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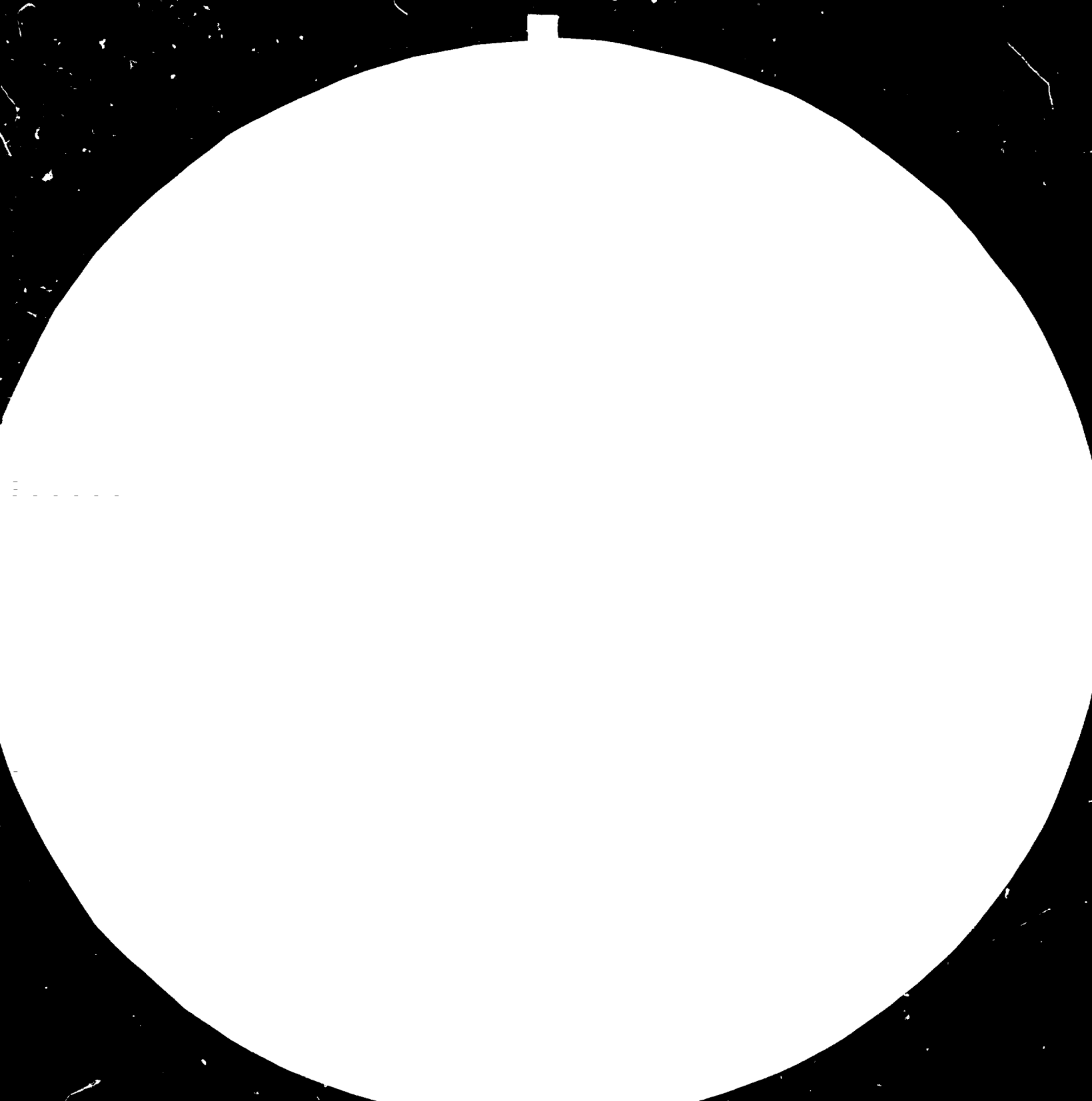
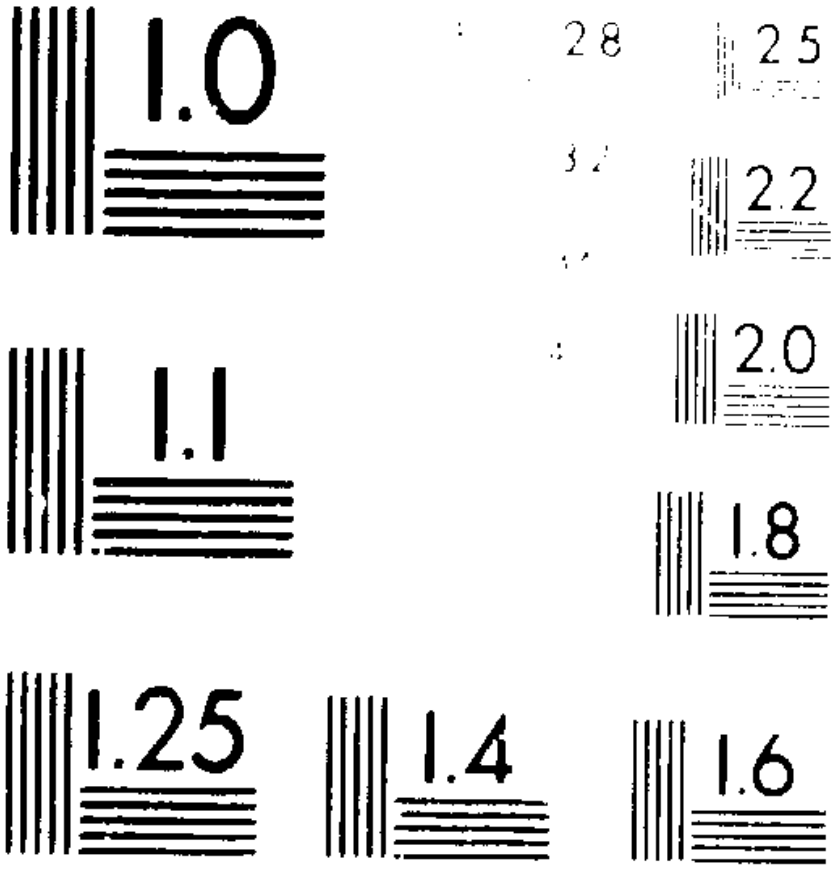
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





14343 1984

Egypt.

Dr. Fayek, Farid

Egypt

1st. March 1984

a) Domestic production of primary energy :

a.1 Coal :

In Egypt , there is nc present production of coal. However , some coal deposits have been discovered in Sinai and the Western Desert. At the area of Maghara at Sinai , the potential deposits are estimated at 51.8 million tons out of which 35.6 million tons of recoverable reserves. At 1967 , a mine was soheduled to operate at 300 000 tons / year but owing to war conditions, no further action to exploit the mine was taken till recently. At present , efforts are made to resume operating the mine and studies are in progress to decide on the most economic mode for using this coal in the coke industry as well as in an electric power station. Economic feasibilities of other discovered deposits are being studied.

a.2 Crude Oil :

Production of oil started in Egypt at the beginning of the present century. Significant production started only since 1973. While total production of oil at 1960 was 3.332 Million tons , it reached 8.479 Million tons at 1973 , and 35.9 Million tons at 1983. Development of production since 1973 up till now is shown in table 1. Most of reserves are located in the Gulf of Suez Basin in addition to few fields in the Western Desert. Potential of new reserves in other parts , the most important of which are Delta Basin and Mediterranean offshore tracts. The Nile basin and northern Sinai also have some potential. Activities to explore new reserves are being encouraged by the Government in order to reach a target of one million barrel per day by the year 1985.

Natural Gas :

At the end of the sixties and beginning of the seventies , natural gas was discovered in Egypt. Since

then , commercial production started 1975 onwards and by now three fields are in operation and production growth is shown in the table . Associated gases were only used for gas lifting of oil in producing wells and the rest , that amounted to about 88% , was flared . A project of making use of the associated gases that were flared had been completed in 1983 and these gases are being used in electrical power stations and in some industries . It is the policy of the Government in Egypt to give great attention to exploration of new natural gas fields . New gas fields have been found and they are being developed to start commercial production .

Hydro Electricity :

Before 1960 , hydro electricity generated energy was insignificant . Electrification of the old Aswan Dam was completed by beginning of 1960 and generated hydro-electric energy increased from 250 Million Kwh in 1960 to 1830 Million Kwh in 1966 . The hydro-electric project of the High Dam at Aswan started generation by end of 1967 and was completed by 1970 . Generated hydro-electric energy has reached 1816 Million Kwh in 1983 and equivalent energy (TJ) during last ten years is shown in table 1 . A new hydro-electric project at Aswan is under contraction and it is planned that it will be completed by end of 1985 . Generated energy of new project amount to 1000 Million Kwh per annum

Nuclear Electricity :

No nuclear electricity had been produced in the last ten years . Future projects of nuclear electricity shall be discussed in the next paragraph . It may be relevant to mention , that there is evidence of finding uranium deposits in Egypt . Prospecting and ground

surveys have been conducted at 50 anomalies and more detailed evaluations have been done at four areas . With proper exploration , there is a good chance of finding significant uranium deposits .

Geothermal Electricity :

Presence of some hot springs at many places has been noted . Information about assessment of geothermal energy sources is very limited but it is believed that the high temperature geothermal reserves necessary for direct electricity generation from steam might not be available .

b) Past and present data , planned future projection for electrical energy generation and consumption

Electrical energy production in the publicy owned and self producer systems jumped from 0.950 Gwh at 1952 to 7.48 Gwh at 1972 at an average annual increase of about 12% . The per capita of electrical energy/annum rose from 43.4 Kwh at 1952 to 240 Kwh at 1972 . The peak load has increased from 110 MW at 1952 to 1230 at 1972 . To meet that development , the installed capacity increased from 384 at 1952 to 3775 Mw at 1972 . Out of the installed capacity at 1972 , the hydro power is 2445 MW and the rest of 1330 MW is conventional thermal (steam and gas) . Generation per installed capacity in (GWH / MW) during that period varied between a minimum of 1.6 to a maximum of 3 . Such was a quick glance at the period preceding the last ten years . However , during the last ten years , average production growth was about 13.2% per annum . Production in publicly owned systems only, increased from 7.435 Gwh at 1973 to 25.879 Gwh at 1983 while the peak load increased from 1250 MW to 4375 MW during the same period .

The per capita electrical enegry per annum has reached 577 KWH at 1983 . Corresponding installed power increased from 3775 MW at 1973 to 5988 MW at 1983 . Required details of production are shown in tables . Regarding consumption , it is noteworthy that electrical energey utilisation in transport is very limited as shown in the table . Projections for the next few years (till 1985) are based on demand of new major projects that have applied for supply of electrical energy in addition to natural growth of demand for each sector . Natural growth demand is estimated from careful studeis of rates of growth of each sector in the past and at present as well as plans of econoric and social development of the country . After the present five year plan (82 / 83 till 86 / 87) , detailed new projects are not yet approved and therefore , rates of growth of demand of electrical energy have been estimated taking into consideration experience of developed and deveoping countries . During the period between 1987 and 1990 , rates of growth of demand are expected to be 9% per annum and during the next five years between 1991 and 1995 a rate of growth of 8% per annum has been adopted . Projections for electrical energy and peak load are shown in table . Keeping in mind that projects of conventional electrical power station take about four years to be commissioned after the date of coming into force of the contract while hydro projects take five to six years and nuclear projects take about eight years it is necessary to fix programmes of new projects in the light of this . New projects of power station have been decided according to techno-economic considerations of each type of generation namely : hydro , nuclear , thermal coal - fired, thermal conventional (oil or natural gas) .

Strategy of generation in Egypt has been based on

minimizing the role of conventional thermal power stations , maximizing the utilisation of hydro electrical energy , using coal fired power stations and using necessary nuclear electrical energy to produce the remaning energy to meet the demand . By the year 2000 it is foreseen to meet the demand from following sources : 40% nuclear , 28% oil , 16% hydro and 16 % coal . Steps of constructing the first two nuclear units in Egypt are well under way and offers submitted in the adjudication are being analysed now. Feasibility studies of new hydro-power projects have been finished and agreement with the Ministry of Irrigation to start the projects is being finalised now and moreover studies of mini hydro projects have been completed . Negotiations with international financing bodies and governments (World Bank , AID , EEC , ...) are continued with the object of raising necessary capital for starting the construction of a coal fired power station and an oil / natural gas power station .

C) Historical Development of agencies involved in generation , transmission and distribution of electrical energy.

Situation till 1954 :

Till 1954 , there were five main bodies in generation , transmission and distribution of electrical energy , apart from bodies that had pricately owned systems .

These five bodies were :

i - Cairo Electricity and Gas Administration and Societe Egyptienne d' Electricité.

ii - Alexandria Electricity , and Gas Administration.

iii - Municipalities Department , Ministry of Municipalities and Rural Affairs .

iv - Mechanical and Electrical Department , Ministry of Public Works.

v - Hydro-electric Power Department , Ministry of Public Works.

i) Cairo Electricity and Gas Administration :

In 1892 , the Egyptian Government granted the French Co. of Lebon its concession for the electric supply of the city of Cairo . In 1948 , the concession expired and this task has been taken over by the Cairo Electricity and Gas Administration which continued this responsibility till the setting up of the Ministry of Electricity at 1964 . This administration was responsible for all aspects of technical and commercial affairs of electrical energy both for operation and the construction of new projects for generation . transmission and distribution . For the first time a high voltage system of 66 KV was built in Cairo by 1954 and the system had to be extended to meet high rates of demand.

Societe Egyptienne D' Electricité :

In 1929 , the Egyptian Governement authorised that Co. to undertake activities of generation , untilisation and selling of electrical energy . It supplied the Cairo tramway Co. , Electric railway of Heliopolis and the Oasis of Heliopolis as well as some parts on the outskirts of Cairo . It continued its activities till it was nationalised at 1961 and it was taken over by the Cairo Electricity and Gas Administration .

ii) Alexandria Electricity and Gas Administration :

On 1st May 1893 , the French Co. of Lebon was granted the concession to feed the town of Alexandria with electric power for lighting purpose . The concession was supposed to expire at 1970 but the Co. was nationalised at 1961 and it was taken over by the Alexandria Electricity and Gas Administration . Alexandria Electricity and Gas Administration tool full responsibility for generation , transmission , distribution and commercial affairs till such task came under the Ministry of Electric Power that was set at 1964 .

iii) Municipalities Department :

Activities of electrifying cities other than Cairo and Alexandria were introduced as early as 1904 . The Municipalities Department was set up to undertake this task . Separate electric system was constructed for each city using diesel set generation and a local medium voltage distribution system . The department gradually electrified all cities , and continued to carry out necessary projects for expansion and modernisation to meet increasing demand of electrical energy and using the high voltage network sources of the Mechanical and Electrical Department instead of the Diesel units wherever possible . It continued to discharge this task till it was transferred to the Ministry of Electric Power , that was set up at 1964 .

iv) Mechanical and Electrical Department , Ministry of Public Works :-

This department was installed as early as 1895 to take the responsibility of Government irrigation and drainage pumping stations . Initially these pumping

stations were steam driven and then it was decided to constuct a system of generation , transmission and distribution of electrical energy for these pumping stations . In 1933 , the electrical system in the Aswan Province in upper Egypt and in the North Delta were started and later two systems were started at Fayoum in Middle Egypt and Nag Hamady in Quena Province , Upper Egypt . These electrical systems comprised steam , diesel , small hydro power stations , high voltage transmission system of 33,66 KV transmission lines and substations in addition to pumping stations extended over large areas . Wherever possible the transmission system of the Mechanical and Electrical Department was used to supply nearby municipalities with electric power . The system was extended to comply with new loads for pumping stations , of irrigation and drainage, rural waterworks , and land reclamation as well as nearly municipalities . The electrical system as well as the pumping system remained to be under the Mechanical and Electrical Department till 1964 when the Ministry of Electricity was set up and then the electrical system was transferred from that department to the new Ministry.

v) Hydro electric Power Department , Ministry of Public Works :

In order to harness electrical energy from the Aswan Dam that was first constructed in 1902 and then heightened a few times, the Government has set up the Hydro electric Power Department in 1948 at the Ministry of Public Works to take responsibility of the hydro electric project of the Aswan Dam . Several projects were considered but the project that did not endanger the safety of the Dam in any way was chosen . A transmission system was constructed to feed the new industry at Aswan as well as the network of the

Mechanical and Electrical Department in the Provinces of Aswan and Qena and also the Municipality of Aswan. The project was parially operated at 1960 and completed in 1961 . Responsibility of operation and maintenance of the scheme was taken by the department till it was transferred to the Ministry of Electricity at 1964 .

Egyptian Electricity Commission :

For the purpose of co-ordinating the existing power systems and planning the electrification of the Republic of Egypt according to a sound , long - range policy , the Permenanent Council for the Development of National Production set up the Egyptian Electricity Commission in March 1954 . For collecting , studying , classifying and correlating informations , data , statistics concerning the power systems in Egypt and following up electrification studies , the Permenant Council for Production also appointed the Technical Bureau in May 1954 . The Electricity Commission and the Technical Bureau continued in their role till the Ministry of Electric Power was set up in March 1964 to undertake all activities mentioned above.

Ministry of the High Dam :

In 1958 , Egypt decided to build the project of the High Dam for dual purpose of storage of the Nile water for irrigation and hydro-electric generation , with the economic and technical assistance of the USSR . In 1960 , the Ministry of the High Dam was set to be responsible for the project and then it was amalgamated with the Electricity Sector in 1967 .

Ministry of Electric Power :

For the first time , the Ministry of Electric

Power was set in March 1964 to take the responsibility of planning , financing , operating electric power generation , transmission and distribution public systems. It was organised from the following bodies :

- General Authority of Republic Electricity
- Egyptian Organisation for the Execution of Electric Power Projects .
- Egyptian Organisation for the Production and Transmission of Electric Power.
- Egyptian Organisation for the Distribution of Electric Power

General Authority of Republic Electricity :

The authority was responsible for the following :

- Studies and Research
- Technical planning of generation , transmission and distribution schemes ,
- Economic and finarcial planning
- Tarrif studies
- Preparparing specifications and issuing adjudications inviting bids for approved projects.
- Making contracts with successful bids and passing it to Egyptian Organization for the Execution of Electric Power Projects .
- Procurement of equipment

Egyptian Organization for the Execution of Electric Power Projects :

The Organization was responsible for the following:

- Managing projects of power stations , substations and transmission lines that are contracted

- Prepare necessary design work for execution of projects
- Hand over projects to Organisations reponsible for operation.

Egyptian Organization for the Production and Transmission of Electric Power :

- Operation and maintenance of public owned power stations and transmission system in Egypt.
- Reception of new projects of generation and transmission from the Egyptian Organisation for the Execution of Electric Power Projects.

Egyptian Organisation for the Distribution of Electric Power :

The organisation was responsible for :

- Operation and maintenance of H.V distribution substations and transmission lines.
- Reception of new projects of H.V distribution systems
- Operation and maintencance of M.V and L.V distribution systems in Cairo and Alexandria.
- Accounting and Billing in Cairo and Alexandria
- Execution of M.V and L.V projects for distribution system in Cairo and Alexandria.
- Rural electrification

General Egyptian Electricity Corporation :

In Decembre 1965 , the Ministry of Electric Power was amalgamated into the Ministry of Industry , Electricity and Mining . In February 1966 , the Authority of Republic Electrification , Egyptian Organisation for Execution of Electric Power Projects ,

Egyptian Organisation for Production and Transmission of Electric Power , and the Egyptian Organisation for the Distribution of Electric Power were amalgamated into the General Egyptian Electricity Corporation . It comprised three sectros :

- Studies and Research Sector
- Operation Sector
- Projects Sector

In 1967 , the Ministry of Electric Power has been formed separately but in conjuction with the Ministry of the High Dam under the name of : Ministry of High Dam and Electricity , and the General Egyptian Electricity Corporation remained without any organisational Changes . In December 1967 , the High Dam Hydroelectric Power station was commissioned and interconnected with the system in Northern Egypt thus forming the unified power system. In 1969 , responsibility of operation and maintenance of distribution networks in Municipalities had been taken over by the General Egyptian Electricity Corporation and thus activities of accounting and billing only remained in the hands of Municipalities .

Egypt Electricity Authority :

In 1976 it was decided to rearganise the General Egyptian Electricity Corporation with the object of giving it wider powers and flexibility from the economic , financial and administrative aspects . These changes were realised through the law passed by the Parliament establishing Egypt Electricity Authority in place of the General Egyptian Electricity Corporation with same tasks and duties .

Rural Electrification Authority :

In January 1971 , the Government decided to start the project of rural electrification . The Rural Electrification Authority was formed in 1971 to carry out this task . The project comprised the construction of H.V substation and transmission lines as well as M.V and L.V systems . Projects ready for operation were handed over to the General Egyptian Electricity Corporation . Since then , the Rural Electrification Authority is going ahead in its task according to funds allotted by the Government .

Qatara Hydro-electric Projects Authority :

In 1976 , the Qatara Project , being a huge scheme , was split from the General Egyptian Electricity Corporation . Researches , studies necessary to assess feasibility of the project as well as executing the project in case of approval were given to a new authority that was given also the task of construction of all hydro-electric scheme , under the name of Qatara hydroelectric Projects Authority . In 1979 it was charged with the responsibility of the projects of renewable energy resources . At the moment the Qatara Hydroelectric Authority is constructing the hydro-electric plant of Aswan II .

Nuclear Power Station Authority :

The programme of electrical energy production during the next twenty years has foreseen the construction of nuclear power stations to take part in meeting the growing demand . In 1976 , it was decided to set up a new body under the name "Nuclear Power Station Authority " to be responsible for the nuclear programme.

from all aspects e.g techical , financial , contractual, project managing , enviroment , training , . . . The authority just opened the bids of the first two nuclear reactors in Novembre 1983 .

Electricity Distribution Companies :

With the progress of the rural electrification plan , it was decided to split the activities of distribution from Egypt Electricity Authority and award it to independant regional companies . In 1978 , seven Distribution Companies were formed to distribute and sell electrical energy to consumers in the region of each company . Each company buys electrical energy from Egypt Electricity Authority at the rates determined by the Ministry of Elecricity and sell it to consumers according to the tariff approved by the Council of Ministers .

Electric Power Distribution Authority :

The Government decided to organise the public sector on new lines based on grouping companies that have similar activities in an authority that owns the capital of these companies , co-ordinates activities , approves goals and follows up the work of these companies. The Electric Power Distribution Authority was formed in November 1983 to supervise the seven distribtution companies .

d) Plans of development of electric power generation , transmission and distribution :

Generation :

The installed power in the public system at the end of 1983 reached 6020 MW . At present the projects

under construction are the following plants :

i) Thermal :

		Date of Operation
a. Conventional		
- 2 Units at Abu Qir P.S	2x150 MW	1984
- 1 Unit at Abu Sultan P.S	1x150 MW	1984
- 3 Units at Shubra El Kheima P.S	3x300 MW	1985,86
- 2 Units at Ataka P.S	2x150 MW	1984,85
- 1 Unit at Ataka P.S	1x300 MW	1986
- 2 Units at Kafr El Dawar P.S	2x110 MW	1984,85
b. Gas		
- Siuf expansion	33 MW	1984
- Wadi Hoff	100 MW	1984
- Damanhour	100 MW	1985

ii) Hydroelectric :

- Units at Aswan II P.S	4x67.5 MW	1985,86

Tenders for the following projects are being analysed and orders shall be placed presently:

- Two nuclear reactors 2x1000 MW at Dabaa

It is already announced the adjudication for constructing 300 MW at Damanhour .

Preparations are made to take steps for the adjudication of following plants :

- 2 Units coal fired at Oune Moussa 2x300 MW
- 2 Units oil-gas fired at El Kuraimat 2x300 MW
- 2 Units coal fired at Sidi Kreir 2x300 MW

- 100 MW hydroelectric P.S at Isna barrage

Other approved projects that are to be a next stage :

- 55 MW hydroelectric P.S at Nag Hamadi barrage
- 55 MW hydroelectric P.S at Assiut barrage
- Pumping Storage hydroelectric scheme at El Galala Mountain with a capacity of 600 MW

Possibilities of mini hydro projects on barrages and canals of River Nile have been studied and so far results have shown that the power that can be generated is of the order of 32 MW at 22 sites in the Upper , Middle and Lower Egypt . Power at these sites varies between 150 to 7600 KW and the head ranges between 5.3 m to 1.3 m . Suitable turbines have been investigated and it is recommended to install an experimental water wheel turbine at a site with a head of the order of one metre . Feasibility studies for ten sites have been completed and it is planned to carry out feasibility studies for the other sites. Projects that prove feasible will be scheduled for implementation .

Regarding micro hydro projects , some preliminary studies have been made and steps for more detailed studies are being taken , keeping in mind experience of other countries in this field .

Transmission :

The transmission system has steadily expanded with the power generation .

Substations :

At the end of 1983 , the substation capacity is given by following :

500 / 220 KV & 500 / 132 KV substations :

3280 MVA

220 / 66 KV substations :

5165 MVA

132 / 66 / 33 KV substations :

1500 MVA

66 KV substations :

4119 MVA

33 KV substations :

1026 MVA

Substations under construction :

220 / 66 KV :

Twelve substations are in the construction stage capacity of each , ranging between 2 x 75 MVA and 2 x 125 MVA

132 / 33 KV :

One substation

66 / 11 KV :

Eighty substations are under construction, with the capacity of each substation varying between

ranges 2 x 10 MVA to 4 x 25 MVA.

33 / 11 KV :

substations are under construction with a total capacity of 190 MVA . Capacity of each is 2 x 12.5 MVA

Future projects :

It is foreseen in the transmission system planning that the increase substation capacity in the next seven years till the year 1990 shall be as follows :-

500	KV	substations	4220	MVA
220	KV	substations	10000	MVA
66	KV	substations	15000	MVA

Transmission Lines :

At the end of 1983 , the length of transmission lines and cables is as follows :

500 KV	:	1576	km
220 KV	:	3063	km
132 KV	:	2158	km
66 KV	:	3398	km
33 KV	:	2239	km

Transmission Lines and cables under construction :

500	KV	:	30	km
220	KV	:	1194	km
132	KV	:	127	km
66	KV	:	600	km
33	KV	:	100	km

Power Stations :

Future projects :

According to planning of transmission system , the increase in the length of transmission lines and cables in the next seven years till the year 1990 shall be as follows :

500	KV	:	1000	km
220	KV	:	5800	km
132	KV	:	200	km
66	KV	:	3000	km

Distribution :

The rural electrification programme started in the year 1971 and by now all the villages larger than 1000 inhabitants have been supplied with electrical energy . The number of these villages amounts to 6000 It is estimated that 80% of the rural population are supplied with electricity . Attention is given now to agglomerates less than inhabitants which are 20000 approximately . A programme is being drawn to supply

these agglomerates with electric power during the next ten years . Demand of already electrified villages has surpassed the design figures of 40 watts per capita and networks are reinforced to comply with such consumption . Plans of the 66 KV transmission systems mentioned above have taken into consideration this development . Networks of 11 KV and C.380/0.220 KV are constructed to fulfil this programme .

In urban distribution systems , city networks are reinforced to cope with the increasing use of electric appliances.

New sattelite towns are constructed around Cairo to ease the ever increasing crowding of the Capital . In these satellite towns it has been decided to adopt distribution systems at 20 KV . In Sinai , it is also decided to construct a 20 KV distribution system and already 65 kms of 20 KV lines and M.T to L.T substations are commissioned .

It is estimated that during the seven coming years the annual increase in medium tension equipment is as follows :

Lines	: 10 000	KM
Cables	: 8000	KM
Substations	: 20000	KM

3. Specific information on the national electric power system :

a) Data of existing electric power generation plants , transmission and distribtution systems is given in the tables in Annex IV .

b) Maintenance activities :

i) Maintenance facilities , spare part supply and repair and maintence management :

Power Stations :

Routine maintenance of different parts whether mechanical , electrical or instrumentation and control is carried out by the maintenance staff of the power station . Repair works due to wear and tear or accidents are also made by this staff unless there is a damage that will necessiate sending this part to the manufacturer's factory for major repair. Each power station is equipped with a workshop that will be used for maintenance and repair work . In addition to this , special tools and jigs , required for maintenance work of the delivered equipment , are supplied as a part of the contract . In case , further facilities for either maintenance or repair are required , power stations make use of existing facilities in other sectors like industry , special workshops , ...

In each contract for the installation of the power station , spare parts sufficient for a period between two to five years are supplied. After such period , non-specialised spare parts are manufactured locally in Egypt and the other spare parts are imported from the manufactures.

Routine maintenance is carried out periodically according to recommendations of the manufacturers . Maintenance and repair work is done by the maintenance staff in each power

station . This staff is headed by a manager and is organised into the following sections :

- boiler and boiler house equipment
- Turbine and auxiliaries
- Electrical
- Instrumentation and control

The manager of the maintenance department is responsible for periodicity of maintenance as well as repair work in front of the plant director .

Substations :

In the contract of supply of the equipment of each substation , the special tools and jigs of this equipment are within the scope of deliveries of the contract . Spare parts sufficient for a period between two to five years are delivered with the equipment of the substation . After such period, non-specialised spare parts are manufactured locally and the other spare parts are imported from the manufacturer.

Routine maintenance is carried out periodically according to recommendations of the manufacturers . Maintence and repair work of a group of substations are carried out by a team that is headed by the maintenance manager who reports to the director of substations .

Transmission Lines :

Maintenance and repair activities for transmission lines are similar to those of substations .

ii) The role of foreign technical assistance in repair

and maintenance activities :

Power Stations :

In the contract of the installation of a training programme for the staff who will run that power station . The training programme for the engineers and technicians of maintenance consists of the following:

- training in the factories of the manufacturers
- training in the servicing departments of the manufacturers
- training in power stations having equipment similar to the delivered.

Such training is the cornerstone of foreign technical assistance in rendered during the guaranttee period of the plant . During that period , the guaranttee personnel carries out necessary routine maintenance and repairs with the participation of manintenance group . At the end of the guaranttee period , the main equipment are inspected and maintained by the foreign specialists . The maintenance group of the plant takes part in this work and acquires further experience . In Egypt , it has been contemplated that foreign technical assistance in repair and maintenance activities is received through specialists of the manufacturers. Therefore , if any problem in maintenance and repair work arises , specialists of the manufacturers are called to the power station to give required assistance to the maintenance group .

Recruiting of the maintenance group for a new power station is accomplished from following sources :

- Thinned Staff of maintenance group of other power stations and these are the people that

are to be trained abroad .

-- Newly appointed personnel .

Substations and Transmission lines :

The situation is very similar to that of power stations .

iii) Training for repair and maintenance :

The newly appointed personnel for repair and maintenance are trained in the training centres, of Egypt Electricity Authority . They receive basic training for appropriate periods and after passing these courses successfully they work as assistants to senior staff , some of whom have been trained abroad . The training centres are set with foreign technical assistance from foreign countries . At the moment , there are two training centres that have been established on these lines . Four other training centres are being set with foreign technical assistance .

iv.) Role of repair and maintenance activities in the creation of domestic production capabilities and its impact on the mastering of technologies:

For many years , the electric power system existed but there was no industry of electric power equipment . During these years many engineers and technicians gained considerable experience in the repair and maintenance of electric power equipment. This experience was very useful in the new industries of electric equipment that started in the mid fifties . A few engineers and technicians were tempted to join the new industries in the early stages of the preparatory work of the installation

of factories e.g. cables , transformers , steel pipes, electrical energy meters , ...

The repair and maintenance activities of parts of the electrical system, were conducted successfully for many years and the concerned staff was assimilating the required technology with a large degree of confidence . This fact in itself was the stimulus of industrialisation in the field of electric power equipment . The founders of these industries were confident about the ability of engineers and technicians to master the technology of the proposed industries .

c. <u>The role of domestic and foreign engineering companies and consultancy services</u> :

Before 1954 , when the Egyptian Electricity Commission was set , each organisation used to carry out its planning activities , feasibility studies by their own staff without dependance on foreign engineering companies . It is worthwhile to mention that were no domestic engineering companies working in this field . Whenever there organisations required technical assistance , they employed foreign specialists for limited periods to participate in specific jobs . In 1954 , a contract was signed with Electricité de France to investigate the technical and economical aspects of electrical power production and utilisation in the Republic of Egypt and to prepare a general plan suitable for the electrical power development of the Republic during the next twenty years .

Around same time , a Government Technical Bureau was appointed , as mentioned earlier under Egyptian Electricity Commission in the paragraph about the

historical development of agencies involved in the field of electrical energy public activities. This bureau can be considered as the domestic engineering body in the field of planning and feasibility studies. After the contract with EDF has terminated in 1956, the Technical Bureau continued its role in planning and feasibility studies. In 1960, an agreement between the Governments of USSR and Egypt called for economic and technical assistance in constructing the power station of Aswan High Dam and its electrical network. Consequently the High Dam Supreme Committee, concluded a contract in 1961 with Hydroproject Institute for the design of the power station and with Energosetproject Institute for the design of the networks. The Technical Bureau continued its role in planning and feasibility, till the set up of the ministry of Electricity in 1964 and hence, it was incorporated in the General Authority of Republic Electrification to continue its role under all organisational changes under the name of Sector for studies and Research. In 1967, a contract was concluded with Energosetproject Institute to provide in collaboration with Sector of Studies and Research a general scheme for the development of the electric power system for the period up to 1980. Planning and feasibility studies continued to be done by the Sector of Studies and Research in Egypt Electricity Authority and Design Department of Rural Electrification Authority. However, since 1978, according to regulations of international lending bodies, foreign engineering companies are appointed to carry out feasibility studies before they agree to finance these projects. Projects financed locally, have their feasibility studies made by a / m own staff. Lately in

1982 , all concerned authorities , construction and distribution companies of the Ministry of Electricity established a new engineering company to carry out all activities of planning , feasibility studies and project management .

In the activity of supervising the erection of the power system , the situation was different . In turn key projects , each organisation responsible for that project , used to supervise the erection by their own staff . However in the mid seventies when foreign engineering companies were awarded jobs of feasibility studies , the tasks of preparing tenders and supervising the erection were given to foreign engineering companies . Erection works of other projects are supervised by own staff of the concerned power system department .

d) Information on the domestic civil works capabilities and their utilisation in the electric power system projects

Traditionally all civil works , of the projects of the power system , were constructed by the domestic civil contractors . Examples of power stations constructed by domestic contractors are given by :

	Plant	Rating	Contractor
-	Suez	4x25 MW	El Nasr Co. for Contracts
-	Damanhour	3x65 MW	
-	Talkha Extension	3x30 MW	General Co. for Contracts
-	Siuf Extension	2x30 MW	
-	Abu Qir	4x150 MW	

Plant	Rating	Contractor
- High Dam	12 x 175 MW	Misr Concrete Co.
- Cairo West	3 x 87 MW	Egyptian Contracts Co.
- Kafr El Dawar	3 x 110 MW	
- Ataka	2 x 150 MW	
- Abu Sultan	3 x 150 MW	Arab Contractors Co.

An exception to such tradition , was the project of Shubra El Kheima P.S 3 x 300 MW which civil works were awarded to a foreign firm .

Civil works of substations and transmission lines are constructed by domestic contractors .

Domestic Production of Electric Power Equipment :

1) El Nasr Company for the Manufacture of Transformers and Electrical Products :

Macro - economic Data : Official rate (1 $ = 0.84L.E)

Gross production : L.E 11.945 Million
Quantity : Transformers 1088 MVA
Disconnecting links : 1714 unit
Welding transfomers : 840 unit
Manufacturing added value : L.E 3.371 Million
Exports :
Imports : L.E 8.9 Million
Employment : 860

Historical Development :

The company was established in 1957 as a private company with a capital of L.E 100,000 (one hundred thousand Egyptian Pounds). In 1959 , the

capital was increased to L.E 160,000, then the company was partly nationalised in 1961. Further capital increase of L.E 100,000 was paid by the Government in 1963 thus the capital totalled 260,000. Successive capital increases were paid by the Government. In 1978, the company formed a joint venture company with Siemens Co., Federal Republic of Germany to manufacture electrical switchgear and since then the company stopped its line of switch-board assembly.

Capital : L.E 7.975 Million
99% public sector
1% private sector

Address : El Sheikh El Shabrawy St. Rod el Farag, Cairo.

Main products:

At present the main products are:

1. Distribution transformers up to 1600 KVA, and high voltage side up to 11 KV

Technology sources:

Since the establishment of the company till last year, transformers were manufactured under the licence of TRAFO UNION , Federal Republic of Germany according to the agreement of technical assistance between the two sides. It comprised the following :

- Training in the field of designing distribution transformers.
- Supply of raw material and parts upon request.
- Call of specialists required by the company .
- Furnishing the company with designs and technical documents.

The agreement included rates of royalties paid for this under license .

Starting from 1984 , the company concluded a new technical assistance agreement with France Trasfo , of France . Elements of the agreement are as the previous one beside the assistance in the layout of the new factory of the company as well as planning of production process . Production of the present factory covers about 60% of the demand in the Egyptian market, and the new factory is set up to meet the demand at home and possibility of exports in addition to producing power transformers at voltages up to 66 KV . It is foreseen that the new factory will start production in the second half of 1985 .

Development of production during the last ten years is shown in Annex V .

2. Out door disconnecting links with drop-out fuses :

Starting from the second half of 1980 , the company produced 11 KV outdoor disconnecting links with drop-out fuses under the license of Brush Power Company of U.K . Period of the agreement between the two companies is twelve years and is renewed each two years unless terminated on the request of one party six months in advance . The agreement aims at :

- Assistance in the design and presentation of technical documentation .
- Supply of parts and material upon request
- Training of engineers and technicians .

Royalties are fixed according to volume of production .

3. Welding transformers :

Beside the a/m products , the company products , the company produces single phase welding transformers , 400 Amp. Volume of production in 1983 is 480 transformers .

Sub-contracting policies :

Material is procured by international tenders for imported part and general tenders for local part . No problems with subcontractors are reported except delay in deliveries sometimes and improper packing .

2) Egyptian Electrical Cables Company :

Macro economic Data : Officail Rate (1$ = 0.84 L.E)

Gross production	: L.E	76.374 Million
quantity	:	56281 tons
Manufacturing value added	: L.E	31.624 Million
Exports	: L.E	2.544 Million
Imports	: L.E	30.5 Million
Employment	:	3022

Historical Development :

The company was founded in 1954 as a private company with a capital of L.E 100,000 (one hundred thousands) , and by end of 1955 , it started producing bare and insulated wires and cables . In 1960 , the production of underground armoured cables for low and medium voltages started . Production of telephone cables began in 1961 . In July 1961 , the company was nationalised . The capital was increased to L.E 1.170 Million in 1972 and at present it has reached L.E 25.596 Million .

Address : 6th Octobre Road , Mostorod , Kalyoubia .

Technology Sources :

The company concluded a contract with the " International Organisation for the Development of Manufacturing Cables at Paris" to furnish it with technical assistance and send specialists to train engineers and technicians on site as well as training in the factories abroad.

Main products :

1. Medium Voltage Armoured Cables :

-- paper impregnated cables

-- cross link polyethene cables : started in 1981 and new lines of production are installed to meet increasing demand on these cables .

2. Low Voltage Cables :

-- PVC cables

3. Telephone cables :

Production in 1983 : 5086 tons

4. Insulated Wires :

Production in 1983 : 6066 tons

5. Varnish Insulated Wires :

Production in 1983 : 787 tons

Subcontracting policies :

Aluminium is obtained from the local aluminium

factory and copper is imported .

3) Helwan Company for non-ferrous industries

Macro economic Data : Official Rate (1 $ = 0.84 L.E)

For conductors and Cables only :

Gross production	:	L.E 8.700 Million
quantity	:	5000 tons
Manufacturing added value	:	L.E 2.770 Million
Exports	:	-----
Imports	:	L.E 1.184 Million
Emplyment	:	123

Historical Development :

The company is basically a military factory that was established by the Government with the object of producing and shaping non-ferrous material and alloys for military and civil purposes . It started in 1954 by producing bands , rods and pipes made of copper and bronze by means of casting , extrusion , cold rolling, drawing in addition to die-casting . In the sixties , the company extended activities to hot rolling copper and aluminium , producing aluminium sheets and manufacturing steel cored aluminium conductors , insulated low voltage cables , equipment for spray irrigation . Moreover , in the eighties the company expanded production of bronze bands , sheets , and pipes by the continous casting method .

Capital	:	L.E 15.044 Million
Address	:	Helwan , Cairo .

Technology Sources :

In the field of extrusion , rolling and drawing

the source of technology is West German . For the manufacture of steel-cored aluminium conductors the source of technology is Hungarian and for the continous casting field , the source is Swiss .

Main products :

Beside procuding the steel-cored aluminum conductors , there are the following main products :

- Bars , bands of copper and bronze
- Sections and pipes of copper , nickel and bronze
- Aluminium sheets cold or hot rolled
- Copper forgings and castings
- Wires , bars and pipes of copper and bronze .

Subcontracting policy :

Aluminium is obtained from the local aluminium factory and the steel wires are imported . Copper and nickel are imported .

4) Egyptian Company for Metallic Construction " METALCO "

Macro Economic Data : (1 $ = 084 L.E)

Gross production	:	L.E 29 Million
quantity	:	26000 tons
Manufacturing added value	:	L.E 8.3 Million
Exports	:	-----
Imports	:	L.E 1.1 Million
Employment	:	4200

Historical development :

The company was founded in 1968 for the manufacture and installation of metallic constructions and

technological equipment . It started production of a total of 6000 tons in 1968 and it was increased to 15000 tons in 1971 . The capital is 100% owned by the public sector . However in 1980 , this company has formed a joint venture with the company of Ferrostaal in the Federal Republic of Germany in the same line of production with the object of meeting the increasing demand in the local market as well as export to Arab and African countries .

Capital : L.E 9 Million
Address : 5-A , 26th July St. , Cairo.

Technology sources :

The source of technology is Ferrostaal Co., Federal Republic of Germany . Besides , there is a licensing agreement with Babener Co. , Federal Republic of Germany for the manufacture of tower cranes .

Main products :

- Steel structures : trusses , frames , sheds , high rise buildings .
- Storage tanks
- Steel towers and poles for electrical transmission & distribution
- Steel towers for communication purposes
- River tugs and barges
- Belt conveyors and technological equipment
- Upper , gantry and tower cranes

5) Engineering Enterprises for Steel Work Company " STEELCO "

Macro economic Data :

Gross production : L.E 15 Million

quantity	:	24000 tons
Manufacturing Value added	:	L.E 4.5 Million
Exports	:	------
Imports	:	L.E 0.6 Million
Employment	:	3500

Historical Development :

The company is the amalgamation of the Egyptian five companies , working in the field of fabrication , manufacture and erection of structural and industrial steel work , before 1961 . The folowing five companies were nationalised in 1961 :

- Egyptian Enterprises for Steel Work Co.
- Engineering and Trading Enterprises Co.
- Egyptian Mining and Construction Co.
- Egyptian Metal Work Co.
- Steel Galvanisation Co.

In 1963 , these companies were amalgamated into the Engineering Enterprises for Steel Work Co.

Capital : L.E 6 Million
Address : 39 , Kasr El Nil St., Cairo .

Main products :

- Light and heavy weight structure .
- Steel bridges
- Over head cranes
- Storage tanks
- Steel towers and poles for electrical transmission and distribution
- River tugs and gantry
- Mechanical handling equipment
- Bus body building and assembly

6) El Nasr Company for the Manufacture of Steel Pipes and their Accessories

Macro - economic data :

Gross production	:	L.E 52.453 Million
quantity	:	82516 tons
Manufacturing Address Value	:	L.E 14.888 Million
Exports	:	L.E 1.269 Million
quantity	:	3599 tons
Imports	:	Insignificant
Employment	:	3979

Historical Development :

The company was founded in 1962 to supply the local market with steel pipes and accessories and at 1975 the company started to export 722 tons of its production to Arab & African countries and gradually enlarged that portion to the a/m figure. Capital is owned by the public sector .

Capital	:	L.E 20881 Million
Address	:	Bin Helwan , Cairo

Technology sources :

The company has connections with many countries to call for technical assistance . As an example , the company together with Tyssen Co. , Federal Republic of Germany , has set up a section for producing protected helical pipes with bitumen & glass wool internally and externally according to specifications of petroleum industry .

Main products :

- Steel pipes logitudnally welded

- Steel pipes helically welded
- Pipe accessories
- Steel Poles for electricity dristribution

7) The Egyptian Company for Pipes and Cement Products " SIGWART "

Macro - economic data :

Gross production	: L.E 37.630	Million
Manufacturing added value	: L.E 17.551	Million
Exports	: ---	
Imports	: L.E 14.776	Million
Employment	: 4864	

Historical Development :

The company started in 1927 as the property of an individual and founded a factory to manufacture concrete pipes using the French method known as " Sigwart " , and in 1931 it became a company. Between 1948 and 1961 , the company introduced other cement and asbestos products . In 1961 , the company , was nationalised and two other factories were amalgamated with it in 1963 . At the beginning of the seventies , the company expanded its production by acquiring new equipment and introducing other products like clay bricks .

Capital : L.E 16.439 Million
Address : 15 , Sherif St., Cairo

Technology sources :

The company has many technology sources for its products . For asbestos products , source is Salfanite and Iterbite , Italy , for prestressed concrete flanks source is Dewidag , Federal Republic of Germany and for

prestressed concrete poles , source is Skoda , Checoslovakia .

Main products :

- Asbestos pipes
- Asbestos sheets
- Pottery pipes
- Concrete pipes
- Concrete poles
- Concrete flanks
- Clay bricks

8) The Egyptian German Company for Electrical Products " EGEMAC "

Macro economic data :

Gross production	: L.E	16.919	Million
Manufacturing added value	: L.E	7.614	Million
Exports	:	----	
Imports	: L.E	8.459	Million
Employment	: 420		

Historical Development :

The company was founded in 1978 as a joint ventrue between El Nasr Company for the Manufacture of transformers and electrical products as one party and Siemens Co., Federal Republic of Germany as second party according to investment law No. 43 year 1974 . The purpose of establishing this company is to manufacture electrical apparatus and equipment in particular switchboards , kiosts , switchgear for the distribution of electrical energy on the medium and low voltage .

The capital was shared as follows :

49 % El Nasr Co. for the manufacture of transformers and electrical products
31 % Siemens Co.
20 % D.A.G , Federal Republic of Germany.

Production started in 1979 by assembly of components and gradually increasing portion of locally manufactured parts. The department of cast resin current and potential transformers started production in 1981.

Capital : L.E 5.5 Million
Address : Kablat St., Mattaria , Cairo.

Technology Sources :

The company concluded a license agreement with Siemens Co. . Under this agreement Siemens Co. shall present to Egemac detailed designs , working drawings of equipment included in the production programme against the royalty on sales after deducting the value of imported complete component from Siemens Co.

Main Products :

- Medium Voltage switchboards
- Kiosks
- Medium voltage ring main swithchgear
- Low voltage switchboards
- Cast resin current and potential transformers
- Cast resin support insulators .

Subcontracting Policies :

General policy is to buy locally the material that comply with required specification . Components of swithchgear are obtained from Siemens Co. as disassembled parts with efforts to increase portion to be manufactured

locally .

9) Arab contractors for Electrical Industries (ARABB)

Gross production : L.E 11.876 Million
Manufacturing added value : L.E 5.938 Million
Exports : -- -
Imports : L.E 5.938 Million

Historical Development :

The company got the license to establish the company in 1979 with the object of the manufacture and assembly of swithchboards for electricity distribution , bus ducts , distribution boxes and all items for power distribution . It was founded as a joint venture between the Arab Contractors Co. and Brown Boveri Co. , Switzerland with a capital of L.E 1.5 Million and then it was increased in 1981 to L.E 2 Million shared as follows :

70 % Arab Contractors Co.
30 % Brown Boveri Co.
Address : 2, El Hassan Habiballah St. Beside 102 El Marghany St. , Heliopolis , Cairo .

Technology Sources :

The company concluded a licence agreement with Brown Boveri Co. to manufactute swithchboards and its components. According to this agreement , the company is entitled to all technical data , know how , production planning from Brown Boveri Co. beside training engineers and technicians in its factories .

Main Products :

- Medium voltage switchboards
- Kiosks
- Medium voltage ring main switchgear
- Bus ducts
- Low voltage switchboards
- Distribution boxes

Subcontracting Policies :

The company buys from the local market available material that complies with technical specifications and imports components of swithchgear from Brown Boveri Co. One of the problems with local supplies is relatively long deliveries in some materials e.g sheet steel , galvanised bolts , ... and on the other hand , it is forbidden to import these locally produced material.

4e. Mastring of technology

Training :

The first step in the development of technology at industry in Egypt was the importation of foreign technical assistance through many forms . In all cases, the technical assistance was rendered by training engineers and technicians who were to run the factory of a certain new industry . During the period of setting up the industry , engineers and technicians were trained in the factory of the foreign firm and then they took part in supervising the erection of the equipment . Such staff were the hard core responsible for operation and maintenance of the local industry . During the trial operation , both foreign and local specialists train the staff on site . Training centres on the national level were set up to give basic training in necessary skills

for specialisation of each centre . Graduates of these centres in addition to graduates of technical schools furnish industries with required personnel .

Indeed , these training aspects are the corner stone in mastering the technnologies and techniques of industries built in Egypt.

Adaptation :

In all cases , a certain amount of adaption is required to suit the new technologies to the local conditions . Exmples of these local conditions are the local materials , ambient conditions , manpower , ... Responsibility of these adaptations is born by the engineering management of such industry . The role of foreign technical assistance in such adaption varied in size according to the ability of the technical management but in all industries , it has been second to the role of the engineering management of these industries .

Research and development

Most of the research is done in the national institutions , and laboratories in addition to universities . Link between universities and industries is being enhanced .

The " National Research Centre " was established in 1946 for the development of applied research work [illegible] to tackle problems raised by industry . Close links between the National Research Centre and different industries in Egypt are continously increasing .

The Ministry of Industry has set " Centre of Industrial Design " to promote design work required for development of the Egyptian industries .

In addition to these two instutions , there exists the " High Voltage Research Centre " which belongs to the Ministry of Electricity and Energy . This centre takes part in testing work required for development processes required by industries of electric power equipment in Egypt .

Assessment and evaluation of the import of technology :

- Till 1974 , the prevailing form for the import of technology in industry was licencing . Agreements of licencing are concluded between the local company and the foreign company . Conditions of licencing between the tw o parties are negotiated and once they reach agreement , it is to be approved by the board of directors of that company . Royalties are to be transferred to the foreign company in the currency agreed upon . Licencing , as a means of technology transfer , has been so far working smoothly even in circumstances that called for cancelling of such agreements .

- Joint ventures with foreign companies : In 1974, law No. 43 , Year 1974 , regarding " Rules of Investment of Arab and Foreign Capital and Free Zones" was issued . Under this law , joint ventures have been formed for the first time in Egypt since 1961 . Some of these companies started production and they are trying to maximize the portion of locally manufactured content at the moment .

Constraints on the domestic production of electric power equipment :

- The largest constraint in developing industry of the electric power equipment in Egypt , is the markets . The demand of the home market in many

industries does not justify the feasibility of such industries . It is only possible to establish these industries if a good part of the feasible production is exported . Hard competition in world markets is not favourable for industries in the developing countries . Chances of export markets can exist if economic co-operation between developing countries grows on the basis of exchanging products of different industries between these countries . One of the means , to promote exports , is to include in agreements of licencing and joint ventures, favourable conditions from the developed countries , to use products manufactured in developing countries in their quotation abroad . No progress has been achieved so far and attempts are pursued .

- Financing has been another constraint . The private capital , in Egypt , does not participate in large industries , and it is the Government that generally sets up these industries . Owing to the large burden of running the country's economy , the Government may not have available , the foreign capital necessary for such industries especially economic assistance from developed countries does not include projects of industrialisation . As soon the balance of foreign currency allows , then priority is given to finacne these industries .

5. Linkages with the other capital goods industries

a. Supply of raw materials :

Industries of electric power equipment use all material manufacuted in the local market . They obtain steel from the Egyptian Iron and Steel Co. that produces 1.2 Million tons of steel per annum, and obtain aluminum from Misr Aluminium Co. that

produces 160000 tons per annum . Local production of electrolytic copper is limited to 5000 ton / annum produced by the Egyptian Co. of Copper and it covers a little portion of demand for industry.

b. Availability of services of basic facilities:

Existing casting facilities can handle requirement of present industries . An example of such facility is the General Co. for Metals " , at El Tibbin , South of Cairo . Similarly in forging , present faciliteis comprise " El Nasr Forging Industries " . Expansion of these facilities will depend on the size of damand of new industries to be established .

c. Multi - purpose production :

In the survey of the industries of electric power equipment in Egypt , it is shown many examples of multi purpose production in particular transmission lines . In future , it is believed that such trend will continue on a bigger scale with the growing activities of industrialsation.

6. Policies and Strategies

a. In the running five year plan great importance is given to the infrastructure in general and to electrical energy in particular . Required foreign and local currency are allocated to the concerned state industry that applies for it. One of the basic features of this five year plan is to develop industrial production for both private and public sectors . Consequently , electric power equipment industry has an appropriate chance to develop in the next few years .

b. The Government is giving its full support to

development of capital goods industry . State enterprises get the investments they need for rehabilitation and expansion as well as for joint ventures .

According to the Act of Rationalisation of Imports, it is forbidden to import any product that is manufactured locally , unless the local production is not sufficient to cover all the demand . At present , the Government is doing its utmost to protect the local industries .

c. In the past , there was no significant co-operation between Egypt and other developing countries. At present , there is an agreement between Egypt and Sudan for technical and economic integration . Joint committees are discussing suitable forms of such co-operation . It is foreseen to carry out noint projects in Egypt and Sudan .

7. Measures to be taken to increase the domestic production of electric power equipment

In view of the points raised in the paragraph of constraints , it is recommended to take up following action :

- Enlarging the markets for regional countries by concluding bilateral and regional agreements to exchange electric power equipment manufactured in the region .

- International co-operation between developed and underdeveloping countries to include in their adjudications parts manufactured in developing countries .

- Invitation of developed countries to direct

part of their economic assistance to developing countries for establishing new industries. International organisations are called upon to play an effective role in this aspect.

- Exchange of experience between countries in different stages of industrialisation through conferences, and seminars organised by international organisations.

DOMESTIC PRODUCTION OF PRIMARY ENERGY (in Terajoules - TJ) */

Energy source / Year	Coal		Other solid fuels		Crude petroleum		Natural gas		Electricity **/		TOTAL	
	TJ	%	TJ	%	TJ	%	TJ	%	TJ	%	TJ	%
1972					456815	89.53	-	-	53426	10.47	510241	100
1973					361318	87.13	-	-	53386	12.87	414704	100
1974					317597	83.35	-	-	63456	16.65	381053	100
1975					500024	87.44	1535	0.27	70314	12.29	571873	100
1976					706017	88.8	5348	0.68	82869	10.43	794234	100
1977					888317	88.7	9530	1.95	93583	9.34	1001430	100
1978					1034779	88.25	34922	2.98	102878	8.77	112579	100
1979					1121113	88.27	49523	3.9	99494	7.83	1270130	100
1980					1253001	86.59	92628	6.4	101492	7.01	1447121	100
1981					1352972	86.77	100440	6.44	105777	6.78	1559189	100
1982					1401978	86.43	111600	6.88	108564	6.69	1622142	100
1983					1529817	86.61	134850	7.63	101645	5.75	1766312	100

*/ This table is related to para. 2.a.

**/ Only hydro and geothermal electricity, i.e. from domestic primary sources.

N.B: Hydro electricity has been estimated at an equivalent consumption of 250 gm mazout / KWH

ELECTRIC ENERGY PRODUCTION AND CONSUMPTION

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
INSTALLED CAPACITY (MW)												
Public and self producer total	3948	3970	3970	3946	3960	4031	4076	4391	4893	5076	5292	6182
Hydro	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445
Conventional thermal	1503	1525	1525	1501	1515	1586	1631	1946	2448	2631	2847	3737
Public total	3775	3775	3775	3775	3789	3860	3905	4229	4731	4914	5130	6020
Hydro	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445
Conventional thermal	1330	1330	1330	1330	1344	1415	1460	1784	2286	2469	2685	3575
PRODUCTION GWh												
Public and self producer total	7979	8008	9097	10340	12171	14033	15507	16864	18975	21292	23898	26424
Hydro	5159	5156	6128	6790	8003	9038	9935	9608	9801	10215	10484	9816
Conventional thermal	2820	2852	2969	3550	4168	4995	5572	7256	9174	11077	13414	16608
Public total	7384	7435	8525	9799	11646	13517	15013	16359	18429	20747	23353	25879
Hydro	5159	5156	6128	6790	8003	9038	9935	9608	9801	10215	10484	9816
Conventional thermal	2225	2279	2397	3009	3643	4479	5078	6751	8628	10532	12869	16063
Net production	7107	7155	8238	9470	11285	13128	14591	15845	17848	20061	22552	24952
Transmission and dist. losses	938	977	1343	1162	1623	1639	1868	2722	3052	3410	3811	4217
Consumption GWh												
Net consumption	6169	6178	6895	8308	9662	11489	12723	13122	14796	16651	18741	20735
Industry and construction	3875	3845	3728	4822	5632	7180	7553	7800	8800	9991	11207	12441
Transport	118	118	125	126	130	132	145	150	160	165	170	175
Household & other consumers	2176	2215	3042	3360	3900	4177	5025	5172	5836	6495	7364	8119
Gneration per installed capacity	2.02	2.02	2.29	2.62	3.07	3.48	3.8	3.84	3.88	4.19	4.52	4.27

ELECTRIC ENERGY PRODUCTION (PROJECTIONS)

	1984	1985	1986	1987	1988	1989	1990	1995	2000
Capacity MW									
Total	6763	7823	9443	9543	9693	9693	10893	16493	23693
Hydro	2445	2445	2715	2715	2715	2715	2715	2915	4415
Conventional Thermal	4318	5378	6728	6828	6978	6978	8178	10878	10878
Nuclear	-	-	-	-	-	-	-	2700	8400
Generation GWh									
Total (Gross)	28900	32000	35400	38600	42060	45840	49960	73400	102900
Hydro	9800	9800	10900	10900	10900	10900	10900	12100	16000
Conventional Thermal	19100	22200	24500	27700	31160	34940	39060	41300	44900
Nuclear	-	-	-	-	-	-	-	20000	42000

EXISTING ELECTRIC POWER EQUIPMENT

(equipment commissioned after 1970)

1 - Generating Stations :

CONVENTIONAL THERMAL

Plant / Data	Cairo West Extension	Kafr El Dawar	Abu Qir	Abu Sultan
Commisioning Date	1979	1980	1983	1983
Plant size MW	1 x 87	2 x 110	2 x 150	2 x 150
Local content	—	—	—	—
Foreign Supplier :				
Boiler and boiler house equipment	Babcock & Wilcox	Skoda	Stein	Foster Wheeler
Turbine	Westinghouse		C.E. M	G. E
Generator	Westinghouse		Alsthom	G. E
Sub-station	Westinghouse		Alsthom	Mc Graw Edison
Control and instrumentation	Bailly Haggan		Alsthom	Foxborough

GAS TURBINES

Data \ Plant	Suez	Ismailia	Cairo North	Abu Matameer	El Tibbin
Commissioning date	1976	1977	1977	1978	1979
Plant size	1 x 14	1 x 20	1 x 20	1 x 20	2 x 20
Local content	--	--	--	--	--
Foreign Supplier:					
Comperssor-turbine	Westinghouse	G.E	G.E	G.E	Alsthom
Generator					
Substation					
Control and Instrumentation					

GAS TURBINES (CONT. I)

Data \ Plant	Cairo East	Talkha	Helwan	Siouf 1	Karmouz
Commissiong date:	1979	1979 - 1980	1980	1980	1980
Plant size	2 x 23	8 x 24	5 x 24	1 x 26	2 x 12.5
Local content	--	--	--	--	--
Foreign supplier:					
Compressor - turbine	Alsthom	G.E	G.E	Alsthom	Staal Laval
Genrator				G.E	
Substation				--	
Control and instrumentation				Alsthom	

GAS TURBINES (CONT. II)

Data \ Plant	Heliopolis	Mahoudia 1	Siouf 11	Shabab	Mahoudia 11
Commissioning date:	1980	1981 - 1982	1981 - 1982	1982	1983
Plant size	3 x 12.5	4 x 50	3 x 33.5	3 x 33.5	4 x 50
Local content	--	--	--	--	--
Foreign supplier:					
Compressor - turbine	Staal Laval	Rolls - Royce	Brown Boveri	Brown Boveri	G.E
Generator		Parsons			
Substation		Reyrolle			
Control and instrumentation		Mother & Platt + Rolls Royce			

GAS TURBINES (Cont. III)

Data \ Plant	Fayoum	Siouf III
Commissioning date	1983	1983 - 1984
Plant size	1 x 24	3 x 33
Local Content	--	--
Foreign Supplier:		
Compressor - turbine	G.E	Westing-house
Generator		
Substation		
Control and instrumentation		

TRANSMISSION

SUBSTATIONS COMMISSIONED AFTER 1970

Name / Data	Talkha	Cairo West	Cairo East	South Tibbin	Cement Suez	Suez 2	Manayef
Commissiong date	1975	1977	1977	1979	1982	1982	1982
Voltage Kv	220 / 66	220 / 66	220 / 66	220 / 66	220 / 66	220 / 66	220 / 66
Rating MVA	40 + 75	2 x 75	2 x 75	2 x 125	2 x 125	2 x 125	2 x 125

Name / Data	Kafr El Sheikh	Ghazl	Hadaba	Port Said	Aluminum	El Seil	Asyout cement
Commissing Date	1983	1983	1983	1983	1976	1980	1983
Voltage Kv	220 / 66	220 / 66	220 / 66	220 / 66	132 / 6	132 / 33	132 / 6.6
Rating MVA	2 x 75	2 x 75	2 x 125	2 x 125	6x 90	2 x 25	3 x 35

N.B : No local content in any substation

TRANSMISSION LINES COMMISSIONED AFTER 1970

Lines Double circuit	Comm. Date	Length of Route	Local Content			
			Tower	Conductor	Insulator	Fittings
220 KV:						
Wady hof-Sokhna	1976	108	-	-	-	-
Amria - Sidy Kreir	1976	28	-	-	-	-
Connection of Kafr El Dawar P.S	1979	5	100%	100%	-	-
Mahoudia - Damanhour	1981	18	100%	100%	-	-
Sokhna- Cement	1982	27	-	-	-	-
Zagazig - Ismailia	1982	85	100%	100%	-	-
Suez - Ismailia	1983	80	100%	100%	-	-
Ismailia - Abu Sultan	1983	8	100%	100%	-	-
Abis - Abu Qir	1983	24	100%	100%	-	-
Hadaba connection	1983	5	-	-	-	-
Talkha - Kafr El Sheikh	1983	70	100%	100%	-	-
Ismailia - Port Said	1983	80	100%	100%	-	-
Kafr El Dawar - Amria	1983	40	100%	100%	-	-
132 KV :						
Nag Hamady - Aluminum	1976	6	100%	100%	-	-
High Dam - El seil	1980	16	100%	100%	-	-
Connection to Asyout Cement	1983	30	100%	100%	-	-

Cables :

220 KV :

Cable Cairo East - Heliopolis, commissioned 1980, Route of 14 Km single circuit, 100% Foreign

TRANSMISSION EQUIPMENT COMMISSIONED (CONT)

(After 1970)

66 KV Substations :

Voltage : 66 / 11 KV

Sum of ratings : 2495 MVA

Local content : --

33 KV Substations :

Voltage : 33 / 11 KV

Sum of ratings : 246 MVA

Local content : --

66 KV Transmission Lines :

Length : 1000 Km (Double circuit)

Local content of towers & conductors : 50%

Local content of insulator and fittings : --

66 KV Cables :

Length : 372 Km

Local content : Nil

33 KV Transmission Lines :

Length : 560 Km (Double circuit)

Local content of towers and conductors : 20 %

Local content of insulator and fittings : --

33 KV Cables :

Length : 110 Km

Local content : --

III - Distribution

(equipment commissioned after 1970)

11 KV Substations:

- Rating varies between 25 to 1000 KVA.
- No. of units = 29360.
- Rating of transformers manufactured locally w.r.t. total rating = 60 % .
- Local content of switchgear = 10 %.

11 KV Transmission Lines:

- Length = 27075 KM
- Percentage of local content .

Towers & poles	:	93 %
Conductors	:	100%
Insulators	:	—
Fittings	:	100 %

11 KV Cables :

- Length : 12980
- Percentage of locally manufactured cables :60%

DOMESTIC PRODUCTION OF ELECTRIC POWER EQUIPMENT

Type of equipment	Specification	Unit	Annual production												Local Content	Local Manufactures
			72	73	74	75	76	77	78	79	80	81	82	83		
Distribution transformers	11 KV	MVA	300	415	392	477	509	619	589	686	704	737	981	1089	25 %	Elmaco
M.V outdoor D.L	11 KV	No.	-	-	-	-	-	-	-	-	-	1097	2595	1714	70 %	Elmaco
M.V Cables	11 KV	Ton	6230	3637	4254	6400	6154	7867	7174	6631	7276	9071	9486	10865	70 %	Egypt. Elect. Cables Co.
L .V Cables	0.38 KV	Ton	5672	4583	4269	6402	5315	5235	8564	9972	11106	11577	12553	12242	75 %	Egypt. Elect. Cables Co.
Al. & SCA conductors	All Volt.	Ton	2422	3291	2609	2139	3525	3996	3417	4063	5125	6192	4955	6000	60 %	Helwan Co. for Non Ferr
Steel towers	"	Ton	1000	1000	1000	2000	2000	2000	3000	3000	3000	4000	4000	4000	100%	Metalco .
Steel Poles	11 KV	Ton	1000	1000	1000	2000	2000	2000	2500	2500	2500	3000	3000	3000	100%	Metalco .
Steel towers	All Volt.	Ton	-	-	-	3600	3600	3600	4000	4000	4000	4500	4500	4500	100%	Steelco
Steel Poles	380 V	No.	31600	32800	29200	34850	44660	48800	58100	13099	91810	75180	41580	46500	100%	El Nasr Co.for Steel Pi
Concrete Poles	11 KV	Ton	5300	5300	5300	7200	7200	8100	9300	10200	11400	12500	12500	12500	80%	Sigwart
Switchboards (with C.B)	11 KV	Cells	-	-	-	-	-	-	-	1152	452	873	246	608	45%	Egemac
Kiosks	11 KV	No.	-	-	-	-	-	-	-	267	393	634	521	381	50%	Egemac
Kiosks	11 KV									-	-	-	700	640	50%	Arab
Switchboards with (L.B.S)	11 KV									38	404	417	305	351	45%	Egemac
Switchboards with (L.B.S)	11 KV										-	-	600	580	45%	Arab
L.V Switchboard	380 V									557	285	1839	2327	3421	55%	Egemac
L.V Switchboards	380 V										-	-	1249	1592	55%	Arab
Current & Pot. Transf.	11 KV	No.									-	730	760	2760	100%	Egemac
Support Insulators	11 KV	No.										450	3800	7800	100%	Egemac

Soure of technology: mentioned in text