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ADDENDUM TO THE FINAL REPORT TO THE
OFFICE OF ENERGY AND INFRASTRUCTURE
BUREAU FOR RESEARCH AND DEVELOPMENT AND CAIRO MISSION,
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

Prepared for:

MINISTRY OF ELECTRICITY AND ENERGY
Egyptian Electricity Authority
Arab Republic of Egypt

POLICY REFORM AND INSTITUTIONAL DEVELOPMENT ASSESSMENT
FOR COMPETITIVE MARKET ADAPTATION OF
THE EGYPTIAN POWER SECTOR

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June 16, 1994

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EGYPTIAN ELECTRICITY AUTHORITY

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CAIRO EGYPT

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Subject: Policy Reform and Institutional Assessment
for Competitive Market Adaptation of the
Egyptian Power Sector

Dear Mr. Trujillo:

We are continuing our review of the subject assessment and are developing an action plan to be submitted to the Ministry of Electricity and Energy which should serve as the basis for discussions leading to eventual agreement on a series of reforms in the sector. Mr. Youssef has advised you of our interest to extend your contract and utilize your services to provide supplemental information and support in the early stages of these discussions. Mr. Youssef will be working closely with the Office of Science and Technology in Washington D.C. to facilitate the necessary contract time extension.

Initially, several areas of your assessment require additional analysis:

Chapter 4 discusses the legal issues of how EEA's Charter might best be modified to facilitate the achievement of fuller autonomy. The assessment concludes that the restructuring of EEA under the provisions of Law 203 is the preferred way of achieving the desired autonomy. This however raises several questions:

1. Over the longer term what is the ideal legal framework for EEA to operate under disregarding existing Egyptian laws?
2. If a new legal framework is envisioned, what are the steps and who are the players to formulate and establish the new laws?
3. It would be interesting to compare the Laws and By-Laws of Incorporation of a number of US investor owned and privately owned US utilities and how they compare to the contemplated laws forming and controlling a restructured EEA.
4. You have reviewed the Laws governing the Suez Canal Authority and the proposed new Law governing Egyptair

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which allow them to operate on a private basis, i.e. their funds are considered as private funds and they operate on a commercial basis. It would be beneficial to receive copies of these two Laws. How would an ideal legal framework for EEA compare to these two Laws and what would be the advantages and disadvantages of replications of these two Laws in the restructuring of EEA?

5. How and why would the ideal legal framework be impacted if EEA were restructured in accordance with Law 203?
6. Of other alternatives, which come closest to affording EEA the optimum legal framework and why?

Chapter 4 also discusses the establishment of a regulatory body for the electricity sector. The establishment of such a body is new to Egypt and is fraught with considerable risk and misunderstanding. A proposal to create a regulatory body will be scrutinized by all levels of the government and must be carefully and fully researched, conceptualized and then marketed throughout the government and the private sector. Numerous questions are apparent.

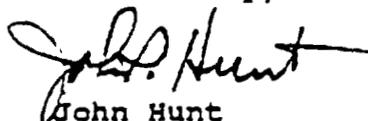
1. Have similar National Regulatory Bodies been established recently in countries similar to Egypt, and if so what have been the problems and lessons learned from these experiences?
2. What has been the scope of the National Regulatory Bodies that have been formed?
3. How have these National Regulatory Bodies been staffed, by political appointments or elected?
4. In the case of Egypt, which has a public sector oriented bureaucracy, how can we ensure that the regulatory body is independent?
5. Are there legal or consulting firms that have been actively assisting governments in the establishment of National Regulatory Bodies and if so, who are they?
6. Can you recommend specialists in this field who would be recognized as experts in the field of electric utility regulation that could meaningfully advise the GOE and provide necessary assistance through the formative and initial years of National Regulatory Body operation?
7. If a National Regulatory Body were to be formed, for which utility services should the initial body be established, i.e. electric power, telecommunications, water, gas, transportation, etc. and why?

Chapter 6 discusses staffing issues and suggests that EEA staffing, particularly in the power stations, is far above typical staffing levels for electric utilities. We have seen staffing data of typical US hydro stations that indicate normal staffing of approximately .05 employees per MW but does not provide specific staffing by specific hydro plant size. We understand that the Washington based Utility Data Bank has assembled, on data base III, a wide range of US electric utility statistics from the FERC 1 Annual Reports. Are you aware of these statistics and particularly statistics related to staffing for individual utilities by installed capacity and kWhr sales, plant staffing versus plant capacity, T&D staffing versus transmission/distribution size, utility customers per employee, etc. We recognize that US utility and plant statistics are not indicative of EEA operations, but ideally EEA should follow the same trend in staffing. Your comments and additional information from other data sources, both from the U.S. and countries at a similar level of development as Egypt, would be of great benefit.

Chapter 11 discusses the importance of timely collection of accounts receivable, and the proposed implementation plan in Chapter 1 recommends a reduction of EEA's accounts payable? Is there a concern that EEA is not making payments on a timely basis? Please comment on whether this is a valid concern, and if so, how it could be resolved.

As you are aware, other international donors are conditioning their funding contributions on reforms in the Egyptian power sector. As we develop an action plan on the reforms we would like to see undertaken, it is important that our efforts be consistent with other international donors' policy agenda. Please provide us with information as to the policy agenda of the other international donors active in the Egyptian Power Sector especially the World Bank.

Yours truly,



John Hunt
Director, of Power and
Telecommunication office

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EGYPTIAN POWER SECTOR**

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INTRODUCTION

The objective of this addendum to the above mentioned report is to answer the questions that came from USAID Mission in Cairo after the Final Report had been completed and delivered. The Final Report completed in December, 1993, contained in each section the comments and requests for revisions received previously from EEA and USAID.

In this addendum we have attempted to respond to the questions and the request for further analysis as per Mr. John Hunt's letter dated January 9, 1994 as well as to the comments received from EEA on April 17, 1994 in reference to chapters 5, 6, 7, 8, 9, 10, and 11;

The addendum has been organized in the following manner:

- Introduction
- Section I: Legal Issues
- Section II: Regulatory Issues
- Section III: Staffing and Technical Issues
- Section IV: Other Issues
- Section V: EEA Comments

SECTION I

LEGAL ISSUES

This section will attempt to answer the six questions raised in Mr. John Hunt's letter regarding legal issues (Chapter 4 of our Report on EEA).

The following are the comments and answers prepared by our legal advisor dealing with the Egyptian Power Sector Legal Restructuring and the analysis of the available alternatives arranged in the same sequence and order as the questions in the above mentioned letter.

1. We believe that it will be more advantageous on the long term, and in line with the Egyptian Government's policy to apply market economy, to convert EEA into business corporations governed by, and subject to, the Public Business Sector Law, Law No. 203 of 1991 ("Law 203").

To achieve this goal, EEA may be converted into a holding company while its different assets may be converted into separate subsidiary corporations. The number and capitalization of such subsidiaries can be determined after conducting a detailed research on the most optimum geographical allocation of such subsidiaries, and a full evaluation of the current value of EEA's assets. Alternatively, if this structure is not feasible from a practical point of view, EEA may itself be converted into an operational company and become a subsidiary of the Holding Company for Construction and Distribution of Electric Power ("HCCDEP") or of a new holding company to be set for that purpose.

This legal structure would be similar to the present set up for distribution of electricity which takes place through HCCDEP and several subsidiaries, which are all subject to Law 203.

In general, a holding company incorporated under Law 203 is a business corporation wholly owned by the state, a governmental body, or a public sector bank. Despite this state ownership,¹ the funds of a holding company or a subsidiary are considered private funds, and said companies are designed to be operated on economic bases.

A holding company takes the form of a joint stock corporation the objective of which is to invest by itself, through its subsidiaries, by forming other corporations, or through acquisition of stocks, with the purpose of enhancing the economy of the state. A holding company operates as a commercial enterprise and is registered in the Commercial Registry. It is managed by a Board of Directors that consist of seven (7) to eleven (11) members appointed by the General Assembly of the holding company in questions, upon the suggestion of the president of the General Assembly. One member must be appointed by the Association of Labor Unions of Egypt. The General Assembly is presided over by the relevant Minister, and includes members who possess certain experiences appointed by the Prime Minister, in addition to the representative appointed by the Association of Labor Unions of Egypt.

Under law 203, a subsidiary of a holding company also takes the form of a joint stock corporation that is quite similar to ordinary business corporations.

In general, the issuance of securities takes place pursuant to the same guidelines for issuance of securities by ordinary commercial corporations. The securities may be dealt with through the stock exchange. Thus, subsidiaries may use various corporate finance techniques, such as issuing bonds.

The management of a subsidiary is carried out through a Board of Directors which has the broadest power to manage the company. The Chairman of the Board represents the company before third parties. A Managing Director who is authorized to represent the company and manage its daily activities, must also be appointed from among the board members. The Managing Director may be himself the Chairman or another member of the board. The company may also appoint a general manager to supervise the daily activities of the company. The General Manager reports to the Chairman or the Managing Director, as the case may be.

A subsidiary also has a Shareholders General Assembly which supervises the activities of the Board of Directors. The General Assembly appoints some of the members of the Board of Directors and has the power to dismiss the board. The General Assembly has specific authorities related to, among other things, appointing the company's Auditor, approving its financial statements, distribution of dividends, and amending in an extraordinary meeting the company's statutes, provided a special quorum and minimum votes exist.

Two members of The Board of Directors of the subsidiary of a holding company have to be elected to the Board by the employees and therefore, the General Assembly does not elect all members of the Board.

Law 203 allows the participation of private shareholders in subsidiary corporations. A private shareholder has equal rights in the General Assembly, and may be appointed as a board member.

Law 203 permits privatizing subsidiary corporations (but not holding companies) by selling all or part of their shares to the private sector. However, if privatization of a subsidiary exceeds 49% of its capital, the subsidiary in question ceases to be governed by Law 203. In other words, the holding company must always own at least 51% of the equity of the subsidiary in order for said subsidiary to fall within the ambit of Law 203.

Law 203 did not clarify what happens if the holding company equity in the capital of the subsidiary becomes less than fifty one percent (51%). However, following general corporate law principles, we believe said subsidiary will be converted by the operation of the law from the day it ceases to be subject to Law 203 to a company subject to Law 159 being the law of general application to companies in Egypt.

Both holding companies and subsidiaries governed by Law 203, are subject to ordinary corporate income tax.

To sum up, we believe the above legal structure achieves the following advantages:

- a) The proposed holding company and subsidiaries will legally become public business sector corporations subject to Law 203 and should, therefore, be operated on economic and commercial bases and with fairly broad degree of freedom.
- b) A subsidiary corporation may be partially or entirely privatized.
- c) EEA as a holding company and its subsidiary corporations may be merged into the existing HCCDEP, or set up under a new holding company.

2. As stated in our memorandum dated July 27, 1993, to the best of our knowledge the legal process under which the conversion of a public authority such as EEA into a holding and subsidiary corporations subject to Law 203, has not been tested yet. This legal uncertainty stems from the second article of the law of issuance of Law 203 which reads as follows:

As of the date of coming into force of this law, holding companies are to replace the public sector authorities which are subject to Law No. 97 of 1983 - subsidiary companies are to replace those companies which are under the supervision of such public sector authorities, without the need for any other procedure.

EEA is not a public sector authority subject to Law 97 of 1983 as clearly expressed in law No. 12 of 1976 organizing EEA and the general principles of administrative law.

Accordingly, and unlike HCCDEP, EEA did not automatically convert into a holding company pursuant to Law 203. Legislative intervention is needed to accomplish such conversion. We believe that thus Article 9 of the law of issuance of Law 203 could provide the legal basis necessary for such intervention, although this matter, from a technical stand point, is subject to various legal interpretations.

Article 9 states that:

It is possible, by virtue of a decision of the President of the Republic, and with the approval of the Council of Ministers, to convert any economic authority, public establishment or special public sector company to a holding company or an affiliated company.

Thus, the players who would formulate the proposed legal framework are: EEA, the Minister of Electricity, the minister of public Business Sector, the Council of Ministers and eventually the President of the Republic.

3. We have reviewed the Articles of Incorporation and By-laws of Pennsylvania Power and Light Company, Virginia Electric and Power Company, and Puerto Rico Electric Power Authority ("PREPA"), for comparison purposes.

The former two utilities are privately U.S. corporations similar to a great extent to ordinary U.S. business corporations. Both companies are engaged in the production, transmission and distribution of electric power (as well as other public utilities) as an integral operations.

The later utility, PREPA, is owned by the Government of Puerto Rico and is governed by a special Law, the Puerto Rico Electric Power Authority Act.

PREPA is a public corporation and a government instrument that has a legal personality separate from the Government. Its By-laws is designed in a way that resembles that of a business corporation in order to ensure an efficient and economic operation. There are certain features, however, that reflect the state ownership of PREPA such as:

- a) The Governor of Puerto Rico appoints seven members of the governing board of PREPA with the advice and consent of the Senate, while two members are elected from among the consumers.
- b) The executive director of PREPA is required to submit the financial statements and complete report to the Governor.
- c) From a financial standpoint, certain subsidies are granted to small consumers, industries and small hotels.

4. As discussed in the Final Report, in greater detail, the laws governing the suez Canal Authority and Egypt Air provide that those entities have a legal personality separate from the Government, and should be operated on economic bases.

We have previously covered the advantages and disadvantages of this option, i.e. amending EEA's law, specifically regarding the autonomous nature of these two entities with respect to their management on commercial bases and the characterization of their funds a private funds.

We regret that we do not have an English translation of these two laws, but we will be glad to provide you with Arabic copies thereof if you wish.

5. See our discussion under 1 and 2 above.

6. Alternatively, under Law 129 of 1947 as amended by Law 61 of 1958, EEA may grant a concession to exploit the power generation qualified private sector grantee, provided such concession is issued pursuant to a Presidential decree and after obtaining the approval of the People's Assembly. (This was the case before nationalization).

The salient legal aspects of that law are as follows:

- a) The term of the concession may not exceed thirty years.

- b) the grantee's portion resulting from the exploitation of a utility may not exceed 10% of the invested capital as approved by the grantor, and after deducting depreciation expenses.

- c) the grantor has a broad range of powers which enable it to unilaterally modify the rules organizing the public utility, as well as the rules of exploitation thereof, and in particular the tariffs for services provided, without prejudice to the rights of grantee to claim damages if applicable.

- d) the grantor also has the right to supervise the construction of the public utility and its operation from a technical, administrative and financial perspective. It may as well appoint representatives who would have access or presence in the grantee's administration in order to scrutinize and review the performance of the utility in question to the supervision of the Central Agency for Audit. He may also appoint any public or private authority for the purposes of technical and administrative supervision.

We hope the foregoing discussion answers the additional questions outlined in your letter. Please do not hesitate to contact us if you need further assistance in this matter.

SECTION II REGULATORY ISSUES

Section II attempts to answer questions 1 to 7 from Chapter 4 regarding regulatory issues. The questions have been answered in the same sequence:

1. The country most similar to Egypt in which a National Regulatory Body is currently being established is Pakistan.

The Government of Pakistan recently agreed to establish a Regulatory Authority as was recommended and described in the "Proposal for a Pakistan National Electric Power Regulatory Authority, Revised Final Draft Report" (December 1992) prepared by International Resources Group, Putnam Hayes & Bartlett, and Hunton & Williams. We understand that the Government plans to implement the Authority this summer.

The most difficult issues that had to be addressed included:

- reaching agreement among the political leaders about the concept and purpose of regulation,
- balancing the needs of the federal government with the needs of the provincial governments, and
- how to handle the complex economic and social issues surrounding the subsidies embedded in the current pricing of electricity to the various customer classes, and
- how to separate the tariff setting process from the political process.

As far as we can determine, all countries that have recently privatized all or a part of their electrical systems have established some type of Regulatory Board similar in scope and structure to the recommendations included in our previous report. Some have been headed by one regulator rather than a small group of regulators.

2. The scope of Pakistan's National Electric Power Regulatory Authority (NEPRA) is limited solely to the electric power sector and, as outlined in the Revised Final Draft Report, its responsibilities include the following:
 - issue exclusive service franchises to transmission and distribution companies,
 - specify and enforce the service obligations of these companies,

- establish and monitor performance standards,
- approve service codes,
- approve rates, terms and conditions of service,
- approve investments and resource acquisition programs,
- authorize land use for transmission lines,
- disseminate information to promote competition and facilitate identification of private investment opportunities,
- develop reports on the industry,
- review publicly-financed projects,
- promote industry standards and codes of conduct, and
- resolve disputes.

Privatization of the electric power sector in Pakistan is being designed to include the creation of a national electric power market supplied by competitive private generators. Consequently, regulation of generation companies by Pakistan's NEPRA will be indirect and rely on the following:

- development and utilization of competitive solicitations,
- review and approval of power pooling pricing and operational rules,
- regulation of the investment and resource acquisition programs of the entities purchasing power, and
- retail rate regulation.

3. The proposed Pakistan National Electric Power Regulatory Authority is to be composed of five members: a Chairman appointed by the Prime Minister and four members appointed by the Prime Minister from candidates nominated by the provincial governments. All are to have expertise from one of the following professions: finance/accounting, economics, law, and engineering. The members will serve staggered five-year terms, but no member will be able to serve more than two five-years terms. The Authority would be staffed by professionals with experience in finance/accounting, economics, law, and engineering.

As was pointed out in our previous report, State regulatory boards in the United States are headed by either elected or (mostly) appointed officials. All are **staffed**, however, primarily from the professional career civil service. The staffing of the newly created regulatory boards in other countries appears to be consistent with this pattern for the most part.

4. An "independent" regulatory authority does not mean an agency that is isolated from government policy or beyond government control. The term "independent" implies an agency that has sufficient autonomy to perform its duties, sufficient autonomy to give the regulatory process credibility and durability, and sufficient autonomy to establish an adequate boundary between politics and utility management. "Independence" can best be established and maintained for regulatory authorities in which:
 - officials are appointed by the Prime Minister rather than elected; (This encourages them to be responsive to government policy in general but not subject to direct electoral politics);
 - officials serve staggered terms that do not coincide with the term of office for the government;
 - the source of operating revenue is from user fees rather than the national budget;
 - the regulated entities are incorporated;
 - the regulatory rules and process are clear and open, and
 - performance agreements are used as the basis for all parties to reach agreement in advance about roles, responsibilities, expectations, and targeted results for which all parties can be held accountable.

5. Consulting firms doing prominent work in this area of regulation include the Washington D.C. office of NERA (National Economic Research Associates), the Washington D.C. office of Putnam, Hayes, Bartlett, the London office of Coopers & Lybrand, and most of the consulting arms of the "Big 6" accounting firms such as Arthur Andersen. The law firms involved are ordinarily hired by the consulting firms.

6. The experts in this field whom we most highly recommend, especially because of their experience as well known former regulators are:

a) Ashley Brown, currently Executive Director of the Harvard Electricity Policy Group at Harvard's Kennedy School. Dr. Brown formerly served ten years as Commissioner of the Public Utilities Commission of Ohio and was nationally recognized as one of the most thoughtful and best regulators in the United States. He has recently been consulting with governments that are in various stages of privatizing, advising them on how to establish regulatory agencies that will work more efficiently and effectively than those in the United States. Mr. Brown is an attorney.

b) Dr. Phil O'Connor, currently Managing Director of Palmer Bellevue, a Division of Coopers & Lybrand. Formerly the Chairman of the Illinois Commerce Commission, Dr. O'Connor is nationally recognized as an expert on the development of competitive energy markets and innovative utility regulation. Dr. O'Connor holds a Ph.D. in Political Science.

7. A regulatory authority must be in place at the time that any part of the Egyptian electrical system is privatized. This is also true for any other utility service that will be privatized in the future. Other than this imperative, there is no reason why a regulatory authority for one particular utility service would precede that of another.

Most regulatory agencies that handle electricity also handle gas. Some of these also handle telecommunications and water, i.e. all those utility services that are both considered necessary and that have the potential for exercising monopoly power. The dominant argument in favor of combining regulation of all utility services under one regulatory authority is that it is more efficient and cheaper to operate one board than it is to operate several. On the other hand, the dominant argument against such consolidation is that such a board tends to accumulate more influence and power over time.

We recommend that the Regulatory Board be established for electricity as soon as necessary, but that the potential for the addition of regulatory oversight of the gas industry be kept in mind during the design phase. We also recommend that consideration be given by the appropriate officials to determine whether there should be some consistency in the structure and philosophy between the separate regulatory authorities for telecommunications and for electricity now under discussion in Egypt.

In reference to the last paragraph of Mr. Hunt's letter asking for the World Bank's agenda on sector reforms.

With respect to the regulation of the sector, the World Bank's agenda is to encourage regulation by an independent regulatory authority that provides a predictable, transparent, consistent, workable and accountable framework for conducting public and private business.

In illustration, the following quotes have been excerpted from various World Bank papers:

- "A requirement for all power sector loans should be explicit country movement toward the establishment of a legal framework and regulatory processes satisfactory to the Bank."
- "In conjunction with other economy-wide initiatives, the Bank should require countries to set up an independent, arm's length, transparent regulatory process between the government and power suppliers that includes an intervention point for debate on power sector economic, financial, environmental, and service issues."
- "The regulatory authority must provide clear pricing guidelines to the power enterprises, which should reflect the sometimes conflicting objectives of
 - a) a commercially-based allocation of costs among consumers according to the burdens they impose on the system,
 - b) assurance of a reasonable degree of price stability,
 - c) provision where economically feasible of a minimum level of service to low-income consumers,
 - d) power prices generating sufficient revenues to meet the financial requirements of the sector, and
 - e) a tariff structure simple enough to facilitate metering and billing of customers."
- "Transparency of decision-making in a regulatory framework is a safeguard against corruption, patronage, waste, and the abuse of executive authority. Competition and deregulation, the removal of unnecessary controls, clear rules, and disclosure are important first steps."

(The quotes above are drawn from: The Bank's Role in the Electric Power Sector, March 18, 1992)

- Transparency is defined as:
 - 1) a clear set of rules, known in advance;
 - 2) rules actually in force;
 - 3) mechanisms to ensure application of the rules;
 - 4) conflicts resolved through binding decisions of an independent judicial body or through arbitration;
 - 5) known procedures for amending the rules when they no longer serve the purpose, and
 - 6) a framework of regulatory incentives (including the possibility price capping) to support competition and induce efficiency."

(The quote above is drawn from: Power Supply in Developing Countries: Will Reform Work?. November, 1993)

SECTION III STAFFING AND TECHNICAL ISSUES

Section III supplements "Policy Reform and Institutional Development Assessment for Competitive Market Adaptation of the Egyptian Power Sector, Section 6.1.6: Plant Staffing/Personnel". The number of employees on an employee/MW capacity basis varies considerably throughout the EEA system; the range is from 0.5 to 19.1 for the thermal units, and from 0.5 to 2.3 for the hydroelectric units. The additional information requested (both for the U.S. and countries at a similar level of development as Egypt) for this revision includes:

- staffing levels by specific hydro plant size;
- staffing for individual utilities by installed capacity and kWhr sales;
- plant staffing v. plant capacity;
- staffing v. transmission/distribution (T&D) size; and
- utility customers per employee.

Ideally, EEA would like to follow the same trends in staffing. However, comparisons and optimization of plant personnel numbers should include the following considerations:

- plant design (e.g. simple cycle v. combined cycle, etc) and location;
- energy generated (higher generation requires more maintenance and engineering);
- number of units within a given plant;
- fuel type;
- type of operation (e.g. peaking v. baseload);
- environmental controls; and
- centralized support facilities.

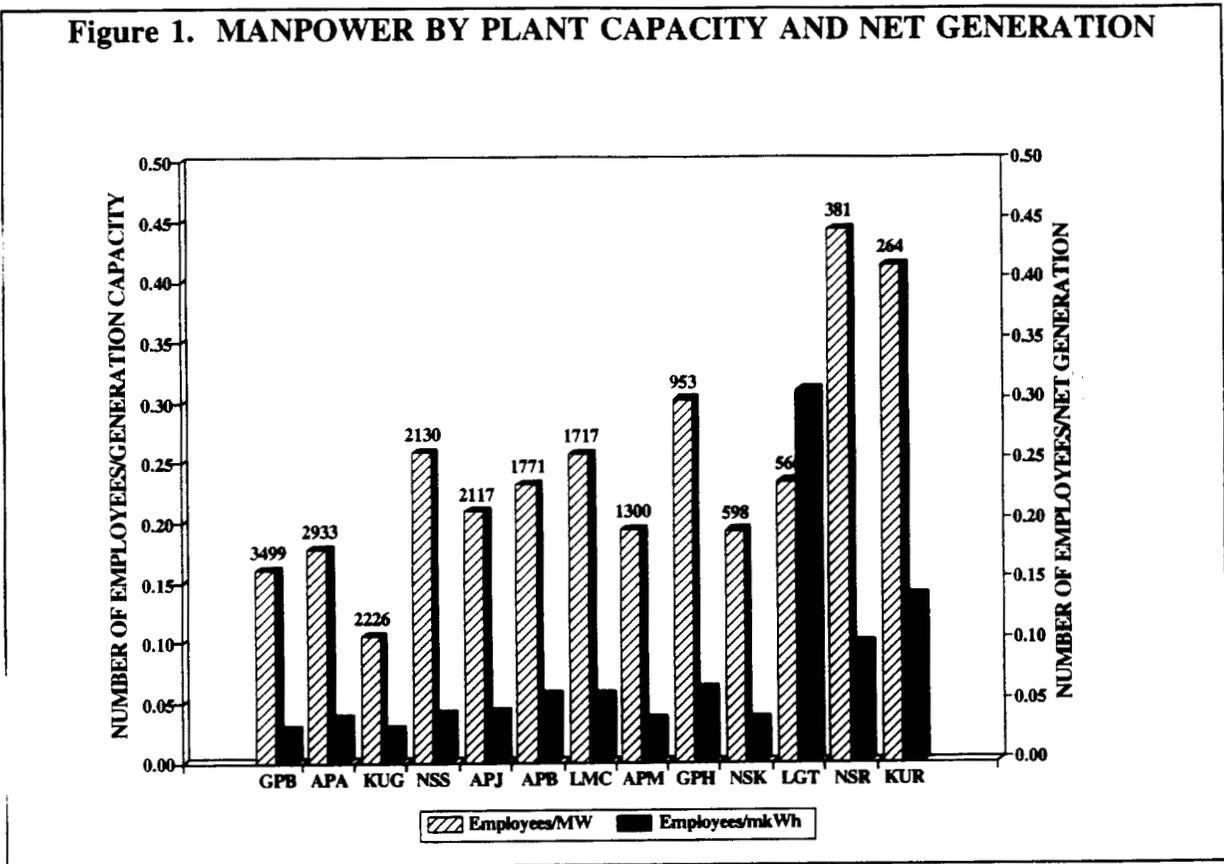
U.S. UTILITY AND PLANT STATISTICS

The performance data presented is derived from both privately- and investor-owned utilities in the United States for 1986-1993. In general, hydroelectric generation requires the fewest employees per MW of electricity, followed by diesel, gas, oil, and coal in ascending order. Utilities that employ predominantly hydro or gas generation typically have 0.1 or 0.2 employees per MW, while utilities that are predominantly oil- and gas-fired, show ratios of 0.3 to 0.5. These kind of aggregate indicators can be useful for identifying areas that warrant further investigation. Such indicators should be compared with year-earlier measurements, and the cause of any year-to-year changes, if it can be determined, should be carefully documented for future reference. In addition, these indicators can be tracked over time for internal budget purposes or can be compared with other utilities with similar operating conditions.

The Ernst & Whitney survey¹ included a generic performance indicator for U.S. coal, oil and gas fired boilers, as well as nuclear and hydro, sampling various size ranges. Full-time equivalent employees include management, skilled, support, and unskilled labor.

Generation employees per MW system capacity (generic):
 minimum value = 0.11
 maximum value = 0.51
 mean value = 0.26

More specifically, Figure 1 shows, on a plant-by-plant basis (13 fossil-fueled steam-electric plants of various capacities shown), ratios of the number of electric plant employees/generation capacity (MW) and number of employees/net generation (million kWh) for 1990^{2,3}. Plant capacity, ranging from 3499 MW to 264 MW, is shown at the top of each bar.



<u>Utility</u>	<u>Plant</u>	<u>Abbreviation</u>
Georgia Power Co.	Bowen	GPB
	Hammond	GPH
Appalachian Power Co.	John E. Amos	APA
	Mountaineer	APM
Kentucky Utilities Co.	Ghent	KUG
	Green River	KUR
Northern States Power Co.	Sherburne County	NSS
	Allen S. King	NSK
	Riverside	NSR
Alabama Power Co.	James H. Miller Jr.	APJ
	Barry	APB
Louisville Gas & Electric Co.	Trimble County	LGT

The number of employees/generation capacity averages 0.244 (range: 0.1047 to 0.4129) and generally increases with decreasing plant capacity. The number of employees/net generation averages 0.074 (range: 0.0267 to 0.3090) employees/million kWh, and also increases with decreasing plant capacity. Representative data is shown below for three selected plants.

Name of Utility	Appalachian Power Co.	Georgia Power Co.	Northern States Power
Name of Plant	Mountaineer	Hammond	Riverside
Installed Generating Capacity (MW)	1300	953	381
Net Generation (mkWh)	7046.2	4769	1717.6
Average Number of Employees	251	287	169
Number of Employees/Installed Capacity	.193	.301	.444
Number of Employees/Net Generation	.036	.060	.098

Comparing the Appalachian Power Company's Mountaineer plant (1300 MW installed capacity), the ratio of the number of employees/installed capacity is 0.193, while for the EEA Shoubra plant (1260 MW) the ratio is 0.8. While this is one of the lower EEA station ratios, there is obviously still room for improvement. Similarly, the Georgia Power Company's Hammond plant (953 MW) has a ratio of 0.301, and the EEA Attaka plant (900 MW) has a ratio of approximately 0.7; and the Northern States Power Company's Riverside plant (381 MW) has a ratio of 0.444, while the EEA's Abu Sultan (600 MW) has a ratio of approximately 1. These three EEA stations, Attaka, Shoubra, and Abu Sultan, have relatively low ratios, therefore the other stations with higher employee/generation capacity ratios should be targeted first for improvement.

Figures 2 and 3 show the number of electric plant employees/MW capacity and employees/net generation (million kWh) by specific hydro plant (indicated by x-axis tick-marks), ranging from 1950 to 28 MW capacity. The employee/capacity ratio averages 0.18 (range: 0.0128 to 0.5920) and basically shows no trend with decreasing capacity. The number of employees/million kWh generated averages .033 (range: 0.0032 to 0.1294), and shows no trend with decreasing capacity.

A summary table of selected plant data follows. Representing smaller U.S. hydro plants are the City of Tacoma's Mayfield plant (162 MW) and Southern California Edison's Big Creek No. 3 (172 MW), which are comparable in size to EEA's Aswan Dam II. With employee/capacity ratios of 0.123 and 0.051, respectively, the U.S. plant ratios are much lower than that of Aswan II at approximately 0.9. Two larger U.S. plants, comparable in size to Aswan I (345 MW), are City of Tacoma's Mossyrock (300 MW) and City of Seattle's Ross Dam (360 MW). Again, the Aswan I ratio at over 2.0, is much higher than that of the U.S. plants (0.02 and 0.036, respectively). EEA's High Dam (2100 MW) employee/capacity is the lowest for EEA hydroelectric stations at approximately 0.5; U.S. plants of similar capacity, Power Authority of State of New York's Moses Power Dam (912 MW) and Moses Niagara (1950 MW), are slightly lower at .287 and .184, respectively.

Figure 2. HYDROELECTRIC PLANT MANPOWER BY CAPACITY
 Plant Capacity Ranges From 1950 to 28 MW

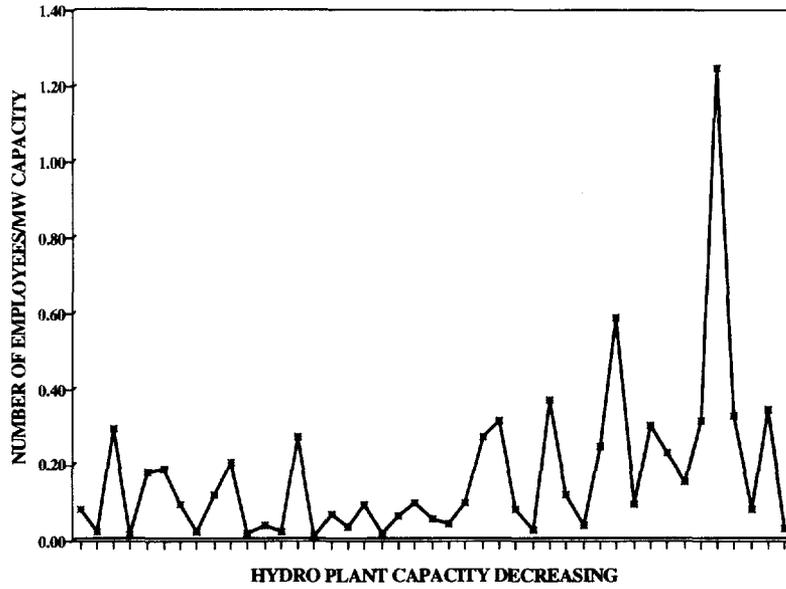
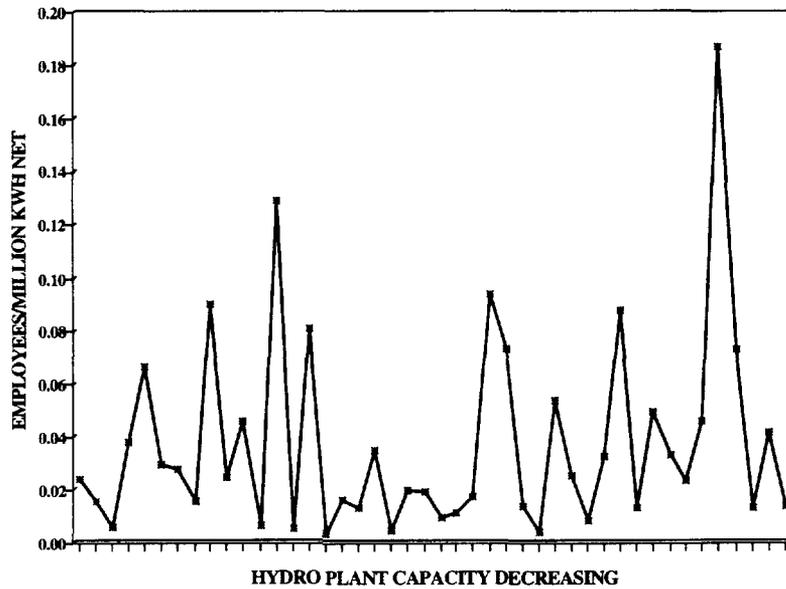


Figure 3. HYDROELECTRIC PLANT MANPOWER BY NET GENERATION
 Plant Capacity Ranges From 1950 to 28 MW



SUMMARY TABLE

Name of Utility	City of Tacoma	Southern California Edison Co.	City of Tacoma	City of Seattle	Power Authority of State of New York	Power Authority of State of New York
Name of Plant	Mayfield	Big Creek No 3	Moneyrock	Ross Dam*	Moses Power Dam	Moses Niagara
Installed Generating Capacity (MW)	162	175	300	360	912	1950
Net Generation (mkWh)	771.0	580.4	1047.8	1026.5	6993.0	14540.3
Average Number of Employees	20	9	6	13	262	359
Number of Employee/Installed Capacity	.123	.051	.02	.036	.287	.184
Number of Employees/Net Generation	.026	.016	.006	.013	.037	.025

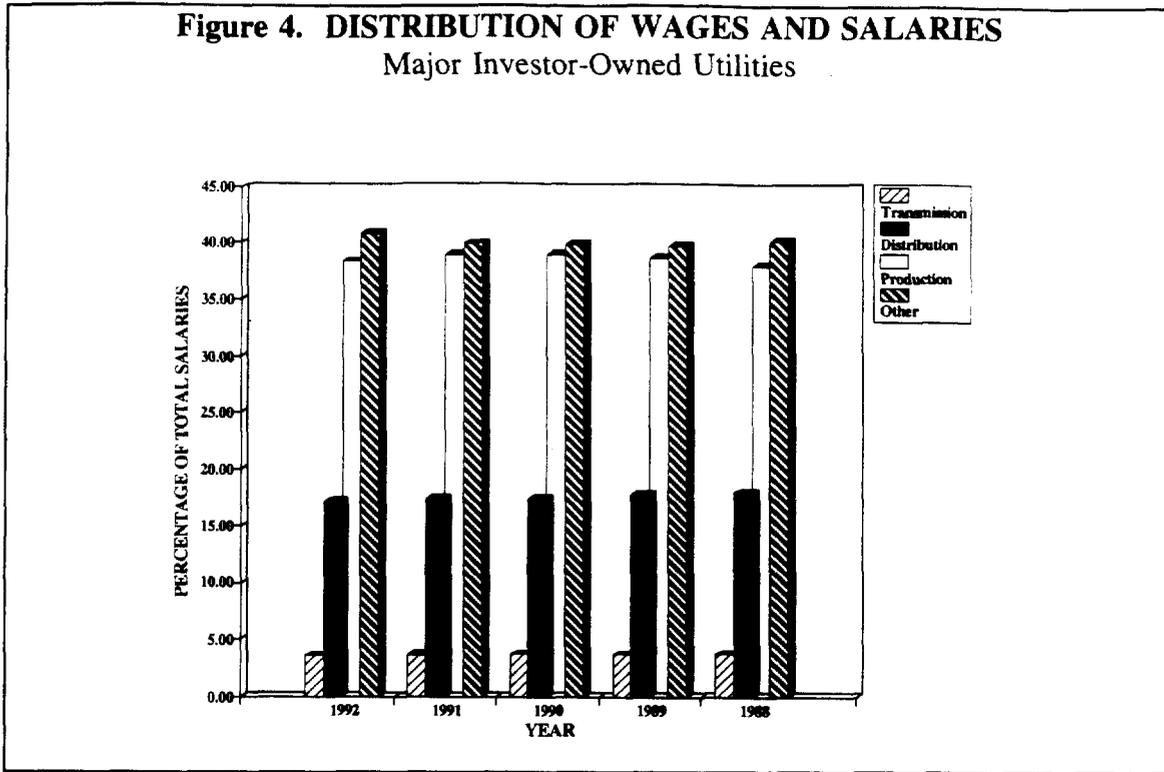
* Part of a complex of three plants which shares a maintenance crew of 100 and also employs remote operation. Many of these smaller plants with very low employee/capacity ratios share additional employees with other plants.

Distribution of Wages and Salaries

Figure 4 shows the distribution of salaries and wages charged to electric operation and maintenance for major investor-owned utilities in the U.S. from 1988 to 1992⁴. Included are transmission, distribution, production, and other (includes customer accounts, customer service and informational expenses, sales expenses, administrative and general, and allocated from clearing accounts). Percentages of salaries/wages paid over the time period (with little variation) average:

- transmission: 3.7%
- distribution: 17.5%
- production: 38.64%
- other: 40.2%.

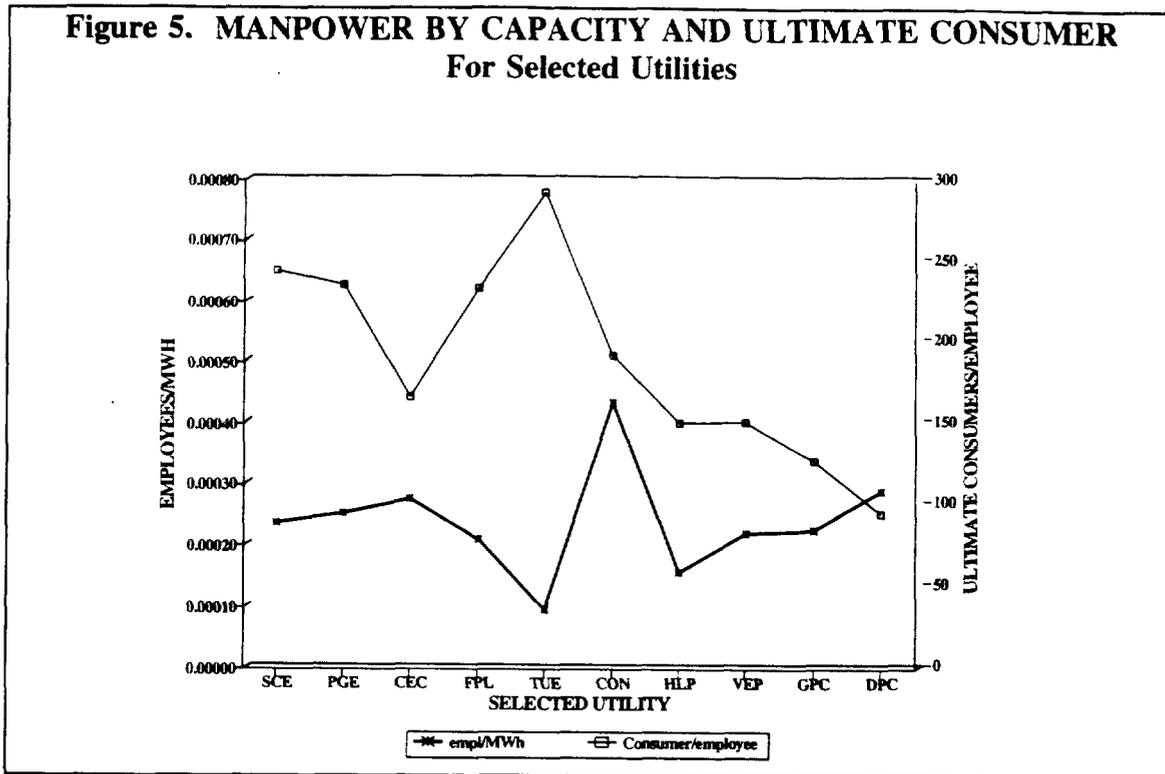
Figure 4. DISTRIBUTION OF WAGES AND SALARIES
Major Investor-Owned Utilities



Consumer Distribution

Figure 5 shows the ratio of ultimate consumers per total number of electric department employees (regular full-time) for the ten largest U.S. investor-owned utilities (based on revenue from sales to ultimate consumers) for 1990. Electric department employees include production, transmission, distribution, and other. Consumers include residential, commercial, and industrial. In addition, the number of employees/MWh sales is shown on the same figure. Utilities included and their corresponding x-axis abbreviations are as follows:

<u>Utility</u>	<u>Abbreviation</u>
Southern California Edison Co.	SCE
Pacific Gas & Electric Company	PGE
Commonwealth Edison Company	CEC
Florida Power & Light Company	FPL
Texas Utilities Electric Co	TUE
Consolidated Edison Co-NY, Inc.	CON
Houston Lighting & Power Co.	VEP
Virginia Electric & Power Co.	HLP
Georgia Power Company	GPC
Duke Power Co.	DPC



The average number of consumers per employee for all investor-owned utilities for the 1988-1992 time period is 174.7.

INTERNATIONAL UTILITY STATISTICS

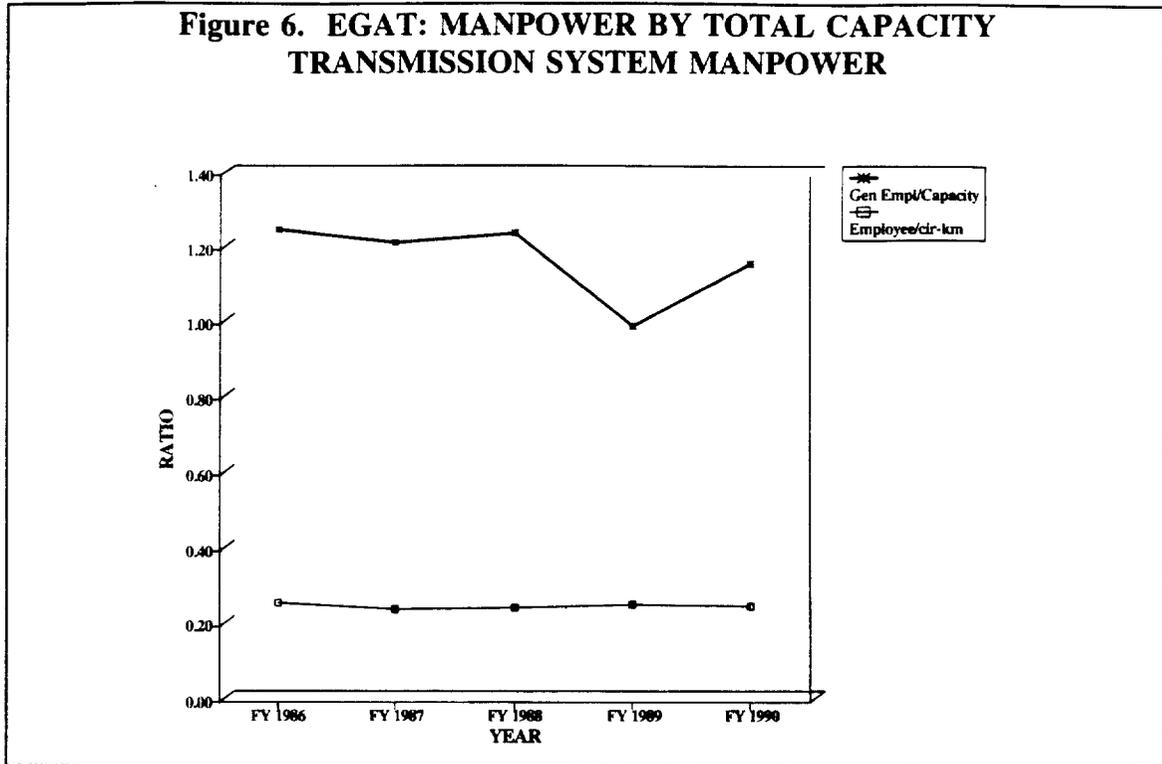
The Ernst & Whitney survey included a generic performance indicator for a sampling of international coal, oil and gas fired boilers, as well as nuclear and hydro, for varying size ranges. Full-time equivalent employees includes management, skilled, support, and unskilled labor.

Generation employees per MW system capacity:
 minimum value = .13
 maximum value = .93
 mean value = .41

Figure 6 shows statistics for EGAT; one plot shows a ratio of the number of generation employees to total capacity (MW) for 1986-1990⁵. This data includes both thermal and hydro generation; the percentage hydro to total generation is 30% for the time period. The average number of employees/capacity over the 5-year period is 1.18.

A plot of the ratio of transmission department employees to transmission system size/capacity (circuit-km) is also shown on Figure 6. The transmission system includes both overhead and underground transmission lines. The average over the 5-year period is .24 employees/circuit-kilometer.

**Figure 6. EGAT: MANPOWER BY TOTAL CAPACITY
TRANSMISSION SYSTEM MANPOWER**



SUMMARY AND CONCLUSIONS

Although many factors influence staffing/labor requirements for power plants, comparisons in staffing levels and labor trends of similar plant types and size can help target plants for optimization. Generally, the EEA plant ratios of the number of employees/installed capacity vary widely and are much higher than power sector averages in the U.S.:

EEA fossil-fueled plants: 0.5 to 19.1
hydroelectric plants: 0.5 to 2.3

U.S. fossil-fueled plants: .10 to .41
hydroelectric plants: .013 to .59

There is a correlation between increasing capacity and decreasing manpower/capacity ratios in the fossil-fueled plants; however, there is no such correlation for the hydroelectric plants.

Percentages of total salaries allocated to transmission, distribution, production and other staff has remained relatively constant for major investor-owned utilities in the U.S. over the last five years at 3.7%, 17.5%, 38.64%, and 40.2%, respectively. The average number of consumers (including residential, commercial, and industrial) for all investor-owned U.S. utilities for 1988-1992 is 174.7. These type of aggregate indicators should be useful tools for identifying staffing inefficiencies within the EEA power system.

REFERENCES

1. World Bank Technical Paper Number 85: Proposals for Monitoring the Performance of Electric Utilities/Industry and Energy Series
2. DOE/Energy Information Administration: Electric Plant Cost and Power Production Expenses 1990
3. DOE/Energy Information Administration: Electric Plant Cost and Power Production Expenses 1991
4. DOE/Energy Information Administration: Financial Statistics of Major U.S. Investor-Owned Electric Utilities 1992
5. Asian Development Bank: Electric Utilities Data Book for the Asian and Pacific Region - 1993

SECTION IV

OTHER ISSUES

This section deals with the other issues raised in the last paragraphs of Mr. Hunt's letter.

TIMELY COLLECTIONS (CHAPTER 11)

The issue of accounts payable was not raised in our report.

To our knowledge the major delay in EEA's payments are to EGPC for fuel consumed. EEA has attempted several times to offset the amount due to EGPC by the receivables from other Government entities and Public Sector Companies.

POLICY AGENDA OF INTERNATIONAL DONORS

International donors have included in recent loan agreements for El Khureimat Power Projects covenants that parallel many of the recommendations of our report and in particular:

- The need to reduce receivables
- Accounting and reporting improvements
- Cash flow generation
- Better internal organization for project management
- Debt equity ratio

The IMF and the World Bank have also raised other policy issues such as:

- Fuel prices and electricity tariff.
- Need for a regulatory framework

All the above issues have been raised periodically by the world Bank teams visiting Egypt. In general, it can be stated that the World Bank Policy agenda is very close to that of USAID.

SECTION V

EEA COMMENTS

Under this section we have attached the comments and remarks received from EEA after the presentation of the Final report in Cairo. We have incorporated in the final version of the report some of the comments that were relevant to its contents specifically:

- Chapter 5 was revised to include EEA's comments and the revised organizational charts, as well as the employment forecast to the year 2007, which shows continuing increases in hiring of personnel notwithstanding the existing over employment situation.
- Chapter 6 was revised and the new generation statistics for 1992/93 were included to compare with the 1991/92 figures. The overall apparent improvement in fuel consumption is due mainly to the combined cycle portion of the Damietta plant coming on stream with a high efficiency and not due to economic dispatch. All the old and inefficient plants remain in service. Therefore the observations and recommendations contained in the report stand.
- Chapter 11 was revised and the comparison with EGAT (Thailand) corrected to reflect new figures obtained from the World Bank. EEA has included a table with several ratios to compare operations of EEA and EGAT. These comparisons involve figures that are difficult to compare in a fair manner due to differences in costs and energy fuel prices in the two countries.

There are other comments which refer mainly to operation and maintenance issues, these are noted and included in the attachment. However, the comments reached us too late to be included in the Final Report in view of the contractual limitations.

EGYPTIAN ELECTRICITY AUTHORITY

ABDASSALAM NASSR - CITY, CAIRO, EGYPT.

TELEGRAM : ELECTROCOP-TELEX : 92097 POWER UN

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Mr. John p. Hunt
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Power and Telecommunication
USAID
106, Kasr El Eini St, Garden City, Cairo

Subject : "Policy Reform and Institutional Development Assessment
for Competitive Market adaptation of the Egyptian Power
Sector." Egyptian Electricity Authority . Final Report

Dear Mr. Hunt,

With reference to the A/M subject, I would like to inform you that after the Consultant K & M submitted the Draft Report on August, 1993 . EEA reviewed the report and handed the attached comments which was mainly on Chapters 5, 6, 7, 8, 9, 10, and 11, to Mr. Khalifa During November, 1993 .

However the Consultant submitted the Final Report on December 15, 1993 and did not take into consideration most of our comments, Please transmitt this message to the consultant K & M to be taken into consideration .

Thank you for your kind cooperation .

Best regards .

Sincerly Yours



Eng. El-Said Issa
Chairman of E.E.A.

17-4-94

**MODIFICATION ON SOME ITEMS
OF THE PRELIMINARY FINDING REPORT OF K&M
CONCERNING
POLICY REFORM AND INSTITUTIONAL DEVELOPMENT**

1. PAGE 9-17, FIRST PARAGRAPH TO BE MODIFIED AS FOLLOWS :

As previously stated in 9.4.1, EEA have started to introduce DSM as a part of the least cost planning process through the integrated resource planning model. But, per the discussion of 9.2. it appears that the evaluations of DSM options are not globally optimized by the EEA along with the supply-side (or transmission) parts of the overall planning equation till now. Hence, a complete "level playing field" integration of the impact of system loads into the overall EEA expansion derivation process is required.

2. PAGE 9-18, THE LAST 2 PARAGRAPHS TO BE MODIFIED AS FOLLOWS :

For example, a significant amount of the EEA's older generating units are candidates for retirement, refurbishment, life extension, or conversion to different duty cycle. EEA optimum expansion plan takes into consideration that some of the older units will be retired and the other will be considered as emergency stand by only.

As an example, a number of EEA's gas turbines with total capacity of about 500 MW located at different sites converted (Talkha) and will be converted (Damanhour, Mahmoudia) to combined cycle operation. This improved their longevity as well as their fuel consumption efficiency.

3. PAGE 9-19, 3rd, 4th, AND THE FIRST 2 LINES OF THE 5th PARAGRAPH TO BE DELETED.

[However, in any case..... to be place on the system through time.]

4. PAGE 9-20, 9.9.5 EEA GENERATION EXPANSION PLAN 1992/2000 TO BE MODIFIED AS FOLLOW :

Table 9-3 shows the additional generation capacity contemplated by EEA to the end of the century. Referring to the analysis previous made about EEA's load forecasting methodology and the elasticity of growth relative to pricing, it is difficult to accept the large amount of

additional capacity projected in this table which totals more than 3800 MW for a system that had a peak load of 7793 MW in 1991/92, with an increase of only 3.1% over the previous year. However, this amount of additional capacity can be accepted for replacing the scheduled retired power generating units, meeting the increasing demand, as well as the reliability levels.

Table 9-3 to be modified as attached.

5. PAGE 9-25, 9.7 SUMMARY OF RECOMMENDATION :

a) Personnel are very capable but need specialized training in country economics (formation of GDP, deflator, price indices, ...etc). Other advanced forecasting techniques and statistical analysis.

d) The forecast scenarios took into consideration the elasticity of price to the demand and EEA demand side management programs, however further consideration should be given to the privatization of industry which should result in greater attention to production cost and profitability as well as energy conservation programs in both public and private sectors.

Serial No.	Comparison	EEA		EGAT		Comments
		ratio	ratio	Thailand	ratio	
1	Sales of Energy/ Energy Generated	$\frac{40751}{41513}$	98,2%	$\frac{44773}{49226}$	90,9%	Loss of energy in E decreases by 8%. Compared to EGAT
2	Energy Generated/ Employees	$\frac{40751}{40579}$ 1,104 G.W.H/ Employee		$\frac{49226}{31383}$ 1,568 G.W.H/ Employee		
3	Fuel / Energy Generated	$\frac{240000}{41513}$ USD 5,078		$\frac{1219000}{49226}$ USD 24,76		
4	Fuel / Sales of Energy	$\frac{240000}{753315}$	31,9%	$\frac{1219000}{2247360}$	54,2%	
5	Fuel / Revenue From Sales	$\frac{240000}{753315}$	31,9%	$\frac{1219989}{2247360}$	54,3%	This is because EEA still purchasing fuel from the General Egyptian Petroleum Corporation at subsidised prices
6	Operations & Maintenance Costs / Energy Generated	$\frac{122448}{41513000}$	USD ,003	$\frac{197145}{49226000}$	USD ,004	Each kW produced electricity costs nearly same costs of operation and maintenance. As EEA adopts updated methods in operations maintenance.

Serial No.	Comparison	EEA		EGAT		Comments
		ratio	Thailand ratio	ratio	Thailand ratio	
7	<u>Interests</u> Revenue from Sales	$\frac{166\ 000}{753\ 315}$	22%	$\frac{171\ 480}{2247360}$	7,6%	The increase in ratios EEA reflects EEA's reliance on loans in financing its utilities
8	Interest Coverage Rate $\frac{\text{Net Income} + \text{Interests}}{\text{Interests}}$	$\frac{40 + 166}{166}$	1,24 times	$\frac{468 + 171,5}{171,5}$	3,7 times	The ratio reflects the interest coverage rate. As EEA self financing sources cover the interest rate by 1,24 time, while it is 3,7 times in EGAT
9	<u>Interests</u> Long-term Debt	$\frac{166}{3795}$	4%	$\frac{171,5}{3611}$	5%	
10	Total Costs/amount of Energy Sold, Coverage Price/kWh sold	$\frac{657448}{40751}$ 16,13		$\frac{1598614}{44773}$ 35,5		
11	Long Term Debt/Equity	$\frac{3795}{925}$	410%	$\frac{3611}{2460}$	147%	The ratio referred to shows imbalance in EEA financing structure and the reliance of EEA on long-term debt (local or foreign) in financing its utilities

EEA comments on the draft final report prepared by K & M Engineering and Consulting Corporation dated Aug 12, 1993 titled : " Policy Reform and Institutional Development Assessment for Competitive Market Adaptation of the Egyptian Power Sector " and is sponsored by USAID .

(i) chapter 6

[1] The report didn't reflect EEA's operation policy which can be summarized in the following :

The system is operated in the most economical manner to meet the system load and reserve requirements within the constraints imposed on the system by utilizing the hydro resources to the maximum extent to levelize the thermal generation and consequently minimizing the thermal production cost.

System Constraints

(i) fixed daily irrigation requirements specified by the ministry of public works , this discharge is the total water discharged from Aswan 1 , 2 and the Aswan dam sluices if necessary , such discharge has to be fixed on a per hour basis .

(ii) hydro & thermal units availability .

(iii) Transmission Network Constraints which is currently in the following areas :

- 1) The 66 KV link between Cairo South and Tebbin which necessiates operating units at Tebbin PS.
- 2) The 66 KV link between Abis and Suif which necessiates operating units at suif PS.
- 3) The 132 KV link between Assuit and Naghamadi which necessiates operating units at Assuit PS.
- 4) The 11 KV network supplying the loads in Suez area which necessiates operating units at Suez PS.

It is to be noted that actions are in progress now to alleviate such transmission constraints which will lead to stopping such units by retiring older ones and keeping newly rehabilitated ones as non-operating reserve for emergency conditions .

(iv) Maximization of Natural Gas utilization which reached currently more than 80 % of the amount of fuel consumed by the thermal units for better environment and to save oil for export.

To achieve such policy , the hydro and thermal resources are scheduled using a computer program based on well known optimization techniques. The Aswan 1,2 are operated as base load to keep the discharge constant hourly during the day , while High Dam is operated to peak shave the daily load curve , the remaining load is met by the thermal units committed according to their efficiencies, better ones are committed first .

Applying this policy , EEA succeeded to reduce the average system fuel consumption to be in the range of 230 - 235 gm/kwh during 1993 from Jan to Sep and will continue to improve due to the careful monitoring of the system performance .

Measures taken to improve the performance is summarized in the following :

- (1) Stopping the units that have unreasonable higher average fuel consumption than the overall system average as non-operating reserve for emergency conditions as given in table 1 herebelow .

Table (1)

#	Station	number of units			
		operat- ing	non-operat- ing reserve	rehabil- itation	overh- aul
1	Shoubra	4	--	--	--
2	Cairo North (S)	1	3	--	1
3	Cairo South (S)	2	1	--	1
4	Cairo South (G)	2	1	--	--
5	Tebbin (S)	2	1	--	--
6	Tebbin (G)	1	1	--	--
7	Cairo West (S)	2	2	--	--
8	Helwan (G)	--	4	--	1
9	Heliopolis (G)	--	1	--	2
10	Wadi Hof (G)	--	3	--	--
11	Suez (S)	2	3	--	--
12	Suez (G)	--	1	--	--
13	Ismailia (G)	--	1	--	--
14	Shabab (G)	--	3	--	--
15	Abu Soltan (S)	4	--	--	--
16	Ataka (S)	4	--	--	--
17	Suif (S)	4	--	--	--
18	Suif (G)	2	4	--	1
19	Max (G)	--	1	--	1
20	Karmouz (G)	--	2	--	--
21	Abu Kir (S)	5	--	--	--
22	Talkha 12.5 (S)	--	3	--	--
23	Talkha 30 (S)	1	1	--	1
24	Talkha 210 (S)	1	--	--	--
25	Talkha (C)	9	--	--	1

Cont. Table (1)

#	Station	number of units			
		operat- ing	non-operat- ing reserve	rchabil- itation	overh- aul
26	Damanhour 15 (S)	--	2	--	--
27	Damanhour 65 (S)	--	--	3	--
28	Damanhour 300(S)	1	--	--	--
29	Damanhour (G)	--	4	--	--
30	Kafr El-Dawar(S)	1	2	--	1
31	Mahmoudia (G)	--	12	--	--
32	Demitta (C)	9	--	--	--
33	Assuit (S)	2	--	--	1
34	Walidia (S)	1	--	--	--
35	Aswan 1 (H)	7	--	2	--
36	Aswan 2 (H)	4	--	--	--
37	High Dam (H)	12	--	--	--

(2) Operating only one unit at Cairo North power station until some of the labor is moved to new power plants while the rest is trained to gain different skills that is needed in other areas within EEA.

(3) Taking action to alleviate Network Constraints.

(4) Preparation of Monthly performance indices and revising operation strategies accordingly.

The following table (2) lists the performance indices averages over nine months from Jan up to Sep 1993 .

#	Station	Load factor %	Capacity factor %	Fuel cons- umption gm/kwh	Effici- ency %
1	Dameita combined	61.90	61.90	185.90	46.97
2	Damanhour 300	60.28	60.28	216.10	40.41
3	Abu Kir (S)	54.12	50.45	220.91	39.53
4	Ataka (S)	63.91	58.94	222.49	39.25
5	Abu Soltan (S)	59.47	57.49	224.36	38.92
6	Walidia (S)	28.95	28.95	227.33	38.41
7	Shoubra (S)	65.95	65.95	228.10	38.23
8	Talkha Combined	63.86	63.86	243.22	35.90
9	Talkha 210	22.36	22.36	246.22	35.47
10	Cairo West (S)	36.39	32.33	261.36	33.41
11	Cairo South (G)	47.30	44.29	265.63	32.87
12	Kafr El-Dawer	33.43	21.66	284.04	30.74
13	Assuit	64.10	55.55	294.99	29.60
14	Suez (S)	44.40	42.00	301.39	28.97
15	Damanhour	20.98	8.77	321.70	27.14
16	Suif (S)	48.17	42.63	322.63	27.07
17	Cairo South (S)	67.24	43.51	326.48	26.75

#	Station		Load factor %	Capacity factor %	Fuel consumption gm/kwh	Efficiency %
18	Cairo North	(S)	40.86	30.24	329.20	26.53
19	Tebbin	(G)	44.22	40.38	331.18	26.37
20	Shabab	(G)	2.49	0.17	337.61	25.87
21	Talkha		59.22	13.47	341.42	25.58
22	Tabbin	(S)	68.38	68.38	349.95	24.95
23	Ismallia	(G)	4.77	4.77	356.78	24.47
24	Suif	(G)	42.79	25.28	358.44	24.36
25	Damanhour	(G)	0.66	0.57	358.73	24.34
26	Port Saib	(G)	0.94	0.60	360.75	24.21
27	Mahmoudia		2.99	1.75	369.13	23.66
28	Karmouz	(G)	2.00	1.36	372.90	23.42
29	Wadi Hof	(G)	2.16	1.90	377.12	23.16
30	Helwan	(G)	2.36	1.34	385.66	22.64
31	Heliopolis	(G)	0.22	0.04	453.49	19.26
32	Max	(G)	1.74	0.68	768.17	11.37

So, according to the above presentation , pages 6-2 , 6-5 , 6-6 including the figures has to be updated in the final report .

- [2] It appears that the report (P.6 - 8) is covering the efforts taken by EEA to computerize the maintenance activities in the power plants like the system in Shoubra and the one implemented at Ataka and planned to be implemented in Abu Kir, High Dam and Damietta power stations, while the presentation made by the consultant on Oct 20 , 1993 denied such efforts !! . However, the final report has to update the information since the status of entering the data at Ataka is more than 90 % currently and a training program for the personnel of the other three power plants is being prepared and ready to be carried at Ataka .
- [3] P. 6-10 , 11 : The maintenance systems at Shoubra and Ataka are mixed in the report . The system described after the two bullets on the top of P.6-11 belongs to Ataka .
- [4] P.6-17 , item 6.1.7.1 , update the percentages of fuel to be : gas 81.5 % , Mazout 18.3 % , other fuels 0.2 % as per July 1993 statistics.

Liquid Fuels

It is worth visiting Shoubra to determine their practice since it will affect the the conclusion derived at the bottom of the page regarding the handling of mazout and its impact on reducing the boiler efficiency .

P.6-19 : It seems that K & M didn't visit the Operation Devision Chemical Lab in Saptia where samples of fuels are tested periodically .

P.6-20 : Incorrect statements in the 3 rd paragraph from the top , An agreement between EEA and the Gas company states that :

- 1) The Gas company calibrates the meters with EEA witnessing the calibration periodically .
- 2) EEA has the right to review and approve the gas quantities billed by the gas company before paying the invoices .

P.6-20 , Item 6 - 1.8 : Incorrect statement regarding installing AGC on all units since it is not a common practice in other utilities world wide. EEA is planning to limit AGC only on the steam units 150 MW and above during the upgrading project of the National Energy Control Center . Combined cycle and gas units will not be under AGC as followed in other utilities .

P.6-21 : Incorrect statement regarding AGC response to emergency conditions. Normally, AGC reacts for small variations in the frequency caused by unbalance between load and generation due to forecast errors and is disabled during emergency conditions created from generation outages or load curtailment.

P.6-25 , item 6.2.2 :

item a : The total daily discharge from Aswan I , II covers the irrigation requirements and High Dam discharge may be more or less depending on the level of the lake between the two Dams .

item C : No water is discharged specially for navigation.

- last paragraph of clause 6.2.2 : delete the last sentence starting from " Nevertheless" up to " breakers " .

P.6-28 , 29 : recommendation from g to l has to be revised in the final report based on the above mentioned EEA's comments .

(ii) Chapter 7

P. 7-5 , item 7.10

* 500 KV line outage : Adjust the figures to be 0.03 % and 2.63 instead of 0.3 % and 26.3 respectively.

- * 220 KV line outage : Adjust the figures to be 0.082 % and 7.18 instead of 0.82 % and 71.8 respectively .
- * 132 KV line outage : Adjust the figures to be 0.003 % and 0.26 instead of 0.003 % and 2.6 respectively .

(iii) Chapter 10

- (1) P. 10 - 1 : The efficiency increase is not a claim , since the actual figure in Sept 1993 reached 37.5 % generated (35.8 % transmitted) , delete the statement expressing this claim .
- (2) Your recommendation of requesting the control center to run simulations to save cost is already an on going daily activity to optimize operation within system constraints , there is no what you call a true least cost dispatching. Accordingly it is incorrect to mention that 15-18 % reduction in cost can be achieved without carrying extensive studies as EEA does . However , the rough calculations referred to it in the report has to be presented . It is also to be noted that the constraints preventing stopping inefficient units are all technical and not social as mentioned , refer to table (1), chapter 6 comments.
- (3) P. 10 - 2 , item 10.2.2 :
This paragraph is entirely incorrect . It has to be modified to reflect that the 66 KV link between Abis and Suif necessitates operating Suif units and this constraint shall be relaxed after the commissioning of Suif 220/66/11 KV substation to be fed from Abu Kir power station .
- (4) P. 10 - 3 , item 10.3 :
The supervisory control feature is part of the existing SCADA system , it can be used in case of major disturbances. However, performing trip/close operation by plant personnel via directions from the NECC does not seem to cause any effect on the performance and security.

regarding the comments on AGC , refer to our comments on chapter 6 regarding this issue.
- (5) P. 10 - 3 , item 10.4 :
revise recommendations # a , b, d, e according to the above comments .

7.17 SUMMARY AND RECOMMENDATIONS.

a- EEA transmission expansion plan includes the construction of a 500 KV network between Cairo and Alexandria and the interconnection of the units (3,4) of Sidi Krir power plant. From our findings, the 500 KV network will be of great importance to the interconnection of the Egyptian and Lybian networks especially in the 2nd stage of this interconnection as these units will mainly evacuate their power to the neighbouring countries.

b- EEA started to use less expensive substation design and study the erection of 500 KV substations with a ring system configuration. At present EEA uses the double busbar double breaker configuration which guarantee a better reliability.

It is realised that EEA has started to use live working cleaning and maintenance for the 220 KV transmission lines and substations. A training centre was established in Delta zone for training EEA's personnel. This method should be used in the future for the 500 KV network. This is an important step forward in the field of capacity building and maintenance cost saving. *This can be repeated in other zones.*

c- It was noticed that there are two power transformers as minimum in each 66 KV substation for the sake of reliability and continuity of supply. Other transformers should be added depending on the capability of the 66 KV network to carry the load from adjoining substations and based on network studies. Under loaded transformers have to be identified periodically.

d- The equipment specifications are based on IEC standards and according to EEA's standards in some cases to suit with the technical requirements and conditions in the different sites. EEA has to encourage the development of these specifications according to the up to date manufacture of the equipment tools and construction materials.

e- EEA is now implementing a patrolling system for the identification of obstructions to the right of way of transmission lines and a governmental law is applied to prevent the construction in the right of way of these lines. This law determines also the safe distance between the lines and the surrounding constructions. The implementation of this system should be supported by all the concerned parties.

7. Transmission system

7.1 Description

The transmission system of the Egyptian Electricity Authority (EEA) consists of all the lines, cables, substations, power transformers, circuit breakers, relays and associated equipment in operation in the voltage classes of 500, 220, 132 and 66 KV. Included in these are step-up transformers with a low voltage to match the generators, and steps down transformers whose low voltage is 11 KV .

In 92/93 the descriptions and approximate lengths of the transmission lines were .

- a) 1,617 Kilometers of double circuit 500 KV lines extending from Aswan High Dam substation to the Cairo 500 KV substation by way of the Nag Hamadi, Assuit, Samalut substations, and 103 Kilometers of single circuit 500 KV lines extending from Tebbin substation to Abu Zabaal substation and Cairo West Power Station interconnection.
- b) 5,931 Kilometers of 220 KV lines and cables located in all zones.
- c) 2,246 Kilometers of 132 KV lines located in the Northern Upper Egypt and Southern Upper Egypt Zones.
- d) 6,174 Kilometers of 66 KV lines and cables located in all zones.

Each zone is responsible for the operation and maintenance of equipment installed within it.

Comments on sec . (5)

Management And Organization

*Maniging Authority Director
For
Training -*

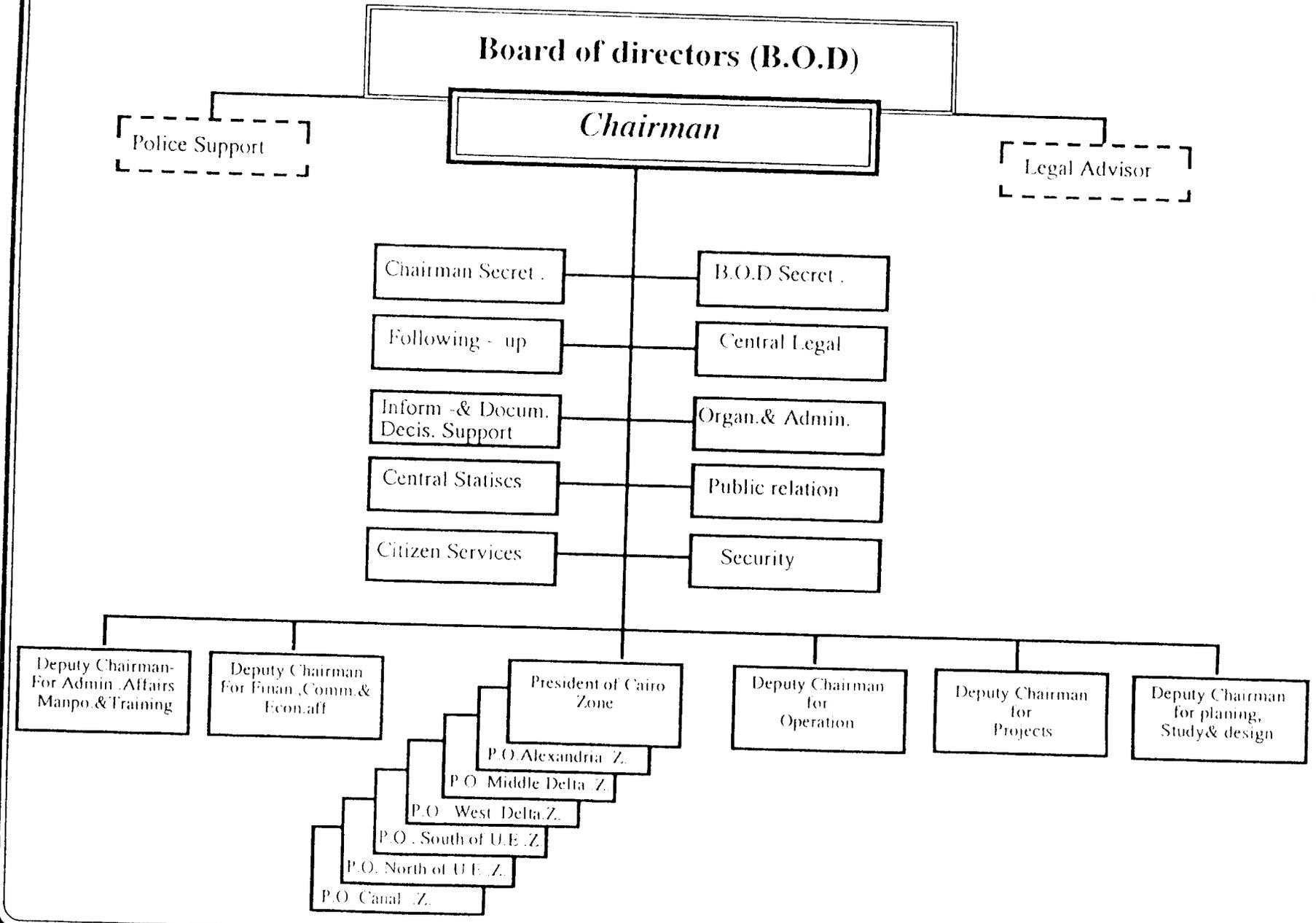
*Bassiony
Dr Bassiony El Baradie
8-11-93*

*Maniging Director
for*

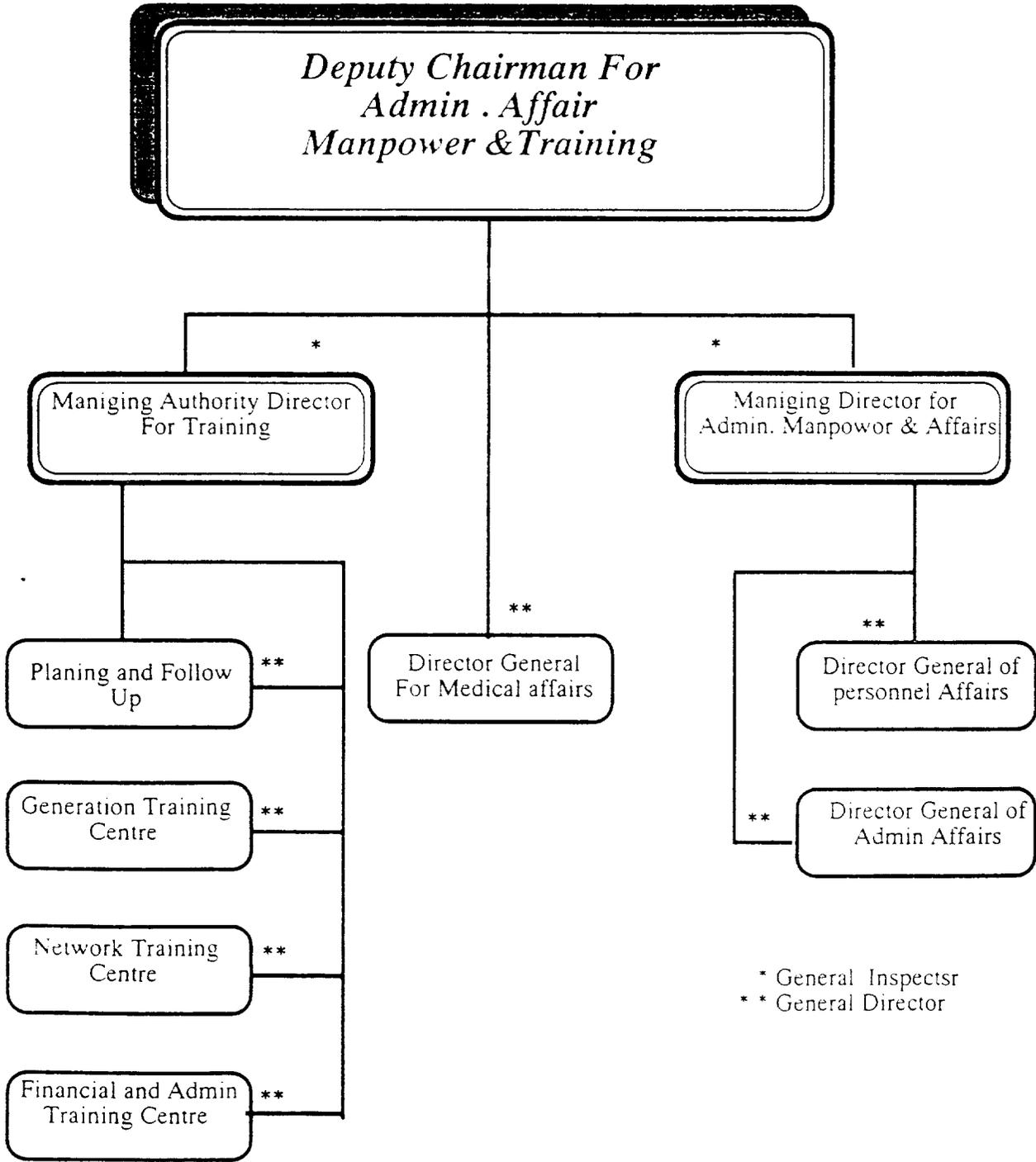
*Admin. Manpowor & Affairs
8-11-93
Eng . Mohamed Gameel A kadir*

1- Their are some corrections indicated in
fig (5-1) in the organization chart of
E. E. A.

The sections to be corrected are indicated
on the original Figure and the correc-
tions have been made in the attached
Figures.



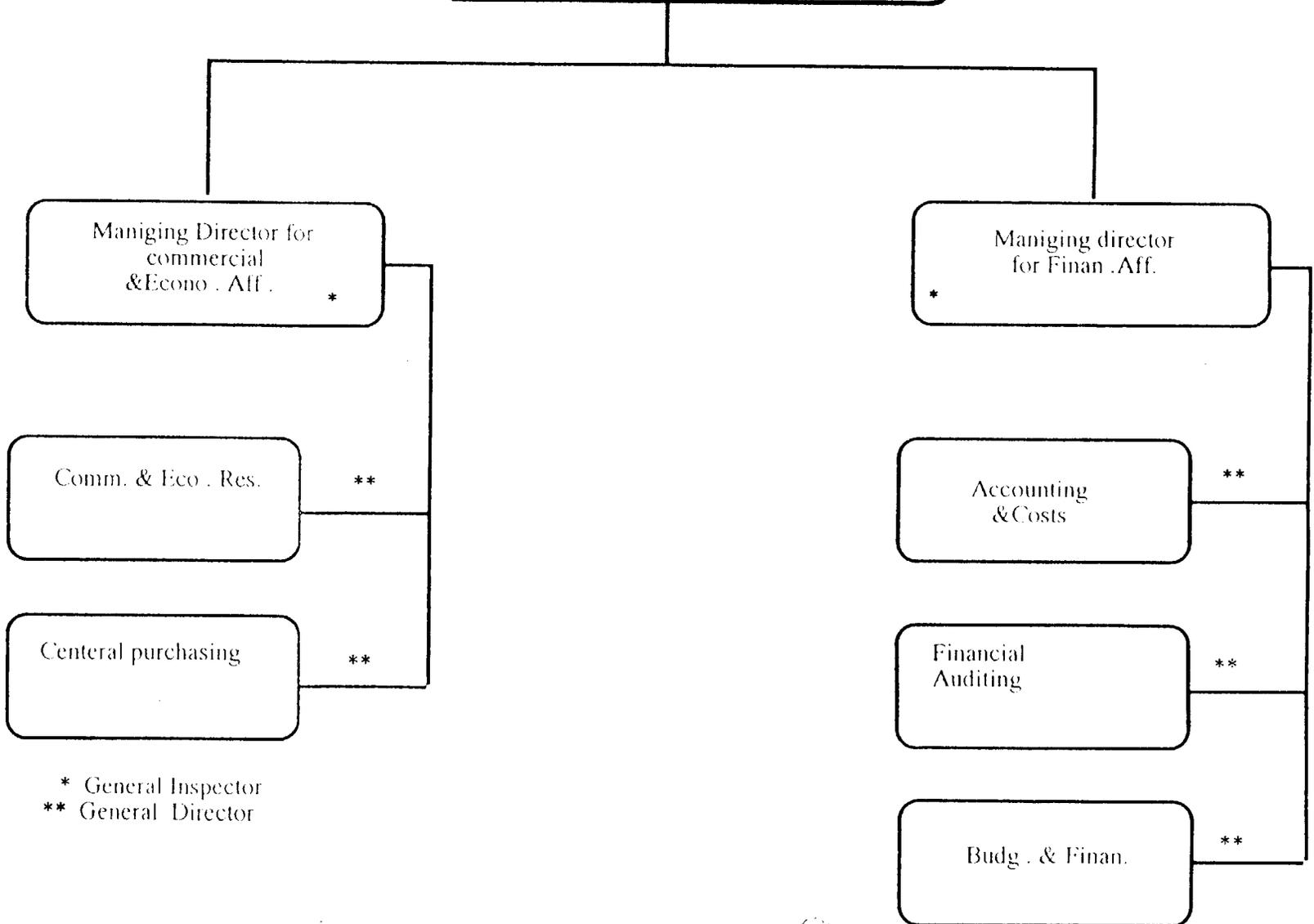
**Correction in the Organization of
E.E.A
Fig 5-1**



* General Inspector
* * General Director

Correction of Fig 5-1
(Cont) Section 5

*Deputy Chairman for
Finan. Comm
Econo.Aff.*



*Deputy Chairman for
Operation*

Industrial safety

Generation & Energy ex-
change costs

Power Plant and
Network Affairs

Protection Systems
Testing & Instrument

Managing Director For
Central Chemical labor.

Chemical Research
and Study

Chemical Analysis
labs.

Oil and Fuel labs.

Managing Director For
Communication
& Computer

Operation & Maint. of
Communication instr.

Programming

Operation & Maint.
of computers

Communication
systems erection

Managing Director For
National Cont. centre

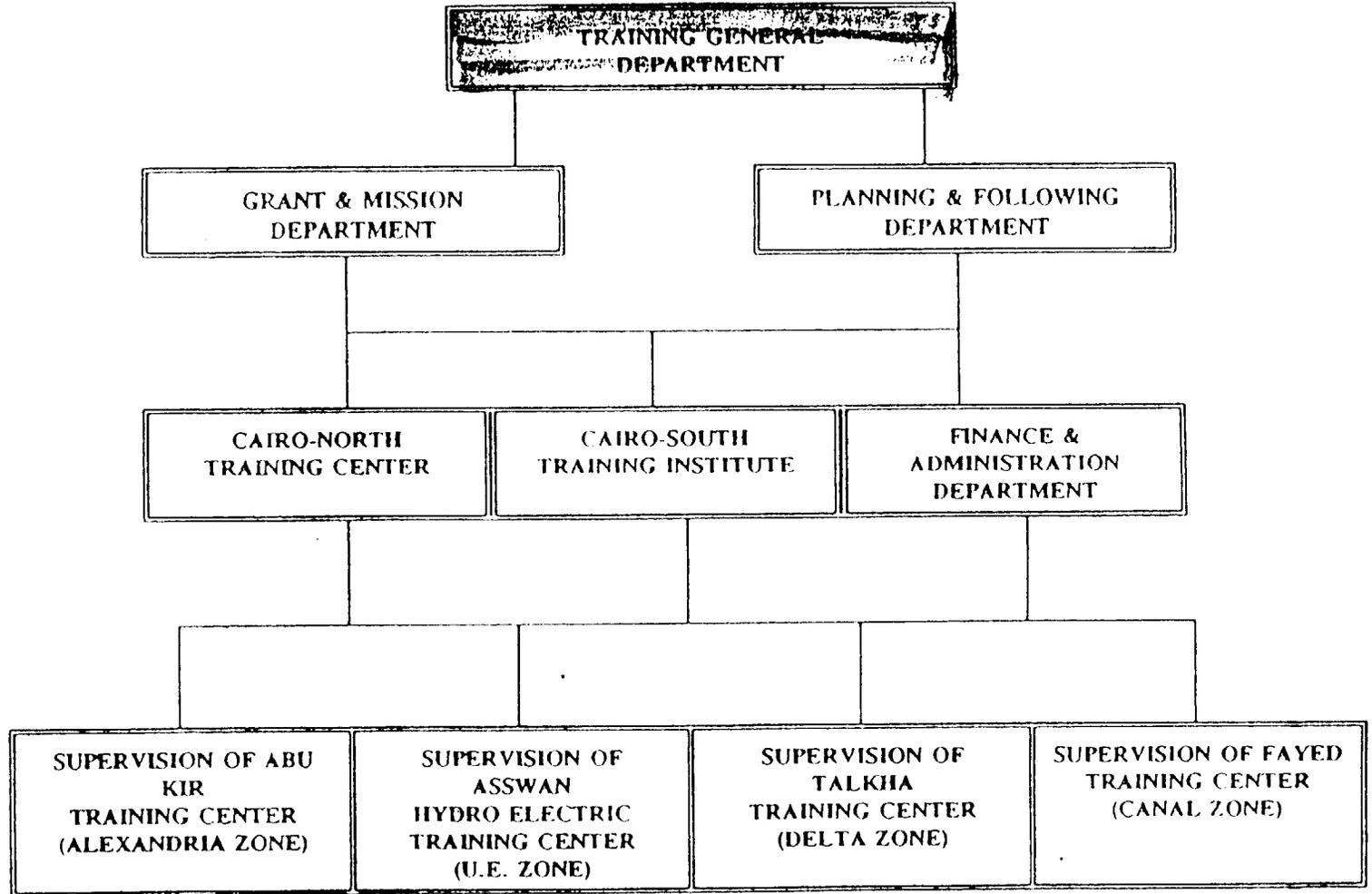
Central Control

Regional Contro
Affairs

Unified network
Operation system

2- The organization chart indicated in Figure (5-2) has been recently modified, the original and the modified one are attached .

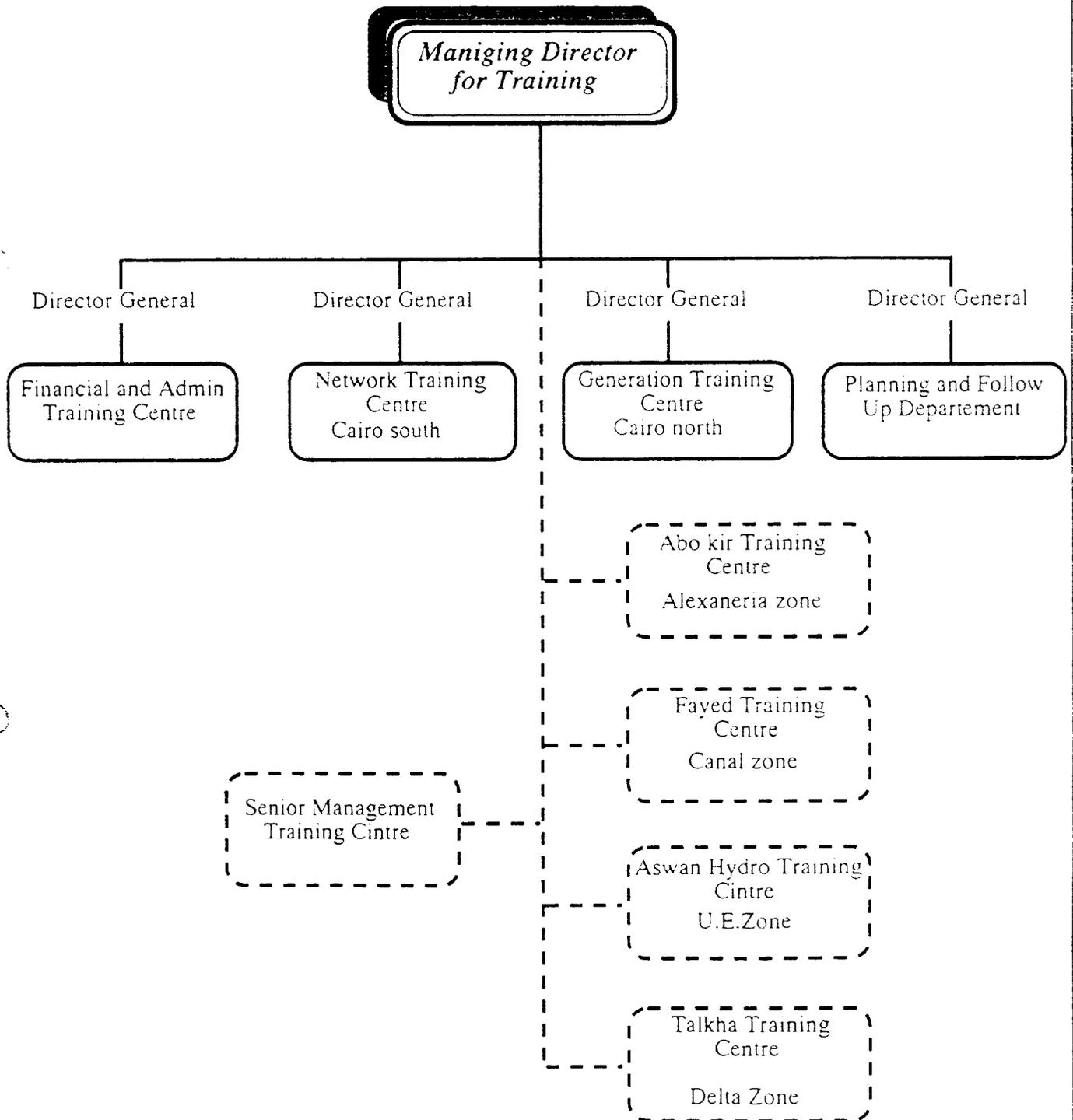
2/0



TRAINING CENTER PROJECTS

EXISTING TRAINING CENTERS

New Organization for Training Departenent



Instead of fig 5 -2 Section 5

3 - On page 5 - 7 concerning the following statement :

" It is , However , clear that management has not yet been able to embark on any program to significantly reduce over employment at EEA"

Our Comment is as follows :

There is a Manpower plan in EEA up to year 2007 , it is based on increasing the productivity (Man/ MW installed) 60% up to the end of the plan , taking into considerations the new installed capacity projects and the retirement staff .

- The plan considered year 1992 as a base , the productivity is calculated as 3.6 Man / MW installed.
- The objective of the plan is to reach to 2 - 18 Man/MW installed at year 2007 and the plan is attached hereafter .

N. B.

- The productivity index in most International Power Utilities is 1 Man/MW installed , but these utilities maintain their Power Plants by other Agencies .

Also all other services are contracted by other firms , for example " Transportation ,Cleaning ...etc"