

*The First*  
**ANNUAL REPORT**  
*of the*  
**CENTRAL ELECTRICITY  
BOARD**

FEDERATION OF MALAYA

*1st September, 1949, to 31st August, 1950*

# THE FIRST ANNUAL REPORT OF THE CENTRAL ELECTRICITY BOARD FEDERATION OF MALAYA

*1st September, 1949, to 31st August, 1950*

ACTION WILL BE TAKEN AGAINST ANY  
STAFF WHO DUTY WHOLOS, MAKES  
NOTES IN THE BOOKS OR DISFIGURES  
OR DAMAGES BOOKS IN ANY WAY.

IKATAN RESOURCE CENTRE  
TENAGA NASIONAL BERHAD  
JALAN SERDANG  
430.9 SERDANG  
SELANGOR DARUL EHSAN ✓

KUALA LUMPUR :  
PRINTED AT THE GOVERNMENT PRESS BY G. A. SMITH,  
ACTING GOVERNMENT PRINTER.

## THE BOARD

---

Chairman ... ..	HONOURABLE MR. W. D. GODSALL, M.A., C.M.G., M.C.S.
Deputy Chairman ... ..	MR. F. P. EGERTON, M.I.E.E. HONOURABLE MR. J. O. SANDERS, C.M.G., M.Inst.T., A.M.I.C.E. HONOURABLE DATO HAMZAH BIN ABDULLAH. MR. E. D. SHEARN. MR. CHONG YOW SHIN. MR. F. S. MCFADZEAN, M.A., LL.B.

The following also served as temporary members for various periods during the year:

Temporary Chairman ...	HONOURABLE MR. W. C. TAYLOR, M.C.S.
Temporary Deputy Chairman	MR. J. SHARPLES, B.SC., A.M.I.E.E. MR. J. M. BELL, B.A. (Cantab). MR. G. E. MOTT.

### *Principal Officers of the Board—*

Deputy Chairman ... ..	MR. F. P. EGERTON, M.I.E.E.
Chief Engineer ... ..	MR. J. SHARPLES, B.SC., A.M.I.E.E.
Secretary and Chief Accountant ... ..	MR. K. REED, A.C.A.
Chief Construction Engineer	MR. C. H. WHITE, M.I.E.E., Mem.A.I.E.E., M.I.E.Aust.
Chief Electrical Inspector ...	MR. J. H. SUMNER, M.SC., A.M.I.E.E.
Superintending Engineers ...	MR. J. V. KEENE, ASSOC.A.I.E.E. MR. J. K. KEENE, A.M.I.E.E. MR. F. BRAND, A.M.I.E.E.
Generation Superintendent	MR. A. GERARD, A.M.I.Mech.E.

# INDEX

---

CHAPTER	PAGE.
I.—Introduction ... ..	1
II.—Operational Reports, 1949/50 ... ..	5
III.—Finance and Accounts ... ..	21
IV.—Long-term Policy ... ..	27

# APPENDICES

---

APPENDIX.	SUBJECT.	PAGE.
I.—C.E.B. Staff Organisation ... ..		31
II & IIA.—List of C.E.B. and other Undertakings ... ..		33
III.—Units Generated and Sold, 1949/50 ... ..		37
IV.—Consumers Statistics ... ..		39
V.—Outputs of C.E.B. Power Stations ... ..		40
VI.—Typical Load Curves of C.E.B. Stations ... ..		41
VII.—Ulu Langat Hydro-Electric Station Operation ... ..		42
VIII.—C.E.B. Sub-stations ... ..		43
IX.—C.E.B. Transmission and Distribution Systems ... ..		43
X.—Apparatus on hire ... ..		43
XI.—Units Generated, Sold, etc., 1926-1950 ... ..		44
XII &		
XIIA.—Analyses of Units Generated and Used Federation of Malaya ... ..		45
XIIB.—Growth of Total Units Generated in the Federation, 1925-1950, by all Public and Private Generating Stations ... ..		46
XIII.—Balance Sheet at 31st August, 1950 ... ..		47
XIV.—Revenue Account for year 1949/50 ... ..		51
XV.—Report of the Auditors ... ..		53
XVI.—Analysis of Revenue and Expenditure ... ..		54
XVII.—C.E.B. Tariffs ... ..		55
XVIII &		
XVIII A.—Maps ... ..		57



## ABBREVIATIONS

---

MW = Megawatt (1,000 Kilowatts).

KW = Kilowatt (1,000 watts).

HP = Horsepower (746 watts).

KWh = Kilowatt-hour (1 Board of Trade Unit).

KV = Kilovolt (1,000 volts).

KVA = Kilovolt-ampere.

U/G = Underground.

O/H = Overhead.

A.C. = Alternating Current.

D.C. = Direct Current.

T.R.S. = Tough Rubber Sheathed Cable.

V.I.R. = Vulcanised India Rubber.

H.S.O.S. = House Service Overhead System.

P.B.J. = Paper Braided Jute Insulated.

C.E.B. = Central Electricity Board.

P.R.H.E.P.Co. = Perak River Hydro-Electric Power Co., Ltd

R.H.T.Co. = Rahman Hydraulic Tin Co.

E.M. & M.Co.Ltd. = Eastern Mining and Metal Co., Ltd

T.C. = Transformer Capacity.

B.S. = Bulk Supply.

P.S. = Power Station.

O.E. = Oil Engine.

S.T. = Steam Turbine.

H.E. = Hydro-Electric.

## CHAPTER I.

### INTRODUCTION.

#### Historical.

As this is the first Annual Report of the Central Electricity Board, Federation of Malaya, it is of interest to give here a brief history of public electricity supply in the Federation.

The first public supply of electricity in the territory now comprising the Federation of Malaya commenced operation in Penang in 1904, and this was followed shortly afterwards by the installation in Kuala Lumpur in 1905 of a supply of electricity, primarily intended for supplying Government quarters and a limited number of arc lamps for street lighting. Electricity was generated in a small hydro-electric power station sited on the Gombak River, 12 miles from Kuala Lumpur. The plant consisted of two 400 K.W. turbo-alternators. About 1919 this supply was augmented by the installation of a station at Gombak Lane in the centre of Kuala Lumpur, with mixed generating plant totalling 1,450 K.W. By 1926, Prai Power Station on the mainland facing Penang, had just been put into commission with an installed capacity of 9,500 K.W., and a steam power station at Bungsar, Kuala Lumpur, was under construction. In the meantime, public electricity supplies had been inaugurated in Ipoh, Johore Bahru, Seremban and Malacca, the latter two supplies being operated by private companies. The Seremban installation was purchased by Government on 1st January, 1924.

Up to this time, the Government Electricity Department had been a sub-department of the Public Works Department, but on the 1st January, 1927, it became an independent Federal Department, controlling supplies of electricity in the former Federated Malay States. In Johore, electricity supplies were under the control of the State Public Works Department, until a rather later date, when a State Electricity Department was formed, which in addition to increasing plant capacity in Johore Bahru, also constructed stations at Muar, Batu Pahat, Kluang, Kota Tinggi and Segamat.

In 1928 and 1929, the Perak River Hydro-Electric Power Company's steam and hydro-electric stations at Malim Nawar and Chenderoh respectively were put into commission and from that time onwards supply was given from the Company's system to most towns and villages in Perak, South of the Perak River, and the Government generating station at Ipoh was shut down, and a bulk supply was taken from the Company's system.

In North Perak, Government erected a power station at Taiping, and in Province Wellesley, Messrs. Huttenbachs Limited purchased current in bulk from the Penang Municipality and distributed it to many small towns in the area. In Kedah that Company also installed a few diesel generating stations.

Electricity supply on the Eastern side of the country commenced about 1928 with the installation of generating plant at Raub and Kota Bahru, the former under the Federated Malay States Electricity Department and the latter under the Kelantan Government. Subsequently, generating plant was installed at Kuala Lipis (1929), Bentong (1929), Kuantan (1931), Mentakab (1938) and Fraser's Hill (1939).

At the outbreak of the second world war, the total generating plant in the country amounted to approximately 140,000 K.W. (including standby plant), and the total units generated in 1940 was 650 million.

As a result of denial of plant to the enemy and neglect during the Japanese occupation, 60 per cent. of the pre-war plant capacity was rendered unusable. At the same time, there had been a general drift of population towards the towns and on the liberation of Malaya in 1945, the Government was faced with a greatly increased demand for electricity and a very considerably reduced plant capacity to meet this demand. This unfortunate state of affairs has persisted since 1945, owing to the extremely slow delivery of equipment from the United Kingdom, although towards the end of 1948 and during 1949, some improvement was obtained.

With the formation of the Malayan Union in April, 1946, Government took over control of all electrical installations in the country with the exception of those operated by private companies and that of the Penang Municipality. It also operated the Malacca Electric Light Company's plant on a rental basis and in July, 1948, this latter plant was purchased outright and the installation became one operated by the Federation Electricity Department.

Shortly before the second world war it was realised that the proper development of electricity in the country necessitated the inter-connecting of the large electricity undertakings and the economic development of hydro-electric power in locations at present removed from immediate load centres. The need for such policy was accentuated by events since the outbreak of the war and the stage was reached where inefficient plant should be discarded and the amount of standby generating plant greatly reduced. In order to control such development it became apparent that a central body was necessary to construct and operate an integrated electricity scheme. It was therefore decided to follow the principle generally established throughout the world that the business of generating and distributing electricity was one which should be in the hands of a public corporation, and as a result the formation of the Central Electricity Board was approved by the Federal Government in



August, 1949, and came into being on the 1st September, 1949, taking over all the undertakings formerly operated by the Electricity Department and so bringing to an end the activities of that Department after a period of 22 years, eight months.

### **Establishment, Constitution and Function of the Central Electricity Board.**

The Electricity Ordinance No. 30 of 1949, provided for the establishment of the Central Electricity Board on 1st September, 1949.

The members of the Board are appointed by the High Commissioner in Council and comprise a Chairman, a Deputy Chairman and five other members, at least three of whom shall not be public officers. In the first instance the High Commissioner in Council appointed as Chairman, the Financial Secretary of the Government of the Federation of Malaya, and as Deputy Chairman, the former Director of Electricity, who became the Board's Chief Executive Officer. The names of these gentlemen and others who have served on the Board during the year 1949/50 will be found on the title page of this Report.

The functions and duties of the Board are set out in Section 15 of the Electricity Ordinance and are :

- (a) to manage and work the electrical installations transferred to the Board by the Ordinance and such other installations and apparatus as may be acquired by the Board under the provision of the Ordinance;
- (b) to establish, manage and work such electrical installations as the Board may deem it expedient to establish;
- (c) to promote and encourage the generation of energy with a view to the economic development of the Federation;
- (d) to secure a supply of energy at reasonable prices;
- (e) to make regulations in accordance with provisions of the Ordinance governing the generation, transmission, distribution and use of energy;
- (f) to advise the High Commissioner on all matters relating to the generation, transmission and distribution and use of energy.

The Board is empowered to grant licences to persons to operate electrical installations for the supply of electrical energy for private or public purposes, and is required to set out in such licences the period of duration of the licences, the area of supply, the declared voltage and the variation permitted therefrom, the maximum charges payable by consumers, and such other matters as the Board may consider desirable. Special provision, however, was made in the Ordinance enabling the Municipal Commissioners of George Town, Penang, to continue to operate their undertaking.

Many licences have been granted for supplies of various types in the Federation, but the principal holders of licences for public supplies are: the Perak River-Hydro Electric Power Co., Ltd., the Kinta Electrical Distribution Co., Ltd., and Messrs. Huttenbachs, Ltd.

### **The Assets of the Central Electricity Board.**

Financial details of the assets of the Board will be found in Chapter III entitled "Finance and Accounts". It may be stated here in brief that under the Electricity Ordinance all public electricity undertakings hitherto owned by the Federation Government, including all plant, land, works, and other property, moveable or immoveable, were transferred to and became vested in the Board on 1st September, 1949.

### **Organisation.**

The Board's organisation is illustrated in diagrammatic form in Appendix I.

The Headquarters of the Board are situated in Kuala Lumpur, from which point administrative control is exercised over the four Regions, into which the country has been divided.

Northern Region comprises the States of Perak, Kedah, Perlis and Province Wellesley, plus Cameron Highlands in Pahang, and less the town of Tanjong Malim in Perak. Eastern Region comprises the States of Kelantan, Trengganu and Pahang, plus the town of Tanjong Malim in Perak and Kuala Kubu in Selangor. Central Region comprises the State of Selangor, less the town of Kuala Kubu. Southern Region comprises the States of Negri Sembilan and Johore and the Settlement of Malacca. The Headquarters of these Regions are situated respectively at Ipoh, Kuala Lumpur (temporarily), Kuala Lumpur and Malacca.

Each Region is under the control of a Superintending Electrical Engineer who himself is directly responsible to the Chief Engineer, Central Electricity Board at Headquarters. Each Region is divided into Districts which are under the control of Electrical Engineers.

The Headquarters organisation is sub-divided into Sections comprising Operation, Planning and Construction, Secretarial, Finance and Stores. A separate section under the Generation Superintendent is in control of the construction of the Connaught Bridge Power Station and is responsible directly to the Deputy Chairman.

### **Power Stations and Undertakings owned by the Board.**

Full details of the Board's Undertakings will be found in Appendix II.

The Board owns 34 Power Stations, totalling 39.88 MW. Of these, one is a steam power station (26.5 MW) one is a hydro-electric power station (2.28 MW) and the remainder diesel power stations (11.1 MW). Bulk supplies of electricity are purchased from other undertakings at eight stations totalling 9.52 MVA. In addition, the Board has one steam power station under construction at Connaught Bridge, the first stage of which will be 40 MW and the second stage probably a further 40 MW.

#### **Staff.**

The Electricity Ordinance provides that every officer on the pensionable and non-pensionable establishment of the Electricity Department of the Federation Government shall upon the commencement of the Ordinance be deemed to be transferred from the services of the Government to the services of the Board for the period specified in the Ordinance. The Ordinance further provides that every such officer shall be so employed by the Board that his remuneration and conditions of service are not less favourable than those which were attached to the appointment of the Federation Government when held by such officer at the commencement of the Ordinance or that would have become attached to such appointment, during such period as the officer served had such officer continued in the service of the Government. Any person not accepting permanent employment under the provision of the Ordinance would be deemed to have retired from the service of the Government in consequence of the abolition of his office. Daily-paid employees were similarly deemed to be transferred to the Service of the Board and the Board was required to continue the same rates of pay and the same conditions of service as those on which they were employed by the Electricity Department.

## **CHAPTER II.**

### **OPERATIONAL REPORTS FOR THE YEAR 1949/50.**

This chapter will deal solely with the activities of the Central Electricity Board. No attempt will be made to describe the activities of licensed undertakings, but analyses of the generation and usage of electricity in the Federation as a whole will be found in Appendices XII and XIII.

#### **General.**

As the Central Electricity Board took over a going concern from the Government Electricity Department there was no sudden change in the general policy which had been pursued by that Department. All commitments entered into by the Electricity Department were taken over by the Board as were all orders placed for equipment with the Crown Agents for the Colonies. Arrangements were completed with the Crown Agents for the Colonies whereby they became the Board's official purchasing agents in the United Kingdom.



Delayed deliveries of plant and equipment ordered as far back as 1945 continued to impede the development of electricity supplies throughout most of the Federation. In practically every town potential load exceeded the total capacity of plant available and the restriction of industrial load during the evening peak hours from 6.30 p.m. to 10.30 p.m. was the rule rather than the exception. It is a tribute to the Board's engineers that they were able to keep their stations running in spite of the lack of standby plant so successfully that there was no need for load shedding as a result of breakdowns of plant, except in one or two isolated instances.

Communist bandit activity resulted in damage to the Board's transmission lines on several occasions. Such damage was however speedily repaired and interruptions of supply were confined to a minimum. Kuala Kubu diesel power station was fired on on several occasions but the attackers were driven off by the Special Constable guards and the officer-in-charge was able to report "no casualties on our side".

Details of the Board's programme of new construction will be found under the Section of this Chapter bearing that heading. It is already known that the full output of the first half of the Board's new power station at Connaught Bridge could be taken up immediately by large industrial consumers, but a proportion of this power will be reserved for the benefit of domestic consumers, who are shewing an ever increasing desire to make use of the innumerable types of electrical appliance now available to make life more pleasant and easy. The full output of this new station will be absorbed in the area lying between the North Selangor boundary and Malacca Town. In other towns and villages additional supplies of energy will be made available as soon as further diesel generating plant can be obtained.

The Board acts as Government's agent in maintaining all Government electrical installations and supervising the contracts for wiring and re-wiring of Government buildings. A great deal of work has arisen as a result of the State of Emergency and the Board has carried out much work in Detention Camps, new Police stations, Military Cantonments and other installations.

Investigation into the Board's proposed Cameron Highlands Hydro-Electric Scheme (100 MW) has had to be curtailed to a very considerable extent as a result of the activities of Communist bandits in that area. It is with deep regret that the death is recorded of Mr. B. Gates, the Board's Hydro-Electric Engineer, who was killed on the 2nd March, 1950, as a result of bandit activity at Cameron Highlands. At the same time, a tribute must be paid to all the Board's Engineers, Technical Assistants, and other staff who have gone about their duties during the past year, in spite of the dangerous conditions prevailing outside the larger towns.

## Inspection.

The Board, under the terms of the Electricity Ordinance, carries out on behalf of the Federal Government certain specified duties previously carried out by Government Electrical Inspectors. The Board is specifically empowered to appoint Electrical Inspectors and a Chief Electrical Inspector, and subject, to the approval of the High Commissioner in Council, to make regulations concerning the construction and operation of electrical installations. In addition to the drafting of Regulations the duties of the Chief Inspector are, briefly, the registration and inspection of certain classes of installations, the issue of licences for public and private electricity supplies, the holding of examinations for certificates of competency as Electrical Engineers, Chargemen and Wiremen, the investigation of electrical accidents and the holding of enquiries into the circumstances of such accidents, together with a number of other duties of less importance. The cost of carrying out the specified duties is paid by the Board in the first instance and subsequently recovered from the Federal Government.

The Board appointed a Chief Inspector but continued shortage of qualified and experienced engineering staff prevented the appointment of any full time Inspectors thus resulting in the slowing down of all sections of the work and virtual closing down of some sections. Recruitment is particularly difficult in that a new recruit from the United Kingdom cannot be of much value in this type of work until he has gained a reasonable knowledge of the country and the Malay language. The time required to gain this necessary background varies with the individual but it is unlikely to be less than twelve months. The position is expected to improve in the forthcoming year with the appointment of full time Inspectors.

The demand for electricity for general lighting and domestic use continued to be noticeably stronger than in pre-war years. Applications for licences to operate public supplies were received for some twenty small villages and after investigation and consideration, the Board by the end of the year had approved the granting of short-term licences for oil engine generating supplies for the villages of Kulai, Senggarang, Bagan Datoh, Tanjong Piandang, Kulai Kurau and Sabak Bernam. The applicant failed to take up the licence for Sabak Bernam and at the year end the supply to this town was again under review by the Board. Approval was also granted to an existing undertaking to give a bulk supply to the village of Permatang Sin Tok.

For the first time since the end of the war the collection of statistics of units generated and used for various purposes throughout the Federation was recommenced, and the results are summarized in Appendices XII and XIIIa.

With reference to Column (2) of Appendix XII a number of private generating installations are known to be operating in estates and small factories without being recorded or sending in returns of units. Most of these installations are of small output (less than 100 KW) and the total is not sufficient to affect the substantial accuracy of the figure of 600 million total units generated. This figure is based on returns from eleven large private mining installations and the five major Public Supply Undertakings, namely, the Central Electricity Board, Perak River Hydro-Electric Power Co. Ltd., Kinta Electrical Distribution Co. Ltd., Huttenbachs, Ltd., and Penang Municipality. Reference to the graph at Appendix XII B shows that the present figure of 600 million is still well below the figure achieved in 1940, and a considerable increase will occur in the near future as soon as new generating plant now under construction is put into commission.

Appendix XII A, the analysis of units used, provides some interesting figures. For instance, out of the 549 million total units used 79 per cent. were supplied by Public Supply Undertakings while out of the total of 432 millions supplied by Public Undertakings 72 per cent. were supplied to tin mines and dredges. Considering the whole Federation, and units supplied from both Public and Private installations, only 12 per cent. of the total is used for Lighting and Domestic Power, and 9 per cent. for small industry and commercial use, the remainder being made up of 75 per cent. for tin mining and dredging, and 4 per cent. for iron, gold and coal mining. The close relation between the mining industry and electricity supply is obvious and needs no emphasis. A broadening of the basis of industry in the country, in accordance with the Government's avowed intentions would improve the situation.

During the year fourteen non-fatal and eleven fatal accidents in which 14 persons were killed and 15 persons were injured were reported and investigated. The persons killed or injured are classified below :

		Killed.		Minor injuries.		Total killed					
		Males.	Females.	Males.	Females.	and injured.					
Europeans	...	—	—	...	1	1	...	2			
Indians	...	1	—	...	6	1	...	8			
Chinese	...	5	1	...	4	—	...	10			
Malays	...	7	—	...	2	—	...	9			
Totals		...	13	...	1	...	13	...	2	...	29

Of the eleven fatal accidents one was a case of deliberate suicide and one involved a fall from a ladder against a low tension pole with no evidence of electric shock. The worst accident was caused by the



erection of a steel pipe lifting tripod directly underneath a 3300 volt service line on a Licencee's installation. The top of the tripod touched the outer conductor of the line and resulted in the death of three Malays and serious injury to a Malay and two Chinese. The fatal accidents can be further analysed, between the different types of apparatus involved, as follows:

Apparatus involved.	Number of fatal accidents.
Low Tension Overhead Lines ... ..	3
Motors and Industrial Wiring ... ..	3
Domestic Wiring and Apparatus ... ..	2
Sub-stations and Switchgear ... ..	2
High Tension Overhead Lines ... ..	1
Total ...	11

The total of all accidents reported, fatal and non-fatal is 26, a figure which is not considered to be unduly high for a population of 5 million with 600 million gross units generated.

A noticeable feature of the accident records in recent years is the relatively high percentage of fatal accidents associated with low tension apparatus. While an obvious reason for this feature is the relatively greater exposure of the population to low tension apparatus as compared with high tension apparatus, examination of the records shews that inefficient earthing of metalwork is a common cause of such accidents. Although Malaya is a country with a high average rainfall, the ground in many places is either laterite or alluvial sand and gravel, both of which have a high resistivity even when appreciably damp. Earth pipes of six to eight feet length vary between about 10 and 400 ohms resistance and it is rarely that less than 30 or 40 ohms is obtainable with a single pipe. Moreover ground which has been newly cleared is subject afterwards to considerable changes near the surface due to the effect of the sun's heat, the torrential rains, and possible changes in the level of the original water table, all of which tends to make the resistance of an earth pipe a somewhat uncertain quantity. Connection to an incoming water service pipe can usually be relied upon to bring the earth resistance down to between 0.5 and 5 ohms depending upon the length of water pipe, depth of burying, and type of ground. It cannot be too strongly emphasised that in the vast majority of places in Malaya effective earthing *cannot* be obtained by driving a single six or eight-foot earth pipe. Moreover apparatus which is ineffectively earthed is likely to be more dangerous than if it had been left unearthed, since when leakage does occur not only does the framework of such apparatus become

alive, but the danger is spread over the whole of the earth connections to the earth electrode. Proper installation, testing, and maintenance of earthing systems is therefore of the utmost importance if safety is to be ensured.

Whenever an accident occurs in Malaya there are also other factors peculiar to the country which operate to increase the probability of the resulting shock proving fatal. These are—

- (a) the high humidity in Malaya resulting in damp skin and low body resistance (death has occurred from a shock received from a 70 volt A.C. transformer welding set)
- and (b) the relative ignorance of electricity of many of the local population which often leads to panic, or delay in removing the victim from contact with live apparatus, and failure to apply proper treatment subsequently.

Of these causes (a) is inherent in the Malayan climate and (b) can only be improved by long-term educational plans.

As already mentioned severe shortage of staff limited the amount of work which it was possible to carry out, and the holding of examinations for Certificates of Competency was a section of the work which suffered heavily on this account. The situation has undoubtedly caused some inconvenience to the electrical staff of commercial and mining installations and it is hoped that the appointment of an additional Inspector during the forthcoming year will enable regular examinations to be held again. Examinations held during the current year were as follows:

	Pass.	Fail.	Total examined.
First Grade Electrical Engineers ...	3	3	6
Second Grade Electrical Engineers ...	11	1	12
Third Grade Electrical Engineers ...	—	2	2
First Grade Chargemen ... ..	16	3	19
Second Grade Chargemen ... ..	26	—	26
Wiremen ... ..	23	11	34
Alteration of Restrictions ... ..	2	—	2
	<hr/> 81	<hr/> 20	<hr/> 101

In addition, four Certificates were issued to qualified and experienced Engineers without examination.

### **New Construction (Connaught Bridge Power Station).**

Immediately after the war consideration was given to several sites for the construction of a new thermal power station having an ultimate output of 80 M.W., and the one finally selected was on the Klang River, a few miles upstream from the town of Klang (23 miles west of Kuala Lumpur), at a point where the tidal rise and fall is approximately 12 feet. The river provides adequate circulating water for the cooling system. The Malayan Railway's Kuala Lumpur, Klang and Port Swettenham branch line, passes along the boundary of the site, and the site itself is only seven miles from the Federation's second largest port of Port Swettenham. Fuel supplies may therefore be brought, in the case of coal, by rail from the Malayan Collieries coal fields at Batu Arang, or, in the case of fuel oil, be pumped direct from ocean going tankers lying alongside the wharf at Port Swettenham.

Only the first half of the station (40 M.W.), is being proceeded with at present, and the building which is of steel frame with brick panel design, will house two Parsons turbine alternator units of 20,000 K.W. each, and four Babcocks and Wilcox boilers of 120,000 lbs. of steam/hour at 825°F and 425 lbs./sq. in. pressure. The alternators will generate at 11,000 volts and be connected solidly to transformers in an outdoor sub-station stepping up to 66,000 volts. All switchgear other than that for the station auxiliaries (3.3 KV and 0.4 KV) is to be situated outdoors and remotely operated from the Station Control Room. The Station House Set is a diesel-alternator of 1,000 KW capacity generating at 3.3 KV.

The year has shewn considerable advancement in the construction, and during the year the piled foundations were completed and a start made on the erection of the building steelwork involving 2,300 tons of steel. Erection of this steelwork was completed towards the end of the year.

Cladding of the steelwork with bricks, the laying of concrete floors and roofs was commenced in July, and good progress was made on the turbine room end of the main Power Station building. Efforts were made to complete the workshop building to provide machine tool facilities for Plant Contractors.

Other civil works commenced included the Circulating or Cooling Water System. This calls for the construction of a pump-house in mid-river, an outlet valve house, and the laying of four 40" diameter pipe lines 1,000 feet long, capable of handling 25,000 gallons/min. each. Steady progress was maintained in laying the pipework, mostly in swamp land necessitating piling and approximately 50 per cent. was completed. A start was made on the sheet steel cofferdam for the pump-house.

Boiler materials began to arrive in March, and erection commenced in July. By the end of the year the sub-structure and framing for Boilers 1, 2 and 3 were well under way.



During the year, a suitable site for the Oil Fuel transfer tank installation was acquired at Port Swettenham, and all the preliminary work in connection with over seven miles of pipe line from the wharf to the transfer tanks at Port Swettenham, and from there to the storage tanks at Connaught Bridge was completed.

Messrs. Preece, Cardew & Rider are responsible for the design of the Station and act as the Board's General and Plant Consulting Engineers for the Station. Messrs. Coode, Vaughan-Lee, Frank & Gwyther act as Civil Consulting Engineers through the Crown Agents for the Colonies.

### **New Construction (Transmission and Distribution).**

The Headquarters Construction Section under the charge of the Chief Construction Engineer is responsible for the planning and execution of all major new construction work which is beyond the capacity of Regional staffs, whose duties are primarily confined to the operation and maintenance of existing installations.

Two major extensions to the Selangor 33 KV system network were made during the year. The first, to supply a tin dredge 12 miles South of Seremban, terminates in an 800 KVA 33 KV/6.6 KV sub-station at the village of Rantau. This extension was carried out along the route selected for the new 66 KV main transmission line from Kuala Lumpur to Malacca and will ultimately be replaced by that transmission line when a 66 KV/6.6 KV sub-station will take the place of the temporary 33 KV/6.6 KV sub-station. This line, which is carried on tubular steel poles, has been erected off-centre in a 2½ chain rentis ("rentis" being the local word for the track cleared through jungle, rubber estates, etc., for a transmission line), so that the 66 KV line may be erected at a later date without interruption of the 33 KV supply.

The second extension was to supply Messrs. Malayan Collieries, Ltd., and was 12½ miles in length commencing from the Board's Sungei Buloh sub-station and terminating at Batu Arang where the Collieries are situated at an indoor sub-station containing two 3,000 KVA 33/3.3 KV transformers and associated switchgear. The Collieries run their own small steam station, which will work in parallel with the Board's system until such time as the new Connaught Bridge Power Station is completed, when the Central Electricity Board will supply the whole requirements of the Collieries for electrical energy.

A 22 KV transmission line from the Singapore Municipality's Bukit Timah sub-station, to the Board's diesel power station at Johore Bahru, to provide a bulk supply for the latter town, was erected during the year. This line will ultimately carry the entire load of Johore Bahru and district, but until the completion of the Singapore Municipality's new power station at Pasir Panjang, supply can be given only during off-peak hours and the Board's diesel power station continues to take the entire peak load. The installation comprises a 22 KV under-

ground cable from the Bukit Timah sub-station to the Public Works Department quarry, a distance of two and a half miles, whence a 22 KV concrete pole overhead line goes on to Woodlands on the North side of Singapore Island, a further six miles distant. From that point, a 22 KV underground cable crosses the Johore Causeway and terminates in a new 22/6.6 KV sub-station in the Johore Bahru power station yard. Two 1,500 KVA transformers controlled by OCB's on the high voltage side, are there situated and on the 6.6 KV side cables are run to the existing 6.6 KV switchboard inside the power station, and arrangements have been made to enable parallel operation between the Board's diesel driven generators and the Singapore supply.

The chief task of the Construction section has, however, been the planning and commencement of work upon the 66 KV inter-connector between the new Connaught Bridge Power Station and the existing Bungsar Power Station. This inter-connector follows the route of a double circuit 66 KV transmission line erected before the war to supply the towns of Klang and Port Swettenham from Bungsar Power Station. At the time of the Japanese invasion of Malaya, however, the 66/11 KV sub-stations were destroyed, and since the war this double circuit line has been operated at 33 KV. In order that supply to the important town of Klang and the port installations at Port Swettenham should not be interrupted, it has been necessary to make temporary arrangements prior to dismantling the old double circuit line and re-erecting it on modified towers with .175 sq. ins. copper conductors in place of the present .05 sq. ins. conductors. At the Klang end a deviation some three miles in length has had to be made to bring the new inter-connector to the site of the Connaught Bridge Power Station. In the same rentis as the inter-connector, a third 66 KV line of .075 sq. ins. copper equivalent Silmalec aluminium conductor will run as far as the Point "E" switching station, seven miles to the West of Kuala Lumpur. At this point, the third line turns North and will be connected to the pre-war 66 KV line supplying the Board's sub-station at Sungei Buloh, where the voltage will be stepped down to 33 KV to tie in with the Board's existing system and the projected North Selangor network. The capacity of the Sungei Buloh sub-station will ultimately be 20,000 KVA. (Appendix XVIII.)

Another major work of the Construction Section has been the planning of a one hundred-mile long 66 KV transmission line from Kuala Lumpur via Seremban to Malacca. This line will give bulk supply to these two major towns and to a number of smaller towns and tin mines along the route. Seremban already receives a bulk supply from Kuala Lumpur at 33 KV but a large section of the present line is carried on wooden poles, erected by the Japanese during the occupation, and the change to 66 KV is dictated by the increased load and by the rapid deterioration of the wooden poles. Ultimately, the new 66 KV line will form an inter-connector between Bungsar Power Station and a projected "base load" steam, or large diesel generating station in the vicinity of Malacca. Work on this project during the year has been



confined to the long and tedious task of land acquisition, but in Malacca town itself, where the system at present is Direct Current and supplied from the diesel engine generators, the work of putting down an 11 KV underground cable distribution system with eight sub-stations was practically completed. To meet the increasing demands of consumers in Malacca town a 520 KW diesel alternator was installed on the site of what will eventually be the bulk supply incoming 66/11 KV sub-station. This alternator temporarily feeds into the Malacca system through a rotary convertor, but will eventually serve the purpose of a stand-by against the failure of the bulk supply or during periods when the 66 KV transmission line has to be taken out of service for maintenance work.

Other work upon which the Construction section has been engaged has been mainly associated with the development of the high tension distribution network necessary to enable delivery to the many consumers now on the Board's waiting list of the additional power which will be made available when Connaught Bridge Power Station is commissioned. Such work included the planning of an extensive V.H.F. radio network for System Control. At present such Control is exercised over the ordinary public telephone system which has, however, the same susceptibility to interruption as the result of thunderstorms as the Board's transmission system itself. Consequently, the Board's Control Engineers have been faced with failure of the telephone system at the very time when it is most required.

The Construction Section's activities throughout the year have been considerably handicapped by the presence of Communist bandits and the difficulty of obtaining an adequate labour force at a time when the high price of rubber provides lucrative employment of a less arduous character. The high price of rubber also added very considerably to the cost of land acquisition, as it is impossible to avoid a large percentage of any transmission line route passing through rubber estates. Shortage of engineers and adequately trained subordinate technical staff has been another great handicap to the Section.

### **Generation.**

The commencement of the first working year of the Central Electricity Board coincided with the putting into service of No. 7 Boiler at Bungsar Power Station. This Boiler replaced one which had been completely destroyed prior to the evacuation of Kuala Lumpur in January, 1942. The new Boiler has an evaporation capacity of 75,000 lbs. per hour, and with the completion of a new spray cooling bank a few months later it became possible to increase the maximum output from Bungsar Power Station to approximately 21,000 kilowatts. The total output from Bungsar Power Station for the year amounted to 115.1 million units as against 91.0 million units for the year 1948/1949. The maximum demand of the Station was 20,500 kilowatts as against 16,000 kilowatts for 1948/1949. Although the year 1948/1949

proved to be a slightly wetter one at the Ulu Langat Hydro-Electric Power Station than the year 1949/1950, average respective rates for rainfall being 48.42 inches and 46.67 inches, better distribution of rainfall resulted in increased output in 1949/50 at 14.4 million units as against 11.8 million units in the previous year.

The combined output of Bungsar and Ulu Langat Power Stations was 129.5 million units for 1949/50 and 102.8 million units for 1948/49, corresponding combined maximum demands were 21,570 kilowatts and 16,450 kilowatts.

The Board has an arrangement with Messrs. Rawang Tin Fields, Ltd., for the interchange of power between their Power Station and the Board's system. Under this arrangement there was a nett transfer of power from the Rawang Tin Fields Power Station to the Board's system of 1,326,158 units in 1949/50 as against 483,388 units in 1948/49.

The Board's 32 diesel stations generated 29.9 million units in 1949/50 as against 26.6 million units in 1948/49. Details of output of individual stations will be found in Appendix III. A new diesel station of 25 kilowatts was installed at Bahau in Negri Sembilan and additional engines were installed at Malacca, Tanjong Malim, Kemaman, Mentakab, Kuala Trengganu, Kota Bharu, Cameron Highlands, Port Dickson and Kuala Lipis. The diesel station at Dungun was closed down and bulk supply taken from a local mining installation. The total capacity of the Board's diesel stations at the end of the year was 11.2 thousand kilowatts as against 10.0 thousand kilowatts at the end of the previous year.

Arrangements were made for bulk supplies of electricity for Johore Bharu and Raub from the Singapore Municipality and the Raub Australian Gold Mining Co. Ltd., respectively. At present these supplies are limited to off peak hours.

In many of the Board's smaller diesel stations there is a substantial demand for power only between the hours of 6.30 p.m. and 10.30 p.m. During the remainder of the night power is only required for a small number of street lamps and during the day for the operation of fans and refrigerators. It is very difficult to supply such a load economically and the Board has therefore evolved a plan for installing in such stations one large set capable of meeting the peak load for the evening and a small automatic set which will run without attention from 10.30 p.m. to 6.30 p.m. the following evening. By so doing the station staff can be reduced to one shift only with a corresponding reduction in the cost of wages. If this plan proves successful it may become possible for the Board to supply a far larger number of small villages than it is doing at present. It may also enable them to give a full 24 hours supply to those villages where it has proved uneconomical to give more than a 12 hours supply up to the present.

### **Sub-stations, High Tension Transmission and Distribution.**

At the 31st August, 1950, the Board maintained 358.7 miles of high tension transmission and distribution lines and 125.6 thousand KVA of sub-stations. This represents an increase of 25.8 miles and 17.8 thousand KVA over the preceding year. In addition, 32.2 miles of high tension transmission and distribution lines were under construction as well as 33 sub-stations of 7,588 KVA. Details will be found in Appendices VIII and IX.

59.3 per cent. of the transmission and distribution lines and 64.3 per cent. of the sub-station capacity is situated in the Board's Central Region and a diagram of the main lines will be found at Appendix XVIII.

During the year 23,800 KVA of transformers were overhauled and repaired in the Board's transformer repair shops in Kuala Lumpur.

The Board's 33 KV transmission and distribution system in Central Region is operated with an arc suppression coil. This coil was installed in 1939 and has proved of immense value in reducing the number of outages caused by lightning. Of 201 faults recorded during the year overload protection operated in 119 cases and earth leakage faults were indicated in 82 cases. The Arc Suppression Coil successfully cleared 52 of the earth leakage faults, thus reducing outages due to this type of fault by  $63\frac{1}{2}$  per cent.

There were no major breakdowns experienced during the year and minor interruptions to supply were usually caused by falling trees, lightning, flying foxes contacting the line, and, in one instance, to a snake climbing up a pole and getting tangled up in the conductors.

In addition to the major construction work detailed earlier in this chapter, a number of lesser schemes were carried out by Regional staff, the principal ones being as follows:

*(a) Northern Region—*

An 11 KV line three miles in length was erected to supply the village of Kamunting from Taiping.

*(b) Central Region—*

An 11 KV underground ring main was laid in the factory area of Kuala Lumpur, to improve the supply in that area which had hitherto been fed partially from the overhead 33 KV system and partially from the Kuala Lumpur town 5.5 KV and 11 KV systems.

Considerable progress was made with the conversion from D.C. to A.C. in the Central area of Kuala Lumpur town.

Rehabilitation of the fourth 4,000 KVA 11/33 KV transformer bank at Bungsar Power Station which had been damaged at the time of the Japanese invasion of Malaya was



completed and the bank put into commission. A fifth bank of similar size to bring the total capacity of the 11/33 KV sub-station to 20,000 KVA was placed on order.

(c) *Eastern Region—*

New high tension overhead transmission lines were erected to supply pumping schemes at Sungei Bilut near Raub, and Salor near Kota Bahru. Construction of another overhead high tension transmission line was commenced to supply a large military installation near Mentakab.

(d) *Southern Region—*

Construction was commenced on an overhead 6.6 KV transmission line from Johore Bahru to Tebrau, where the British Far Eastern Broadcasting Service are erecting a large transmitting station. From Malacca a line was planned to supply a Government Approved School seven miles to the South of the Town, and at Port Dickson a considerable amount of work was carried out on the scheme for converting the present 2.2 KV underground high tension system to an 11 KV partially underground and partially overhead system. The change to the higher voltage was dictated by the greatly increased demand of the Malay Regiment Cantonment, and to enable the extension of the system to the 8th mile Coast Road of this increasingly popular holiday resort.

In Seremban the change-over from D.C. to A.C. was continued and practically completed.

### **Low Tension Distribution.**

With the exception of the central town area of Kuala Lumpur where the distribution is underground, overhead low tension mains are universally employed in towns in the Federation of Malaya. In the past the general practice has been to run the conductors in horizontal formation with a split neutral guard underneath. In general multiple earthing of the neutral was not used, though it was applied in a few towns. Tubular steel poles were generally favoured but with the increasing cost and difficulty in getting such poles other types are adopted. Square cut, hard wood poles of local timber were at first easy and cheap to obtain, but with the development of dangerous conditions in the local jungles, supplies became more difficult and cost increased very sharply. A local firm offered to manufacture concrete poles to an approved specification and large numbers of such poles are now being used for low tension distribution in Kuala Lumpur. The cost compares favourably with tubular steel poles but is still appreciably higher than that of hard wood poles. The heavy weight of concrete poles makes transport difficult and their use is therefore restricted to within a short radius of the firm's works, which are situated in Kuala Lumpur. A big advantage lies in the fact that once erected these poles require little or no maintenance.





The Board has decided to adopt as standard practice a vertical formation of conductors using a single neutral only. Owing to the high resistivity of soils in Malaya as mentioned under the heading "Inspection", it has been found extremely difficult to get a really good single earth point and the Board has therefore decided to utilise multiple earthing on all its low tension systems throughout the country.

Several types of conductor have been used over the past years for insulated services. T.R.S., P.B.J. and V.I.R. cables used out of doors retain their properties for a very short time and become a source of considerable danger if they are relied upon as insulated conductors. The Board has therefore decided to standardize on H.S.O.S. cables for all its insulated overhead services.

The principal disadvantages of overhead low tension distribution lines, namely, their susceptibility to lightning storms, falling trees, and runaway vehicles, kept the Board's breakdown service busy as usual throughout the year. The low diversity of dwelling-houses in the suburban areas of all towns precludes the use of underground cables as a means of distribution, on the score of expense.

The Board has an agreement with Rediffusion, Ltd., whereby that Company utilises the Board's poles for carrying its conductors which relay radio programmes. The Rediffusion conductors are carried below the Board's neutral and may be observed in the photographs of Low Tension Mains at the end of the Report.

### **Consumers' Section.**

The Board Consumers Section, in addition to attending to applications for new supplies, extensions of supplies and disconnections, maintains a large organisation for the hiring of domestic and industrial apparatus, including motors, cookers, water heaters, ceiling fans, table fans and refrigerators, statistics of which will be found in Appendix X. The Consumers Section also installs and removes meters and has control of the meter-reading and billing organisation. It attends to consumers' complaints and the efficiency of this service has frequently been favourably commented upon by the general Public.

The Board act as agents for the Government in maintaining all Government electrical installations and supervising the wiring and re-wiring of all Government Quarters and Buildings. In this connection 9,138 new points were wired and 17,650 old points re-wired during the year.

The total number of consumers supplied by the Board as at the 31st August, 1950, was 50,006 comparing with 45,495 at the 31st August, 1949. This represents an increase of 9.9 per cent. Whilst the increase in the number of consumers is satisfactory, their connected load has had to be severely restricted through shortage of generating plant and insufficient capacity of sub-stations and distribution mains.

It is hoped that these difficulties will be overcome within the next two years and that consumers will then be allowed an unrestricted supply in practically all towns.

Inhabitants of Malaya shew a great partiality towards fluorescent electric lamps and many tens of thousands are in service throughout the country, despite lurid stories which emanated from overseas publications regarding the dangers to health of such lamps. Evidence which was studied by the Board's engineers led to the conclusion that such dangers were greatly exaggerated.

Tampering with meters is a serious problem and the Board maintains a full time staff engaged on the detection of such offences. Some of the methods employed are extremely ingenious. Minor cases are dealt with by disconnection of supply for a limited period, and major offences are taken to court.

Meter testing and repairs are carried out in the Board's test rooms at Kota Bharu, Kuala Lumpur, Seremban, Ipoh, Malacca and Johore Bahru. The total number of meters tested in 1949/50 was 8,194 as against 11,879 in 1948/49 and the total number of meters repaired in 1949/50 was 4,233 as against 4,859 in 1948/49.

The Board's tariffs are shewn in Appendix XVII from which it will be seen that there is a flat rate for mines, a graduated scale for consumers using energy for power purposes, and another graduated scale for consumers using energy for lighting. This form of tariff is not entirely satisfactory and the Board have given their attention to devising a two part tariff comprising a fixed charge based on floor area and a low running charge per unit consumed. A surcharge on the tariff is made in order to meet increased cost of operation. It was considered preferable to making frequent variations of the basic charges at the present time of instability of prices throughout the world. The cost of electricity in the Federation of Malaya is admittedly high and results partially from the low efficiency of the Board's old power station at Bungsar and the multiplicity of small diesel generating units. It is hoped that the commissioning of the new Connaught Bridge Power Station and the development of hydro-electric power stations, together with an extensive "grid", will enable costs to be reduced appreciably over the next ten years.

A study of statistics given in Appendix IV reveals that the consumption per head of the population is very low in the Federation, and Malaya may be considered to be still in its infancy as regards electrical development. The Board's staff organisation compares with that of an Area of the British Electricity Authority whereas its output of energy is only that of a small sub area. As the usage of electricity expands this disproportion will diminish and the spreading of overheads over a far larger number of units sold will lead to a further reduction of cost per unit.

## Personnel and Welfare.

The shortage of Engineering staff both Senior and Junior which existed before the formation of the Board still persists. Recruitment of suitable Expatriate officers has proved difficult, and local staff with the necessary qualifications and experience is not yet available in sufficient numbers. Three Asian Shift Engineers are to be sent to the United Kingdom for a period of one year to gain experience in B.E.A. power stations and three Asian Technical Assistants have been sent to the U.K. for further study with a view to obtaining their full professional qualifications. The shortage of technical staff is general throughout the whole of Malaya, and both Government and Commercial undertakings are experiencing the same difficulties. While Government has under review the general expansion of educational facilities, the benefits resulting from such expansion must of necessity take some years to become fully effective. In order to overcome this difficulty, the Board has approved the policy of sending selected employees to the U.K. for training to enable them to obtain Corporate membership of the Institution of Electrical Engineers.

The steady rise in the cost of living since the end of the Second World War has led to a demand from all grades of staff for increases in salary scales. Negotiations are about to commence with the leading staff organisations, namely, the Electricity Department Junior Officers Union, the Technical Services Union, and the Electricity Department Workers' Union. To facilitate these and other negotiations which may arise, in future years, Staff Councils are about to be formed on general "Whitley" Council lines and a great deal of preliminary work has been put in to this task by the Board's Personnel Department.

Employees of the Electricity Department, particularly those above the rank of daily pay, were given accommodation in Government Quarters. Upon the formation of the Board, certain State Governments gave notice that it expected the Board to build its own houses and would require the Board's employees to vacate Government Quarters within a reasonable time. The Board has set aside the sum of \$3 million (£350,000) and have embarked on a Building Programme totalling some 800 houses. The sum so far set aside will not enable the programme to be completed and a further \$1½ million or \$2 million will eventually be required. The types of houses being constructed are similar, class by class, with those provided by Government for its employees. Although funds have been provided by the Board, great difficulty has been experienced in obtaining land suitable to build upon, and, in the case of Kuala Lumpur, where the majority of the houses are to be built, in obtaining an adequate water supply. These difficulties are however gradually being overcome and it is hoped that Government, realising the difficulties which face the Board, will permit its employees to remain in occupation of Government Quarters for an extended period.



Social activities for the Board's staff are catered for by the Kilat Club, which has branches in nearly all the large stations. This Club provides facilities for many out-door sports and in-door recreations and has a large membership. The Club teams take part in local football, cricket, and badminton leagues wherein they have met with considerable success. Several State representatives have been chosen from the Board's teams.

Under the Electricity Ordinance the Board is bound to offer to its employees the same facilities of free medical attention as are given in Government Service. This has been rendered throughout the past year by the Government Medical Service, but arrangements are being made in the larger centres to obtain the services of private practitioners. The first step in this direction has already been taken in Kuala Lumpur where a Dispensary is now being built at Bungsar Power Station for the use of the Board's employees, most of whom are housed in that neighbourhood.

The Board records its appreciation of the loyal and efficient co-operation by the staff which enabled the initial problems during the first year of operation to be successfully overcome.

---

### CHAPTER III.

#### **FINANCE AND ACCOUNTS.**

The Balance Sheet and Revenue Account are given in Appendices XIII and XIV.

#### **Vesting of the Undertakings.**

Under the provisions of the Electricity Ordinance, 1949, the assets and liabilities of the Electricity Department of the Government of the Federation of Malaya on the 31st August, 1949, vested in the Central Electricity Board. The Electricity Ordinance provides that the Board shall, as compensation for the transferred undertakings, issue to the Federal Government, ordinary stock of a total nominal amount to be agreed upon by and between the High Commissioner in Council and the Board. Subject to the grant of satisfactory titles to the land formerly occupied by the Electricity Department and now occupied by the Board, the sum of \$30,000,000 has now been agreed as the amount of Ordinary Stock to be issued to the Government of the Federation of Malaya in respect of the transferred Undertakings. The sum of \$30,000,000 has therefore been entered in the Balance Sheet as an amount due to the Government. The basis for the valuation of the fixed assets and stores is the original cost less depreciation at the rates adopted by the Director of Electricity before the Board was established. The actual valuation on this basis after making appropriate adjustments for liabilities and other assets such as cash, stores, book debts taken over by the Board amounts to \$29,612,962.

### Financial Powers and Duties of the Board.

The Electricity Ordinance provides that the Board may with the approval of the High Commissioner in Council borrow money by the issue of debentures or debenture stock or raise capital by the issue of shares or stock for the provision of working capital and in order to meet capital expenditure. The Ordinance also provides that it shall be the duty of the Board to exercise and perform its functions so as to secure that the total revenues of the Board are sufficient to meet its total outgoings properly chargeable to revenue account, taking one year with another.

### Revenue and Expenditure on Revenue Account.

#### A.—REVENUE.

	Units.	\$
Sales of Electricity amounted to ...	141,363,811	13,090,138
Other Revenue amounted to :		
Rentals on Apparatus ... ..	—	290,449
Profit on Contract Work and		
Sale of Stores ... ..	—	160,671
Rentals on Quarters, Interest and		
Miscellaneous Revenue ... ..	—	98,275
		<hr/>
		\$13,639,533

The amount of revenue received from the various classes of consumers is illustrated in the diagram given in Appendix XVI.

#### B.—EXPENDITURE.

Provision amounting to \$1,663,509 for the cost of renewing fixed assets has been charged to Revenue Account. This sum includes the special provision referred to later in this paragraph. The standard provision for renewals is calculated by reference to the estimated economic life of the various classes of assets and their original cost. It is considered however that the eventual cost of replacing the capital works installed before the war will be much greater than the original cost. The sum of \$687,283 has therefore been charged to Revenue Account as an additional special provision for renewals.

The relative proportions of the main classes of expenditure is illustrated in the diagram given in Appendix XVI.

After charging all expenditure on revenue account including provision for renewals and pensions the net profit for the year amounts to \$1,761,897. This profit is equivalent to 5.8 per cent. on the proposed capital of \$30,000,000. The average profit per unit of electricity sold amounted to 1.25 cents.

### **Capital Expenditure.**

The expenditure during the year on capital works amounting to \$5.475 millions is equivalent to 18.2 per cent. of the cost of fixed assets taken over by the Board on the 1st September, 1949, and includes the sum of \$3,265,049 in respect of additional generating plant and buildings.

### **Expenditure on Renewal of Plant and Equipment.**

Expenditure on renewal of plant and equipment amounted to \$878,221.

### **Loan from the Colonial Development Corporation.**

Negotiations which were commenced with the Colonial Development Corporation shortly after the Board was formed for a loan of £3,580,000 (\$30,685,714) were completed successfully and the Corporation agreed to take up Debentures bearing interest at the rate of four per cent. per annum and redeemable at par on the 31st December, 1960. The Board has the right to redeem all or any part of the Debentures at any time after the 31st December, 1950, provided that if the stock is redeemed:

- (i) between the 1st January, 1951, and the 31st December, 1955, inclusive, the redemption price is £102 per £100 stock or
- (ii) between the 1st January, 1956, and the 30th June, 1960, inclusive, the redemption price is £101 per £100 stock.

The debentures create a floating charge on the property of the Board.

The Colonial Development Corporation has the right to convert all or any part of the debentures it holds into Ordinary Stock after giving three months notice.

The sum of \$2,914,286 was advanced by the Corporation during the year ending 31st August, 1950, but the Debentures were not actually issued until after that date.

### **Funds for Development Works.**

The floating assets exceed the current liabilities including deposits by the sum of \$8.7 millions but after allowing for the necessary sums for stocks, book debts and working cash balances, the cash available, apart from the amount of \$27,771,428 not yet drawn on account of the agreed loan from the Colonial Development Corporation, for capital works and dividend on the Ordinary Stock to be issued to Government amounted to approximately \$2.6 millions. The Board's Bankers have however agreed to make a short term loan to the Board of a sum up to \$9,000,000. The question of the future financing of the various development works which require to be undertaken received the earnest attention of the Board. A sum of at least \$60,000,000 will be required over the course of the next few years.



### Insurance.

It was decided not to take out insurance policies in respect of the Board's property, workmen's compensation and third party risks. The sum of \$60,000 has been appropriated, from the Profits for the year, as an initial contribution to Insurance Reserve.

### Transfer of Profits to General Reserve.

The profits earned during the year are sufficient to pay a dividend on the Ordinary Stock, but the cash resources of the Board are fully committed to capital works. The Board hopes to obtain further capital funds in the near future and if successful will declare a dividend of 4 per cent. on the Ordinary Stock of \$30 millions. Pending a final decision on this matter it has been decided to transfer, after deducting the contribution to Insurance Reserve referred to above, the profits for the year to General Reserve.

### Charges for Electricity.

The electricity tariffs of the Electricity Department immediately prior to the establishment of the Board were adopted by the Board but owing to a substantial increase in the price of diesel oil and petrol in November, 1949, the charges were increased with effect from the 1st December, 1949. The cost of coal remained unchanged throughout the year.

The actual increases made were as follows:

#### Lighting.

Ipoh, Batu Gajah, Tanjong Rambutan and	
Klian Intan ... ..	No change
All other towns and villages ... ..	Surcharge increased from 15 per cent. to 20 per cent.

#### Power—Domestic and Commercial.

Kuala Lumpur and District, Kajang, Klang, Port Swettenham, Rawang and Seremban	Surcharge increased from 15 per cent. to 30 per cent.
Ipoh, Batu Gajah, Tanjong Rambutan and	
Klian Intan ... ..	No change
All other towns and villages ... ..	Surcharge increased from 15 per cent. to 40 per cent.
Mines and Tin Dredges ... ..	From 3 $\frac{3}{4}$ cents to 4 $\frac{1}{4}$ cents per unit.

### Taxation and Stamp Duties.

The Board is exempted by the provisions of the Electricity Ordinance from payment of stamp duties.

In April, 1950, the Legislative Council resolved that the Board be exempted from Income Tax.

### **Audit.**

Messrs. Price Waterhouse & Co. were appointed the Auditors for the year ending the 31st August, 1950, and have conducted a continuous audit at the Head Quarters of the Board. The Auditor's Report is given in Appendix XV.

An internal audit staff consisting of five Accounts Inspectors and one clerk were employed by the Board to carry out a continuous audit of the books and accounts in the Districts and in particular the audit of the revenue collections and stores.

### **Payment for all Government Services.**

The following services and supplies, which were obtained by the Electricity Department free of charge, are paid for by the Board:

Local postage.

Public Works Department buildings occupied by the Board or by its employees.

Medical attention to employees and their dependants.

Printing and stationery.

Legal services.

Architects' services.

Audit of accounts.

Motor vehicles licences.

Training apprentices at the Technical College.

The Board pays local authority assessment and customs duty on the same basis and at the same rates as are applicable to the general public.

### **Appointment of Agents in the United Kingdom.**

Immediately the Board was established arrangements were made to appoint the Crown Agents for the Colonies the Agents of the Board for the purchase of supplies in the United Kingdom, recruitment of staff and various other services undertaken by that authority.

### **Number of Consumers.**

The number of consumers increased from 45,495 on the 1st September, 1949, to 50,006 on the 31st August, 1950.

A public supply of electricity at Bahau was commenced in March, 1950.

### **Stores.**

The increase in the value of the stores held from \$2.395 millions to \$3.485 millions is mainly due to the more rapid delivery of materials from the United Kingdom, the increase in stocks held by the Construction Branch for the capital works in progress, and rising prices. Local purchases amounted to \$847,102 and purchases through the Crown Agents \$2,142,279.

### Sales of Electricity and other Revenue.

Total revenue and sales of electricity for the three months prior to the establishment of the Board and for the three months ending 31st August, 1950, amounted to :

June, July and August, 1949.			June, July and August, 1950.	
Electricity (Units).	Total Revenue.		Electricity (Units).	Total Revenue.
30,522,919	\$2,934,087	...	38,668,307	\$3,696,513

The increase in units sold and total revenue is equivalent to 26.6 per cent. and 25.9 per cent. respectively. While the charges for electricity were increased with effect from the 1st December, 1949, a larger proportion of electricity was sold to large power consumers at comparatively low rates and the average revenue per unit obtained by the Board during the last three months of the year was slightly below the average amount obtained by the Electricity Department during the three months ending the 31st August, 1949.

### Collection of Electricity Bills.

The collection of electricity bills is carried out at the larger stations by the Board's staff except, in the case of Klang where the Town Board continued to collect the bills on behalf of the Board. In the smaller stations and in several villages either within the Kuala Lumpur Municipal area or in the Kuala Lumpur district the bills were collected at the local Post Offices. It is believed that these arrangements are of considerable convenience to the public.

The bad debts incurred amounted to \$542.

The accounts in respect of consumers in the following towns are maintained at Head Quarters by means of electrical book-keeping machines :

Kuala Lumpur and district, Kajang, Rawang, Kuala Kubu Bharu, Tanjong Malim, Cameron Highlands, Batu Gajah, Ipoh and Sitiawan.

The Consumers accounts for other towns are for the time being maintained in the Districts.

### Works undertaken on Contract.

The Board undertakes the work of maintaining the electrical installations, installation of electrical wiring in new buildings and the replacement of old electrical wiring in Government quarters and buildings. A scale of charges as agreed with Government is made for this work.

Service lines exceeding the length provided free are also erected and the cost recovered from consumers.

The amount charged for this work completed during the year amounted to \$1,139,652.



## CHAPTER IV.

**LONG-TERM POLICY.**

The future development of electricity supply in Malaya falls naturally into two main divisions—

- (i) the extension of individual small town supplies provided by local diesel generating plant;
- and (ii) the extension and ultimate interconnection of the two major bulk supply schemes in Selangor and Perak, the first operated by the Board, and the second by the Perak River Hydro-Electric Power Co., Ltd.

Considering first of all small town supplies, the provision of additional generating plant for existing towns, and the installation of entirely new supplies, presents no very unusual difficulties. Owing to the nature of the country this method of supply is often the only feasible one for small towns remote from a bulk supply line, the dense jungle or even worse, rubber plantations, making it an extremely expensive matter to clear a rentis for an overhead line across country. In some cases supply is commenced on a six-hour basis, is later improved to 12 hours, and eventually grows to a full 24-hour supply. The ultimate aim wherever this becomes possible is the connection of such supplies to the bulk supply system and the closing down of the diesel generating plant. This has already been done in one or two cases, and the diesel plant removed to initiate new supplies elsewhere, or to reinforce other diesel stations still too remote to be given a bulk supply. Largely owing to the high costs of generation in small individual stations it is usually not possible at first to connect very much domestic or industrial load to such supplies. Where a 24-hour supply is given, and the capacity of the plant has grown sufficiently, the connection of domestic and small industrial power becomes feasible, though never to the extent possible where a bulk supply is given.

The size of the 32 diesel generating stations at present operated by the Board ranges from 22 KWs to 1,600 KWs, and the area covered extends the length and breadth of Malaya. Supervision involves long and expensive journeys, and the rising cost of fuel, wages, and salaries since the war has resulted in increased electricity charges. Consideration is now being given to the installation of automatic unattended sets in very small stations. These will operate during the off peak period and will enable a reduction to be made in the number of shift workers employed.

Turning next to the second type of development, the extension and interconnection of the existing bulk supply systems, the future hinges primarily on questions of finance. The technical requirements are clear and not seriously in doubt and it is obvious that very considerable

increases in available generating capacity are essential if the system is to keep pace with the growing demand for industrial and domestic power. From the wider viewpoint of the economy of the country as a whole it is equally obvious that the attempt to broaden the basis of industry, and thus make the country slightly less dependent on the fluctuations of the world tin and rubber market can never succeed to any extent unless sufficient cheap electric power is made available. A glance at the graph of total units generated in the country (Appendix XII B) shews that the position in 1950 was still well below that achieved in 1941, and the probable present demand (indicated by the dotted curve in the graph) is greatly in excess of the present available output. In Selangor all mining and large industrial consumers are restricted, the slightest breakdown of generating plant results in load shedding, and this situation must continue until the Board's new thermal station at Connaught Bridge near Klang is in operation, the target date for which is January, 1953.

Tentative estimates of future growth of load, based on known industrial demands, the records for past years, and the estimated future growth of population, have been made, and it is considered that to keep pace with demand, planning must be based on a ten-year forecast with approved construction programmes on a five-year basis.

The Board's approved construction programme includes the construction of the new Connaught Bridge Power Station and the extension of the 66 Kv transmission system, and it is now estimated that by the time this programme is completed the available additional generating capacity will be entirely absorbed within the Selangor, Negri Sembilan, Malacca area. This estimate is based on known demands for power plus normal annual increase of existing load.

Further provision must therefore be planned now for continued growth of load, in that area, and for the future increase in demand in the Perak region where the available generating capacity of the Perak River Hydro-Electric Power Co., Ltd. is approaching its peak capacity.

Some immediate benefit would accrue from the interconnection of the Perak and Selangor systems due to the reduction in standby plant which would be made possible, but it is fairly certain that the cost of the necessary 100-mile 132 Kv Interconnecting line could not be justified on that account alone. The installation of a small unit thermal station at the end of the Selangor-Malacca 66 Kv transmission line would also improve the situation in the Malacca area, but would not assist in overcoming future power shortage in the Perak area.

The long-term solution which offers the maximum benefit to the country is undoubtedly the development of new hydro-electric power in the Cameron Highlands area near the Perak-Selangor boundary. A possible 100 MW scheme consisting of two stations of 40 and 60 MW capacity has been investigated in this area, and reported on favourably

by the Board's consulting engineers. Two years approximate measurements of river flow confirmed the original estimate of output, but further investigation was brought to a halt by the unfortunate death of the engineer concerned (as mentioned at the beginning of Chapter 11). The site of the proposed hydro scheme is shewn on the Map at Appendix XVIII A.

This scheme involves a considerable amount of tunnelling which it is thought would be the deciding factor in completion time, and the complete development of the two stations would probably require seven to ten years. Other rivers in the same area are capable of developing appreciable amounts of power using a number of small stations with about 600 ft. head and outputs of 2,000 to 5,000 KWs each, and the development of these stations would involve less initial outlay than the major 100 MW project and might result in a wet season output of 20 to 30 MW. These smaller stations could therefore be developed before the large 100 MW scheme, at the same time as the large scheme, or subsequently as an addition to the large scheme, according to the exigencies of the situation.

The development of the hydro-electric resources of this area, feeding into both the Selangor and Perak networks, is probably the only way in which the cost of 132 Kv interconnection can be justified.

One unfortunate factor that has become obvious since the war, is that difficulties in obtaining sufficient local coal must inevitably make both existing and future thermal stations increasingly dependent on imported fuel oil. At the present time fuel oil is burned as well as coal in both Perak and Selangor and there is every sign that coal supplies in the future will not be able to cater for the anticipated growth in demand.

In a country the existing economy of which already depends too much on the world tin and rubber market it would seem to be highly undesirable to make the basic power supply of the country also dependent on imported fuel the price of which is almost entirely outside its control. Therefore the financing and developing of the natural hydro-electric resources of Malaya is considered to be of the utmost urgency if a viable industrial economy is to exist in 10 or 20 years time. The advantages of cheap hydro-electric power are too well known to need further emphasis in this report, but it may be said that they are even more manifest than usual in this country, where the power demand is unusually sensitive to a retraction in the world demand for tin. At such times hydro power enables low cost production to be continued, whereas dependence on imported fuel would make a bad situation worse. The point is one of considerable importance for the future since the current demand for a rising standard of living will become more and more incompatible with any large scale cessation of production.



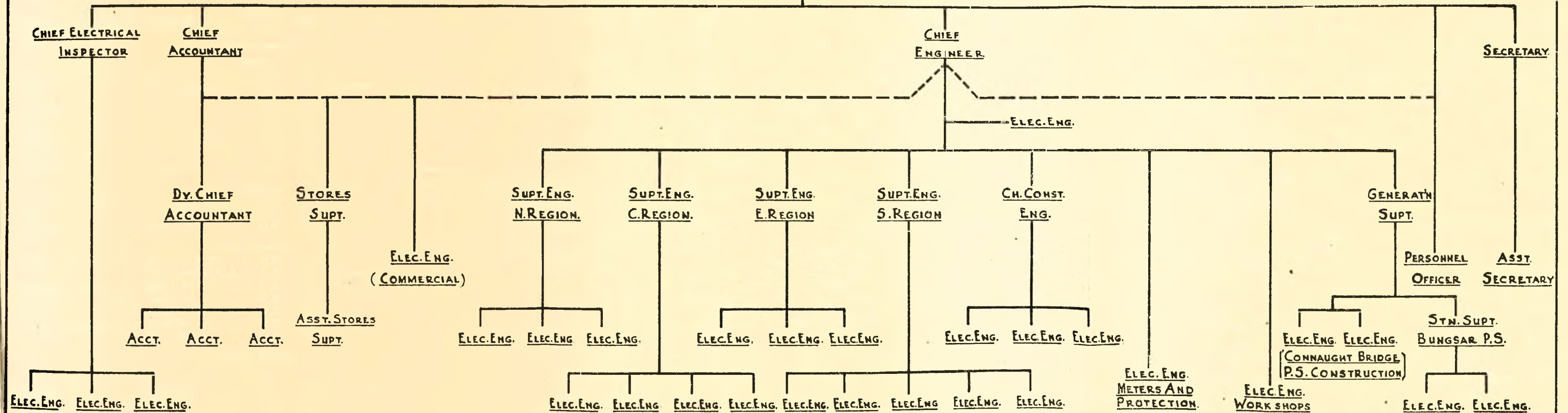
# CENTRAL ELECTRICITY BOARD

## SENIOR STAFF ORGANISATION

### THE BOARD

MEMBER	MEMBER	CHAIRMAN	DY. CHAIRMAN	MEMBER	MEMBER	MEMBER
--------	--------	----------	--------------	--------	--------	--------

CONFIDENTIAL  
SECRETARY.

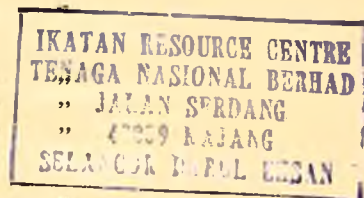


## APPENDIX II.

## LIST OF CENTRAL ELECTRICITY BOARD PUBLIC SUPPLIES.

THE SYSTEM OF SUPPLY (UNLESS OTHERWISE STATED) IS A.C. 400/230 VOLTS 50 CYCLES.

Name of town or village.	Capacity of generating or receiving station plant.	Motive Fuel. Power.	Receives bulk supply from	Owner and Operating Authority.
<b>Northern Region.</b>				
<i>Perlis.</i>				
1. Kangar .. ..	62 K.W. ..	O.E. Oil	— ..	C.E.B.
<i>Perak.</i>				
2. Taiping .. ..	1,136 K.W. ..	O.E. Oil	— ..	"
3. Ipoh .. ..	T.C. 6,250 K.V.A.	B.S. —	P.R.H.E.P. Co. ..	"
4. Batu Gajah ..	T.C. 350 K.V.A. ..	B.S. —	" ..	"
5. Sitiawan .. ..	82 K.W. ..	O.E. Oil	— ..	"
6. Klian Intan ..	T.C. 25 K.V.A. ..	B.S. —	R.H.T. Co. ..	"
<i>Pahang.</i>				
7. Cameron Highlands	335 K.W. ..	O.E. Oil	— ..	"
<b>Southern Region.</b>				
<i>Johore.</i>				
1. Johore Bahru ..	1,470 K.W. ..	O.E. Oil	— ..	"
	T.C. 3,000 K.V.A.	B.S. —	Singapore ..	"
2. Kluang .. ..	600 K.W. ..	O.E. Oil	— ..	"
3. Batu Pahat ..	730 K.W. ..	O.E. Oil	— ..	"
4. Muar .. ..	800 K.W. ..	O.E. Oil	— ..	"
5. Segamat .. ..	D.C. 300 K.W. ..	O.E. Oil	— ..	"
6. Kota Tinggi ..	100 K.W. ..	O.E. Oil	— ..	"
7. Tangkak .. ..	50 K.W. ..	O.E. Oil	— ..	"
<i>Malacca.</i>				
8. Malacca Town ..	A.C. 620 K.W. ..	O.E. Oil	— ..	"
	D.C. 1,000 K.W.	O.E. Oil	— ..	"
9. Jasin .. ..	62.6 K.W. ..	O.E. Oil	— ..	"
<i>Negri Sembilan.</i>				
10. Seremban .. ..	D.C. 460 K.W. ..	O.E. Oil	— ..	"
	T.C. 1,500 K.V.A.	B.S. —	Bungsar ..	"
11. Port Dickson ..	350 K.W. ..	O.E. Oil	— ..	"
12. Gemas .. ..	150 K.W. ..	O.E. Oil	— ..	"
13. Nilai .. ..	22 K.W. ..	O.E. Oil	— ..	"
14. Kuala Klawang ..	22 K.W. ..	O.E. Oil	— ..	"
15. Bahau .. ..	25 K.W. ..	O.E. Oil	— ..	"
<b>Eastern Region.</b>				
<i>Pahang.</i>				
1. Raub .. ..	200 K.W. ..	O.E. Oil	— ..	"
2. Kuantan .. ..	300 K.W. ..	O.E. Oil	— ..	"
3. Mentakab .. ..	225 K.W. ..	O.E. Oil	— ..	"
4. Pekan .. ..	100 K.W. ..	O.E. Oil	— ..	"
5. Kuala Lipis ..	293 K.W. ..	O.E. Oil	— ..	"
6. Fraser's Hill ..	65 K.W. ..	O.E. Oil	— ..	"
7. Bentong .. ..	150 K.W. ..	O.E. Oil	— ..	"
8. Temerloh .. ..	T.C. 50 K.V.A. ..	B.S. —	Mentakab ..	"



## APPENDIX II—(cont.)

## LIST OF CENTRAL ELECTRICITY BOARD PUBLIC SUPPLIES—(cont.)

Name of town or village.	Capacity of generating or receiving station plant.	Motive Power.	Fuel.	Receives bulk supply from	Owner and Operating Authority.
<b>Eastern Region—(cont.)</b>					
<i>Perak.</i>					
9. Tanjong Malim ..	200 K.W.	O.E.	Oil	—	C.E.B.
<i>Kelantan.</i>					
10. Kota Bharu ..	688 K.W.	O.E.	Oil	—	"
11. Kuala Krai ..	67 K.W. . .	O.E.	Oil	—	"
12. Pasir Mas ..	T.C. 125 K.V.A. . .	B.S.	—	Kota Bharu	"
13. Tumpat ..	T.C. 125 K.V.A. . .	B.S.	—	"	"
14. Palekbang ..	T.C. 100 K.V.A. . .	B.S.	—	"	"
15. Wakaf Bharu ..	T.C. 25 K.V.A. . .	B.S.	—	"	"
<i>Trengganu.</i>					
16. Kuala Trengganu	250 K.W.	O.E.	Oil	—	"
17. Dungun ..	T.C. 50 K.V.A. . .	B.S.	—	E.M. & M. Co. Ltd.	"
18. Kemaman ..	125 K.W.	O.E.	Oil	—	"
<i>Selangor.</i>					
19. Kuala Kubu Bharu	197 K.W.	O.E.	Oil	—	"
<b>Central Region.</b>					
<i>Selangor.</i>					
1. Bungsar, Kuala Lumpur ..	26,500 K.W.	S.T.	Coal & Oil	—	"
2. Ulu Langat ..	2,288 K.W.	H.E.	Water	—	"
3. Klang ..	T.C. 3,000 K.V.A.	B.S.	—	Bungsar	"
4. Port Swettenham	T.C. 800 K.V.A. . .	B.S.	—	"	"
5. Kajang ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
6. Serdang Village ..	T.C. 50 K.V.A. . .	B.S.	—	"	"
7. Serdang Plantations	T.C. 25 K.V.A. . .	B.S.	—	"	"
8. Ampang Village ..	T.C. 400 K.V.A. . .	B.S.	—	"	"
9. Salak South ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
10. Puchong Village ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
11. Sungei Buloh ..	T.C. 100 K.V.A. . .	B.S.	—	"	"
12. Pudu Ulu ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
13. Sungei Way ..	T.C. 50 K.V.A. . .	B.S.	—	"	"
14. Petaling Village ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
15. Batu Caves ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
16. Kent Village ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
17. Rawang Town ..	T.C. 100 K.V.A. . .	B.S.	—	"	"
18. Setapak Village ..	T.C. 200 K.V.A. . .	B.S.	—	"	"
19. 4th Mile Village, Ampang ..	T.C. 100 K.V.A. . .	B.S.	—	"	"
20. Rasa Village ..	T.C. 50 K.V.A. . .	B.S.	—	Kuala Kubu Bharu	"



## APPENDIX IIA.

## LIST OF LICENSED PUBLIC SUPPLIES.

THE SYSTEM OF SUPPLY (UNLESS OTHERWISE STATED) IS A.C. 400/230 VOLTS 50 CYCLES.

## Southern Region.

Name of town or village.	Capacity of generating or receiving plant.	Motive Power.	Fuel.	Receives bulk supply from	Owner and Operating Authority.
<i>Johore.</i>					
1. Senggarang ..	27.5 K.V.A.	O.E.	Oil	—	Lee Leong Piow
2. Renggit ..	15 K.V.A.	O.E.	Oil	—	Tay Chin Tiong
3. Bukit Gambir ..	110v. D.C. 22 KW.	O.E.	Oil	—	Yeo Kee Keng
<i>Negri Sembilan.</i>					
4. Kuala Pilah ..	245 K.W.	O.E.	Oil	—	Huttenbachs Ltd.
5. Tampin ..	255 K.W.	O.E.	Oil	—	" "

## Northern Region.

<i>Kedah.</i>					
1. Alor Star ..	1,600 K.W.	O.E.	Oil	—	Huttenbachs Ltd.
2. Padang Serai ..	32 K.W. . .	O.E.	Oil	—	" "
3. Lunas ..	D.C. 17 K.W.	O.E.	Oil	—	" "
4. Sungei Patani ..	470 K.W.	O.E.	Oil	—	" "
5. Kulim ..	200 K.V.A.	B.S.	—	Prai	" "
6. Bandar Bharu ..	(see Parit Buntar)				

*Province Wellesley.*

7. Prai P.S. ..	10,000 K.W.	S.T.	Oil	—	Penang Municipality
8. Prai Village ..	T.C. 200 K.V.A.	B.S.	—	Prai	" "
9. Bukit Mertajam ..	T.C. 200 K.V.A.	B.S.	—	"	Huttenbachs Ltd.
10. Butterworth ..	T.C. 300 K.V.A.	B.S.	—	"	" "
11. Nebong Tebal ..	T.C. 100 K.V.A.	B.S.	—	"	" "
12. Bukit Tengah ..	T.C. 60 K.V.A.	B.S.	—	"	" "
13. Simpang Ampat ..	T.C. 20 K.V.A.	B.S.	—	"	" "
14. Sungei Bakap ..	T.C. 50 K.V.A.	B.S.	—	"	" "
15. Bagan Agam ..	T.C. 20 K.V.A.	B.S.	—	"	" "
16. Penaga ..	T.C. 20 K.V.A.	B.S.	—	"	" "
17. Kepala Batas ..	T.C. 100 K.V.A.	B.S.	—	"	" "
18. R.A.F. Station, Butterworth ..	T.C. 100 K.V.A.	B.S.	—	"	" "
19. Bagan Jermal ..	T.C. 50 K.V.A.	B.S.	—	"	" "
20. Permatang Sin Tok ..	T.C. 20 K.V.A.	B.S.	—	"	" "
21. Bukit Panchor ..	T.C. 50 K.V.A.	B.S.	—	"	Penang Municipality
22. Jawi ..	T.C. 20 K.V.A.	B.S.	—	"	" "
23. Sungei Kechil ..	T.C. 10 K.V.A.	B.S.	—	"	" "
24. Sungei Nyok ..	T.C. 400 K.V.A.	B.S.	—	"	" "

*Penang.*

25. George Town and Penang ..	T.C. 12,500 K.V.A.	B.S.	—	"	" "
----------------------------------	--------------------	------	---	---	-----

## APPENDIX IIA—(cont.)

## LIST OF LICENSED PUBLIC SUPPLIES—(cont.)

## Northern Region—(cont.)

Name of town or Village.	Capacity of generating or receiving plant.	Motive Power.	Fuel.	Receives bulk supply from	Owner and Operating Authority.
<i>Perak.</i>					
26. Chenderoh P.S. ..	27,000 K.W. ..	H.E.	Water	— ..	P.R.H.E.P. Co.
27. Malin Nawar P.S.	30,000 K.W. ..	S.T.	Coal	— ..	"
28. Batu Gajah P.S. ..	19,950 K.W. ..	S.T.	Coal	— ..	"
29. Parit Buntar ..	T.C. 100 K.V.A. ..	B.S.	—	Prai ..	Huttenbachs Ltd.
30. Teluk Anson ..	D.C. 640 K.W. ..	O.E.	Oil	— ..	"
31. Lumut ..	D.C. 50 K.W. ..	O.E.	Oil	— ..	Sitiawan Electric Light Co.
32. Kampar ..	T.C. 810 K.V.A. ..	B.S.	—	P.R.H.E.P.Co.	K.E.D. Co.
33. Temoh ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
34. Tapah ..	T.C. 300 K.V.A. ..	B.S.	—	"	"
35. Chenderiang ..	T.C. 100 K.V.A. ..	B.S.	—	"	"
36. Tanjong Tualang ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
37. Tronoh ..	T.C. 100 K.V.A. ..	B.S.	—	"	"
38. Siputeh ..	T.C. 20 K.V.A. ..	B.S.	—	"	"
39. Pusing ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
40. Papan ..	T.C. 100 K.V.A. ..	B.S.	—	"	"
41. Lahat ..	T.C. 60 K.V.A. ..	B.S.	—	"	"
42. Menglembu ..	T.C. 1,150 K.V.A.	B.S.	—	"	"
43. Gopeng ..	T.C. 75 K.V.A. ..	B.S.	—	French Tekka Mines Ltd.	"
44. Chemor ..	T.C. 60 K.V.A. ..	B.S.	—	P.R.H.E.P.Co.	"
45. Sungei Siput ..	T.C. 300 K.V.A. ..	B.S.	—	"	"
46. Kuala Kangsar ..	T.C. 620 K.V.A. ..	B.S.	—	"	"
47. Malin Nawar Village ..	T.C. 60 K.V.A. ..	B.S.	—	"	"
48. Bidor ..	T.C. 250 K.V.A. ..	B.S.	—	"	"
49. Enggor ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
50. Tanjong Rambutan ..	T.C. 100 K.V.A. ..	B.S.	—	"	"
51. Salak North ..	T.C. 60 K.V.A. ..	B.S.	—	"	"
52. Kanthan Village ..	T.C. 150 K.V.A. ..	B.S.	—	"	"
53. Kota Bharu ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
54. Jelapang ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
55. Changkat ..	T.C. 10 K.V.A. ..	B.S.	—	"	"
56. Ayer Papan ..	T.C. 20 K.V.A. ..	B.S.	—	"	"
57. Southern Tronoh ..	T.C. 10 K.V.A. ..	B.S.	—	"	"
58. M.T.D. Village ..	T.C. 10 K.V.A. ..	B.S.	—	"	"
59. Tambun ..	T.C. 100 K.V.A. ..	B.S.	—	"	"
60. Buntang Village ..	T.C. 50 K.V.A. ..	B.S.	—	"	"
61. Tapah Road ..	27 K.W. ..	O.E.	Oil	— ..	"
62. Parit ..	60.5 K.W. ..	O.E.	Oil	— ..	"
63. Lenggong ..	60.5 K.W. ..	O.E.	Oil	— ..	"
64. Batu Kurau ..	40 K.W. ..	O.E.	Oil	— ..	"
65. Bruas ..	26 K.W. ..	O.E.	Oil	— ..	"
66. Kati ..	13 K.W. ..	O.E.	Oil	— ..	"
67. Padang Rengas ..	26.5 K.W. ..	O.E.	Oil	— ..	"
68. Bagan Serai ..	180 K.W. ..	O.E.	Oil	— ..	"
69. Grik ..	60.5 K.W. ..	O.E.	Oil	— ..	"
70. Selama ..	40 K.W. ..	O.E.	Oil	— ..	"
71. Trong ..	4.8 K.W. ..	O.E.	Oil	— ..	"

## APPENDIX III.

## STATISTICS OF UNITS GENERATED AND SOLD 1949/1950.

Stations.	Units generated and/or purchased.	Units used on works.	Units lost in transformers.	UNACCOUNTED FOR		UNITS SOLD.						Two-part Tariff.	Total Units Sold.
				Units.	% of column 2.	Domestic Light and Power.	Lighting other than Domestic.	Public Lighting.	LARGE POWER CONSUMERS.				
									Commercial and Industrial.	Dredges.	Open Cast Mines.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NORTHERN REGION.													
Taiping .. .. .	3,825,819	73,215	101,280	391,206	9.96	1,080,932	1,007,841	245,717	925,628	—	—	—	3,260,118
Kangar .. .. .	145,420	2,094	—	10,733	7.38	24,934	76,683	8,241	22,735	—	—	—	132,593
Klian Intan .. .. .	29,189	—	—	1,950	3.68	6,724	14,707	5,808	—	—	—	—	27,239
Ipo .. .. .	12,132,741	51,293	163,205	1,484,535	12.23	2,917,089	2,589,796	612,049	4,314,774	—	—	—	10,433,708
Batu Gajah .. .. .	835,800	1,409	9,390	64,917	7.77	161,335	132,917	95,533	370,299	—	—	—	760,084
Tanjong Rambutan .. .. .	168,465	110	—	—	—	77,381	34,254	18,837	37,883	—	—	—	168,355
Sitiawan .. .. .	148,664	4,711	—	19,936	11.17	35,163	65,320	18,066	5,468	—	—	—	124,017
Cameron Highlands .. .. .	478,382	11,031	13,224	16,360	3.41	260,257	68,403	2,381	106,726	—	—	—	437,767
CENTRAL REGION.													
Kuala Lumpur .. .. .	a 130,961,158	9,651,230	383,446	16,114,446	12.33	8,044,298	8,558,039	827,016	12,764,144	24,844,658	642,397,520	90,053 b	97,525,723
Klang .. .. .	—	—	—	—	—	656,815	1,129,859	136,533	4,116,392	—	—	—	6,039,599
Kajang .. .. .	—	—	—	—	—	119,090	161,050	30,474	745,349	—	—	—	1,056,863
Rawang .. .. .	—	—	—	—	—	32,064	92,850	5,840	59,097	—	—	—	189,851
EASTERN REGION.													
Kuantan .. .. .	655,027	18,910	12,094	65,006	9.92	131,981	228,480	40,560	157,996	—	—	—	559,017
Pekan .. .. .	141,722	1,995	—	2,665	1.86	64,680	43,684	20,585	8,115	—	—	—	137,064
Kemaman .. .. .	91,624	1,991	—	5,296	5.77	25,236	51,372	7,645	82	—	—	—	84,337
Mentakab and Temerloh .. .. .	481,091	17,615	17,342	19,909	4.14	57,850	163,666	21,098	183,610	—	—	—	426,224
Bentong .. .. .	473,915	16,717	3,497	20,095	4.24	105,244	161,313	48,753	118,291	—	—	—	433,601
Fraser's Hill .. .. .	140,157	6,265	11,404	5,355	3.82	10,309	91,671	—	15,152	—	—	—	117,132
Raub .. .. .	426,473	10,406	4,986	35,996	8.44	110,108	152,617	22,234	90,126	—	—	—	375,085
Kuala Lipis .. .. .	702,013	8,552	15,062	73,530	10.47	186,492	181,331	39,171	197,875	—	—	—	604,869
Tanjong Malim .. .. .	312,431	18,045	—	26,178	8.37	44,831	99,988	14,022	109,367	—	—	—	268,208
Kuala Kubu Bharu .. .. .	273,905	16,240	19,400	16,210	5.92	75,345	91,677	18,644	36,380	—	—	—	222,046
Kota Bharu .. .. .	2,353,955	59,162	184,965	228,462	9.71	487,689	586,630	118,444	738,607	—	—	—	1,931,364
Kuala Krai .. .. .	144,951	7,044	—	15,452	10.66	19,137	67,836	12,083	23,396	—	—	—	122,435
Kuala Trengganu .. .. .	607,331	16,465	16,835	54,169	8.92	121,975	360,972	28,946	7,967	—	—	—	519,860
Dungun .. .. .	37,837	—	1,972	2,264	5.95	7,808	22,686	3,104	—	—	—	—	33,601

Continued on page 38.



APPENDIX III—(cont.)

STATISTICS OF UNITS GENERATED AND SOLD 1949/1950—(cont.)

Stations.	Units generated and/or purchased.	Units used on works.	Units lost in trans-formers.	UNACCOUNTED FOR		UNITS SOLD.						Two-part Tariff.	Total Units Sold.
						Domestic Light and Power.	Lighting other than Domestic.	Public Lighting.	LARGE POWER CONSUMERS.				
				Units.	% of column 2.				Commer-cial and Industrial.	Dredges.	Open Cast Mines.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
SOUTHERN REGION.													
Seremban .. .. .	5,441,320	35,488	123,354	602,795	11.08	1,159,019	976,202	220,315	1,145,272	1,178,875	—	—	4,679,683
Nilai .. .. .	24,628	1,997	—	850	3.45	2,253	17,845	740	943	—	—	—	21,781
Kuala Klawang .. .. .	47,324	1,239	—	2,815	5.95	9,947	24,836	7,675	812	—	—	—	43,270
Gemas .. .. .	556,447	11,372	2,874	39,474	7.09	71,160	125,644	21,568	284,355	—	—	—	502,727
Port Dickson .. .. .	682,677	21,614	28,863	72,734	10.65	356,961	91,954	20,344	90,207	—	—	—	559,466
Bahau .. .. .	21,133	814	—	—	—	1,540	16,767	1,541	471	—	—	—	20,319
Malacca .. .. .	4,217,628	126,835	133,857	927,708	21.99	701,456	1,203,519	171,674	952,579	—	—	—	3,029,228
Jasin .. .. .	70,305	3,157	—	1,124	1.60	22,052	28,867	10,344	4,761	—	—	—	66,024
Muar .. .. .	3,106,950	104,376	66,837	575,015	18.51	388,036	728,051	108,584	1,136,051	—	—	—	2,360,722
Batu Pahat .. .. .	1,711,583	60,987	25,491	242,454	14.17	299,986	581,652	92,445	408,568	—	—	—	1,882,651
Kluang .. .. .	1,657,341	35,582	23,634	125,608	7.58	219,141	620,726	47,833	584,817	—	—	—	1,472,517
Segamat .. .. .	920,213	38,587	—	50,756	5.52	25,248	376,102	44,096	385,424	—	—	—	880,870
Tangkak .. .. .	82,441	696	—	5,297	6.43	10,106	41,363	20,583	4,396	—	—	—	76,448
Johore Bahru .. .. .	6,287,091	166,476	191,607	556,223	8.89	1,000,410	1,751,618	261,907	2,265,850	—	—	—	5,369,785
Kota Tinggi .. .. .	236,039	8,628	13,688	26,433	11.19	35,078	99,801	32,009	20,402	—	—	—	187,280
	c 175,401,436	10,612,353	1,518,311	21,906,961	12.46	19,258,056	22,920,595	3,463,442	32,440,367	26,023,528	37,167,770	999,053	c 141,363,811

*a* Includes 3,578,253 units supplied free to Sungai Besi Mines under the terms of the 1933 Agreement for the purchase of the Ulu Langat Hydro Electric Station. *b* Includes Bulk Supply from Bungsar to Seremban 5,229,750. *c* Excludes Bulk Supply from Bungsar to Seremban 5,229,750.

## APPENDIX IV.

## NO. OF CONSUMERS, UNITS SOLD AND OTHER PARTICULARS RELATING TO AREAS SUPPLIED BY THE BOARD.

Station.	Popula- tion.	No. of Consumers.		Connected Load in K.W.						Units Sold 1-9-49-31-8-50.			Total Units Sold. 1-9-48- 31-8-49.	Units Sold per Head of Population.		
	(1947) Census.	31-8-49.	31-8-50.	Industrial.		Other.		Total.		Industrial.	Other.	Total.		1-9-49-31-8-50.		
				31-8-49.	31-8-50.	31-8-49.	31-8-50.	31-8-49.	31-8-50.					Indus- trial.	Other.	Total.
Taiping	41,361	2,579	2,738	1,027	1,055	2,060	3,966	3,087	5,021	925,628	2,334,490	3,260,118	3,222,583	22.88	56.44	78.82
Kangar	3,970	185	217	1	13	72	79	73	92	22,735	109,858	132,593	74,521	5.73	27.67	33.40
Klian Intan	1,694	66	76	—	—	20	23	20	23	—	27,239	27,239	19,893	—	16.08	16.08
Ipoh	80,894	5,001	5,402	4,537	5,085	7,256	8,107	11,793	13,192	4,314,774	6,118,934	10,433,768	9,667,678	53.33	75.65	128.98
Batu Gajah	7,480	466	492	178	184	405	432	583	616	370,299	389,785	760,084	659,359	49.51	52.11	101.62
T. Rambutan	5,453	327	325	13	13	144	143	157	156	37,883	130,472	168,355	200,140	6.95	23.92	30.87
Sitiawan	1,950	264	312	1	23	152	174	153	197	5,468	118,549	124,017	101,410	2.80	60.79	63.59
C. Highlands	2,596	185	203	16	16	276	281	292	297	106,726	331,041	437,767	178,829	41.12	127.52	168.63
Kuala Lumpur	197,213	12,609	14,335	22,561	27,766	14,117	15,442	36,678	43,208	80,096,370	17,429,353	97,525,723	74,137,584	406.14	88.38	494.52
Klang	45,841	2,117	2,264	3,743	4,131	1,143	1,287	4,886	5,418	4,116,392	1,923,207	6,039,599	5,060,703	89.80	41.95	131.75
Kajang	7,543	554	585	202	273	215	234	417	507	745,349	311,514	1,056,863	1,011,742	98.81	41.30	140.11
Rawang	3,106	292	306	65	65	162	167	227	232	50,087	180,754	189,851	167,496	19.02	42.10	61.12
Johore Bahru	38,826	2,734	2,954	300	376	3,280	3,733	3,580	4,109	2,265,850	3,103,935	5,369,785	4,654,259	58.36	79.94	138.30
Kota Tinggi	4,709	227	261	6	6	119	127	125	133	20,402	166,888	187,290	161,651	4.33	35.44	39.77
Batu Pahat	26,506	1,330	1,460	169	183	616	679	725	862	408,568	974,083	1,382,651	1,253,925	15.41	36.75	52.16
Kluang	15,954	665	717	107	133	551	586	658	719	584,817	887,700	1,472,517	1,221,793	36.66	55.64	92.30
Muar	34,195	1,765	1,905	568	588	853	897	1,421	1,485	1,136,051	1,224,671	2,360,722	2,043,372	33.22	35.81	69.03
Segamat	7,289	536	570	139	139	277	295	416	434	385,424	445,446	830,876	716,386	52.88	61.11	113.99
Malacca	54,507	3,535	3,793	523	816	1,835	1,945	2,358	2,761	952,579	2,076,648	3,029,228	2,575,128	17.48	38.10	55.58
Jasin	2,152	176	180	15	15	57	58	72	73	4,761	61,263	66,024	67,082	2.21	28.47	30.68
Seremban	35,274	2,579	2,729	749	835	4,317	4,455	5,066	5,290	2,324,147	2,355,536	4,679,683	3,072,313	65.89	66.78	132.67
Port Dickson	3,353	365	445	107	94	486	681	593	775	90,207	469,259	559,466	412,095	26.90	139.95	166.85
K. Klawang	1,307	112	113	1	1	55	57	56	58	812	42,458	43,276	19,451	0.59	31.06	31.65
Gemas	2,849	339	411	122	126	205	233	327	359	284,356	218,372	502,727	447,675	99.81	76.64	176.45
Nilai	581	64	69	3	3	19	21	22	24	943	20,838	21,781	11,605	1.62	35.87	37.49
Bahau	2,430	—	91	—	1	—	58	—	59	471	19,848	20,319	—	0.19	8.15	8.34
Tangkak	3,939	178	174	—	—	49	50	49	50	4,396	72,052	76,446	75,132	1.11	18.29	19.00
Kuantan	8,084	611	647	234	260	497	556	731	816	157,996	401,021	559,017	491,318	19.53	49.61	69.14
Pekan	1,695	212	228	3	9	109	131	112	140	8,115	128,949	137,064	110,349	4.79	76.07	80.86
Kemaman	2,419	220	260	4	—	65	78	69	78	82	84,255	84,337	39,761	0.03	34.83	34.86
Mentakah and Temerloh	5,169	353	371	48	59	156	174	204	233	183,610	242,614	426,224	296,875	35.52	46.94	82.46
Bentong	7,087	497	533	56	82	361	370	417	452	118,291	315,310	433,601	319,034	16.68	44.47	61.15
Fraser's Hill	882	81	82	37	37	138	147	175	184	15,152	101,986	117,132	102,661	17.18	115.62	132.80
Raub	3,616	347	428	47	58	283	309	330	367	90,126	284,959	375,085	325,295	24.92	78.81	103.73
Kuala Lipis	5,204	465	511	76	85	584	620	660	705	197,875	406,994	604,869	545,529	39.03	78.21	116.24
Tanjong Malini	3,527	321	340	33	19	148	153	181	172	109,367	158,841	268,208	181,655	31.01	45.03	76.04
Kuala Kubu Bharu	3,882	322	344	38	50	161	175	199	225	36,380	185,666	222,046	163,122	9.37	47.82	57.19
Kota Bharu	30,821	2,021	2,171	317	500	1,368	1,566	1,685	2,066	738,607	1,192,757	1,931,364	1,635,806	23.96	38.70	62.66
Kuala Krai	2,326	220	228	11	14	106	112	117	126	23,396	99,059	122,455	104,751	10.06	42.56	52.65
K. Trengganu	27,004	460	595	3	3	209	289	212	292	7,967	511,893	519,860	243,477	0.29	18.96	19.25
Dungun	4,256	75	140	—	—	24	47	24	47	—	33,601	33,601	31,547	—	7.91	7.91
Total	739,010	45,495	50,006	36,080	43,116	42,950	48,937	79,010	92,053	100,951,468	45,642,093	146,593,561	115,831,890	136.60	61.76	198.36

# APPENDIX V.

## MONTHLY OUTPUT OF THE BOARDS POWER STATIONS AND BULK PURCHASES, 1949/50.

Output in Millions of Units (KWh).

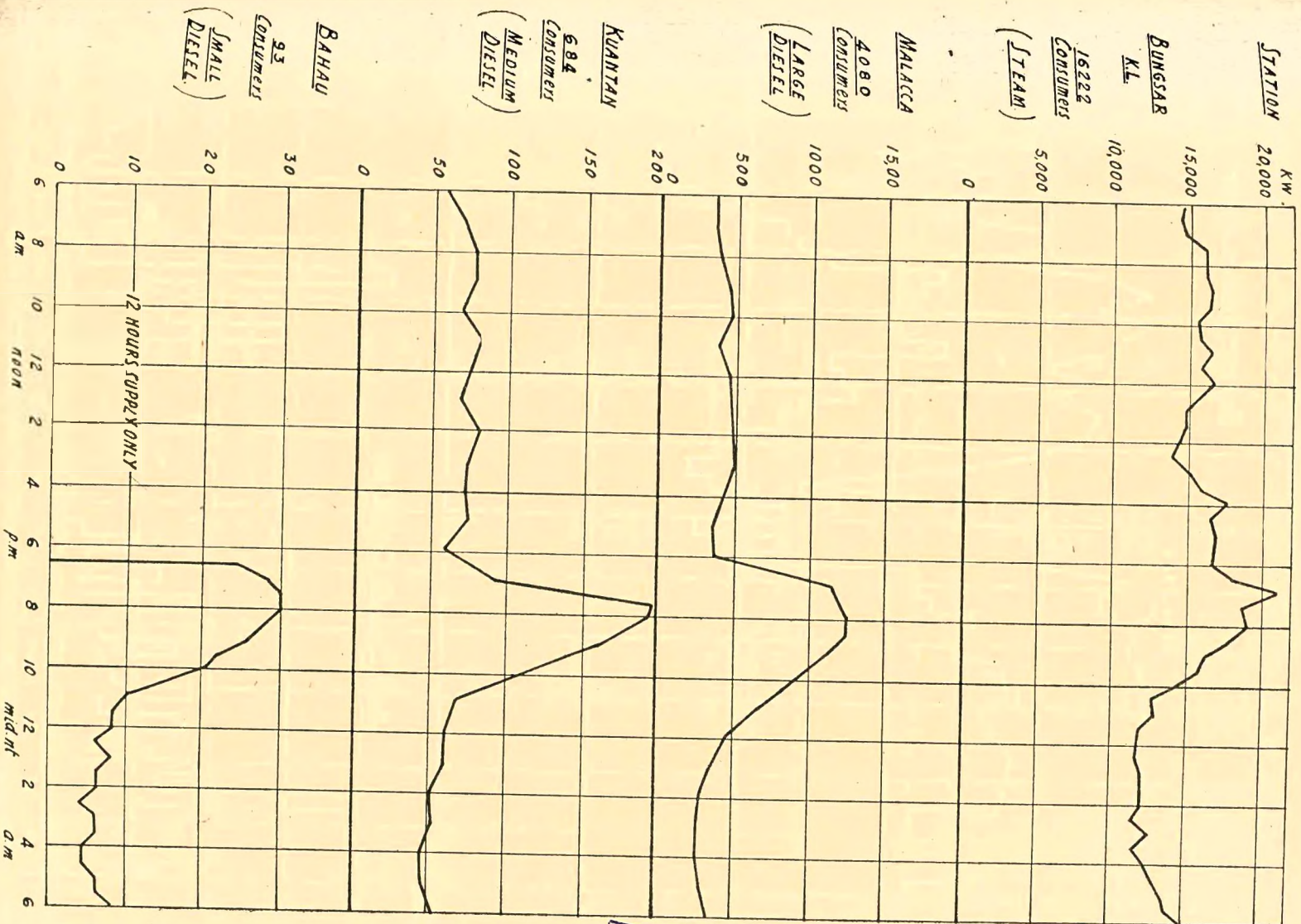
Nature of Station.	1949.				1950.								Total.
	Sep- tember.	Octo- ber.	Novem- ber.	Decem- ber.	Janu- ary.	Febru- ary.	March.	April.	May.	June.	July.	August.	
Steam .. ..	7.9	8.3	8.3	8.8	8.9	9.2	10.3	10.3	10.4	10.2	11.2	11.3	115.1
Hydro .. ..	1.4	1.6	1.6	1.6	1.5	.8	.8	1.0	1.3	1.3	.8	.7	14.4
Diesel .. ..	2.3	2.4	2.4	2.5	2.5	2.3	2.6	2.5	2.7	2.6	2.7	2.4	29.9
Bulk Purchases ..	1.0	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.6	2.0	16.0
Total ..	12.6	13.5	13.5	14.1	14.1	13.5	15.0	15.1	15.8	15.5	16.3	16.4	175.4



# TYPICAL DAILY LOAD CURVES

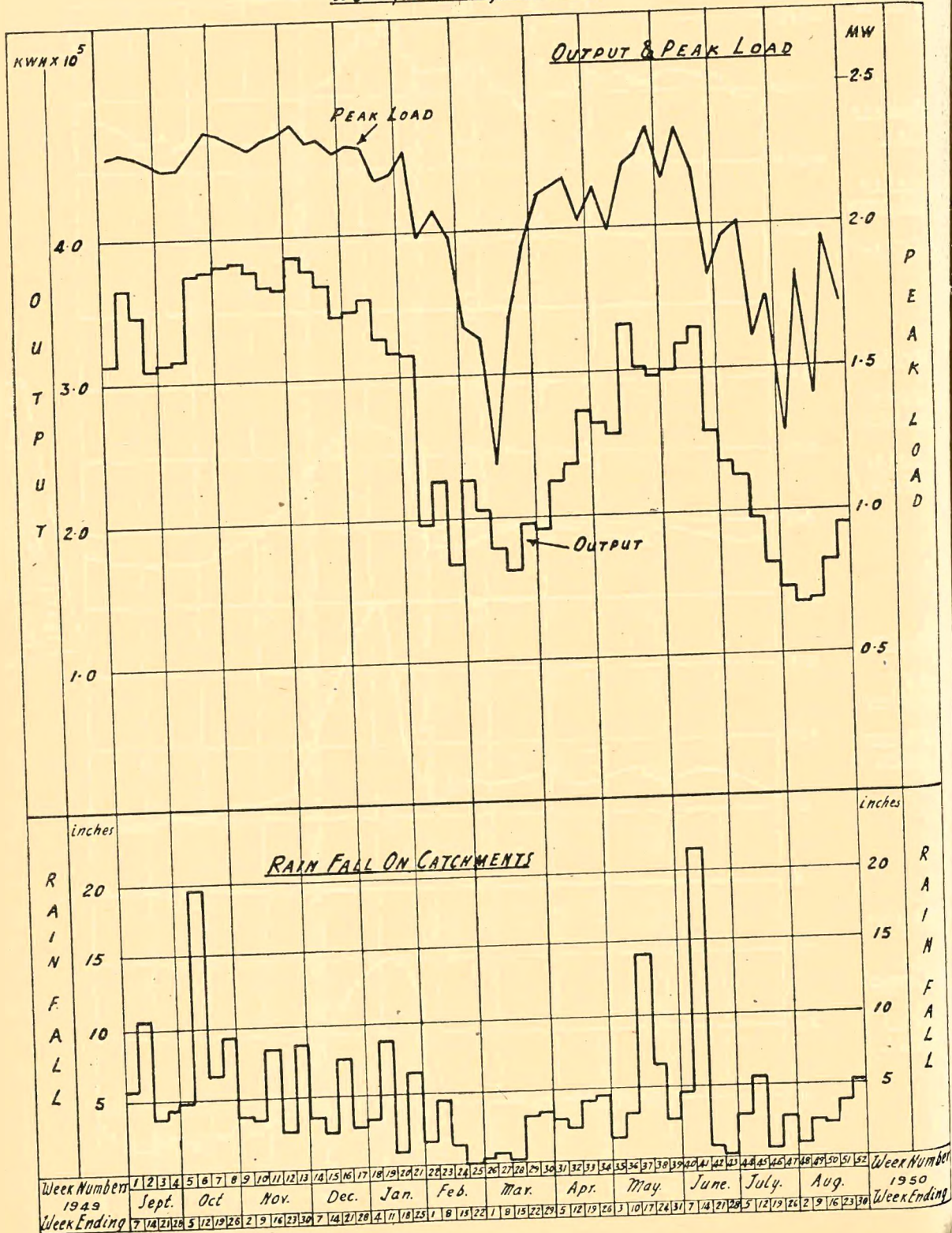
Year Ending 31st August 1950

Appendix VI



IKATAN RESOURCE CENTRE  
TENAGA NASIONAL BERHAD  
JALAN SERDANG  
43009 KAJANG  
SELANGOR

ULU LANGAT  
HYDRO-ELECTRIC P.S.  
Weekly Operating Conditions.





## APPENDIX VIII.

## SUB-STATIONS OF THE CENTRAL ELECTRICITY BOARD AS AT 31-8-50.

Voltage of Transformer Stations.	Number in Commission.	Total Capacity in K.V.A.	Increase in Capacity over preceding year in K.V.A.	Under Construction or rehabilitation. No. K.V.A.
66 K.V. .. ..	—	—	—	—
33 K.V. .. ..	83	57,285	11,550	—
22 K.V. .. ..	2	7,000	3,000	—
11 K.V. .. ..	76	47,671	3,185	1-2,000
6.6 K.V. .. ..	53	8,295	50	14-3,950
5.5 K.V. .. ..	22	4,100	50	10- 900
3.3 K.V. .. ..	4	200	—	3- 375
2.2 K.V. .. ..	22	1,005	—	—
Totals .. ..	262	125,556	17,835	5- 363
				33-7,588

NOTE.—(i) Step up transformers in power stations, etc., are included in the category of the higher voltage.

(ii) In Power Stations all transformers of similar ratio are considered as forming one "Sub-station".

## APPENDIX IX.

## EXTENT OF TRANSMISSION AND DISTRIBUTION SYSTEMS OF THE CENTRAL ELECTRICITY BOARD AT 31-8-50.

Voltage of Transmission Lines.	Length in Miles.	Increase over preceding year in miles.	Length Under Construction in miles.	
66 K.V. O/Head ..	—	—	—	
33 K.V. O/Head ..	150.00	12.00	—	
22 K.V. U/Ground ..	2.54	2.50	—	
11 K.V. O/Head ..	40.18	1.83	18.12	
11 K.V. U/Ground ..	62.68	9.42	.48	
6.6 K.V. O/Head ..	5.75	—	3.80	
6.6 K.V. U/Ground ..	54.15	.06	1.31	
5.5 K.V. O/Head ..	8.80	—	6.00	
5.5 K.V. U/Ground ..	17.00	—	—	
3.3 K.V. O/Head ..	1.00	—	—	
3.3 K.V. U/Ground ..	1.50	—	—	
2.2 K.V. O/Head ..	5.60	—	2.50	
2.2 K.V. U/Ground ..	9.50	—(a)	—	(a) Decrease 3.00
Totals .. ..	358.70	25.81	32.21	3.00
Net Increase .. 22.81				

## APPENDIX X.

## APPARATUS HIRED AS AT 31-8-50.

Region.	Cookers.	Water Heaters.	Ceiling Fans.	Table Fans.	Refri-gerators.	Motors.	
						No.	H.P.
Northern ..	281	267	989	185	15	6	97
Central ..	396	553	2,145	64	70	186	9,222
Southern ..	153	375	1,851	57	84	80	747
Eastern ..	105	135	700	62	24	26	203
Total .. ..	935	1,330	5,685	368	193	298	10,269



APPENDIX XI.

UNITS GENERATED/SOLD/REVENUE, PRICE/UNIT SOLD, NO. OF CONSUMERS, UNITS/CONSUMER.

UNITS GENERATED/SOLD/REVENUE, PRICE/UNIT SOLD, NO. OF CONSUMERS, UNITS/CONSUMER										
Authority.	Year.	Units		Revenue.		Av. Price per unit sold.		No. of Consumers.	Units sold per Consumer.	Remarks.
		Generated.	Sold.	\$x1,000	£x1,000	Cents.	Pence.			
Fed. Malay States	1926	6,321,508	5,279,954	998.8	116.7	18.90	5.30	5,034	1,048	} Slump Years
"	1927	7,400,000	6,380,147	1,087.1	126.9	17.10	4.80	5,818	1,100	
"	1928	17,550,067	14,155,371	1,531.4	178.7	10.80	3.15	7,503	1,888	
"	1929	28,008,729	24,138,549	2,280.1	266.1	9.45	2.64	11,153	2,075	
"	1930	31,760,297	26,367,689	2,494.4	291.0	9.45	2.64	13,975	1,890	
"	1931	28,282,491	22,472,361	2,275.9	265.5	10.12	2.83	15,794	1,423	
"	1932	24,671,710	28,770,116	1,960.8	228.8	10.45	2.93	16,576	1,133	
"	1933	27,168,168	19,508,997	1,810.7	211.3	9.28	2.60	16,570	1,176	
"	1934	41,091,933	31,150,958	2,208.2	257.6	7.10	1.99	17,675	1,760	
"	1935	57,797,454	46,038,830	2,661.0	310.4	5.79	1.62	18,561	2,475	
"	1936	83,080,165	68,982,094	3,233.6	377.3	4.69	1.31	20,237	3,400	
"	1937	91,013,387	78,111,585	3,596.7	419.6	4.61	1.29	21,981	3,550	
"	1938	71,495,668	60,010,165	3,242.7	378.3	5.40	1.51	23,485	2,575	
"	1939	74,503,421	55,785,393	3,205.4	374.0	5.74	1.61	25,555	2,180	
"	1940	121,503,012	97,887,501	4,326.2	504.7	4.43	1.24	25,836	3,780	
"	1941	..	..	..	..	..	..	..	..	} Not available
"	1945	..	..	..	..	..	..	..	..	
Malayan Union and F. of M. ..	1946	63,895,899	49,007,752	4,379.2	510.9	8.96	2.50	41,537	1,108	9 months 1-4-46-31-12-46 only
"	1947	102,533,237	80,011,234	7,478.9	872.5	9.35	2.62	41,751	1,920	
"	1948	123,957,654	96,910,878	9,182.6	1,071.3	8.57	2.40	46,153	2,100	
C.E.B. ..	1-9-49-31-8-50	175,401,436	141,363,811	13,639.5	1,593.0	9.65	2.70	50,006	2,827	

## APPENDIX XII.

ANALYSIS OF GROSS UNITS GENERATED IN THE FEDERATION FOR THE  
PERIOD 1-9-49 TO 31-8-50.

Type of Prime Mover.	(1) Units Generated by Public Utilities.		(2) Units Generated by Private Mining Installations.		(3) Total Units Generated in the Federation (1)+(2).	
	Millions.	Percentage.	Millions.	Percentage.	Millions.	Percentage.
Steam ..	238.073	48.7	40.993	37.1	279.066	46.5
Diesel ..	36.096	7.4	31.700	28.7	67.796	11.3
Hydro ..	215.921	43.9	37.795	34.2	253.716	42.2
Total ..	490.091	100%	110.490	100%	600.578	100%

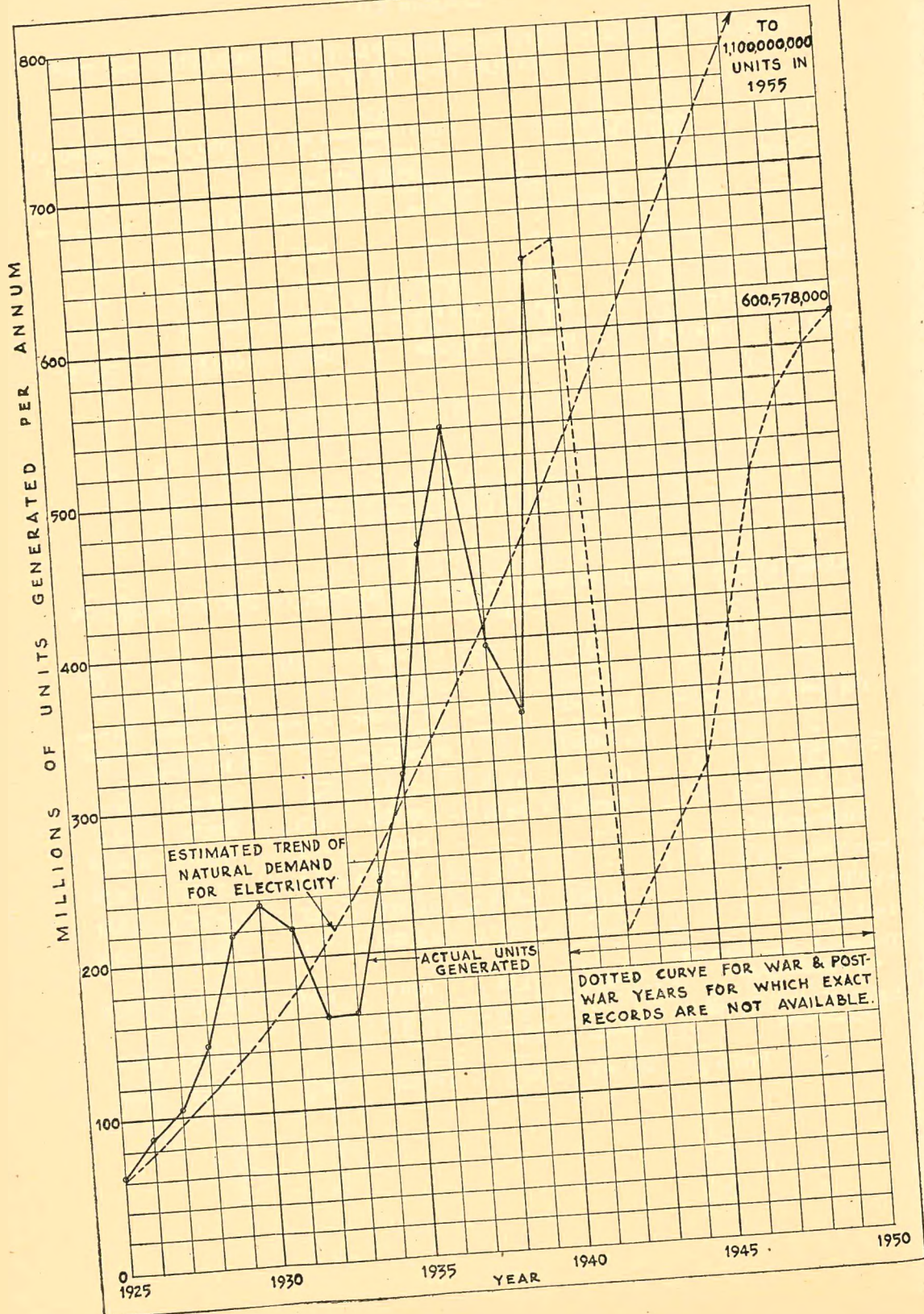
## APPENDIX XIIA.

ANALYSIS OF UNITS USED FOR VARIOUS PURPOSES IN THE FEDERATION  
1-9-49 TO 31-8-50.

Purpose Units Used for	(1) Units Produced by Public Supplies. In millions.		(2) Percen- tages.		(3) Units Produced by Private Installations. In millions.		(4) Percen- tages.		(5) Total Units used in the Federation Col. (1)+Col. (3). In millions.		(6) Percen- tages.	
Tin Mining :												
Dredging ..	138.931	32.18			35.289	30			174.220	31.7		
Open Cast ..	174.326	40.38			51.465	43.8			225.791	41.1		
Under-ground ..	—	—			14.642	12.4			14.642	2.66		
Iron Mining ..	—	—			1.535	1.3			1.535	0.28		
Coal Mining ..	4.104	0.95			10.233	8.7			14.337	2.61		
Gold Mining ..	—	—			4.570	3.8			4.570	0.83		
Industrial and Commer- cial Installations ..	48.985	11.29			0.016	0.01			49.001	8.92		
Lighting and Domestic Installations ..	65.633	15.2			—	—			65.633	11.9		
Totals ..	431.981	100%			117.752	100%			549.733	100%		



# GROWTH OF GENERATION OF ELECTRICITY IN THE FEDERATION 1925-1950





APPENDIX XIII.

# CENTRAL ELECTRICITY BOARD OF THE FEDERATION OF MALAYA BALANCE SHEET AS AT 31st AUGUST, 1950.

IKATAN RESOURCE CENTRE  
TELAGA BOLEK BIRHAD  
JALAN BERA G  
430.9 BERA G  
SELANGOR DARUL EHSAN

The Colonial Development Corporation has agreed to make further advances amounting to \$27,771,428 to the Board on the security of the Corporation's assets.

The Colonial Development Corporation has agreed to make further advances amounting to \$27,771,428 to the Board on the security of 4 per cent. Debenture Stock. Note No. II gives further particulars of this agreement.

The explanatory notes on the Accounts, Numbers I to VII form an integral part of this Balance Sheet.

W. D. GOMMALL,  
Chairman.

\$7,604,160  
By Board of Directors

F. P. EGERTON,  
*Deputy Chairman.*

K. REED,  
Secretary and Chief Accountant.

## NOTES ON THE ACCOUNTS.

Note No I.

Note No 1.  
 AMOUNT PROVIDED FOR COMPENSATION PAYABLE TO THE GOVERNMENT OF THE FEDERATION  
 OF MALAYA IN RESPECT OF ASSETS VESTED IN THE BOARD.  
 Section 1049 provides :

Section 32 of the Electricity Ordinance, 1949, provides:

Section 32 of the Electricity Ordinance, 1949, provides :  
 " As soon as practicable after the commencement of this Ordinance, the Board shall create and shall, by way of compensation for the transferred undertakings, issue to the Chief Secretary, Federation of Malaya, incorporated by the Chief Secretary (Incorporation) Ordinance, 1949, to hold for the purposes of the Federal Government, ordinary stock of a total nominal value to be agreed upon by and between the High Commissioner in Council and the Board ".

Subject to the grant of satisfactory titles to the land formerly occupied by the Electricity Department and now occupied by the Board, it has now been agreed that Ordinary Stock amounting to \$30,000,000 will be issued to Government in respect of the compensation.

*Note No. II.*

ADVANCE FROM COLONIAL DEVELOPMENT CORPORATION.

ADVANCE FROM COLONIAL DEVELOPMENT CORPORATION.

1. The Colonial Development Corporation has agreed to advance to the Board £3,580,000 (\$30,685,714) on the security of 4 per cent. Debenture Stock redeemable on the 31st December, 1960, or at the option of the Board at any time after the 31st December, 1950. The debenture when issued will be a floating charge on the Board's assets and undertakings.

2. The Board has also agreed upon receipt from the Corporation of three months' notice in writing requiring it so to do, to redeem all or any part of the debenture stock which may then be outstanding by the issue to the Corporation of fully paid Ordinary Stock of the Board equivalent to the nominal value of the Debenture Stock so required to be redeemed on the same terms and conditions as apply to all other Ordinary Stock then outstanding and in satisfaction of all rights of the Debenture Stock so redeemed.

3. Advances made by the Colonial Development Corporation under this agreement amounted to £340,000 (\$2,914,286) on the 31st August, 1950.

*Note No. III.*

### CURRENT LIABILITIES AND PROVISIONS.

	CURRENT LIABILITIES	\$ 67,708	
Provision for :		115,629	
Pensions .. .. .		64,306	
Leave Pay and Passages .. .. .		48,591	
Gratuities (Daily rated employees) .. .. .			\$ 296,284
Local Authority Assessment .. .. .			787,698
			307,495
			4,003
General Creditors for Revenue Expenditure .. .. .			
General Creditors for Capital Expenditure .. .. .			
General Creditors for Renewals Expenditure .. .. .			
Federal Government :		\$ 1,794	
W. & O. P. Contribution .. .. .		205,056	
Pension Contribution .. .. .		1,777	
Comptroller of Income Tax .. .. .		154	
Family Remittances .. .. .		13,354	
Custodian of Enemy Property .. .. .		45,529	
Crown Agents Payments .. .. .			267,664
	TOTAL		\$1,663,094



## NOTES ON THE ACCOUNTS—(cont.)

## Note No. IV.

LAND .. \$1,570,750.

Section 29 of the Electricity Ordinance, 1949, provides :

" 29. (1) Upon the commencement of this Ordinance all public undertakings shall be deemed to have been transferred to, and shall vest in, the Board.

(2) Such transfer shall extend to the whole of such undertakings and shall include all plant, lands, works and other property, movable or immovable, assets, powers, rights and privileges held or enjoyed in connection therewith or appertaining thereto.

(3) For the purposes of this section all land reserved, under the provisions of any written law relating to land, for the purpose of a public undertaking shall, upon the commencement of this Ordinance, be deemed to be reserved for the purpose of the Board, and such purpose shall be deemed to be a public purpose accordingly. Except as specifically provided in this sub-section, every such reserve shall continue subject to the provisions of the written law relating to land applicable to such reserve."

2. Subject to the grant of satisfactory titles to the land formerly occupied by the Electricity Department and now occupied by the Board, the sum of \$30,000,000 has been agreed as the amount of Ordinary Stock to be issued to the Government of the Federation of Malaya in respect of the properties transferred to the Board by the provisions of Section 32 of the Electricity Ordinance. This amount includes the sum of .. \$1,146,852 for land.

Land purchased by the Board during the year ending 31st August, 1950, .. .. 423,898  
cost the sum of .. .. .. \$1,570,750

## 3. Land occupied by the Board includes :

- (a) State or Crown Land not gazetted as a Reserve for the Electricity Department.
- (b) State or Crown Land which has been gazetted as a Reserve for the Electricity Department.
- (c) Land which was in the course of acquisition at the time when the Board was established.
- (d) Land acquired by the Board since the 1st September, 1949.

With regard to land in category (a) all States and Settlements have been asked :

- (i) to record the occupation of the Board in the Land Registers and
- (ii) for an assurance that the Board will be consulted prior to the alienation of State or Crown Land occupied by the Board.

With regard to land in category (b) it is proposed to negotiate with the States and Settlements for a formal grant to the Board of an appropriate title.

4. It is anticipated that in the near future a conference with the State and Settlement Authorities will be held in order to ensure that the position of the Board in regard to State and Crown Land occupied by the Board is adequately safeguarded.

## Note No. V.

## FIXED ASSETS.

Description of Asset.	At cost 1st September, 1949.	Additions during year ended 31st August, 1950.	Less Sales and amounts written off.	Amount at 31st August, 1950.
Land .. .. .	\$ 1,146,852	\$ 423,898	\$ —	\$ 1,570,750
Generation : .. .. .	1,437,113	29,771	—	1,466,884
Buildings .. .. .	7,620,870	382,519	29,248	7,974,141
Machinery .. .. .				
Work-in-Progress— .. .. .				
Connaught Bridge Power .. .. .	1,834,009	2,852,759	—	4,686,768
Station .. .. .	39,964	23,951	—	63,915
Hydro Electric Investigation .. .. .				



## NOTES ON THE ACCOUNTS—(cont.)

## Note No. V—(cont.)

Description of Asset.	Fixed Assets—(cont.)		Less Sales and amounts written off.	Amount at 31st August, 1950.
	At cost 1st September, 1949.	Additions during year ended 31st August, 1950.		
Distribution:				
Sub-stations .. ..	3,352,110	154,761	—	3,506,871
Mains and Services .. ..	9,818,607	794,439	55,000	10,558,046
Motors .. ..	796,527	108,809	4,500	900,836
Work-in-Progress—Transmission Line .. ..	287,730	89,923	—	377,653
General:			1,750	1,598,135
Apparatus on hire .. ..	1,428,647	171,238	—	444,862
Mechanical Transport and other vehicles .. ..	411,288	33,574	—	248,960
Furniture and Fittings .. ..	168,611	80,349	—	225,479
Tools and Implements .. ..	206,979	28,500	—	420,690
Other Buildings .. ..	387,076	33,614	—	1,283,892
Quarters and Labourers Lines .. ..	1,016,598	267,294	—	556
Private Telephone .. ..	556	—	—	—
	<u>29,953,537</u>	<u>5,475,399</u>	<u>90,498</u>	<u>35,338,438</u>
				<u>9,387,570</u>
				<u>25,950,868</u>

## Less Renewals Provision ..

## Note No. VI.

## STORES.

Stores in hand at the 31st August, 1950, are shown in the Balance Sheet at cost which amounts to \$3,485,021. The officers in charge of various stations have certified the book values which in the aggregate agree with the figure entered in the Balance Sheet.

2. Committees of Survey of responsible officers of the Board who are not employed in or in charge of the Stores concerned have checked the actual stores with the books at various times during the year and any shortages have been written off and excesses brought on charge.

## Note No. VII.

## DEBITORS—MISCELLANEOUS.

Amounts due in respect of Work undertaken for Government Departments and the General Public		
Sundry Debtors. Hire Purchase Electric Kettles .. ..	.. ..	\$339,074
Rantau Transmission Line .. ..	.. ..	198
Rent Collectable .. ..	.. ..	13,053
Crown Agents Claims Account .. ..	.. ..	21
Federal Government:		
Amounts recoverable in respect of—		
Gratuities .. ..	.. ..	\$ 2,177
Leave Pay and Passage .. ..	.. ..	80,283
Inspection Branch Fees and Recoverable Expenditure .. ..	.. ..	9,216
Refund of Pre-War Deposits .. ..	.. ..	2,169
Interest accrued due in respect of Treasury Bills .. ..	.. ..	3,526
East African Current Account .. ..	.. ..	34
Insurance Premium .. ..	.. ..	108
Medical Installation, Johore Bahru .. ..	.. ..	1,877
		99,390
TOTAL .. ..		<u>\$456,910</u>

# APPENDIX XIV.

## CENTRAL ELECTRICITY BOARD, FEDERATION OF MALAYA.

REVENUE ACCOUNT FOR THE YEAR ENDED 31ST AUGUST, 1950.

Expenditure.	Per Unit Sold	Amount.	Income.	Per Unit Sold	Units.	Amount.
	Cents.	\$		Cents.		\$
<b>To GENERATION EXPENSES :</b>			<b>By SALES OF ELECTRICITY :</b>			
Fuel and Purchase of Current—			Domestic Light and Power	16.82	10,258,056	3,230,540
Boiler Fuel Oil		2,490,707	Lighting Other than Domestic	20.87	22,920,505	4,784,280
Coal		740,814	Public Lighting	17.25	3,403,442	597,050
Purchase of Current		1,020,063				
Fuel Oil		114,058				
Oil Waste, Water and Engine Room Stores	3.53	258,482				
Salaries	.08	643,051	<b>Power Consumers—</b>			
Wages	.19	29,512	Commercial and Industrial	5.67	32,440,367	1,838,308
Repairs and Maintenance—	.46	150,317	Dredges	4.17	28,023,528	1,085,703
Buildings, Roads, Sidings and Compound		7,180	Open Cast Mines	4.14	37,167,770	1,537,561
Plant and Machinery		29,884	Two Part Tariff	7.72	90,053	6,947
Travelling Expenses	.11	3,609				
Mechanical Transport	.02		<b>Total Electricity Sales</b>	9.26	141,363,811	13,000,138
General Charges						
<b>Total Generation Expenses</b>	4.41	6,230,170	Rentals of Apparatus			
			Profit on Contract Work and Sale of Stores			200,440
<b>To DISTRIBUTION EXPENSES :</b>			Rentals on Quarters and Furniture	.39		160,671
Salaries	.31	444,343	Interest Received			10,821
Wages	.39	548,139	Profit on Exchange			24,813
Repairs and Maintenance—			Miscellaneous			59,344
Main and Services	.07	95,604				
H.T. Lines, B.P.S. to Seremban	.01	25,070				
H.T. Line, B.P.S. to Klang	.02	449				
Sub-station Machinery and Equipment	.06	29,159				
Public Lighting	.03	84,743				
Meters	.06	42,320				
Apparatus on Hire	.01	79,096				
Buildings, Roads, Sidings and Compound		10,929				
Instruments and Testing Equipment	.01	57				
Small Tools and Equipment	.02	9,857				
Travelling Expenses	.08	26,558				
Mechanical Transport		113,786				
General Charges		4,227				
<b>Total Distribution Expenses</b>	1.07	1,514,337				
<b>To MANAGEMENT EXPENSES :</b>						
Salaries	.46	646,578				
Wages	.03	39,211				
Repairs and Maintenance—	.04	60,172				
Quarters and Labourers Lines	.53	745,961				
<b>Management Expenses—(cont.)</b>						
<b>Generation and Distribution Expenses</b>						
(Carried forward)	5.48	7,744,507				
			Carried forward	9.65	141,363,811	13,639,533





## APPENDIX XV.

ACCOUNTS FOR THE YEAR ENDED 31st AUGUST, 1950.

AUDITORS' REPORT TO THE CHAIRMAN AND MEMBERS OF THE CENTRAL  
ELECTRICITY BOARD, FEDERATION OF MALAYA.

We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit. In our opinion proper books of account have been kept by the Board so far as appears from our examination of those books and proper returns adequate for the purposes of our audit have been received from district offices not visited by us.

We have examined the annexed Balance Sheet and Revenue Account which are in agreement with the Books of Account and returns. We have not seen title deeds to the properties vesting in the Board under Section 29 of the Electricity Ordinance, 1949, of the Federation of Malaya. In our opinion and to the best of our information and according to the explanations given to us, the Balance Sheet gives a true and fair view of the state of the affairs of the Board at the 31st August, 1950, and the Revenue Account gives a true and fair view of the results of its operations for the year ended on that date.

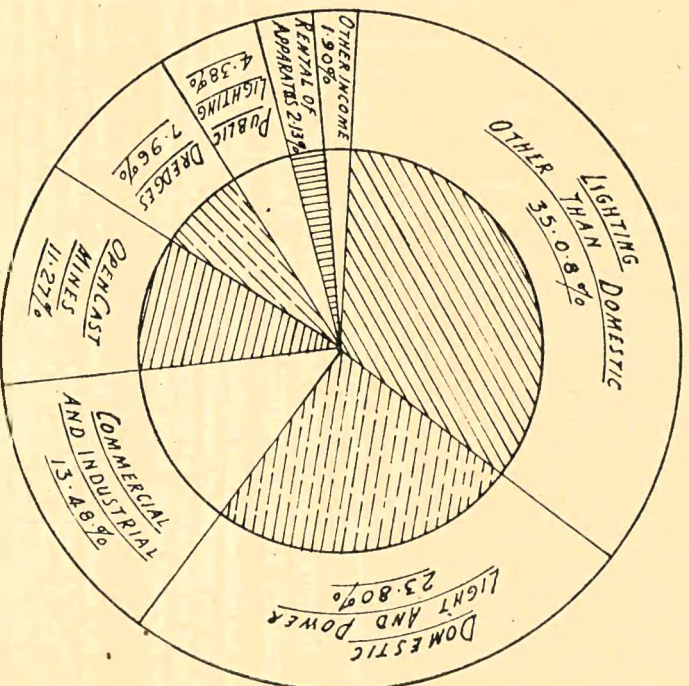
KUALA LUMPUR,  
14th April, 1951.

PRICE WATERHOUSE & Co.,  
Chartered Accountants,  
Auditors.

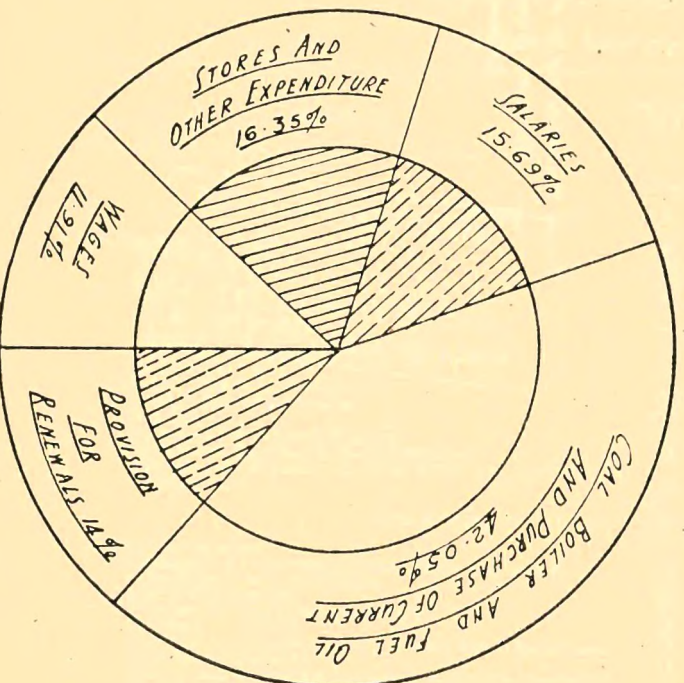


RELATIVE PROPORTIONS OF THE MAIN CLASSES OF REVENUE  
AND EXPENDITURE FOR THE YEAR 1949/50

REVENUE



EXPENDITURE



# APPENDIX XVII.

## TARIFFS.

### Schedule Rates

1. Rates for energy consumed for lighting, fans and domestic appliances not separately metered, per Board of Trade Unit :

(1) By consumers in Kuala Lumpur and District,  
Kajang, Klang, Port Swettenham, Rawang,  
Ipoh, Batu Gajah and Seremban—

	Cents.	Pence.		Temporary Surcharge.
The first 50 units per month .. .. .	22	6.16	per unit.	15% Ipoh and Batu Gajah 20% all other stations
The next 200 units per month .. .. .	18	5.04	"	" " " "
The next 200 units per month .. .. .	15	4.20	"	" " " "
Each additional unit per month .. .. .	10	2.80	"	" " " "

(2) By consumers in Fraser's Hill for houses subject  
to non-continuous occupation .. .. .

16 4.48 per unit. 20% .. ..

In addition to a standing charge as follows—

Per single bedroom per mensem .. .. .	\$1.50	3s. 6d.	20% .. ..
Per double bedroom per mensem .. .. .	\$3.00	7s. 0d.	" " " "

(3) By consumers in all other towns and villages—

	Cents.	Pence.		
The first 50 units per month .. .. .	25	7.00	per unit.	15% Tanjong Rambutan and Klian Intan 20% all other stations
The next 200 units per month .. .. .	20	5.60	"	" " " "
The next 200 units per month .. .. .	15	4.20	"	" " " "
Each additional unit per month .. .. .	10	2.80	"	" " " "

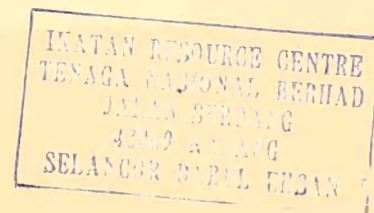
2. Rates for energy consumed for cooking, heating, motors, motor generators, lifts and other power purposes separately metered, per Board of Trade Unit :

	Cents.	Pence.		Temporary Surcharge.
The first 1,000 units per month .. .. .	5	1.40	per unit.	15% Ipoh, Batu Gajah, 30% Kuala Lumpur
The second 1,000 units per month .. .. .	4½	1.26	"	Klian Intan and Tanjong and Dist. Seremban,
Each additional unit per month .. .. .	4	1.12	"	Rambutan Klang, Rawang,
				Port Swettenham
				Kajang

3. (1) For public lighting the charge for energy consumed including switching, maintenance and relamping shall be 15 cents (4.20d) per Board of Trade Unit .. ..

(2) General Mining Rate 4.25 cents (1.19d) per unit .. .. Nil.

15%







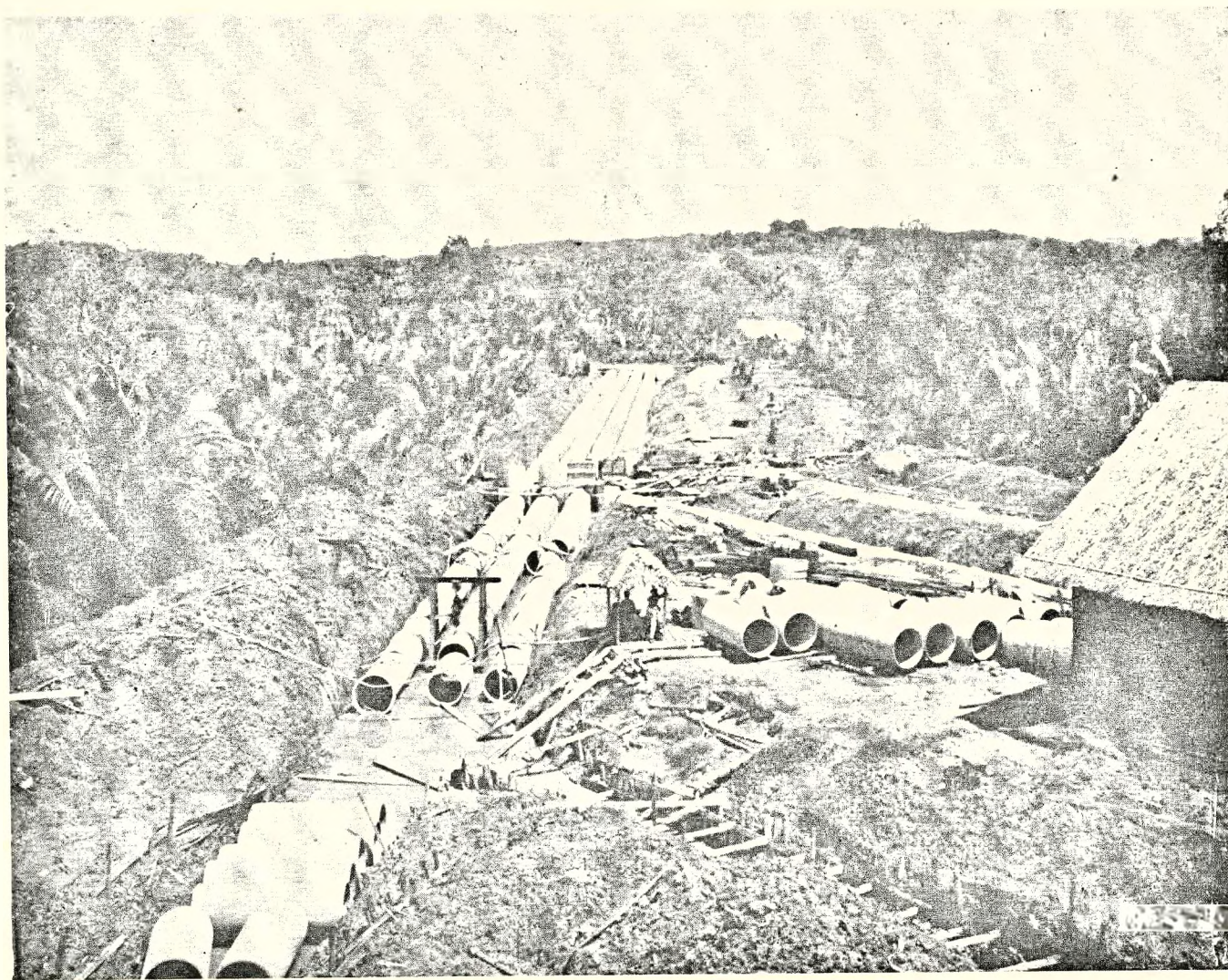
CONNAUGHT BRIDGE POWER STATION.  
The site before work commenced.





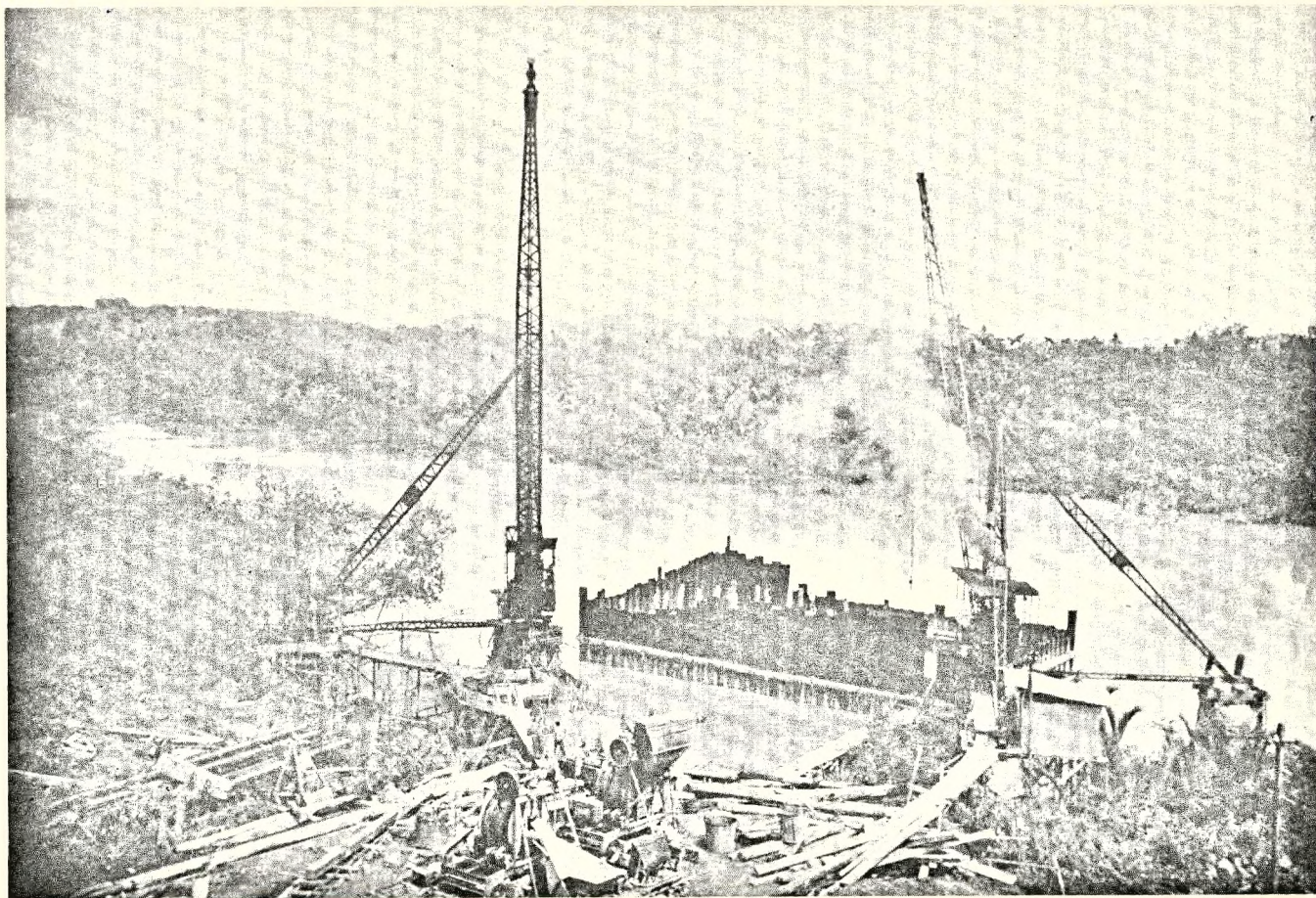
CONNAUGHT BRIDGE POWER STATION.  
Excavating the circulating water outlet pipe trenches through Swamp.





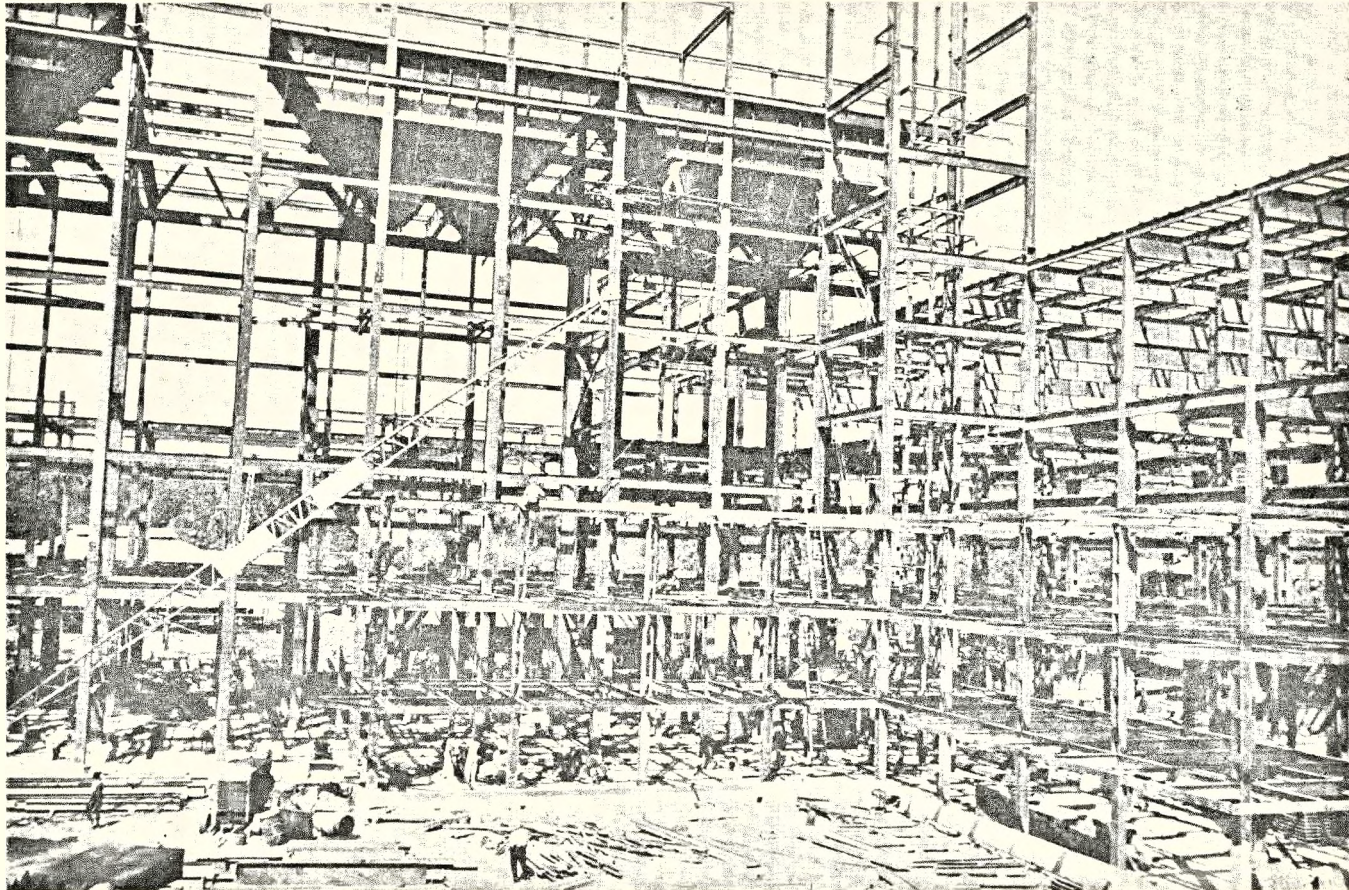
CONNAUGHT BRIDGE POWER STATION.  
Circulating water outlet pipes.





CONNAUGHT BRIDGE POWER STATION.  
Coffer Dam for construction of the circulating water intake monolith.

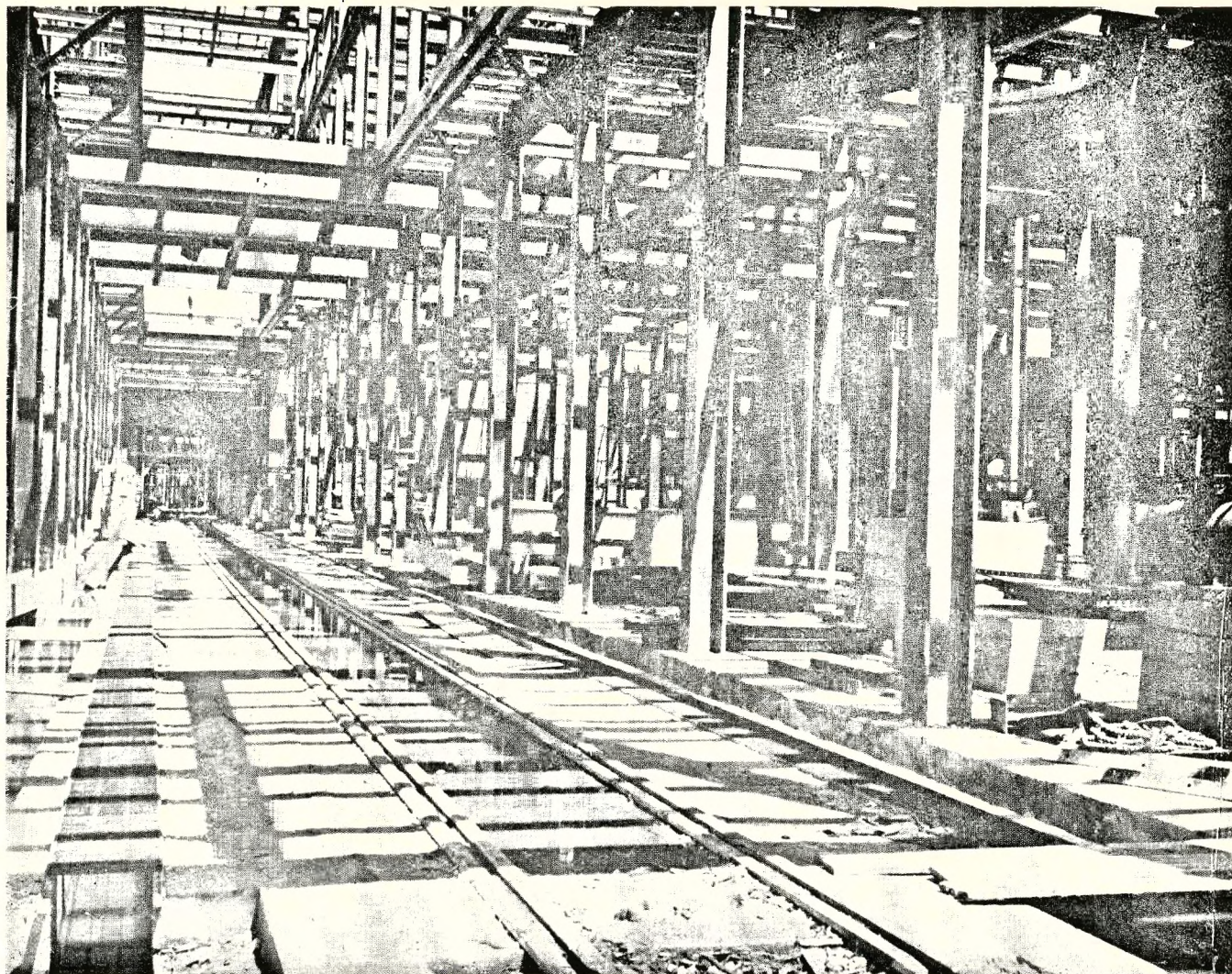




CONNAUGHT BRIDGE POWER STATION.  
General view of steel work showing coal bunkers.

IKATAN RESOURCE CENTRE  
TENAGA NASIONAL BERHAD  
JALAN SERDANG  
43069 KAJANG  
SELANGOR DARUL EHSAN

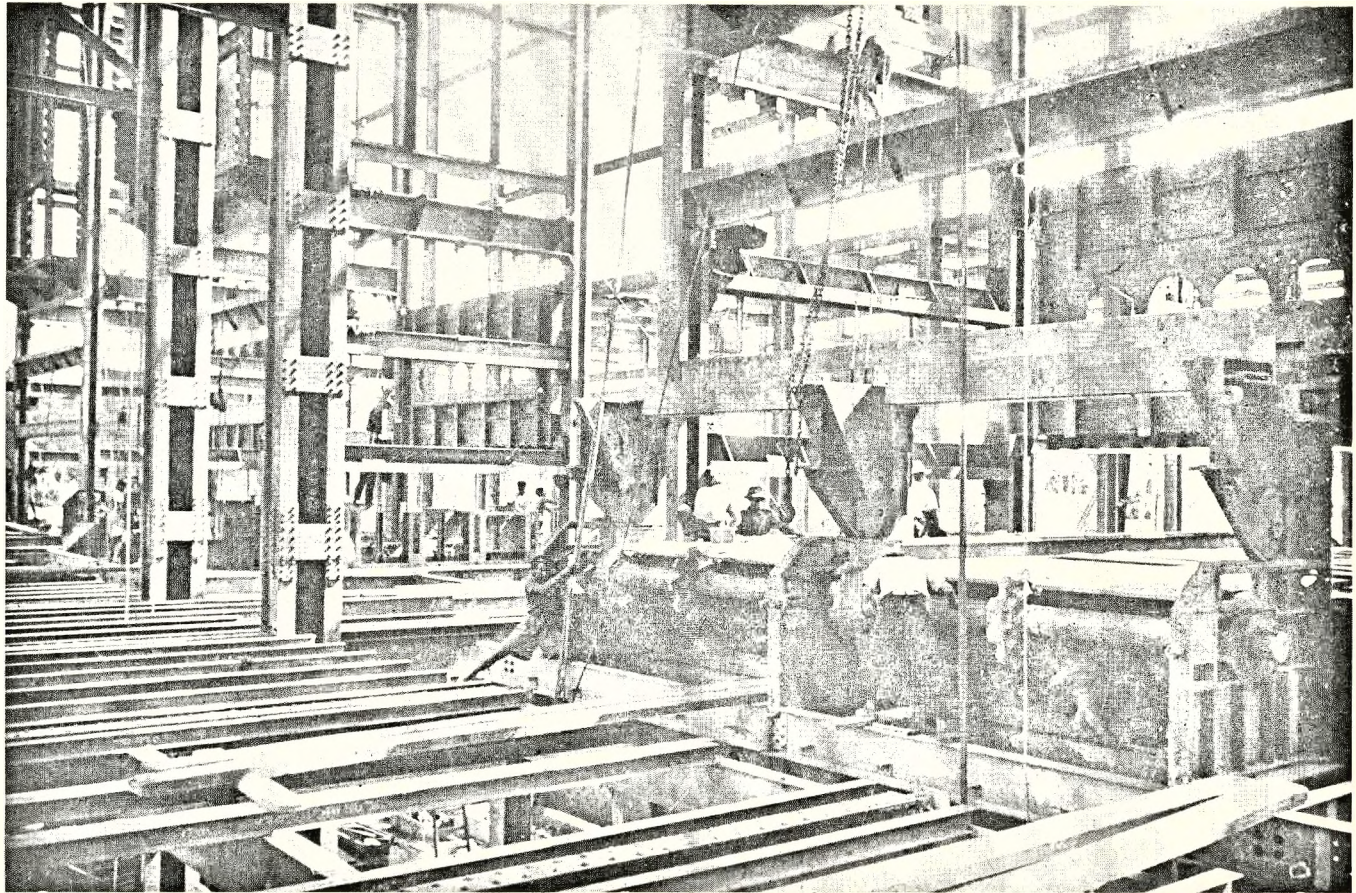




CONNAUGHT BRIDGE POWER STATION.

Internal view of steel work looking down the Loading Bay with boiler house to the right. On extreme right may be seen an Ash Hopper and a Boiler Drum ready for lifting into position.



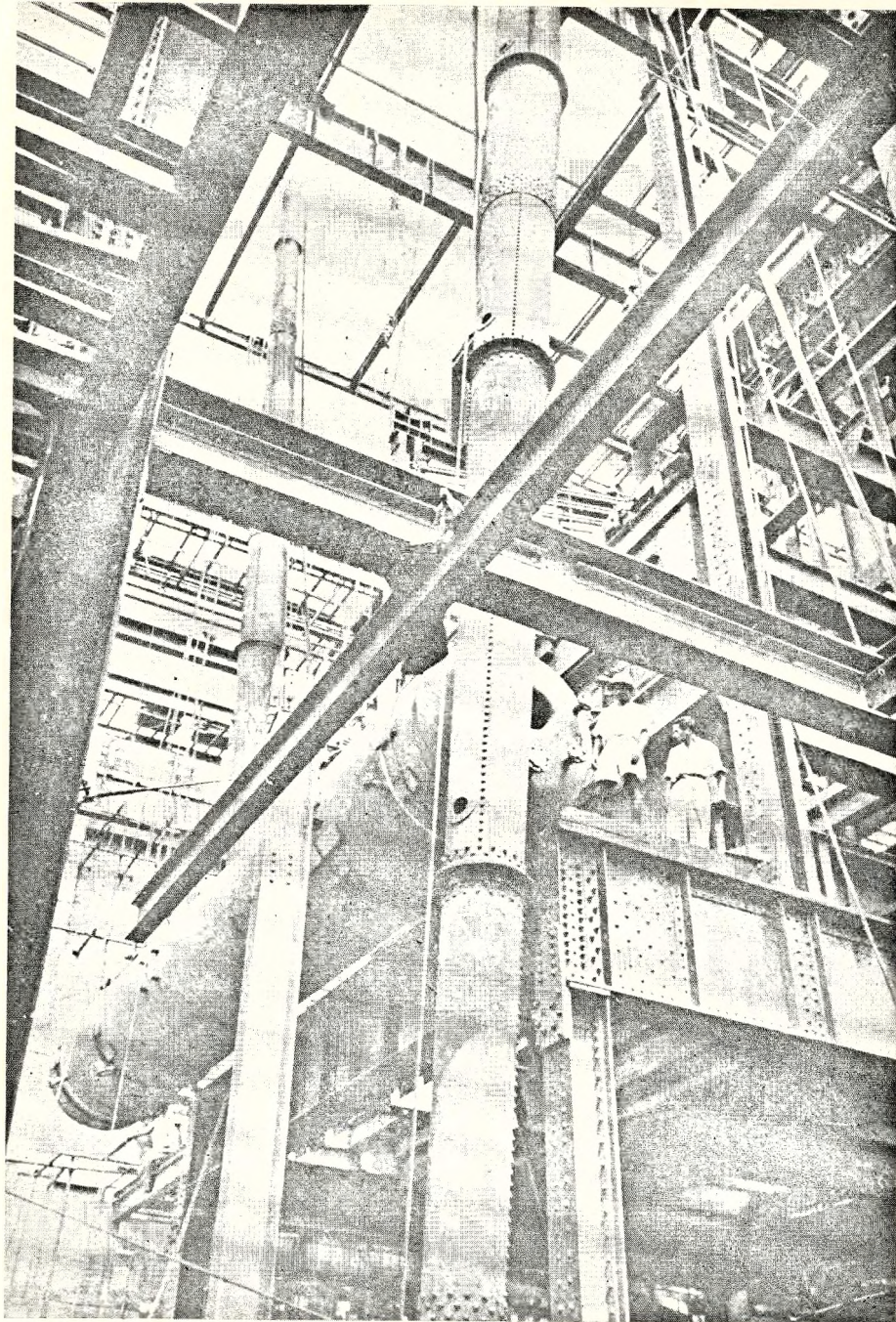


CONNAUGHT BRIDGE POWER STATION.

Boiler House firing floor showing chain grate stoker in course of erection.

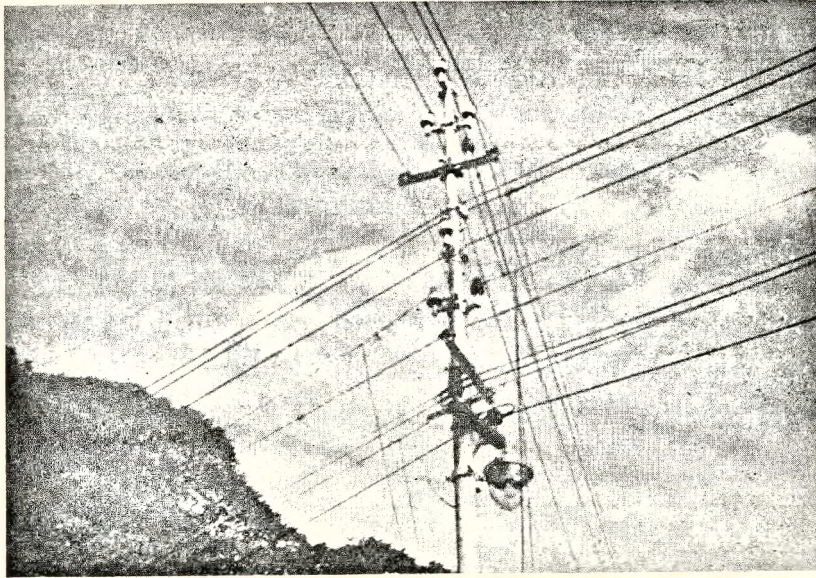
IKATAN RESOURCE CENTRE  
15 AGA NASIONAL BERHAD  
JALAN SERDANG  
43009 KAJANG  
SELANGOR DARUL EHSAN



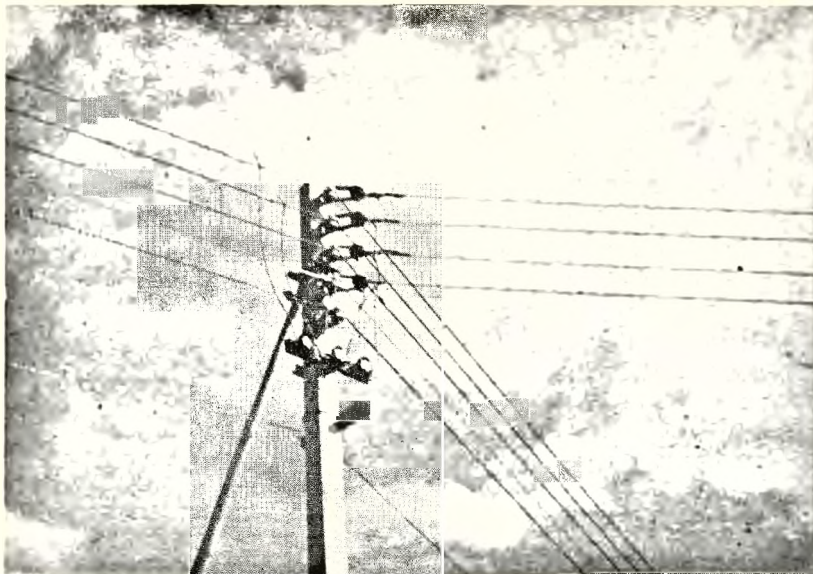


CONNAUGHT BRIDGE POWER STATION.  
Lifting a boiler drum.

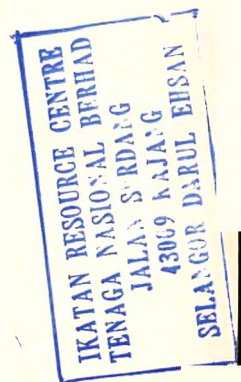




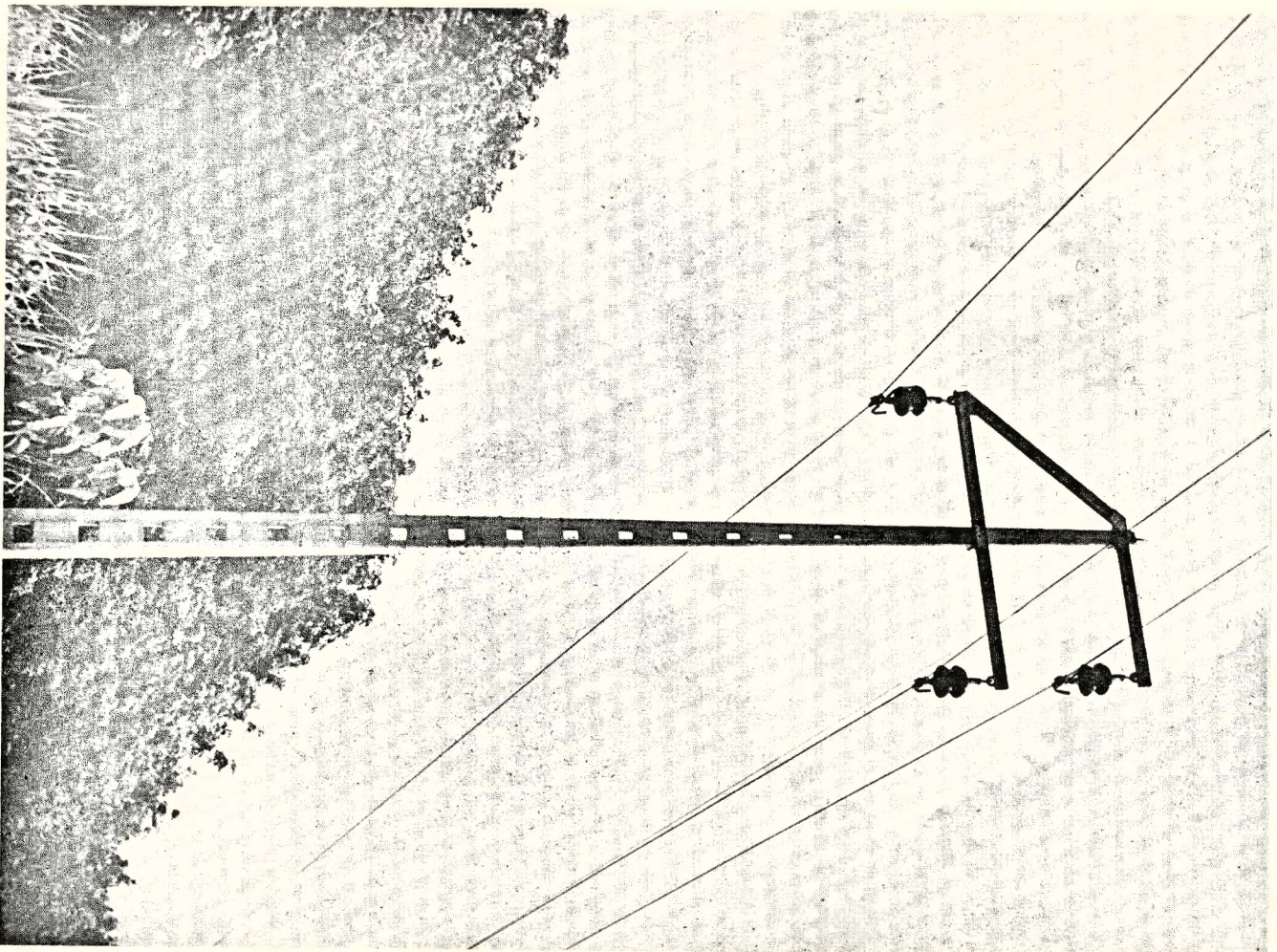
LOW TENSION MAINS.  
Old Style, Steel Pole, Horizontal Formation, Split Neutral.



LOW TENSION MAINS.  
New Style, Concrete Pole, Vertical Formation Single Neutral.  
(Note:—Yorkshire Type Service Fuses and "Rediffusion"  
Distributor Beneath).

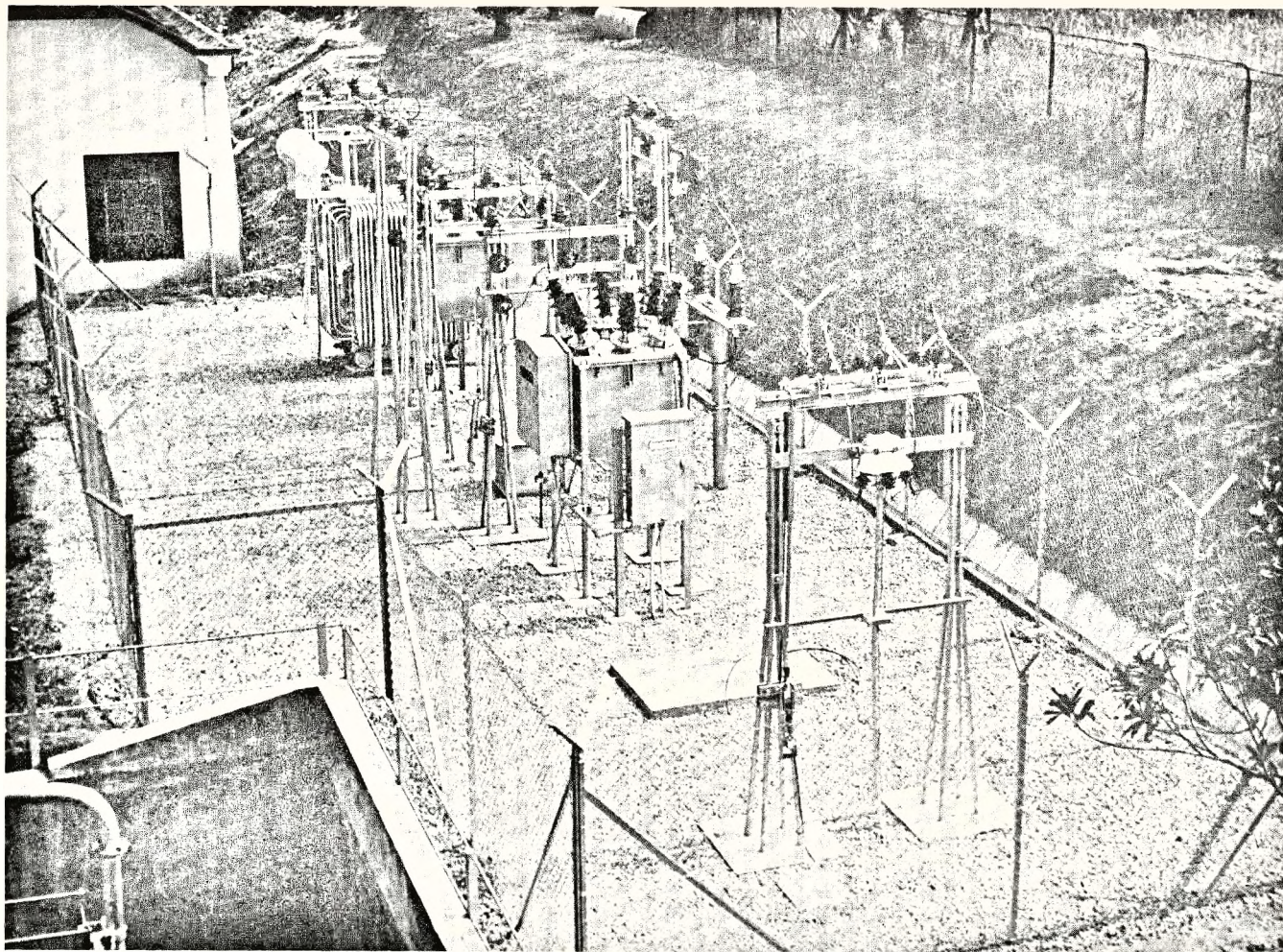






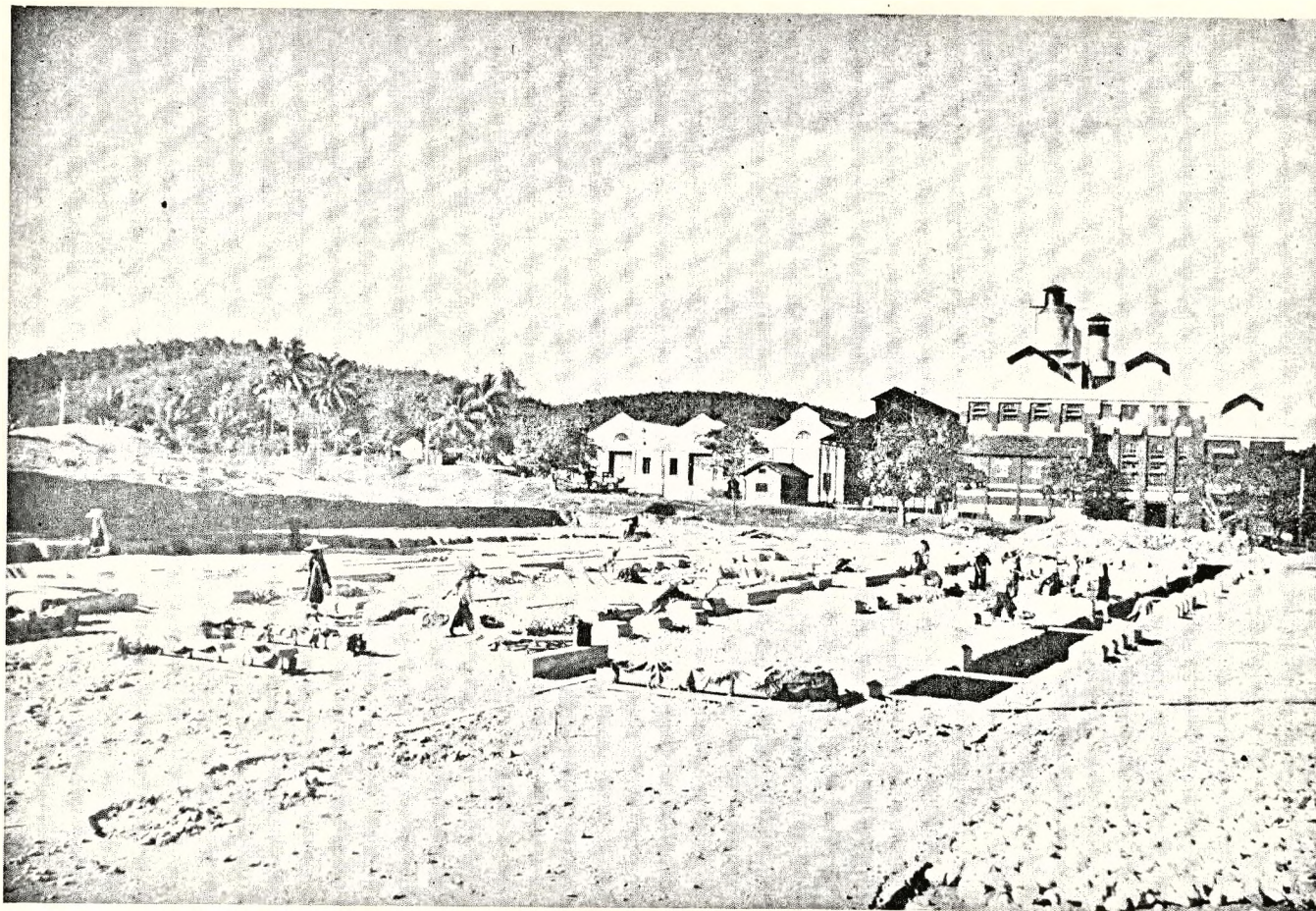
SINGAPORE-JOHORE BHARU.  
22 KV TRANSMISSION LINE.  
Typical Straight Line Concrete Pole.





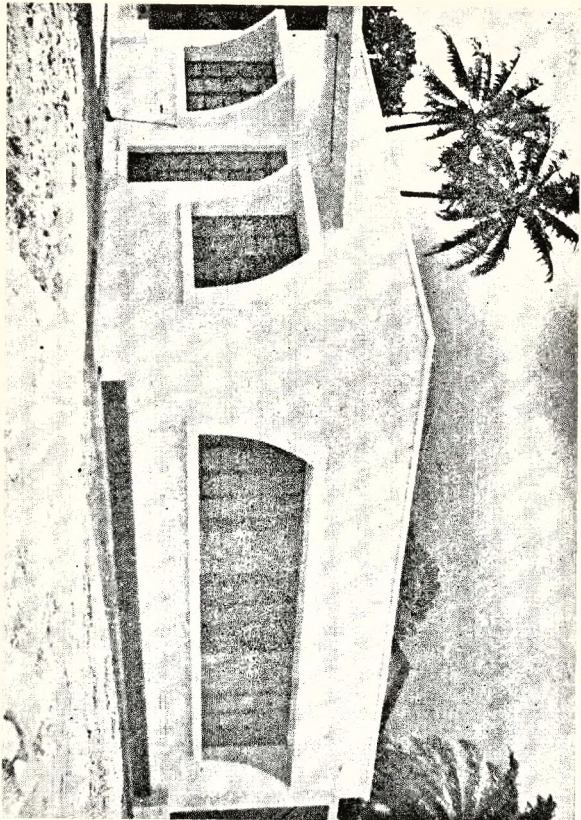
RECEIVING SUB-STATION, JOHORE BHARU.  
22/6.6 KV 300 KVA.  
One 1500 KVA transformer not yet installed.



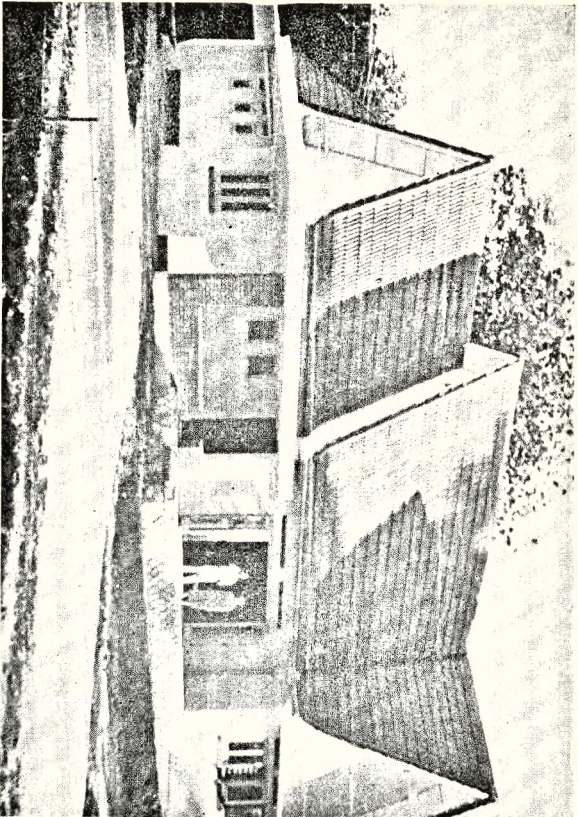


BUNGSAR POWER STATION.  
Construction of the 66/11 KV sub-station for interconnection with Connaught Bridge  
Power Station in progress in the foreground.



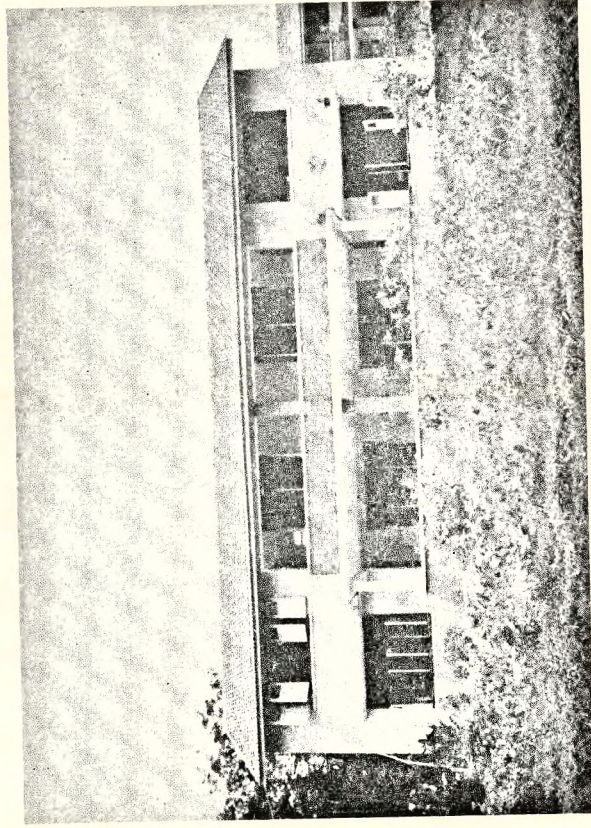


DISPENSARY AT BUNGSAR,  
KUALA LUMPUR.

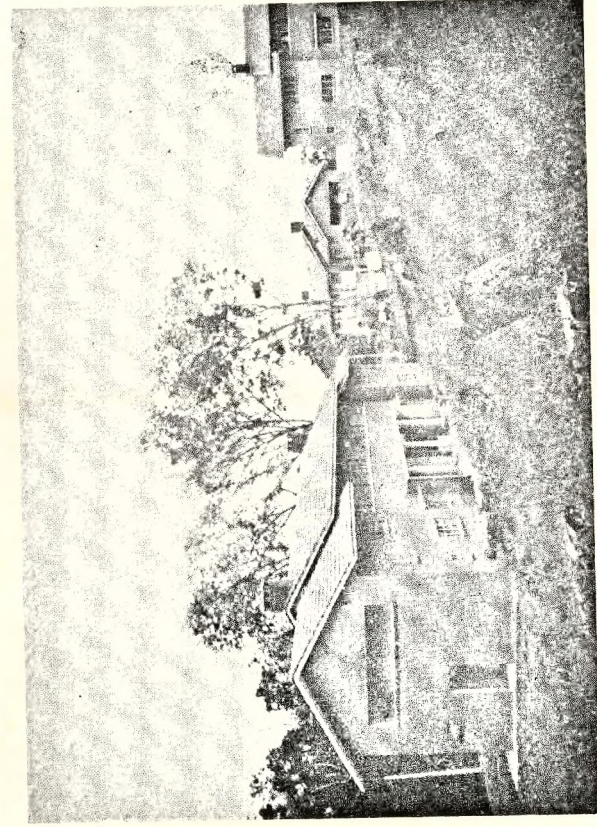


CLASS "C" BUNGALOW.





CLASS "E" SEMI-DETACHED HOUSES.



CLASS "D" SEMI-DETACHED HOUSES.



