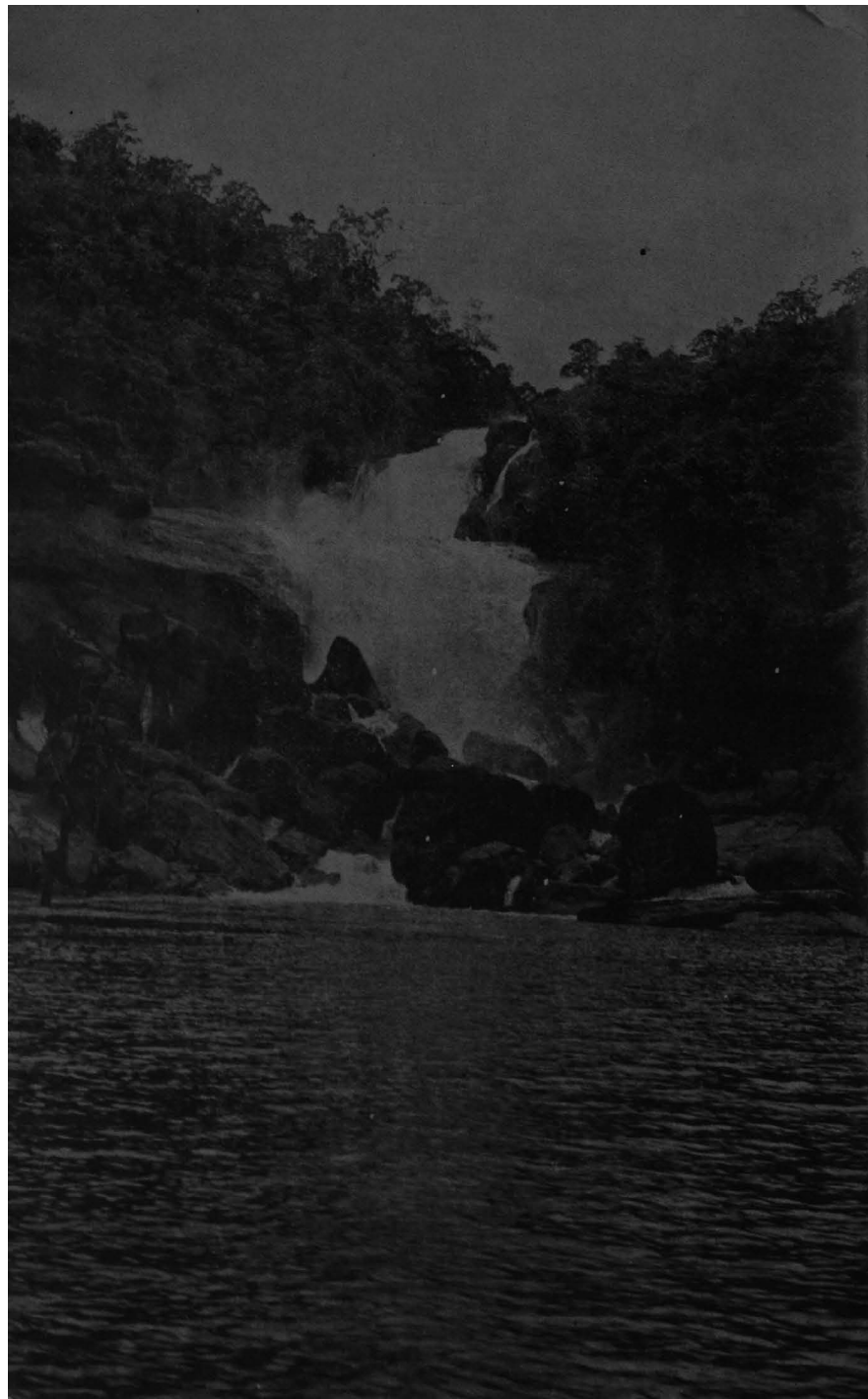
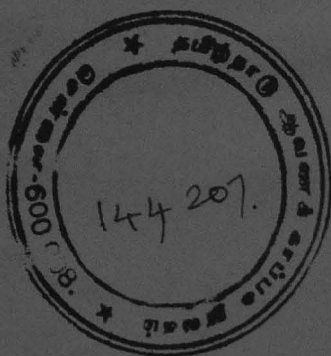


POWER
SUPPLY
IN MADRAS STATE



POWER SUPPLY IN MADRAS STATE



By
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1950.

Opposite Page
Banathirtham falls on
Thambraparni river

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PYKARA RIVER



General Outline

Madras State ranks third in India in the matter of electricity supply, Bombay and West Bengal leading. Electricity is available in practically all municipal towns and in 1,600 villages in the State.

76% of the power output is from Government hydro-electric stations and the rest from thermal stations.

Installed capacity of generating plant in the State totals 183,000 K.W. Peak demand in 1949-50 was 131,500 K.W. Generation in 1949-50 was 612 million units.

The power network comprises 6,100 miles of high tension lines of voltages varying from 11,000 to 110,000 and 6,500 miles of low tension distribution lines.

History

Power generation in the Madras State until about 1908 was confined mainly to a few tiny plants in tea estates run on water power, and to the small hydro installation at Kateri in the Nilgiris for making cordite.

The first public electric supply in the State was commenced in Madras City in 1909 by the Madras Electric Supply Corporation under licence. The next one was in Ootacamund in 1925 by the Municipality also under licence.

Real progress dates from 1925 when Sir C. P. Ramaswami Iyer as Member of Council in charge of Electricity of the Government of Madras initiated the policy of active development of the power resources by the State. He was responsible for the creation in 1927 of the Government Electricity Department and for starting the Pykara Hydro-electric Scheme.

The Department under its first Chief Engineer, Sir Henry Howard, built the Pykara Hydro Scheme in 1933, the Mettur Hydro Scheme in 1937, the Visakhapatnam Thermal Scheme in 1938 and the Vijayavada Thermal Scheme in 1939.

Later in 1944 the Papanasam Hydro-electric Scheme was completed. In 1947 the Madras City Electricity Undertaking was taken over by the Department from the licensee on the expiry of the licence period.

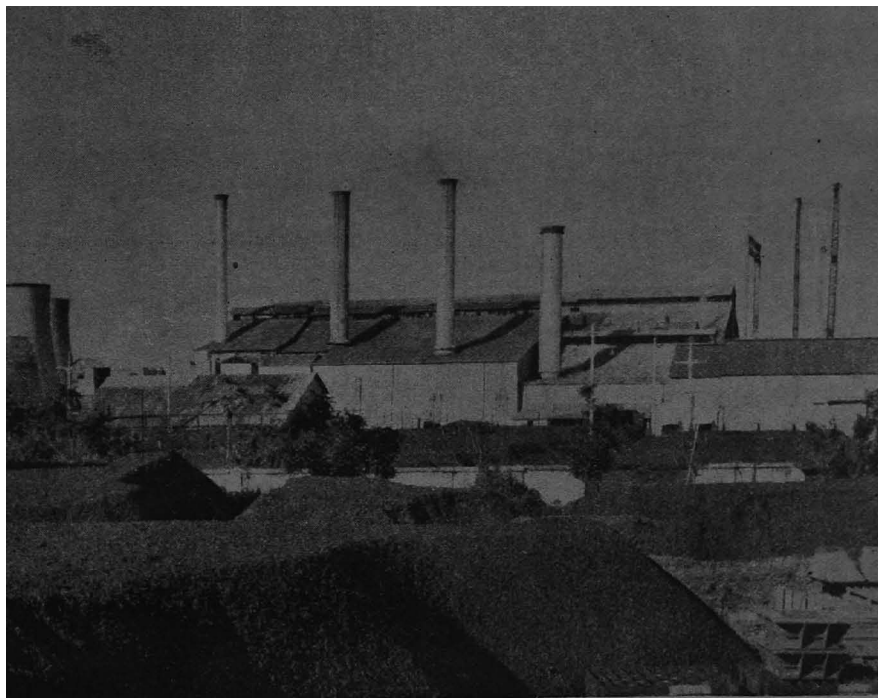
Agency of Supply

Electricity Supply in Madras State at present is in the hands of three agencies.

(1) The Government Electricity Department which generates 99% of the total output in the State and distributes to the ultimate consumer about 70% of it over a widely extended network. Majority of the large industrial concerns like textile mills, cement factories, steel rolling mills, chemicals, shipbuilding yards, railways, workshops and tea factories get supply direct from Government.

(2) 31 municipal or other local body licensees all of whom are distributors in their areas of bulk power received from the Government Electricity Department.

(3) 43 private company licensees of whom 9 are self-generating and the rest distributors of bulk power received from the Government Electricity Department.



MADRAS THERMAL STATION

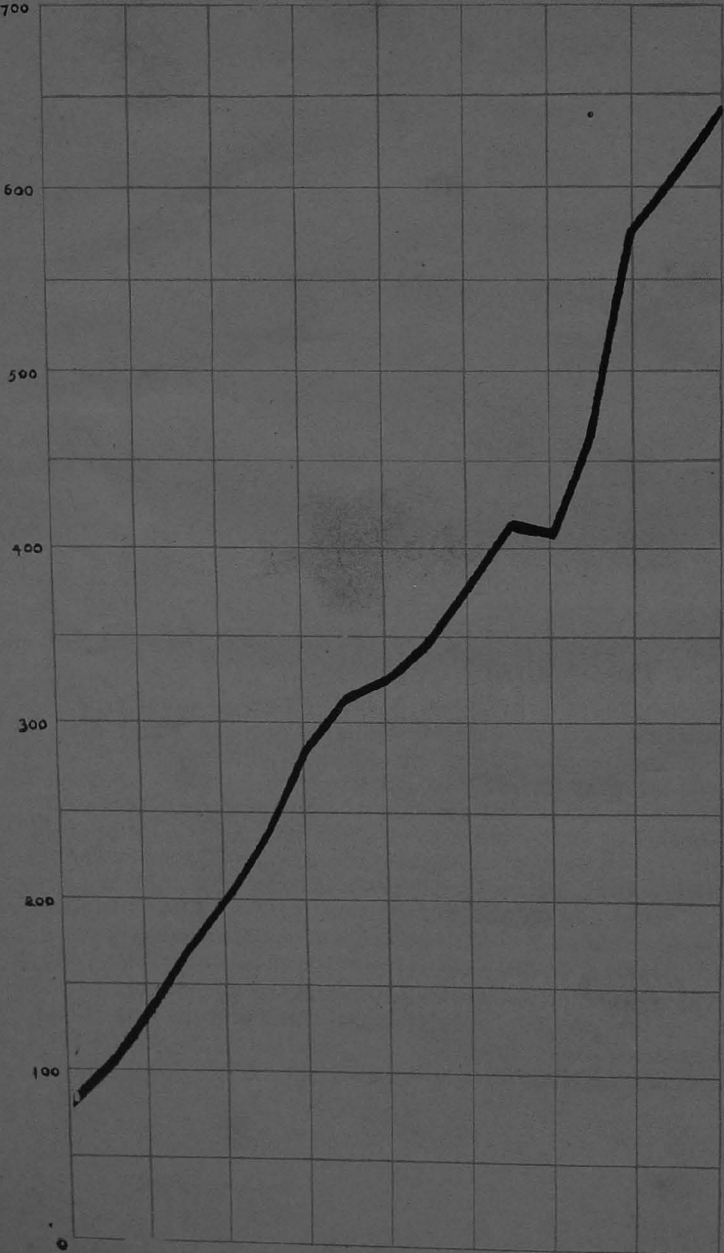
Madras Power Grid

To develop the available power resources in an orderly and rational way and make it available over the whole State cheaply and in abundance, the Electricity Department ever since its inception in 1927 has had as its objective the creation of an electric power grid covering the whole State. This grid was planned so that eventually it would link the several hydro-electric and thermal stations in the country and convey their power to consumers in all villages and towns through a network of transmission and distribution lines. All planning in the Department and all its activities are dominated and controlled by this conception of a State-wide electric power grid.

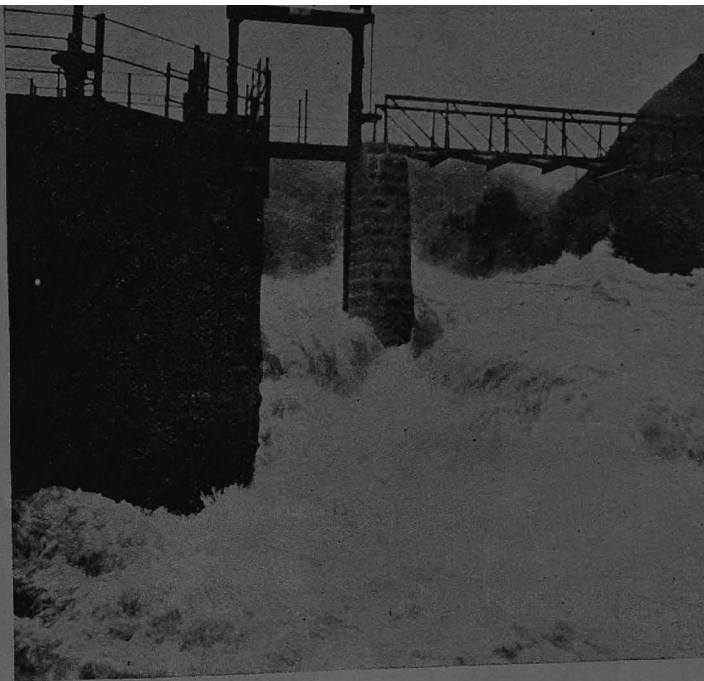
The map on page eight shows the Madras Power Grid. It indicates the existing power houses and main transmission lines as also those under execution and those projected for construction in the immediate future.

PRODUCTION OF ELECTRICITY IN MADRAS STATE, 1934—1950

MILLION
KWH
700



1934 1936 1938 1940 1942 1944 1946 1948 1950



PYKARA DIVERSION WEIR

Progress So Far

The Madras Power Grid at present comprises

- 3 hydro-electric power stations,
- 4 thermal-steam-stations besides a number of small diesel electric stations,
- 4500 miles of high tension transmission lines and
- 3200 miles of low tension distribution lines.

The grid in the southern part of the State is well formed and consists of 3 hydro-electric power stations viz., those at Pykara, Mettur and Papanasam. A fair portion of 13 districts from Chittoor to Tirunelveli and Chingleput to Malabar is covered by it. In the central and northern regions of the State the grid is yet to take shape. In the central area there is the Madras Thermal Station supplying Madras City and its suburbs. In the north, there are the thermal stations at

THE MADRAS GRID

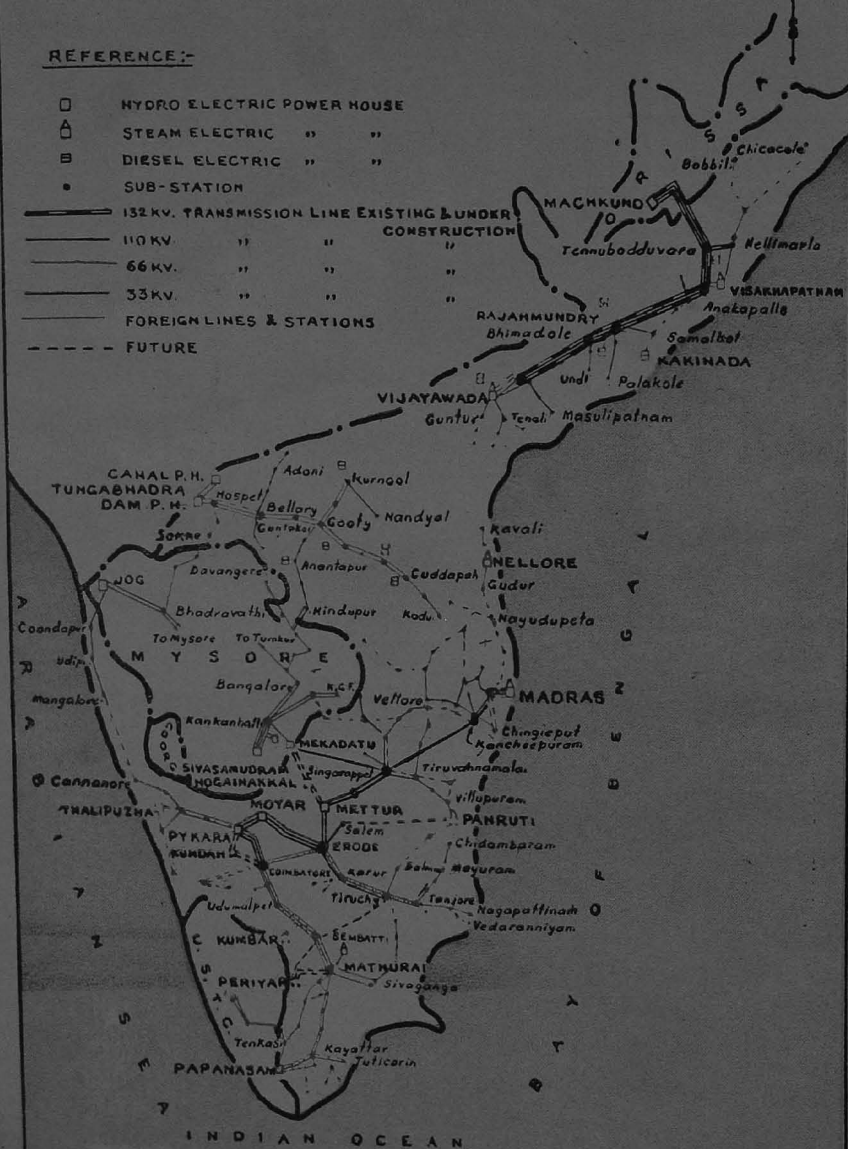
SCALE: 1" = 128 MILES



REFERENCE:-

- HYDRO ELECTRIC POWER HOUSE
- △ STEAM ELECTRIC " "
- DIESEL ELECTRIC " "
- SUB-STATION

- 132 KV. TRANSMISSION LINE EXISTING & UNDER CONSTRUCTION
- 110 KV. " " "
- 66 KV. " " "
- 33 KV. " " "
- FOREIGN LINES & STATIONS
- - - FUTURE



Visakhapatnam, Kakinada, Vijayavada and Nellore each serving the local area but not interconnected. The Ceded Districts area is fed from the Mysore Jog supply and the small oil engine stations at Kurnool, Cuddapah and Anantapur.

When the Mettur-Madras Interconnection Scheme now in execution is completed, Madras will be connected to the hydro-electric grid in the south. With the completion of the Machkund Hydro-electric Scheme in the Visakhapatnam District and the Tungabhadra Hydro-electric Scheme in the Ceded Districts, the separate areas of the grid will get extended and interlinked until eventually a single grid covers the whole of the Madras State.

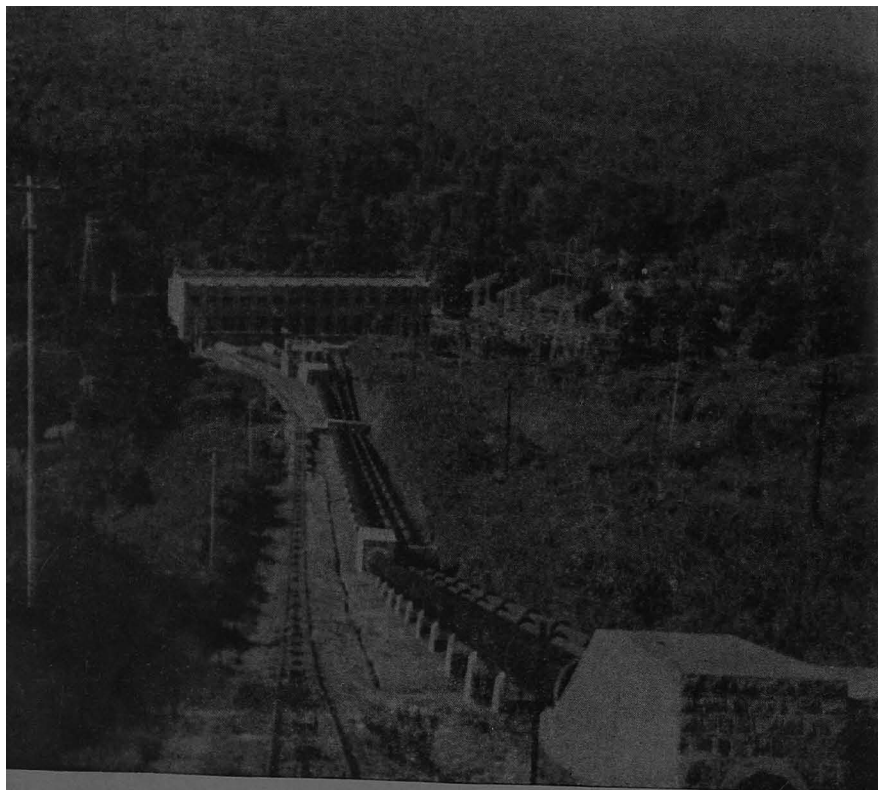
Details of the Grid

(a) Power Houses.

		Installed capacity K.W.
Hydro-electric:	1. Pykara	43,000
	2. Mettur	40,000
	3. Papanasam	28,000
Thermal (steam):	4. Madras	48,000
	5. Vijayavada	6,000
	6. Visakhapatnam	3,750
	7. Nellore	5,000
Diesel stations		5,350
Total		179,100

(b) Transmission lines.

Name of System	Route miles of line		
	High tension	Low tension	Total
1. Pykara	1513	1475	2988
2. Mettur	1703	796	2499
3. Papanasam	521	319	840
4. Andhra	590	257	847
5. Madras	184	357	541
Total	4511	3204	7715



PYKARA POWER HOUSE

(c) Substations.

Name of System.	Extra High tension substations 110 & 66 K.V.		High tension substations 33 and 22 K.V.		Distribution transformer stations.	
	No.	Capacity in K. V. A.	No.	Capacity in K.V.A.	No.	Capacity in K.V.A.
1. Pykara	7	81,750	3	2,750	643	35,111
2. Mettur	15	53,850	11	11,500	397	22,058
3. Papanasam	7	26,750	3	2,975	167	8,463
4. Andhra	3	3,250	10	8,750	126	6,782
5. Madras	—	—	9	19,150	108*	25,140*
	32	165,600	37	45,125	1441	92,944

* Figures include 4 No. rectifier stations of 2750 K.W. installed capacity and 6 No. rotary substations of 13,500 K.W. installed capacity.

Capital investment by Government in the power grid under operation is Rs. 15 crores so far and the gross revenue in 1949-50 was Rs. 3.17 crores.

Natural Power Resources

The State has no oil deposits. Until recently it was believed that it had no coal deposits either. A few years back lignite or brown coal was located in the South Arcot area about 120 miles south of Madras City. The deposit is fairly extensive and is of good quality. If it is found economically workable considerable power can be generated from it.

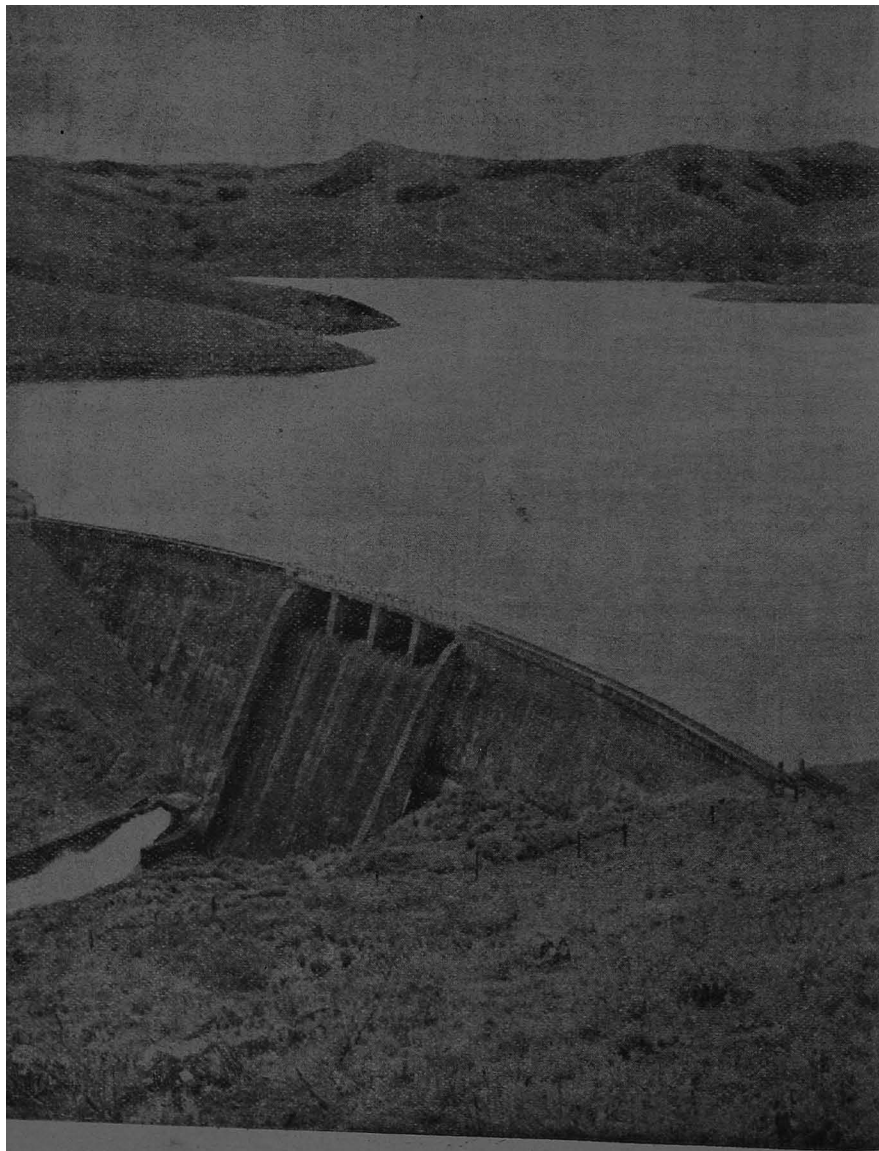
There is a fair number of water power sites in the State but the total potential wealth is not much compared to some of the northern States like Punjab, Uttar Pradesh or Bengal. The sites are mostly in the Western Ghats especially in the region of the Nilgiris and Palnis. Sites in the Eastern Ghats are few and some of them are on border streams. A close estimate of the available power has not yet been made. Survey and hydro-metric work over several river basins are in progress. A rough estimate with the available data indicates that over one million kilowatts of hydro power can be developed in the Madras State. This is exclusive of the power that can be developed from future large irrigation dams like those projected at Ramapadasagar on the Godavari and on the Krishna and Pennar rivers.

Most of the rivers have small dry weather flow and hence hydro schemes involve storages. Should the lignite deposits prove workable, balanced power development will result with hydro and thermal stations working in mutual support and producing power at minimum cost.

The existing steam stations use coal imported from Hyderabad and Bengal. The Diesel Stations use imported oil.

Hydro-Electric Stations

About three-quarter of the power output of the grid comes from hydro-electric stations and the balance from thermal stations. The total installed generating capacity in the hydro stations is 111,000 K.W. Madras State ranks second only to Bombay in regard to hydro-power output. Brief descriptions of the hydro-stations are given below.



MUKURTI RESERVOIR

1. Pykara Hydro Station (Head 3,080 ft.).

This station utilises the waters of the Pykara river which drains a portion of the Nilgiris plateau having a catchment

area of 38 sq. miles and an average rainfall of 80 inches per annum. The river flow though perennial is extremely variable, the maximum discharge recorded being over 20,000 cusecs in July and the minimum 15 cusecs during the dry months of April & May. The topography however embraces a number of feasible storage sites which could be developed according to the growth of power demand. The estimated potential capacity of the full development is around 100,000 K.W.

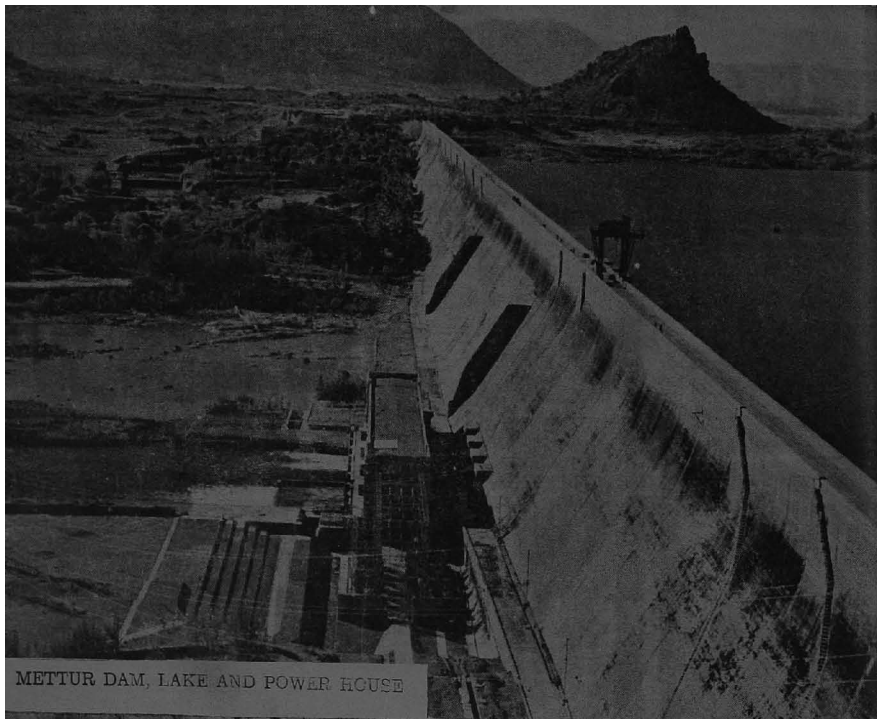
A fall of 3,080 feet has been brought to use in this scheme. It is believed to be the highest head in all Asia.

The scheme has been developed in 3 stages. The first stage was commenced in 1929 and completed at the end of 1932. Only the run of the river was utilised with the aid of two small storages of 58 M.C.Ft. in the forebay and 28 M.C.Ft. in the Glenmorgan Reservoir. The rapid growth of load necessitated the early construction of the dam at Mukurti to store 1,400 M.C.Ft. with open spillways. This work constituting the second stage was commenced in January 1935 and completed in June 1938. By installing automatic gates over the spillways the storage capacity was raised to 1,800 M.C.Ft. in April 1946. The third stage now in execution will provide a further increase of 2,000 M.C.Ft. storage by the construction of a second dam across the Pykara river.

The Headworks are situated at Glenmorgan 16 miles from Ootacamund and the Pykara Power House is located at the foot of the Singara slopes about 10,000 feet from Glenmorgan.

The power plant in the first stage of development consisted of 3 single jet horizontal pelton wheels rated at 10,900 H.P. each direct coupled to 7,810 K.V.A. 3 phase 50 cycle 600 RPM alternators working at 11,000 volts. The water wheels were manufactured and erected by Messrs. Escher Wyss & Co. and the generators were supplied and erected by Messrs. Metropolitan-Vickers Electrical Co., Ltd. Power was stepped up to 66,000 volts by means of three 7,810 K.V.A. 3 phase 11 K.V./66-110 K.V. transformers for transmission to Coimbatore.

In 1939, two 12,500 K.V.A. generating units and two 12,500 K.V.A. transformers were added. The Pykara-Coimbatore transmission line was changed from 66 K.V. to 110 K.V. operation to suit the increased load demand. In 1947 two 5,000 K.V.A. 11 K.V./66 K.V. transformers were added to feed two 66 K.V. lines to the West Coast.



METTUR DAM, LAKE AND POWER HOUSE



INSIDE VIEW OF METTUR POWER HOUSE

Transmission and Distribution

Power from Pykara is transmitted to Coimbatore, which is the main receiving station and also the chief load centre, by means of a 50 mile double circuit 110 K.V. line. The line is extended therefrom at 66 K.V. to Tiruppur, Erode, Udumalpet, Sembatti and Mathurai. At Erode and Mathurai tie is established with the Mettur and Papanasam Systems respectively. Power is also supplied from Pykara to Calicut and Cannanore on the West Coast through 66 K.V. lines.

The Pykara Power House supplies power to as many as 41 textile mills, one cement factory at Madukkarai, a cordite factory at Aruvankadu and a number of tea factories in the Nilgiris, and Anamalais. In addition to the above 5,700 Nos. of agricultural services with a connected load of 24,900 K.W., 425 Nos. rural industries with a connected load of 6,400 K.W. and other domestic, street lighting and small power loads are being served by the station.

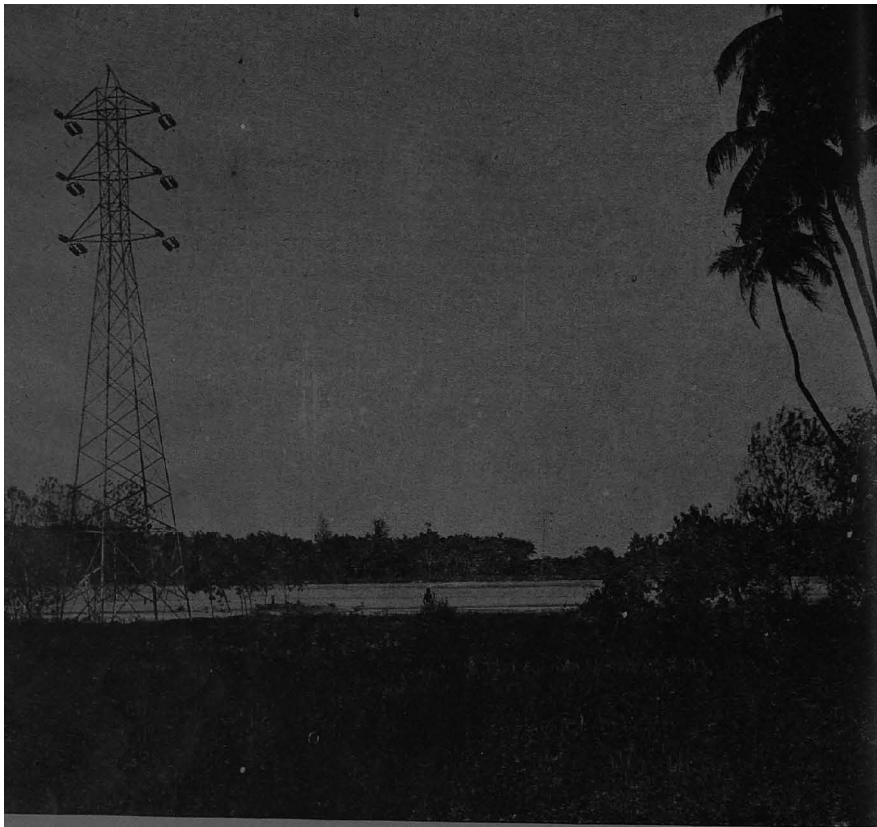
2. Mettur Hydro Station (Head 60 to 150 feet).

The Mettur Dam, one of the largest structures of its kind in the world is 5,300 ft. long and 176 ft. high and is capable of impounding 100,000 million cubic feet of water. It is built across the Cauvery river at Mettur in the Salem District. The storage is used primarily for irrigation purposes, and incidentally generates electric power.

The power house is built at the foot of the dam and has four generating units of 12,500 K.V.A. 250 RPM coupled to twin horizontal Francis turbines one on each side of the generator. The turbines are fed by pipes 8'-6" in dia. built into the dam at 48 ft. centres. The turbines were supplied by Messrs. English Electric Co. and the generators by Messrs. Metropolitan-Vickers. Electrical Co. Ltd.

The operating head varies from a maximum of 150 ft. at full reservoir level to a minimum of 60 ft.

The total installed capacity of the power house is 50,000 K.V.A. Power is generated at 11 K.V. 50 cycles, 3 phase and stepped up to 66,000 volts and transmitted to Singarappet in the north and Erode in the south by means of two 66 K.V. 110 K.V. trunk lines (a total mileage of 100 miles) taking off from the Power Station.



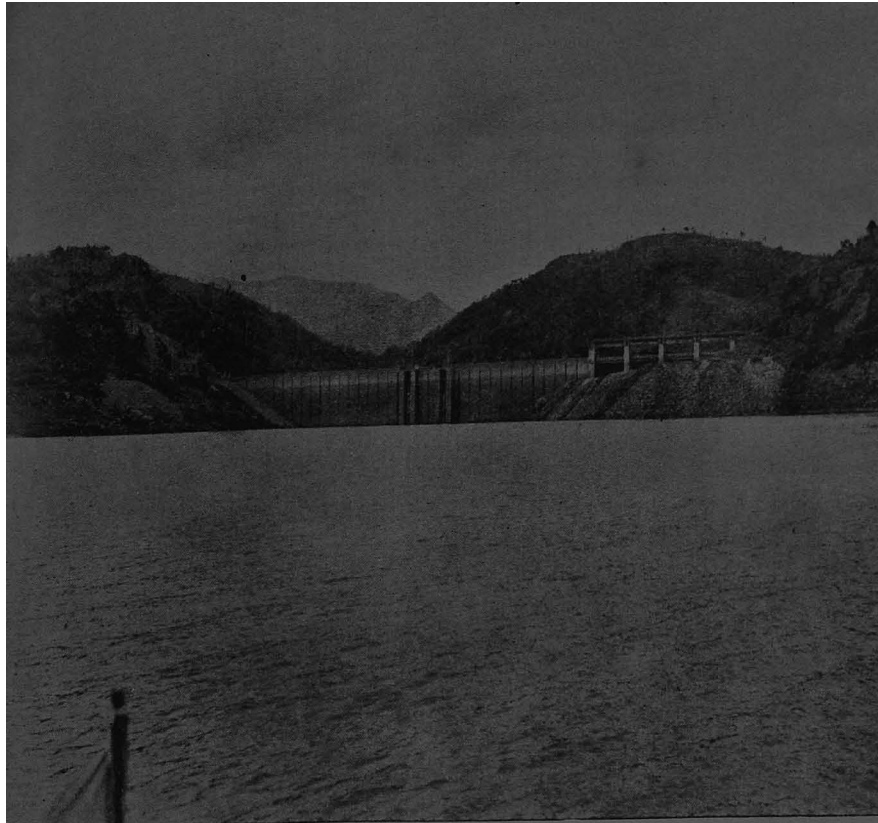
AMARAVATHI RIVER CROSSING

Construction of the Power House was started in April 1935 and the first stage of the work with 3 units was completed by December 1937. The fourth unit was installed and put into commission in October 1946.

Transmission and Distribution

66 K.V. lines carry Mettur power to Singarappet, Vellore, Tiruvannamalai and Villipuram in the east and to Erode, Tiruchirapalli, Tanjore and Nagapattinam in the south. To ensure proper voltage regulation two 2,500 K.V.A. synchronous condensers are installed at Tiruchirapalli.

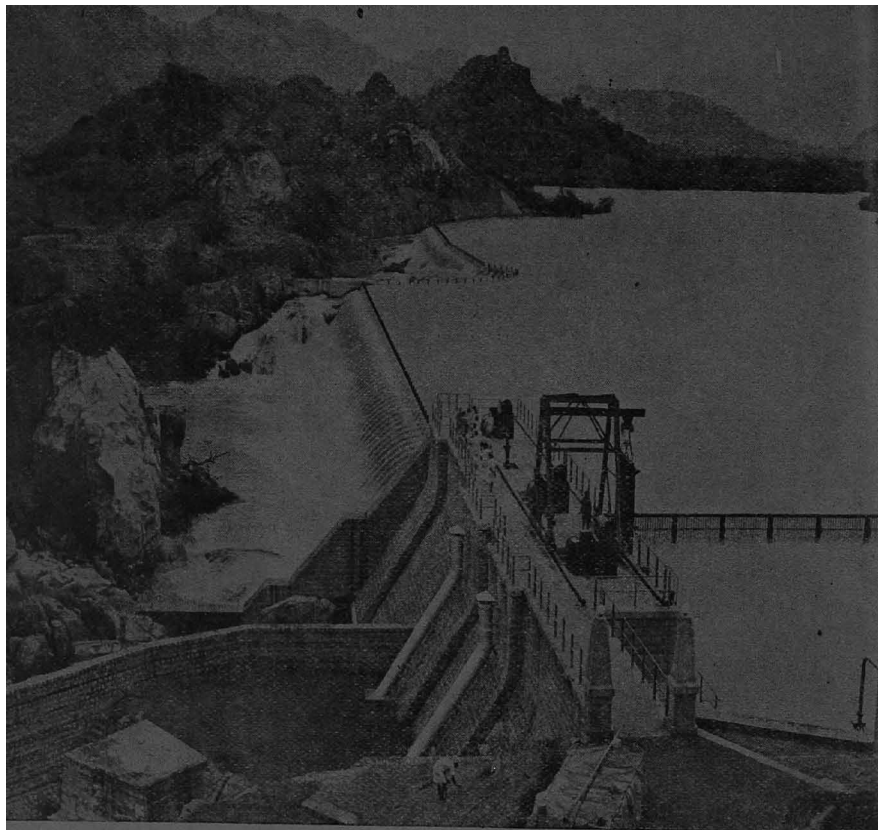
Among the major industries served by Mettur are 9 textile mills, 1 cement factory, 1 electro-chemical works, 2



PAPANASAM LAKE

rolling mills and 1 railway workshop. Besides, 3,000 agricultural services with a connected load of 12,400 K.W., 620 rural industries with a connected load of 8,900 K.W. and other loads such as domestic, street lighting and small power loads are also supplied.

At Erode the Mettur System is linked with Pykara network. Inter-connection of Mettur Power House with Madras Thermal Station has been envisaged to enable diversion of surplus power at Mettur during the irrigation season to Madras thereby conserving coal at the Madras Station. During the dry months Madras will assist Mettur enabling larger firm demand being met in the Mettur System than is possible at present. A 110 K.V. line has already been constructed and



PAPANASAM DIVERSION WEIR

terminal equipment is shortly expected to enable interconnection.

3. **Papanasam Hydro Station (Head 330 feet).**

This was the third hydro-electric scheme undertaken by the State. It is designed to function as a hydro-thermal scheme. The hydro-portion of the scheme was developed first and has been functioning since 1944. The thermal station is under execution at present.

The hydro power house is located near the Papanasam Falls on the Thambraparni river 8 miles from Ambasamudram in Tirunelveli District, the southernmost district of this State.

The catchment area developed is 127 sq. miles with an average rainfall of 87 inches per annum. It benefits from both the south-west and north-east monsoons.

6 miles above the Falls a reservoir of 5,500 M.C.Ft. capacity has been formed by constructing a masonry dam 176 ft. high and 814 ft. long, across the river. Water is drawn from the reservoir by means of two 8'-6" dia. pipes embedded in the dam and fitted with valves to control flow. About $\frac{3}{4}$ mile above the falls the water is diverted from the river course by a diversion weir 1,350 ft. long and 35 ft. high which provides a small storage of 28 M.C.Ft. for daily regulation. Two 9 ft. dia. steel pipes each 3,500 ft. long lead the water from the diversion weir to the surge towers. From there, four 66" dia. penstock pipes each 520 ft. long lead the water down the hill slopes to the power station located at the foot of the Papanasam Falls. The gross head developed is 330 ft.

The power house has 4 generating units coupled to vertical type Francis turbines of 9850 H.P. rating 600 R.P.M. The generators operate at 11,000 volts 50 cycles having a maximum continuous rating of 7000 K.W. each. The station capacity is 28,000 K.W. The turbines were supplied by Messrs. English Electric Co. and the generators by Messrs. British Thomson-Houston Co. The power is stepped up to 66 K.V. for transmission.

Transmission and Distribution

The transmission system extends to Tuticorin, Koilpatti and Mathurai. Bulk of Papanasam power is consumed at Mathurai. At Mathurai the System is linked with the Pykara Hydro-electric System and for purposes of voltage regulation two 2500 K.V.A. synchronous condensers are installed there.

Among the major industrial consumers are 20 textile mills and 1 cement factory. Bulk power to the extent of 3000 K.W. is also being delivered to the Travancore State for their Aluminium Factory at Alwaye.

Grid Helps Regulation of Power

During the last four years when monsoons were partial failures the interconnection between the hydro power stations proved its value over and over again in ensuring continuous power supply in deficit areas. The energy of the water stored in the Mukurti lake in the Nilgiris went time and again to supplement the output at Papanasam and at Mettur in the dry months.

Thermal Stations

About a quarter of the total power output comes from thermal stations, both steam and oil. The total capacity of the thermal plants amounts to 68,000 K.W. Brief descriptions of these follow.

1. Madras Thermal Station

It is the oldest power station in the State built in 1909 by the Madras Electric Supply Corporation. It is also the largest thermal station in the Madras Power Grid, having been taken over by the State in August 1947 from the licensee on the expiry of the licence period.

The power station is located near the Basin Bridge railway station and has an installed generating capacity of 46,500 K.W. with six turbo-alternators ranging in capacity from 1500 to 15,000 K.W. The boiler plant comprises nine boilers of Babcock and Wilcox make with mechanical chain grate stokers suitable for burning nut coal and with steam conditions at 200 lbs./sq. inch pressure and 600°F temp.

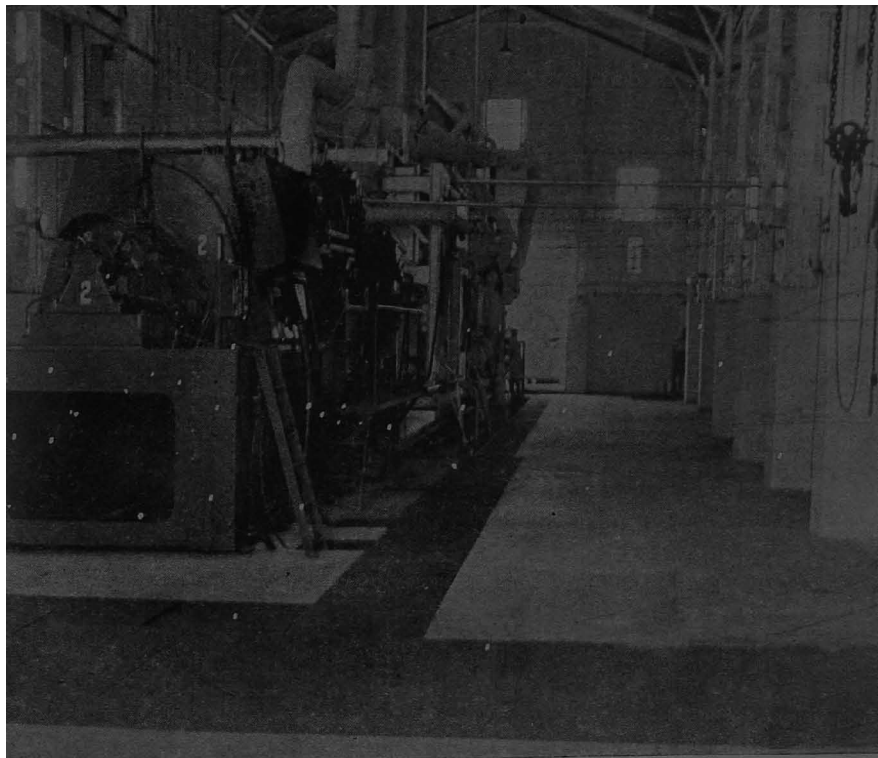
The cooling water for the condensers is supplied by a close circulation system through 3 cooling towers.

Power is generated at 5000 volts A.C. and transmitted at 5000 volts through underground cables to 6 rotary convertor substations and 4 rectifier substations where power is converted into Direct Current for supply to the consumers and tramways. A.C. power is also supplied within the City through transformer substations. For suburban areas power is transmitted at 33 K.V. and distributed through 33 K.V./5 K.V. substations.

Among the more important consumers served by the Madras Station are the textile mills of Messrs. Binny & Co., the M. S. & M. Railway Workshops, the S. I. Railway suburban traction service, the Madras Electric Tramways, Municipal street lighting and water works, and the Madras Port Trust.

2. Vijayavada Power Station

This is the second largest steam station under the grid with an installed generating capacity of 6000 K.W. with 3 turbo-alternators. The boiler plant consists of 2 Nos. 22,000



INSIDE VIEW OF NELLORE POWER STATION

lb./hr. and one No. 33,000 lb./hr. Babcock & Wilcox water tube boilers with mechanical chain grate stokers suitable for burning slack coal. Steam pressure and temperature are 265 lb./sq. inch and 680°F. Two more 3000 K.W. sets with 2 Nos. 55,000 lb./hr. boilers are being added to the power house.

3. Visakhapatnam Power Station

This has three turbo-alternator sets with a total capacity of 3750 K.W. There are 2 Nos. 11,000 lb./hr. and 2 Nos. 22,000 lb./hr. Babcocks and Wilcox water tube boilers with steam pressure and temperature at 265 lb./sq. inch and 680°F. The station is being extended with 2 Nos. 22,000 lb./hr. boilers and two additional 1500 K.W. sets.

4. Nellore Power Station

This station is the latest addition to the grid having been commissioned early October 1950. The power plant consists

of 2 transportable sets each comprising a 2500 K.W. turbo-alternator set with an oilfired Yarrow boiler of 33,000 lb./hr. capacity at 370 lb./sq. inch pressure 675°F. superheat.

Diesel Stations

Diesel engine power stations operated by the State are six in number their capacity ranging from a few hundred K.W. to a thousand K.W. They serve chiefly the urban areas where they are situated. Their aggregate capacity is 5300 K.W.

110 K.V. and 66 K.V. transmission lines constitute Trunk circuit of an extensive transmission system.

The primary transmission system is operated at 66,000 and 110,000 volts and the total length of these lines is 1100 miles. Over 1500 miles of additional lines are under construction. There are 32 Nos. 110 & 66 K.V. substations situated normally about 40 miles apart. Voltage is stepped down at these substations either to 33 K.V. for secondary transmission or to 22 and 11 K.V. for distribution.

Supply of Power to Consumers

Over 3000 miles of 11 and 22 K.V. distributors convey power from the principal substations to the rural areas and to bulk consumers in the urban areas. Power is supplied at 11 or 22 K.V. to the large industries, towns, municipalities and licensees for further distribution.

Rural lines and distributors are generally carried on rail, tubular or wood poles. To these lines small distribution transformers are connected at load centres for stepping down to low voltage. Most of these transformers are pole mounted and have a capacity ranging from 75 to 100 K.V.A. The low voltage system adopted is 400/230 volts three phase 4 wire with neutral earthed.

How Power is put to use

The power was distributed to 256,900 consumers in 1949-50 in 79 municipal towns and 1600 villages, and was utilised in the following manner:—

Use.	Percentage of total consumption.
1. Industrial supplies	69
2. Irrigation and agriculture	11
3. Domestic light and small power	11
4. Street lighting	3
5. Traction	4
6. Miscellaneous	2
	100

It will be seen that about 80% of the power output is used in industries and agriculture helping directly to produce wealth. Industry is the chief power consumer. Among the major industries working on grid power are

Textiles
Cements
Chemicals
Steel rolling
Railway workshops
Shipbuilding

There are over 60 textile mills, 40 tea factories, 5 cement mills, 2 rolling mills, 2 railway workshops and one shipbuilding yard in the consumers' list.

The Madras Electric Tramways and the South Indian Railway Madras suburban traction also get supply from the grid.

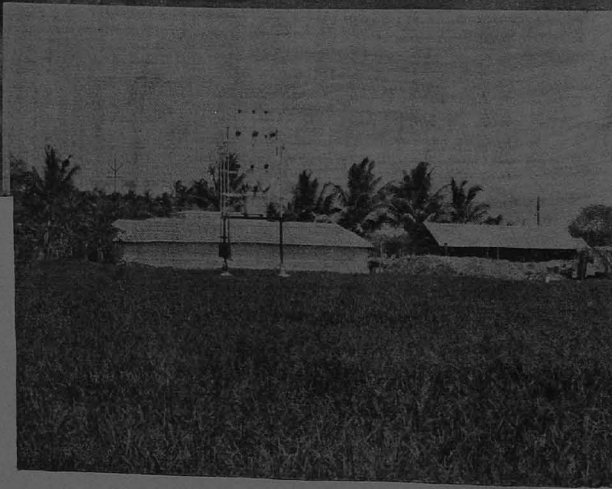
Rural Electrification

In 1949-50, 86 million K.W.H. were consumed in the rural areas. It is about a sixth of the total power consumed in the State. Out of the total connected load of 417,000 K.W. on the grid the rural load is around 97,000 K.W. i.e., 23% of the total. Rural electrification has been receiving growing attention in recent years and today Madras State leads all the other States in India in rural electrification with over 1,600 villages electrified.

Use of electricity in villages is confined mainly to pumping water from wells and canals for irrigation and to processing

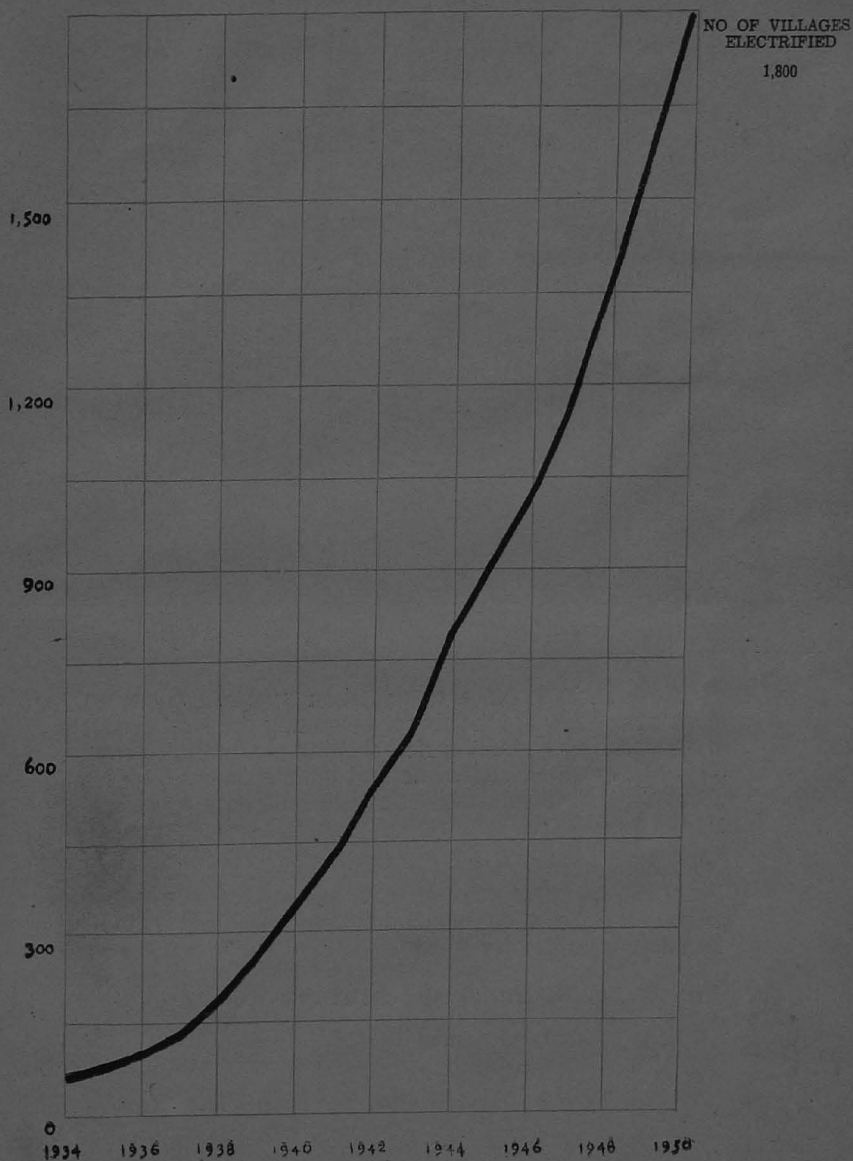


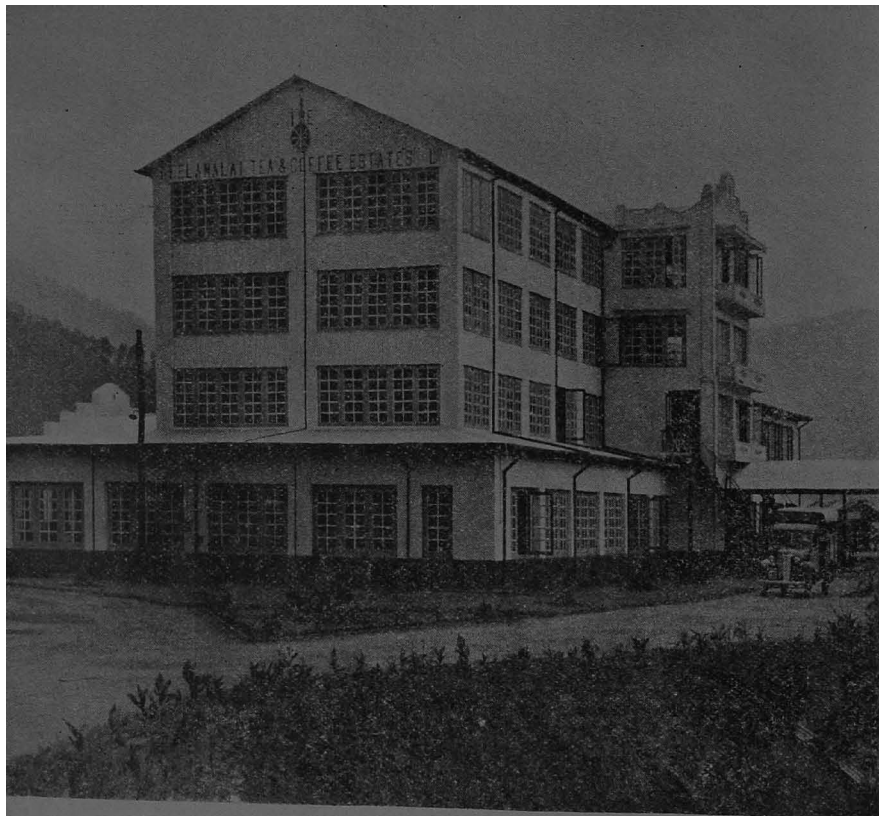
RURAL ELECTRIFICATION



of produce locally grown. There are over 15,000 electric pumps in use in this State and they consumes over 50% of the power used in the villages. Every encouragement is given to the installation of these pumps in the "Grow More Food" campaign.

RURAL ELECTRIFICATION IN MADRAS STATE, 1934-1950





TEA FACTORY

Next in importance to irrigation pumping come rural industries. They are mostly for processing the local products of agriculture e.g., hulling rice, shelling ground nut, pressing oil seeds, crushing sugarcane and milling flour. There are about 1500 such industrial establishments with a connected load of 20,400 K.W.

Another important processing industry is tea curing. Electricity is being supplied to 47 tea estates mostly in the Nilgiri and Anamalai Hills and is used for withering, rolling and drying the tea leaf.

Power Tariffs under the Grid

The power tariffs under the grid are kept low to benefit industries. Special tariffs are offered to large industries like

cement. As examples of Madras hydro-power tariffs it may be mentioned that a large industry with an annual consumption of 20 million units and a maximum demand of about 3,000 K.W. pays on the average 0.375 anna per unit. A smaller industrial consumer who takes power amounting to 2.5 million units with a maximum demand of 500 K.W. pays 0.80 anna per unit. For bonafide agricultural purposes and cottage industries power is sold at an average rate of 1.00 anna per unit. The domestic consumer is charged at 4 annas per unit for lights and fans and at 1.8 annas per unit for cookers, heaters, refrigerators, etc. metered on a separate circuit.

Thermal tariffs are higher than hydro tariffs and usually have a fuel surcharge added on. This surcharge is sometimes substantial in view of the high cost of fuel.

Five Year Plan of Development for the Grid

During the war years 1939 to 1945 no progress could be made as new schemes or extensions were barred. The only work done was to complete with great difficulty the few schemes already started. With the ending of the war, however, the State Government sanctioned several schemes constituting a five-year plan of development. The plan provides for

- (a) 4 new power houses at
 - Machkund
 - Moyar
 - Nellore and
 - Mathurai
- (b) Extensions to 5 existing power houses
 - Pykara
 - Papanasam
 - Madras
 - Vijayavada
 - Visakhapatnam
- (c) 1650 miles of new high tension lines.

These schemes will add 180,000 K.W. of extra generating capacity to the Grid. In other words, when the plan is completed the existing generating capacity will get **doubled**. The estimated cost of the five-year plan is Rs. 30 crores.

With the additional power that will become available from the schemes it is expected that about 1400 new villages will be electrified and 18,000 additional pumps and 1500 rural industries will receive supply in the course of five years besides the development of industrial and other loads in the urban areas.

Work is in progress on all the schemes included in this five year plan. Delayed delivery of steel, cement, power plant and lack of enough number of civil engineers have, however, been impeding progress. The plan was to have been completed in 1951, but may not be until 1952-53.

The more important schemes included in the plan are the following:—

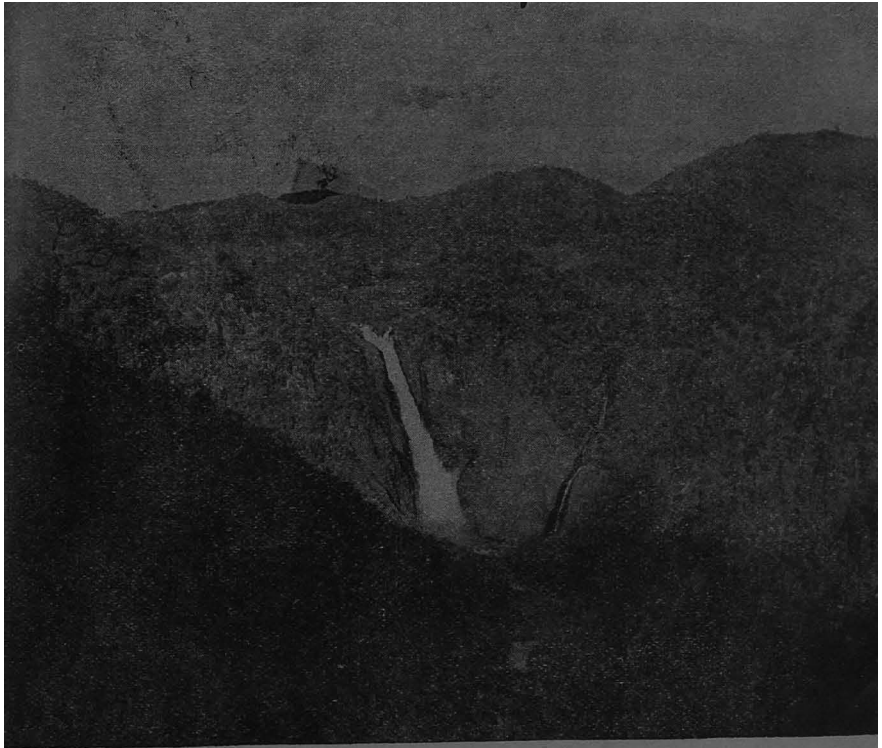
New Power Schemes

1. Machkund Hydro-electric Scheme. (Head 870 ft.).

This is the most important hydro-electric project in execution under the five year plan. It is designed to utilize the waters of the Machkund river which forms the boundary between Madras and Orissa States, and develop power on the right bank of the river near the Duduma Falls where a drop of 850 ft. is available. The first stage of the scheme provides for an installed generating capacity of 51,000 K.W. The scheme is capable of an ultimate development of 100,000 K.W.

The project is being worked jointly by the Madras and Orissa States under an agreement, the capital outlay and power being shared in the ratio of 70 : 30. The power scheme is to be executed and operated by the Madras Government under the terms of the agreement.

The power site is situated at the Duduma Falls about 125 miles by road from Visakhapatnam. In the initial stage of the scheme a masonry dam 1300 ft. long 134 ft. in height with a capacity of 25,650 M.C.Ft. will be built across the Machkund river at Jalaput, 2 miles below the confluence of its chief tributary the Patala. The water stored by the dam will be

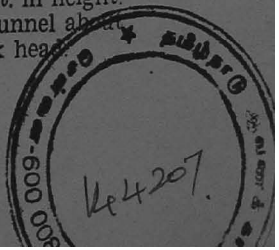


DUDUMA FALLS, MACHKUND

let down according to power requirements into the river and picked up at the Diversion Dam about 17 miles below and $1\frac{1}{2}$ miles above Duduma Falls. The Diversion Dam will be 1033 ft. in length and about 80 ft. in height at its lowest point with an effective storage capacity of 389 M.C.Ft.

Water from the Diversion Dam will be taken along a concrete lined contour channel about 4060 ft. long skirting the hill slopes on the right bank of the river and through a free flow tunnel about 4250 ft. in length to a stream called Makkiput where a small pondage is created by the construction of a dam called the "Tunnel Pond Dam" 54 ft. in height. The water is then conveyed through a pressure tunnel about 3000 ft. in length to the surge shaft and penstock head.

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Three Nos. of steel pipes of diameter varying from 63" to 57" and each of length 1690 ft. will lead the water from the penstock head to three turbines installed in the Power House. The power plant will consist of 3 vertical type reaction turbines of Morgan Smith make rated at 25,000 H.P. each coupled to 17,000 K.W. 50 cycle 600 R.P.M. Westinghouse generators, gross head on the turbines being 870 ft. Three more penstocks and three more generating units will be installed as power demand increases.

Power will be generated at 11 K.V. 3 phase 50 cycle and stepped up to 132 K.V. for transmission. A 132 K.V. transmission line will carry the Madras share of power to Visakhapatnam, Rajahmundry and Vijayavada where the voltage will be stepped down to feed the existing and new 33 K.V. and 11 K.V. networks. The transmission system covers the districts of Visakhapatnam, Godavari, Krishna and Guntur now served by the thermal stations.

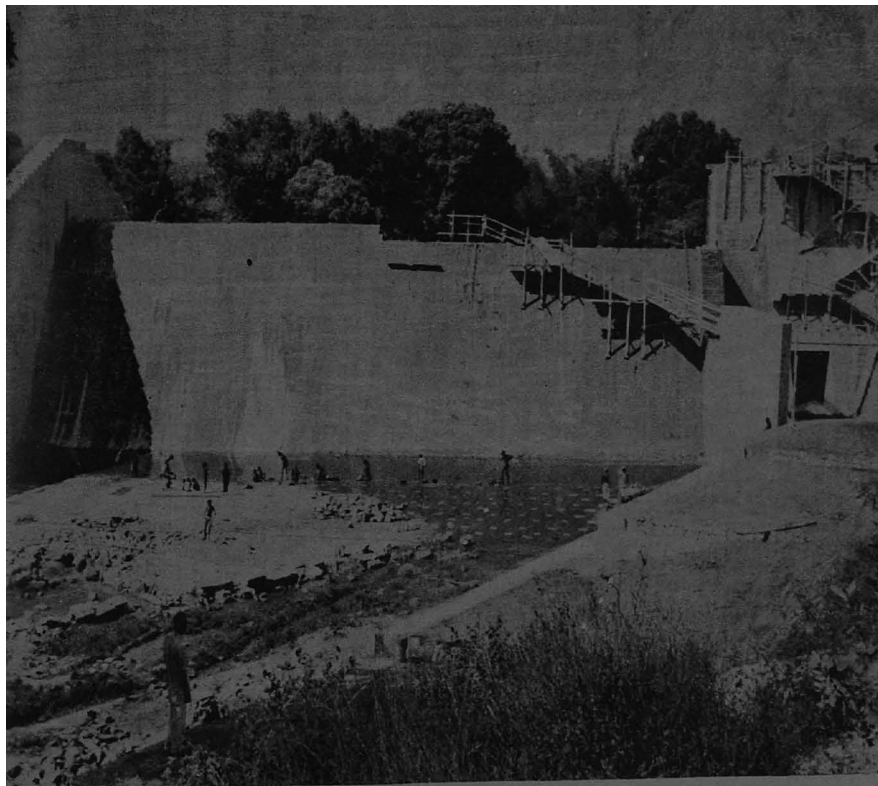
Work on the Machkund Project is in good progress and its initial stage is expected to be completed about the middle of 1953. Pending its completion additional generating plant totalling 9000 K.W. is being installed at the Vijayavada and Visakhapatnam Thermal Stations to meet the interim power demand of the region.

2. Moyar Hydro-electric Scheme (Head 1280 ft.).

The Moyar Power House will be the 4th hydro-electric station of the grid in the southern part of the State. It is intended to utilise the tail waters of the Pykara Power House over a 1280 ft. drop in the Moyar gorge 9 miles lower down.

The main features of the Scheme are as follows:—

The tail water of the Pykara Power Station will be diverted by means of a masonry diversion weir 283 ft. long and 50 ft. high built across the Glenmorgan Stream just below the junction of the tail race and the stream. A channel 7600 ft. long will carry the water so diverted to an adjacent stream called Avaraihalla. A regulating reservoir of 28 M.C. Ft. capacity will be formed at Maravakandy 4 miles lower down by constructing a dam across the Avaraihalla. The dam will be of solid masonry gravity type about 1360 ft. long in the central portion with 2 earthen bunds on either side. It will be 75 ft. high with a spillway section 150 ft. long. A



MOYAR HYDRO-ELECTRIC SCHEME—MARAVAKANDY DAM - WORK IN PROGRESS

flume channel 23,000 ft. long will lead the water from the reservoir to the forebay and head works at Guruva-Gowden Hundi. A 7 ft. dia. low pressure pipe line conveys the water from the forebay to the surge tank at the head of the penstocks on the top edge of the Moyar gorge. 3 penstocks 2880 ft. long in 2 sections 45" and 42" dia. will then lead the water to the power station below.

The station will have 3 Nos. 18,000 H.P. two nozzle vertical type impulse wheels of Boving & Co., make coupled to 12,000 K.W. 428 R.P.M. alternators of Metropolitan-Vickers Co. Power will be generated at 11 K.V., 3 phase, 50 cycle, stepped upto 110 K.V. and transmitted to Pykara and Erode through 110 K.V. double circuit transmission lines. The station will meet the increasing power needs of the Mettur System. The

civil works of the Project are in advanced stages of progress and the power house is likely to be commissioned in 1951.

3. Nellore Thermal Scheme.

The Nellore Thermal Station with an initial installation of two Nos. 2500 K.W. turbo alternator sets with oil fired boilers of capacity 33,000 lb. of steam/hr. at 370 lb./sq. inch working pressure 675°F temp. has already been commissioned early October 1950, and supply to Nellore town and Bitragunta given. A small net work of 33 and 11 K.V. lines is being constructed to feed Gudur and neighbouring areas and eventually it will be linked with the southern grid.

4. Mathurai Thermal Station.

This is a new auxiliary steam station of 14,000 K.W. capacity. It is mainly intended to supplement the power output in the hydro grid during dry months. A 4000 K.W. turbo set with 3 Nos. coal fired boilers of capacity 36,000 lbs. of steam/hr. at 275 lb./sq. inch pressure and 725°F. temp. is under erection and it is likely to go into commission in January 1951. A further 10,000 K.W. set with 2 Nos. 55,000 lb./hr. boilers has been ordered and is expected to be in service in 1952.

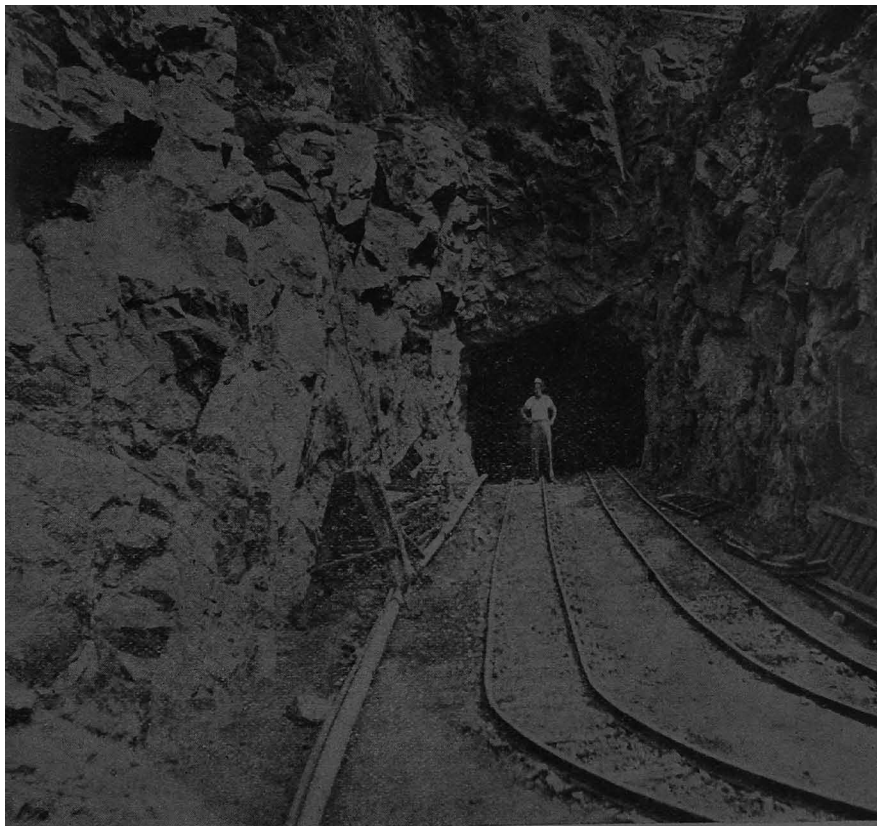
Extensions to Existing Power Houses

1. Pykara Plant Extensions.

The Scheme comprises a second dam across the Pykara river to provide a storage of 2000 million cubic feet, a new penstock line and 2 generating units of 13,500 K.W. each at the Pykara Power House. It is under execution and is expected to be in service in 1953. The additional output will help to meet the growing power demands of the southern area.

2. Papanasam Plant Extensions.

The scheme includes provision of spillway gates to the Papanasam Dam enabling additional storage in the reservoir and extension to the Papanasam Power House by an additional generating unit of 7000 K.W. The work is practically complete. This along with the completion of the Mathurai Thermal Station will bring the Papanasam Hydro-Thermal Scheme to its final stage.



MACHKUND HYDRO-ELECTRIC SCHEME— TUNNELLING IN PROGRESS

3. Madras Thermal Station Extensions.

To augment the power supply in the Madras City, the Basin Bridge Power House is to be extended to receive 30,000 K.W. of additional power plant. It is being done in 2 stages. Work under the initial stage with one 15,000 K.W. set and 3 Nos. 80,000 lb./hr. boilers has been commenced and programmed for completion by end of 1951. One more 15,000 K.W. unit with 2 Nos. 80,000 lb./hr. boilers under the 2nd stage is also on order.

The new power plant will operate at 400 lbs./sq. inch. pressure and 750°F. Cooling system will be strengthened by two more natural draught cooling towers.

The 110,000 volt tie transmission line between Mettur and Madras which has already been completed will be commissioned next year on receipt of terminal equipment. Another big step forward will then have been taken in the development of the State grid.

Transmission Lines

To convey the additional power that will become available on completion of the above schemes, to the centres of use about 1650 miles of high voltage lines are projected. A portion of these has already been completed and commissioned and the rest is under construction.

Ceded Districts Grid

By agreement with Mysore State, power from their Jog Hydro-electric Scheme upto 4000 K.W. has been made available for distribution to the Ceded Districts area. A portion of the Ceded Districts grid has already been constructed and places like Tungabhadra Dam, Hospet, Bellary and Adoni are receiving supply. The Scheme is expected to be completed by the end of 1950. At Kurnool, Cuddapah and Anantapur to which places the Mysore supply cannot be extended the existing oil engine stations are being strengthened suitably to meet the increasing demands in the area. Besides, two new oil engine stations with a capacity of 470 K.W. each are being installed at Nandyal and Tadpatri. When the Tungabhadra Hydro-power Station of capacity 37,500 K.W. is built and brought into commission around 1954, it will take over the entire Ceded Districts area and supply from Mysore will be stopped and the oil engine stations shut down.

The above schemes cover a major part of the Madras State and will result as already mentioned, in doubling the existing generating capacity and adding over 1650 miles of H.T. lines. They are all scheduled to be completed before 1953

Future Plans

Demand for power in the State is widespread and insistent. Several new industries are being planned all over the State and power for them is to be provided from the grid. Schemes

for railway electrification are likely to be taken up in the near future. More important perhaps than all these will be the demand for electricity from the rural areas where the advantages of electric pumping for irrigation have been strikingly apparent in the last few years of monsoon failure.

The Electricity Department of the State is planning ways and means to meet these demands as they arise. Agreement with Mysore is being completed for the development of the Mekadatu Falls in the Cauvery river. Additional power to the extent of 13,000 K.W. will then be available in the Mettur-Salem areas. 6000 K.W. will also be delivered in bulk from the Mysore Jog Scheme for distribution in the South Kanara District.

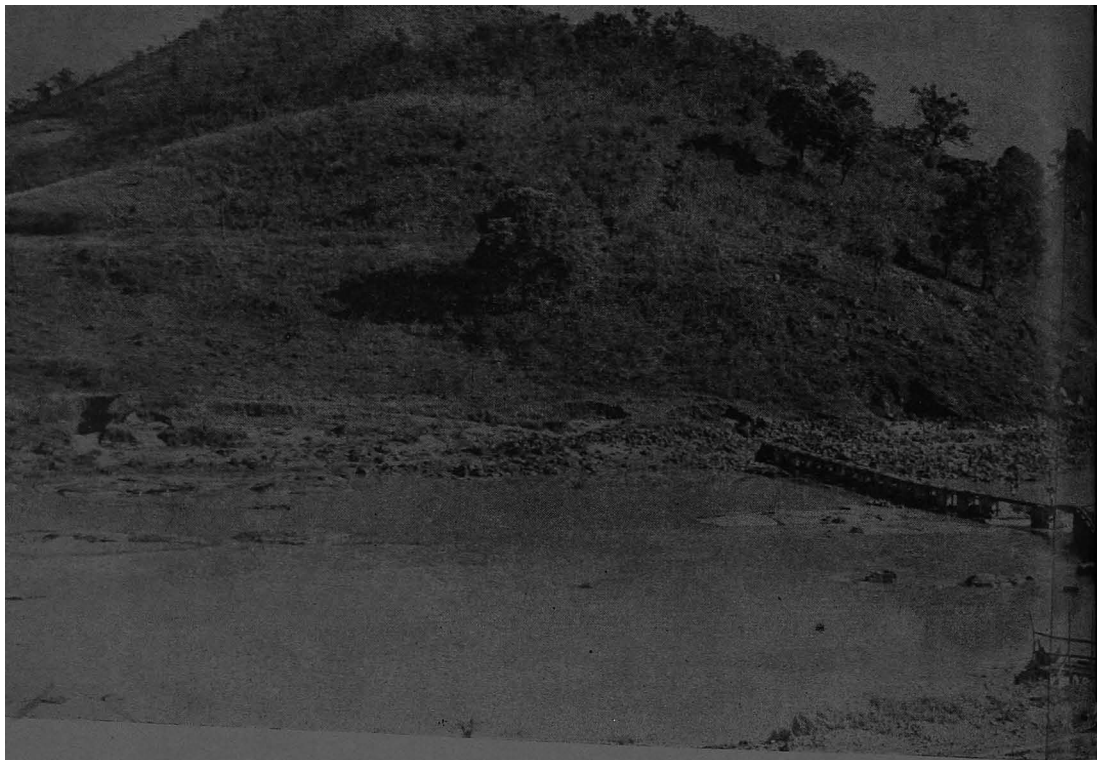
Plans for the Tungabhadra Hydro-electric Scheme with an installed capacity of 37,500 K.W. have been completed and the Scheme may be taken up early.

Agreement has been reached with the Travancore-Cochin Government enabling development of the Periyar Hydro-electric Scheme in the Palnis. About 40,000 K.W. would be obtainable therefrom.

Systematic examination of all likely water power sites in the State is being made and a very promising scheme on the Kundah River in the Nilgiris of potential capacity of 100,000 K.W. is under investigation.

Considerable lignite deposits have been located as previously mentioned, in the South Arcot District and if the experiments which are being made as to their workability are successful, it is proposed to build a large thermal power station in that area using lignite as fuel. It will be linked to the grid and will serve to increase its firm power output.

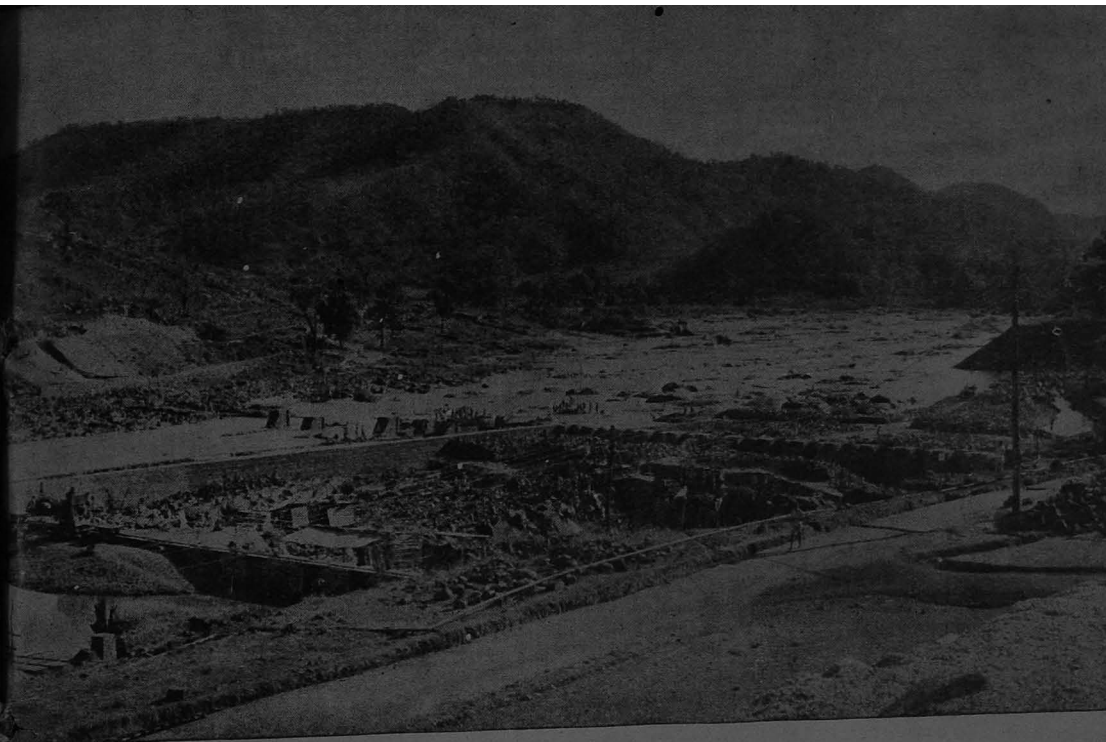
When the Ramapadasagar Project on the Godavari and the Krishna-Pennar Project are taken up about 300,000 K.W. of power will be available, enough to meet all demands in the Andhra area including the Ceded Districts for several years to come and to export to adjacent deficit areas as well.



DIVERSION DAM, MACHKUND-

Nationalisation of Electricity Supply

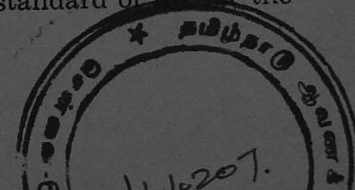
Government in their power houses generate at present 99% of all the electricity produced in the State. So, for all practical purposes, generation of power is already nationalised. Distribution of power is, however, not yet so. The Government themselves distribute to the ultimate consumer 70% of the power they produce and the balance of 30% is being distributed through private and local body licensees. Though a few of them have done good pioneering work in their areas, development has, in the main, been restricted by them to urban areas. Rural electrification has received little or no attention in the hands of the licensees barring a few excep-



WORK IN PROGRESS

tions like the South Madras Electric Supply Corporation and the South Arcot Electricity Distribution Co., Ltd. In view of the great importance the Government attach to rural electrification as a potent instrument of social and economic betterment, they have decided to nationalise all distribution of electricity. An Act for the compulsory acquisition of all licensee undertakings was passed early in 1950 and will be fully implemented in the next few years.

The electric power utility in all its functions of generation, transmission and distribution to the ultimate consumer would then have been wholly nationalised, leading, it is hoped, to widespread use of power and a higher standard of life for the people.



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