077	15,962	13,835	13,543	17,458	15,389	
20 kV	83,307	71,224	62,410	50,685	47,824	65,777	67,506	52,536	66,441	60,964	
20/0.4 kV	114,854	116,706	164,503	252,858	235,526	179,448	173,302	249,662	236,179	244,093	
0.4 kV						19,665	24,704	26,613	28,320	26,240	
Total for motive energy	198,161	187,930	226,913	328,922	300,427	280,852	279,347	342,354	348,398	346,686	5.41
Street Lighting	21,350	33,648	15,623	1,635	1,809	1,074	1,493	2,476	2,651	3,807	37.21
Domestic	771,062	864,445	922,455	969,394	814,099	672,385	802,336	869,428	1,052,612	995,210	10.30
Commercial						119,677	170,413	197,648	265,646	332,145	29.07
Public Office	98,772	90,764	73,986	26,919	19,759	35,450	55,439	64,866	48,034	34,239	-0.87
PEDEEE Office	1,640	2,052	1,324	4,241	17,022	1,501	18,431	2,232	6,643	22,315	96.36
Religion Office	8,248	10,953	8,610	14,968	9,279	9,705	9,034	12,428	35,360	71,846	64.95
Total for Lighting Energy	901,072	1,001,862	1,021,998	1,017,157	861,968	839,792	1,057,146	1,149,078	1,410,946	1,459,562	14.82
Total Sale	1,099,233	1,189,792	1,248,911	1,346,079	1,162,395	1,120,644	1,336,493	1,491,432	1,759,344	1,806,248	12.67
Distribution Loss			404,030	373,680	567,890	768,240	764,040	800,962	717,187	713,177	
Loss in %			24.44	21.73	32.80	40.67	36.37	34.94	28.96	28.31	
Load Shedding			45,828	40,000	100,254	2,174,760	2,136,730				
Growth Rate											Average
Industry		-5.16	20.74	44.96	-8.66	-6.52	-0.54	22.56	1.77	-0.49	5.82
Commercial							42.39	15.98	34.40	25.03	29.45

Rural Damascus (Energy in MWh)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Growth 93-97
Net Energy ready to Damascus Rural			1,345,390	1,407,050	1,432,430	1,423,980	1,836,320	2,216,628	2,482,200	2,734,110	17.71
Motive Energy Sale											
66 kV	99,600	104,400	130,100	125,044	120,228	130,318	134,305	137,855	145,555	158,783	
20 kV	77,900	81,300	100,859	105,706	126,951	92,712	107,153	128,348	103,581	105,251	
20/0.4 kV	244,000	251,500	231,242	240,241	278,328	109,721	246,253	419,652	415,636	672,882	
0.4 kV	0	0	5,471	5,000	7,118	6,918	8,409	10,922	12,666	13,956	
Total for motive energy	421,500	437,200	467,672	475,991	532,625	339,669	496,120	696,777	677,438	950,872	29.35
Street Lighting	7,100	7,700	6,667	12,480	7,786	3,774	14,126	17,537	18,350	28,834	66.26
Domestic	372,000	387,500	424,109	481,326	401,521	382,798	477,684	567,557	774,335	756,583	18.57
Commercial						37,455	45,155	74,326	77,509	86,129	23.14
Public Office	9,240	2,010	17,111	7,320	5,644	3,774	4,925	4,764	6,266	9,972	27.50
PEDEEE Office	800	4,600	1,078	998	1,549	1,157	1,344	1,699	3,501	214	-34.42
Religion Office	3,300	3,100	4,050	3,360	4,228	3,952	4,303	3,827	6,377	7,984	19.22
Total for Lighting Energy	392,440	404,910	453,015	505,484	420,728	432,910	547,537	669,710	886,338	889,716	19.73
Total Sale	813,940	842,110	920,687	981,475	953,353	772,579	1,043,657	1,366,487	1,563,776	1,840,588	24.24
Distribution Loss	219,500	354,200	424,690	425,580	475,080	649,730	792,660	850,141	913,424	893,522	
Loss in %			31.57	30.25	33.17	45.63	43.17	38.35	36.80	32.68	
Load Shedding			0	42,303	195,000	172,380	55,179				
Growth Rate											Average
Industry		3.72	6.97	1.78	11.90	-36.23	46.06	40.45	-2.78	40.36	31.02
Commercial							20.56	64.60	4.28	11.12	25.14

Source : PEDEEE (Figures in red were received from Mr. Mustafa, Deputy Director of Department of Planning and Statistics, PEDEEE)

Table 3.2-11 Number of Customer

Damascus

	1990	1991	1992	1993	1994	1995	1996	1997
66 kV						2	2	2
20 kV						14	14	14
20/0.4 kV						1,415	1,541	1,583
0.4 kV						2,034	2,034	1,978
Total for motive energy	0	0	0	0	0	3,465	3,591	3,577
Street Lighting						411	464	511
Domestic						289,132	299,144	302,706
Commercial						78,535	82,189	85,787
Public Office						2,618	2,560	2,538
PEDEEE Office						61	69	80
Religion Office						626	633	646
Total for Lighting Energy	0	0	0	0	0	371,383	385,059	392,268
Total	0	0	0	0	0	374,848	388,650	395,845

Damascus Rural

	1990	1991	1992	1993	1994	1995	1996	1997
Motive Energy Sale								
66 kV			5	5	5	5	5	5
20 kV			68	69	70	70	74	85
20/0.4 kV			2,375	2,480	2,405	2,480	3,209	3325
0.4 kV				2,072	2,264	2,442	2,389	2627
Total for motive energy	0	0	2,448	4,626	4,744	4,997	5,677	6,042
Street Lighting			718	758	788	913	970	1,051
Domestic			241,802	236,605	257,508	272,683	293,081	310,192
Commercial				22,535	25,397	34,597	39,121	43,041
Public Office			1,349	1,355	1,253	1,363	1,606	1,695
PEDEEE Office			71	74	206	75	42	56
Religion Office			662	690	715	867	740	778
Total for Lighting Energy	0	0	244,602	262,017	285,867	310,498	335,560	356,813
Total	0	0	247,050	266,643	290,611	315,495	341,237	362,855

Table 3.7-2 PEDEEE's 5-year Investment Plan (Whole Country)

(NP x1,000)

	1996				1997				1998				1999				2000			
	L	LF	F	Total	L	LF	F	Total	L	LF	F	Total	L	LF	F	Total	L	LF	F	Total
(1) Replacemnet and Rehabilitaion																				
(2) The Continuous Projects																				
A-66 kV Projects																				
-66 kV Line	282,844	209,000	0	282,844	514,000	463,000		514,000	1,026,770	919,400		1,026,770	1,155,115	1,034,300		1,155,115	1,155,115	1,034,300		1,155,115
-66/20 SS	226,293	136,000	384,376	610,669	521,500	457,500	957,000	1,478,500	653,480	512,660	600,000	1,253,480	553,500	470,475	400,000	953,500	553,500	470,475	400,000	953,500
B-Distribution Project																				
-20 kV Line	346,681	122,400	0	346,681	475,178	215,954		475,178	799,000	360,170		799,000	799,000	360,165		799,000	799,000	360,165		799,000
-0.4 kV Line	244,659	19,120	0	244,659	280,027	46,000		280,027	296,300	48,685		296,300	353,400	58,030		353,400	421,800	69,260		421,800
-20/0.4 kV Tr.	277,797	191,790	0	277,797	326,416	167,611		326,416	646,800	285,935		646,800	759,700	335,445		759,700	788,100	347,985		788,100
-Supply of illegal area	17,941	0	0	17,941	23,245	0		23,245	30,000			30,000	35,700			35,700	35,700			35,700
C-Rural Project																				
-20 kV Line	204,826	68,733	0	204,826	223,557	63,000		223,557	371,500	98,700		371,500	371,500	101,500		371,500	371,500	112,800		371,500
-0.4 kV Line	192,392	5,495	0	192,392	237,565	80,000		237,565	323,000	98,490		323,000	323,000	108,500		323,000	323,000	117,250		323,000
-20/0.4 kV Tr.	64,471	36,935	0	64,471	125,282	90,000		125,282	175,330	113,400		175,330	175,330	122,400		175,330	175,340	104,400		175,340
D-Improvement of System	727		42,728	43,465	15,000		43,000	58,000	15,000		43,000	58,000	15,000			15,000	10,000			10,000
H-Other Projects																				
-Assistance Service	38,572	27,000		38,572	222,634	91,740		222,634	260,000	22,600		260,000	291,000	53,300		291,000	286,000			286,000
-Building & Stores	62,306	0		62,306	137,967			137,967	170,000	0		170,000	173,000			173,000	162,000			162,000
-Cars & Machines	125,243	125,243	23,000	148,243	142,775	140,744		142,775	350,000	345,000		350,000	380,000	375,000		380,000	380,000	375,000		380,000
-Study for Renewable Energy	0	0	0	0	100			100	5,000	2,500		5,000	5,000	2,500		5,000	10,000	5,000		10,000
(3) New Projects	-	-	-	-	-	-	-	-	200,000	-	400,000	600,000	-	-	-	-	-	-	-	-
A-66 kV Projects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-66 kV Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-66/20 SS	-	-	-	-	-	-	-	-	-	-	-	-	300,000	-	600,000	900,000	300,000	-	600,000	900,000
B-Distribution Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-20 kV Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-0.4 kV Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-20/0.4 kV Tr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-Supply of illegal area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C-Rural Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-20 kV Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-0.4 kV Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-20/0.4 kV Tr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-Improvement of System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H-Other Projects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-Assistance Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-Building & Stores	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-Cars & Machines	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-Study for Renewable Energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

L : Local expenditure

LF : Foreign expenditure financed locally, included in L

F : Foreign expenditure financed by external source

Table 3.9-1 Current Prices of Equipment and Materials (1)

Voltage	Items		Specifications	Unit	C & F Rate (US$)
66/20 kV	Substation	Transformer	20 (MVA) with on-load tap changer	unit	171,507
			30 (MVA) with on-load tap changer	unit	195,869
		Circuit Breaker (conventional)	Breaking capacity of 1,250A & 25 kA	set	
			Breaking capacity of 1,600A & 25 kA	set	
		Circuit Breaker (SF6)	Breaking capacity of 1,250A & 25 kA	set	25,935
			Breaking capacity of 1,600A & 25 kA	set	25,935
		Switchgear	Transformer Bay	set	62,852
			Outgoing Feeder Bay	set	70,478
			Busbar Coupler Bay	set	54,657
			Measuring Set	set	17,586
			Busbar Protection	set	54,782
20/0.4 kV	Transformer Station	Transformer	50 kVA 3-phase	unit	1,400
			100 kVA 3-phase	unit	2,100
			200 kVA 3-phase	unit	2,450
			400 kVA 3-phase	unit	4,500
			630 kVA 3-phase	unit	6,800
			1,000 kVA 3-phase	unit	8,500
			1,600 kVA 3-phase	unit	11,000
		Switchgear Panel	Incoming	panel	26,225
			Outgoing	panel	24,115
			Measuring	panel	7,435
		Sectionalizer		nos.	46,358
-	Control Equipment	Transformer Bay		set	3,346
		Outgoing Feeder		set	3,654
		66 kV Measuring		set	4,003
		Busbar Coupler Bay		set	3,396
-	Protection Equipmen	Transformer Bay		set	14,331
		Outgoing Feeder		set	15,196
		Busbar Coupler		set	2,170
		Relay Testing Equipment		set	35,140
66 kV	Overhead Feeder	W/Tower & Fitting	Al/St of 240 mm^2	km	20,000
	Underground Cable		Copper of 300mm^2	km	90,000
20 kV	Underground Cable		Copper 185 mm2	km	5,000
			Aluminium 120 mm2	km	3,458
			Aluminium 185 mm2	km	3,000

(Source : PEDEEE, December 1998)

Table 3.9-1 Current Prices for Equipment and Materials (2)

Strength (N-m)	Height (m)	Rate (SP)	Note
Latticed Steel Pole			
10,000	15	29,155	Local Product
10,000	17	33,005	Local Product
16,000	12	20,195	Local Product
16,000	13.5	25,830	Local Product
16,000	16	32,480	Local Product
25,000	11.5	22,400	Local Product
25,000	13.5	29,480	Local Product
25,000	16.5	39,480	Local Product
32,000	13.5	37,905	Local Product
32,000	11.5	26,075	Local Product
32,000	15	47,740	Local Product
44,000	11.5	26,705	Local Product
44,000	13.5	42,875	Local Product
44,000	15	51,345	Local Product
56,000	13.5	46,165	Local Product
56,000	15	60,200	Local Product
Concrete Poles			
3,000	9.15	4,950	Local Product
3,000	10.5	5,830	Local Product
3,000	12	6,820	Local Product
6,000	9.15	8,140	Local Product
6,000	10.5	9,460	Local Product
6,000	12	10,560	Local Product

Note	Height (m)	Rate w/Taxes(SP)	C & F Rate w/o Taxes (US$)
Wooden Poles			
Imported	7	3,801	
Imported	8	4,437	
Imported	9	4,879	50
Imported	10	7,604	
Imported	11	8,840	
Imported	12	11,115	155
Imported	15	17,446	

(Source : PEDEEE, December 1998)

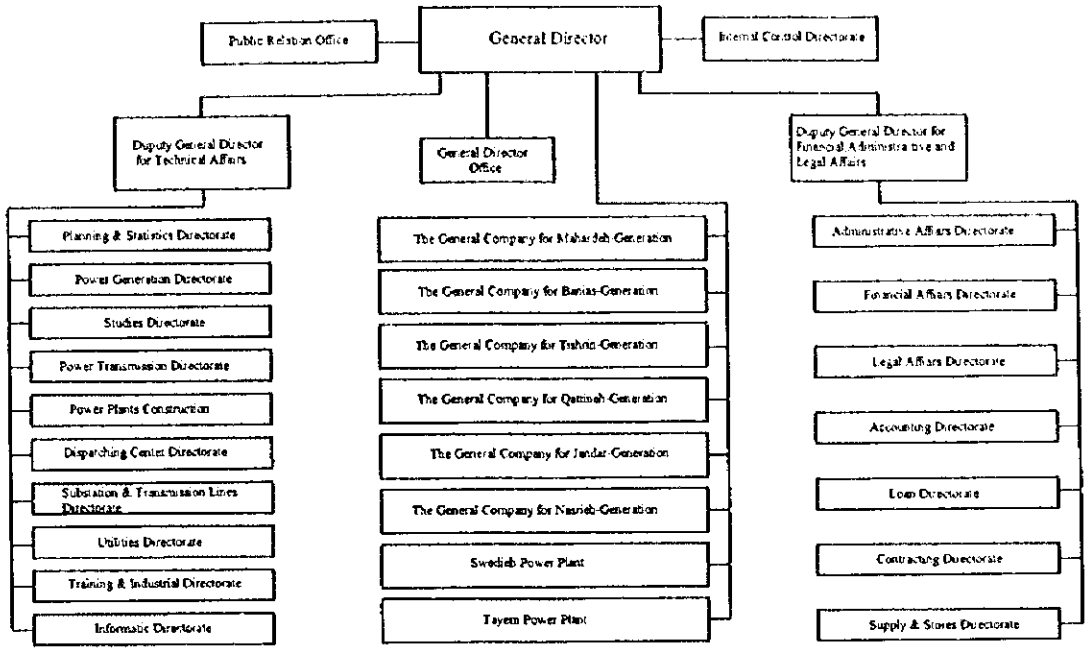


Figure 3.1-1 Organization Chart of PEEGT

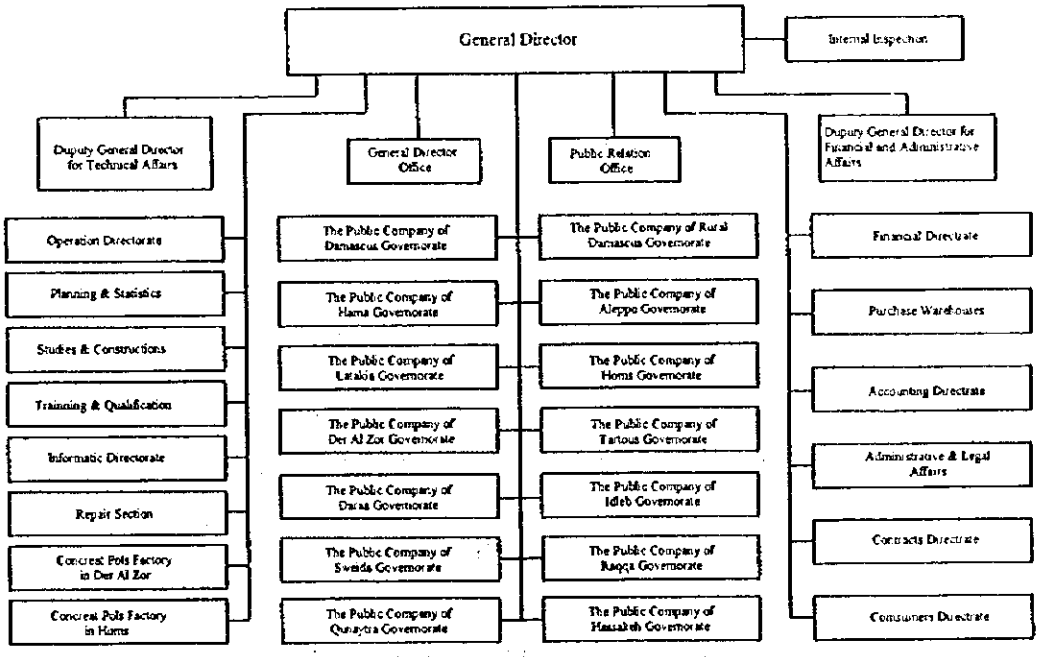


Figure 3.1-2 Organization Chart of PEDEEE

Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)	Japan International Cooperation Agency (JICA) Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd	The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network	Figure Title

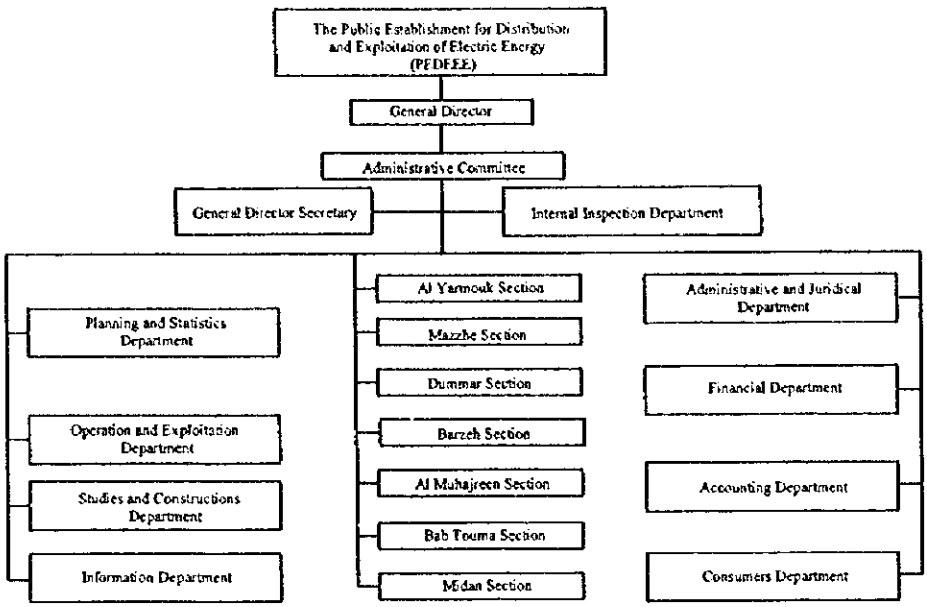


Figure 3.1-3 Organization Chart of the Damascus City Distribution Company

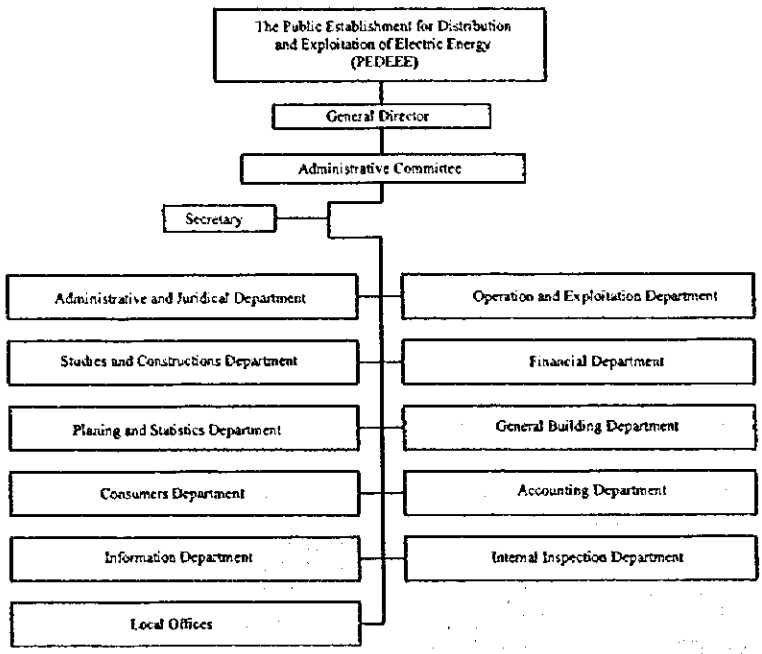


Figure 3.1-4 Organization Chart of the Damascus Rural Distribution Company

Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)	Japan International Cooperation Agency (JICA) Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd	The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network	Figure Title

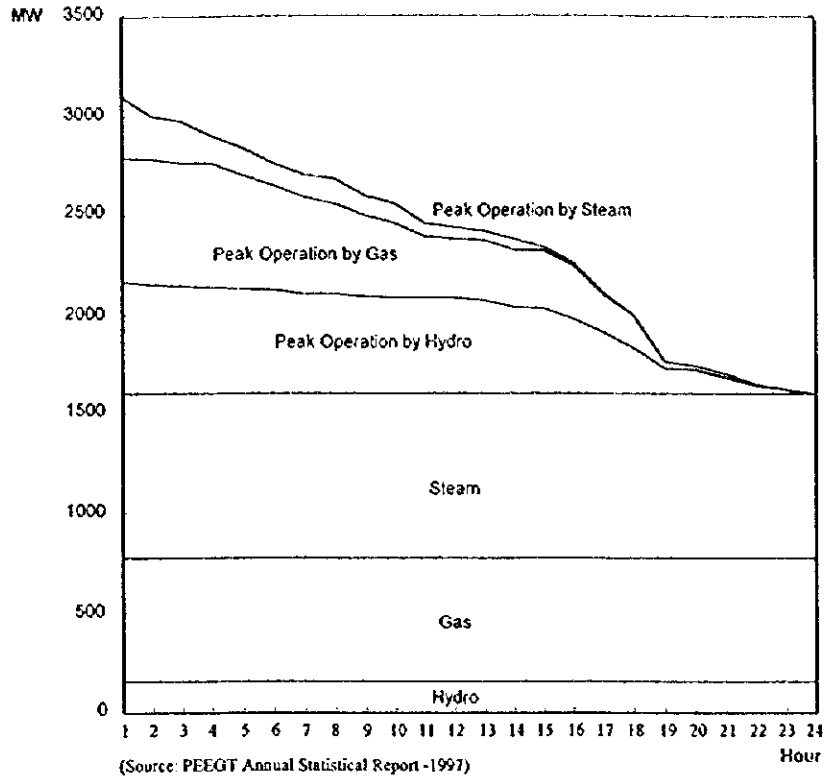


Figure 3.2-1 Load Duration Curve and Generation Pattern of PEEGT (18/12/1997)

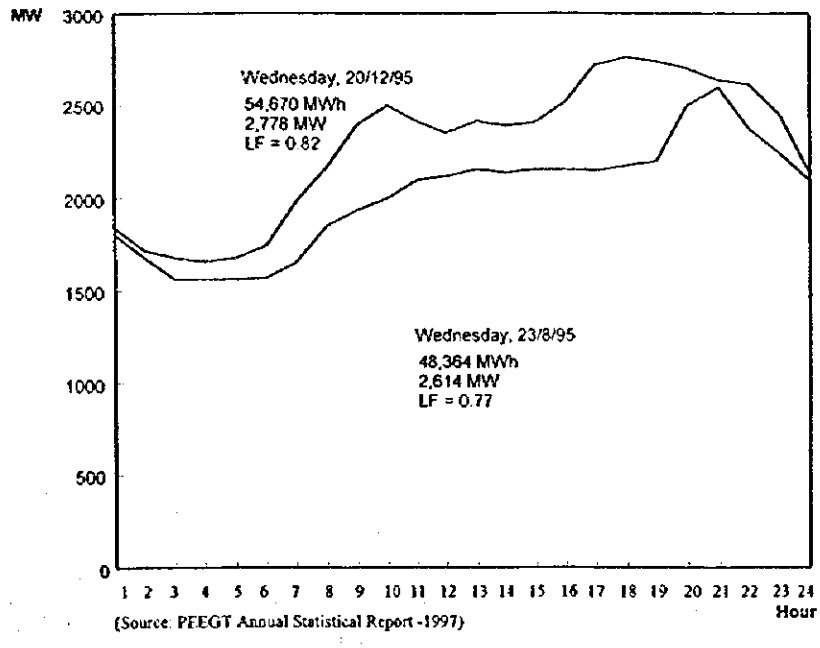


Figure 3.2-2 Daily Load Curves for the Syrian Power System

Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)	Japan International Cooperation Agency (JICA)	The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network	Figure
	Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd		Title

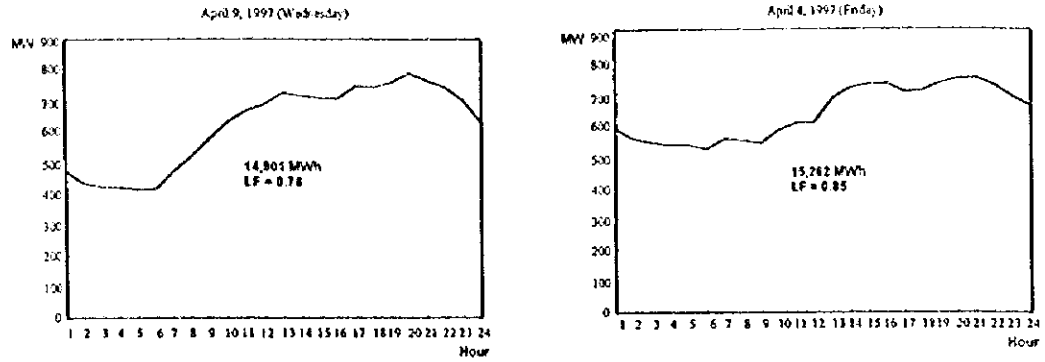


Figure 3.2 - 3 Daily Load Curves for Damascus City and Rural (Spring)

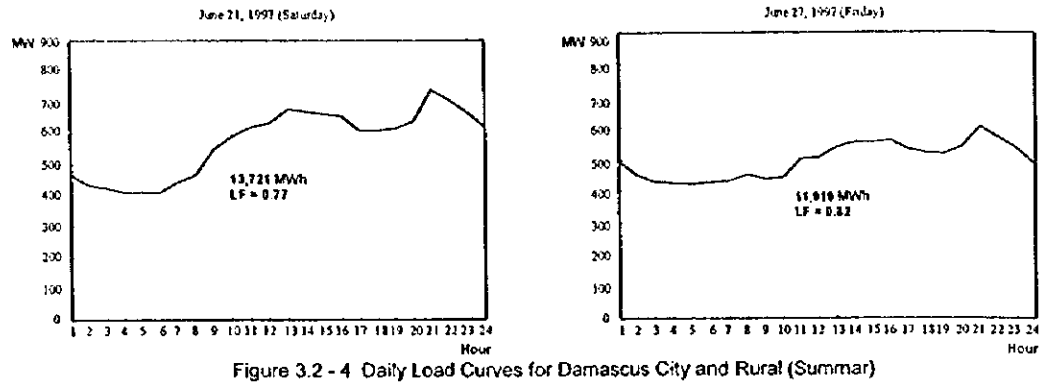


Figure 3.2 - 4 Daily Load Curves for Damascus City and Rural (Summar)

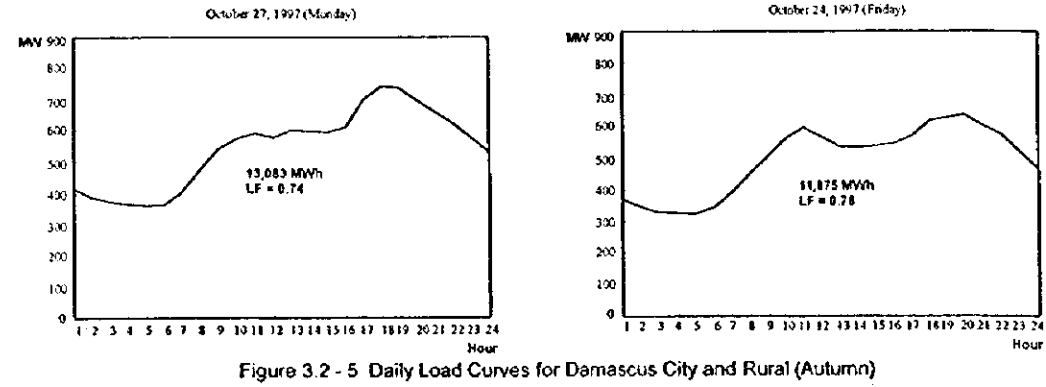


Figure 3.2 - 5 Daily Load Curves for Damascus City and Rural (Autumn)

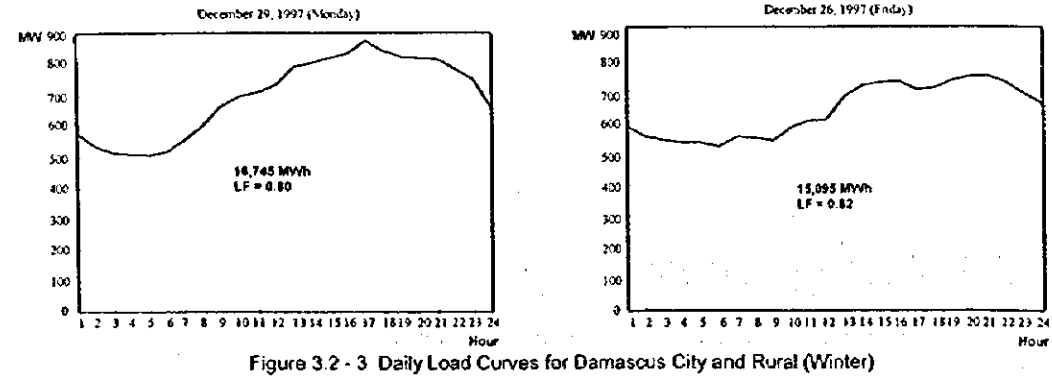


Figure 3.2 - 3 Daily Load Curves for Damascus City and Rural (Winter)

Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)	Japan International Cooperation Agency (JICA) Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd	The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network	Figure Title

(Substation: Al Faihaa, Feeder: Al Bostan)

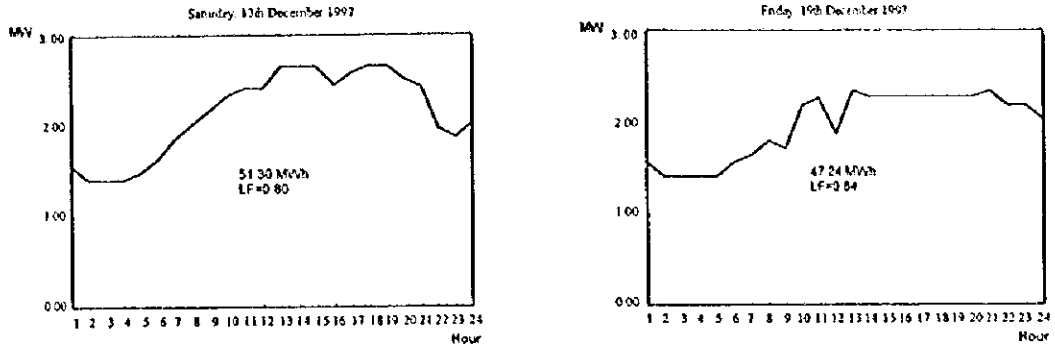


Figure 3.2 - 7 Daily Load Curves of the 20 kV Feeder (Commercial Area)

(Substation: Midan 2, Feeder: Semex)

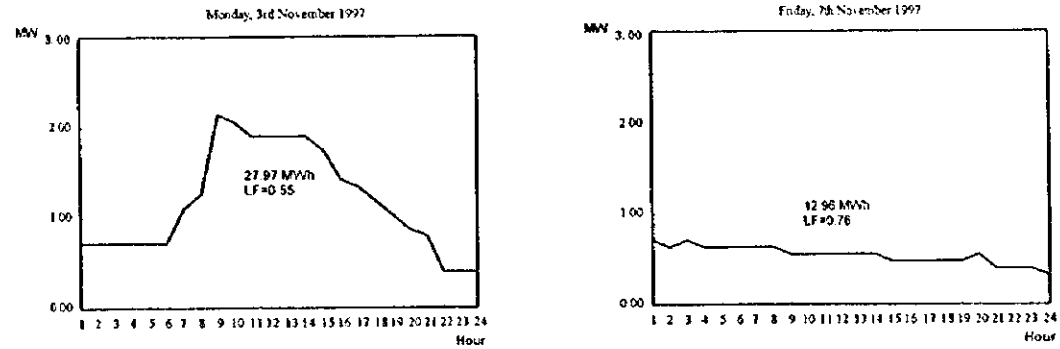


Figure 3.2 - 8 Daily Load Curves of the 20 kV Feeder (Industrial Area)

(Substation: Erbeen, Feeder: Kafer Batna)

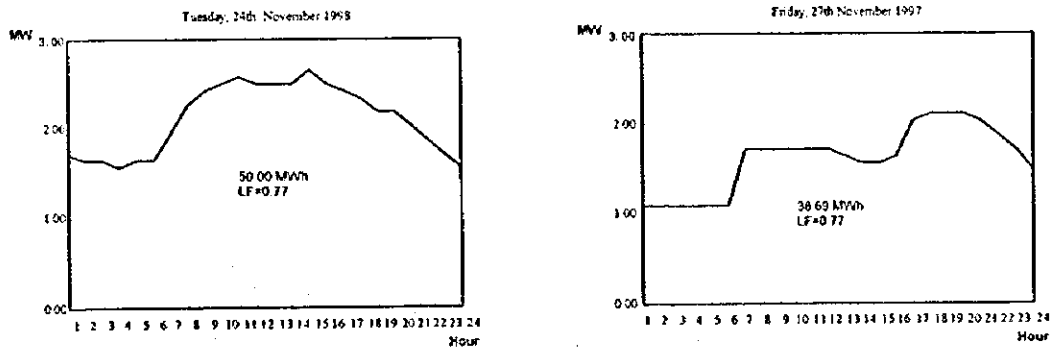
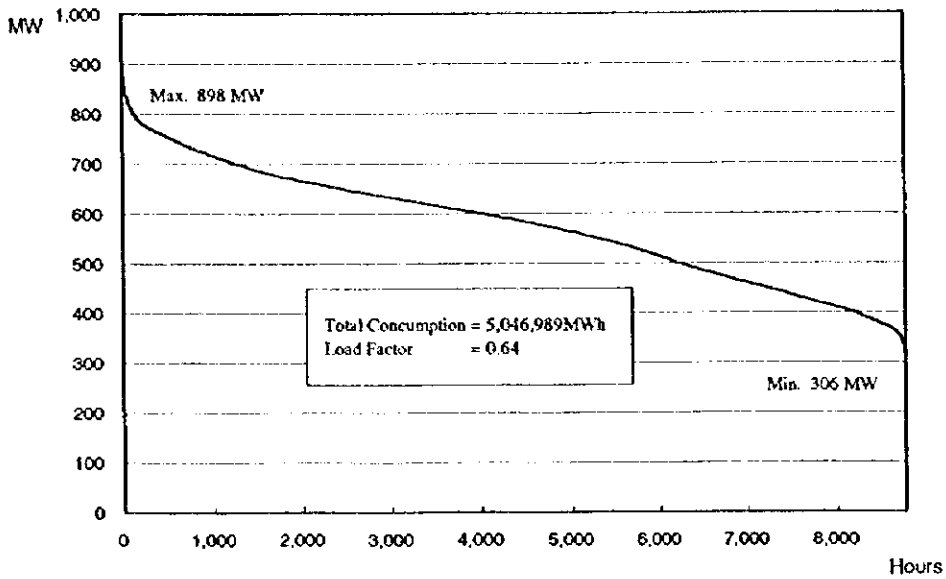
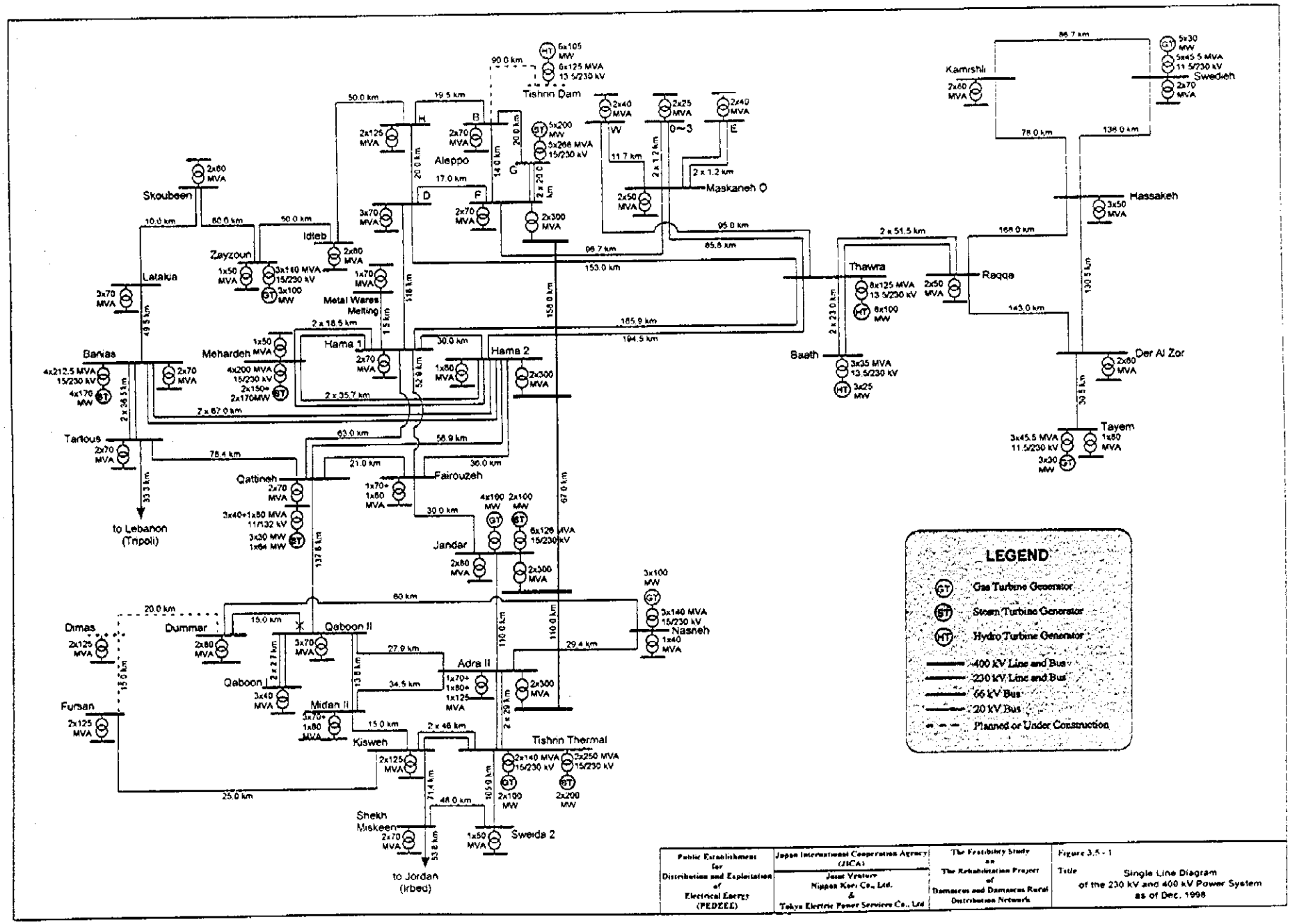


Figure 3.2 - 9 Daily Load Curves of the 20 kV Feeder (Domestic Area)

Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)	Japan International Cooperation Agency (JICA) Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd	The Fessibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network	Figure Title



Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)	Japan International Cooperation Agency (JICA) Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd	The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network	Figure 3.2 - 10 Title Load Duration Curve for the Study Area in 1997


Tishrin Dam
Aleppo
Skoubeen
Latakia
Zayzoun
Idleb
Metal Wares Melting
Meharden
Hama 1
Hama 2
Banias
Tartous
to Lebanon (Tripoli)
Qattineh
Fairouzeh
Jandar
Maskaneh
Kamrshli
Swedeh
Hassakeh
Thawra
Raqqa
Baath
Der Al Zor
Tayem
Dimas
Dummar
Qaboon II
Qaboon I
Adra II
Nasreh
Midan II
Kisweh
Tishrin Thermal
Fursan
Shekh Miskeen
Sweida 2
to Jordan (Irbed)
LEGEND
Gas Turbine Generator
Steam Turbine Generator
Hydro Turbine Generator
400 kV Line and Bus
230 kV Line and Bus
66 kV Bus
20 kV Bus
Planned or Under Construction
Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)
Japan International Cooperation Agency (JICA)
Joint Venture Nippon Koei Co., Ltd. & Tokyo Electric Power Services Co., Ltd
The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network
Figure 3.5 - 1
Title
Single Line Diagram of the 230 kV and 400 kV Power System as of Dec. 1998

CHAPTER IV

DEMAND FORECAST AND DEMAND - SUPPLY BALANCE

CHAPTER 4 Demand Forecast and Demand - Supply Balance

The demand forecast and demand - supply balance for the whole Syrian power system and also the demand forecast for the study area (Damascus city and Damascus rural governorates) including breakdown to each substation are discussed in this chapter.

The primary function of the transmission system is to deliver the electric energy generated at power stations to demand centers. The long-term plan for development of power generating plant was prepared under the ESSP study and this plan was taken up as the generation development plan of the country. Based on these generation and demand data, a network reinforcement plan and its implementation timing shall be worked out.

A detailed forecast up to the year 2010 for the whole country has been prepared by the EDF mission for the purpose of formulating a Generation and Transmission Master Plan for Syria under ESSP financed by EU. Results of the study were summarized in the EDF's reports (Technical Report No.1 and its annexes) prepared in April 1997. All studies for the Syrian power sector performed later were based on this forecast. The Team reviewed this forecast for the whole country.

While, demand forecast for the JICA's study area (Damascus Metropolitan area) only has not been performed by any party. Therefore, the Team investigated the past trends of electricity consumption and present situation of the sector in the study area, and tried to collect necessary information on social development plans and economic indices in the study area as well as load records of each substation and feeder. However, the Team found that the social development plans and regional economic indices are not available at present, and most of the past load records are not well sorted out. Under such a situation, the Team prepared a forecast of the study area for the purpose of formulating a rehabilitation plan of the distribution network on the basis of maximum available data and reasonable assumptions as discussed in this chapter.

4.1 Forecast of the Whole Country

4.1.1 Load Demand Forecast of ESSP

(1) General

Since basic economic data of the country were not available and officially not obtained due to various reasons, ESSP made some assumptions based on relevant experiences in other countries. While, detailed information on the power system was available for macroscopic load forecast of the country, although there

were data limitations for further accurate forecasting due to improper data assortment. The main problem was difficulty in getting macro-economic data at regional level in order to perform accurate region-wise demand forecast. Under such a situation, ESSP should have introduced some hypotheses into the demand forecasts for the whole country.

(2) Hypotheses of ESSP

ESSP studied the load forecast in four (4) scenarios under the various economic and the sector's backgrounds of the future. The major hypotheses introduced are summarized below:

Table 4.1-1 Major Hypotheses of ESSP

Particulars	Scenario-1	Scenario-2	Scenario-3	Scenario-4
Population (3.5% at present)	Decline to 2.5% in 2010	Decline to 2.5% in 2010	Decline to 2.5% in 2010	Decline to 2.0% in 2010
GDR Growth (7.6%/annum in the past 5 years)	6.5% constant to 2010	6.5% constant to 2010	6.5% constant to 2010	6.5% to 2000 4.5% to 2010
Unit consumption per domestic appliance	Slightly higher Than 1.5% per Annum (till 2000)	Slightly higher than 1.5% per annum (till 2000)	1.5% per annum	Constant
Tertiary appliance Possession	4% per annum	4% per annum	4% per annum	4% per annum
Tertiary consumption per sq. m	4.5% per annum	4.5% per annum	4.5% per annum	Constant
Industry electric Intensity (DSM)[1]	15% reduction (2000-2010)	15% reduction (2000-2010)	15% reduction (2000-2010)	20% reduction (2000-2010)
Technical loss (17% base)	13% in 2010	13% in 2010	13% in 2010	13% in 2010
Non-technical loss (17% base)	3.5% in 2010	1.5% in 2010	0% after 2000	0% after 2000
Release of suppressed demand	Absorbed by 2000	Absorbed by 2000	Absorbed by 2000	Absorbed by 2000

It is particularly noted that:

(a) PEDEFE estimates that commercial losses (basically due to improper metering and meter reading and billing errors) are accounted for 2%, while the remainder of non-technical loss is due to illegal consumption,

(b) Low voltage feeders in the distribution, and even the high voltage transmission network have caused high technical losses,

(c) A highly suppressed demand till 1993 due to shortage in generating capacity was estimated at 20% of supplied demand in 1993, however the suppressed demand turned to 10% in 1995 as the supply conditions started to improve after 1994 with the commissioning of new generating units, and

[1] Electric intensity is specific consumption per unit of economic production.

(d) Analysis of past sales and generation trends was not used in the forecast, but future sales and generation trends were prepared taking into account the levels of suppressed demand as well as non-technical losses.

The scenarios 1 to 3 were defined assuming identical macro-economic parameters for the future and the adoption of a relatively limited DSM and Energy Efficiency Program to be achieved in future to the national power system. The Scenario-1 was electrically characterized for low loss reduction rate (the pessimistic loss reduction scenario), the Scenario-2 for medium loss reduction (the optimistic loss reduction scenario) and Scenario-3 for high loss reduction rate (the strict loss reduction scenario). The Scenario-4 was studied for comparison purpose only assuming a gradual declination of GDP and population growth rates, being combined with a relatively aggressive DSM policy and a stringent loss reduction program.

Those applied scenarios and hypotheses are considered to be reasonable under the present situations in the country. ESSP recommended finally to employ the Scenario-1 forecast for the future development of the country's power sector, anticipating the pessimistic loss reduction due to difficulty of an action to be taken against non-technical losses.

(3) Energy Demand Forecast

The ESSP's energy demand forecast for the whole country is shown on Table 4.1-2 (Scenario-1) and Table 4.1-3 (Scenario-2). The following are abstracts from the tables for overview:

Net generation required in 2010 is forecasted to be 43,000 to 44,000 GWh at average annual growth rate of 7.2 to 7.4%. The required generation in 2010 is equivalent to about 2.4 times that in 1997.

Table 4.1-4 Energy Demand Forecast for Whole Country (Scenario-1)

(unit: GWh)

Scenario-1	1995	2000	2005	2010	Ave. Annual Growth (%)
Total Net Generation	15,258	23,752	32,300	44,307	7.37
Export to Lebanon	292	0	0	0	-
Total Net Internal Supply	14,966	23,752	32,300	44,307	7.50
Sales at 230 kV Level	226	285	360	447	4.65
Sales at 66 kV Level	1,209	1,692	2,486	3,743	7.83
Sales at 20 kV Level	2,466	4,324	6,820	10,695	10.28
Sales at 0.4 kV Level	6,052	9,939	15,416	22,073	9.01
Total T & D Losses	5,013	7,512	7,218	7,349	2.58
Technical Loss	(2,424)	(3,880)	(4,764)	(5,840)	(6.03)
Non-technical Loss	(2,589)	(3,632)	(2,454)	(1,509)	(-3.53)
Total Internal Sales	9,953	16,240	25,082	36,958	9.14

Table 4.1-5 Energy Demand Forecast for Whole Country (Scenario-2)

(unit: GWh)

Scenario-2	1995	2000	2005	2010	Ave. Annual Growth (%)
Total Net Generation	15,258	21,971	30,657	43,249	7.19
Export to Lebanon	292	0	0	0	-
Total Net Internal Supply	14,966	21,971	30,657	43,249	7.33
Sales at 230 kV Level	226	285	360	447	4.65
Sales at 66 kV Level	1,209	1,692	2,486	3,743	7.83
Sales at 20 kV Level	2,466	4,324	6,820	10,695	10.28
Sales at 0.4 kV Level	6,052	10,290	15,717	22,073	9.01
Total T & D Losses	5,013	5,380	5,274	6,291	1.52
Technical Loss	(2,424)	(3,523)	(4,458)	(5,659)	(5.81)
Non-technical Loss	(2,589)	(1,857)	(816)	(632)	(-8.97)
Total Internal Sales	9,953	16,591	25,383	36,958	9.14

As seen in the tables, growths of the energy sales in both scenarios are forecasted at the same rate, and the difference between the both scenarios are reduction of T & D losses only. Reference is made to the assumptions mentioned above.

Increase of T & D losses in the Scenario-1 and Scenario-2 are slowed down at rates of 2.58% and 1.52% respectively comparing with 3.08% of increasing rate in the last three years. Those declinations of losses resulted in decrease of required generation. Less declination of loss reduction in the Scenario-1 requires generation of 44,307 GWh in 2010, while the Scenario-2 requires 43,249 GWh in the same year, reflecting effect of the anticipated loss reduction effect.

(4) Peak Load Forecast

Due to the lack of information for the medium and low voltage networks in the country, forecast for those networks was simulated in the ESSP study by analyses on load curves of the sampled 20 kV feeders. The peak load forecasts were prepared for the Scenario-1 and Scenario-2 by region and by 230/66 kV substation.

The ESSP's peak load forecast for the whole country is shown in Table 4.1-6 (both Scenario-1 and Scenario-2). The following Tables 4.1.7 and 4.1.8 are abstracts from the table for overview.

Peak load of the whole country is forecasted at 7,800 to 7,600 MW in 2010 being approximately 2.9 times that in 1996.

The forecasted peak loads of the country for the Scenario-1 and Scenario-2 are almost same because of application of common assumptions to each region. Average annual growth rates of the two scenarios for all regions in the period of 1995 to 2010 are resulted in a similar level of 7.2-7.4% recorded actually during the period of 1990-1996.

Table 4.1-7 Peak Load Forecast for Whole Country (Scenario-1) (unit: MW)

Scenario-1	1995	2000	2005	2010	Ave. Annual Growth (%)
South Region	837	1,286	1,748	2,398	7.27
Central Region	444	702	955	1,309	7.47
West Coast Region	337	537	730	1,001	7.53
North Region	657	1,019	1,387	1,901	7.34
East Region	386	627	853	1,171	7.68
Total in the country	2,661	4,171	5,673	7,781	7.42

Table 4.1-8 Peak Load Forecast for Whole Country (Scenario-2) (unit: MW)

Scenario-1	1995	2000	2005	2010	Ave. Annual Growth (%)
South Region	837	1,189	1,660	2,341	7.10
Central Region	445	649	905	1,278	7.29
West Coast Region	337	496	692	977	7.35
North Region	657	943	1,316	1,856	7.17
East Region	385	582	811	1,145	7.54
Total in the country	2,661	3,859	5,384	7,596	7.24

4.1.2 Development Program of Power Facilities

Based on the study results of ESSP, PEEGT and PEDEE have prepared expansion programs of generation, transmission and distribution facilities to meet the growing demand and to secure the electricity required for different economic sectors in the most economic and reliable way.

(1) Generation and Transmission Facilities

Generating Plants

PEEGT is now constructing the following power plants.

(a) Tishrin dam power plant on the Euphrates river with 6 hydroelectric units (total capacity of 630 MW). The plant will function as the control plant for peak load and frequency of the system. The plant is scheduled to be commissioned in 1998-2000 in turn.

(b) Al Zara power plant consisting of 3 steam units with a total installed capacity of 600 MW. The plant is scheduled to be commissioned in 1999.

On the basis of recommendations in the master plan study undertaken by ESSP, PEEGT plans to construct the following combined cycle power plants for system base load and open cycle gas turbine power plants for system peak load. A feasibility study for those power plants including optimum site selection are urgently required. The major hydro resource is the Euphrates hydroelectric chain. Hydro-power development was not positively recommended by ESSP because of various problems associated with development of the

international river and also water-rights for irrigation and city water supply.

Table 4.1-9 Planned Power Plants

Commissioning Year	New Construction		Total Capacity
	Combined Cycle	Gas Turbine	
2004/5	1 plant of 330 MW	-	330 MW
2006	1 plant of 330 MW	1 plant of 110 MW	440 MW
2007	1 plant of 330 MW	1 plant of 110 MW	440 MW
2008	1 plant of 330 MW	1 plant of 110 MW	440 MW
2009	1 plant of 330 MW	1 plant of 110 MW	440 MW
2010	2 plants of 330 MW	2 plants of 110 MW	880 MW
Total	7 plants of 330 MW	6 plants of 110 MW	2,970 MW

(Source: PEEGT-Extension of the Generation & Transmission Master Plan, Vol. 1-6)

Transmission Facilities

PEEGT programs the following facilities to be commissioned by 2001:

Table 4.1-10 Expansion of 230 kV and 400 kV Facilities

Facilities	1998	1999	2000	2001
400/230 kV Substations (places)	3	0	0	1
230/66 kV Substations (places)	6	3	2	1
400 kV Transmission Lines (*)	317 km	220 km	0	250 km
230 kV Transmission Lines (*)	352 km	185 km	0	70 km

(Source: ESSP-Merz & McLellan TD-004)

(*): Construction of lines in kilometers per year. 400 kV project includes facilities for the international connection with Iraq.

Besides, ESSP recommended to construct 400/230 kV transmission lines commensurate with development of new power plants stated above as well as 400/230 kV ring line around Damascus.

For the expansion of the systems, PEEGT allocated budget of 60,810,000,000 SP (equivalent to approximate US$ 1,322 million) for generation projects and 26,568,000,000 SP (equivalent to approximate US$ 578 million) for transmission projects for the period of 1996-2000.

(2) Distribution Facilities

PEDEEE also programs 5-year (1996-2000) investment plan for the whole country as mentioned in Subclause 3.7.1 and Table 3.7-2. Total budget of each year by voltage level is as summarized below:

Table 4.1-11 Total Budget of Each Year by Voltage Level

(Unit : 1,000 SP)

	1996	1997	1998	1999	2000	Total
Continuous Projects						
66 kV lines and substations	893,513	1,992,500	2,280,250	2,108,615	2,108,615	9,383,493
20 kV facilities	887,078	1,104,866	1,772,100	1,947,800	2,044,600	7,756,444
Rural Projects	461,689	586,404	869,830	869,830	869,840	3,657,593
System Improvements	43,465	58,000	58,000	15,000	10,000	184,465
Others	269,121	503,476	805,000	849,000	858,000	3,284,597
Subtotal (Syrian Pound)	2,554,866	4,245,246	5,785,180	5,790,245	5,891,055	24,266,592
(Eq. US$ x 1000)	(55,540)	(92,290)	(125,765)	(125,875)	(128,066)	(527,536)
New Projects						
66 kV lines and substations	-	-	-	-	-	0
20 kV facilities	-	-	-	900,000	900,000	1,800,000
Rural Projects	-	-	-	-	-	0
System Improvements	-	-	-	-	-	0
Others	-	-	-	-	-	0
Subtotal (Syrian Pound)	-	-	-	900,000	900,000	1,800,000
(Eq. US$ x 1000) (*)	-	-	-	(19,565)	(19,565)	(39,130)
Total (Syrian Pound)	2,554,866	4,245,246	5,785,180	6,690,245	6,791,055	26,066,592
(Eq. US$ x 1000) (*)	(55,540)	(92,290)	(125,765)	(145,440)	(147,631)	(566,666)

(*) Assuming the exchange rate to be at US$ 1.00=SP 46.

In addition, PEDEEE prepared its general expansion plans of distribution network for the whole country as follows:

Table 4.1-12 Medium Term Development Program for the Whole Country (per year)

Project	Unit	1998	1999	2000	2001	2002	2003
66 kV Lines	Km	271	285	290	255	295	300
66/20 kV Substations	Nos.	11	10	10	10	10	10
	MVA	721	720	600	600	600	600
20 kV Lines	Km	1,852	1,590	1,420	1,500	1,300	9,300
20/0.4 kV Transformers	Nos.	1,300	1,350	1,290	1,700	1,300	1,400
0.4 kV Lines	Km	1,500	1,400	1,535	1,400	1,450	1,550
New Customers	Nos.	135,000	130,000	135,000	135,050	129,950	137,500
New Electrification	Village	347	300	300	300	310	350

(Source: PEDEEE's Future Plans for Period of 1998-2003)

4.1.3 Balance of Demand and Supply

Table 4.1-13 shows the future balance of demand and supply of peak power and energy over the country. Until the year 2004, the existing and committed generating plants will be able to meet the forecasted power demand taking into account necessary system spinning reserve. In order to meet the demand after 2005, new generating plants have not been committed yet at the present. ESSP recommended to commission 440

MW generating plants each year after the year 2005, which comprises combined cycle plant of 330 MW capacity and gas turbine plant of 110 MW capacity. After the year 2010, double capacity was recommended. The following figure is illustration of the balance of demand and supply up to the year 2010.

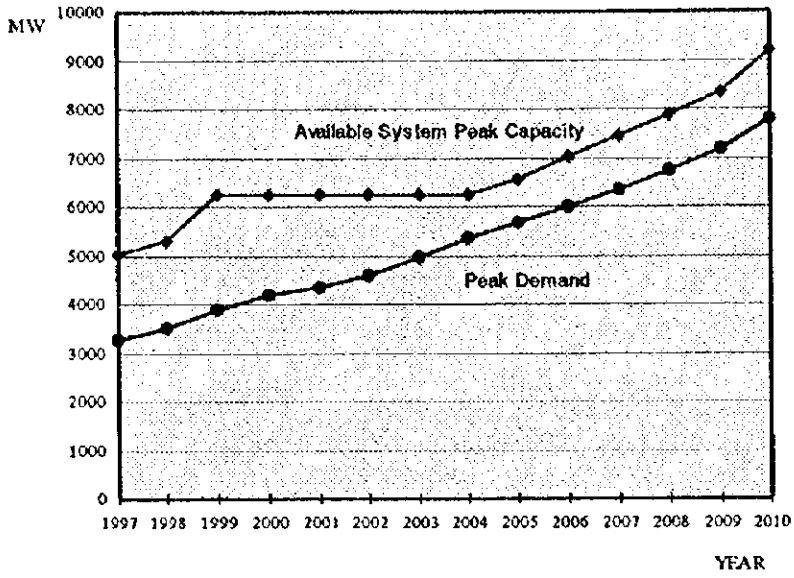


Figure 4.1-1 Balance of Demand and Supply of the whole Country

4.2 Forecast of Study Area (Damascus City and Rural Governorates)

4.2.1 Energy Demand Forecast

(1) Domestic Sector

(a) Forecast of Population Increase

In accordance with the Statistical Abstract of 1997 published by the Central Bureau of Statistics, the number of inhabitants actually living in Syria classified by Governorate or Mohafaza based on the results of 1970, 1981 and 1994 population censuses is available as shown in Table 4.2-1. However, numbers of inhabitants of small administrative divisions, e.g. Mantika or Nahia, are not available to the Study Team. Accordingly, it is very difficult for the Team to conduct power demand forecast of small administrative divisions. Forecasting was performed only on the governorate basis.

Table 4.2-1 Population in Syria

		1970	1981	1994	1995(*)	1996(*)	1997(*)
Syria	(x 1000)	6,305	9,046	13,782	14,153	14,619	15,100
Damascus	(x 1000)	839	1,113	1,394.3	--	--	1,463
Share	(%)	13.3	12.3	10.1			9.7
Damascus Rural	(x 1000)	624	914	1,646.7	--	--	1,866
Share	(%)	9.9	10.1	11.9			12.4

(Source: Statistical Abstract 1997 published by the Central Bureau of Statistics)

Note: Figures in 1995, 1996 and 1997 are estimated by the Central Bureau of Statistics.

The population of Syria has increased with a growth rate of 3.1% up to date. The same assumption with the EDF report is used to estimate the population growth in this study, in which the growth rate is assumed to decrease in the study period and reach 2.5% in 2010. From the actual growth rate up to 1997 and the estimated growth rate in the future, the evolution of growth rate in population is represented by an exponential curve as shown on Fig. 4.2-1.

To obtain a population in the Damascus and Damascus Rural area, we refer the shares of population of the Damascus or Damascus Rural area in the population of whole Syria which were announced by the Central Bureau of Statistics for the years 1970, 1981 and 1994. It is found that the share of Damascus has decreased from13.3 % in 1970 to 10.1 % in 1994, and on the contrary, the share of Damascus Rural area has increased from 9.9 % to 11.9 %. While the share of population of the combined Damascus and Damascus Rural area has remained almost constant. As shown on Fig. 4.2-2, the shares of both Damascus and Damascus Rural areas are extended from the historical trends to the study period by means of exponential and logarithmic curves. Thus, numbers of population in the Damascus and Damascus Rural areas are calculated by the shares in the population of whole Syria obtained from the above exponential and logarithmic curves.

(b) Number of Consumers in Domestic Sector

Number of person per household in 1994 was 5.14 for Damascus and 6.04 for Damascus Rural areas. Both figures are less than the average number of person of whole Syria, which stands at 6.12 for urban and 6.9 for rural area. According to the EDF report, the number of person per household is supposed to increase up to 2000 and decrease thereafter. Based on the EDF's assumptions it is estimated in our study that the numbers of person per household for both Damascus and Damascus Rural areas will remain at the same level up to 2000 and decrease by 1.12 point for the both areas up to 2010.

The geographical coverage by the distribution network or, in other words, electrification ratio in the country is reported at 100% in cities and 94% in rural areas in 1994. For the Damascus City and Damascus Rural area, the ratio is estimated at 100%.

A number of customers, therefore should be the same with the number of households. However, the number of domestic consumers in Damascus City is more than the number of households by around 6%. It seems that a lot of people from the countryside of Syria as well as foreigners are living in Damascus and extra dwelling units are required for them. Therefore, the number of consumers in Damascus City is to include such extra dwelling units for the study period with the same ratio of 6 % in 1994.

(c) Unit Consumption per Consumer

EDF has made a forecast of the energy consumption per household based on the estimated penetration rates of electrical appliances by household. The following table shows the penetration rate of each appliance:

Table 4.2-2 Penetration Rates of Appliances (%)

Item	City Centers			Rural areas		
	1994	2000	2010	1994	2000	2010
Basic Appliances (TV, lighting and refrigerator)	100	100	100	100	100	100
Washing machines	22	24	30	12	15	22
Water heaters	65	73	77	25	31	46
Air conditioners	47	63	89	15	18	24
Electric heaters	43	49	59	21	22	27

(Source: Load Forecast Study in 1996, ESSP Generation and Transmission Master Plan)

Consumption of appliances are also estimated by the EDF as follows:

Table 4.2-3 Consumption of Appliances

	kW	Hour/day	kWh/year
Lighting	1.4	3	470
TV	0.05	5	92
Refrigerator	0.1	12	438
Water heater	3	3.2	1500
Air conditioner	4	10	2700
Electric heater	3	8	900

(Source: Load Forecast Study in 1996, ESSP Generation and Transmission Master Plan)

Note: Air conditioning, 2.25 months per year

Electric heater, 40 days per year.

From the above assumptions, annual energy consumption per household was estimated in the EDF report for the urban and rural areas and the Team estimated for the Damascus and Damascus Rural areas as follows:

Table 4.2-4 Unit Consumption per Household

(in kWh/year)

	1994	2000	2010
EDF's forecast for whole country			
Urban	3,586	4,170	4,878
Rural	2,052	2,251	2,790
Team's forecast			
Damascus	3,288 in 1997	3,528	4,327
Damascus Rural	2,439 in 1997	2,875	4,327

(Source: Load Forecast Study in 1996, ESSP Generation and Transmission Master Plan)

The electricity consumption per household for Damascus is assumed to increase with the same pace of that for Urban area in the EDF report, starting from the actual consumption of 3,288 kWh in 1997. Unit consumption for the Damascus rural area was 2,439 kWh in 1997, which was much lower than that of Damascus city. In this study, it is assumed that the unit consumption of the Damascus Rural area will increase with a higher pace than Damascus and finally reach the same as Damascus in 2010 as shown in the above Table 4.2-4 and Fig. 4.2-3.

(d) Total Energy Consumption by Domestic Sector

The energy consumption figures by the domestic sector of the Damascus City and Damascus Rural areas are calculated by the number of consumers multiplied by the unit consumption by household. The results of calculated consumption are shown in Table 4.2-5 and summarized in Table 4.2-6.

Table 4.2-6 Summary of Domestic Consumption

		1997	2000	2005	2010
Damascus					
Population	(x 1000)	1,463	1,564	1,696	1,815
No. of consumers	(x 1000)	302.7	322.6	392.7	478.5
Consumption	(GWh)	995	1,138	1,542	2,071
Growth Rate	(%)		(96-2000)	(2000-5)	(2005-10)
			1.96	6.26	5.04
Damascus Rural					
Population	(x 1000)	1,866	2,065	2,470	2,911
No. of consumers	(x 1000)	310.2	341.7	450.5	591.7
Consumption	(GWh)	753	982	1,622	2,560
Growth Rate	(%)		(96-2000)	(2000-5)	(2005-10)
			6.12	10.55	9.56

(2) Industrial and Commercial Sectors

(a) Gross Domestic Product (GDP)

GDP of whole Syria is obtained from the Statistical Abstract of 1997 published by the Central

Bureau of Statistics, but the regional GDPs especially for Damascus Governorate and Damascus Rural Governorate are not available to the study team. The structure of GDP for region or Governorate is different among each other depending on the respective economical activities.

In order to estimate the GDP for the Damascus and Damascus Rural areas, the Statistics of Economical Establishments by Mohafaza in 1994 from the Central Bureau of Statistics are used as suggested by the Counterpart of PEDEEE. Table 4.2-7 shows the numbers of economic establishments by Mohafaza in 1994 for various sectors and Table 4.2-8 shows the number of economic establishments for the Damascus and Damascus Rural areas rearranged in the same categories of GDP and the ratio of number of establishments to that of whole Syria. GDPs for respective Damascus and Damascus Rural areas are estimated as shown in Table 4.2-9, in which the regional GDP for each sector are calculated from GDP of whole Syria in 1994 multiplied by the ratios of Damascus and Damascus Rural areas. By applying the same method to GDP from 1990 to 1996 for whole Syria, the regional GDP for Damascus and Damascus Rural areas from 1990 to 1996 are calculated and shown in Table 4.2-10.

(b) Evolution of GDP

On the basis of the EDF's assumptions for the Scenario-1 made in the report of Load Forecast Study, the evolution of GDP for the study period is assumed as follows:

(i) GDP of whole Syria would increase with a growth rate of 6.5% per annum during the study period.

(ii) The service activities will play an important role in the economical development in Syria, of which the share in GDP will reach 50% in 2010.

(iii) The industry will remain essentially constant, but the mining will decrease its share during the period. The total share of mining and manufacturing is estimated to decrease from 30% in 1996 to 25% in 2010 in our study.

(iv) The agriculture will continue to develop on the past tendency, however its share in GDP will gradually decrease from 20% in 1996 to 17% in 2010.

From the above assumptions for economical activities of Syria during the study period, GDP for whole Syria is developed for the study period as shown in Table 4.2-11. The growth rate of each sector obtained in the above table is applied to the respective sectors of the Damascus and Damascus Rural areas to extend to future evolution in GDP. The preliminarily estimated GDPs for the Damascus and Damascus Rural areas for 1997 to 2010 are shown in Table 4.2-12. However, it is found in the forecast of GDP in Damascus city that the share of commercial sector in the total GDP will increase and exceed 50% in 2000 with the high average growth rate of around 8% through the study area, and then finally reaches 58% in 2010. It is generally said that Damascus city has been well developed in the industrial and commercial fields and has nearly

saturated at the present so that further development will be taken over by the Damascus Rural Governorate in every respect. The Team, therefore assumed that some portions of GDP in commercial sector after 2000 will shift to that of the Damascus Rural area and the total GDP in commercial sector of both Damascus and Damascus Rural area will be equally shared by the both governorates, as shown in Table 4.2-13.

The estimated GDP growths in the study period for the both Damascus and Damascus Rural areas are accordingly adjusted and shown in Table 4.2-14.

(c) Relation between Energy Sales and GDP

The electricity consumption is closely related to the economic activities, especially for industrial and commercial consumption. In forecasting the energy demand of the industrial and commercial sectors, the growth of GDP is considered to be an important parameter in estimating future energy consumption.

The elasticity, relation factor between growth rates of energy consumption and GDP in the respective sector, is obtained from the historical trends of energy consumption and GDP as presented by the following formula:

$$\text{Elasticity} = \frac{\text{Average Growth Rate of Energy Demand (\%)}}{\text{Average Growth Rate of GDP (\%)}}$$

The following Table 4.2-15 summarizes the results of calculating elasticity obtained through our analysis on past trends of energy consumption and GDP growth.

Table 4.2-15 Elasticity

District	Sector	Ave. growth Rate		Elasticity	After Adjusted
		Energy (%)	GDP (%)		
Damascus	Industry	4.49	7.11	0.63	0.7
	Commercial	20.51	9.90	2.07	2.0
Damascus Rural	Industry	10.75	7.06	1.52	1.5
	Commercial	15.48	10.09	1.53	1.5

The detailed methods to obtain average growth rates of energy consumption and GDP are explained in Attachment 4-1.

(d) Energy Consumption by Industrial and Commercial Sectors

The future energy consumption of the industrial sector and commercial sector is computed using the above elasticity and the estimated growth rate of GDP of each sector. Details of calculation is shown in Tables 4.2-16 (1) and (2) and summarized as follows:

Table 4.2-17 Summary of Industrial and Commercial Consumption

(in GWh)

	1997	2000	2005	2010	Ave. Growth Rates (%)		
					96-2000	2000-05	2005-10
Damascus							
Industry	346.7	386.5	462.5	551.8	2.63	3.65	3.60
Commercial	332.1	535.8	1,023.4	1,903.2	19.17	13.82	13.21
Damascus Rural							
Industry	950.9	1,194.7	1,740.5	2,521.1	15.24	7.82	7.69
Commercial	86.1	124.1	258.5	526.6	12.50	15.80	15.30

(3) Other Sectors

(a) Street Lighting

As suggested in the EDF's report, the energy consumption by street lighting is linked with the number of domestic consumers. The electricity consumption of street lighting in the study area has grown in proportion to the growth of the number of domestic consumers.

(b) Government Services

The consumption of government offices including PEDEEE's offices and religious places are assumed to grow in proportion to the growth of population.

(4) Losses

The past trends of losses in the Damascus and Damascus Rural area and the analysis on the losses by the PEDEEE are described in the Sub-Clause 3.2.2 (6).

For the energy demand forecast, it is assumed that the losses will decrease gradually during the study period as follows:

(a) Technical losses will decrease to 11.4% by 2010, which comprises 0.9% for 66 kV, 2.5% for 20 kV and 8.0% for 400 V systems.

(b) Non-technical loss of Damascus is supposed to decrease by 9.0 points and reach 3.5 % in 2010, which is the same level as that EDF estimated in his report.

(c) Non-technical loss of the Damascus rural area was 16.2% in 1997, 4% higher than that of Damascus. It is assumed that the non-technical losses of the Damascus rural area will also decrease by the same points as Damascus, e.g. 9.0 points, and finally reach 7.0% in 2010.

(d) Out of non-technical losses, commercial losses are considered to decrease from 2% in 1997 to around 0.5% in 2010 for the both areas.

(5) Results of Energy Demand Forecast

The following are a summary of the energy forecast calculated with the above assumptions and methodology:

Table 4.2-18 Summary of Energy Demand Forecast

(in GWh)

	1997	2000	2005	2010
Damascus				
Total Sales	1,806.2	2,216.4	3,198.0	4,707.9
- Motive Energy	346.7	386.5	496.5	551.8
- Lighting Energy	1,459.6	1,829.9	3,228.0	4,156.1
Distribution Losses	713.2	747.2	817.2	824.1
	(28.3 %)	(25.2 %)	(20.1 %)	(14.9 %)
Damascus Rural				
Total Sales	1,840.6	2,356.6	3,691.5	5,696.4
- Motive Energy	950.9	1,194.7	1,740.5	2,521.1
- Lighting Energy	889.7	1,161.9	1,951.0	3,175.3
Distribution Losses	893.5	980.7	1,158.9	1,284.5
	(32.7 %)	(29.4 %)	(23.9 %)	(18.4 %)

The detail of results is shown in Tables 4.2-16 (1) and (2) and the graphical presentation of the results is shown on Figs. 4.2-4 and 4.2-5.

4.2.2 Peak Load Forecast

Table 4.2-19 shows the recent values of peak load of the Damascus and Damascus Rural area:

Table 4.2-19 Peak Load in Damascus and Damascus Rural

	1995	1996	1997
Damascus			
Total Consumption (GWh)	2,292	2,476	2,519
Peak Load (MW)	402	400	495
Load Factor	0.65	0.71	0.58
Damascus Rural			
Total Consumption (GWh)	2,216	2,477	2,734
Peak Load (MW)	371	441	468
Load Factor	0.68	0.64	0.67
Damascus and Damascus Rural			
Total Consumption (GWh)	4,509	4,954	5,253
Peak Load (MW)	767	776	912
Load Factor	0.67	0.73	0.66

Source: Regional Control Center, PEDEEE

Note: All peak loads for Damascus, Damascus Rural areas and combined system of study area did not occurred simultaneously. The summation of peak loads for Damascus and Damascus Rural, therefore do not correspond with the peak load of combined area.

As seen in the above table, the load factors of the combined Damascus and both areas were different among each other. Further, even in the same area the load factors varied in a wide range year by year. The Team considers that the 1997 load factors of each area and the combined area are considered to represent the actual situations very closely. For conducting the peak load forecast, the Team assumes the following conditions based on the peak loads in 1997:

(i) The daily load curve of Syria is of evening peak pattern. Therefore, the daily load factor tends to rise by increase of the daytime peak like industrial load and go down by increase in night peak like domestic load. The increase in commercial load will not much affect the daily load factor.

(ii) The load factor of 0.60 of Damascus City is assumed to rise gradually and that of the Damascus Rural area decline gradually.

(iii) The load factor of the combined Damascus and Damascus Rural area is assumed to remain unchanged at around 0.65 through the study period as no definite causes to change load factor can be identified.

The result of peak load forecast is shown in Table 4.2-21 and on Fig. 4.2-6, and summarized below:

Table 4.2-20 Summary of Peak Load Forecast

	1997	2000	2005	2010
Damascus				
- Peak Load (MW)	495	555	737	1,002
- Load Factor	0.58	0.61	0.62	0.63
Damascus Rural				
- Peak Load (MW)	468	573	845	1,245
- Load Factor	0.67	0.67	0.66	0.64
Total for Damascus and Damascus Rural				
- Peak Load (MW)	912	1,107	1,554	2,198
- Load Factor	0.66	0.65	0.65	0.65

4.2.3 Energy and Peak Load Forecast by Substation

Non-simultaneous peak load recorded at each substation in 1995 to 1997 in the Damascus and Damascus Rural area is shown in Table 4.2-22, in which peak loads are expressed in MVA. The energy demand recorded at each substation in 1990 to 1997 is shown in Table 4.2-23. It is noted that some substations, e.g. Midan-II, Qaboun-II, Al Hajer Al Aswad, etc. are supplying to both Damascus and Damascus Rural areas and, therefore, these substations are listed in the both areas with separate energy demand and peak load for each supplying area. The total energy consumption for the Damascus and Damascus Rural areas obtained by summing up all substation loads were not exactly same with the figures appeared in the Table3.2-9.

However, these data are considered still useful to understand the historical trends of energy and peak demand of each substation. The forecast of energy demand and peak load of each substation will be developed from actual figures of energy demands and peak loads recorded in 1997 at all substations.

Damascus City is administratively an independent Mohafaza and smaller administrative division does not exist, while in the Damascus Rural area there are smaller administrative divisions under the Mohafaza, namely Mantika under the Mohafaza and Nahia under the Mantika. However, social data or economic data of such smaller divisions were not available to the Team in terms of populations, number of household, GDP, number and floor spaces of establishment or consumer in each category, etc. Therefore, it was difficult to develop power demand forecast by district or substation in the same methodology applied to the energy demand forecast of the whole Damascus and Damascus Rural area as described in Sub-clause 4.2.1.

Under such a situation, a different method was employed to obtain the load demand forecast by substation by analyzing the following information:

(a) Supply area of each of the existing substations. The attached Figs. 4.2-7 and 4.2-8 show locations of the existing and planned substations as well as areas covering by the existing substations for the Damascus and Damascus Rural area.

(b) Characteristics of loads supplied by each substation, e.g. residential, commercial, and industrial uses.

(c) Any development plans near the substation, e.g. new residential town development, industrial zone development, etc.

(d) Other huge development plans by the Government, if any.

(e) Other information related to power consumption.

With the above information, the energy demand and peak load were forecasted in the following manner.

Energy Demand Forecast

(a) Sales energy of each substation was roughly divided into three categories, e.g. residential, commercial and industrial sectors, according to the collected information on characteristics of loads for each substation. Other miscellaneous small loads such as religious installations, street lighting, etc. were neglected.

(b) Energy demand of each category was developed for the study period by applying the same growth rate obtained from the energy demand forecast in the Sub-clause 4.2.1. Thus, energy demands of three categories were obtained for each substation.

(c) Additional power demand, which will be required for specific development plans known to the

Team, were added to the above energy demands.

(d) Losses were equally distributed to all substations in addition to the above energy demand. The rates of losses to the total energy consumption of each substation were the same as those assumed in Sub-clause 4.2.1 (4).

Peak Load Forecast

(a) Annual load factors were calculated from actual energy sales and peak loads in 1997 for all substations. The calculated load factor of each substation was applied through 1998 to 2010 to calculate the peak load from estimated energy. Load factor of each substation is assumed to remain same throughout the study period for the most of substations.

(b) In some substations, the calculated load factors in 1997 were judged significantly low or high compared with others. In such cases, the load factors were adjusted to realistic levels by the Team.

The details of the energy demand and peak load forecast by substations are shown in Table 4.2-24 for Damascus and Table 4.2-25 for Damascus Rural.

As shown in these tables, the total energy demand and peak load of each of Damascus and Damascus Rural area, which were obtained by summing up all figures of substation loads, were not same with values estimated in Sub-clause 4.2.1 and 4.2.2. The differences between two values of the total energy demand and peak load are adjusted by distributing the balance to all substations. The summary of the energy demand and peak load forecast by substation after such adjustments are tabulated in Tables 4.2-26 and 4.2 - 27.

PEDEE plans to construct the following new 66/20 kV substations in the study area during the period from 1999 to 2010, which are already committed or being under discussion with international organizations for financing. The details of development plans for substation facilities are explained in Chapter-6.

Damascus City : (1) Kafersuseh and Harash to be completed in 1999
(2) Barzeh, Jalaa, Shaik Hasan, Qsoor, Zablatani, Hosh Blas and Ibn Al Nafis to be completed in 2002

Damascus Rural : (1) Jededat Artouz, Bludan and Yalda to be completed in 2004
(2) Jaramana to be completed in 2002.
(3) Al Tal, Yabroud, Harasta, Nashabieh, Meleha, Kudseia 1, Kudseia 2, Darea and Saiedeh Zanab to be completed in 2006.

With the completion of the above planned substations, some substation loads will be shifted and/or reallocated to new substations. The peak load forecast by substation has been modified taking into account

the construction of new substations and reallocation of loads to the new substations. The simultaneous peak load forecast by substation including new substations modified based on the above peak load forecast after adjustment is shown in Table 4.2-28 for the study area, which will be used for the power flow analysis as described in the Chapter-7. The forecast for non-simultaneous peak loads by substation modified based on the same forecast but before adjustment is shown on the Table 4.2-29.

Table 4.1-2 Energy Demand Forecast for Whole Country (Scenario-1)

(Unit : GWh)

Scenario - 1	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Gross Generation	16,443	25,002	26,044	27,478	29,759	32,177	34,000	35,906	38,002	40,306	43,046	46,639
Total Auxiliary Consumption	1,185	1,250	1,302	1,374	1,488	1,609	1,700	1,795	1,900	2,015	2,152	2,332
Total Net Generation	15,258	23,752	24,742	26,104	28,271	30,568	32,300	34,111	36,102	38,291	40,894	44,307
Export to Lebanon	292	0	0	0	0	0	0	0	0	0	0	0
Total Internal Supply	14,966	23,752	24,742	26,104	28,271	30,568	32,300	34,111	36,102	38,291	40,894	44,307
Losses in 400kV & 230kV	580	744	757	779	823	868	893	918	946	975	1,011	1,063
Sales at 230kV Level	226	285	284	297	320	344	360	376	392	410	428	447
Supply to 66kV System	14,160	22,723	23,701	25,028	27,128	29,356	31,047	32,817	34,764	36,906	39,455	42,797
Losses in 66kV System	212	315	324	338	361	385	402	418	437	457	481	514
Sales at 66kV Level	1,209	1,692	1,740	1,752	2,102	2,446	2,486	2,644	2,840	3,083	3,380	3,743
Supply to 20kV System	12,739	20,716	21,637	22,938	24,665	26,525	28,159	29,755	31,487	33,366	35,594	38,540
Losses in 20kV System	515	795	823	865	922	982	1,033	1,082	1,134	1,190	1,258	1,349
Sales at 20kV Level	2,466	4,324	4,608	4,948	5,606	6,321	6,820	7,388	8,045	8,805	9,683	10,695
Supply to 0.4kV System	9,758	15,597	16,206	17,125	18,137	19,222	20,306	21,285	22,308	23,371	24,653	26,496
Losses in 0.4kV System	3,706	5,658	5,123	5,058	5,000	4,947	4,890	4,776	4,663	4,551	4,458	4,423
Sales at 0.4kV System	6,052	9,939	11,083	12,067	13,137	14,275	15,416	16,509	17,645	18,820	20,195	22,073
Total Sales	9,953	16,240	17,715	19,064	21,165	23,386	25,082	26,917	28,922	31,118	33,686	36,958
Total T & D Losses	5,013	7,512	7,027	7,040	7,106	7,182	7,218	7,194	7,180	7,173	7,208	7,349
Technical Loss	2,424	3,880	3,978	4,139	4,354	4,580	4,764	4,930	5,104	5,286	5,511	5,840
Non-technical Loss	2,589	3,632	3,049	2,901	2,752	2,602	2,454	2,264	2,076	1,887	1,697	1,509

(Source : ESSP G & T Master Plan)

Table 4.1-3 Energy Demand Forecast for Whole Country (Scenario-2)

(Unit : GWh)

Scenario - 2	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Gross Generation	16,443	23,127	24,199	25,661	27,972	30,418	32,270	34,338	36,595	39,060	41,962	45,525
Total Auxiliary Consumption	1,185	1,156	1,210	1,283	1,399	1,521	1,613	1,717	1,830	1,953	2,098	2,276
Total Net Generation	15,258	21,971	22,989	24,378	26,573	28,897	30,657	32,621	34,765	37,107	39,864	43,249
Export to Lebanon	292	0	0	0	0	0	0	0	0	0	0	0
Total Internal Supply	14,966	21,971	22,989	24,378	26,573	28,897	30,657	32,621	34,765	37,107	39,864	43,249
Losses in 400kV & 230kV	580	688	703	728	774	820	848	878	911	945	986	1,038
Sales at 230kV Level	226	285	284	297	320	344	360	376	392	410	428	447
Supply to 66kV System	14,160	20,998	22,002	23,353	25,479	27,733	29,449	31,367	33,462	35,752	38,450	41,764
Losses in 66kV System	212	291	301	315	339	364	381	400	420	442	469	501
Sales at 66kV Level	1,209	1,692	1,740	1,752	2,102	2,446	2,486	2,644	2,840	3,083	3,380	3,743
Supply to 20kV System	12,739	19,015	19,961	21,286	23,038	24,923	26,582	28,323	30,202	32,227	34,601	37,520
Losses in 20kV System	515	730	759	802	861	923	975	1,030	1,088	1,150	1,223	1,313
Sales at 20kV Level	2,466	4,324	4,608	4,948	5,606	6,321	6,820	7,388	8,045	8,805	9,683	10,695
Supply to 0.4kV System	9,758	13,961	14,594	15,536	16,571	17,679	18,787	19,905	21,069	22,272	23,695	25,512
Losses in 0.4kV System	3,706	3,671	3,170	3,139	3,114	3,094	3,070	3,128	3,187	3,245	3,324	3,439
Sales at 0.4kV System	6,052	10,290	11,424	12,397	13,457	14,585	15,717	16,777	17,882	19,027	20,371	22,073
Total Sales	9,953	16,591	18,056	19,394	21,485	23,696	25,383	27,185	29,159	31,325	33,862	36,958
Total T & D Losses	5,013	5,380	4,933	4,984	5,088	5,201	5,274	5,436	5,606	5,782	6,002	6,291
Technical Loss	2,424	3,523	3,631	3,802	4,028	4,263	4,458	4,656	4,862	5,076	5,331	5,659
Non-technical Loss	2,589	1,857	1,302	1,182	1,060	938	816	780	744	706	671	632

(Source : ESSP G & T Master Plan)

Table 4.1-6 Peak Load Forecast (Scenario-1 & 2) for Whole Country

(Unit : MW)

Scenario - 1	1996	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
South Region	898	1,260	1,312	1,385	1,500	1,622	1,713	1,810	1,915	2,031	2,168	2,350
Central Region	477	688	717	756	819	885	936	988	1,046	1,109	1,184	1,283
Coast (West) Region	362	526	548	578	626	677	715	755	800	848	905	981
North Region	705	999	1,040	1,098	1,189	1,285	1,359	1,435	1,518	1,610	1,720	1,863
East Region	414	615	641	676	732	791	836	883	935	991	1,058	1,147
Total in the Country	2,856	4,088	4,258	4,493	4,866	5,260	5,559	5,871	6,214	6,589	7,035	7,624

Scenario - 2	1996	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
South Region	879	1,165	1,219	1,293	1,409	1,533	1,626	1,730	1,843	1,968	2,114	2,294
Central Region	467	636	666	706	769	837	887	944	1,006	1,074	1,154	1,252
Coast (West) Region	354	486	509	539	588	639	678	722	769	821	882	957
North Region	690	924	967	1,026	1,118	1,215	1,289	1,371	1,462	1,561	1,677	1,819
East Region	404	570	597	633	690	750	795	846	902	963	1,034	1,122
Total in the Country	2,794	3,781	3,958	4,197	4,574	4,974	5,275	5,613	5,982	6,387	6,861	7,444

(Source : ESSP G & T Master Plan : Load Demand Forecast Tables-18 & 19)

Table 4.1-13 Balance of Demand and Supply of the Whole Country

Year	Actual/Forecasted Peak Demand (MW) (*1)	Available Capacity of Generating Plant (MW) (*2)	Balance (MW)	Actual/Forecasted Energy Required (GWh) (*3)	Remarks
1997	3,259	5,004	1,745	19,014	
1998	3,516	5,304	1,788	20,749	Addition of 1st Tishren (*4)
1999	3,883	6,234	2,351	22,918	Addition of 2nd Tishren & Al-Zara (*4)
2000	4,171	6,234	2,063	25,002	
2001	4,345	6,234	1,889	26,044	
2002	4,584	6,234	1,650	27,478	
2003	4,965	6,234	1,269	29,759	
2004	5,368	6,234	866	32,177	
2005	5,673	6,564	891	34,000	Planned with 330MW C.C & 110MW Gas (*5)
2006	5,991	7,004	1,013	35,906	Planned with 330MW C.C & 110MW Gas (*5)
2007	6,340	7,444	1,104	38,002	Planned with 330MW C.C & 110MW Gas (*5)
2008	6,725	7,884	1,159	40,306	Planned with 330MW C.C & 110MW Gas (*5)
2009	7,182	8,324	1,142	43,046	Planned with 330MW C.C & 110MW Gas (*5)
2010	7,781	9,204	1,423	46,639	Planned with 660MW C.C & 220MW Gas (*5)

(*1) Table 4.1-6 (Scenario-1)

(*2) Table 3.4-1, Technical Statistical Report-1996 of MOE

(*3) Table 4.1-2 (Scenario-1)

(*4) Technical Statistical Report-1996 of MOE

(*5) Technical Report No.3 of ESSP-EDF (Page-70)

Table 4.2-5 Energy Demand Forecast for Domestic Sector

		1970	1981	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Population in Syria	(x 1000)	6,305	9,046	13,782	14,153	14,619	15,100	15,580	16,066	16,556	17,051	17,551	18,055	18,563	19,075	19,590	20,109	20,630	21,154	21,681
Growth Rate	(%)				2.69%	3.29%	3.29%	3.18%	3.12%	3.05%	2.99%	2.93%	2.87%	2.81%	2.76%	2.70%	2.65%	2.59%	2.54%	2.49%
Damascus																				
Population in Damascus	(x1000)	839	1,113	1,394.3	1,417	1,440	1,463	1,507	1,536	1,564	1,591	1,618	1,644	1,670	1,696	1,721	1,745	1,769	1,792	1,815
Share against Whole Syria		13.30%	12.30%	10.1%	10.0%	9.8%	9.7%	9.68%	9.56%	9.44%	9.33%	9.22%	9.11%	9.00%	8.89%	8.78%	8.68%	8.57%	8.47%	8.37%
Growth Rate					1.61%	1.61%	1.63%	3.04%	1.88%	1.82%	1.75%	1.69%	1.64%	1.58%	1.52%	1.47%	1.41%	1.36%	1.31%	1.26%
Nos. of Person per household				5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.03	4.91	4.80	4.69	4.58	4.47	4.35	4.24	4.13	4.02
Nos. of household	(x1000)			271.4	275.7	280.2	284.7	293.4	298.9	304.3	316.6	329.3	342.5	356.2	370.4	385.3	400.8	417.0	433.9	451.4
Electrification Ratio	(%)				100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Nos. of customer	(x1000)				289.1	299.1	302.7	311.0	316.8	322.6	335.6	349.0	363.0	377.5	392.7	408.4	424.9	442.0	460.0	478.5
Consumption per household	(kWh)				3,007	3,519	3,288	3,368	3,448	3,528	3,608	3,688	3,768	3,848	3,928	4,008	4,088	4,167	4,247	4,327
Consumption	(GWh)				869	1,053	995	1,047	1,092	1,138	1,211	1,287	1,368	1,453	1,542	1,637	1,737	1,842	1,954	2,071
Growth Rate						21.06%	-5.45%	5.25%	4.30%	4.18%	6.38%	6.32%	6.26%	6.21%	6.17%	6.13%	6.10%	6.07%	6.05%	5.99%
Damascus Rural																				
Population in Damascus Rural	(x1000)	624	914	1,646.7	1,717	1,790	1,866	1,913	1,988	2,065	2,143	2,223	2,304	2,386	2,470	2,556	2,642	2,731	2,820	2,911
Share against Whole Syria		9.9%	10.1%	11.9%	12.1%	12.2%	12.4%	12.28%	12.38%	12.47%	12.57%	12.66%	12.76%	12.85%	12.95%	13.05%	13.14%	13.24%	13.33%	13.43%
Growth Rate					4.26%	4.26%	4.26%	2.54%	3.92%	3.85%	3.78%	3.71%	3.65%	3.58%	3.52%	3.46%	3.40%	3.34%	3.28%	3.22%
Nos. of Person per household				6.04	6.04	6.04	6.04	6.04	6.04	6.04	5.93	5.82	5.71	5.60	5.48	5.37	5.26	5.15	5.04	4.92
Nos. of household	(x1000)			272.5	284.1	296.2	308.8	316.6	329.0	341.7	361.3	381.9	403.6	426.5	450.5	475.8	502.4	530.5	560.1	591.7
Electrification Ratio	(%)				100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Nos. of customer	(x1000)				272.7	293.1	310.2	316.6	329.0	341.7	361.3	381.9	403.6	426.5	450.5	475.8	502.4	530.5	560.1	591.7
Consumption per household	(kWh)				2,081	2,642	2,439	2,584	2,730	2,875	3,020	3,165	3,311	3,456	3,601	3,746	3,891	4,037	4,182	4,327
Consumption	(GWh)				567.6	774.3	757	818	898	982	1,091	1,209	1,336	1,474	1,622	1,782	1,955	2,141	2,342	2,560
Growth Rate						36.43%	-2.29%	8.15%	9.76%	9.38%	11.08%	10.79%	10.53%	10.29%	10.07%	9.87%	9.69%	9.53%	9.37%	9.31%
Damascus + Damascus Rural																				
Population (City + Rural)		1,463	2,026	3,041	3,134	3,230	3,329	3,421	3,524	3,629	3,734	3,841	3,948	4,057	4,166	4,276	4,388	4,499	4,612	4,726
Share against Whole Syria		23.20%	22.40%	22.07%	22.14%	22.09%	22.05%	21.96%	21.94%	21.92%	21.90%	21.88%	21.87%	21.85%	21.84%	21.83%	21.82%	21.81%	21.80%	21.80%
Growth Rate					3.04%	3.06%	3.08%	2.76%	3.02%	2.96%	2.91%	2.85%	2.80%	2.75%	2.70%	2.65%	2.60%	2.55%	2.50%	2.46%
Nos. of household				543.9	559.8	576.4	593.5	610.0	627.9	646.0	677.9	711.2	746.1	782.6	820.9	861.1	903.2	947.5	994.0	1,043.1
Nos. of customer	(x1000)				561.8	592	613	628	646	664	697	731	767	804	843	884	927	972	1,020	1,070
Consumption per household	(kWh)				2,558	3,085	2,858	2,973	3,082	3,192	3,303	3,415	3,527	3,640	3,753	3,867	3,981	4,096	4,211	4,327
Consumption	(GWh)				1437.1	1,827	1,752	1,866	1,991	2,120	2,302	2,496	2,704	2,926	3,164	3,419	3,692	3,983	4,296	4,631
Growth Rate						27.13%	-4.11%	6.50%	6.69%	6.52%	8.56%	8.44%	8.33%	8.23%	8.13%	8.05%	7.97%	7.90%	7.84%	7.80%
Nos. of person per household(by EDF's report)																				
Urban				6.12	6.20	6.25	6.30	6.30	6.30	6.30	6.20	6.10	6.00	5.90	5.80	5.70	5.60	5.50	5.30	5.00
Rural				6.90	7.05	7.15	7.15	7.15	7.20	7.10	7.00	6.80	6.70	6.60	6.50	6.40	6.30	6.20	6.10	6.00

Table 4.2-7 Economical Establishment by Governorate in 1994

	Syria (Nos.)	Damascus (Nos.)	(%)	Damascus Rural (Nos.)	(%)	Remarks
(1) Agriculture+Hunting+Planting	6,557	142	2.17	725	11.06	
(2) Fishing	35	5	14.29	0	0.00	
(3) Mining	85	16	18.82	4	4.71	
(4) Manufacturing	86,517	14,894	17.22	14,634	16.91	
(5) Gas+Electicity+Water	762	27	3.54	84	11.02	
(6) Building & Cconstruction	3,917	1,028	26.24	606	15.47	
(7) Trade	240,761	37,582	15.61	28,757	11.94	
(8) Hotel & Restaurant	10,539	2,158	20.48	1,538	14.59	
(9) Transport & Communication	4,054	589	14.53	594	14.65	
(10) Finance	341	84	24.63	17	4.99	
(11) Estate & Renting	13,803	3,317	24.03	1,867	13.53	
(12) General management & Welfare	4,468	511	11.44	379	8.48	
(13) Education	13,211	853	6.46	937	7.09	
(14) Health & Social work	16,450	3,378	20.53	1,833	11.14	
(15) Social and personnel service	25,393	4,089	16.10	3,051	12.02	
(16) Unknown	4,929	1,882	38.18	169	3.43	
Total	431,822	70,555	16.34	55,195	12.78	

Table 4.2-8 Economical Establishment Adjusted for Sectors of GDP

	Syria (Nos.)	Damascus (Nos.)	(%)	Damascus Rural (Nos.)	(%)	Remarks
Agriculture	6,592	147	2.23	725	11.00	(1) + (2)
Mining & manufacturing	87,364	14,937	17.10	14,722	16.85	(3)+ (4) +(5)
Building & construction	3,917	1,028	26.24	606	15.47	(6)
Wholesale & retail trade	265,103	43,057	16.24	32,162	12.13	(7) + (8)+ (11)
Transport & communication	4,054	589	14.53	594	14.65	(9)
Finacne & insurance	341	84	24.63	25	7.22	(10)
Social & personnel services	34,129	4,742	13.89	3,149	9.23	(12) + (13) + (14)
Government service	25,393	4,089	16.10	3,051	12.02	(15)
Private non-profit service						
Total	426,893	68,673		55,034		

Table 4.2-9 GDP in 1994 Extended for Governorate

At Constanct Price in 1985 (Million SP)

	Syria	Damascus	(%)	Damascus Rural	(%)	Remarks
Agriculture	23,990	535	2.23	2,638	11.00	
Mining & manufacturing	33,210	5,678	17.10	5,596	16.85	
Building & construction	3,047	800	26.24	471	15.47	
Wholesale & retail trade	24,439	3,969	16.24	2,965	12.13	
Transport & communication	14,041	2,040	14.53	2,057	14.65	
Finacne & insurance	5,809	1,431	24.63	420	7.22	
Social & personnel services	1,849	257	13.89	171	9.23	
Government service	13,330	2,147	16.10	1,602	12.02	
Private non-profit service	113	0				
Total	119,828	16,856		15,920		

(Source: Statistics for Economical Establishment by Central Bureau of Statistic)

Table 4.2-10 GDP by Sector for Syria, Damascus and Damascus Rural Area

GDP by Sector in Whole Syria [1]

	1990	1991	1992	1993	1994	1995	1996	Share (%)	Growth 90-96	91-96
Agriculture	17,891	19,099	22,661	22,805	23,990	24,895	26,134	19.98	6.52	6.47
Mining & manufacturing	26,434	27,599	29,558	32,011	33,210	37,695	38,274	29.27	6.36	6.76
Building & construction	2,257	2,485	2,556	2,878	3,047	3,535	3,373	2.58	6.93	6.30
Wholesale & retail trade	16,032	17,531	21,421	21,986	24,439	24,659	23,175	17.72	6.33	5.74
Transport & communication	9,436	9,694	10,005	11,391	14,041	15,633	16,637	12.72	9.91	11.41
Finacne & insurance	3,974	4,190	4,797	5,530	5,809	6,011	6,728	5.14	9.17	9.93
Social & personnel services	1,315	1,512	1,633	1,738	1,849	1,732	1,701	1.30	4.38	2.38
Government service	12,063	13,724	13,302	13,899	13,330	13,620	14,612	11.17	3.25	1.26
Private non-profit service	83	90	108	108	113	124	136	0.10	8.58	8.61
Total	89,485	95,924	106,041	112,346	119,828	127,904	130,770	100.00	6.53	6.39

Damascus City	1990	1991	1992	1993	1994	1995	1996	Share (%)	Growth 90-96	Growth 93-96
Agriculture	399	426	505	509	535	555	583	3.16	6.52	4.65
Mining & manufacturing	4,520	4,719	5,054	5,473	5,678	6,445	6,544	35.49	6.36	6.14
Building & construction	592	652	671	755	800	928	885	4.80	6.93	5.43
Wholesale & retail trade	2,604	2,847	3,479	3,571	3,969	4,005	3,764	20.41	6.33	1.77
Transport & communication	1,371	1,408	1,454	1,655	2,040	2,271	2,417	13.11	9.91	13.46
Finacne & insurance	979	1,032	1,182	1,362	1,431	1,481	1,657	8.99	9.17	6.75
Social & personnel services	183	210	227	241	257	241	236	1.28	4.38	-0.71
Government service	1,942	2,210	2,142	2,238	2,147	2,193	2,353	12.76	3.25	1.68
Private non-profit service	0	0	0	0	0	0	0			
Total	12,590	13,505	14,713	15,805	16,856	18,119	18,440	100.00	6.57	5.27

Damascus Rural	1990	1991	1992	1993	1994	1995	1996	Share (%)	Growth 90-96	Growth 93-96
Agriculture	1,968	2,101	2,492	2,508	2,638	2,738	2,874	16.43	6.52	4.65
Mining & manufacturing	4,454	4,651	4,981	5,394	5,596	6,352	6,450	36.87	6.36	6.14
Building & construction	349	384	395	445	471	547	522	2.98	6.93	5.43
Wholesale & retail trade	1,945	2,127	2,599	2,667	2,965	2,992	2,812	16.07	6.33	1.77
Transport & communication	1,383	1,420	1,466	1,669	2,057	2,291	2,438	13.93	9.91	13.46
Finance & insurance	287	303	347	399	420	434	486	2.78	9.17	6.75
Social & personnel services	121	140	151	160	173	160	157	0.90	4.38	-0.71
Government service	1,449	1,649	1,598	1,670	1,602	1,636	1,756	10.04	3.25	1.68
Private non-profit service	0	0	0	0	0	0	0			
Total	11,957	12,774	14,029	14,914	15,920	17,150	17,494	100.00	6.55	5.46

(1) Source :Statistical Abstract 1997 by "Central Bureau of Statistic"

Table 4.2-11 Growth of GDP in Syria

GDP for Whole Syria (at constant price of 1985, in M. Syrian Pounds)

	1990	1991	1992	1993	1994	1995	1996	Growth 90-96	Growth 90-95	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	17,891	19,099	22,661	22,805	23,990	24,895	26,134	6.52	6.83	26,134	27,876	29,344	30,884	32,501	34,198	35,978	37,845	39,802	41,854	44,005	46,259	48,619	51,091	53,679
Mining & manufacturing	26,434	27,599	29,558	32,011	33,210	37,695	38,274	6.36	7.36	38,274	40,836	42,998	45,268	47,652	50,154	52,781	55,536	58,427	61,460	64,639	67,972	71,466	75,126	78,961
Sub-total for Industry	44,325	46,698	52,219	54,816	57,200	62,590	64,408	6.43	7.14	64,408	68,713	72,342	76,153	80,154	84,352	88,759	93,381	98,230	103,314	108,644	114,231	120,085	126,217	132,639
Building & construction	2,257	2,485	2,556	2,878	3,047	3,535	3,373	6.93	9.39	3,373														
Wholesale & retail trade	16,032	17,531	21,421	21,986	24,439	24,659	23,175	6.33	8.99	23,175														
Transport & communication	9,436	9,694	10,005	11,391	14,041	15,633	16,637	9.91	10.62	16,637														
Finacne & insurance	3,974	4,190	4,797	5,530	5,809	6,011	6,728	9.17	8.63	6,728														
Ssub-total for Commercial	31,699	33,900	38,779	41,785	47,336	49,838	49,913	7.86	9.47	49,913	54,985	59,759	64,922	70,504	76,536	83,055	90,098	97,706	105,923	114,794	124,371	134,709	145,865	157,897
Social & personnel services	1,315	1,512	1,633	1,738	1,849	1,732	1,701	4.38	5.66	1,701														
Government service	12,063	13,724	13,302	13,899	13,330	13,620	14,612	3.25	2.46	14,612														
Private non-profit service	83	90	108	108	113	124	136	8.58	8.36	136														
Sub-total for others	13,461	15,326	15,043	15,745	15,292	15,476	16,449	3.40	2.83	16,449	15,572	16,221	16,889	17,574	18,278	18,998	19,735	20,488	21,255	22,035	22,827	23,628	24,437	25,257
Total	89,485	95,924	106,041	112,346	119,828	127,904	130,770	6.53	7.41	130,770	139,270	148,323	157,964	168,231	179,166	190,812	203,215	216,424	230,491	245,473	261,429	278,422	296,519	315,793

Historical Trends of Share by each Sector

	1990	1991	1992	1993	1994	1995	1996			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	19.99	19.91	21.37	20.30	20.02	19.46	19.98			20.25	20.02	19.78	19.55	19.32	19.09	18.86	18.62	18.39	18.16	17.93	17.69	17.46	17.23	17.00
Mining & manufacturing	29.54	28.77	27.87	28.49	27.71	29.47	29.27			29.65	29.32	28.99	28.66	28.33	27.99	27.66	27.33	27.00	26.66	26.33	26.00	25.67	25.34	25.00
Sub-total for Industry	49.53	48.68	49.24	48.79	47.74	48.94	49.25			49.90	49.34	48.77	48.21	47.64	47.08	46.52	45.95	45.39	44.82	44.26	43.69	43.13	42.57	42.00
Building & construction																								
Wholesale & retail trade																								
Transport & communication																								
Finacne & insurance																								
Ssub-total for Commercial	35.42	35.34	36.57	37.19	39.50	38.97	38.17			38.67	39.48	40.29	41.10	41.91	42.72	43.53	44.34	45.15	45.96	46.76	47.57	48.38	49.19	50.00
Social & personnel services																								
Government service																								
Private non-profit service																								
Sub-total for others	15.04	15.98	14.19	14.01	12.76	12.10	12.58			11.43	11.18	10.94	10.69	10.45	10.20	9.96	9.71	9.47	9.22	8.98	8.73	8.49	8.24	8.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Historical Trends of Growth Rate and Forecast by EU's Report

	1990	1991	1992	1993	1994	1995	1996	Growth 90-96		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture		6.75	18.65	0.64	5.20	3.77	4.98				6.67	5.26	5.25	5.24	5.22	5.20	5.19	5.17	5.16	5.14	5.12	5.10	5.08	5.07
Mining & manufacturing		4.41	7.10	8.30	3.75	13.50	1.54				6.69	5.29	5.28	5.27	5.25	5.24	5.22	5.21	5.19	5.17	5.16	5.14	5.12	5.10
Building & construction																								
Wholesale & retail trade																								
Transport & communication																								
Finacne & insurance																								
Ssub-total for Commercial		6.94	14.39	7.75	13.28	5.29	0.15				10.16	8.68	8.64	8.60	8.56	8.52	8.48	8.44	8.41	8.38	8.34	8.31	8.28	8.25
Social & personnel services																								
Government service																								
Private non-profit service																								
Sub-total for others		13.85	-1.85	4.67	-2.88	1.20	6.29				-5.33	4.17	4.11	4.06	4.00	3.94	3.88	3.81	3.74	3.67	3.59	3.51	3.43	3.35
Total		7.20	10.55	5.95	6.66	6.74	2.24				6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5

Table 4.2-11 Growth of GDP in Syria

GDP for Whole Syria (at constant price of 1985, in M. Syrian Pounds)

	1990	1991	1992	1993	1994	1995	1996	Growth 90-96	Growth 90-95	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	17,891	19,099	22,661	22,805	23,990	24,895	26,134	6.52	6.83	26,134	27,876	29,344	30,884	32,501	34,198	35,978	37,845	39,802	41,854	44,005	46,259	48,619	51,091	53,679
Mining & manufacturing	26,434	27,599	29,558	32,011	33,210	37,695	38,274	6.36	7.36	38,274	40,836	42,998	45,268	47,652	50,154	52,781	55,536	58,427	61,460	64,639	67,972	71,466	75,126	78,961
Sub-total for Industry	44,325	46,698	52,219	54,816	57,200	62,590	64,408	6.43	7.14	64,408	68,713	72,342	76,153	80,154	84,352	88,759	93,381	98,230	103,314	108,644	114,231	120,085	126,217	132,639
Building & construction	2,257	2,485	2,556	2,878	3,047	3,535	3,373	6.93	9.39	3,373														
Wholesale & retail trade	16,032	17,531	21,421	21,986	24,439	24,659	23,175	6.33	8.99	23,175														
Transport & communication	9,436	9,694	10,005	11,391	14,041	15,633	16,637	9.91	10.62	16,637														
Finacne & insurance	3,974	4,190	4,797	5,530	5,809	6,011	6,728	9.17	8.63	6,728														
Ssub-total for Commercial	31,699	33,900	38,779	41,785	47,336	49,838	49,913	7.86	9.47	49,913	54,985	59,759	64,922	70,504	76,536	83,055	90,098	97,706	105,923	114,794	124,371	134,709	145,865	157,897
Social & personnel services	1,315	1,512	1,633	1,738	1,849	1,732	1,701	4.38	5.66	1,701														
Government service	12,063	13,724	13,302	13,899	13,330	13,620	14,612	3.25	2.46	14,612														
Private non-profit service	83	90	108	108	113	124	136	8.58	8.36	136														
Sub-total for others	13,461	15,326	15,043	15,745	15,292	15,476	16,449	3.40	2.83	16,449	15,572	16,221	16,889	17,574	18,278	18,998	19,735	20,485	21,255	22,035	22,827	23,628	24,437	25,257
Total	89,485	95,924	106,041	112,346	119,828	127,904	130,770	6.53	7.41	130,770	139,270	148,323	157,964	168,231	179,166	190,812	203,215	216,424	230,491	245,473	261,429	278,422	296,519	315,793

Historical Trends of Share by each Sector

	1990	1991	1992	1993	1994	1995	1996			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	19.99	19.91	21.37	20.30	20.02	19.46	19.98			20.25	20.02	19.78	19.55	19.32	19.09	18.86	18.62	18.39	18.16	17.93	17.69	17.46	17.23	17.00
Mining & manufacturing	29.54	28.77	27.87	28.49	27.71	29.47	29.27			29.65	29.32	28.99	28.66	28.33	27.99	27.66	27.33	27.00	26.66	26.33	26.00	25.67	25.34	25.00
Sub-total for Industry	49.53	48.68	49.24	48.79	47.74	48.94	49.25			49.90	49.34	48.77	48.21	47.64	47.08	46.52	45.95	45.39	44.82	44.26	43.69	43.13	42.57	42.00
Building & construction																								
Wholesale & retail trade																								
Transport & communication																								
Finacne & insurance																								
Ssub-total for Commercial	35.42	35.34	36.57	37.19	39.50	38.97	38.17			38.67	39.48	40.29	41.10	41.91	42.72	43.53	44.34	45.15	45.96	46.76	47.57	48.38	49.19	50.00
Social & personnel services																								
Government service																								
Private non-profit service																								
Sub-total for others	15.04	15.98	14.19	14.01	12.76	12.10	12.58			11.43	11.18	10.94	10.69	10.45	10.20	9.96	9.71	9.47	9.22	8.98	8.73	8.49	8.24	8.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Historical Trends of Growth Rate and Forecast by EU's Report

	1990	1991	1992	1993	1994	1995	1996	Growth 90-96		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture		6.75	18.65	0.64	5.20	3.77	4.98				6.67	5.26	5.25	5.24	5.22	5.20	5.19	5.17	5.16	5.14	5.12	5.10	5.08	5.07
Mining & manufacturing		4.41	7.10	8.30	3.75	13.50	1.54				6.69	5.29	5.28	5.27	5.25	5.24	5.22	5.21	5.19	5.17	5.16	5.14	5.12	5.10
Building & construction																								
Wholesale & retail trade																								
Transport & communication																								
Finacne & insurance																								
Ssub-total for Commercial		6.94	14.39	7.75	13.28	5.29	0.15				10.16	8.68	8.64	8.60	8.56	8.52	8.48	8.44	8.41	8.38	8.34	8.31	8.28	8.25
Social & personnel services																								
Government service																								
Private non-profit service																								
Sub-total for others		13.85	-1.85	4.67	-2.88	1.20	6.29				-5.33	4.17	4.11	4.06	4.00	3.94	3.88	3.81	3.74	3.67	3.59	3.51	3.43	3.35
Total		7.20	10.55	5.95	6.66	6.74	2.24				6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5

Table 4.2-12 Growth of GDP in Damascus and Damascus Rural

Damascus	1990	1991	1992	1993	1994	1995	1996	Growth 90-96	Growth 90-95	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	399	426	505	509	535	555	583	6.52	6.83	583	622	654	689	725	763	802	844	888	933	981	1032	1084	1139	1197
Mining & manufacturing	4,520	4,719	5,054	5,473	5,678	6,445	6,544	6.36	7.36	6,544	6,982	7,352	7,740	8,147	8,575	9,024	9,495	9,990	10,508	11,052	11,622	12,219	12,845	13,500
Sub-total for Industry	4,918	5,145	5,559	5,982	6,213	7,000	7,127	6.38	7.31	7,127	7,604	8,006	8,428	8,872	9,338	9,826	10,339	10,877	11,441	12,033	12,653	13,303	13,984	14,697
Building & construction	592	652	671	755	800	928	885	6.93																
Wholesale & retail trade	2,604	2,847	3,479	3,571	3,969	4,005	3,764	6.33																
Transport & communication	1,371	1,408	1,454	1,655	2,040	2,271	2,417	9.91																
Finacne & insurance	979	1,032	1,182	1,362	1,431	1,481	1,657	9.17																
Sub-total for Commercial	5,546	5,940	6,785	7,343	8,240	8,685	8,724	7.84	9.38	8,724	9,610	10,445	11,347	12,323	13,377	14,516	15,747	17,077	18,513	20,064	21,737	23,544	25,494	27,597
Social & personnel services	183	210	227	241	257	241	236	4.38																
Government service	1,942	2,210	2,142	2,238	2,147	2,193	2,353	3.25																
Private non-profit service	0	0	0	0	0	0	0																	
Sub-total for others	2,125	2,420	2,369	2,480	2,403	2,434	2,589	3.35	2.75	2,589	2,451	2,553	2,658	2,766	2,877	2,991	3,107	3,225	3,346	3,469	3,593	3,719	3,847	3,976
Total	12,590	13,505	14,713	15,805	16,856	18,119	18,440	6.57	7.55	18,440	19,665	21,004	22,434	23,961	25,592	27,333	29,193	31,179	33,300	35,565	37,984	40,567	43,325	46,270
Growth Rate																								
Industry incl. Agriculture		4.60	8.05	7.60	3.87	12.67	1.81				6.69	5.29	5.28	5.26	5.25	5.23	5.22	5.20	5.19	5.17	5.15	5.14	5.12	5.10
Commercial		7.10	14.23	8.23	12.21	5.40	0.45				10.16	8.68	8.64	8.60	8.56	8.52	8.48	8.44	8.41	8.38	8.34	8.31	8.28	8.25
Total for Damscus		7.27	8.95	7.42	6.65	7.49	1.77				6.65	6.81	6.81	6.81	6.81	6.81	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80

Damascus Rural	1990	1991	1992	1993	1994	1995	1996	Growth 90-96	Growth 90-95		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	1,968	2,101	2,492	2,508	2,638	2,738	2,874	6.52	6.83	2,875	3,066	3,228	3,397	3,575	3,762	3,958	4,163	4,378	4,604	4,841	5,088	5,348	5,620	5,905
Mining & manufacturing	4,454	4,651	4,981	5,394	5,596	6,352	6,450	6.36	7.36	6,449	6,881	7,245	7,628	8,029	8,451	8,894	9,358	9,845	10,356	10,892	11,453	12,042	12,659	13,305
Sub-total for Industry	6,422	6,751	7,473	7,902	8,235	9,090	9,324	6.41	7.20	9,324	9,947	10,473	11,025	11,605	12,213	12,851	13,521	14,223	14,960	15,732	16,542	17,390	18,279	19,210
Building & construction	349	384	395	445	471	547	522	6.93																
Wholesale & retail trade	1,945	2,127	2,599	2,667	2,965	2,992	2,812	6.33																
Transport & communication	1,383	1,420	1,466	1,669	2,057	2,291	2,438	9.91																
Finance & insurance	287	303	347	399	420	434	486	9.17																
Ssub-total for Commercial	3,964	4,234	4,807	5,181	5,913	6,263	6,257	7.91	9.58	6,257	6,893	7,491	8,139	8,838	9,595	10,412	11,295	12,249	13,278	14,391	15,591	16,887	18,286	19,794
Social & personnel services	121	140	151	160	171	160	157	4.38																
Government service	1,449	1,649	1,598	1,670	1,602	1,636	1,756	3.25																
Private non-profit service	0	0	0	0	0	0	0																	
Sub-total for others	1,571	1,788	1,749	1,830	1,772	1,796	1,913	3.34	2.72	1,913	1,811	1,886	1,964	2,043	2,125	2,209	2,295	2,382	2,471	2,562	2,654	2,747	2,841	2,937
Total	11,957	12,774	14,029	14,914	15,920	17,150	17,494	6.55	7.48	17,494	18,651	19,851	21,127	22,486	23,933	25,472	27,110	28,854	30,710	32,685	34,787	37,025	39,406	41,940
Growth Rate																								
Industry incl. Agriculture		5.13	10.69	5.74	4.21	10.39	2.57				6.69	5.28	5.27	5.26	5.24	5.23	5.21	5.20	5.18	5.16	5.15	5.13	5.11	5.09
Commercial		6.83	13.52	7.79	14.13	5.92	-0.10				10.16	8.68	8.64	8.60	8.56	8.52	8.48	8.44	8.41	8.38	8.34	8.31	8.28	8.25
Total for Rural Damscus		6.84	9.82	6.31	6.75	7.72	2.01				6.62	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43

Table 4.2-13 Adjustment in Commercial Sector

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Commercial Sector Before Adjustment															
Damascus	8,724	9,610	10,445	11,347	12,323	13,377	14,516	15,747	17,077	18,513	20,064	21,737	23,544	25,494	27,597
Damascus Rural	6,257	6,893	7,491	8,139	8,838	9,595	10,412	11,295	12,249	13,278	14,391	15,591	16,887	18,286	19,794
Total	14,981	16,503	17,936	19,486	21,161	22,972	24,928	27,042	29,325	31,792	34,454	37,329	40,431	43,780	47,391
Shares in Commercial Sector before Adjustment															
Damascus	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582	0.582
Damascus Rural	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418	0.418
Shares in Commercial Sector after adjustment															
Damascus	0.582	0.582	0.582	0.582	0.582	0.574	0.566	0.558	0.550	0.541	0.533	0.525	0.517	0.509	0.500
Damascus Rural	0.418	0.418	0.418	0.418	0.418	0.426	0.434	0.442	0.450	0.459	0.467	0.475	0.483	0.491	0.500
Commercial Sector After Adjustment															
Damascus	8,724	9,610	10,445	11,347	12,323	13,188	14,107	15,082	16,115	17,210	18,369	19,596	20,894	22,265	23,695
Damascus Rural	6,257	6,893	7,491	8,139	8,838	9,784	10,821	11,960	13,210	14,582	16,085	17,733	19,538	21,514	23,695
Total	14,981	16,503	17,936	19,486	21,161	22,972	24,928	27,042	29,325	31,792	34,454	37,329	40,431	43,780	47,391

Table 4.2-14 Adjusted Growth of GDP in Damascus and Damascus Rural

Damascus	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	583	622	654	689	725	763	802	844	888	933	981	1032	1084	1139	1197
Mining & manufacturing	6,544	6,982	7,352	7,740	8,147	8,575	9,024	9,495	9,990	10,508	11,052	11,622	12,219	12,845	13,500
Sub-total for Industry	7,127	7,604	8,006	8,428	8,872	9,338	9,826	10,339	10,877	11,441	12,033	12,653	13,303	13,984	14,697
Building & construction															
Wholesale & retail trade															
Transport & communication															
Finance & insurance															
Sub-total for Commercial	8,724	9,610	10,445	11,347	12,323	13,188	14,107	15,082	16,115	17,210	18,369	19,596	20,894	22,265	23,695
Social & personnel services															
Government service															
Private non-profit service															
Sub-total for others	2,589	2,734	2,848	2,965	3,085	3,209	3,335	3,465	3,597	3,732	3,869	4,008	4,148	4,290	4,434
Total	18439.7	19,948	21,299	22,741	24,280	25,735	27,269	28,886	30,589	32,383	34,271	36,257	38,345	40,540	42,827
Growth Rate															
Industry incl. Agriculture		6.69	5.29	5.28	5.26	5.25	5.23	5.22	5.20	5.19	5.17	5.15	5.14	5.12	5.10
Commercial		10.16	8.68	8.64	8.60	7.02	6.97	6.91	6.85	6.79	6.74	6.68	6.62	6.57	6.42
Total for Damscus		8.18	6.77	6.77	6.77	5.99	5.96	5.93	5.90	5.86	5.83	5.79	5.76	5.72	5.64

Damascus Rural		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	2,874	3,066	3,227	3,397	3,575	3,761	3,957	4,162	4,378	4,603	4,840	5,088	5,347	5,619	5,904
Mining & manufacturing	6,450	6,851	7,246	7,628	8,030	8,452	8,894	9,359	9,846	10,357	10,893	11,454	12,043	12,660	13,306
Sub-total for Industry	9,324	9,947	10,473	11,025	11,605	12,213	12,851	13,521	14,223	14,960	15,732	16,542	17,390	18,279	19,210
Building & construction															
Wholesale & retail trade															
Transport & communication															
Finance & insurance															
Ssub-total for Commercial	6,257	6,893	7,491	8,139	8,838	9,784	10,821	11,960	13,210	14,582	16,085	17,733	19,538	21,514	23,695
Social & personnel services															
Government service															
Private non-profit service															
Sub-total for others	1,913	2,020	2,104	2,190	2,279	2,370	2,464	2,559	2,657	2,756	2,858	2,960	3,064	3,169	3,275
Total	17,494	18,860	20,068	21,354	22,722	24,367	26,136	28,040	30,091	32,298	34,675	37,235	39,992	42,962	46,181
Growth Rate															
Industry incl. Agriculture		6.69	5.28	5.27	5.26	5.24	5.23	5.21	5.20	5.18	5.16	5.15	5.13	5.11	5.09
Commercial		10.16	8.68	8.64	8.60	10.70	10.60	10.53	10.45	10.38	10.31	10.24	10.18	10.12	10.14
Total for Rural Damscus		7.81	6.41	6.41	6.41	7.24	7.26	7.29	7.31	7.34	7.36	7.38	7.41	7.43	7.49

Damascus + Damascus Rural		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	3,457	3,688	3,882	4,085	4,299	4,524	4,759	5,006	5,265	5,537	5,821	6,119	6,431	6,758	7,101
Mining & manufacturing	12,994	13,863	14,597	15,368	16,177	17,027	17,918	18,854	19,835	20,865	21,944	23,076	24,262	25,504	26,806
Sub-total for Industry	16,451	17,551	18,479	19,454	20,477	21,551	22,678	23,860	25,101	26,401	27,765	29,195	30,693	32,263	33,907
Building & construction															
Wholesale & retail trade															
Transport & communication															
Finance & insurance															
Ssub-total for Commercial	14,981	16,503	17,936	19,486	21,161	22,972	24,928	27,042	29,325	31,792	34,454	37,329	40,431	43,780	47,391
Social & personnel services															
Government service															
Private non-profit service															
Sub-total for others	4,502	4,754	4,952	5,155	5,365	5,579	5,799	6,024	6,254	6,488	6,726	6,968	7,213	7,460	7,710
Total	35,933	38,808	41,367	44,094	47,002	50,101	53,405	56,926	60,680	64,681	68,946	73,492	78,337	83,502	89,008
Growth Rate															
Industry incl. Agriculture		6.69	5.29	5.27	5.26	5.24	5.23	5.21	5.20	5.18	5.17	5.15	5.13	5.11	5.10
Commercial		10.16	8.68	8.64	8.60	8.56	8.52	8.48	8.44	8.41	8.38	8.34	8.31	8.28	8.25
Total for Rural Damscus		8.00	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59