







REF. 4

ROADS WITH STREET LIGHTS  
AND DISTRIBUTION BOUNDARIES  
OF PRIMARY SUBSTATIONS

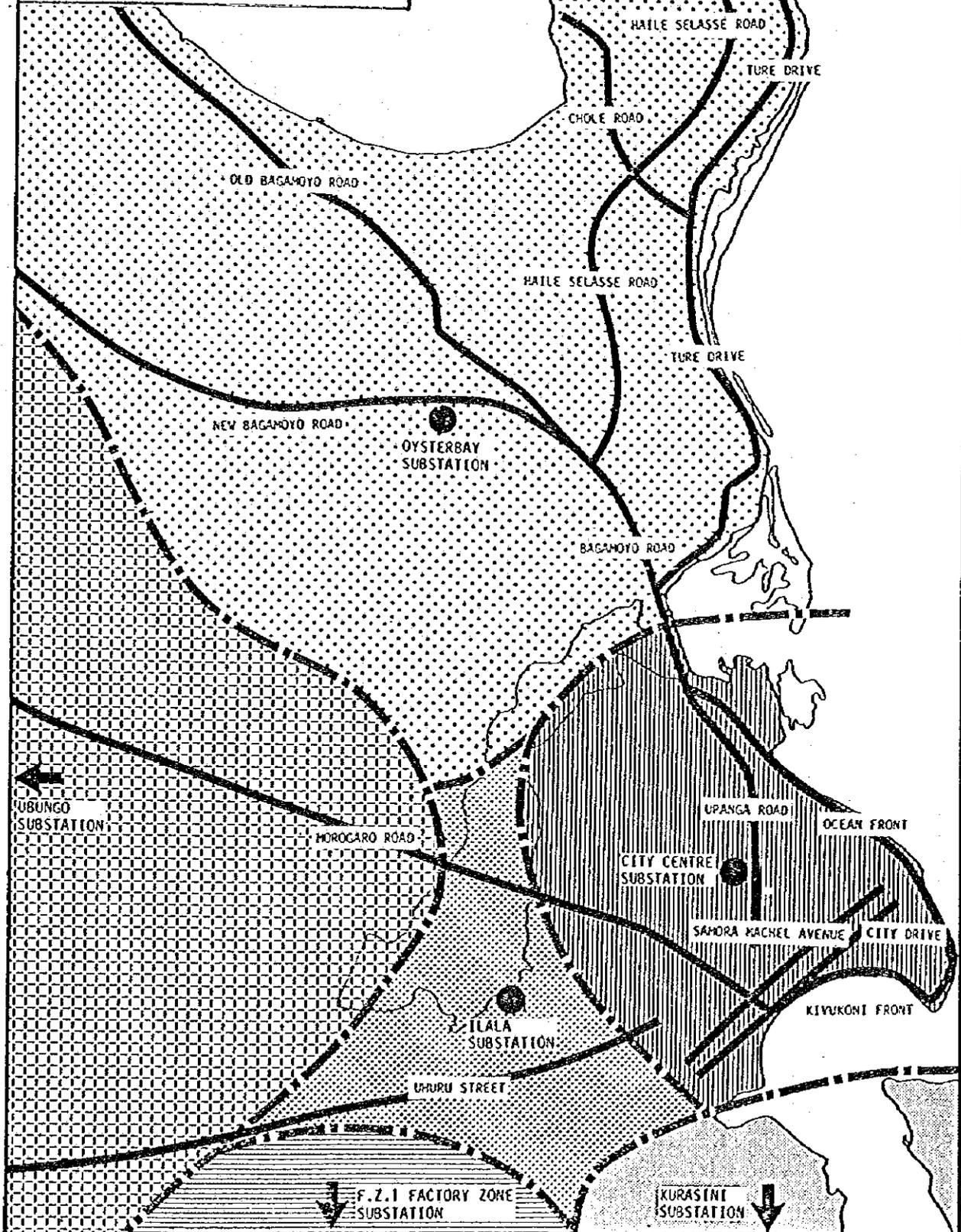
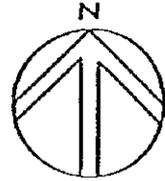
LEGENO



ROADS TO BE EQUIPPED  
WITH STREET LIGHTS



DISTRIBUTION BOUNDARIES  
OF PRIMARY SUBSTATIONS



REF. 5

REQUEST FOR FEASIBILITY STUDY ON  
A COMPREHENSIVE DAR ES SALAAM  
DISTRIBUTION NETWORK REHABILITATION

TANZANIA ELECTRIC SUPPLY COMPANY LTD.

REQUEST FOR FEASIBILITY STUDY ON A COMPREHENSIVE  
DAR ES SALAAM DISTRIBUTION NETWORK REHABILITATION

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## DAR ES SALAAM DISTRIBUTION NETWORK

### 1. INTRODUCTION

#### 1.1. City of Dar es Salaam:

The City of Dar es Salaam is the main Commercial, Industrial and Administrative Centre of Tanzania. It is by far the largest town in the country and its population is reaching one million inhabitants. Over 50% of the country's industries are located in this town. Dar es Salaam is presently served with electricity from the Coastal Grid system which also serves towns as far afield as Moshi and Arusha.

#### 1.2. General Technical Data:

- a) The approximate area covered by existing Distribution network: 120 sq. km.
- b) The total number of primary 33/11/kV substations: 3
- c) The total capacity of Secondary 11/0.4kV substations: 90MVA
- d) The total length of 33kV lines: 150 km.
- e) The total length of 11 kV lines: 450 km.
- f) The total length of MV/LV lines: 800 km.
- g) The total number of street lights: 4500
- h) The total number of consumers: 69,700
- i) The Map of City Distribution System is shown in Figure No: 1.

The Dar es Salaam distribution network has expanded quite considerably since 1970. The growth in terms of the number of electricity consumers, route lengths of 11kV and 33kV lines, maximum demand and units imported is shown on appendix 1 whilst the corresponding graphs are shown on fig. 2 and 3.

### 2. EXISTING DISTRIBUTION SYSTEM

#### 2.1. General Layout:

The present 33kV and 11kV distribution system in Dar es Salaam is, in effect, fed from a single main source, namely the 220/132/33kV substation. However, since Ilala is itself fed from the same 132kV bus at Ubungo, the result is essentially a single point of supply.

The existing 33/11kV substations with the installed capacities and peak demand are shown below:-

<u>Substation</u>	<u>Installed Capacity (MVA)</u>	<u>1982 Peak Demand (MVA)</u>
Ubungo	3x5 = 15	3.0
Ilala	2x7.5 = 15	15.3
City Centre	3x5 = 15	17.25
Oysterbay	2x5 = 10	12.5
Factory Zone I	3x5 = 15	14.75
Factory Zone II	1x5 = 5	4.5
Nbezi	1x5 = 5	2.25
Kurasini	1x5 = 5	5.00
Total	125	

In addition, there are a number of major industries which take their power supply directly from the 33kV system. The installed capacities of these consumers' 33kV substations and their peak demands are shown below:-

Consumer's Name	Installed Capacity (MVA)	1981 Peak Demand (MVA)
ALAF	30	11.25
Wazo Hill Cement Factory	15	8.25
Friendship Textile	5	3.75
TAZARA	5	1.50

### 2.2. Loading Conditions:

The shape of the daily load demand is very consistent, with a peak in the middle of the day between about 11.00 hours and 14.00 hours and a secondary peak at about 20.00 hours. The only exception is Oysterbay substation which feeds a suburban area having residences with high power consumption rates including a large number of embassies and their associated diplomatic residences. The combined effect of these particular loads, which represent 15% of the total, is to produce an evening peak between 15.00 hours and 20.00 hours.

The seasonal pattern for the city as a whole is even more regular and rises gradually to a peak during the hot months of November to February and falls away again to a low point in July and August. The difference between the two is, however, very small, and since 1971 the ratio has varied between 82% and 94% only. The annual load factor is about 72%, and it is therefore concluded that the daily load factor is between 75% and 80%.

From these figures, together with local observations, it is confirmed that the pattern is largely governed by the use of air conditioning in the commercial areas of the city. Although light industry is now much in evidence, little of it appear to work more than one shift per day.

### 2.3. Physical Plant:

The physical condition of the distribution network is generally good. It is basically in sound condition and of a design appropriate to the relatively modest sources of this Company. In many areas, however, the system is outdated and far inadequate in terms of both substation and line capacity. It is rapidly nearing the upper limit of its capability. Both the 33kV, 11kV and most of the HV/LV systems are overloaded. A major portion of the existing system was constructed in 1960s when the power demands and load densities were relatively low.

..//..

The main problems experienced with existing system include:-

- a) Low voltage - due to network inadequacy or overload.
- b) High voltage, - due to loose connection, uneven loading or broken conductor.
- c) Voltage fluctuations - due to loose connection or system weakness.
- d) Power interruptions - due to line or equipment breakdown.

The above problems are very common in Dar es Salaam, especially those related to loose connections. This is because the line connectors which link aluminium and copper conductors invariably get corroded and loose due to the salty coastal atmospheric conditions. The salty - moist air gradually causes an electrolytic action between the two dissimilar conductors and corrosion follows.

#### 2.4. Street lighting:

The City of Dar es Salaam is badly lit. Most of the main roads and highways are provided with street lights. However, quite a large number of these lights are not working due to the shortage of replacement spares and bulbs. Out of 4500 street lights existing only about 3,200 are functioning. On the other hand, there are many roads in the city which require lighting but this has not been accomplished due to the acute shortage of street light fittings, gear and spares. The shortage of tools and working equipment has also adversely affected the performance of lighting in the city.

### 3. ANALYSIS OF SPECIFIC SET BACKS

#### 3.1. Alternate or Parallel Feeding:

The mere fact that Dar es Salaam is being fed from a single source of supply is in itself a big drawback.

Although the Company generally has the ability to transfer load from one station to another in the event of transformer outage, there are several locations where this is not really feasible. There are many incidences when it has been necessary to keep a large section of community out of supply until when a new transformer was obtained and installed. In the case of the City Centre substation for example, the recorded peak demand is 15MVA on the three transformers. Thus, if one unit was to fail, about 4 or 5MVA would have to be distributed between Ilala, Oysterbay and Factory Zone I, all of which are equally heavily loaded.

#### 3.2. Upgrading of Overloaded Network:

There is an urgent need to increase the capacities of Ilala, City Centre, Oysterbay and Factory Zone I substations. Both the transformers, bus bars and switching equipment of these stations are due for upgrading.

..!..

Likewise most of the 33kV and 11kV overhead lines and terminations require complete overhaul or outright replacement. The MV/LV network requires general review and re-configuration so as to cut down the lengths of some of the highly extended L.V. lines and introduction of new transformers to arrest the low voltage problems complained.

In these primary 33/11kV substations there is also a very pressing need of improving telecommunication and telecontrol with the main control centres at Ilala and Ubungo. The present communication facility using pilot cables is old and outdated.

### 3.3. Shortage of Line Material and Equipment:

There is an acute shortage of line material and other working equipment. The shortage is badly affecting the general performance of the system.

However, the main shortages include the following items:-

- a) Line material
- b) Protective equipment
- c) Underground cable
- d) Working tools and vehicles
- e) Radio communication equipment and spares
- f) Safety equipment
- g) Spares, tools and equipment for street lighting.

### 3.4. Outstanding Requirements:

Due to the acute shortage as outlined in 3.3. above, the following works and statutory obligations cannot be undertaken effectively:-

- a) The execution of Preventive Maintenance.
- b) The repair and maintenance of several known distribution lines and equipment in the system.
- c) A total of 69 new distribution extension projects which have been paid for by prospective industrial and commercial consumers are kept pending.
- d) A total of over 5,000 new service line connections which have been paid for are awaiting connections.
- e) Over 5,000 prospective consumers are in the waiting list.
- f) Repair and maintenance of about 1,000 faulty street lights.
- g) The general upgrading of the system as proposed under Section 4 below.

## 4. REQUIREMENT AND COST ESTIMATES

### 4.1. Existing Primary Substations:

The substation at Ubungo, Ilala, City Centre, Oysterbay, Mbezi, Factory Zone I and II will require the following equipment for upgrading:-

.../..

a) Ubungo 132/33kV Substation:-

A new 50MVA 132/33/11kV transformer complete with switchgear will be required to match and operate in parallel with the existing two units. The 33kV bus bar has to be extended and four new 33kV OCBs for new feeders to MAF, Kurasini, Factory Zone I and a spare be made available.

b) Ilala 132/33/11kV Substation:-

New 2 x 30/50MVA 132/33kV transformers to replace the existing ones. One 132kV circuit breaker complete with appropriate disconnect switches and protection to be provided. 2 x 33kV circuit breakers with 2 x 33kV disconnect switches and other accessories are required.

c) City Centre 33/11kV Substation:-

New 2 x 15MVA 33/11kV transformers, circuit breaker and isolators to be provided. Also two 11kV OCBs will be required. Three 5MVA 33/11kV transformers will be released for use elsewhere.

d) Oysterbay 33/11kV Substation:-

One ex-City Centre 5MVA transformer together with switchgear will be installed here. A new 11kV feeder will also be created.

e) Factory Zone I:-

New 2 x 15MVA, 33/11kV transformer complete with 33kV switchgear and isolators to be installed.

f) Factory Zone II Substation:-

This station to be relocated since its existing control room is in a poor condition. An additional 5MVA ex-City Centre complete with accessories to be installed.

4.2. Additional Primary Substation:

It is very essential to reinforce the existing network by putting up additional 33/11kV primary substation to avoid voltage drop arising from long overloaded 11kV lines. The additional substations are also intended to cater for known industrial developments.

a) Factory Zone III Substation:-

This is to be located in Kipawa area to relieve Factory Zone I substation and take up the new Airport load as well as the proposed 15MVA J.V. Garment Factory. 2 x 5MVA 33/11kV transformers and switchgear will be required. 11kV switchgear and accessories will also be made available.

.../...

b) Ovsterbay II Substation:

Due to the heavy load demand at Msesani in Dar es Salaam, the present facility is getting inadequate. It is proposed to establish a 2 x 5MVA 33/11kV complete with all accessories for this station to be located in Msesani Peninsular.

c) Kibaha Substation:

Due to the load increase for the Kibaha Centre and the new regional headquarter, it is proposed to construct a new 33kV line from Ubungo to Kibaha and establish a 2 x 5MVA 33kV 33kV substation complete with the usual line and equipment accessories.

4.3. Line Materials:

Quite a large amount of overhead line materials, especially conductors will be required for comprehensive network rehabilitation. A number of 11kV feeders will have to be rebuilt due to old age and others un-graded due to loading conditions. New circuits will have to be built to increase reliability.

4.4. 11kV Undergrounding:

There are various areas within the City Centre which requires undergrounding for safety, reliability and amenity point of view. It is proposed to procure about 9 km of 70mm<sup>2</sup> PILSTA/PEX and 8 km of 185mm<sup>2</sup> for this purpose.

4.5. Vehicles:

The Dar es Salaam Distribution network has been facing an acute shortage of reliable vehicles for a long time. One major pre-requisite for accomplishing the rehabilitation is the availability of suitable lorries, four-wheel drives, pick-ups and special mechanised working equipment.

4.6. Tools and Safety Equipment:

A number of new tools, testing instruments and Safety gear are urgently required. These include meggers, cable fault locators, linesman working equipment, ladders etc.

4.7. Radio Communication:

It is proposed to reinforce the existing VHF telephone network to improve field communication. It is also intended to augment the remote indication and if possible control for the primary substation.

.../..

4.8. Street Lighth:

A number of street light fittings will be required to renovate the badly lit streets. Also lighting units complete with columns will be required for new streets which have remained without this facility for a long time.

4.9. Cost Estimates:

It is not possible at this stage to work out the cost estimates for this comprehensive network rehabilitation. However, it is anticipated that the amount involved will be in the region of 100 million shillings.

5. ECONOMIC AND SOCIAL ASPECTS

This exercise is confined to the Distribution Network which is within the Grid System. The power supply derived from the Grid is essentially hydro generated and therefore cheap. By connecting the many consumers and industries given in section 3.4, TANESCO will earn extra revenue with very little additional operating costs since at present there is an excess power in the Grid.

On the other hand, the many prospective consumers who are in the waiting list will get this much needed services if the exercise of rehabilitation by acquiring line materials from abroad is achieved. Furthermore, there are numerous complaints from the public due to voltage fluctuations and power interruptions experienced by the consumers. A number of consumers have had their equipment damaged as a result of these fluctuating voltages. This exercise, once implemented will therefore provide a great relief and happiness to alot of Dar es Salaam electricity consumers.

6. CONCLUSIONS AND IMPLEMENTATIONS PRIORITIES

In view of the heavy expenditure anticipated to accomplish the comprehensive Distribution rehabilitation, it is intended to carry out this work in two phases:-

6.1. 1st Phase - Emergency Overhaul:

It is expected that this phase will be carried out as soon as possible to alleviate the many problems and overloading currently facing the City of Dar es Salaam. This emergency overhaul exercise is subject to a separate report which has been prepared, so that limited funds could be made available to arrest the immediate problems of the City.

.../...

6.2. 2nd Phase - Comprehensive Rehabilitation

This phase will of necessity be subject to a detailed feasibility study. It is hoped that all other works not covered in Phase 1 would be undertaken during this phase of development. Terms of Reference for the feasibility study is outlined in Appendix 2.

DAR ES SALAM SYSTEM GROWTH 1970-1982

Year	Consumers (No)	Units Imported (kWh)	MD (MW)	Growth 11 & 33kV Lines (km)
1970	24,059	192,859,137	34.6	453.00
1971	26,746	203,093,014	36.6	454.53
1972	28,949	237,103,315	41.2	482.33
1973	30,505	252,057,437	47.7	516.23
1974	33,694	270,340,746	54.3	530.43
1975	35,784	274,359,364	51.0	542.17
1976	39,331	284,631,092	54.4	582.33
1977	43,305	320,375,807	59.1	617.92
1978	54,317	361,620,819	65.4	628.97
1979	61,947	397,302,827	69.0	642.36
1980	63,565	404,573,745	70.3	652.36
1981	66,399	408,436,745	72.0	659.36
1982	69,703	414,466,191	73.4	663.46

TERMS OF REFERENCE OF THE STUDY

We expect the study to be conducted in accordance with the following Terms of Reference:-

1. Load Forecast:  
About 10 years load forecasting will be needed for areas to be covered by each primary substation in Dar es Salaam City.
2. Appropriate planning for overall rehabilitation of sub-transmission and distribution lines in Dar es Salaam system:-
  1. Principle of planning
  2. Establishment planning for new substations
  3. Extension planning for existing substations
  4. Up-grading planning for 33kV subtransmission lines
  5. Reinforcement planning for 11kV distribution system
  6. Communication and supervising system planning
  7. Establishment of principle for rehabilitation of low voltage system.

Planning of the above should be made appropriately to take into account the regulations and present economical conditions of the country.

3. General design of each facility:-
  1. Detail design of new substations
  2. Typical design of new transmission and distribution lines
  3. General design for extension and up-grading of existing substations and lines
  4. General design for all other facilities for low voltage system and communication system.

The above should be available for tender.

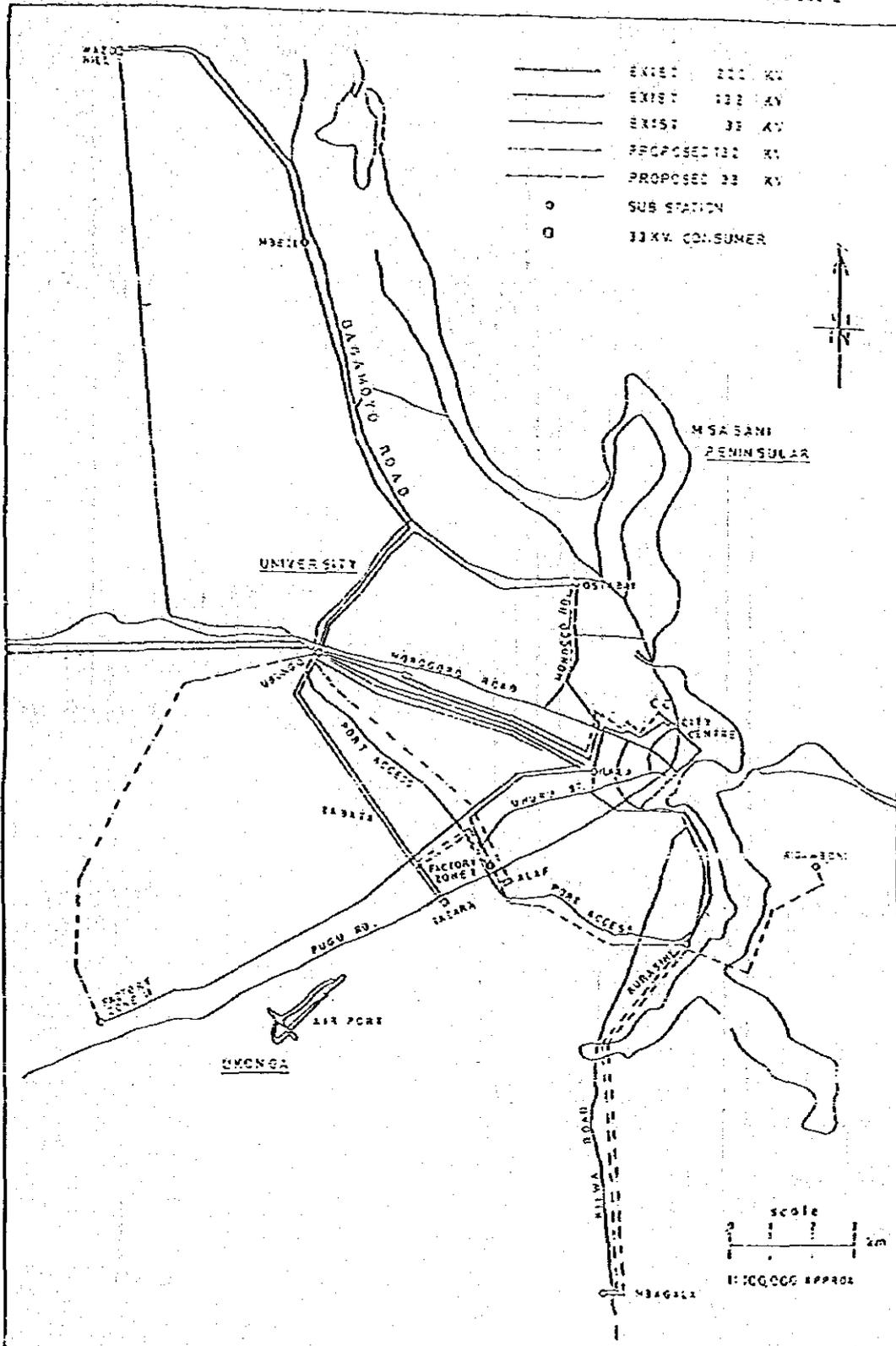
4. Cost estimation in general:

<u>Items:</u>	<u>Requirement:</u>
New substations	On full turn key bases
New transmission lines	Supply of materials and equipment
Up-grading of existing substations	--"---
Up-grading of existing lines	--"---
Communication and supervision facilities (services for adjustment and tests are needed)	--"---
Equipment and materials for low voltage lines	Supply of materials and equipment.

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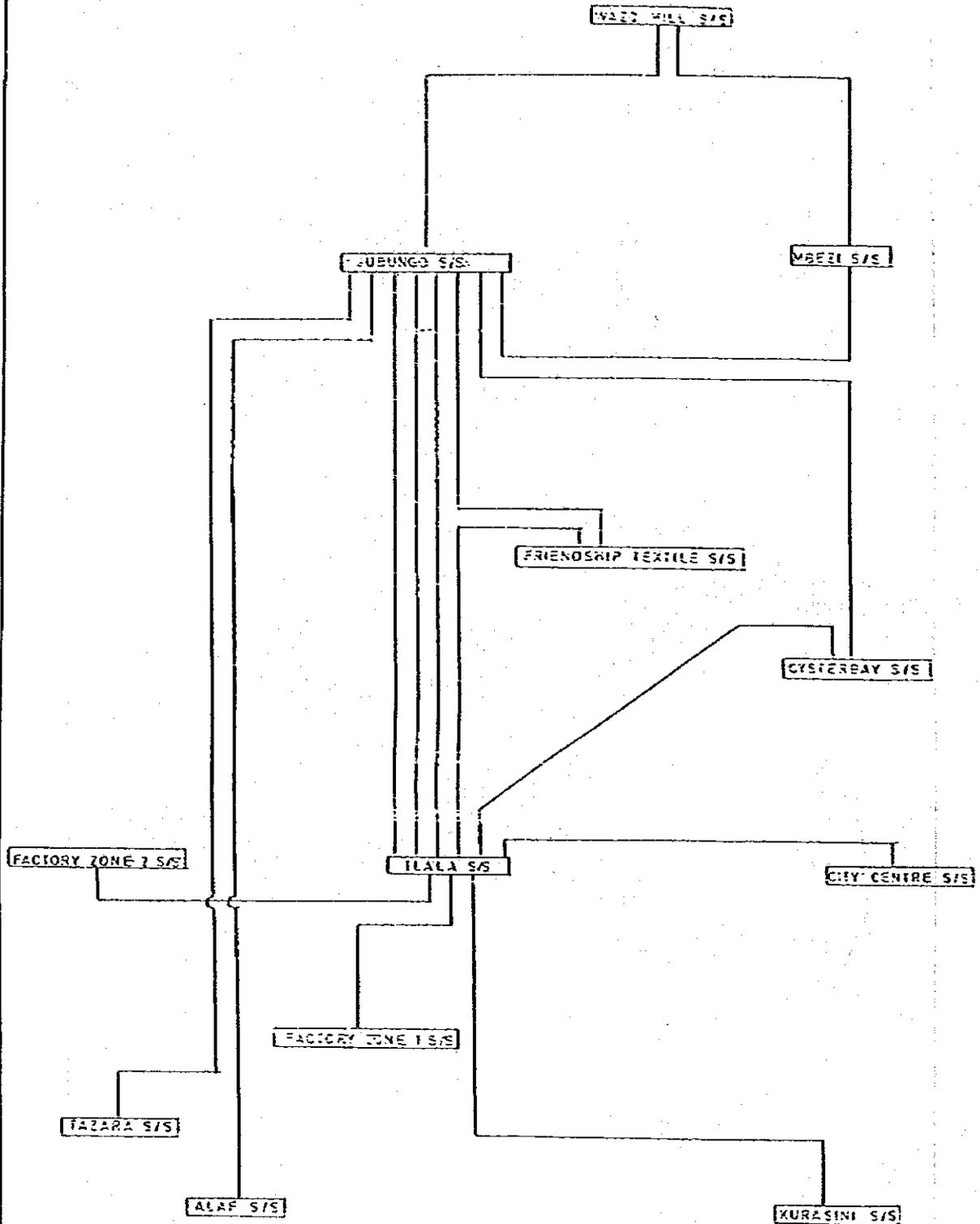
5. Preparation of lists for necessary materials, equipment, tools and spares.
6. Preparation of implementation programme (including time schedule).
7. Evaluation of feasibility of the project.
8. Preparation of the recommended programmes and procedures for routine preventive maintenances.

FIGURE NO. 1



	<p>DAR-ES-SALAAM 33 KV DISTRIBUTION NET WORK</p>	<p>DRG No. 2726</p>
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Figure No.2



TA/1517

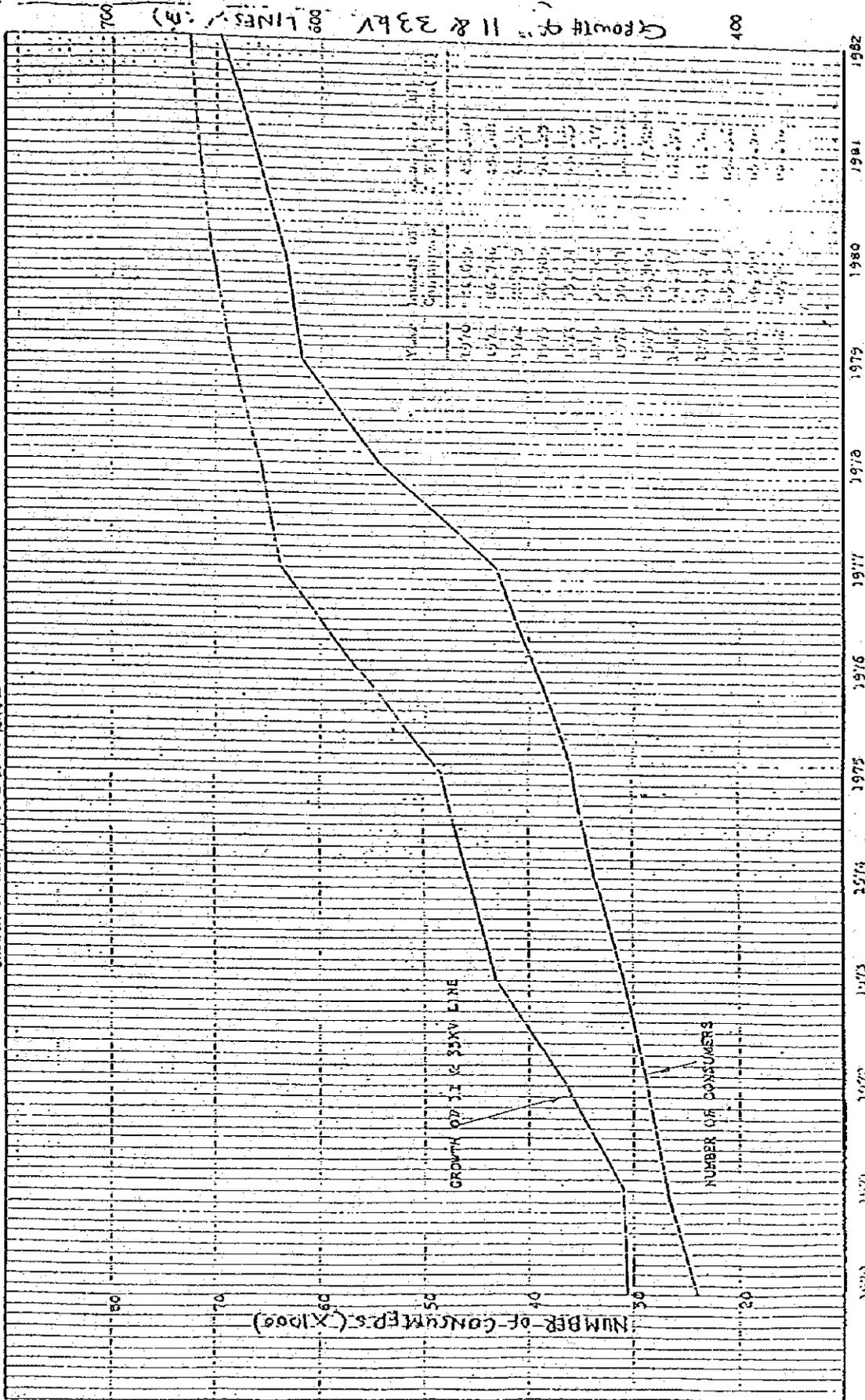
DAR-ES-SALAAM 33kV PRIMARY  
DISTRIBUTION NETWORK

DRAWN BY	
TRACED BY	
CHECKED BY	
SCALE	
DATE	11/11/1988

DRG  
NO  
4983

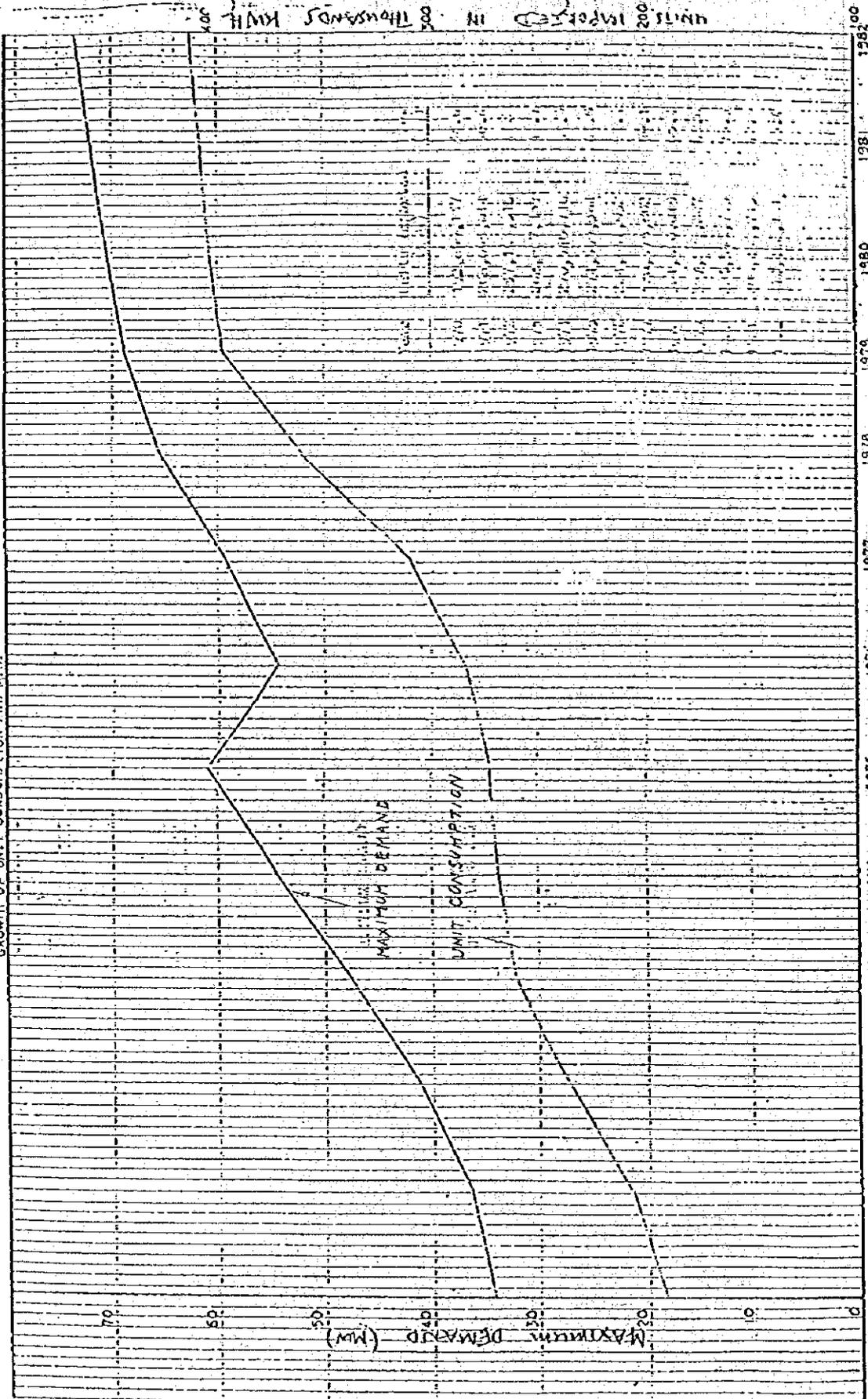
# TANZANIA ELECTRIC SUPPLY COMPANY LIMITED.

GROWTH OF 11 & 33KV LINES, ROUTE LENGTHS



TANZANIA ELECTRIC SUPPLY COMPANY LIMITED.

GROWTH OF UNIT CONSUMPTION AND M.D.



T.E.S.C. Figure No. 4

REF. 6

**REQUIRED INFORMATION AND DATA**

3. REQUIRED INFORMATION AND DATA

3-1 INSTALLED AND AVAILABLE CAPACITIES OF TANESCO-OWNED FACILITIES DURING THE PAST FIVE (5) YEARS.

	HYDRO		THERMAL	
	INSTALLED CAPACITY (MW)	AVAILABLE CAPACITY (MW)	INSTALLED CAPACITY (MW)	AVAILABLE CAPACITY (MW)
1978				
1979				
1980				
1981				
1982				

3-2 ANNUAL ENERGY PRODUCTION DURING THE PAST FIVE (5) YEARS

	HYDRO (GWH)	THERMAL (GWH)
1978		
1979		
1980		
1981		
1982		

3-3 ENERGY CONSUMPTION DURING THE PAST FIVE (5) YEARS (GWH)

1) ENERGY CONSUMPTION IN WHOLE COUNTRY

1978 (AVAILABLE IN TOKYO)  
 1979 (AVAILABLE IN TOKYO)  
 1980  
 1981  
 1982

2) RATIO OF ENERGY SOLD (CONSUMPTION) IN DAR ES SALAAM AREA TO THAT IN WHOLE COUNTRY (STANDARD OF DAR ES SALAAM TAKEN IN THE TOTAL ENERGY CONSUMPTION THROUGHOUT TANZANIA)

3-4 DATA AND/OR BOOKLET(S) ON POWER MARKET SURVEY THROUGHOUT THE COUNTRY FOR THE COMING TEN (10) YEARS, IF ANY. JICA WISHES TO KNOW HOW THE POWER DEMAND AND SUPPLY CONDITION IN DAR ES SALAAM CAN BE SITUATED IN THE TOTAL VALUES OF DEMAND AND SUPPLY CONTAINED IN THE SAID POWER MARKET SURVEY PERFORMED ON A NATION-WIDE SCALE.

3-5 ORGANIZATION OF TANESCO

- 1) CHARTERED FUNCTIONS AS STATED IN LAWS AND/OR ORDINANCES
- 2) ORGANIZATION CHART (EFFECTIVE AS OF JULY 1983)

3-6 DATA AND/OR INFORMATION ON POWER DEVELOPMENT AND/OR EXPANSION PROGRAM, INCLUDING DAR ES SALAAM DISTRIBUTION REHABILITATION PROGRAM, FOR THE COMING TEN (10) YEARS, IF ANY.

3-7 TANESCO'S DEFINITE REQUIREMENTS OF DAR ES SALAAM DISTRIBUTION REHABILITATION PROGRAM IN RESPECT OF THE SCOPE OF AREA AND ITS PRIORITY ALTHOUGH SUCH ITEMS ARE TO BE FINALIZED THROUGH THE SURVEY TO BE CONDUCTED UNDER THE SPONSORSHIP OF JICA.

3-8 1) HAS TANESCO EVER MADE A REQUEST OR REQUESTS TO OVERSEAS COUNTRY(ES) AND/OR INTERNATIONAL ORGANIZATIONS SUCH AS ISRD AND SO FORTH FOR FINANCIAL AND/OR TECHNICAL ASSISTANCE IN CONNECTION WITH THE DAR ES SALAAM DISTRIBUTION REHABILITATION PROGRAM?

2) DOES TANESCO MAKE A REQUEST OR REQUESTS TO COUNTRY(ES) OTHER THAN JAPAN AND/OR INTERNATIONAL ORGANIZATIONS REGARDING THE REALIZATION OF THE SAID PROGRAM?

3-9 LATEST MAP(S) INDICATING THE LOCATIONS OF POWER PLANTS, SUBSTATIONS AND THE ROUTES OF TRANSMISSION LINES BY EACH VOLTAGE (EXISTING AND PROPOSED) THROUGHOUT TANZANIA

TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

From

To

Your Ref.

Our Ref.

Date 16th July, 1983

3.1 INSTALLED AND AVAILABLE GENERATION CAPACITY FOR THE PAST 5 YEARS

YEAR	HYDRO INSTALLED	CAPACITY(MW) AVAILABLE	THERMAL INSTALLED	CAPACITY(MW) AVAILABLE	TOTAL INSTALLED	CAPACITY(MW) AVAILABLE
1978	149.22	149	102.19	40.90	251.41	189.9
1979	249.22	249	102.43	40.97	351.65	239.9
1980	249.22	249	125.05	50.02	374.27	299.02
1981	249.22	249	130.11	50.02	379.33	299.02
1982	249.22	249	141.10	51.60	390.32	300.6
1983	249.22	249	141.10	51.60	390.32	300.6

3.2 ENERGY PRODUCTION FOR THE PAST 5 YEARS

YEAR	UNITS GENERATED HYDRO (KWhr)	UNITS GENERATED THERMAL (KWhr)	UNITS GENERATED TOTAL (KWhrs)
1978	585,457,175	94,813,356	680,270,531
1979	648,781,267	102,976,504	751,757,771
1980	683,652,498	115,820,298	799,532,796
1981	722,749,410	100,655,856	823,405,266
1982	727,057,495	102,477,953	829,535,348

3.3 ENERGY CONSUMPTIONS FOR THE PAST 5 YEARS

YEAR	UNITS SOLD TOTAL (KWhr)	UNITS SOLD DSM (KWhr)	RATIO DSM/ TOTAL
1978	587,620,631	364,950,367	62%
1979	653,719,174	370,718,750	57%
1980	732,076,905	436,784,966	60%
1981	751,950,567	429,010,508	57%
1982	705,907,300	411,270,560	58%

POWER MARKET SURVEY IN THE COMING 10 YEARS (ROUGH ESTIMATES)  
MAXIMUM DEMAND (M.W.)

YEAR	DAR ES SALAAM	EXTENDED GRID	%
1980	73.050	122	59.836
1981	74.950	124	60.483
1982	75.750	133	57.143
1983	77.290	181	42.512
1984	78.820	205	38.916
1985	80.400	225	36.000
1986	82.010	245	35.745
1987	83.650	259	32.452
1988	85.320	272	31.453
1989	87.050	286	30.419
1990	88.770	300	29.667

3.5 ORGANISATION OF TANESCO:

(1) TANESCO is a fully owned Government Parastatal Institution. It operated under the Laws of the Country ref. Cap. 131 of the Electricity Ordinance.

(2) The Organization Chart effective to date is attached. The Organizational review of the Company is being considered.

3.6 Data/Information on Power Development in the next 10 years not available. However, the available City Master Plan can be made available while in Dar-es-Salaam.

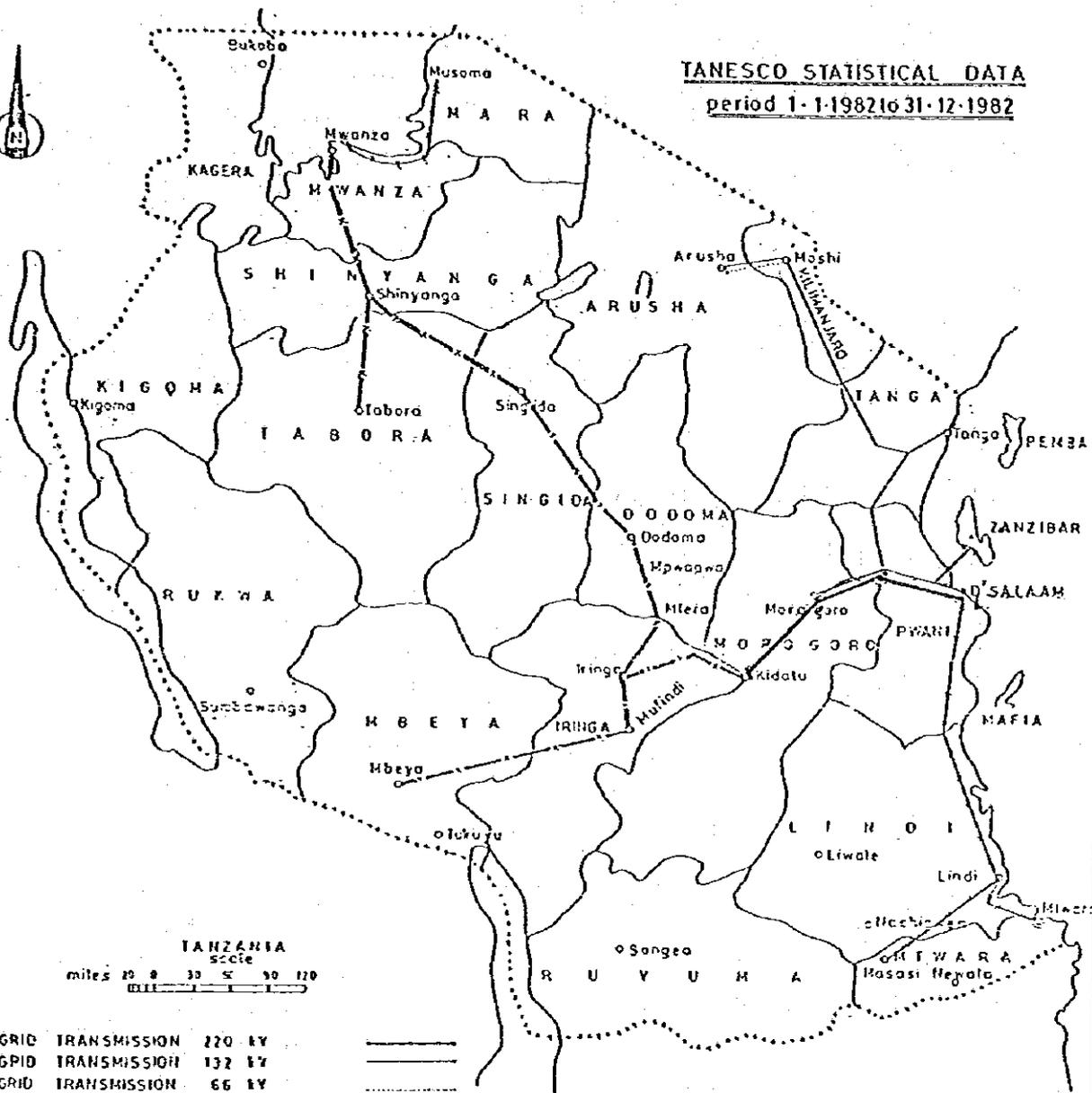
3.7 Definite requirement of the Dar-es-Salaam Rehabilitation include: making an inspection and a sufficiently detailed study of the existing distribution network to be able to determine the comprehensive rehabilitation program.

3.8 (1) Yes, requests have been made to NORAD and IBRD for Immediate and Emergency spares for sustaining the Dar-es-Salaam Distribution network which is ready about to collapse.

(2) No. The Rehabilitation Program is expected from JAPAN only.

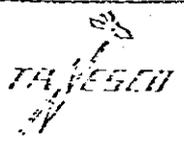
OPERATIONS DIVISION - 16TH JULY, 1983

**TANESCO STATISTICAL DATA**  
period 1-1-1982 to 31-12-1982



TANZANIA  
 Scale  
 miles 0 20 30 50 120

- GRID TRANSMISSION 220 kV
- GRID TRANSMISSION 132 kV
- GRID TRANSMISSION 66 kV
- PROPOSED TRANSMISSION 220 kV
- PROPOSED TRANSMISSION 132 kV



REF. 7

TARIFFS EFFECTIVE 1ST JANUARY, 1984

TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

TARIFFS EFFECTIVE 1ST JANUARY, 1984

TARIFF NO.1

Applicable to premises used exclusively for domestic and private residential purposes excluding a group of residential premises with one meter.

- Step: 1. .... First 0-10 units, minimum charge Shs.15/00  
2. .... Next 90 units at -/60 cents per unit  
3. .... In excess of 100 units at -/75 cents per unit.

TARIFF NO.2

Applicable to restaurants, theatres, hotels, clubs, cinema halls, shops, schools, hospitals, lodging places, harbours, airports, military camps, prisons, office blocks, bars, poultry and animal farms, a group of residential premises with one meter, and places where similar business or trade is conducted and where consumption is less than 10,000 units per meter reading period.

- Step: 1. .... First 0-15 units, minimum charge Shs.60/00  
2. .... Next 485 units at Shs.3/- per unit  
3. .... In excess of 500 units at Shs.2/10 per unit

Temporary Supplies:

Temporary Supplies will be given on this tariff, for which a deposit of Shs.12/- per KV connected load per day for two months required prior to connection.

TARIFF NO.3

Applicable to premises engaged in the production of any article, commodity or industrial process where the main use of electricity is motive power or an electrothermal or electro-chemical process including textiles factories, oil mills, flour mills, garages, workshops, farming estates, pumping stations, etc., and where consumption is less than 10,000 units per meter reading period.

- Step: 1. .... First 100 units, minimum charge Shs.180/-  
2. .... Next 900 units at Shs.1/35  
3. .... In excess of 1,000 units at Shs.1/20 per unit

TARIFF NO.4

Applicable to premises as in Tariff 3 but where consumption is more than 10,000 units per meter reading period.

Maximum Demand Charge:

The kVA Demand indicator will be reset each month.  
For the first 0-80 kVA - minimum charge Shs.7,200/-  
In excess of 80 kVA - at Shs.90/- per kVA.

Unit charge:

All units at -/95 cents per unit.

TARIFF NO.5

Applicable to premises as in Tariff 2 but where consumption is more than 10,000 units per meter reading period.

Maximum Demand Charge:

The kVA Demand indicator will be reset each month.  
For the first 120KVA, minimum charge Shs. 11,520/-  
In excess of 120KVA Shs.96/- per KVA.

Unit Charge:

All units at -/90 cents per unit.

TARIFF NO.6

Applicable to street lighting, religious organization like mosques, churches, temples, etc. or charitable institutions.

All units at 1/10 per unit.

LEF. 8

タンザニア緊急援助要請に対する考察

- APP. 1 DAR ES SALAH DISTRIBUTION NETWORK  
(ダルエスサラーム送配電網の緊急援助要請)
- APP. 2 LINE MATERIALS  
(緊急援助用LINE MATERIALSの説明)
- APP. 3 VEHICLE REQUIREMENTS FOR DAR ES SALAH EMERGENCY MAINTENANCE  
(ダルエスサラーム緊急補修作業必要車両)

## REF.8 タンザニア緊急援助要請に対する考察

タンザニア政府はTANESCOの予備調査に基き、日本政府に対し昭和57年2月、ついで昭和58年9月に、ダルエスサラーム送配電網のリハビリテーション計画についての協力要請を行った。そのPhase 1は緊急援助資材の供与要請であり、要請総額は約5.4億円である。これを大別すると

(1) 架線材料およびその付属品	380百万円
(2) 工事およびパトロール用車輛	51
(3) 工具および安全用具	69
(4) 街路灯灯具および電球	30
(5) 技術教育費	15
計	545百万円

で、その70%は電線を主体とした架線材料である。このほか、車輛と工具類で21%、その他となっている。これらの明細はAPP1、2及び3の通りであるが、これを緊急性から区分すると大体70~80%は現段階ですでに改修箇所が決定されていて、入荷待ちの状況にあるもので、残りが逐次改修するための資材である。

### (1) TANESCOの要請の妥当性について

TANESCO側要請の妥当性については、今後詳細に検討される手筈になっているが、現地調査の際、その一部について内容説明を受けた。その要点を文書化したものがAPP1~3である。

要請の内容は、緊急修復用資材類と、その作業に必要な工具ならびに車輛とに2大別される。以下に要請の妥当性をこの2つに分けて考察する。

#### (a) 修復用資材

資材の大部分は配電用架線材料とその付属品であり、ほかに街路灯灯具も含まれる。架線材料の要求総額は3.8億円であり、その内わけは電線材(46%)とヒューズ類(27%)とで占められている。

##### (a-1). 100mm ACSR 高圧電線

ダルエスサラーム市水道ポンプ所(Nordic)用配電線60km(亘長20km×3本)とHlala~Factory Zone II間の45km(亘長15km×3本)の計105kmの改修に使用される100mm ACSRの緊急度は高いと判断される。

とくに市民生活に欠かせない水道ポンプ所用動力配電線が1年間に31回もトリップを記録しており、老朽線の張替えは1日も早い実施が切望されている。また後者の老朽化も著しく工場生産活動を阻害している。この他に95kmの同種電線が市内の高

圧配電網の改修用として要請されている。

入手した TANESCO 作成の配電網図から City Center 地区と Oysterbay 地区の高圧配電網の亘長を推定すると 17.3 km であるので、電線延長に換算すると 3 倍して 51.9 km となる。残りの要請分 9.5 km はこの両地区のみに限っても、改修対象電線の 1.8 倍相当長であって、目視による配電線の損傷度合からみて、当面、最少限度の緊急修復分を要請したものと判断される。

(a-2). 100 mm<sup>2</sup> A A 種か低圧電線

市内の低圧配電線の現況図は入手できなかつた。ここに低層一戸建てで密集する地区の架空配電線網実施例にインドネシア国のアサハ新都市建設工事がある。この低圧配電線の総延長は 500 m/ha である。これによると Oysterbay 地区 (市街地分 20.5 km<sup>2</sup>) 及び City Center 地区 (7.1 km<sup>2</sup>) の低圧配電線の総延長は 1,380 km (500 m × (20,500 + 7,100)) 前後と類推される。

これに対して TANESCO の要請は総長 36.5 km であるので類推総延長の 2.6 倍程度を必要としていることになる。

なお前述の通り目視調査の結果はこの比率を超える老朽との印象であるので、この電線は全市を対象とするよりも、この両地区内の老朽線の引替え用として使用し、さらにこの地区内の高低圧ヒューズの更新を集中して実施し、その効果が認められる程度の数量と判断される。

(a-3). 各種ヒューズ類

現地写真事例のように、ヒューズ在庫がないため、裸銅線が代用されている。

400 V 用変圧器の一次、二次側の保護ヒューズが常時適正に使用されれば、前述の配電線の改修とによって、需要家側あるいは引込線に起因する故障は局限されて、広く波及することはないものと判断される。

なお、ヒューズは 3.3 KV 放出形、1.1 KV 放出形、400 V 用 (含ホルダー) であって、要請数量は従来 of 消耗実績の 2 年分相当となっている。上記の理由と同国の輸入困難の現状からみて妥当な在庫補給量であろう。

(b) 作業用工具ならびに車輛類

TANESCO の作業班編制を図 11-1 に示した。これは固定したものではなく、作業の種類によって随時編制変えされている。

また、ダルエスサラーム地区の作業車配車計画を表 11-1 に示した。現在需要家から持込まれる停電事故件数は 1 日平均 70 件に達し、現保守体制の 1 班 3 名、4 班 3 交代制では応じ切れないために、機動力の強化が急がれている。

### (b-1). 工具と計器

TANESCO 保守作業員の腰廻り工具は10人に1組程度の保有量であり、安全作業用装具は皆無である。また緊線用工具、電線接続用圧縮器、梯子、ウインチ等の保有数も不足している。このため緊急改修作業の能率は極めて低いものとなる。

TANESCOの要請する工具は現況装備を先進国の標準装備に近づけるための補充工具であるが、活線作業用工具、防具及び安全作業用の感電防止警報器などのハイレベルのものは含まれていない。

要するに緊急対策の趣旨を生かすための配慮としても、電力供給信頼度を維持するためにもこれら工具と計器は常備機材として必要であろう。

### (b-2) 車輛

タンザニアでは現在、車輛の輸入は禁止されている、TANESCO 所有車も老朽車が多く、一番新しい車でも2~3年経過している。

表11-1において要請車輛を一覧表に示したが、この中には先進国では標準とされている建柱車、架線車、バスケット車などは含まれていない。

要するに工具と同じような視点から、この程度の車輛の補充は必要であろう。

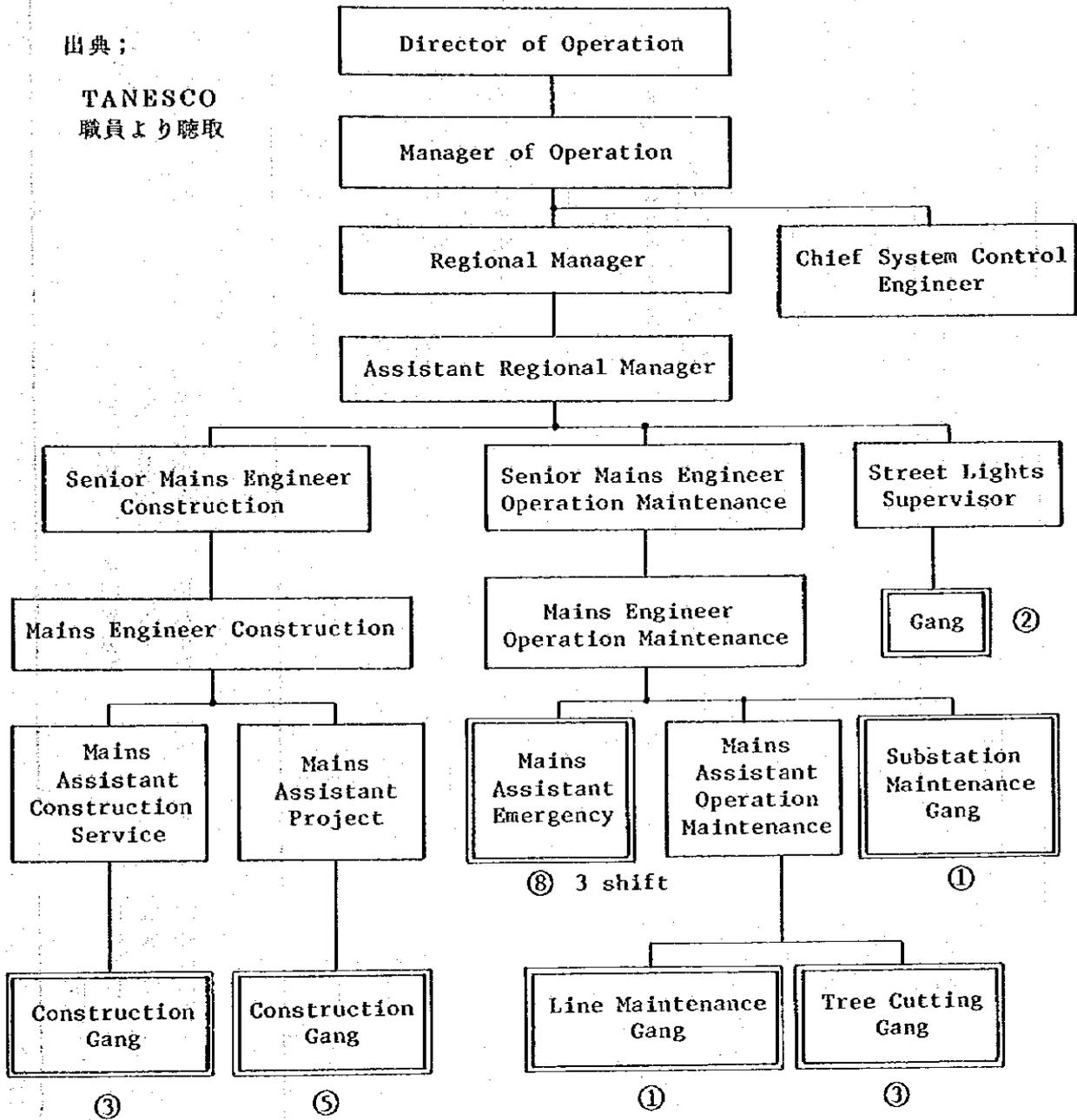
### (2) 緊急対策時における地域の限定

緊急対策の実施に当っては Oysterbay および City Center 変電所の供給範囲に重点をおき実施するようにしたい。これらの地区は前述の通り需要増も多く、事故回数も異常である。TANESCO 要請の緊急供与機材の数量も、いままで検討してきたように、両地域の修復に見合う程度のものである。まず、両地域に重点的に資材を投入してはつきり投資効果が得られるような方向で技術・資金協力を進めるならば、協力の成果に相手国関係者の高い評価が集まるものと期待できる。限定したこのモデル地区の実績を足がかりとして、逐次電力供給、信頼度の向上地区が拡大していくようになれば、技術能力を TANESCO に移転するための教育訓練を含めて、この緊急対策を有意義に実らせたことになるであろう。

図11-1 作業班編成表(ダルエスサラーム地区)

出典:

TANESCO  
職員より聴取



○内の数字は gang 数

作業車配車計画(ダルエスサラム地区)

作業班名	車種				備考
	小型トラック (ピックアップ)	軽トラック (3~5ton)	トラック (5~7ton)	乗用車 (4WD)	
不点事故修理班	3	-	-	-	City Center. Oyster bay masani peninsular 地区の3班に 各1台常備
応急対策作業班		2		1	ダルエス(管)常備 常時補修材料工具を塔載し 待機(昼・夜)
修繕拡充工事班 配電班 変電班	2 1		2	1	ダルエス(管)管内配電線改修および 拡充工事用 全上変電所
合 計	6	2	2	2	12台
備 考 (全車VHF移動電線機塔載)	電工3人乗車 工具, 諸材料 を常時塔載し 待機	全	左 "	作業管理者用 (緊急出勤および 改修工事)	注)

出典: TANESCO職員より聴取。

APP. 1

**DAR ES SALAAM DISTRIBUTION NETWORK**  
**(ダルエスサラーム送配電網の緊急援助要請)**

## TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

### DAR ES SALAAM DISTRIBUTION NETWORK

#### 1. INTRODUCTION

The City of Dar es Salaam is the main Commercial, Industrial and Administrative Centre of Tanzania. It is by far the largest town in the country and its population is reaching one million inhabitants. Dar es Salaam is presently served with electricity from the Coastal Grid system which also serves towns as far afield as Moshi and Arusha.

The approximate area covered by the existing power distribution network is about 180 sq.km. Over 50% of the country's industries are located in this town. By the end of 1982, the 33kV and 11kV distribution lines had expanded to over 660 km. and the MV/LV lines extended beyond 1,000 km. mark. The number of consumers has increased to 70,000 and this represents over 50% of the total number of electricity consumers in the country.

In effect, for the past decade electricity consumption in Dar es Salaam has doubled from about 200,000 kWh in 1971 to 400,000 in 1981 and during the same period, the number of consumers has almost trebled from 27,000 to 66,000. This is a very fast rate of growth which should be matched with an adequate supply of line materials, working equipment, reliable operation and maintenance facilities and effective distribution reinforcement programmes.

This fast rate of growth has been occasioned by the rapid and to some extent un-coordinated industrial and housing developments in the town. Areas which had been completely undeveloped only a few years ago like Msasani, Regent Estate, Kijitonyama etc., are now fully built up with modern houses. Many residences in these areas are now facing frequent power interruptions and low voltage problems due to inadequate power distribution facilities available there.

#### 2. DISTRIBUTION PROBLEMS IN DAR ES SALAAM

Due to a number of problems which will be enumerated below, TANESCO has faced in the recent years, serious, unprecedented difficulties and constraints in operating and maintaining the existing power network at an acceptable standard, let alone the inability to extend such needed service to new consumers. A total of 70 new power extensions projects which have been paid for by prospective industrial and commercial applicants are pending, over 2,000 new applicants who have already paid for their service lines are awaiting connections and more than 5,000 prospective consumers are in the waiting list.

.../..

2.1. Shortage of Line Materials:

There is an acute shortage of line materials since early 1981. It is now becoming extremely difficult to maintain the existing network. Repair and maintenance can hardly be done. There are several cases when emergency repairs could not be undertaken fast enough due to this shortage. We have had incidences when it became necessary to recover a line conductor from uncommissioned line for emergency replacement elsewhere.

2.2. Shortage of Working Equipment:

The network has expanded far beyond the capabilities of the existing working facilities, especially vehicles. In actual fact the number of serviceable vehicles available for emergency today is just about the same as what was available in 1971, when the system was relatively small.

2.3. Shortage of Tools, Protective and Safety Equipment:

There is virtually no suitable working tools in use. Most of those available are old, defective and inefficient. The essential protective and safety gear are not there. Mains personnel are therefore working under extremely hazardous conditions, contrary to the safety regulations.

2.4. Network old age and overloading:

Some of the distribution network in Dar es Salaam is over 20 years old and very much due for up-grading. In other areas the network and service lines are just overloaded as a result of increased power demands. In a number of cases, particularly with the residential houses, new and large electrical appliances like air conditioners have been added without prior notice to TANESCO.

2.5. Insufficient Street Lighting:

The City of Dar es Salaam is badly lit. Most of the main roads and highways are provided with street lights. However, quite a large number of these lights are not working due to the shortage of replacement spares and bulbs. Out of 4,300 street lights existing only about 3,200 are functioning. On the other hand, there are many roads in the city which require lighting but this has not been accomplished due to the acute shortage of street light fittings, gear and spares. The shortage of tools and working equipment has also adversely affected the performance of lighting in the city.

..!..

3. REMEDIAL MEASURES

From the foregoing the DSD distribution is generally in poor condition and some overhead lines and distribution equipment are in a dangerous state. At places they pose real danger to the public. The number of consumers who have registered their claims for damaged equipment due to high voltages is colossal. The average number of consumers queries received per day in Dar es Salaam is about 70 when in the normal circumstances the number would be only about 20 - 30. Due to the shortages, especially reliable vehicles for emergency working teams, it is now taking too long to attend to these queries. In the past all the consumers complaints received in any day would be attended and cleared before mid-night. Now it is not possible, instead about 50 - 60 queries remain unattended and are carried over to the following day. As a result, these days some electricity consumers can remain un-attended for 2 - 3 days.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Emergency Overhaul

To arrest this sad situation it is very important and urgent to procure as a matter of utmost priority limited amount of line material, vehicles, tools and safety equipment so as to undertake emergency repair and maintenance before the system network gets out of control.

The list of limited material, working equipment, vehicles, tools, street lights, protective and safety equipment required to revive the network to an acceptable, bearable condition is attached. Rough cost estimates are shown against the required items. These items are desperately required to save the system from total collapse and restore the good public image TAMESCO used to enjoy in the past. The list of areas which are badly affected by low voltages and frequent interruptions are also attached.

4.2. Comprehensive Rehabilitation

The provision made in the above emergency overhaul will only allow for the system to sustain for a while. It is therefore imperative that the comprehensive rehabilitation study is commenced immediately in parallel with the emergency overhaul exercise. This would entail a full feasibility study before the funds are lined-up.

..!..

#### 4.3. Technical Services and Training

It would be extremely useful and worthwhile to allow for some limited technical service and training in the Emergency Overhaul exercise. This will enable one or two technicians from TANESCO to visit manufacturer's works to familiarise with the materials and equipment to be procured and/or one or two experts to come over and conduct an on-the-job training for the use of the new equipment during the implementation stage.

#### 4.4. Appendixes

Also appended with this report is the map of Dar es Salaam depicting the 33kV distribution system and the major streets which require lighting improvement. The system growth in terms of the number of consumers, electricity consumptions, maximum demands and route lengths, from 1970 - 1982 are also given.

Dar es Salaam

17th October, 1983

(A) LINE MATERIALS

<u>NO.</u>	<u>MATERIAL LIST</u>	<u>REQUIREMENT</u>	<u>T.SHA. x 10<sup>3</sup></u>	<u>AMOUNT</u>
1.	<u>11kV Pilecta/sex copper cable</u>			
	70 mm <sup>2</sup> x 3 core	2 km	7.59	15,000
	300 mm <sup>2</sup> x 1 core	1 km	250	5,000
2.	<u>Heat shrinkable 11kV termination#</u>			
	70 mm <sup>2</sup> x 3 core	400	600	12,000
	185 mm <sup>2</sup> x 3 core	400	600	16,000
	300 mm <sup>2</sup> x 1 core	120	300	6,000
3.	<u>Cable Compound</u>			
	EC 900 or G8	5,000 kg	125	2,500
4.	<u>Copper Cable lugs compression type</u>			
	70 mm <sup>2</sup>	20,000	200	4,000
	300 mm <sup>2</sup>	10,000	250	5,000
5.	<u>M<sup>1</sup> Seal termination kit</u>			
	70 mm <sup>2</sup>	10	75	1,500
	185 mm <sup>2</sup>	20	75	1,500
	300 mm <sup>2</sup>	10	75	1,500
6.	<u>400 Volts PVC Copper Cable</u>			
	16 mm <sup>2</sup> x 4 core	30 km	900	18,000
	70 mm <sup>2</sup> x 4 core	5 km	625	12,500
	300 mm <sup>2</sup> x 1 core	2 km	264	5,280
	185 mm <sup>2</sup> x 4 core	2 km	650	13,000
7.	<u>Overhead line conductors</u>			
	100 mm <sup>2</sup> ACSR	200 km	1,500	30,000
	25 mm <sup>2</sup> AA	60,000 m	150	3,000
	100 mm <sup>2</sup> AA	200 km	1,500	30,000
	25 mm <sup>2</sup> AA PVC	80,000 m	200	4,000
	100 mm <sup>2</sup> AA PVC	25 km	1,875	3,750
8.	<u>11kV Expulsion Fuses</u>			
	3 Amps	500	350	100
	5 Amps	600	90	180
	8 Amps	2,000	500	1,000
	25 Amps	5,000	3,500	7,000
	30 Amps	2,000	1,300	3,600
	40 Amps	2,000	2,300	4,600
	50 Amps	500	750	1,500

....//..

LINE MATERIALS (Contd:-)

<u>NO.</u>	<u>MATERIAL LIST</u>	<u>REQUIREMENT</u>	<u>T. SHS. x 10<sup>3</sup></u>	<u>J. TEN x 10<sup>2</sup></u>
9.	<u>33 KV Expulsion Fuses</u>			
	2 Amps	500	3.7	75
	55 Amps	2,000	30	600
	5 Amps	2,000	50	1,000
	10 Amps	2,000	60	1,200
	20 Amps	1,000	60	1,200
	25 Amps	1,000	75	1,500
10.	11 kv Expulsion Fuse holder	500	375	7,500
11.	33 KV Expulsion Fuse holder	200	170	3,400
12.	PC cut out 400A	2,000	2,500	50,000
13.	Fuse cartridge HRC (JP) 3 1/2 Centre	4,000	120	2,400
	200 Amps	5,000	150	3,000
	300 Amps	5,000	150	3,000
	400 Amps	400	500	10,000
14.	Iron Clad 300A cut outs with neutral link	1,200	1,500	30,000
15.	<u>Insulators</u>			
	11KV Pin/Post insulators with spindle	600	165	3,300
	33KV pin/post insulators with spindle	200	35	700
	11KV disk insulators			
	LV shackle insulators	10,000	200	4,000
	LV Bobin insulators	10,000	300	6,000
16.	Meter seals	100 kg	} 50	1,000
	Meter seal wire	20 rolls		
17.	Guy wire	5 km	17.5	350
18.	33KV Air Break switches	10 sets	5,000	10,000
19.	33 KV 120mm <sup>2</sup> 3 core copper PILESTA Cable terminators	50 sets	125	2,500
20.	Spares & Sundries Items		150	30,000
		<b>TOTAL</b>	<b>19,215</b>	<b>390,235</b>

KENYA ELECTRIC SUPPLY COMPANY LIMITED

(B) WORKING EQUIPMENT-VEHICLES

<u>ITEM</u>	<u>EQUIPMENT DESC</u>	<u>REQUIREMENT</u>	<u>COST T.SHS.</u>	<u>COST YEN</u>
1.	5 to 7 Ton Lorry	4	900,000/=	12,000,000
2.	4 Wheel drive C/W carrier	6	500,000/=	15,000,000
3.	4 Wheel drive-Hissen	2	300,000/=	6,000,000
4.	VHF Radio Telephones	12	300,000/=	6,000,000
5.	Motor-bikes	10	150,000/=	3,000,000
		Total	2,550,000/=	51,000,000

(C) STREET LIGHTS

<u>ITEM</u>	<u>NAME OF STREET</u>	<u>NO. OF LIGHTS</u>	<u>COST T.SHS.</u>	<u>COST YEN</u>
1.	Tourne/Drive	112	112,000/=	2,240,000
2.	Kenyatta Drive	22	22,000/=	440,000
3.	Haile Selassie	80	80,000/=	1,600,000
4.	Chole Road	62	62,000/=	1,240,000
5.	Kivukoni Road	39	39,000/=	780,000
6.	Ocean Road	84	84,000/=	1,680,000
7.	City Drive	31	31,000/=	620,000
8.	Samora Machel Avenue	25	25,000/=	500,000
9.	Upanga Road	92	92,000/=	1,840,000
10.	Morogoro Road	100	100,000/=	2,000,000
11.	Uhuru Street	100	100,000/=	2,000,000
12.	Old Eggenoyo Road	100	100,000/=	2,000,000
13.	New Eggenoyo Road	153	153,000/=	3,060,000
		Total	1,000,000/=	20,000,000
14.	Spare bulbs, Chokes etc.	1 lot:		10,000,000
		Total	1,500,000/=	30,000,000

(D) TOOLS TESTING AND SAFETY EQUIPMENT

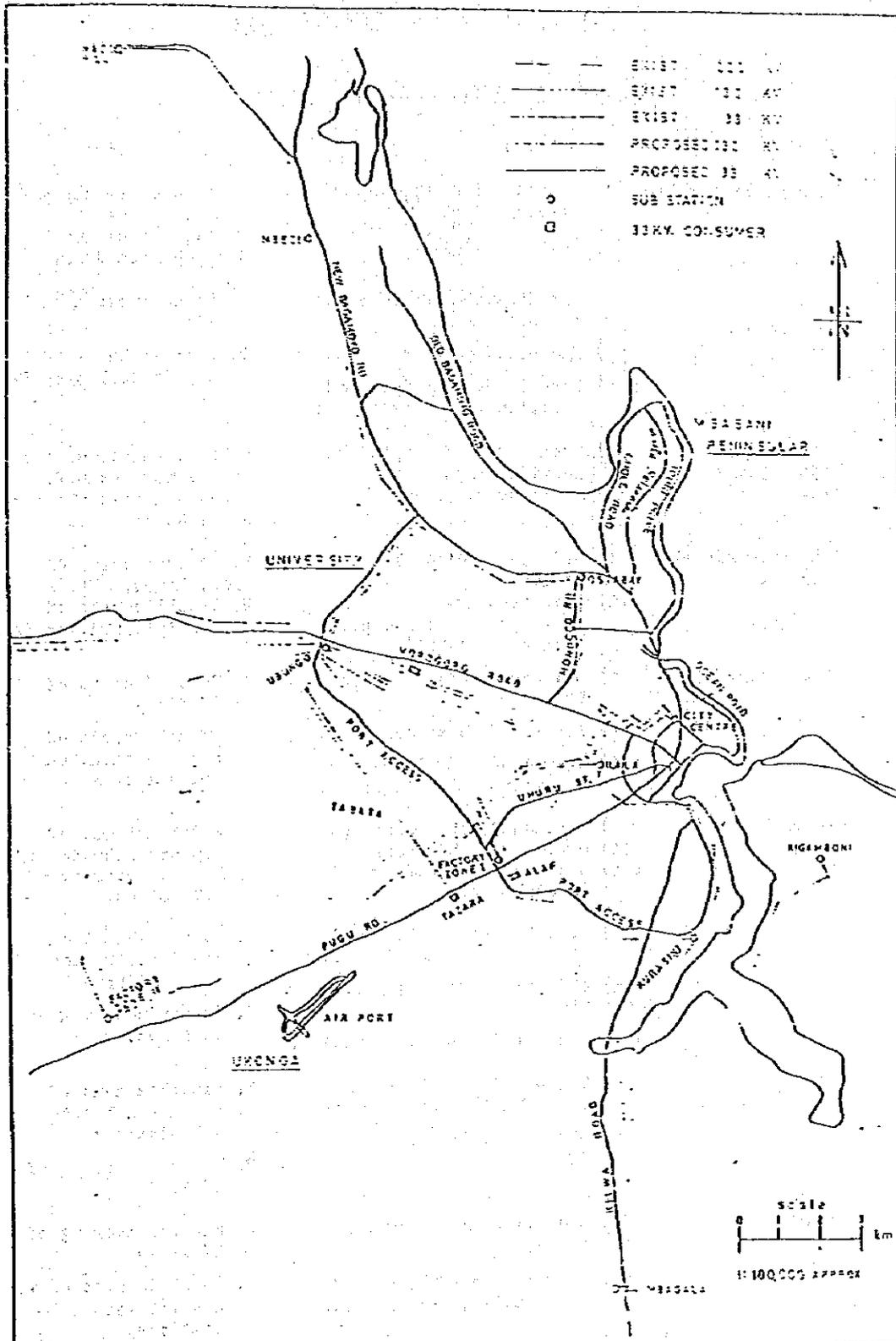
<u>NO.</u>	<u>MATERIAL LIST</u>	<u>REQUIREMENTS</u>	<u>COST T.SRS.</u>	<u>COST (YEN)</u>
1.	Full lift C/W cone a long			
	1½ ton	20	50,000	1,000,000
	3 ton	20	60,000	1,200,000
2.	Draw vice C/W clings and Clamp			
	Medium	30	75,000	1,500,000
	Large	20	60,000	1,200,000
3.	Tripod C/W steel rope			
	3 ton	30	225,000	4,500,000
	5 ton	20	300,000	6,000,000
4.	Compressors C/W kinematic chamber	2	350,000	7,000,000
5.	36 ft. extension ladders	50	300,000	6,000,000
6.	28 ft. extension ladders	80	400,000	8,000,000
7.	Safety gloves	500	100,000	2,000,000
8.	Safety belts	100	50,000	1,000,000
9.	Earthing gears	30	50,000	1,500,000
10.	Extracting rods	30	50,000	1,500,000
11.	Binooculars	10	10,000	200,000
12.	Portable A. meters	10	20,000	400,000
13.	Tong testers	10	25,000	500,000
14.	Voltage chart recorders	10	125,000	2,500,000
15.	Loop impedance tester	5	12,500	250,000
16.	Earth meggers	10	60,000	1,200,000
17.	Phase sequency meters	4	4,000	80,000
18.	Split core C.T.S.			
	75/5	10	10,000	200,000
	100/5	10	10,000	200,000
	200/5	10	15,000	300,000
	300/5	10	15,000	300,000
	400/5	10	15,000	300,000
19.	Phasing equipment 33kV	5	25,000	500,000
20.	Phasing equipment 11kV	5	50,000	1,000,000
21.	Cable fault locator	2	20,000	400,000
22.	First aid mkits	40	20,000	400,000
23.	Heavy duty multimeters	10	15,000	300,000
24.	Tool Box	100	100,000	2,000,000
25.	General Work Tools	1 lot	250,000	5,000,000
26.	Measuring apparatus	1 lot	250,000	5,000,000
27.	Security goods	1 lot	250,000	5,000,000
		<b>TOTAL</b>	<b>3,451,500</b>	<b>69,010,000</b>

(E) TECHNICAL SERVICE & TRAINING

<u>NO:</u>	<u>CONTENT/REQUIREMENTS</u>	<u>CCST</u> <u>T.SHS: x 10<sup>5</sup></u>	<u>CCST</u> <u>J. YEN x 10<sup>3</sup></u>
1	Technical Services 1 loc	500	10,000
1	Training	250	5,000
	Total	<u>750</u>	<u>15,000</u>

SUMMARY OF REQUIREMENTS

	<u>T. SHS:</u>	<u>YEN</u>
(A) LINE MATERIAL	18,915	380,235,000
(B) WORKING & EQUIPMENT-VEHICLES	2,550,000	51,000,000
(C) TOOL & SAFETY EQUIPMENT	3,451,500	69,030,000
(D) STREET LIGHTS	1,500,000	30,000,000
(E) TECHNICAL SERVICE	<u>750,000</u>	<u>15,000,000</u>
TOTAL	<u>27,166,500</u>	<u>545,265,000</u>



	<b>DAR-ES-SALAAM 33KV DISTRIBUTION NET WORK</b>	<b>ORG No.</b> 2726
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TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

Areas Badly Affected By Low Voltage

<u>Area</u>	<u>Cause</u>	<u>Remedy</u>
Msasani Peninsular	i) Over extended un-planned service lines ii) Rapid development	Design, construct and commission new low voltage lines and distribution S/Ss.
Uganja	i) The distribution LT lines are old. ii) Increased power consumption iii) Over loaded LT lines and distribution transformers.	1. Re-conduction of LT lines 2. Establishment of new distribution S/Ss.
Singa/Ubugo/ Kijitonyama/ Tabata	i) Over extended un-planned service lines ii) Rapid development	Design, construct and commission new L.V. lines and distribution sub-stations
Chang'ochu/Teneke Magoneni	i) Old age of distribution LT lines ii) Increased power consumption without prior notice to TANESCO	1. Re-conduction of LT lines. 2. Establishment of new distribution S/Ss.
City Centre/Ilala	i) Old age of distribution LT lines ii) Increased power consumption. iii) Over loaded LT lines and distribution transformers.	1. Re-conduction of LT lines 2. Establishment of new distribution sub-stations
Kinera	i) Increased power consumption ii) Over-loaded LT lines and iii) Distribution lines rapid development.	1. Establishment of new distribution S/Ss. 2. Re-conductoring of L.T. lines.
Mwananyaraha	i) Over-loaded LT lines and distribution transformers. ii) Old age of LT distribution lines. iii) Increased power consumption.	1. Establishment of new distribution sub-stations 2. Re-conductoring of LT lines.
Mtoni	i) Over-loaded LT lines and distribution transformers. ii) Old age of distribution LT lines.	1. Establishment of new distribution sub-stations 2. Re-conductoring of LT lines.
Tandika	i) Old age of distribution lines. ii) Over-loaded LT lines and distribution transformers.	1. Re-conductoring of LT lines. 2. Establishment of new distribution sub-stations.
Kinondoni Shamba	i) Over extended un-planned service lines. ii) Over-loaded LT lines and distribution transformers.	Design, construct and commission new low voltage lines and distribution sub-stations.

DAR ES SALAM SYSTEM GROWTH 1970 - 1981

<u>Year</u>	<u>Consumer's (No)</u>	<u>Units Imported (KWH)</u>	<u>MD (%)</u>	<u>Growth 11 &amp; 33kv Lines (km)</u>
1970	24,059	192,859,137	34.5	653.00
1971	26,746	208,093,014	36.5	654.68
1972	28,949	237,103,315	41.2	632.33
1973	30,905	262,087,437	47.7	516.23
1974	33,694	270,340,746	54.9	530.43
1975	35,784	274,359,364	61.0	542.17
1976	39,531	284,531,092	54.4	582.83
1977	43,305	320,375,807	59.1	617.92
1978	54,317	361,620,819	65.4	628.97
1979	61,947	397,802,827	69.0	642.36
1980	63,585	404,573,745	70.5	652.36
1981	65,399	408,436,745	72.0	659.36
1982	69,703	414,466,191	73.4	663.46

APP. 2

**LINE MATERIALS**  
**(緊急援助用LINE MATERIALSの説明)**

TAUZAMIA ELECTRIC SUPPLY COMPANY LIMITED

LINE MATERIALS

1) <u>Item No. 1: - 11KV Cables</u>	<u>Immediate Use</u>	<u>Emergency Use</u>
70mm <sup>2</sup> x 3 core 1 km for establishing pole mounted Substations - Chole road. (4) Mazengo, Ilala, and Sewa Haji.	90%	10%
300mm <sup>2</sup> x 1 core - 1 km to replace 11KV cables for 2 x 15 MVA 33/11KV transformers at City Centre. Provide alternative feeder Magogoni area Factory zone 1 Substation.	80%	0%
2) <u>Item No. 2:</u>		
Heat shrinkable terminations 70mm <sup>2</sup> x 3 core for pending substations as detailed below: -	60%	40%
185mm <sup>2</sup> x 3 core. Repairing 11KV terminations on 50MVA transformers at Ubungo, Oysterbay Substations. Major consumers who are fed at H.T. e.g. Simba Plastic, Kioo, Alaf, Mbagala Glass Factory, Muhimbili Hospital, Agakhan Hospital, Sewa Haji street, Telephone & Extelecom House etc.	50%	50%
3) <u>Item No. 3: - 11KV Compound.</u>		
To repair all ring mains units along Pugu road. To repair cable boxes on transformers T1, T2 at Ubungo Power Station. To energize certain distribution substations not completed because of compound e.g. Mzarano, NPF, Kisutu, Msasani Peninsula commissioning of third 5MVA 33/11KV transformer at Oysterbay Substation. Second transformer 5MVA at Mbezi Substation.	70%	30%
4) <u>Item No. 4: - Copper Cable rings.</u>		
Required at all the new substations mentioned above. Also to replace the make-shift terminations in City Centre, Ilala, Oysterbay, Msasani areas.	60%	40%
5) <u>Item No. 5: - H - Seal Compound.</u>		
To repair defective terminations.	50%	50%
6) <u>Item No. 6: - 400V Cable.</u>		
16mm <sup>2</sup> x 4 Core Street lights that are not functioning. Additional New street lights. To repair defective Service Lines. New Service Lines that are pending) -	80%	20%
70mm <sup>2</sup> x 4 Core 5 km:		
For taking our circuits (400V) from Distribution Pillars or from P.C. Cut-outs. To replace defective/Fault cables.	70%	30%
7) <u>Item Nos: 7:</u>		
33KV Line from Ubungo City Centres. 11KV linkage between O5 (from Oysterbay Substation) and O2 (City Centre Substation) along Salender Bridge.	80%	20%
100mm <sup>2</sup> ACSR 200km from Dar-es-Salaam Water Supply (60kms) reconductoring of 11KV Lugalo feeder (5km), 33KV line Ilala to F2 (45km). Part of O6(Oysterbay),		

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	<u>Immediate Use</u>	<u>Emergency Use</u>
<p>C8 to Msasani Peninsular. Extension of 11KV to establish new substations in City Centre, Chole road, Msasani, Ilala, Kinondoni areas to improve voltage. Second 11KV feeder to Msasani/Oysterbay area.</p>		
<p>25mm<sup>2</sup> Bare and PVC A/A conductor. Emergency break-downs of service lines. Completion of pending service lines since 1981 - there are more than one thousand.</p>		
	65%	35%
<p><u>100mm<sup>2</sup> A/A Bare and PVC:</u></p>		
<p>To construct additional 400V circuit in City Centre: - Mzaramo, Mfaume road, Alykhan road, Temple road, Ilala, Magoeni, Msasani, Mmenge, Sinza areas to improve voltage.</p>		
<p>Power supply to Lugalo A, Shariff Shamba substation, Mahando Substation. To improve voltage in Mwananyamala near Roman Catholic Church, Saba-Saba Substation, Pugu road etc. To replace aged conductors in part of the above areas, Kaluta street.</p>		
8) <u>Item No. 8: - 11KV Fuses.</u>		
<p>To replace all the existing fuses with the correct ones of the right ratings. For new substations as above.</p>		
	60%	40%
9) <u>Item No. 9:- 33KV fuses:</u>		
<p>As above to replace the existing ones with the correct types.</p>		
	60%	40%
10) <u>Item No. 10 and 11: - Fuse Holders</u>		
<p>Because of using wrong types (rating) of fuses, a lot of holders are damaged and new replacements are required.</p>		
	70%	30%
11) <u>400 Volts/400A PC Cut-outs:</u>		
<p>To replace the defective and broken ones in City Centre, Hindu street, Ilala, Kurasini, Magoeni, Msasani, Oysterbay areas. For new distribution Substations.</p>		
	80%	20%
12) <u>Item No. 13: - 400V HRC Fuses:</u>		
<p>Replacement with correct ratings of fuses on all existing substations and 400V circuits in areas as mentioned above.</p>		
<p>(Average annual consumption of fuses in D'Salaam is 12,000 units).</p>		
	70%	30%
13) <u>Item No. 14: - Iron clad cut-outs:</u>		
<p>Required for new substations, new L.T. Circuits, and major electricity consumers who have yet to be connected.</p>		
	60%	40%
14) <u>Item No. 15: - Insulators</u>		
<p>For all the projects and new consumers as detailed in item No. 7.</p>		
	80%	20%

...../3....

	<u>Immediate Use</u>	<u>Emergency Use</u>
15) <u>Item No. 16:</u> Most of the energy meters and cut-outs at Consumers premises in Dar-es-Salaam have no seals and as such these are required urgently to prevent tampering of these items.	75%	25%
16) <u>Item No. 17: Guy (Stay) wires</u> We have no guy wire in stock and as such, a lot of it will be used on all pending projects, extension of high tension lines for new substations and replacing stay poles with stay wires.	60%	40%
17) <u>Item No. 18: - 33KV ABS with Earth Switches.</u> Replacement required on Nordic feeder, Oysterbay : and Mbezi Substation for new transformers, Factory Zone 1 Substation, Kurasini line at Ilala, City Centre 2nd feeder.	50%	50%
18) <u>Item No. 19: - 33KV PLICSTA Cable terminations.</u> Undergrounding of power supply to Alaf; feeder termination crossing points on Fugu road of Alaf and Kurasini 33KV feeders crossing points of Tazara, and Factory Zone 1 and Alaf lines on Fugu and Port Access roads.  Recommissioning of 33KV cable from Ilala Substation for Kurasini 33KV Line.	40%	60%

APP. 3

**VEHICLE REQUIREMENTS FOR DAR ES SALAM EMERGENCY MAINTENANCE**  
**(ダルエスサラム緊急補修作業必要車両)**

TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

VEHICLE REQUIREMENTS FOR DAR ES SALAAM  
EMERGENCY MAINTENANCE

In recent years, Dar es Salaam Distribution Network has expanded at a rapid rate and the areas of the services covered has also more than doubled; while we are not able to match our services to this growth due to lack of materials and adequate transports. Therefore, we were unable to carry out regular routine maintenance thus resulting in frequent breakdowns of the line due to old age and corrosion of the same.

For the attendance of emergency breakdowns, we have three shifts of three (3) gangs per shift and three 4-wheel drive vehicles. We receive about seventy (70) reports of temporary breakdowns per day and on an average day, we can attend 30 such breakdowns provided all the vehicles are in road worthy condition. Moreover, these vehicles are more than three years old and are on the road all the time - so breakdowns of them are frequent - thus further aggravating the situation.

Because of all these problems, the attendance of emergency breakdowns is planned on zonal basis in order to minimise the breakdown times and the additional vehicle requirements will be as follows:-

- (a) 3 Pick-ups with VHF radio telephones for emergency gangs to be stationed at City Centre (1) and (2) in Msasani Peninsular/Oysterbay areas. These gangs will attend to minor repairs.
- (b) 2-5 - 7 ton trucks with VHF radio telephones to attend major breakdowns.
- (c) One 4 - wheel drive vehicle with VHF radio telephone for the Supervisor for the emergency works.

During this emergency, Dar es Salaam rehabilitation programme, a lot of maintenance works will be required specially in replacing old conductors on both H.T. and L.T. lines and establishing of new distribution sub-stations. In order to accomplish this, we will require:-

- (a) Two - 5 - 7 ton trucks with VHF radio telephones for construction of H.T. and L.T. lines.
- (b) Two Pick-ups with VHF radio telephones for the above works.
- (c) One pick-up for the sub-station gang for balancing loads etc.
- (d) One 4 wheel drive vehicle with VHF radio telephones for the maintenance Supervisor.

*Jays*  
*27/2/54*





JICA