

THE FEASIBILITY STUDY
ON
THE REHABILITATION PROJECT
OF
DAMASCUS AND DAMASCUS RURAL DISTRIBUTION NETWORK
IN
SYRIAN ARAB REPUBLIC

FINAL REPORT

October 1999

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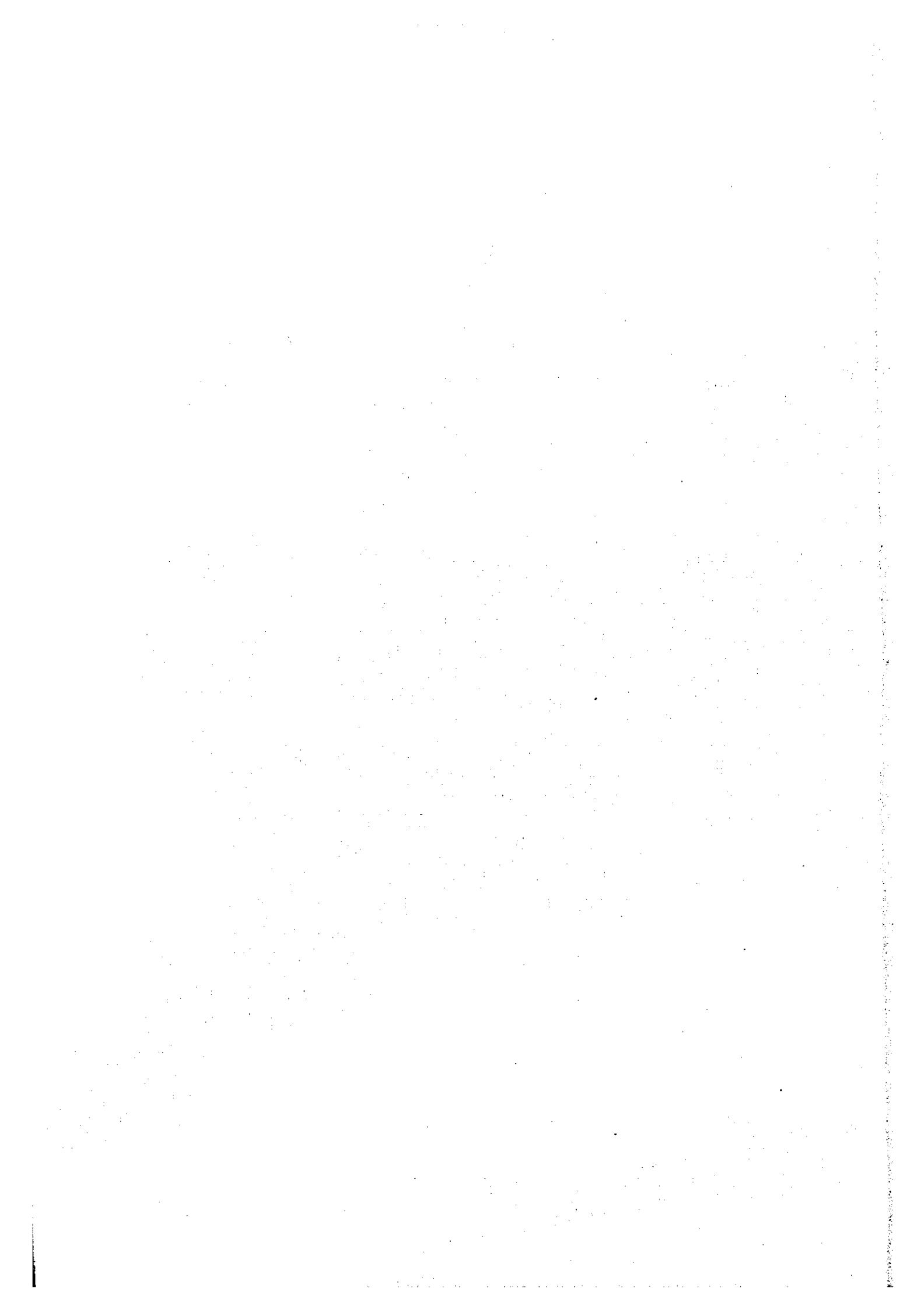
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JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.

TOKYO ELECTRIC POWER SERVICES CO., LTD.

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PREFACE

In response to a request from the Government of Syria, the Government of Japan decided to conduct and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent a study team led by Mr. Takao Sakuma of Nippon Koei Co., Ltd. and organized by Nippon Koei Co., Ltd. and Tokyo Electric Power Services Co., Ltd. to Syria four times from October 1998 to August 1999.

The team held discussions with the officials concerned of the Government of Syria, and conducted related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I hope this report will contribute to the improvement of the situation of Damascus and Damascus Rural Distribution Network and to enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Syria for their close cooperation throughout the study.

October 1999



Kimio Fujita

President

Japan International Cooperation Agency



October 1999

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita

Letter of Transmittal

We are pleased to submit you the feasibility study report on the rehabilitation project of Damascus and Damascus Rural distribution network in Syrian Arab Republic.

This study was conducted by the joint venture of Nippon Koei Co.,Ltd. And Tokyo Electric Power Services Co.,Ltd., under a contract to JICA, during the period from October 13, 1998 to November 8, 1999. The major contents of the Study are the preparation of basic rehabilitation plans of the distribution network in Damascus and Damascus Rural area, which are technically and economically feasible, and the feasibility study on the rehabilitation project for the period from 1999 to 2010.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs and the Ministry of International Trade and Industry. We would also like to express our gratitude to the officials concerned of the Ministry of Electricity, PEDEEE, JICA Syria office and Embassy of Japan in Syria for their cooperation and assistance throughout our field survey.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



Takao Sakuma

Team Leader

The feasibility study team on
the rehabilitation project of Damascus and
Damascus Rural Distribution Network

Syrian Arab Republic

The Joint Venture of Nippon Koei Co.,Ltd. and
Tokyo Electric Power Services Co.,Ltd.



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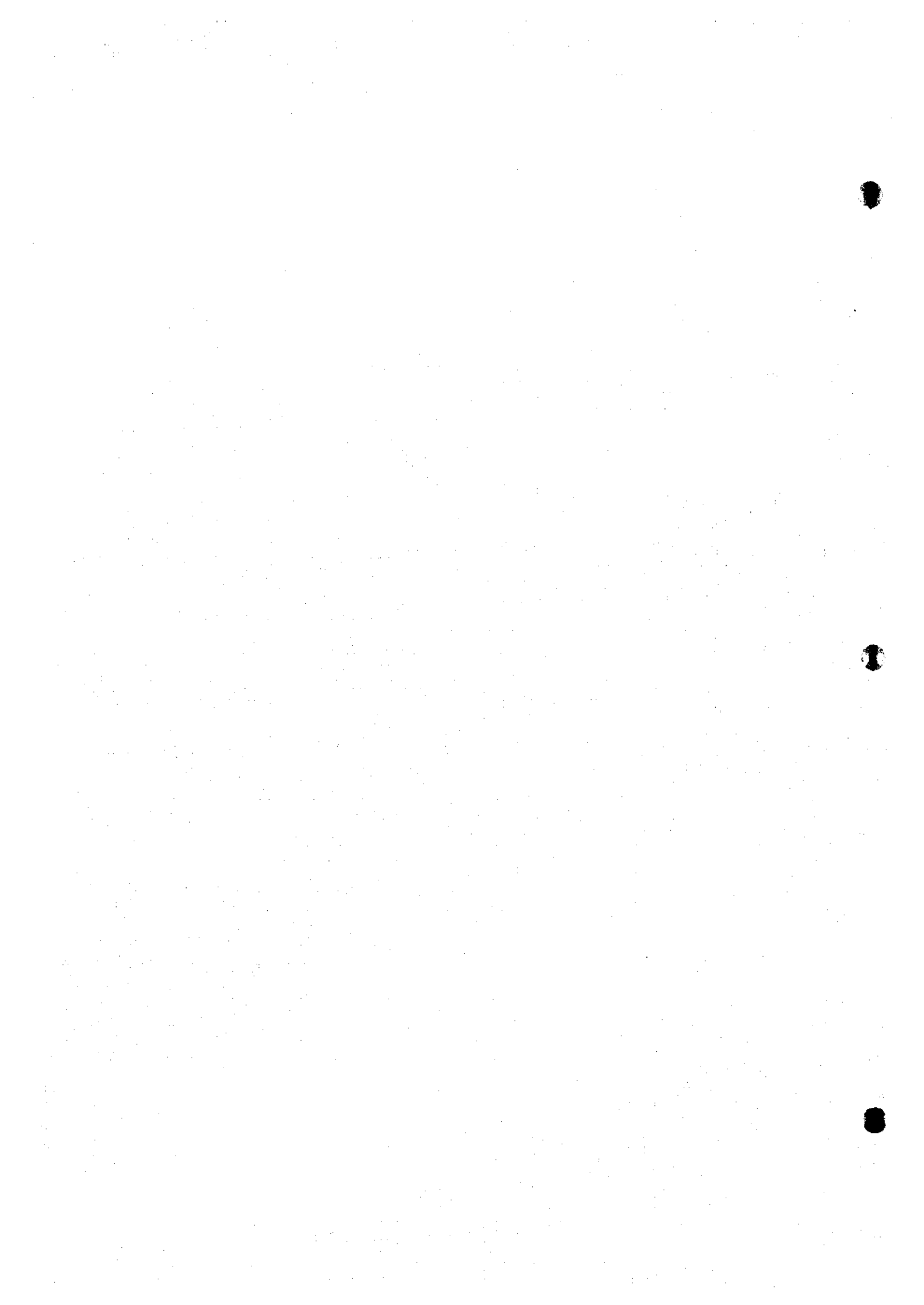
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ABBREVIATIONS

b/d	:	barrel per day
boe/d	:	barrel oil equivalent per day
DSM	:	Demand Side Management
ECU	:	Euro Currency Unit (ECU 1.00 = US\$ 1.0626, May 25, 1999)
EDF	:	Electricite de France
EIRR	:	Economic Internal Rate of Return
ENCC	:	Emergency National Control Center
ESSP	:	Electricity Sector Support Program
EU	:	European Union
FIRR	:	Financial Internal Rate of Return
FOB	:	Free on Board
GDP	:	Gross Domestic Product
GEF	:	Global Environmental Facilities
GIS	:	Gas Insulated Switchgear
GWh	:	Giga Watt-hour (10^6 kWh)
HV	:	High Voltage (400 kV and 230 kV in Syria)
HAL	:	Hard-drawn Aluminum Conductors
IEC	:	International Electro-technical Committee
IRR	:	Internal Rate of Return
ISO	:	International Standards Organization
JICA	:	Japan International Cooperation Agency
LF	:	Load Factor
LOLP	:	Loss of Load Probability
LRAIC	:	Long Run Average Incremental Cost
LRMC	:	Long Run Marginal Cost
LV	:	Low Voltage (400/220 V in Syria)
M & M	:	Merz & MacLellan
MOE	:	Ministry of Electricity
mteo	:	million tons of equivalent oil

MV	:	Medium Voltage (66 kV and 20 kV in Syria)
MVA	:	Mega Volt Ampere
MVar	:	Mega Volt Ampere Reactive
MW	:	Mega Watt (10^3 kW)
NCC	:	National Control Center
NPV	:	Net Present Value
O & M	:	Operation and Maintenance
OPC	:	Operation and Control (component of ESSP)
PEE	:	Public Establishment of Electricity (no more existed)
PEEGT	:	Public Establishment of Electricity for Generation and Transmission
PEDEEE	:	Public Establishment for Distribution and Exploitation of Electrical Energy
PLC	:	Power Line Carrier
PSS/E	:	Power System Simulator for Engineering (published by PTI, USA)
RCC	:	Regional Control Center
RTU	:	Remote Terminal Unit
SCADA	:	Supervisory Control and Data Acquisition
SP	:	Syrian Pound
SPC	:	State Planning Commission
T & D	:	Transmission and Distribution
VHF	:	Very High Frequency

CHAPTER I
INTRODUCTION



CHAPTER 1 INTRODUCTION

1.1 Background of the Study

The Power Supply situation of the Syrian Arab Republic (Syria) was very tight in the early 1990s and load shedding was prevailing due to severe shortage of generating capacity. However, since 1994 the supply capacity has been much increased by the commissioning of a number of thermal power plants, and at present the generation capacity is sufficient to meet the demand. Further development of power plants and extension of the existing 400/230 kV transmission system are planned to be implemented according to the Master Plan Study for Generation and Transmission System Development, which was formulated with assistance of European Union (EU).

While, the overall distribution system including 66 kV network in the country, that is under the control of the Public Establishment for Distribution and Exploitation of Electric Energy (PEDEEE), have been deteriorated as fundamental rehabilitation nor reinforcement works have not been performed for a long time. Due to improper configuration of the 20/0.4 kV network and shortage in capacity of distribution facilities, the system reliability has much declined and frequent fault outages and load shedding are therefore unavoidable. Very high system energy loss of around 30% is another problem. Thus, thorough system study and fundamental rehabilitation of the overall distribution system are urgently required.

Under such a situation, the Government of Syria officially requested the Government of Japan to conduct a comprehensive study of the existing distribution networks in the Damascus metropolitan area to formulate a rehabilitation plan of the distribution network. In reply to the request, the Government of Japan decided to implement this technical cooperation and entrusted the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan. JICA dispatched a preliminary study team in June 1998 to discuss with the Government of Syria about the implementing methods of the Study. The Scope of Works, that described works to be performed in the intended Study, were agreed between PEDEEE and JICA, and an agreement was signed in June 1998.

This study team conducted the Feasibility Study for the Rehabilitation Project of Damascus and Damascus Rural Distribution Network in Syrian Arab Republic as agreed between the both governments. The study area is limited to the areas covered by the Damascus Governorate and Damascus Rural Governorate.

1.2 Objectives and Contents of the Study

1.2.1 Objectives of the Study

Major problems of the existing distribution network in the study area to meet the future growing demand are

Introduction

as mentioned below:

- (a) Extraordinary high energy losses
- (b) Very large voltage drop in the low voltage distribution network
- (c) Insufficient capacity of distribution facilities in meeting demand
- (d) Deterioration of distribution facilities
- (c) Poor reliability of energy supply

Objectives of the Study are, therefore, to formulate a basic rehabilitation plan of the distribution network in the study area and to execute a feasibility study on the formulated rehabilitation plan.

Main objectives of the Study are as follows:

- (a) Finding of current problems and examination of improvement plans of 66 kV lines, 66/20 kV substations, 20 kV lines, 20/0.4-0.22 kV (0.4-0.22 kV is called 0.4 kV in this report) transformer facilities, and 0.4 kV network
- (b) Collection and analysis of necessary data related to the above facilities to understand the current problems in the system
- (c) Review of demand forecasts in the system including those of individual substations
- (d) Review of the current PEDEEE's standards/regulations/criteria for distribution facilities, equipment and system reliability
- (e) Review of and examination on PEDEEE's operation and maintenance practices and facility rehabilitation regulations/criteria, and preparation of recommendation for improvement of the regulations/criteria, if any
- (f) Preparation of basic criteria for rehabilitation of the distribution network in the study area
- (g) Preparation of a recommended system rehabilitation plan and a feasibility study on the prepared plan
- (h) Transfer of team's technical knowledge to counterpart personnel of PEDEEE through the whole study period

1.2.2 Contents of the Study

Contents of the Study that were agreed between PEDEEE and JICA, and carried out up to the completion of the Study are mentioned below.

The Study was conducted on the distribution network in the study area at the voltage level of 66 kV, 20 kV and 0.4 kV in the following three stages;

(1) Preliminary Investigation Stage

In order to clarify the current situation of Syrian electric power supply and present conditions of the distribution network in the study area, the following investigation and preparatory works shall be carried out:

- (a) Collection and review of relevant data and information including previous study reports
- (b) Field survey and investigation on the existing distribution facilities
- (c) Investigation of electric power loss at each voltage level of distribution network
- (d) Measurement of voltage drop at each voltage level of distribution network
- (e) Investigation of distribution system outages
- (f) Investigation of protective relaying system
- (g) Investigation of distribution facilities management system
- (b) Identification of problems on the distribution network (operation and maintenance)

(2) Detailed Investigation Stage

In order to prepare the optimum rehabilitation plans, the following review and studies were carried out:

- (a) Review of power demand forecast in the study area
- (b) Review of available distribution network expansion plans including ongoing projects.
- (c) Review of present design criteria and reliability standards
- (d) Review of present protective relaying system
- (e) Study on the improvement frameworks of the existing distribution network to meet the future demand in the study area
- (f) Preparation of rehabilitation plans for the existing distribution network in line with the above improvement frameworks
- (g) System analysis for the rehabilitation plans
- (b) Identification of effects of the rehabilitation plans such as loss reduction, improvement of system reliability and environmental impacts, etc.
- (i) Review of management system for distribution facilities (operation and maintenance)

(3) Feasibility Study Stage

The feasibility design for the above rehabilitation plans was formulated by assessing from a technical, economic and financial points of view.

- (a) Feasibility design for the rehabilitation plans of distribution network
- (b) Cost estimation
- (c) Formulation of an implementation work schedule
- (d) Economic and financial evaluation
- (e) Financial procurement

1.3 Schedule of the Study

(1) Preliminary Investigation Stage

A. Preparatory Works in Japan

Prior to commencing the site works, available data and information on general situation of Syria and present conditions of the PEDEEE power system including generation and transmission facilities were collected and analyzed in Japan. An execution plan of the Study was worked out, then the Inception Report was prepared referring to the terms of reference presented by JICA, describing in detail the proposed procedures of the Study to be carried out.

B. First Site Investigation Works

The First Site Investigation Works were carried out for the duration of two months from October to December 1998. On arrival in Damascus, the contemplated workflow and schedule of the Study were explained to PEDEEE based on the Inception Report. The PEDEEE working group fully understood the scope and methodology of the Study mentioned in the report, and accepted the whole content of the report. Besides, PEDEEE explained the current situation of the Master Plan Study under the EU's fund and relevance of the study to the JICA's study. PEDEEE promised to coordinate two studies so as to avoid duplication and contradiction between the both studies. Minutes of meeting for the discussion on the Inception Report is enclosed at the end of this Chapter as Attachment 1-1.

Major work items that were carried out during the First Site Investigation Works are as mentioned below:

- (a) Investigation of the existing facilities and proposed places for extension
- (b) Study on the existing power facilities and development plans programmed in the country
- (c) Collection of, review on and/or study of the nation-wide and region-wide power and energy demand forecasts
- (d) Investigation and analysis of PEDEEE's operation and maintenance systems
- (e) Investigation and analysis of the existing standards and criteria for distribution facilities and system reliability
- (f) Measurement of electrical elements of the distribution network in the study area.
- (g) Investigation of the protection relaying system
- (h) Investigation of PEDEEE's financial situation and local market survey for obtaining materials locally available and the experienced similar projects

C. First Study in Japan

Data and information collected and analyzed in Syria were reviewed, and draft "Database System for

Operation and Maintenance of PEDEEE" was prepared. The Progress Report was prepared summarizing the results of the site investigation and preliminary analysis.

(2) Detailed Investigation Stage

D. Second Site Investigation Works

The Second Site Investigation Works were carried out for the duration of two months from January to March of 1999. The contents of the Progress Report were explained to PEDEEE. Minutes of meeting for the discussion on the Progress Report is enclosed at the end of this Chapter as Attachment 1-2. And the following site works were performed:

- (a) Detailed investigation and examination of development/ rehabilitation plans of the distribution network studied by PEDEEE and others
- (b) Examination of and studies on improvement of standards/ regulations/ criteria for distribution facilities and system reliability applied by PEDEEE
- (c) Examination of the existing protection relaying system and studies on improvement of the system
- (d) Power flow analysis of the planned 66 kV network in the study area
- (e) Examination and formulation of the basic rehabilitation plans of the 66 kV network and 20 kV network in the study area
- (f) Estimation of effects of the formulated rehabilitation plans
- (g) Environmental assessment on the formulated plans
- (h) Transfer of the recommended database for operation and maintenance of the system to the PEDEEE's computer

E. Second Study in Japan

The Interim Report was prepared summarizing the results of examination and formulation of optimum rehabilitation plans for the overall distribution network in the study area.

(3) Feasibility Study Stage

F. Third Site Investigation Works

The Third Site Investigation Works were carried out for the duration of one month from May to June of 1999. The contents of the Interim Report were explained to PEDEEE. Minutes of meeting for the discussion on the Interim Report is enclosed at the end of this Chapter as Attachment 1-3. And the following site works were performed:

- (a) Feasibility design on the formulated rehabilitation plans for the distribution network

- (b) Preparation of an implementation schedule for the formulated plans
- (c) Estimation of investment costs and their programs for the formulated plans
- (d) Economic and financial evaluation of the formulated plans
- (e) Examination of funding sources for the formulated plans
- (f) Case study on one each 0.4 kV feeder selected by PEDEEE in the study area.

G. Third Study In Japan

The Draft Final Report for rehabilitation of the distribution network in the study area was prepared.

H. Fourth Site Works

The Draft Final Report was explained to PEDEEE, and discussions were made regarding the contents of the report. Further, the third seminar was held for more detail explanation of rehabilitation projects proposed in the draft final report. Minutes of meeting for the discussion on the Draft Final Report is enclosed at the end of this Chapter as Attachment 1-8.

I. Fourth Study in Japan

The Final Report was prepared by correcting the Draft Final Report referring to the comments from PEDEEE.

1.4 Personnel Related to the Study

The Syrian side organization participated in the Study was PEDEEE. The Study works were undertaken in the office of PEDEEE with good cooperation of the counterpart engineers from PEDEEE, the Public Distribution Companies of Damascus Governorate and of Damascus Rural Governorate.

(1) Syrian Side Organization

The PEDEEE's organization in charge of the Study was the Planning and Statistics Directorate under Eng. Emile Khadalaft, the Assistant General Director for Technical Affairs of PEDEEE. The counterpart engineers represented by Eng. Mustafa Sikhani, Deputy Director of Planning Dept. from PEDEEE, two person from the Public Distribution Company of Damascus, and three person from the Public Distribution Company of Damascus Rural were assigned to cooperate with the study team covering all the site work period. The list of key personnel who participated in the Study is in Attachment 1-4.

(2) JICA Study Team

The Feasibility Study on the Rehabilitation Project of Damascus and Damascus Rural Distribution Network

was carried out by the team of consultants from Nippon Koei Co., Ltd. and Tokyo Electric Power Services Co., Ltd., which was appointed by JICA. The team leader was Mr. Ko Nakajima (the first stage) / Sumio Tsukahara (the second stage) / Takao Sakuma (the third stage); they are the Senior Power System Engineers of Nippon Koei Co., Ltd. The list of JICA team members is in Attachment 1-5.

1.5 Provision of Equipment

As agreed between PEDDEE and JICA, JICA was to arrange equipment and devices listed in Table 1.5-1 to implement the Study. Measuring devices and equipment were used to measure electric elements of the distribution networks at site by the study team and the counterpart personnel. During the measuring works, the study team trained the counterpart personnel about how to use those measuring devices and equipment.

All of these equipment and devices were handed over to PEDDEE for their use in maintenance works at the end of the forth site investigation and study.

Table 1.5-1 List of Measuring Devices and Equipment

Device and Equipment	Specifications	Q'ty
Personal Computer (Laptop Type)	IBM ThinkPad 380 ED with MMX Pentium 166 MHz and 85 MB memory. Windows 98 and Microsoft Office Professional	3 units
Laser Printer	HP Laser Jet 6L, A4 size	1 set
Load Analyzer	HIOKI 3166 Clamp On Power Hi Tester with Options	3 sets
Clip-on Ammeter	HIOKI 3266 Clamp On P.F. Hi Tester	21 nos.
Portable type AC Volt meter	YOKOGAWA 2013-19, 300/700 V	1 unit
Portable type AC ammeter	YOKOGAWA 2013-06, 1/5 A	1 unit
Insulation Tester	YOKOGAWA 2406E, 250/500/1000 V	1 unit
Spot Thermometer	MINOLTA 505S with Options	1 unit
Cable Locator	Radio detection RD 400 PL	2 units
Leaders in Cable Fault Location	Bicest T510, Measurement of 3km maximum	1 unit
Meter Storage Box		2 units

1.6 Transfer of Knowledge

The Team transferred the team's knowledge to the counterpart personnel from PEDDEE and two Public Distribution Companies through the whole study period in Syria. The means of transfer were accomplished in the ways of (a) three seminars held in Damascus, (b) daily site studies jointly with the counterpart personnel and (c) counterpart training program of JICA in Japan.

1.6.1 Seminars

The team held three seminars during the study period as mentioned below:

(1) The First Seminar

The first seminar was held in Damascus on November 15, 1998 under attendance of 45 participants from the Syrian side. The list of participants is in Attachment 1-6. Main subjects of the seminar were general approach to formulation of rehabilitation plans of distribution network with examples of the current distribution network in Japan.

(2) The Second Seminar

The second seminar was held on February 24, 1999 under attendance of 47 participants from the Syrian side. The list of participants is in Attachment 1-7. Main subjects of the seminar were result of power flow calculation, recommended standards for design and planning of facilities and basic rehabilitation and improvement plans of distribution facilities.

(3) The Third Seminar

The third seminar was held on 16th August 1999 in Damascus during the forth site investigation period under attendance of Deputy Minister of Ministry of Electricity and 31 participants from Syrian side. The list of participants is in Attachment 1-9. Main subjects of the seminar were the detailed sequence and conclusion of the study for the rehabilitation of the distribution network in the Damascus metropolitan area.

1.6.2 Daily Transfer of Knowledge

During the site investigation work periods, members of the Team transferred the following particulars to the counterpart personnel through daily works at site.

(1) System Planning

- (a) Explanation of study items for the system planning
- (b) Methodology of review on demand forecast and utilization of the forecast to system planning
- (c) Consistency of various plans for system rehabilitation
- (d) Study flow of distribution system planning and overall procedure of system planning
- (e) Overall evaluation of the planned project

(2) Distribution Planning

- (a) Detailed procedure of distribution system planning
- (b) Introduction of various international technical standards for distribution facilities
- (c) Evaluation methodology of loss reduction program
- (d) Approach for the highly reliable system formation
- (e) Procedure of F/S for the formulated project

-
- (3) Substation Facilities
 - (a) Load forecast for the study area
 - (b) Methodology of investigation and analysis on the existing 66 kV facilities
 - (c) Evaluation methodology of existing equipment standards
 - (d) Main issues and reinforcement of the existing protection system
 - (e) Procedure of F/S for the formulated project
 - (4) Substation Facilities
 - (a) Methodology of investigation and analysis on the existing distribution facilities
 - (b) Importance of standard unification of distribution system equipment and Examples
 - (c) Evaluation methodology of existing equipment standards
 - (d) Procedure of F/S for the formulated project
 - (5) System Management and Data Base
 - (a) Importance of the distribution system management and principle of the management
 - (b) Methodology of collection, arrangement, storage and utilization of the system data
 - (c) Preparation and operation methodology of data base system for distribution facilities
 - (6) Economic and Financial Analysis
 - (a) General methodology of project evaluation
 - (b) Collection and utilization of data necessary for economic and financial analysis
 - (c) Methodology and purpose of FIRR and EIRR evaluation
 - (d) Methodology and purpose of sensitivity analysis of FIRR and EIRR
 - (7) Electric Measurements
 - (a) Electric measurements with counterpart personnel and utilization of measured values
 - (b) Preparation of Arabic manuals of measuring installments
 - (c) Instructions for use of measuring installments using above manuals
 - (d) Instructions for power flow analysis above 66 kV system using PSS/E

1.6.3 Counterpart Training Program of JICA in Japan

JICA invited two engineers in 1998 of PEDEEE and one engineer in 1999 to Japan under the counterpart training program.

Mr. Mustafa Shikahani, Deputy Director of Planning and Statistics Directorate of PEDEEE, and Ms. Nawal Al Masri, Engineer of Planning and Statistics Directorate of Damascus Rural Distribution Company, came to Japan for the period of one month from the middle of March 1999. They visited to electrical installations and factories and took classes by the consultant.

Mr. Akram Al Khatib, Manager of Regional Control Center of PEDEEE was invited to Japan in the middle of August 1999, who participated in the group training program sponsored by JICA for planning, operation and maintenance of distribution facilities, for the period of two months starting from the middle of August 1999.

ATTACHMENT

- Attachment 1-1 Minutes of Meeting on the Inception Report of JICA Study
- Attachment 1-2 Minutes of Meeting on the Progress Report of JICA Study
- Attachment 1-3 Minutes of Meeting on the Interim Report of JICA Study
- Attachment 1-4 Member of Syrian Side Organization
- Attachment 1-5 Member of JICA Study Team
- Attachment 1-6 Participants to the First Seminar
- Attachment 1-7 Participants to the Second Seminar
- Attachment 1-8 Minutes of Meeting on the Draft Final Report of JICA Study
- Attachment 1-9 Participants to the Third Seminar

The Feasibility Study on the Rehabilitation Project of
Damascus & Damascus Rural Distribution Network

Minutes of Meeting on the Inception Report for JICA Study

The meeting was held on November 8, 1998 (from 9:00 A.M.) at the meeting room in the Arnous Building in Damascus. This was the first official meeting between PEDEEE and JICA Study Team.

Main objective of the meeting was the Team's explanation on to explain the substance of the Inception Report to the participants from PEDEEE and public companies for the Damascus and Damascus Rural Governorates. Participants to the meeting from both parties are listed in the attached sheet. Following were major discussions in the meeting.

(A) Inception Report

Although the Team had explained the detailed substance of the Report to the working group on October 29, this was the official presentation to PEDEEE and the public companies.

(1) The team explained that

- (i) the report was prepared on the basis of scope of work and also items agreed between PEDEEE and the JICA Preliminary Study Team during June 1998, and
- (ii) the chief aim of the report was to enhance mutual understanding for the JICA's study on formulation of the rehabilitation plan of the distribution network in the project area and to inform to the PEDEEE working group the Team's methodology to approach the project formulation.

(2) The Team continued to explain the content of the report chapter by chapter.

(3) The PEDEEE working group understood the scope and methodology of the study mentioned in the report, and accepted the whole content of the report.

(4) Both parties discussed about the undertaking of the Government of Syria. PEDEEE confirmed that all items would be properly provided to the team in time.

(B) EU's Master Plan Study for Distribution Network

After the discussions on the report, PEDEEE explained the present situation of the Master Plan

Study under the EU's fund and relevance of the Study to the JICA's study as follows:

- (1) T.O.R for the master plan study has been approved recently by the EU authority. The study may start May 1999 at the earliest in consideration of necessary period for approval of T.O.R, International Competitive Bidding for consultants, evaluation of the bids, approval of the evaluation and negotiation/contract, etc.
- (2) Main objective of the Master Plan Study is to formulate the medium- and long-term general development plan of distribution network in the country. Damascus governorate area is selected as one of the model area for the Study.
- (3) While, JICA's F/S study is particularly characterized by formulation of the urgent rehabilitation plan of the existing distribution network in the Damascus and Damascus Rural governorates.
- (4) Although there will be some items over-lapped in both studies, PEDEEE working group shall be responsible for coordinating two studies; JICA's Feasibility Study and EU's Master Plan Study, to avoid duplication and contradiction between them to the minimum as far as possible.

(C) The First Seminar

The first seminar intended by the Team was set up to be held on November 15 (Sunday), 1998. PEDEEE will issue its invitation to the seminar to persons concerned.

The first official meeting was closed at 10:30 A.M.

Damascus, Syria

Eng. Mustafa Shekhani
Leader of Working Group
PEDEEE

Eng. Emile Kandaraft
Assistant General Director
PEDEEE

Koh Makajima
Leader of JICA Study Team

List of Attendant to Meeting on Inception Report

(1) PEDEEE

Name	Position
Mr. Najiti Jawdat	General Director
Mr. Emile Kandalafi	Deputy General Director
Mr. Mustafa Shekhani	Deputy Director of Planning Department
Mr. Mouhammad Al Mouhammad	
Mr. Imad Al Ghawi	

(2) Damascus Distribution Company

Name	Position
Mr. Amin Al Khawam	General Director
Mr. Mustafa Shaneneh	Assistant General Director
Mr. Gamal Abo Took	Planning Director
Mr. Nobeil Bahsas	
Mr. Emad Khames	
Mr. Mohamd Imad Ajaja	
Ms. Enayat Bitar	

(3) Damascus Rural Distribution Company

Name	Position
Mr. Jamaf Al Ahmar	General Director
Mr. A-Abazed	
Mr. Abedalea Mansoer	
Mr. Mohamad Zohir Kourboutly	
Mr. Mossa Al Khoury	
Mr. Hussen Rachid	
Mr. Bassam Toryman	
Mr. Rameh Al Hat	
Mr. Emad Rahmoun	
Ms. Wafaa Kassem	
Ms. Nawal Al Masri	
Mr. Abdul Raheem Dumiered	

**The Feasibility Study on the Rehabilitation Project of
Damascus and Damascus Rural Distribution Network**

Minutes of Meeting on the Progress Report for JICA Study

The meeting was held on February 3, 1999 at the meeting room in the Arnous Building in Damascus.

Main objective of the meeting was the Team's explanation on the Progress Report to the participants from PEDEEE and public distribution companies for the Damascus and Damascus Rural Governortes. Participants to the meeting from both parties are listed in the attached sheet. Following were major discussion in the meeting.

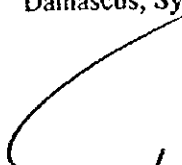
- (1) The Team has submitted 20 copies of Progress Report to the PEDEEE and two distribution Companies on January 18, 1999 prior to the Meeting, which has been prepared by the Team upon completion of the first site investigation stage carried out in October to December 1998. According to the attached agendum, the Team explained the content of the Progress Report to the participants in the meeting for their understanding and comments.

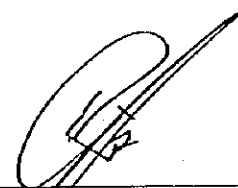
PEDEEE and both distribution Companies, in principle, agreed with the content of the Progress Report except some minor comments which will be incorporated in the report by the Team in preparation of the Interim Report.

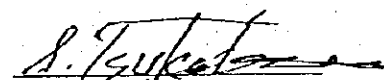
- (2) The Team also explained in the meeting the detailed scope of work during the second site investigation stage in January to March 1999, for which PEDEEE and both Distribution Companies agreed to cooperate with the Team in performing the study.

The meeting was closed at 11:00 AM.

February 3, 1999
Damascus, Syria


Eng. Mustafa Shekhani
Leader of Working Group
PEDEEE


Eng. Emile Kandaraft
Assistant General Director
PEDEEE


Sumio Tsukahara
Leader of JICA Study Team

**The Feasibility Study on the Rehabilitation Project of
Damascus & Damascus Rural Distribution Network
In Syrian Arab Republic**

**Explanation and Discussion on
Progress Report**

Date and Time : February 3, 1999 9:30 AM
Place : Arnouse Building

- | | | | |
|----|---|---------------------------------|--------|
| 1. | Opening speech | Mr. S.Tsukahara | 5 min. |
| 2. | Explanation of Progress Report | | |
| | (1) Chapter 1 "Introduction" | Mr. S. Tsukahara | 2 min |
| | (2) Chapter 2 "Syrian Arab Republic" | Mr. S. Tsukahara | 2 min |
| | (3) Chapter 3 "Current Situation of Power Sector" | Mr. S.Tsukahara | 2 min |
| | (4) Chapter 4 "Demand forecast and supply balance" | Mr. T. Sakuma | 10 min |
| | (5) Chapter 5 "Current Distribution System in the Study area" | | |
| | 5.1 Formation of existing distribution facilities | Mr. T.Sakuma | 5 min |
| | 5.2 Existing 66kV Distribution Facilities | Mr. T. Sakuma | 5 min |
| | 5.3 Existing 20 kV Distribution Facilities | Mr. K.Sakuma | 10 min |
| | 5.4 Existing Low Tension Distribution Facilities | Mr. K.Sakuma &
Mr. Fukunaga | 10 min |
| | 5.5 Facility Operation System | Mr. K. Sakuma &
Mr. S.Suzuki | 10 min |
| | 5.6 Repair Shop | Mr. T.Sakuma | 2 min |
| | 5.7 Summary of Current Issues | Mr. M.Yogo &
Mr. S.Suzuki | 10 min |
| | (6) Chapter 6 "System Improvement Program in the Study Area" | Mr. T. Sakuma | 5 min |
| 3. | Discussion | | 15 min |
| 4. | Closing Speech | | 5 min. |

List of the Attendance

Date: February 03, 1999

Place: Meeting Room of Arnous Building

Name	Position
(1) PEDEEE	
Mr. Emile Kandalaft	Deputy General Director
Mr. Mustafa Shikhani	Deputy Director of Planning Dept.
(2) Damascus Public Company for Electricity	
Mr. Amin Al Khawam	General Director
Mr. Mustafa Chenenh	Study and Construction Director
Mr. Gamal Abo Took	Planning Director
Mr. Mohamad Emad Ajaja	
Mr. Emad Khamis	
Ms. Enayat Bitar	
(3) Damascus Rural Public Company for Electricity	
Mr. Jamal Al Ahmar	General Director
Mr. Abedal Mamsoon	
Mr. Mohamad Zohir Kourboutly	
Mr. Mossa Al Khoury	
Mr. Zohir Chahin	
Mr. Hussen Rachid	
Ms. Wafaa Kassem	
Ms. Nawal Al Masri	
Mr. Abd Al Hakeem Aba Zaid	
(4) JICA Study Team	
Mr. Sumio Tsukahara	Team Leader / System Planning
Mr. Masaharu Yogo	Distribution Plan
Mr. Takao Sakuma	Substation Facilities
Mr. Kyo Sakuma	Distribution Facilities
Mr. Seichi Suzuki	Distribution System Management & Database
Mr. Junichi Fukunaga	Electrical Measurements

**The Feasibility Study on the Rehabilitation Project of
Damascus and Damascus Rural Distribution Network**

Minutes of Meeting on the Interim Report for JICA Study

The meeting was held on May 24, 1999 at the meeting room in the Arnous Building in Damascus.

Main objective of the meeting was the Team's explanation on the Interim Report to the participants from PEDEEE and public distribution companies for the Damascus and Damascus Rural Governorates. Participants to the meeting from both parties are listed in the attached sheet. Following were major discussion in the meeting.


1. The Team has submitted 30 copies of Interim Report to the PEDEEE and two distribution Companies on May 17, 1999 prior to the Meeting, which has been prepared by the Team based on the result of site investigation works carried out from October 1998 to March 1999. According to the attached agendum, the Team explained the content of the Interim Report to the participants in the meeting for their understanding and comments.
2. PEDEEE and both distribution Companies, in principle, agreed with the content of the Interim Report except the following, which will be incorporated in the draft final report by the Team.
 - (1) PEDEEE asked the Team to consider the full reserved margin or "N-1" criteria in the determination of transformer capacities of substations according to the growing peak loads. The Team agreed to review the schedule of increasing transformer capacities for each substation taking into account "N-1" criteria. In case of increasing number of transformer units, the possibility for adding an additional transformer unit to the existing substations in view of availability in space as well as modification in the existing substation design shall be taken into account.
 - (2) PEDEEE requested the Team to use one standardized size of Cu. 630 mm² for the future 66kV underground cable lines having a larger transmission capacity while the existing Cu. 300mm² cable still remains as a standard size for lines having normal transmission capacity. The Team agreed.
 - (3) PEDEEE requested the Team to provide in the Report the most economical capacity of 20/0.4kV transformers and size of LV cables for each level of demand density, taking the consideration of not only losses in the low tension feeders but also losses in the transformers, construction costs of transformers and low voltage feeder lines, etc. as well as a brief explanation of methodology to study the most economical transformer capacity. The Team agreed to study and show in the final report the most economical capacity of transformers for each level of demand density for indication purpose only.

The Team added that the Team is ready to receive any further comment on the Interim Report which will be studied by the Team and incorporated in the Final Report, if necessary.

3. The Team also explained in the meeting the schedule of feasibility study for improvement plans and a methodology of economic and financial analysis which will be made during the third site investigation stage in May to June 1999, for which PEDEEE and both Distribution Companies agreed to cooperate with the Team in performing the study.

The meeting was closed at 12 : 00 noon.

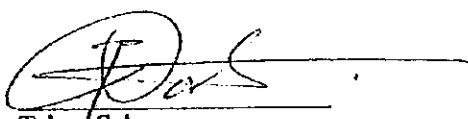
May 24, 1999
Damascus, Syria



Eng. Mustafa Shekhani
Leader of Working Group
PEDEEE



Eng. Emile Kandarafi
Assistant Director
PEDEEE



Taka Sakuma
Leader of JICA Study Team

**THE FEASIBILITY STUDY ON
THE REHABILITATION PROJECT OF
DAMASCUS AND DAMASCUS RURAL DISTRIBUTION NETWORK**

EXPLANATION MEETING FOR INTERIM REPORT

Date and Time : May 24, 1999
Time : 9:30 AM to 11:00 PM
Place : Arnous Building

PROGRAM

- | | | |
|----|---|------------------------------|
| 1. | Outline of Chapter 1 to Chapter 6 | Mr. T. Sakuma |
| 2. | Basic Rehabilitation Plan and Improvement Plan for 66kV facilities (Chapter 7 & 8) | Mr. Matsushima |
| 3. | Basic Rehabilitation Plan and Improvement Plan for 20kV and 0.4kV Distribution Facilities (Chapter 7 & 8) | |
| | 3.1 Improvement of 20kV system reliability | Mr. Yogo |
| | 3.2 Installation of 20/0.4kV transformers | Mr. Yogo |
| | 3.3 Reinforcement and construction of low voltage distribution feeders | Mr. Yogo |
| | 3.4 Replacement of 20kV Oil cables to Non-oil cables | Mr. K. Sakuma |
| | 3.5 Repair of the existing facilities and removal of unnecessary junk equipment | Mr. K. Sakuma |
| | 3.7 Countermeasures against illegal connections | Mr. K. Sakuma |
| 4. | Effects of Development Plan (Chapter 9) | Mr. M. Yogo |
| 5. | Discussion on the above Explanation | |
| 6. | Schedule for Feasibility Study of Improvement Plan of Distribution System and Methodology for Economic and Financial Assessment | Mr. T. Sakuma
Mr. Kataoka |
| 7. | Closing | |

List of the Attendance

Date: May 24, 1999

Place: Meeting Room of Arnous Building

Name	Position
(1) PEDEEE	
Eng. Najati Jawdat	General Director
Eng. Emile Khandataft	Deputy General Director
Eng. Mustafa Shekhani	Deputy Director of Planning Dept.
Eng. Kamal Habbal	
Eng. Ali Al Kalib	
Eng. Abeer Al Waffar	
Eng. Ahmad Abu karoub	
Eng. Khalil Al Omari	
(2) Damascus Public Company for Electricity	
Eng. Mustafa Shinenha	Deputy General Director
Eng. Gamal Abu Took	Planning Director
Eng. Imad Khamis	Operation Director
Eng. Wabil Bahsas	
Eng. Mohamad Emad Ajaja	
Eng. Enayat Bitar	
(3) Damascus Rural Public Company for Electricity	
Eng. Jamarl Al Ahmar	General Director
Eng. Mossa Al Khoury	Deputy General Director
Eng. Abdullah Mansor	
Eng. Bassam Turjman	
Eng. Zoher Kourboutly	
Mr. Hussen Rachid	
Eng. Wafaa Kassem	
Eng. Abd Al Hakeem Aba Zaid	
(4) JICA Study Team	
Mr. Takao Sakuma	Team Leader / System Planning
Mr. Masaharu Yogo	Distribution Plan
Mr. Noriaki Matsushima	Substation Facilities
Mr. Kyo Sakuma	Distribution Facilities
Mr. Shigeru Kataoka	Economic and Financial Analysis
Mr. Seiichi Suzuki	Distribution System Management & Database
Mr. Junichi Fukunaga	Electrical Measurements
Mr. Eiji Matsuda	Team Coordinator

Attachment 1-4 Member of Syrian Side Organization

(1) PEDEEE

Name	Position
1. Mr. Najiti Jawdat	General Director
2. Mr. Emile Kandalaft	Assistant General Director
3. Mr. Mustafa Shekhani	Deputy Director of Planning Directorate
4. Mr. Akram Al Khatib	Manager of Regional Control Center

(2) Damascus Distribution Company

Name	Position
1. Mr. Amin Al Khawan	General Director
2. Mr. Mustafa Shaneneh	Assistant General Director
3. Mr. Nobeil Bahsas	Operating Department
4. Mr. Mohamad Imad Ajaja	Chief of Low Voltage Section
5. Mr. Enayat Bettar	Counterpart

(3) Damascus Rural Distribution Company

Name	Position
1. Mr. Jamal Al Ahmar	General Director
2. Mr. Mossa Al Khoury	Assistant General Director
3. Mr. Wafaa Kassem	Counterpart
4. Mr. Nawal Al Masri	Counterpart

Attachment 1-5 Member of JICA Study Team

Main Duty	Name	Note
1. Team Leader and System Plan	: Koh NAKAJIMA	(the first stage)
	: Sumio TSUKAHARA	(the second stage)
	: Takao SAKUMA	(the third stage)
2. Distribution Plan	: Masaharu YOGO	
3. Substation Facilities	: Takao SAKUMA	(the first and second stage)
	: Noriaki MATSUSHIMA	(the third stage)
4. Distribution Facilities	: Kyo SAKUMA	
5. Distribution System Management and Database System	: Seiichi SUZUKI	
6. Economic and Financial Analysis	: Shigeru KATAOKA	
7. Electric Measurements of Distribution System	: Junichi FUKUNAGA	
8. Team Coordinator	: Tatsuya SHIGETA	(the first stage)
	: Eiji MATSUDA	(the third stage)

Attachment 1-6 Participants to the First Seminar

Date and Time : November 15, 1998, 10:00 A M to 1:30 P M

Place : Conference Room of Cham Palaces Hotel in Damascus

	Name	Position
Embassy of Japan	Mr. Katushito Saka	First Secretary
JICA Syria Office	Mr. Hiroyuki Mori	Assistant Resident Representative
Ministry of Electricity	Eng. Sufian AL-alao	Deputy Minister
PEDEEE	Eng. Abd Al Raof Yehya	
	Eng. Najati Jawdat	General Director
	Eng. Emile Khandalaft	Assistant General Director
	Eng. Mustafa Shekhani	Deputy Director of Planning Dept.
	Mr. Mouhammad Al Mouhamad	Assistant Engineer to Planning Dept.
	Eng. Imad Al Ghawi	
	Eng. Ahmad Abu Karoub	
	Eng. Rayan Obied	
	Eng. Abdul Aziz Wanli	
	Eng. Haifa Doghoz	
	Eng. Kamal Habbal	
	Eng. Salah Deen Yehia	
	Eng. Adnan Khreben	
	Eng. Hanna Awad	
	Eng. Bassam Al Saleh	
	Eng. Ak Ram Al Khatib	
	Eng. Omar Kamaun	
	Eng. Khilil Al Omari	
	Other 4 gentlemen	
Damascus City Co.	Eng. Amin Al Khawam	General Director
	Eng. Mustafa Shaneneh	Assistant General Director
	Eng. Gamal Abu Took	Planning Director
	Eng. Imad Khamis	
	Eng. Nabil Bahsas	
	Eng. Mhd Imad Ajaja	
	Eng. Enayat Bitar	
	Eng. George Al Eissa	
Other 3 gentlemen		
Damascus Rural Co.	Eng. Jamar Al Ahmar	General Director
	Eng. Messa Al Khoury	
	Eng. A. Abazed	
	Eng. Nawal Al Masri	
	Eng. Wafaa Kasem	
	Eng. Zeher Kourboully	
	Eng. Zohir Chahen	
	Mr. Hussen Rachid	
	Eng. Ead Abava	
	Eng. Emad Rahmoun	
Another 1 gentleman		

Attachment 1-7 Participants to the Second Seminar

Date and Time : February 24, 1999, 10:30 A.M to 1:30 P.M

Place : Conference Room of Semiramis Hotel in Damascus

	Name	Position
Embassy of Japan	Mr. Katushito Saka	First Secretary
JICA Syria Office	Mr. Katsuhiko Ibina	Resident Representative
PEDEEB	Eng. Emile Khandalafi	Assistant General Director
	Eng. Mustafa Shekhani	Deputy Director of Planning Dept.
	Eng. Imad Al Ghawi	Planning Directorate
	Eng. Mariam Hannd	Planning Directorate
	Eng. Abeer Al Waffar	Planning Directorate
	Mr. Mouhammad Al Mouhammad	Planning Directorate
	Eng. Abdul Razak Saab	Operation Directorate
	Eng. Hassan Suleman	Operation Directorate
	Eng. Akram Al Khatib	Operation Directorate
	Eng. Khalil Al Omari	Operation Directorate
	Eng. Salah Al Deen Yahya	Operation Directorate
	Eng. Samir Fransis	Studies and Construction Directorate
	Eng. Raian Obeid	Studies Directorate
	Eng. Mamoun Al Shafer	Studies Directorate
	Eng. Anwar Shammul	Studies Directorate
	Eng. Hanna Awad	Studies Directorate
	Eng. Salim Hejab	Customers Directorate
	Eng. Rana Shukhch	Customers Directorate
	Eng. Nizer Kassomeh	Training Directorate
	Eng. Buthayna Talab	Information Directorate
	Eng. Fatina Al Darra	Information Directorate
	Mr. Omar Al Shaal	Contracts Directorate
	Mr. Ahmad Al Ali	Contracts Directorate
	Eng. Marwar Al Obeid	PIU-ESSP
	Eng. Daa Inayeh	General Director Office
	Eng. Mohamad Ghiath Sedan	Repairshop
Damascus Public Distribution Company	Eng. Amin Al khawam	General Director
	Eng. Mustafa Shaneneh	Assistant General Director
	Eng. Jamal Abo Took	Planning Director
	Eng. Imad Ajaja	
	Eng. Enayat Bitar	
	Eng. Gerg Al Isd	
	Eng. Imad Khamis	
	Eng. Akram led	
	Eng. Nabil Bahsas	
Damascus Rural Public Distribution Company	Eng. Jamal Al Ahmar	General Director
	Eng. Zuher Shahin	
	Eng. Musa Khouri	
	Eng. Imad Rahmouu	
	Eng. Zuher Kharbotli	
	Eng. Nawal Al Masri	
	Eng. Wafaa Kasen	
	Eng. Ahed Abu Khohor	
	Eng. Ramch Al Haj	
	Eng. Bassam Turjman	
	Eng. Abdala Mansour	
	Mr. Husen Rashid	

**The Feasibility Study on the Rehabilitation Project of
Damascus and Damascus Rural Distribution Network**

Minutes of Meeting on the Draft Final Report for JICA Study

The study team of Japan International Cooperation Agency (hereinafter referred to JICA) for "The Feasibility Study on The Rehabilitation Project of Damascus and Damascus Rural Distribution Network" (herein after referred to the Study), headed by Takao Sakuma, visited Syria to carry out the Forth Site Investigation Study during the period of August 11 to 23, 1999.

During the forth investigation study, the explanation meeting was held on August 14, 1999 and the third seminar on August 16, 1999 respectively. The following were discussed and concluded in the explanation meeting, seminar and other separate meetings with the distribution companies.

Main objective of the forth site investigation study was the Team's explanation on the Draft Final Report to the PEDEEE and public distribution companies for the Damascus and Damascus Rural Governorates.

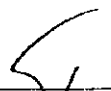
1. The study team has submitted 30 copies each of Draft Final Report and the Summary to the PEDEEE and two distribution Companies on July 8, 1999 by courier service prior to the forth site investigation study. The study team explained the content of the Draft Final Report to the participants in the meetings for their understanding and comments.
2. The representative of European Commission Delegation pointed out the following:
 - (1) The power demand forecast for whole country made by the EDF under ESSP was prepared in 1994 based on the various hypotheses on the country's economic background due to insufficient data and information. As the EDF's demand forecast seems to become slightly different from the actual present situation of power demand, it is advisable to update the EDF's demand forecast with the latest information for the purpose of preparing the demand forecast of the study area. The team replied that they principally followed the EDF's hypotheses in preparing the demand forecast, however, these hypotheses were modified according to the latest information and data collected during the investigation stage in order to prepare the demand forecast for the Study.
 - (2) In reply to EC delegation question, the study team explained that they tried to collect necessary data as much as possible through the team's site investigation works for the study, when it was not available. The study team has prepared and installed a data-base system during the study to the counterpart's computer for management of distribution facilities, e.g. distribution transformers, underground cable lines, overhead lines, supporting structures, switchgear equipment, etc. This data-base system may be helpful for PEDEEE and the distribution companies to manage all necessary information and data regarding the distribution facilities.
3. PEDEEE commented that the Long Run Marginal Cost used in the economic evaluation of the Project shall be reviewed by the study team based on the accurate and latest information in respect of types of generating plants under consideration, operation and maintenance cost, fuel consumption per kWh, etc. LRMC cost per kWh at outlet of low voltage distribution

seems low price. The team agreed to review the LRMC by the latest data and information.

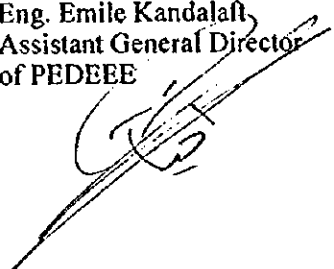
4. PEDEEE commented that, due to the improvement of power supply reliability, the considerable reduction in the power failure duration and un-served energy is expected so that the country's economy will be revitalized to increase the outputs because of un-necessity of paying additional cost for preparation of stand-by diesel generator or uninterrupted power supply system by factories, shops, office, etc. Such indirect benefit shall be emphasized in economic evaluation. Further, the cost for alternative power supply to compensate the un-served energy should be considered at higher unit price/kWh in the economic evaluation. The study team agreed to study the indirect benefit by improvement of supply reliability and state in the report.
5. PEDEEE commented that the emission of CO₂, NO_x and SO_x will be reduced much by the reduction of technical losses which shall be evaluated in the cost according to the GEF guideline. The study team agreed to study the above and express the result in the report.
6. PEDEEE also commented that said, for the purpose of economic and financial evaluation, the alternative case shall be also considered as a reference case in which the distribution facilities will be expanded with the minimum investment to meet the growth of power demand but the other power supply conditions may remain in the same level with those of 1997. The team agreed to consider the said reference case for the economic and financial evaluation.
7. PEDEEE asked the team that the schedule of increasing 66/20 kV transformer capacity shall be reviewed to fully satisfy N-1 criteria of supply reliability. The team explained that, under one unit of transformer out of service, the required transformer capacity for the respective year were decided to allow the remaining transformers carrying 110 to 130 % loading of rated capacities during peak time. The team agreed to review the schedule of transformer capacity increase.
8. The Damascus Distribution Company requested to consider the training of their personnel for improvement of their technique and/or skill in the planning, designing, constructing, operation and maintenance of the distribution facilities under the JICA study. The study team replied that the training of personnel was excluded from the scope of Work for the Study and this matter shall be considered separately.
9. PEDEEE and two distribution companies agreed in general the content of draft final report, and the above comments shall be further studied by the study team and incorporated in the final report. The team will accept further comments, if any, from PEDEEE and two distribution companies, which shall be reached to the team by September 10, 1999 through facsimile transmission. These comments will be further studied by the team for modification of report if necessary.
10. In accordance with Article 10 "Publication of Reports" of the Minutes of Meeting between PEDEEE and JICA dated June 17, 1998, PEDEEE will inform to JICA Tokyo, within two weeks from the date of signing of this Minutes of Meeting, the confidentiality of data and information in the draft final report to be excluded in the preparation of the final report.
11. JICA study team transferred all the measuring equipment and instruments to PEDEEE on August 19, 1999.

Participants to the explanation meeting from both parties are listed in the attached sheet.

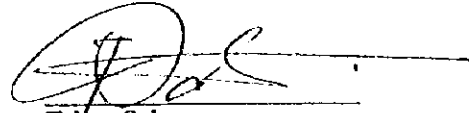
August 22, 1999
Damascus, Syria



Eng. Mustafa Shekhani
Leader of Working Group
PEDEEE




Eng. Emile Kandalafi
Assistant General Director
of PEDEEE



Takao Sakuma
Leader of JICA Study Team

Approved by:

Eng. Najati Jawdat
General Director of PEDEEE



List of the Attendance

Date: August 14, 1999

Place: Meeting Room of Arnous Building

Name	Position
(1) PEDEEE	
Eng. Najati Jawdat	General Director
Eng. Mustafa Shekhani	Deputy Director of Planning Dept.
Mr. Nohammad Al Mohammad	Planning Department
Eng. Imad Al Ghawi	Planning Department
Eng. Bassam Al Salek	Operation Department
Eng. Ali Al Katib	Planning Department
Eng. Abeer Al Waffar	Planning Department
Eng. Ahmad Abu karoub	Planning Department
Eng. Marwon Obeid	Co-Director - ESSP
(2) Damascus Public Company for Electricity	
Eng. Amin Al Khawam	General Director
Eng. Mustafa Shinenha	Deputy General Director/Director of Study
Eng. Gamal Abu Took	Director of Planning
Eng. Imad Khamis	Director of Operation
Eng. Mohamad Emad Ajaja	L.V. Operation Department
Eng. Enayat Bitar	Study Department
(3) Damascus Rural Public Company for Electricity	
Eng. Jamarl Al Ahmar	General Director
Eng. Mossa Al Khoury	Deputy General Director
Eng. Zouhir Chaheen	Director of Study Department
Eng. Hussen Rachid	Director of Planning Department
Eng. Zohar Kourboutly	Operation Department
Eng. Nawal Al Masri	Study Department
Eng. Wafaa Kassem	Operation Department
(4) Others	
Dr. Gernot W. Ruths	MEDA Team, Delegation of European Commission
Dr. Hashem Oirkozek	Professor, Damascus University
(5) JICA	
Mr. Teruhiko Kawabata	Assistant Resident Representative, JICA Syria office
Mr. Kobayakawa	JICA Head office
(6) JICA Study Team	
Mr. Takao Sakuma	Team Leader / System Planning
Mr. Masaharu Yogo	Distribution Plan
Mr. Kyo Sakuma	Distribution Facilities
Mr. Shigeru Kataoka	Economic and Financial Analysis

SYRIAN ARAB REPUBLIC
MINISTRY OF ELECTRICITY
PUBLIC ESTABLISHMENT FOR
DISTRIBUTION AND EXPLOITATION
OF ELECTRICAL ENERGY

الجمهورية العربية السورية
وزارة الكهرباء
المؤسسة العامة لتوزيع واستثمار الطاقة الكهربائية

NO: 457/231
DATE: 30.9.1999

الرقم: ٤٥٧ / ٢٣١
التاريخ: ٣٠ / ٩ / ١٩٩٩

FACSIMILE MESSAGE

FROM FAX NO : 00963 11 2223686

ATTENTION :	JAPAN INTERNATIONAL COOPERATION AGENCY
COMPANY :	JICA - Tokyo office
TO FAX NO :	813-5442-9129 COUNTRY: JAPAN - Tokyo
MESSAGE NO :	pages including this cover page:(1)
SUBJECT :	The Feasibility study on the Rehabilitation Project of DAMASCUS AND DAMASCUS RURAL Distribution network

Dear sirs:

Ref to the agreement concluded between your Organization and PEDEE E for the feasibility study on the rehabilitation project of Damascus & Damascus Rural distribution net work and further to item No (10) from the minutes of meeting of this agreement which stipulates publishing the final report for the various entitles in Japan and syria

We In form you Kindly that no reason prevents ditribution of the Said report in Japan and syria .

Thanking for your cooperation



PEDEEE G.D

Eng.N. JAWDAT

ص ب : ٢٥١٩٩ دمشق - الجمهورية العربية السورية

تلفون : ٢٢٢٥٩١٦٦ فاكس : ٢٢٢٣٦٨٦ تكلم : ٢٢٢٣٦٨٦ - ١١١١٢٨

TEL: 22259166 - FAX 2223686 - TLX SYRPED 611918

P.O.BOX: 25199-DAMASCUS-SYRIAN ARAB REPUBLIC

Attachment 1-9 Participants to the Third Seminar

Date : August 16, 1999

Place : Conference room of Semiramis Hotel, Damascus

Name	Position
(1) Ministry of Electricity	
Eng. Sufian Allao	Deputy Ministry
(2) PEDEEE	
Eng. Najati Jawdat	General Director
Eng. Emile Kandarraft	Deputy General Director
Eng. Mustafa Shekhani	Deputy Director of Planning Dept.
Mr. Nohammad Al Mohammad	Planning Department
Eng. Imad Al Ghawi	Planning Department
Eng. Zokhir Chaheen	Director of Study
Eng. Hassan Shemeh	Operation Department
Eng. E. Abd Al Razzak Saab	Operation Department
Eng. Ali Al Katib	Planning Department
Eng. George Alissa	
Eng. Hanna Awad	
Eng. Raxan Obied	
Eng. Issam Bahssas	
Eng. Abeer Al Waffar	Planning Department
Eng. Ahmad Abu karoub	Planning Department
Eng. Rashed Shaubor	Store house
Eng. Akram Al Khatib	Dispatching center
(3) Damascus Public Company for Electricity	
Eng. Amin Al Khawam	General Director
Eng. Mustafa Shinenha	Deputy General Director/Director of Study
Eng. Gamal Abu Took	Director of Planning
Eng. Mouhamad Al Alti	
Eng. Mohamad Emad Ajaja	L.V. Operation Department
(4) Damascus Rural Public Company for Electricity	
Eng. Mossa Al Khoury	Deputy General Director
Eng. Hussien Rachid	Director of Planning Department
Eng. Basam Tourgman	
Eng. Emad Rahnouh	
Eng. A. Abazed	
Eng. Nawal Al Masri	Study Department
Eng. Wafaa Kassem	Operation Department
(5) Others	
Dr. Gernot W. Ruths	MEDA Team, Delegation of European Commission
Dr. M. Nidal Rayes	Professor, Damascus University
(6) JICA	
Mr. Teruhiko Kawabata	Assistant Resident Representative, JICA Syria office
Mr. Kobayakawa	JICA Head office
(7) JICA Study Team	
Mr. Takao Sakuma	Team Leader / System Planning
Mr. Masaharu Yogo	Distribution Plan
Mr. Kyo Sakuma	Distribution Facilities
Mr. Shigeru Kataoka	Economic and Financial Analysis

CHAPTER II

SYRIAN ARAB REPUBLIC

Chapter 2 SYRIAN ARAB REPUBLIC

2.1 Profile of the Country

2.1.1 Geography and Population

Syria is situated on the eastern coast of the Mediterranean Sea, and is surrounded by Turkey to the north, by Iraq to the east, by Palestine and Jordan to the south and by Lebanon and the Mediterranean Sea to the west. Its Mediterranean coastline stretches over 193 km. International borders are those with Iraq (605km), with Jordan (375km), with Palestine (76km), with Lebanon (375km), and with Turkey (822km). Its total land area is 185,180 km², of which only about 60,000 km² is cultivated and the remaining is covered with deserts and rocky mountains. The wide areas of Syrian Deserts are suitable for growing grass and are used as pastures when the lands receive sufficient rainfall.

Geographically, Syria is divided into four regions: (i) the coastal region, lying between the mountain ranges and the Mediterranean Sea; (ii) the mountainous region, running from the north down to the south of the country, including mountains and hills running parallel to the Mediterranean Sea; (iii) the interior region or the plain region, comprising the plains of Damascus, Homs, Hama, Aleppo, Hassakeh and Daraa being situated to the east of the mountainous region; and (iv) the desert region, comprising desert plains situating in the southeastern part of the country, and facing with the Jordanian and Iraqi borders.

The capital city of the country is Damascus located in the southern part of the country. Other large cities are Aleppo, Latakia, Homs, Hama, Der Al Zor, Kamisbli and Hassakeh. Damascus in the south and Aleppo in the north are the country's two largest governorates, with 3.3 millions and 3.5 millions inhabitants respectively.

Syria's population in 1994 and 1997 were 13.8 and 15.1 million (estimation by the Central Bureau of Statistics), respectively. The annual growth rate during this period was 3.1%. Syria is one of the fastest population growing countries in the World. Today, around 60% of its population are under the age of twenty.

Over 51% of the population live in urban areas, and the migration to urban areas has been rapid in recent years. The government has enforced a program to limit the expansion of cities over the last ten years, and it appears that this program has worked effectively, as the growth rate of urban population fell to 4.1% in 1994.

2.1.2 Climate

The climate of the Mediterranean Sea generally prevails in Syria. This climate is characterized by a rainy winter and a dry and hot summer separated by two short transitional seasons. From the climate points of view, Syria may be divided into four regions that coincide with the geographic regions mentioned above. The coastal region is characterized by heavy rainfall in winter and moderate temperature and high relative humidity in summer. The areas in the mountains with an altitude of 1,000 meters or above are characterized by a rainy winter where annual rainfall may exceed 1,000 mm and by a moderate climate in summer. The interior region is characterized by a rainy winter and a hot and dry summer. The daily variations between the maximum and minimum temperature in the interior region during summer time are high and subject to large fluctuation. In Damascus, the average maximum air temperature was 25.9 °C and average minimum was 9.0 °C in 1996. The desert region is characterized by a small amount of rainfall in winter and a hot and dry summer.

2.1.3 Administrative Structure

Syria's current legal and political systems are based on the 1973 constitution, which declared the country a socialist republic. Head of state is the president. 26 ministries in total are organized under the executives¹. The executive branch is drawn up by the executives and passed for approval to a directly elected unicameral parliament, the People's Assembly or Majlis Al Sha'ab, with currently 250 members. The parliament election takes place every four years, and the members are elected through general election voted by all citizens with the age of 18 and above.

On a local level, regular elections are held for town and regional councils.

Syria is divided into 14 provinces or Muhafazat (locally called governorates): Hassakeh, Latakia, Qunaytra, Raqqa, Sweida, Daraa, Der Al Zor, Damascus City, Damascus Countryside, Aleppo, Hama, Homs, Idleb, and Tartous. Each province is governed by the provincial governor who is appointed by the central government. The provinces are further subdivided into a total of 59 areas or Mantiqas (districts) in the country.

2.2 Economy

2.2.1 Overall Economy

Syria is classified into a middle-income developing country. In 1996, its GDP amounted to Syrian Pound

¹ Names of ministries are Agriculture and Agrarian Reform, Communications, Construction, Culture, Defense, Economy and Foreign, Education, Electricity, Finance, Foreign Affairs, Health, Higher Education, Housing and Utilities, Industry, Information, Interior, Irrigation, Justice, Local Administration, Oil and Mineral Resources, Planning, Social Affairs and Labor, Supply and Internal Trade, Tourism, Transport, and Wharf.

(SP) 655.1 billion or about US\$ 15.4 billion. The per capita GDP was US\$ 1,054 in 1996. However, Syria's development has been hampered due to the rapidly growing population.

The country's economic base is diversified among agriculture, industry, and expanding energy sector. The local economy relies largely on agricultural products that account for around 27% of GDP. Percentage GDP breakdown² in 1996 for agriculture, mining and manufacturing, wholesale and retail trade, and transport and communications was 27%, 20%, 22%, and 11%, respectively. For the agriculture sector in particular and the national economy in general, the country's economic activities are heavily influenced by low annual rainfall and geographic distribution of rainfall. The Syrian government has given high priority to irrigation programs in its development efforts.

The oil sector accounts for 68% of exports and is now the country's top foreign currency earner.

Major current economic indicators of Syria are summarized below.

- (a) Export subsidies:
None (However, tax exemption is granted to production of fruit and vegetables)
- (b) Import subsidies:
Given to Sugar and Rice (Difference between subsidized price and price in a free market is around 1 to 3)
- (c) Exchange rates between Syrian Pound and US Dollar:
Refer to Table 2.2-1 below.

Table 2.2-1 Exchange Rate against US Dollar

Average	Syrian Official	Neighboring Countries
1992	11.23	42.50
1993	11.23	42.50
1994	11.23	42.50
1995	11.23	42.50
1996	11.23	42.50
1997	11.23	45.25
1998	45.50	

(Source: 1992-1997: Central Bank)

(Notes)

- i) For the 1997 national budget, SP35.45/US\$ 1.0 was used for revenues and SP35.50/US\$ 1.0 for expenditures and in 1998, SP 45.45/US\$ 1.0 was used for revenues and SP 45.50 for expenditures.
- ii) For the balance of payments, the exchange rates used in conversion were SP 39.15/US\$ 1.0 in 1996 and SP 44.88/US\$ 1.0 in 1997.
- iii) For statistics of customs of foreign trade, the official conversion rate of SP 11.20 has been used from 1988 up to now.

² excluding oil

(d) Discount rates/ Interest rates (in 1997):

- Official discount rate: 5.00%
- Interest of savings deposits not less than one year: 9.00%

(e) Foreign currency reserve:

The foreign currency reserve has been increasing year by year as seen in Table 2.2-2 below.

Table 2.2-2 Foreign Currency Reserve

	(million SP)		
	1995	1996	1997
Foreign assets	187,226	231,276	274,647
Foreign liabilities	18,188	16,951	14,826
Net foreign assets	169,038	214,325	259,821

The recent trends of GDP and GDP per capita, Structure of GDP, and Local Inflation Indexes are shown in Tables 2.2-3, 2.2-4 and 2.2-5 hereunder.

Table 2.2-3 GDP and GDP per Capita

	Unit	1994	1995	*Provisional 1996*
Constant prices of 1985	SP million	119,828	127,904	130,770
Current prices	SP million	506,101	569,262	655,124
Growth (%)	(%)	6.7	6.7	2.2
GDP in US\$ million				
Current prices	US\$	11,908	13,394	15,415
Population	('000)	13,782	14,153	14,619
Per Capita GDP in US\$	US\$	864	946	1,054

(Source: GDP expressed by Syrian Pound: Statistical Abstract 1997;

GDP expressed by US\$: Team's estimate using exchange rate of SP42.5/US\$1.0)

Table 2.2-4 Structure of Gross Domestic Product

	(1994 through 1996, at current prices)		
Sectors	1994	1995	1996
Agriculture	28	28	27
Mining and manufacturing	14	14	20
Building and construction	4	4	4
Wholesale and retail trade	27	26	22
Transport and communications	11	12	11
Finance and insurance	5	5	5
Social and personal service	2	2	2
Government services	9	9	9
Private non-profit services	0	0	0
Total	100	100	100

(Source: Statistical Abstract 1997)

Table 2.2-5 Price Index (Local Price Index during 1991-1996)

	(1990 = 100)		
	A	B	C
1991	109	-	-
1992	121	-	-
1993	137	127	125
1994	154	145	148
1995	170	155	159
1996	185	160	167
p.a. (1990-1996) (%) /I	10.8	8.1	8.9

(Source: Statistical Abstract 1997)

(Note) A: General Index for Retail Prices

B: General Index of Wholesale Price (PAASCHE/I)

C: General Index of Wholesale Price (LASPEYRES/I)

/I: Based on different calculation methodologies proposed by two economists.

2.2.2 National Budget

After a series of austerity budgets in the late 1980s, the government has embarked on an expansionary fiscal policy since 1990. One of the fundamental principles to elaborate the 1998 budget is to increase the total amount of investment projects as would realize the basic service and production objectives in various economic sectors towards supporting investment projects and self reliance. The proportion of earmarked investment projects to the total appropriations in the 1998 budget amounted to 50.4%. This justifies the 1998 budget being called a "development budget". It reflects the developmental efforts streamlined towards supplementing the infrastructures needed in Syria and buttressing the promotion of Syria's national economy.

A summary of the draft national budgets of Syria in 1997 and 1998 are shown in Table 2.2-6.

Table 2.2-6 National Budgets of Syria

Description	(SP million)			
	1997	1998	Differential	Increase (%)
Expenditure				
Transactions underway	102,425	117,700	+15,275	+14.9
Investment transactions	108,700	119,600	+10,900	+10.0
Total	211,125	237,300	+26,175	+12.4
Revenue				
Taxes and Duties	69,296	75,516	+6,220	+9.0
Others	141,829	161,784	+19,955	+14.1
Total	211,125	237,300	+26,175	+12.4

(Source: Report on the 1998 Syria's Budget, published by Office Arabe de Presse et de Documentation)

Of the total amount of appropriations 50.4% was allocated to the investment projects in 1998, the allocations to major sector categories are as follows:

- Irrigation and agriculture	SP Million 23,229 (19.5%)
- Electricity and water	SP Million 25,823 (21.7%)
Of which, Electricity	SP Million 19,961 (16.8%)
Water	SP Million 5,862 (4.9%)

Major important projects of the electricity sub-sector stated in the draft 1998 national budget are:

- Construction of the Aleppo steam power plant (1,000 MW);
- Construction of the Al Zara steam power plant (600 MW);
- Construction of the project of electric linkage with Jordan and Turkey by 400 kV lines, 547 km long transmission lines, and 4 substations of 400/230 kV;
- Construction of 230 kV lines, 480 km long: 90 km line from Tishrin Dam to Aleppo, 45 km line from Tishrin thermal plant to Al Zahera substation in Damascus, and 25 km line between Baath Dam and Raqqa;
- Construction of 5 substations of 230/66 kV (Sweida, Dimas, Kamishli, Skoubeen and Aleppo), commencement of construction of the Al Zahera and Mazzrba substations in Damascus, and invitation to tender and entering into contract for construction of 6 new substations;
- Installation of 66 kV lines of 322 km in length, commencement of construction of new 66 kV lines, and routing study of 66 kV lines of 640 km long;
- Accomplishment and installation of 12 substations of 66/20 kV, and expansion of 25 substations of 66/20 kV;
- Electric power supply to 140,000 new customers;
- Construction of the training centers at Adra and Jandar.

2.2.3 Balance of Payments

The overall balance of payments of Syria with foreign countries in 1996 and 1997 were in surplus by +US\$802.5 million and +US\$461.0 million, respectively. The trade balance in 1996 was in deficit by -US\$339.0 million and that in 1997 was surplus of +US\$454.0 million. The deficit in trade balance in 1996 is primarily caused by the increase in imports by private sector.

The balance of payments in 1996 and 1997 expressed both in Syrian pounds and in US dollars are shown in Table 2.2-7. The exchange rates used in conversion are SP39.15 = US\$1.0 in 1996 and SP44.88 = US\$1.0 in 1997.

Table 2.2-7 Balance of Payments of Syria in 1996 and 1997

	(SP million)		(US\$ million) (*)	
	1996	1997	1996	1997
Current Account Balance	6,480	25,312	165.5	564.0
1. Goods and services	-2,355	25,536	-60.2	569.0
A. Trade balance (FOB)	-13,272	20,376	-339.0	454.0
Public sector	52,936	87,068	1,352.1	1,940.0
Private sector	-66,208	-66,693	-1,691.1	-1,486.0
B. Services	10,917	5,161	278.9	115.0
Freight	-21,716	-20,376	-554.7	-454.0
Travel	27,214	21,992	695.1	490.0
Government's service	2,945	2,286	75.2	50.9
Other service	2,474	-1,257	63.2	-28.0
2. Income	-15,669	-22,620	-400.2	-504.0
3. Transfers	24,504	22,395	625.9	499.0
Capital and Financial Accounts	27,803	3,726	710.2	83.0
Net Errors and Omissions	-2,867	-8,347	-73.2	-186.0
Overall Balance	31,416	20,690	802.5	461.0

(Source: Central Bank of Syria): (39.15 SP/US\$ for 1996 & 44.88 SP/US\$ for 1997)

The current level of foreign debts has been substantially remaining unchanged. As of 1994, there was the aggregate amount of around \$15.9 billion debt comprising \$12.0 billion from the former Soviet Union and \$3.9 billion from EU and the World Bank (Source: Oxford Business Guide). However, Syria commenced to refund the debt to the World Bank based on their agreed rescheduling.

The foreign currency reserve has been increasing year by year since 1991 as referred to Clause 2.2.1.

2.2.4 Industry

During the last ten years, Syria has undertaken an accelerated economic development. In the period from 1987 to 1996, GDP increased by 5.1 times (current price base). The agriculture sector has been continuously an important pillar of the Syrian economy. The agriculture sector accounted for 25 to 31 percent of GDP in the past ten years (28% in 1994 and 1995 and 27% in 1996: Table 2.2-4 regarding details). The mining and manufacturing sector accounted for 14 to 20 percent of GDP in the past ten years. In this sector, the development of oil industry and the development of electric power and water have been key factors in Syria.

The first exploitation of oil took place in the 1950's. However, after the discovery of large light crude oil fields in the mid-1980's the oil began to play a major role in the Syrian economy. Since then, output has expanded rapidly, and around 600,000 barrel per day is produced at present. Exports of SP 28,000 million in 1997 accounted for about 63.6% of Syria's total exports. The oil industry has substantially contributed to

Syrian Arab Republic

the Syrian economy. The oil industry in Syria is coordinated by a number of public establishments. The overall responsibility for oil exploitation and production lies with the state-owned Syrian Petroleum Company.

Syria's natural resources in terms of energy sources are modest compared with those of neighboring countries. Proved oil reserves in 1996 were 341 mtoe (2.5 billion barrel) while natural gas reserves are 500 billion cubic meter, which is equivalent to 450 mtoe. Itemized primary energy production and consumption in Syria and total energy production and consumption vs. GDP growth are summarized below:

Table 2.2-8 Primary Energy Production

	1991	1992	1993	1994	1995	1996
Crude Oil Δ	473	542	588	598	623	612
Natural Gas Δ	3.3	4.2	4.8	5.0	6.0	6.6
Hydro-electricity Δ	8.0	13.8	13.8	12.3	13.8	15.0

Δ : '000 b/d (barrel per day) Δ : billion cubic meter per day Δ : '000 boe/d (barrel oil equivalent per day)

Table 2.2-9 Primary Energy Consumption

	1991	1992	1993	1994	1995	1996
Crude Oil Δ	170	188	194	183	183	174
Natural Gas Δ	19	30	35	53	59	60
Hydro-electricity Δ	8	14	14	12	14	15

Δ : '000 boe/d (barrel oil equivalent per day)

Table 2.2-10 Total Production and Consumption of Energy vs. GDP Growth

	1991	1992	1993	1994	1995	1996	Annual Growth
Production Δ	549	641	704	716	761	761	6.7%
Consumption Δ	197	232	244	249	256	249	4.8%
GDP Index (Constant prices)	100	110.6	117.2	125.0	133.4	136.4	6.4%

Δ : '000 boe/d (barrel oil equivalent per day)

Table 2.2-11 Exports of Crude oil and Petroleum Products

	1991	1992	1993	1994	1995	1996	Annual Growth
Exports of crude oil	219	294	368	377	369		13.9%
Exports of Petroleum products	65.9	49.0	57.1	35.6	43.3		

2.2.5 Trade

Since the end of the 1980s, the Syrian foreign trade has remarkably expanded, mainly because of increase in oil exports. Due to large oil exports, the trade levels have since remained at high levels. Non-oil exports have, however, plummeted. Indicators of foreign trade and exports/ imports of oil and its products are shown in Tables 2.2-12 and 2.2-13.

Table 2.2-12 Indicators of Foreign Trade

Year	(SP million)		(US\$ million)	
	Export	Import	Export	Import
1988	15,093	25,040	1,348	2,226
1990	47,282	26,936	4,221	2,394
1993	35,318	46,469	3,153	4,131
1994	39,818	61,374	3,555	5,455
1995	44,562	52,856	3,979	4,698
1996	44,887	60,385	4,008	5,368
1997	43,953	45,211	3,924	4,019

(Source: Statistical Abstract of 1997. Imports and exports were calculated in SP based on the official exchange rate. Since 1987 through 1997, the official price of US dollar was 11.25 SP for imports and 11.20 for exports.)

Table 2.2-13 Petroleum Oil and its Products

Year	(SP million)	
	Export	Import
1995	27,863	574
1996	30,712	1,082
1997	27,948	1,915

(Source: Central Bureau of Statistics)

2.2.6 Foreign Investment and Assistance

In 1991, the Investment Law No.10 was enforced to encourage private investment. The development process was fostered in all sectors and dedicated to production and services. Investors under the law are granted wide-ranging tax holidays, exemptions from import restrictions and permitted to import capital at duty free. Profits can be repatriated on an annual basis and capital re-transferred after five years.

The Team contacted with State Planning Commission (SPC) to obtain information about the current status of the foreign aids and investments for industrial projects. However, no specific information has been made available so far.

2.2.7 Infrastructure

The Syria's infrastructure is generally well developed. In recent years, the Syrian government has

substantially concentrated its efforts on the development of telecommunications, electricity and water to meet with their increasing demand.

The Syrian road network expanded rapidly in the 1980s. In total, the length of roads has increased from 19,800 km in 1980 to 36,000 km up to 1994. Roads are the most important means for commercial transport.

The railway system consists of a number of narrow and normal gauge tracks with a total length of 2,300 km. The main lines are connecting Damascus, Aleppo, Der Al Zor and Kamishli.

The port facilities are relatively under-sized. Syria's three Mediterranean ports of Latakia, Baniyas and Tartous are used almost exclusively for goods traffic. The oil terminal at Baniyas is the main channel for local oil exports, while the other two ports deal with most other sea transport.

Syria has two international airports in Damascus and Aleppo and a few domestic airports in Latakia, Der Al Zor and Kamishli.

Throughout the 1980s, the electricity demand recorded a drastic growth. However, thereafter until 1993, power generation could not meet the growing demand. In 1993, the gross production was 12,510 GWh, while demand including latent load was around 15,400 GWh. However in 1994 and later, the situation has been substantially improved. New thermal plants such as Jandar (Combined Cycle 600 MW, commissioned in 1994 and 95); Tishrin (Gas 200 MW, 1994); Nasrieh (Gas 300 MW, 1995); Zayzoun (Gas 300 MW, 1996); Aleppo (Steam 1,000 MW, 1997 and 98) have been completed and commenced operation. The succeeding reinforcement of transmission and distribution networks is now the most important issue that Syria is currently facing.

Syria has modernized and expanded the telecommunication system, and reached a standard that can be compared favorably with those of neighboring Arab countries.

Potable water consumption has remained broadly stable in recent years. However, loss in the supply routes is increasing because of the aging of the distribution network. Purification of polluted water is another issue. In 1996, the total production was 589.8 million cubic meter, while priced consumption, free consumption and loss in supply route were 329.7, 123.8, and 136.3 million, respectively. The number of subscribers in 1996 was 1.09 million. To meet with the increasing requirements, budgetary amount of SP 5.86 billion, 4.9% of the total investment project appropriations in 1998, is allocated to new supply lines, water purification plants and renovation of the existing lines.

2.2.8 Economic Policy and Future Development Plans

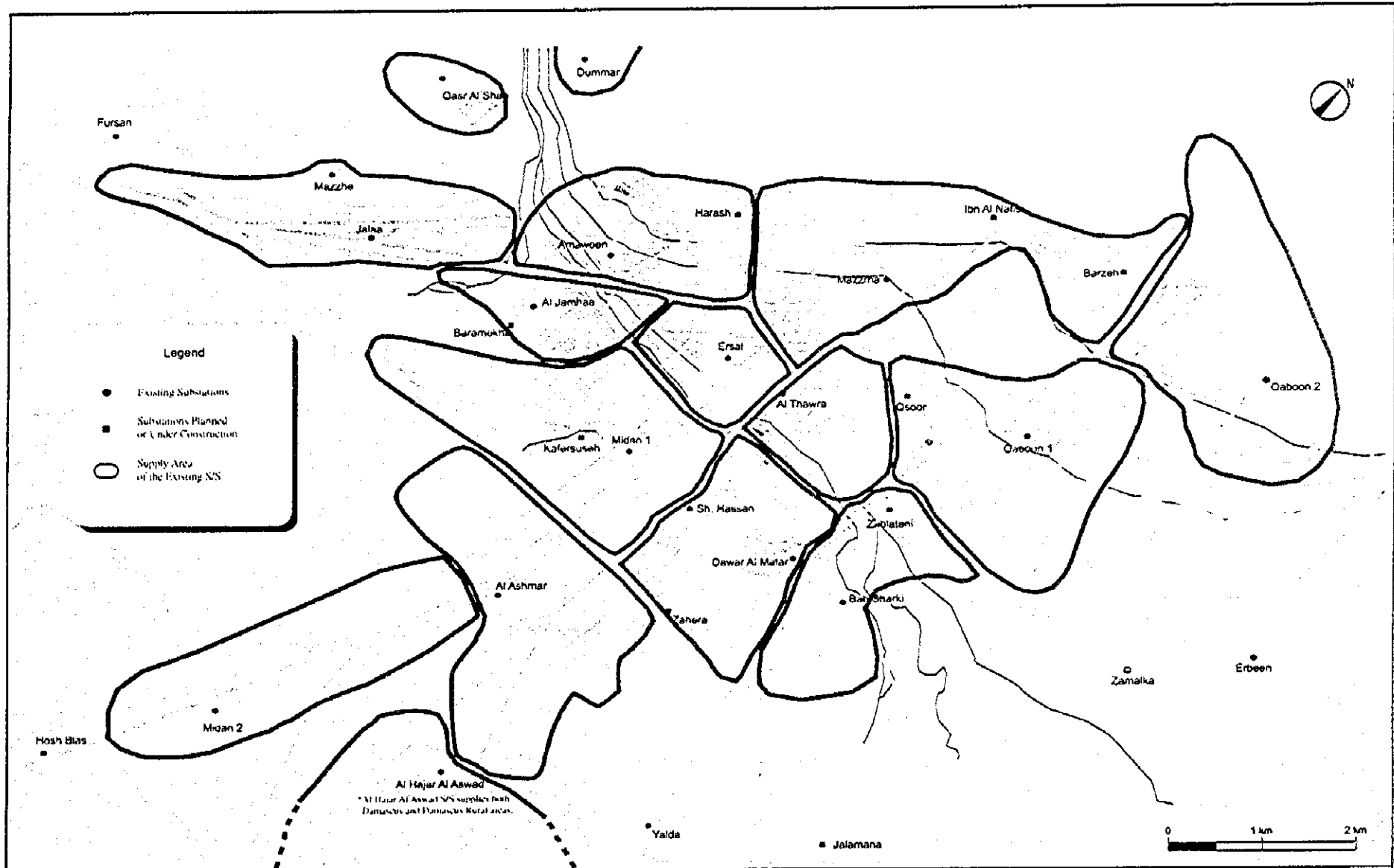
SPC explained the Team that since the sixth 5 years plan (1986-1990) no national development plans have

been approved by the parliament. Thus, no definite information is available at present.

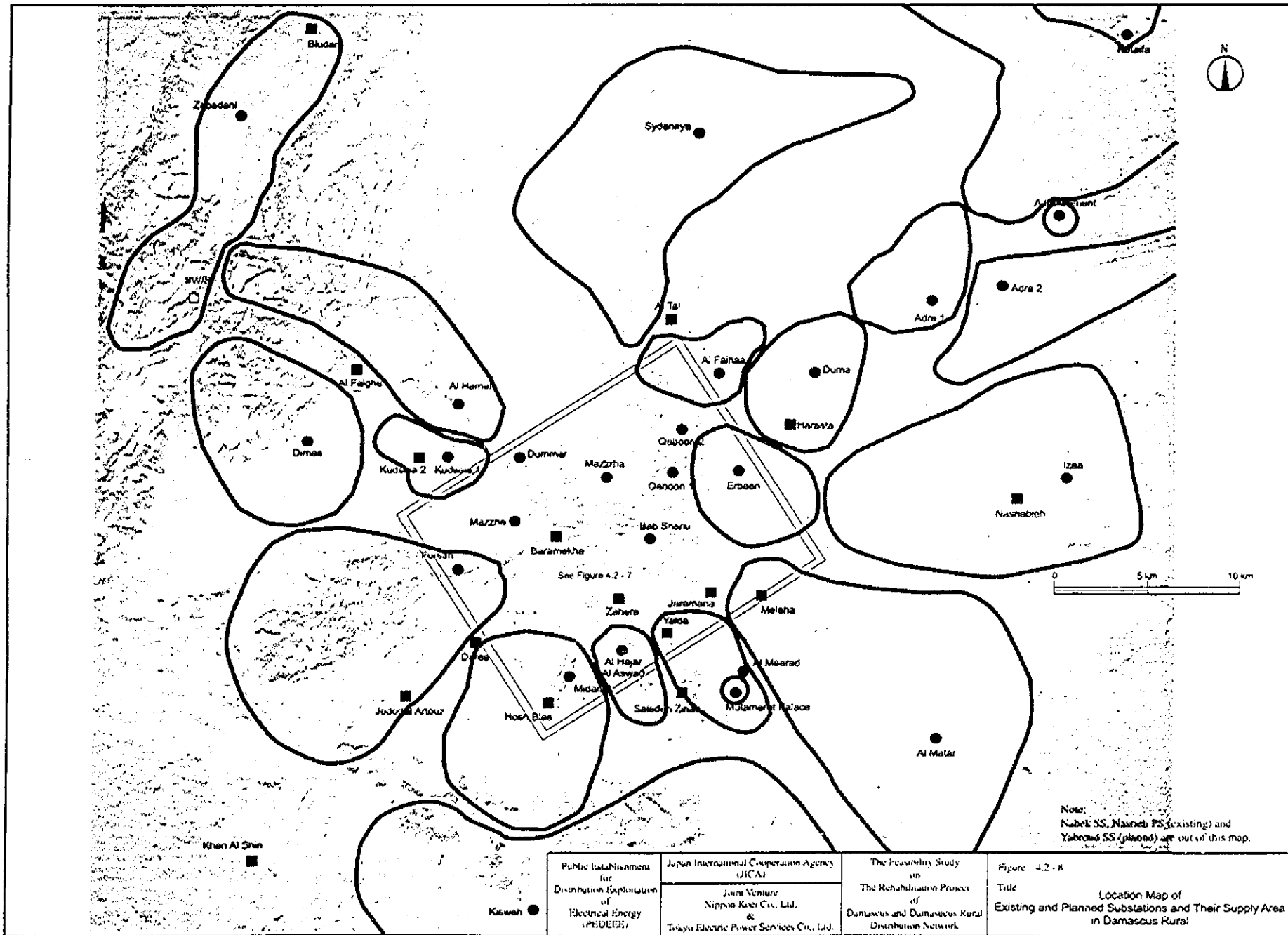
2.3 Development Policy of Energy Sector

The following are general development policies of the energy sector in the country, that were announced by the Ministry of Energy, PEEGT, PEDIEE and stated in other various reports.

- (1) To meet with continuously growing load demand, Syria has promoted construction of new power plants, mainly of gas turbines and combined cycle configuration because of high efficiency and low pollutant emission characteristics.
- (2) Syria is promoting energy efficiency projects including Demand Side Management (DSM), reduction of losses as a national target. Recently, an energy efficiency project funded by UN/GEF (Global Environment Facilities) that amounted to US\$ 4.1 million was signed. A Central Energy Service Company (to be established in near future) jointly managed by the Ministry of Electricity and UNDP/GEF will implement (a) a computerized O&M management system for Baniyas thermal units and (b) promotion of DSM projects in the country.
- (3) Promotion of international interconnection of the transmission grid: As a long-term program for international interconnection of 300 to 400 MW capacity among five countries comprising Egypt, Iraq, Jordan, Syria and Turkey has been planned as an EIIST project. Cairo-Amman-Damascus-Aleppo-Turkey-Iraq and Damascus-Beirut will be interconnected through 400 kV lines. Interconnections between Egypt and Jordan (Aqaba and Amman) have already been completed.
- (4) Environmental consideration to reduce air pollutant emissions (CO₂, SO₂, and NO_x) is one of the key issues in the energy sector. Conversion from the sulfur-rich oil firing to the gas firing at the existing oil-fired plants, and development of new high-efficiency combined cycle plants have been and will be promoted.



Public Establishment for Distribution Exploitation of Electrical Energy (PDEEE)	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 4.2-7 Title Location Map of Existing and Planned Substations and Their Supply Area in Damascus City
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Public Establishment for Distribution 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 4.2-8
 Title
 Location Map of Existing and Planned Substations and Their Supply Area in Damascus Rural

CHAPTER III

CURRENT SITUATION OF POWER SECTOR

CHAPTER 3 CURRENT SITUATION OF POWER SECTOR

3.1 Organization and Functions of the Power Sector

3.1.1 Power Sector Public Establishments

The power sector of Syria is presently managed and controlled by the Ministry of Electricity. Under the Ministry, the following two (2) public establishments are responsible for the planning, designing, construction, and operation and maintenance of the power facilities in the country¹.

(1) Public Establishment of Electricity for Generation and Transmission (PEEGT)

PEEGT is responsible for generation and transmission (400/230 kV voltage level) of electricity in the country. PEEGT is now managing and controlling nine (9) public companies that are operating large power generating plants. PEEGT is responsible for planning, designing, construction, and operation and maintenance of power generating plants and 400/230 kV transmission facilities up to 230/66 kV substations. The number of 66 kV feeders is determined according to the request of PEDEEE, and any feeder addition at a later date is charged to PEDEEE. 66/20 kV substations in the premises of 230/66 kV substations are also looked after by PEEGT. The organization of PEEGT is shown in Fig. 3.1-1.

PEEGT sells the electric energy to PEDEEE at the 66 kV level. Though all the 66 kV facilities belong to PEEGT, energy to PEDEEE is measured at the secondary side of the 230/66 kV transformers. In addition, there is some sales by PEEGT to very large consumers at the 230 kV and 66 kV levels.

There are some generating power plants that are directly operated by certain public entities in the country. The General Establishment for the Euphrates Dam is operating two hydro-electric power plants; Thawra and Baath. The Ministry of Oil and Mineral Resources is also operating power with generating facilities in its refineries at Homs and Banias and at its oil fields with gas turbines.

(2) Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)

PEDEEE is responsible for distribution of electricity received from PEEGT. The overall distribution system managed by PEDEEE has networks of three voltage classes, 66 kV, 20 kV and 0.4 kV.

¹ Public Establishment of Electricity (PEE) was formed in 1965 to deal with generation, transmission, distribution and operation of electric energy all over the country. In 1994, two organizations (PEEGT and PEDEEE) were founded to substitute the previous PEE.

PEDEEE has its head office in Damascus and comprises head office organizations and fourteen (14) public distribution companies, one public distribution company in each administrative governorate, to execute the power distribution activities to end users. The organization chart of PEDEEE is shown in Fig. 3.1-2.

PEDEEE buys the electric energy from PEEGT at the 66 kV level, operates 66 kV lines and 66/20 kV substations, and sells energy to the distribution companies at the secondary side of the 66/20 kV transformers. PEDEEE also sells energy directly to large 66 kV consumers. The distribution companies operate the 20 kV and 0.4 kV networks and are retailing energy to 20 kV, 20/0.4 kV² and 0.4 kV general consumers.

PEDEEE's board of directors comprises seven members, the General Director, Deputy General Director for Technical Affairs (position of another DGD for Financial, Administrative and Legal Affairs is vacant at present), Director of Planning and Statistics, Director of Operation, Director of Financial Affairs, and two representatives from the Union Workers. They are appointed by the government in accordance with Decree 20 concerning public establishments issued by assignment of the President of Syria. The board of directors meeting is held weekly to determine all the important matters relating to the administration and operation of PEDEEE.

3.1.2 Duty Demarcation between PEDEEE and Distribution Companies

The duty demarcation between PEDEEE and public distribution companies for each voltage class of distribution network is mentioned below:

- PEDEEE is responsible for overall administration of the distribution network, and planning, designing, budgeting, construction, and operation and maintenance of the 66 kV network up to 66/20 kV transformers in substations including the 66 kV buses in the 230/66 kV substations.
- Public Distribution Companies are responsible for planning, designing, construction, and operation and maintenance of the 20/0.4 kV network including 20 kV cubicles in the 66/20 kV substations.

PEDEEE provides the distribution companies with technical support, training and supply of equipment and materials for 20 kV and 0.4 kV facilities.

3.1.3 Project Implementing Organization of PEDEEE

The PEDEEE's organizations for performing duties relating to project implementation are mentioned below:

² 20/0.4 kV is a peculiar supply category to large LV consumers in Syria. In this system, a power utility installs a 20/0.4 kV transformer for exclusive use of the consumer and supply power at 400 V, and energy consumption is measured on the 20 kV side.

(1) System Planning

Plans of the 66 kV network are prepared the Planning and Statistics Directorate, and facility design of 66/20 kV substations and 66 kV lines is performed by the Studies and Construction Directorate. PEDEEB introduced the PSS/E software of PTI Inc. of USA in 1997 and has acquired technology of transmission network analysis using this computer software.

The normal planning and designing works are carried out only by Syrian engineers without assistance of foreign consultant.

Development projects are acknowledged by the government by obtaining approval of SPC against project budget for investment.

(2) Project Implementing Activities

The project implementing activities, covering detailed design including preparation of tender documents, tender processing, and construction, are undertaken under the Studies and Construction Directorate.

A Project Office is established to implement a large project and a Project Manager who is fully responsible to all aspects of project implementation is appointed.

Major equipment and materials are purchased under international tendering basis including guidance services as required, and local tender is called for materials to be purchased locally. The erection works of equipment including those of international purchase are performed under a local contract basis.

Preparation of detailed design and preparation of draft tender documents for international tender and preparation of tender documents for local tender are performed by PEDEEB.

Foreign consultants are employed when an external construction fund is provided.

(3) Operation and Maintenance

Operation and maintenance activities of network facilities are under control of the Operation Directorate. Periodic and emergency maintenance activities are performed by the maintenance groups, for transmission lines and for substations, under the Directorate.

Minor repairing works of equipment and facilities executed by the maintenance groups.

The Informatic Directorate is a new directorate established to meet requirements for computerization of PEDEEB's operation.

3.1.4 Damascus City and Rural Distribution Companies

The 20/0.4 kV distribution network in the study area is under the control of the Damascus City and Damascus Rural distribution companies. The current organizations of these two companies are shown in Figs. 3.1-3 and 3.1-4 respectively.

Under the Damascus City company, 17 local (or district) offices have been set up in the governorate. Those offices are functioning for maintenance and for designing LV facilities as required in their controlling districts. All the actions performed by the local offices must be reported to the related department in the head office.

Similarly, there are 54 local offices in the Damascus Rural Company to maintain and design extension or rehabilitation LV facilities in each controlling district. The local offices of the Rural Company are responsible also for meter reading and collection of electricity charges.

The organizations of the two companies for implementing projects are same and as mentioned below:

(1) System Planning

The system planning and designing of the 20 kV network is carried out, when distribution problems arose due to load increase or any other reasons and when applications for new connection is received, by the Studies and Construction Department by reviewing the available line capacity, voltage drop, etc. The Companies have not yet introduced computer software for network analysis of the 20 kV distribution networks. The local offices perform the design works of 0.4 kV network when necessity arose.

(2) Project Implementing Activities

The construction works are executed by the Studies and Construction Department on a local contract basis. Necessary equipment and materials for implementation are provided from PEDEEE. The Distribution Companies are not allowed to execute any project without approval of PEDEEE.

(3) Operation and Maintenance

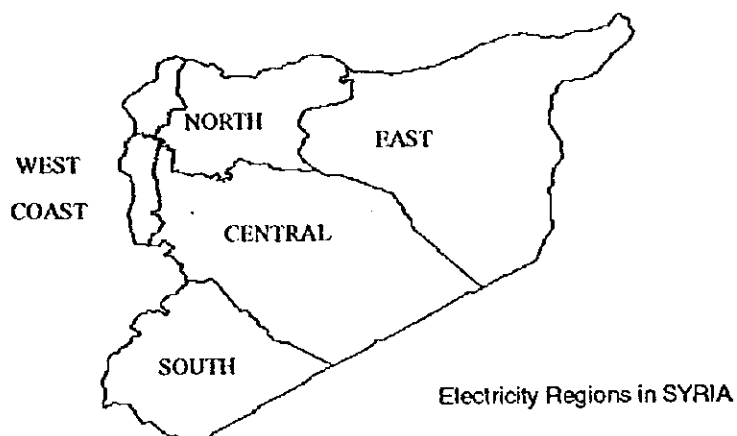
The local office in each district looks after maintenance of 20/0.4 kV network. However, the actual maintenance works including minor repairing are being performed by the emergency offices on contract basis. The distribution companies are operating the 66/20 kV substations including 66 kV facilities of PEDEEE. Maintenance of 66 kV facilities is executed by PEDEEE.

3.2 Past Records of Electricity Supply and Consumption

The country is geographically divided into five electricity regions; South, Central, West Coast, North and East. Each region comprises the following administrative governorates:

Table 3.2-1 Regions and Governorates

Region	Governorates
South	Damascus City, Damascus Rural, Swedia, Daraa and Qunaytra
Central	Hama and Homs
West Coast	Tartous and Latakia
North	Aleppo and Idleb
East	Hassakeh, Raqqah and Der Al Zor



3.2.1 Gross Generation in Syria

The gross generation of the country in 1990 to 1997 is tabulated in Table 3.2-2, with classifications according to the type of generation and region-wise generation. The total generated energy in the country was 19,323 GWh in 1997, increased from 11,324 GWh in 1990 at an annual rate of 7.9%. The increase rate after 1993 went up high as the latent demand due to power shortage till 1993 came out after the commissioning of new power plants. As seen in Table 3.2-2 the addition of new gas turbine and combined cycle plants is remarkable after 1995. The increase of gas generation plants was remarkable due to large availability of indigenous natural gas.

The region-wise historical generation records are summarized in Item 2 of Table 3.2-2. The South, Central and North regions constitute the main generation belt of the country and generated more than 76% of total production in the country in 1997.

Table 3.2-2 Gross Generation in Syria

1. Type of Generation						(GWh)
Year	Hydro	Steam & Comb. Cycle	Gas Turbine	Import from Jordan	Total	
1990	1,337	8,053	1,934	0	11,324	
1991	1,590	8,226	2,264	0	12,080	
1992	1,502	8,187	2,636	67	12,392	
1993	1,538	8,301	2,626	45	12,510	
1994	2,459	9,757	2,484	0	14,700	
1995	2,800	7,404	6,242	0	16,446	
1996	3,550	7,312	7,928	0	18,160	
1997	3,535	7,914	7,874	0	19,323	
Annual Growth (%)						
(1990-1997)	14.9	-0.2	22.2	-	7.9	
(1993-1997)	23.1	-1.2	31.6	-	11.5	
2. Region-wise Generation						(GWh)
Regional Generation	South	Central	W. Coast	North	East	Total
1990	211	4,556	3,629	1,379	1,549	11,324
1991	175	4,555	3,890	1,606	1,854	12,080
1992	293	4,323	4,243	1,482	2,051	12,392
1993	1,262	3,994	3,610	1,521	2,123	12,510
1994	2,287	3,704	3,761	2,426	2,414	14,700
1995	3,235	5,135	2,485	2,766	2,824	16,446
1996	4,513	5,433	1,849	3,531	2,834	18,160
1997	5,029	5,447	1,814	4,258	2,745	19,323
Annual Growth (%)						
(1990-1997)	57.3	2.7	-9.4	17.5	8.5	7.9
(1993-1997)	41.3	8.2	-15.8	29.4	6.6	11.5

(Source: Annual Statistical Report-1995 of MOE and information from PEDEEE)

3.2.2 Past Power Demand of the Country

(1) Past Energy Consumption Record

The past energy consumption in the country for the period from 1990 to 1997 is summarized in Table 3.2-3.

The table shows:

- (a) Total energy consumption in the country was 18,843 GWh in 1997, and increased from 9,738 GWh in 1990.
- (b) An average growth rate of energy consumption in the whole country in a period of 1990 to 1997 was 9.9%, while that in the latest four years of 1993 to 1997 was 11.9%. Sufficient generating capacity after the commissioning of large power plants in 1994 and later in the country has contributed to such high growth of energy demand after 1993.

- (c) In 1997, the share of the South region was about 36.0% of energy consumption of 14 distribution companies, followed by the north region at 26.9%, the east region at 13.3%, the central region at 12.1% and the west coast region at 11.0%. In the period of 1990 to 1997, there was not drastic change in share of each region, however the south and central regions decreased their shares and the west coast, north and east regions increased their shares.

Table 3.2-3 Historical Annual Energy Consumption (GWh) and Peak Load (MW)

	Annual Energy Consumption (GWh)								Ave. Growth Rate (%)		Share of Region (%)	
	1990	1991	1992	1993	1994	1995	1996	1997	(90-97)	(93-97)	(1990)	(1997)
Total HV Level (PEEGT)	225	229	210	230	195	518	911	871	21.33	39.50	-	-
230 kV Level	225	229	210	230	195	226	238	263	2.25	3.41	-	-
Exp. to Lebanon 230 kV	0	0	0	0	0	292	673	608	-	-	-	-
Total MV Level (PEDEEE)	910	919	1,030	1,001	1,064	1,160	1,226	1,378	6.11	8.32	-	-
66 kV Level	910	919	1,030	1,001	1,064	1,160	1,226	1,378	6.11	8.32	-	-
Distribution Companies	8,603	9,229	9,523	10,784	12,471	14,143	15,230	16,594	9.84	11.38	100	100
South Region	3,378	3,577	3,639	3,764	4,446	5,113	5,615	5,969	8.47	12.22	39.27	35.97
Damascus Gov.	1,641	1,739	1,780	1,889	2,101	2,292	2,477	2,519	6.31	7.46	19.07	15.18
Damascus Rural Gov.	1,290	1,366	1,398	1,424	1,836	2,217	2,482	2,734	11.33	17.71	14.99	16.48
Daraa Gov.	307	330	324	321	368	442	476	519	7.79	12.76	3.57	3.13
Swedia Gov.	101	105	103	104	120	138	154	168	7.54	12.74	1.17	1.01
Qunaytra Gov.	39	37	34	26	21	24	26	29	-	-	0.45	0.17
Central Region	1,123	1,176	1,215	1,415	1,669	1,850	1,924	2,112	9.44	10.53	13.05	12.73
Homs Gov.	592	626	652	690	889	975	1096	1,156	10.03	13.77	6.88	6.97
Hama Gov.	531	550	563	725	780	875	828	956	8.76	7.16	6.17	5.76
West Coast Region	816	877	929	1,179	1,346	1,485	1,638	1,831	12.24	11.63	9.49	11.03
Tartous Gov.	289	300	294	515	576	612	604	702	13.52	8.05	3.36	4.23
Latakia Gov.	527	577	635	664	770	873	1,034	1,129	11.50	14.19	6.13	6.80
North Region	2,186	2,384	2,441	2,818	3,310	3,759	4,044	4,470	10.76	12.23	25.41	26.94
Idleb Gov.	392	411	430	416	504	581	634	759	9.90	16.22	4.56	4.57
Aleppo Governorate	1,794	1,973	2,011	2,402	2,806	3,178	3,410	3,711	10.94	11.49	20.85	22.36
East Region	1,100	1,215	1,299	1,608	1,700	1,936	2,009	2,212	10.49	8.30	12.79	13.33
Raqqa Gov.	253	270	290	390	422	484	488	517	10.75	7.30	2.94	3.12
Der Al Zor Gov.	432	509	560	529	665	753	771	853	10.21	12.69	5.02	5.14
Hassakeh Gov.	415	436	449	689	613	699	750	842	10.64	5.14	4.82	5.07
Total Annual Consumption	9,738	10,377	10,763	12,015	13,730	15,821	17,367	18,643	9.89	11.91	-	-
Peak Load in the Whole Country (MW)	1,919	2,032	2,254	2,225	2,474	2,847	2,944	3,259	7.86	10.01	-	-

(Source: Annual Statistics Report -1995 of Ministry of Electricity and updated by PEDEEE)

(2) Past Record of Peak Load

The annual peak load (sum of generated output) has been recorded at around 6:00 P.M. in winter season (November and December) during the period from 1990 to 1997. The 1997 peak load was 3,259 MW, and increased from 1,919 MW in 1990 as seen in Table 3.2-3.

The average annual growth rate of peak load was 7.9% during the period from 1990 to 1997, while the rate during the recent four years (1993 to 1997) was 10.0%. The growth rate of peak load was slightly lower than that of energy consumption, which is considered to be caused by the change in economic structure or

Current Situation of Power Sector

suppression of peak due to insufficiency in power transfer capacity of the power system.

The country's load duration curve on December 18, 1997 (Thursday) is illustrated in Fig. 3.2-1. Each power plant (hydro, steam and gas) is operated for either base-load or peak load supply based on characteristics of the plants.

(3) Annual Energy Sales to Consumers

The average growth rate of total energy sales to all consumer categories in the period of 1990 to 1997 was 8.5%, while the rate of 1993 to 1997 was 15.0% as seen in the Table 3.2-4.

Table 3.2-4 Past Annual Sales of Energy in Syria by Consumer Category

Customers	Energy Sales (GWh)								Annual Growth Rate (%)		Share of Consumers (%)	
	1990	1991	1992	1993	1994	1995	1996	1997	(90-97)	(93-97)	(1990)	(1997)
Total High Voltage Level	225	229	210	230	195	518	911	871	21.30	39.50	-	-
230 kV level (country)	225	229	210	230	195	226	238	263	2.25	3.41	-	-
230 kV level (Exp. to Lebanon)	0	0	0	0	0	292	673	608	-	-	-	-
Total Medium Voltage Level	3,024	3,099	3,526	2,958	3,333	3,873	4,001	4,667	6.40	12.08	100.00	100.00
66 kV level	910	919	1,030	1,001	1,064	1,160	1,226	1,378	6.11	8.32	30.09	29.53
20 kV level	842	893	867	816	928	1,004	1,002	1,047	3.16	6.43	27.84	22.43
20/0.4 kV level	1,272	1,287	1,359	1,141	1,341	1,709	1,773	2,242	8.43	18.40	42.06	48.04
Total Low Voltage Level	4,082	4,231	4,222	4,228	5,263	6,001	7,090	7,460	9.00	15.25	100.00	100.00
Household sector	3,533	3,676	3,651	3,433	4,166	4,695	5,450	5,576	6.74	12.89	86.55	74.75
Small scale activities	94	93	117	90	150	180	245	245	14.67	28.45	2.30	3.28
Commercial sector	103	145	111	388	504	621	804	918	36.64	23.96	2.52	12.31
Government offices	193	154	165	150	215	226	217	232	2.66	11.52	4.73	3.11
Street lighting	107	95	90	90	113	170	217	255	13.21	29.74	2.62	3.42
Religion buildings	41	50	54	61	73	86	125	185	24.02	31.97	1.00	2.48
PEEGT & PEDEEE offices	11	18	34	16	42	23	32	49	23.79	32.29	0.27	0.66
Total sales	7,331	7,559	7,688	7,417	8,791	10,392	12,002	12,998	8.53	15.03	-	-

(Source: Annual Statistics Report -1995 of Ministry of Electricity and updated by PEDEEE)

From the records, the following facts are noted:

- 4.7% of the total energy sales was export to Lebanon at the 230 kV level since 1995.
- PEDEEE sold 25.3% of energy to medium voltage consumers and 57.4% to low voltage consumers. Medium voltage consumers comprise agriculture, industries and large commercial consumers.
- 74.7% of energy for low voltage consumers was sold within the domestic sector.
- 12.3% of energy to low voltage consumers was sold under the commercial sector. The remaining energy (12.9%) was sold under the categories of small scale activities, government offices, street lighting, religious buildings and the establishments offices.

Thus, about 43% of energy of the country was sold to household (domestic) consumers.

The following are records of share of annual energy consumption classes in each consumer category:

Table 3.2-5 Share of Annual Energy Consumption (1995) (unit: %)

Annual Consumption (kWh)	Domestic	Commercial	Industrial	Government	Lighting	Religious Buildings
0 – 600	7.7	17.5	10.3	17.7	3.7	11.5
600 – 1,200	15.3	15.0	10.3	14.7	4.5	9.0
1,200 – 2,400	29.6	20.0	12.8	12.2	6.0	15.0
2,400 – 3,600	21.7	15.0	10.3	9.1	3.7	8.5
3,600 – 6,000	20.0	18.0	15.4	12.6	8.5	12.0
6,000 – 12,000	5.0	12.5	15.3	14.5	16.5	18.5
12,000 – 24,000	0.7	2.0	12.8	11.1	22.4	16.5
24,000 – 76,800	0	0	7.7	6.5	25.4	8.0
Above 76,800	0	0	5.1	1.5	9.4	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

(Source: ESSP TD 007-Table C1)

Half of domestic consumers consumed 100 to 300 kWh per month. Two third of commercial consumers consumed 300 kWh per month at maximum. Most of the consumption seems to be by lighting in shops.

Although the monthly consumption by industrial consumers was widely scattered, majority of industrial consumers also consumed not more than 2,000 kWh per month. The LV industrial consumers are usually of small scale.

(4) Number of Consumers and Household Electrification

Table 3.2-7 is abstract from Table 3.2-6 for numbers of consumers by category and region. In terms of the number of consumers, the 0.4 kV class occupied 99.5% of the total.

Regional characteristics are assumed from the table as below:

- (a) Regional share of total number of consumers was largest in the south region at 33%, the north at 28%, the central at 16%, the east at 12% and the west at 11%.
- (b) Among 0.4 kV consumers, the share of domestic consumers was largest being 84% and followed by the commercial consumers 13%, then others. The share of south (Damascus metropolitan) and north (Aleppo) regions was more than 60% of the total number of consumers in the country.
- (c) The central region covering Homs and Hama is the industrial zone, occupying 29% share. The south, north and west coast regions occupied about 20% share in the industrial category as of 1996.
- (d) In the commercial category, the south and north regions occupied two third of the total with shares of 38% and 30%, respectively.

Table 3.2-7 Number of Consumers by Region in 1996

Category	South R.	Central R.	North R.	West R.	East R.	Total
66 kV						
Industrial	7	15	12	7	6	47
20 kV						
Industrial	7	29	57	14	15	122
Agriculture	78	29	58	13	15	193
Others	11	7	15	3	3	39
Sub-total	96	65	130	30	33	354
20/0.4 kV						
Industrial	2,634	666	1,243	314	561	5,418
Commerce	636	232	296	127	212	1,503
Agriculture	928	857	1,302	301	722	4,110
Others	1,578	260	121	50	501	2,510
Sub-total	5,776	2,015	2,962	792	1,996	13,541
0.4 kV						
Domestic	749,128	375,344	652,764	253,212	279,173	2,309,621
Industrial	7,570	11,417	8,417	8,469	3,485	39,358
Commerce	134,771	55,222	107,210	31,370	29,998	358,571
Government	6,605	4,774	6,435	2,613	4,428	24,885
Lighting	2,482	2,243	1,511	710	555	7,501
Religious	-	-	-	-	-	-
Sub-total	900,556	449,000	776,337	296,374	317,639	2,739,906
Total	906,435	451,095	779,441	297,203	319,674	2,753,848

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

The rural electrification activities in Syria have well progressed. Especially in the study area, it is told that the rural electrification has almost completed.

(5) Seasonal and Daily Load Patterns

The annual peak load of the country appears in the winter season (November or December). While, the annual lowest load is recorded in the spring season (May). Typical daily load curves of summer and winter working days in 1995 are shown on Fig. 3.2-2. From the figure, the following are noted:

- (a) The winter peak load appears around 6 o'clock in the evening,
- (b) The summer peak load appears three hours later than the winter peak, and
- (c) The daily load factor in summer is around 82%, while that in winter is 77%.

In Syria, it is noted that the peak load appears just after sunset. The very peculiar period in Syria is the Ramadan month, when the daily load factor rises up to 85% and the peak time lasts long. The annual load factor of the Syrian system is around 66%.

(6) Energy Losses

Energy loss is one of the most serious problems of the Syrian power system. As seen in Table 3.2-8, the total system losses amounted to around 30% of the total generated energy in the country. This figure is very high compared with those of other developed and developing countries. PEDEEE estimates that the technical loss is around 16% and non-technical loss 14%. It is reported that the technical loss is attributable mainly to excessive loading on the existing facilities, while the non-technical loss is generally the results of combination of inadequate metering, billing, revenue collection, conspiracies and illegal connections.

Table 3.2-8 Recent Power Records of Whole Syria (1995-1997)

Description	Records (GWh)			Ave. Annual Growth (%)	
	1995	1996	1997		
(1) Total Generation	16,450	18,160	19,325	8.39	
(2) Auxiliary Consumption	750	771	839	5.77	
(3) Net Generation ready to Sales	15,700	17,380	18,486	8.51	
(4) Sales at 230 kV Level	226	238	263	7.88	
(5) Sales at 66 kV Level	434	433	522	9.67	
(6) Export to Lebanon	292	673	608	44.30	
(7) Net Energy to PEDEEE	14,144	15,300	16,594	8.32	
(8) Sales to Special Consumers	At 66 kV	1,160	1,226	1,378	8.99
	At 20 kV	1,004	1,002	1,047	2.12
	At 20/0.4 kV	1,709	1,773	2,242	14.54
	At 0.4 kV	180	245	245	16.67
(9) Total Sales	4,053	4,246	4,912	10.01	
(10) Sales to General Consumers	Domestic	4,695	5,450	5,576	8.98
	Commercial	621	804	918	21.58
	Public Offices	226	217	232	1.32
	Public Lighting	170	217	255	22.47
	PEDEEE Offices	23	32	49	45.96
	Religious Places	86	125	185	46.68
(11) Total Sales	5,821	6,845	7,215	11.33	
(12) Total Sales in System = (4)+(5)+(6)+(9)+(11)	10,826	12,435	13,520	11.75	
(13) Sales by PEDEEE = (9)+(11)	9,874	11,091	12,127	10.82	
(14) Total System Losses = (3)-(12)	4,874	4,945	4,966	0.94	
(15) Percentage of System Losses = [(14)/(3)]x100 (%)	31.04	28.45	26.86		
(16) Losses of PEDEEE = (7)-(13)	4,270	4,209	4,467	2.28	
(17) Percentage of Losses in PEDEEE System = [(16)/(7) x 100] (%)	30.18	27.51	26.90		

(Source: PEDEEE's information as of Dec. 15, 1998)

From the table, the decreasing trend of system loss is evident. PEDEEE has been trying to the loss reduction and made up a target to reduce the non-technical loss to 8.7% of the net supply by 2005 and 4.5% by 2010.