TRAVANCORE ELECTRICITY DEPARTMENT

THE PALLIVASAL HYDRO ELECTRIC PROJECT

LOAD AND REVENUE FORECAST FOR A PERIOD OF 10 YEARS OF OPERATION FROM 1940—1950, CORRESPONDING TO 1116—1125

TRIVANDRUM:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS
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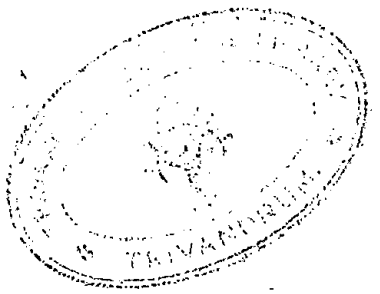

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PALLIVASAL HYDRO ELECTRIC PROJECT.

REPORT

on

LOAD AND REVENUE FORECAST

For a period of 16 years of operation from 1940-1950.

CONTENTS.

GENERAL.

PALLIVASAL HYDRO ELECTRIC PROJECT.

Report on load and Revenue Forecast for a period of 10 years of operation from 1940—1950, corresponding to 1116—1125.

The capital expenditure on the P. H. E. Project as completed at the time it was brought into commercial operation in March 1940 was Rs. 131·27 lakhs which includes Rs. 15·68 lakhs for interest charges during construction. The following is a summary of the capital expenditure.

		Rs.	
A.	Civil Engineering works such as Head-works, tunnel, penstock, power house buildings, staff quarters, roads etc.	44·4	Lakhs
B.	Generating plant and 66 K. V. Outdoor station at Pallivasal	9·24	,,
C.	Transmission Lines and 66 K. V. Sub-stations including staff quarters	41·80	,,
D.	Distribution system and 11 K. V. Sub-stations	8·66	,,
E.	Supervision	4·60	,,
F.	Contingencies	6·89	,,
G.	Interest charges	15·68	,,
	Total	Rs. 131·27	Lakhs

The Pallivasal Power House as now completed contains 3 generating sets of 4,500 K. W. each of which one is a standby. With the present equipment, power corresponding to 7,000 KVA is available for transmission to the distribution centres in the plains while 3,000 KVA is ear-marked for distribution at 11 KV to the bulk consumer in the High Range area. The present Transmission system consists of:

134 miles of double circuit 66 KV lines
26 miles of single circuit 33 KV lines
11 miles of double circuit 11 KV lines
130 miles of single circuit 11 KV lines and
92 miles of L. T. distribution network.

The following are the major 66 KV substations now operation *viz.*, Kothamangalam, Alwaye, Pallam, Mavelikara and Kundara. There is besides a 33 KV step down station at Alleppey. The transformer capacities of the various stations are as follows:

Pallivasal	...	2×5,000 KVA (11/11/66).
Kothamangalam	...	2×500 KVA (66/11)
Alwaye	...	2×2,000 KVA (66/11)

G. P. T 2547, 100. 25-1-1117.

Pallam	...	2 × 66/11
Mavelikara	...	2 × 3,500 K V A (66/11/33)
Kundara	...	2 × 2,000 K V A (66/11)
Alleppey	...	2 × 1,250 K V A (33/11)

There are 44 Nos. of 11 K V/400 transformer stations installed in this system. Except for the distribution in the High Ranges where power is sold in bulk and for the Kottayam town which is operated under a license, all consumers in the entire network covered by the P. H. E. Project are supplied direct by the Department. At the end of 1115, the connected load in the system was 4,155 K. W. while the average peak-load in station was 2,000 K. W. with a monthly generation of 800,000 units.

It is now proposed to consider in the following pages the development of the load during the next 10 years in the various centres which are already supplied with power and other places to which the supply has to be extended. It is anticipated that in the course of the next 10 years, the P. H.E. Scheme will have to be developed to its fullest capacity when 3 further sets of 7,500 K. W. will have to be added necessitating the installation of 2 more penstocks and the provision of adequate storages in the upper reaches of the Mudirapuzha River. The Civil works for such extensions are not discussed in this report but it is roughly estimated that these will cost approximately Rs. 100 Lakhs of which about Rs. 28 Lakhs will have to be spent on the penstocks, Rs. 2 Lakhs for the Power House buildings extensions and other subsidiary works and the remaining Rs. 70 Lakhs for the storage. The total capital expenditure at the end of the 10th year is estimated to go up to Rs. 350 Lakhs and the works in the completed stage will then provide for an effective capacity of 31,540 K. W. in the generating station. One additional 66 K V step down station at Mundakkayam and another one at Trivandrum besides an 11 K V receiving station at Peermade have been provided for under these extensions. Besides, the transmission and distribution systems will be extended by the additions of the following lines :

94 miles of double circuit 66 K V lines
28 miles of single circuit 66 K V lines
12 miles of double circuit 33 K V lines
19 miles of double circuit 11 K V lines
375 miles of single circuit 11 K V lines and
290 miles of L. T. distribution network.

At this stage of development, there will be 245 Nos. of 11 K V/400 volts transformer stations. It is expected that at the end of the 10 year, the maximum demand at the power house will reach 29,000 K. W. with an annual generation of A 192 million units. The major load on the system will be 14,000

K. W. of supply to the Aluminium factory at a load factor of approximately 85%. This corresponds to about 15,900 K. W. in the generating station with an annual generation of 110 million units. Out of the remaining 14,000 K.W, 3, 800 K.W. will be reserved for the bulk supply to Cochin leaving a balance of 10, 200 K. W. of maximum demand in the Power House which will be available for the system load in the state representing an annual generation of about 63·5 Million units to cater for a connected load of approximately 27,900 K. W.. The combined maximum demand of the various loap centres will then be 31, 300 K. W.

This report proposes to deal with a forecast of the development expected during the next 10 years of operation of the Project and for this purpose the load conditions on the system are dealt with having regard to the area covered by each major 66 KV substation. Such an area will comprise of the major 66 KV or 33 KV sub station,

the 11 KV distribution lines,
the 11 KV step down transformers and
the L T distribution net work.

1. *The Pallivasal Centre.* The generation in the Pallivasal Power House is at 11 KV which is stepped up to 66 KV for the transmission of power to the Plains. The transformers at the station are provided with 3 windings. The load near the Pallivasal generating station which consists of bulk supply to the K. D. H. P. Co.'s Tea Factories, of which 34 are now operated with electric power. They used to generate their own power from 2 small water plants near the Pallivasal Estate. Since the inauguration of the Government Hydro Electric Project, they have closed down these stations and they are taking their supply from the Government system. The chief requirements of power for the K. D. H. P. are for the running of the machinery at the various tea factories and for operating their ropeways in addition to the lighting of their bungalows and staff quarters situated in about 40 square miles of territory through which they run their distribution system. Power is also used in the Factories to a limited extent for the withering of the tea leaves. The total connected load as it stood at the end of 1115 was 1700 K. W. with a maximum demand of 1200 K. W. and an average maximum consumption of 4·2 million units. This tea load is not anticipated to show any phenomenal increase during the next 10 years. The only increase anticipated as shown in the statement appended to this report is due mainly to the consumption in the new factories that may be installed hereafter in the new estates that have been opened recently. It is also anticipated that developments may take place for the extended use of electric power for withering purposes especially in

those estates where the humidity of the atmosphere may justify the installation of such a plant. Some of the latest type of factories are using electric power for drying also and it is possible that in course of time some of the very important factories may be improved on those lines. Such anticipations are, however, not considered in this forecast and the increased demand for power has been estimated on a more conservative basis having regard only to the natural development of the load in the factories primarily for motive purposes. It is also expected that some of the estates outside the K. D. H. P. Company's area may also take the supply as soon as the necessary distribution license is granted to this company. On such a basis, it is not unreasonable to anticipate that the increase of demand may go up to 1600 K. W. within 10 years when the annual consumption will reach 6 million units. To cater for this additional increase in demand, no capital expenditure will have to be incurred by the Department as the supply is given in bulk at the K. D. H. P. Co.'s receiving station and the existing lines to this station have been designed to carry the full load anticipated.

There are no other load centres to be supplied from the Pallivasal station.

2. *Kothamangalam Centre*: The 66 K. V. transmission lines from Pallivasal enter the Kothamangalam substation, 31 miles away and from there branch off to Alwaye and Pallam. The importance of this station is not due to the load that can be anticipated in the areas which can be conveniently fed from this station but because it is a main switching-in station. Advantage has however been taken to utilise this station to develop the load in the areas nearby. Kothamangalam is an agricultural district where extensive paddy cultivation exists at present. Within a mile of the station there are 2 rice mills with a total demand of 50 K. W. L. T. supply has already been given to the town, but so far only lighting load has been connected up. The 11 K. V. lines have been extended from this town to Mudikal about 11 miles away. There is a Match Factory here which has been running with its own steam plant, but now they are changing over to electric drive. From the 11 KV line to Mudikal a tapping has been taken to the Perumbavur village and L. T. supply made available. This small township is also an important rice-hulling centre. Besides lighting of the roads and supply of power for domestic consumption, power has been made available to a rice mill already. There are two more rice hullers which will change over in due course. It is expected that some small industries will also come up in due course in this place.

The extension to Malayattur and other areas for the irrigation of the lands covering 10,000 acres is anticipated very

shortly. This extension will involve the construction of 5 miles of 11 K. V. lines. Sugar-cane is largely grown in this area and it is expected that power to some extent may be utilized for crushers in due course. Investigations have been carried out in the area south of Kothamangalam for the supply of power to Muvattupuzha and Thodupuzha. Supply to Muvattupuzha can be made by extending 5 miles of 11 K. V. lines and by a further extension of 12 miles, power can be supplied for lighting, domestic consumption and rice hulling in Thodupuzha. There is likely to be a very great demand for power for lift irrigation purposes en route. But this has however to be considered only for the period of the last 5 years in this report when the irrigation load is anticipated to be developed in collaboration with the Irrigation and Agricultural Departments. The load in the Thodupuzha area is more promising. There are some rice mills and oil mills at present worked by gas and oil engines. All these will change over to electric drive in course of time. Within a radius of 5 miles from Thodupuzha town there are a large number of rubber estates developing their own power from oil engines. Supply can be made to these estates by extending 11 K. V. lines from Thodupuzha. Enroute to Thodupuzha is the small township of Vazhakulam where there is a rice huller worked by an oil engine. There is a large monastery and several residential buildings in this place. Power can be supplied to this locality by taking a tapping from the 11 K. V. Muvattupuzha Thodupuzha lines. The development of the Muvattupuzha and Thodupuzha areas can be taken up in stages during the next 2 or 3 years.

The Kothamangalam sub-station is at present provided with two 500 KVA transformers, of which one is a standby. This arrangement will be ample to supply all the load anticipated in that area. The maximum demand is expected to reach 500 K. W. by 1125 with an annual output of 1 million units. The capital investment required to develop this load is given in the estimates appended to this report.

3. *Alwaye Centre*: Alwaye will be the most important load centre in the whole P. H. E. system taking into account the supply to the Cochin State and for the Aluminum Factory the total of both will reach 18,000 K. W. by the end of 1125. The existing 66 K. V. double circuit transmission lines feeding Alwaye from Kothamangalam are 19½ miles long and are designed to carry approximately 7,000 K. W. The Alwaye sub-station is provided with two 2,000 KVA transformers of which one is a standby. Power is supplied from Alwaye at 11 K. V. to Sri Chitra Mills at Kalamasserry which is about 3½ miles from the sub-station. These are owned by Messrs. E. D. Sassoons & Co., Bombay and they are at present confining their attention only to bleaching and finishing piece

goods. The load connected up at present is only 120 K. W. for driving the machinery, and water pumps for the above processes. They have a scheme to install power looms for which another 200 K. W. will be required ultimately. But such developments and the consequent increase in consumption are not taken into account in this forecast and only the gradual expansion of the existing business is alone taken in to consideration. The present connected load is expected to go up to 150 K. W. with an average annual consumption rising from 110,000 units to 137,000 units by 1121.

On the 11 K. V. line route to the Sri Chitra Mills are situated the Standard Potteries and Tile Works where supply has already been made available. They were originally using gas engines for driving their machinery, but most of the machinery have now been changed over to electric drive. The complete change over is expected to be made by the end of 1116. The connected load of 132 K. W. at the end of 1116 is expected to rise up to 165 K. W. in 1121-1125 due to the extension of plant, and the annual consumption is expected to rise from 200,000 units to 250,000 units. There are several rice hullers and one oil mill at Alwaye which are using electric power. Power is also supplied for street lighting, Cinema and for domestic consumers.

From Alwaye the 11 K. V. lines have already been extended to Parur a distance of 9½ miles. Parur is a medium sized municipal town in the Northernmost part of the State where rice hulling and oil milling plants are operating. Besides supplying power for street lighting and domestic consumption, supply has also been given to motors for driving rice hullers, presses etc. There is a Cinema also in this town taking power from the distribution system.

The 11 K. V. lines from Parur have been further extended to Kuthiathodu to serve the requirements of lift irrigation for raising a second crop in the extensive paddy fields in this area. Pumping with electric power was tried during the last season on an experimental basis and the results were found to be highly satisfactory. It is therefore anticipated that electrically driven pumps will be used on a very large scale in this area for raising a second crop. The load from such a source will be only seasonal but it will be amply remunerative due to the higher tariffs for such loads.

Another scheme for using electric power in lift irrigation in the extensive paddy fields along the 11 K. V. line route from Alwaye to Parur is also under consideration. But any development on this account has not been included in this forecast as the scheme has not yet taken a definite shape. In the meantime, supply has been made in the intermediate places enroute primarily for domestic purposes and the extended use for such consumers has been provided for.

Investigations have been completed for supplying power to Pallikara which is 7 miles from Alwaye and the centre of an agricultural district. Besides lighting load in the bungalows of the rich landlords in this area, power will be supplied for pumping and rice hulling. Extension of supply lines to the tile factories on the northern side of the Alwaye river and distribution to the towns of Ankamali and Kaladi are also under contemplation. Three tile factories are ready to change over to electric power, scrapping their existing oil and gas engine plants when supply is made available to them. The Ankamali and Kaladi lighting load as well as power loads for rice hulling and pumping purposes can be developed. It is also intended to extend the supply lines to the village of Edappalli on the Travancore—Cochin frontier. Lighting load and a small power load consisting of one rice mill and one oil mill are anticipated in this area.

The total connected load for the distribution system will be over 400 K. W. with a maximum demand of approximately 350 K. W. at the end of 1116. This is expected to increase to a connected load of about 968 K. W. by 1125 with a maximum demand of 550 K. W. The annual consumption is expected to be 440,000 units in 1116, rising steadily to about 1,100,000 units by 1125.

The other loads immediately anticipated to be supplied from Alwaye centre are those for the Aluminium Factory and for the Cochin State. Since these are bulk consumers of large magnitude they are discussed separately towards the end of this report as major items not included under Alwaye distribution centre.

4. *Pallom Centre*: The 66 K. V. sub-station at Pallom is situated 3 miles to the south of Kottayam. This station is fed from Kothamangalam at 66 K. V. through a double circuit transmission line 37½ miles long. At Pallom, two 2,000 KVA transformers are installed for the distribution in the areas covered by this centre. One of these transformers is a standby.

Power at 11 K. V. is supplied in bulk from Pallom to the Kottayam Electric supply agency for distribution in the Kottayam town coming within his licensed area. The peak load of the Kottayam supply was 90 K. W. in 1115 with an annual consumption of 2 lakhs of units. Kottayam is an important business centre, but industrial development in the town was very slow due to the difficulty of obtaining cheap power. The inauguration of the P. H. E. supply will remove this handicap and already several developments have become manifest. There are rice mills and flour mills in the town using electric drive. An oil mill is about to be started and a rubber factory taking 45 K. W. has been connected up at the beginning of 1116.

From Kottayam, the 11 K. V. distribution lines are to be extended to Mannanam and Athirampuzha, a distance of 5 miles. Mannanam is an old Christian centre with monasteries and convents. The main load will be only for lighting and printing purposes, but the small town of Athirampuzha about 1½ miles from Mannanam has 3 rice mills running on gas and oil engines. Athirampuzha is the centre of an agricultural district, and besides the lighting load and rice hullers power will be required for dewatering paddy fields. This last load has not been considered in the forecast. From Athirampuzha the lines will be extended to Palai, *via* Ettumanur. The total distance to be covered is 15 miles. The consumption at Ettumanur will be small as it will mainly be only a lighting load. Near Ettumanur is a tile factory on the route to Palai, where a steam engine is used at present. Negotiations are in progress to change this over to electric drive. The prospective load at Palai is attractive. It is an agricultural and business centre with many rich capitalists. Power is anticipated to be used for rice hullers and oil mills besides for lighting.

The 11 K. V. lines from Pallom supply power to the Municipal towns of Changanacherry and Thiruvalla. L. T. distribution has already been completed in both these areas. The loads are mainly for lighting and rice hulling. East of Thiruvella is an area where sugar cane cultivation is carried on an extensive scale. The crushing of sugar cane was until recently done entirely by bullock driven mills. During the last season, the 11 K. V. supply was extended by 5 miles to Eraviperur, and 3 electrically driven crushers were installed. The results were very satisfactory and it was found that the electrically driven crushers were able to extract more juice and give a higher return to the cultivators. More crushers are expected to be installed during the next season. This load is only seasonal, but is amply remunerative due to the slightly higher tariffs. The 11 K. V. lines will be further extended from Thiruvella to Chengannur for distribution in that area. The load anticipated at Chengannur is also for lighting and small power. Extension to Kozhencherry can be made from Chengannur. The usual lighting and small power loads are available in this town as well.

Between Pallom and Changanacherry power has been supplied to an Engineering Workshop at Chingavanam. This was a change over from gas engine to electric drive. There are two more gas engines in the workshop. These also will be changed over in due course.

It is also proposed to supply power to some of the residential areas near Pallom. An investigation has shown that such an extension will be remunerative.

The most important load supplied from the Pallom centre is for dewatering the punja fiels. Extensive areas in blocks of hundreds of acres reclaimed from the Vembanad lake are dewatered during certain seasons and paddy cultivated there. The dewatering will have often to be carried out to a depth of 6 or 7 feet. It was the practice until this year to make use of gas and oil engines for this purpose, but a trial pumping done with electric drive undertaken before the inauguration of the P. H. E. supply showed that electrially driven pumps will be able to effect economy. After the inauguaration of the Project, a scheme was prepared for the distribution of power at 11 KV in this area, and the work was carried out and supply made for 15 pumps each coupled to 50 HP motor during the last season. This pumping load is expected to increase from a M. D. of 550 K. W. in 1116 to over 2,000 K. W. by 1125. This is only a seasonal load for $1\frac{1}{2}$ to 2 months in the year, but it will be amply remunerative due to the special tariffs. This seasonal load has the advantage that it comes on when the tea load in Munnar and Peermade will be very low (for about 2 months) and so these two loads will have the cumulative effect of not increasing the peak load appreciably. Moreover this pumping load comes on at a time just after the North East Monsoon and hence no water will have to be drawn from the storage for generating the power required to meet this seasonal load.

The distribution in the Punja area will cover lines up to Kumarakam and Vechur from where a 5 miles extension will carry power to Vaikom. The load in Vaikom will be as usual for lighting and for small power purposes. The Municipality will change over to electric lights when supply is made available.

The only other important load to be supplied from Pallom is the supply to Peermade. This will be at 66 KV and is dealt with separately.

The connected load in the Pallom centre excluding Peermade will be over 1,000 K. W. in 1116 with a maximum demand of approximately 500 K. W. and a consumption of approximately 860,000 units. This load is anticipated to grow up steadily to about 4,800 K. W. connected load, 1,900 K. W. maximum demand and an annual consumption of 3·8 million units by 1125.

The capital expenditure for this development is given in the estimates accompanying this report.

5. *Mavelikara Centre.* The main importance of Mavelikara centre is that it is the branching point from which power is transmitted to Alleppey and Kundara. Supply to Mavelikara is made from Pallom through a 66 K. V. double circuit lines 24 miles long. At Mavelikara two 3,500 KVA/3 winding

transformers step down the power from 66 KV to 33 and 11 KV. Alleppey is now supplied from Mavelikara at 11 KV. As soon as the 33 K. V. transformers at Alleppey are dried out, supply will be changed over to 33 K. V. The 11 K. V. lines which supply power to Alleppey now will then be used only for distribution in the area between Mavelikara and Alleppey.

Supply has already been made available from the Mavelikara substation to the local township through an L. T. fletwork, and to Kayamkulam through 11 K. V. lines. The load at present in Mavelikara town is for lighting and for one or two rice mills. Kayamkulam is a business centre where besides lighting power, is supplied to oil and rice mills. It may become necessary to extend these 11 K. V. lines along the costal region as far as Karunagapalli and Chavara to cater for the additional load coming under the Quilon area of supply. The further development in the Kayamkulam area is not expected to be very appreciable.

The prospective supplies from Mavelikara are also not very many. There is a Government leper colony at Noornad which has its own Diesel engine driven generators and a storage battery plant. It is proposed to extend 11 K. V. lines from Mavelikara to Nooranad. Supply will then be made available to the places enroute. The saving in the maintenance and running costs of the Noornad plant will be appreciable when the extention is taken up. Supply to Muttam, Haripad and similar small towns will be undertaken by tapping the 11 K. V. lines extending up to Alleppey. The load in this area will be mainly lighting with a small power load due to rice hullers and oil mills.

In the Thottapalli area, there are extensive paddy fields where pumping also can be undertaken with electric power. The load in the Mavelikara centre is expected to increase from 100 K. W. M. D. and 170,000 units consumption in 1116 to 500 K W. maximum demand and a consumption of 1,000,000 units by 1125.

The capital expenditure for developing this load is given in the estimates accompanying this report.

6. *Alleppey Centre*: Alleppey is the most important port in Travancore. It is also an industrial centre where several oil mills and coir factories are working. Most of them used to run on gas, oil or steam engines, but some have now changed over to electric drive. The main difficulty at present for effecting a change over now is the increased cost of electric motors and other equipment due to the war conditions. The general business slump experienced at Alleppey due to want of shipping facilities has affected the coir factories very seriously, several of which had even to shut down due to the

European markets being closed. The oil mill industry is also adversely affected to some extent due to the present condition brought about by the war. As soon as conditions become normal, most of the existing factories will be able to change over to electric drive.

In several of the coir factories, steam is used to a limited extent for heating up the dye liquor. Special low tariffs have been allowed for such heating purposes and it may therefore be possible to develop this load in due course. This particular load has however not been taken into account in this forecast.

The town distribution has been planned in detail to make changeover of existing plant to Electric drive very easy and convenient. The capital to be spent will be very low hereafter for connections to such power consumers as due to the extensive town area and distributed loads. Alleppey is fed from 3 separate 11 K. V. substations, with a 11 K. V. ring main (under-gound cable) already laid for the purpose. The street lighting and domestic load in Alleppey are also appreciable. Outside Alleppey town is the Water Works pumping plant drawing water from very deep tube wells. The pumping and auxiliary power plant are all supplied from the Alleppey distribution system. Power for dewatering the paddy fields near Alleppey will also be supplied from the Alleppey substation. The 11 K. V. lines have been extended from Alleppey to Shertallai and a substation has been installed there for supply of power to the large oil mills in the area. The changeover has not yet been effected. This is anticipated in the next 2 or 3 years. There are oil mills at Kuthiathodu and Thycauttuserry near Shertallai. Supply will be given to these places as well. Extension to the town of Ambalapuzha is also proposed to be taken up.

The connected load at Alleppey at the end of 1116 will be about 700 K. W. with a maximum demand of approximately 400 K. W. and a consumption of 1·14 million units. This is anticipated to increase steadily to a connected load of 4,100 and a M. D. of 2,000 K. W. and an annual consumption of 9·0 million units when the majority of the mills and factories are connected up.

Details of capital expenditure for this development are given in the estimates accompanying this report.

7. *Kundara and Quilon Areas.* Kundara is at present the southern-most point in the P. H. E. system served by a 66 K. V. double circuit line from the Mavelikara substation. The distribution from Kundara is at 11 K. V.

The only load in the immediate neighbourhood of Kundara is the Government Ceramic Factory where the entire plant is electrically driven. Electric power is also used to work a

furnace in the factory. At present, the Ceramic Factory is concentrating mainly on the refinement of China clay, and the manufacture of finished articles is done only on a small scale. But this section is being extended. It is anticipated that due to the additional machinery which will be installed for the manufacture of such finished articles, the load will go up appreciably within the next few years. There is also the proposal to start a textile mill near Kundara. This may be a *fait accompli* within the next 3 or 4 years.

A double circuit 11 K. V. line transmits power from Kundara to Quilon. Enroute a tapping is made to supply power to Kilikollur for a cashewnut factory. The load in this small centre is not expected to increase appreciably, although it is sufficiently remunerative to make the local distribution self supporting.

Quilon is the biggest load centre for distribution at 11 K.V. in the whole P. H. E. system. Before the inauguration of the system, the town was served by a thermal plant which built up most of the small load in the area. But due to the limited capacity of the plant, it was not possible to supply power to all those who wanted it. Rapid development has taken place in the supply with the inauguration of P. H. E. Project.

From Quilon Power is transmitted to Chavara and Neendakara for supply to the illmenite factories. There were 3 factories at Chavara before the supply of hydro electric power. The total connected load was 500 K. W. with an annual consumption of approximately 1·4 million units. This load has since increased due to the installation of additional plant in the existing factories. Moreover a new factory has since come into existence in this area. The load factor of this mining industry is very high as it operates continuosly on a 21 hour basis throughout the year except for a shut down of 8 hours every Sunday. All these factories are gradually expanding and additional plants are being installed. They started work at Manavalakurichi in southern Travancore first, and plants which generate their own power are still working in that area. But the mineral deposits at the old site are getting exhausted and so within the next two or three years the companies propose to concentrate their entire attention in this area. This will gradually increase the load at Quilon.

The Quilon town is also a large industrial and business centre. Besides the lighting load for private consumers and street lights, power loads are also important in the town. Messrs. A. D. Cotton Mills in Quilon town used to work with their own steam plant till the end of 1115. They have now scrapped their engines and changed over to electric drive. The present connected load is over 250 K. W. and average monthly consumption of 1 lakh of units. They are making

arrangements to complete their entire changeover within the next four months and also to connect their weaving section which is at present worked by a gas engine of 200 H. P. Oil mills, saw mills and rice mills in the town are also taking power from the P. H. E. system. There are a large number of tile factories also besides other small industries which will change over within the next 3 to 4 years.

Besides the Quilon load which is fed at 11 K. V. from Kundara, supply will also have to be extended to the Punalur Paper Mills, 20 miles to the east of Kundara. These mills are at present working with their own power plant partly hydraulic and partly steam. A changeover is anticipated in 1119. From the supply lines to Punalur power will be tapped for distribution at Kottarakkara which is a small town on the route to Punalur. The load in this town will be mainly for lighting and for rice hulling.

The load in the Kundara centre was approximately 1,700 K. W. connected load with a maximum demand of 550 K. W. at the end of 1115. The annual consumption was just over 2 million units. The connected load at the end of 1116 is anticipated to be about 2,700 K. W. Maximum demand of 1,000 K. W. and annual consumption of over 5 million units. This load is expected to rise up to a connected load of 4,780 K. W. by 1125, with a maximum demand of 1,750 K. W. and consnmption of over 11 million units per annum.

The details of capital expenditure anticipated for developing this load are given in the estimates accompanying this report.

8. *Aluminium Factory at Alwaye.* So far, only those areas covered by the P. H. E. system and the extensions contemplated therein have alone been considered. But there are some important bulk consumers like the Aluminium factory and the Cochin Government to whom supply has to be given very soon now that a satisfactory agreement has been reached with both the parties.

The Aluminium Production Co., of India Ltd., have made all arrangements for opening their factory at a place 3 miles from the Alwaye sub-station. They will be requiring 4,500 K. W. from March 1942 and 1,000 K. W. of seasonal power for about 8 to 9 months in addition. The load factor of this supply will be very high, as the factory will be working continuously. The next stage of the development of this factory will be in 1944 when they will be requiring 7,500 K. W. of firm power. It will work to its fullest capacity from 1945 when 14,000 K. W. will have to be delivered to them. This will mean an annual consumption of 120 million units and an annual return of Rs. 10·575 lakhs to the department. The supply is to be made at 66 K. V. at the Company's premises.

For the first block of power to be supplied by 1942 March, the existing plant capacity at Pallivasal will be ample. The only additional construction required is to extend the 66 K. V. feeder lines to the company's works from Alwaye sub-station and to make the switching arrangements at Alwaye. An additional 8,825 KVA transformer will also be installed at Pallivasal. These works are being taken up. By the time the final stage is reached, *i. e.*, when 14,000 K. W. have to be delivered, the extension of the plant at Pallivasal will be necessary. For this purpose, plans and specifications have been prepared, tenders invited for the whole plant and the work is expected to be started in another year. A duplicate double circuit line will also have to be erected to supply power from Pallivasal to Alwaye as the existing lines will not be enough to carry the full load for the Aluminium factory. Tenders have been invited for this item of work also. All these works are expected to be completed by the end of 1943 so that the 7,500 K. W. of firm power required may be delivered to the Aluminium works by 1944 July and 14,000 K. W. by July 1945. Works are also in progress for the construction of the necessary storages to supplement the flow in the river.

The details of capital expenditure for the supply of power to this industry are given in the estimates accompanying this report.

3. *Supply to the Cochin State.* The supply is proposed to be made in bulk to the neighbouring State of Cochin at 3 points. The immediate requirements of the Cochin Government for supply at Ernakulam are expected to be met by December 1941. The 11 K. V. lines will be extended from Alwaye to Ernakulam for this purpose and will cater for a maximum demand of about 600 K. W. with an annual consumption of 3 million units in the 1st year of supply.

Another point where supply will be given immediately is the Cochin Government's Water Works station at Chowwara. This pumping plant is at present worked by diesel engines and has a maximum demand of 120 K. W. and average 24 hour load of 100 K. W. The consumption will approximately be 1 million units per annum. As a second stage, power will be delivered at the Northern frontier at 33 K. V. for transmission to Trichur and other places. This is expected to be completed in another 2 years. The maximum demand for this supply will be 800 K. W. to start with and with an annual consumption of 4 million units which will gradually rise up to a maximum demand of 1,800 K. W. at the end of the 7th year. The total maximum demand of the supply to Cochin by the end of 1125 is expected to reach 3,500 K. W. and the annual consumption will then be 17·5 million units. Details of capital expenditure to supply power to Cochin are given in the accompanying estimates.

10. *Extension to Trivandrum.* Trivandrum, the capital of the State is at present served by a diesel plant. The maximum demand during 1115 was 720 K. W. with an annual generation of 1·35 million units. It is expected to connect Trivandrum to the Hydro Electric system by 1119 when the maximum demand will be about 850 K. W. with a consumption of about 2 million units. 39 miles of 66 K. V. double circuit lines will be required for extending the supply from Kundara to Trivandrum. The development of power loads in Trivandrum at present is handicapped by the fact that very attractive rates cannot be offered due to the higher cost of generation from a diesel plant. Supply from the P. H. E. system will overcome this difficulty.

After the Trivandrum Extension is carried out, extension can also be taken up at 11 K. V. to Thuckalai in South Travancore for bulk supply to the Nagercoil Licensee. Supply can also be given to the towns of Balaramapuram, Neyyattinkara and Kuzhithurai enroute. These towns have lighting load, cinemas and small industries. The extension to Trivandrum and the south is expected to bring in a load of 1,000 K. W. maximum demand and an annual consumption of 2·5 million units by 1125.

11. *Extension to Peermade.* Peermade is in the High Ranges, 46 miles to the east of Kottayam. This area has an extensive tea plantation and a large number of tea factories with a connected load of about 1,200 K. W. at present developed by isolated oil engine units. The consumption in Peermade area will be about 4 million units within 2 or 3 years of extending the supply. The planters in the area are anxious to obtain power from the Hydro Electric supply and it is likely that they may ultimately use electric power for withering also. In that case, the consumption will be much higher than 4 million units, but such a development of load has not been taken into account in the forecast. It is proposed to extend the supply by 1119. Mundakayam which is 33 miles from Kottayam on the Peermade route is an important area where there are a number of rubber estates. There is at present a connected load of over 350 K. W. in the various factories in these estates situated within a small radius of Mundakayam. If the supply is extended to Peermade, all these factories at Mundakayam can be supplied from a sub-station located here. This rubber estate load will bring in a consumption of about 1 million units within 2 or 3 years of inauguration. As a first stage, it is proposed to construct a single circuit 66 K. V. line on T. W. poles up to Mundakayam where the voltage will be stepped down to 11 K. V. Local supply will be at 11 K. V. and power to Peermade will also be transmitted at 11 K. V. for the next 10 miles. There will be a main 11 K. V. Receiving Station at Peermade

from where power will be distributed at 11 K. V. to the various factories.

The capital expenditure to be incurred for this development is given in the accompanying estimates.

12. *Miscellaneous.*

(*a*) *Caustic Soda Plant.* With the opening of the Aluminium Factory at Alwaye, an increased demand for caustic soda will arise, as c ustic soda is required in the process of manufacturing Aluminium. Travancore has at present a surplus production of good quality common salt which can be used economically for the production of caustic soda. Chlorine which is the by-product will also find a good market in neighboring textile mills. Hence every facility exists for the opening of a caustic soda factory in Travancore and the question is being considered by Government. It is anticipated that a factory of small size (at least 500 K.W.) will begin operation by 1121. The load factor will be high in the case of a caustic soda plant and the annual consumption is expected to be about 3·5 million units. The most suitable place for the factory may be at Alwaye near the Aluminium Factory, the main consuming centre for Caustic Soda. The capital cost to be incurred for supply will be small as it will be only for an 11 K. V. service and metering equipment.

(*b*) *Cement Factory* : Travancore imports a large quantity of cement every year for Government works as well as for private use. Besides an abundant supply of suitable raw materials, cheap power is now available. The question of starting a cement factory is now under the consideration of Government. The shell deposits of the Vembanad lake have been found to be an excellent substitute for this industry. It is anticipated that between 1121-1125 a cement factory with a maximum demand of 700 K. W. and 4·9 million units annual consumption will come into operation. The probable site is near Pallom on the shores of the Vembanad lake where shells are available. The capital cost for the extension of the supply to this factory will be small since Pallom station is near by.

(*c*) *Paper and Pulp Industry.* The suitability of the reeds available in the local forests for the manufacture of pulp and paper has already been well established. It is therefore anticipated that a paper or pulp factory utilising these raw materials will be very soon established near about Alwaye on the banks of the Periyar river which affords excellent facilities for the transport of the reeds from the forests higher up. The capital expenditure for extending the supply to this factory will not be high as the Alwaye substation is near by. The annual consumption is anticipated to be 7·5 million units with a maximum demand of 1000 K. W.

(*d*) *Other Industries.* It is also anticipated that several smaller industries such as an aluminium rolling mill, manufacture of surgical bandages etc., (by Johnson and Johnson) and the development of plywood manufacture will be started in Travancore in the course of another 10 years. 2,000 K. W. of power is only a modest estimate of such loads, and the annual consumption may be about 7 million units. Such industries will be started in areas where power is already available and so the additional capital investment for the extension of the lines will not be appreciable.

13. *Summary.* The following statement gives an annalysis of the connected load and maximum demand of the various industries and other power consumers expected to be supplied from the P. H. E. system by the end of 1125.

No.	Details.	Connected Load K. W	Maximum Demand. K. W.	Remarks.
1.	Aluminium Production ...	15,000	14,000	
2.	Bulk supply to the Cochin State ...	3,500 (Max.demand)	3,500	
3.	Tea Industry ...	3,300	2,000	
4.	Rubber Industry ...	800	600	
5.	Ceramics (*a*) Porcelain and China Clay ...	420	250	
	(*b*) Tile factories ...	520	250	
	(*c*) Cement Factory ...	1,0 0	700	
6.	Textile mills	1,100	900	
7.	Oil Mills	1,840	1,200	
8.	Coir Industry	1,200	700	
9.	Rice and flour mills	1,540	750	
10.	Engineering Workshops ...	600	400	
11.	Sugar cane crushing ...	350	250	Seasonal
12.	Dewatering in the Punja Fields ...	3,300	3,000	Seasonal
13.	Lift Irrigation	550	450	Seasonal
14.	Chemical Works	600	500	
15.	Paper and Pulp Industry ...	1,80)	1,200	
16.	Domestic and factory lighting, Cinema and street light Installations ...	6,000	2,500	
	Miscellaneous loads such as saw mills, wood works, match factory, printing presses, cashewnut factory, cold storage, laundry, Jin factory etc.	3,000	1,200	
	Total	46,420		

It is anticipated that by 1125, the maximum demand at the Power House will be about 29,000 K. W. with an annual generation of approximately 192 million units. Out of this, 18,800 K. W. represents the combined demand of the Aluminium Factory and the supply to Cochin. The balance of 10,200 K.W. therefore represents the maximum demand of the Travancore system, the connected load of which will be about 27,900 K. W.

14. *Capital Expenditure and Revenue.* A forecast of the progressive capital expenditure and revenue is given in App. 3. The capital investment on the 1st stage of the P. H. E. Project to the end of 1115 is Rs. 131·27 Lakhs. The additional annual investment under each load centre is given in the accompanying statement and the details are given in the estimates given in the Appendix 5. When the Quilon Electric Supply was amalgamated with the P. H. E. system the capital investment on that distribution stood at Rs. 315,500 and the Depreciation Fund at Rs. 73,000. The nett balance B. Rs. 2,38,500 has been added to the P. H. E. capital during 1116. The Trivandrum Electric Supply capital less depreciation fund as it is expected to stand at the end of 1118 is Rs. 3,93,000. This amount is also shown as being added to the capital of the P. H. E. system in 1119 when Trivandrum Electric Supply will be absorbed in the P. H. E. system.

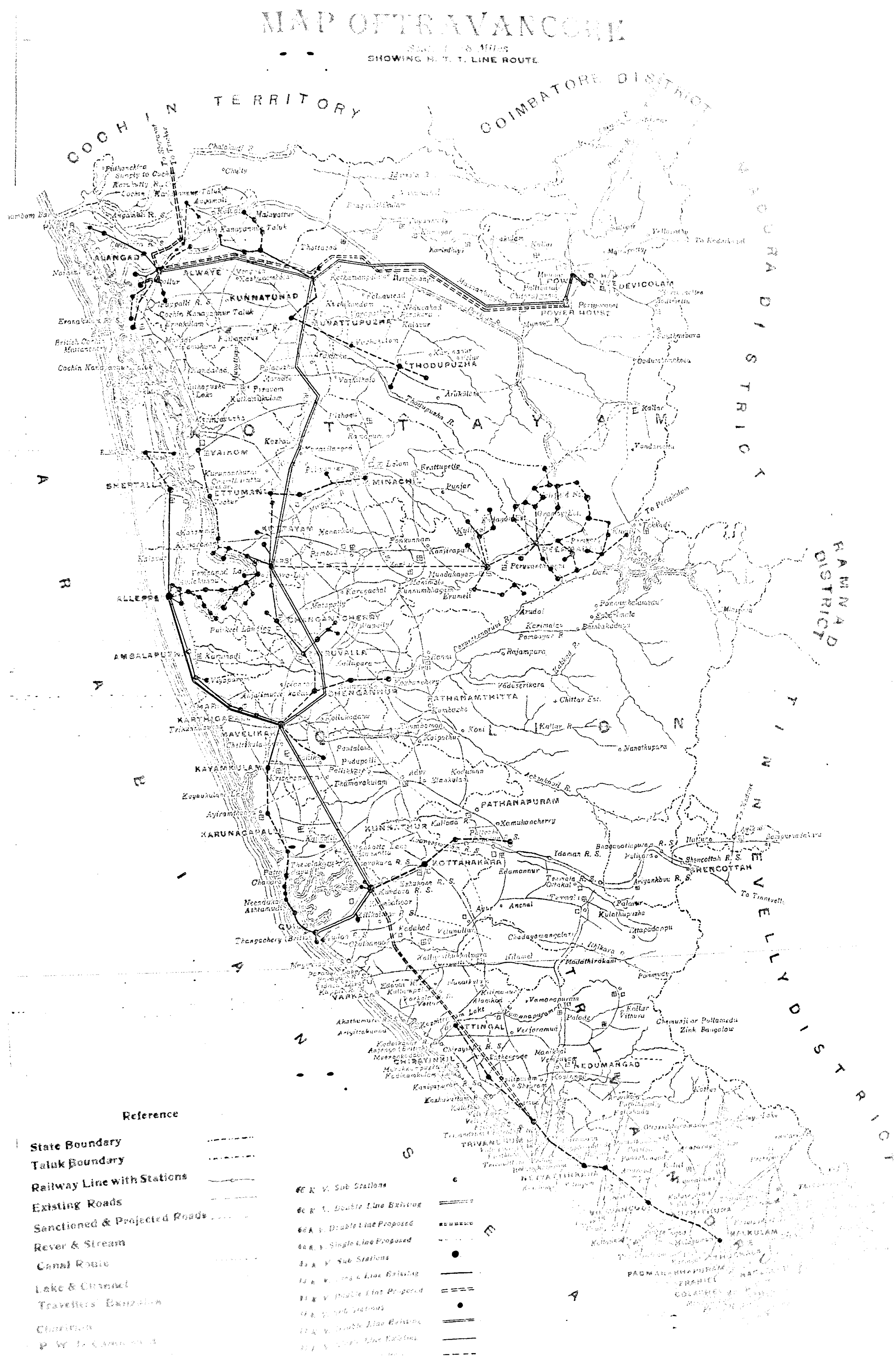
The total capital investment when the full development is complete is anticipated to be B. Rs. 350 lakhs. The corresponding progressive gross revenue figures are shown year-war in the statement in Appendix 3. The operation expense towards the latter part has been estimated to be about 2 per cent. of capital. Interest is taken at 4 per cent. of capital and Depreciation at 2¼ per cent of capital. It is seen that in 1116, there will be an interest deficit of Rs. 4,48,000 without leaving any amount to be set apart for depreciation. During 1117, *i. e.*, in the 2nd year of operation, the interest for the year will be covered, and a part of previous year's deficit cleared up, leaving a balance of interest deficit of Rs. 4,43,520. In the third year of operation, this balance will be reduced to Rs. 2,37,660 which will be completely cleared in the 4th year. An amount of B. Rs. 1, 95,036 will be set apart towards depreciation fund in 1119. The depreciation Fund set apart will be the full amount of B. Rs. 7,17,500 in 1120 besides clearing an amount of Rs. 4,09,500 under depreciation deficits of the previous years. After 1120 the surplus profits will be used for the depreciation deficit not set apart in the 1st four years of operation. It is anticipated that by 1122, the scheme will be able to yield substantial profits allowing for the Working

Expenses. The statement in Appendix 4 gives the details at the end of the 10th year. The scheme is expected to yield a net return of 6·4 per cent. and the depreciation fund to the credit of the scheme at that time will be Rs 70 Lakhs.

A map of Travancore enclosed with this report shows the Transmission and Distribution system at the end of 1125.

Trivandrum,
25th March 1941.

K. P. P. MENON,
trical Engineer.


MAP OF TRAVANCORE
SHOWING H. T. LINE ROUTE
COCHIN TERRITORY
COIMBATORE DISTRICT
MADURA DISTRICT
RAMNAD DISTRICT
TINNEVELLY DISTRICT
ARABIAN SEA
KOTTAYAM
QUILON
TRIVANDRUM
ALWAYE
KUNNATUNAD
MUVATTUPUZHA
THODUPUZHA
DEVICOLAM
POWER HOUSE
MINACHIL
ETTUMANUR
SHERTALLAI
VAIKOM
ALLEPPEY
AMBALAPUZHA
CHANGANACHERRY
TIRUVALLA
CHENGANNUR
PATHANAMTHITTA
KARTHIGAPALLI
MAVELIKARA
KAYAMKULAM
KARUNAGAPALLI
KUNNATHUR
PATHANAPURAM
KOTTARAKARA
SHENCOTTAH
VARKALA
ATTINGAL
CHIRAYINKIL
NEDUMANGAD
NEYYATTINKARA
VILAVANCODE
KALKULAM
PADMANABHAPURAM
Reference
State Boundary
Taluk Boundary
Railway Line with Stations
Existing Roads
Sanctioned & Projected Roads
River & Stream
Canal Route
Lake & Channel
Travellers' Bungalow
66 K. V. Sub Stations
66 K. V. Double Line Existing
66 K. V. Double Line Proposed
66 K. V. Single Line Proposed

)-50.)

Item No.		(1944 – 45)	1121—25 M. E. (1945—50)	
		Units sold	M.D. (KW)	Units sold
1	Palli	4,500,000	1,600	6,000,000
2	Koth	900,000	500	1,000,000
3	Alwa	880,000	550	1,100,000
4	Palla	2,800,000	1900 1500 seasonal	3,800,000
5	Mave	680,000	500	1,000,000
6	Allep	7,500,000	2,000 750 seasonal	9,000,000
7	Kund	9,700,000	1,750	11.000,000
8	Triva clud	2,100,000	1,000	2,500,000
9	Peern	2,000,000	1,000	4,000,000
10	Alum	100,000 000	14,000	100,000,000
11	Cochi	12,000,000	3,500	17,500,000
12	Other	..	3,000	18,100,000
13		700 seasonal)	31,300 (2250 seasonal)	
14		060,000	175,000,000	
15		00 K W	29,000 K W	
16		000,000	192,000,000	

APPENDIX 2

P. H. E. Project – Forecast of Maximum demand and Units Sold 1116-25 M. E. (1940-50.)

Item No.	Name of centre.	1115 M. E. (1940—1941)		1117 M. E. (1941—1942)		1118 M. E. (1942—43)		1119 M. E. (1943—44)		1120 M. E. (1944 – 45)		1121—25 M. E. (1945—50)	
		M. D. (K W)	Units sold.	M. D. (K W)	Units sold.	M.D. (KW)	Units sold.	M.D. (KW)	Units sold.	M.D. (KW)	Units sold	M.D. (KW)	Units sold
1	Pallivasal centre	1,200	4,100,000	1,2000	4,100,000	1.300	45,000,000	1,300	4,500,000	1,300	4,500,000	1,600	6,000,000
2	Kothamangalam centre	50	100,000	200	500,000	250	600,000	300	800,000	350	900,000	500	1,000,000
3	Alwaye centre	250	440,000	400	700,000	450	750,000	475	810,000	500	880,000	550	1,100,000
4	Pallam centre	500 400 seasonal	860,000	900 750 seasonal	1;500,000	1'200 1000 seasonal	2,000,000	1,400 1200 seasonal	2,600,000	1500 1200 seasonal	2,800,000	1900 1500 seasonal	3,800,000
5	Mavelikara centre	100	170,000	200	400,000	280	510,000	350	630,000	400	680,000	500	1,000,000
6	Alleppey centre	400	1,140,000	600 100 seasonal	2,300,000	900 300 seasonal	4,150,000	1200 400 seasonal	6,000,000	1,500 500 seasonal	7,500,000	2,000 750 seasonal	9,000,000
7	Kundara and Quilon	1,000	5,440,000	1,300	8,400,000	1,350	9,000,000	1,450	9,350,000	1,550	9,700,000	1,750	11.000,000
8	Trivandrum and Suburbs including extension to South	..	..	..	..	..	..	850	2,000,000	900	2,100,000	1,000	2,500,000
9	Peermade and Mundakayam	..	..	..	..	..	..	450	1,300,000	600	2,000,000	1,000	4,000,000
10	Aluminium factory	..	..	4500+ 1000 seasonal (part year only)	20,000,000	4,500+ 1000 seasonal	38,000,000	4.500+ 1000 seasonal	38,000,000	14,000	100,000 000	14,000	100,000,000
11	Cochin State supply	..	..	800	4,000,000	1,800	9,000,000	1,900	10,000,000	2,200	12,000,000	3,500	17,500,000
12	Other Industries	..	..	..	..	..	..	..	..	..	..	3,000	18,100,000
13	Total of Max. demands	3,500 (400 seasonal)		11000 (850 seasonal)		13,030 (1300 seasonal)		(15175 1600 seasonal)		248000 (1700 seasonal)		31,300 (2250 seasonal)	
14	Total units sold	12,250,000		41,900,00		68,510,'00		75,990,000		143,060,000		175,000,000	
15	Station Peak load	3,000 K. W		8,500 K W		9000 KW.		11,000 K W		22,000 K W		29,000 K W	
16	Units Generated	13,000,000		45,000,000		74,000 000		82,000,000		156,000,000		192,000,000	

APPENDIX 3.

P. H. E. Project—Forecast of Capital Expenditure and Revenue for period 1116-1125 M. E. (1940-1950).

No.	Name of Station.	Capital Expenditure (New Generating sets, Lines' Stepdown Plant, etc.						Gross Revenue.					
		1116 (1940-1941) B. Rs.	1117 (1941-1942) B. Rs.	1118 (1942-1943) B. Rs.	1119 (1943-1944) B. Rs.	1120 (1944-45) B. Rs.	1121-25 (1945-50) B. Rs.	1116 (1940-41) B. Rs.	1117 (1941-42) B. Rs.	1118 (1942-43) B. Rs.	1119 (1943-44) B. Rs.	1120 (1944-45) B. Rs.	1121-25 (1945-50) B. Rs.
1	Pallivasal	..	..	..	..	..	..	77,200	77,200	83,000	83,000	83,000	1,05,000
2	Kothamangalam	14,520	1,25,300	34,000	8,000	43,100	10,000	6,000	30,000	35,000	40,000	45,000	75,000
3	Alwaye	14,400	1,49,100	5,300	7,000	4,600	5,250	33,400	50,000	51,000	65,000	75,000	87,000
4	Pallom	1,60,000	4,30,000	1,60,000	97,700	57,800	1,39,100	50,000	98,000	1,27,100	1,61,600	1,79,400	2,40,000
5	Mavelikara	56,400	1,06,100	50,800	33,200	13,200	35,000	14,300	31,100	41,000	51,000	57,500	86,000
6	Alleppey	67,000	56,000	61,500	77,000	44,500	1,61,600	80,000	1,40,000	1,90,000	3,00,000	3,10,000	4,60,000
7	Kundara and Quilon	37,100	27,150	1,15,000	10,100	16,000	10,000	2,20,000	3,90,000	4,00,000	4,38,000	4,50,000	5,00,000
8	Trivandrum and Suburbs including extension to south	..	..	..	12,00,000	..	1,82,000	..	..	..	2,60,000	2,80,000	3,50,000
9	Peermade and Mundakayam	..	..	..	12,35,000	1,95,000	1,95,000	..	..	..	56,100	75,000	1,20,000
10	Aluminium Factory	3,00,000	3,40,000	25,00,000	35,00,000	25,00,000	54,50,000	..	1,75,000	3,50,000	3,50,000	10,57,500	10,57,500
11	Cochin State	..	1,57,000	3,40,000	..	..	..	..	78,000	1,75,000	1,95,300	2,31,700	3,50,000
12	Other industries	..	.	..	..	..	1,25,000	..	..	..	..	..	4,20 000
13	Total	6,49,420	13,90,650	32,66,600	59,68,000	28,68,200	63,12,350	4,80,900	10,69 300	14,52,100	20,00,000	28,74,100	38,50,000
14	P. H. E. Capital to end of 1115 S. Rs. 133,62,392	131,27,900	..	..	..	..	..	..	..	..	..	..	..
15	Further expenditure to complete 1st stage of works	2,00,000	6,00,000	..	..	..	..	..	..	..	..	..	
16	Q. E. S. Capital less depn. at the end of 1115 S. Rs. 2,42,757	2,38,500	..	..	..	.	..	..	..	..	..	..	..
17	T. E. S. Capital less Depn. at the end of 1118 S. Rs. 4,00,000	..	..	..	3,93,000	..	..	..	..	..	..	..	..
18	Total (Rounded off)	142,00,000	161,90,000	194,60,000	258,60,000	287,00,000	350,00,000	4,80,000	10,70,000	14,52,000	20,00,000	28,75,000	38,50,000

APPENDIX 4.

P. H. E. Project—Forecast of Revenue and working expenses 1116—1125 M. E. (1940—1950)

Serial No.	Year	Capital Expenditure at the end of the year.	Capital for works taken to use for calculating depreciation.	Gross Revenue.	Working Expenses.				Nett Revenue.	Depreciation arrears.	Total Depreciation Fund at the end of the year. Interest 3 per cent.	Remarks.
					Operation.	Interest (normal 4 per cent. of capital)	Depreciation (normal 2½ per cent of capital.)	Total				
		B. Rs	B. Rs.	B. Rs.	B. Rs.	B. Rs.	B. Rs.	B. Rs.	B. Rs.	B. Rs.	B. Rs.	
1	1116 (1940—1941)	142,00,000	138,00,000	4,80,000	3,60,000	5,68,000	.. 3,45,000 C. O.	9,28,000	—4,48,000	—3,45,000	..	Interest Deficit carried over to 1117 with 4 per cent. interest added. Deficit—4,48,000 B. Rs.
2	1117 (1941—1942)	161,70,000	153,70,000	10,70,000	4,00,000	6,47 600	.. 3,84,250 C. O.	10,47,600	+22,400	—7,29,250	..	Surplus Revenue absorbed to clear interest deficit. Interest deficit at the end of the year B. Rs. 4,43,520.
3	1118 (1942—1943)	194,60,000	169,60,000	14,52,000	4,50,000	7,78,400	.. 4,24,000 C. O.	12,28,400	+2,23,600	—11,53,250	..	Interest deficit plus 4 per cent. interest =B. Rs. 4,61,260. Surplus revenue taken to clear part of the above. Deficit C O. 2 37,660.
4	1119 (1943—1944)	258,20,000	198,20,000	20,00,000	5,25,000	10,32,800	1,95,036 (3 00,464 C. O.)	17,52,836	+2,47,164	—14,53,714	1,95,036	Surplus Revenue completely covers interest deficit. Amount 2,47,164.
5	1120 (1944—1945)	287,00,000	287,00,000	,28,75,000	6,00,000	11,48,(00	7,17,500 (Full amount)	24,65,600	+4,09,500	—10,44,214	13,27,886	Surplus Revenue taken to cover depreciation deficit.
6	1121 (1945—1946)	300,00,000	300,00,000	32,00,000	6,25,000	12,00,000	7,50,000 (Full amount)	25,75,000	+6,25,000	—4,19,214	27,42,720	Surplus Revenue taken to cover depreciation deficit
7	1122 (1946—1947)	320,00,000	320,00,000	35,00,000	6,50,(00	12,80,000	8,00,000 (Full amount)	27,30,000	+7,70,000	Nil	40,44,215	Nett return after covering full depreciation deficit =3,50,786 Nett return=5·1 per cent.
8	1123 1947—1948	330,00,000	330,00,000	36,30,000	6,75,000	13,20,000	8,25,000 (Full amount)	28,20,000	+8,10,000	Nil	49,90,541	Nett return=6·4 per cent. (including interest)
9	1124 1948—1949	340,00,000	340,00,000	37,60,000	7,00,000	13,60,000	8,50,000 (Full amount)	29,10,000	+8,50,000	Nil	59,90,256	Nett return=6·5 per cent.
10	1125 1949—1950	350,00,000	350,00,000	38,50,000	7,20,000	14,00,000	8,75,000 (Full amount)	29,95,000	+8,55,000	Nil	70,44,962	Nett return=6·4 per cent.

APPENDIX 5,

P. H. E. Project.

Abstract of Estimate for final stage of completion.

		Rs.	
First stage completed	...	131·27	Lakhs
Quilon Electric Supply Capital	...	2·38	,,
First stage still to be completed (such as head works etc.)	...	8·00	,,
Second stage.			
Civil works including Head Works, 2 pipe lines, and storages (approximate)	...	100·00	,,
Generating plant and 66 K. V. outdoor station at Pallivasal	...	24·55	,,
Transmission and 66 and 33 K. V. Substations	...	40·40	,,
11 K. V. and L. T. distribution including Trivandrum Electric Supply capital	...	43·40	,,
	Total ...	350·00	,,

P. H. E. PROJECT.

Abstract of estimate of capital expenditure for 1116—1125.

KOTHAMANGALAM CENTRE.

Year.	*Item No.*	*Particulars.*	*Amount.*	
				Rs.
1116	1	L. T. distribution net work and 40 services as per sanctioned estimate at Kothamangalam ...		6370
	2	2·75 miles of L. T. lines and 30 services for Perumbavoor as per sanctioned estimate ...		8150
				14520
				or B. Rs. 14500
1117	1	12 Nos. L. T. services for Kothamangalam ..	300	
	2	40 street lights for Kothamangalam...	1200	
	3	1½ miles L. T. lines extension at Perumbavoor ...	2600	
	4	4 Nos. L. T. services for Perumbavoor ...	100	
	5	5 miles 11 K. V. lines from Kothamangalam to Muvattupuzha ...	25000	
	6	1 No. step down transformer station for Muvattupuzha ...	2000	
	7	3 miles L. T. lines at Muvattupuzha ...	6000	
	8	36 Nos. L. T. services at Muvattupuzha ...	1000	
	9	1 No. step down transformer equipment at Vazhakulam ...	2000	
	10	½ mile L. T. line at Vazhakulam ...	1500	
	11	7 Nos. services at Vazhakulam ...	200	
	12	10 miles 11 K. V. lines from Muvattupuzha to Thodupuzha ...	50000	
	13	1 No. step down transformer at Thodupuzha ...	3000	
	14	3 miles L. T. lines at Thodupuzha ...	7000	
	15	53 services at Thodupuzha ...	1400	
	16	5 miles 11 K. V. lines and step down equipment for supply to Malayattur ...	22000	
				125300

KOTHAMANGALAM CENTRE—(*Contd.*)

Year.	*Item No.*	*Particulars.*	*Amount.*	
			Rs.	
1118	1	8 Nos. L. T. services at Kothamangalam ...	200	
	2	5 Nos. L. T. services at Perumbavoor ...	150	
	3	4 Nos. L. T. services at Muvattupuzha ...	100	
	4	5 Nos. L. T. services at Vazhakulam ...	125	
	5	4 miles 11 K. V. lines for extension to Malankara Rubber Estate from Thodupuzha ...	20000	
	6	1 No. step down transformer at Malankara Estate ...	3000	
	7	6 Nos. services at Thodupuzha ...	150	
	8	Metering equipment service lines and step down plant at match factory Mudical ...	10000	
				33725 or 34000
1119	1	1 mile conversion of existing L. T. lines to 11 K. V. (feeder from substation to town) at Kothamangalam ...	2000	
	2	One No. step down transformer at Kothamangalam town ...	3000	
	3	2 Nos. services 3 phase at Kothamangalam ...	150	
	4	1½ miles single phase L. T. lines at Muvattupuzha ...	2500	
		4 Nos. L. T. services at Muvattupuzha ...	100	
	5	4 Nos. L. T. services at Vazhakulam ...	100	
	6	5 Nos. L. T. services at Thodupuzha ...	125	
				7975 or 8000
1120	1	1 No. 3 phase service at Kothamangalam ...	100	
	2	20 Nos. street lights at Kothamangalam ...	600	
	3	1½ miles L. T. lines at Muvattupuzha ...	2700	

KOTHAMANGALAM CENTRE—(*Contd.*)

Year.	*Item No.*	*Particulars.*	*Amount.*	
			Rs.	
1120	4	20 services at Muvattupuzha ...	600	
	5	4 Nos. L. T. services at Vazhakulam ...	100	
	6	6 Nos. services at Thodupuzha ..	200	
	7	7 miles 11 K. V. lines from Thodupuzha to Rubber Estates ...	35000	
	8	1 No. step down transformer for the Estates ...	4000	
				43300 or 43300
1121 to 1125	1	8 Nos. L. T. services at Perumbavoor ...	200	
	2	4 Nos. L. T. services at Muvattupuzha ...	100	
	3	4 Nos. L. T. services at Vazhakulam ...	100	
	4	5 Nos. L. T. services at Thodupuzha ...	125	
	5	11 K. V. cubicle and supply arrangements for pumping load ...	9450	
			9975 or	10000

Abstract of estimate for capital expenditure. 1116 to 1125.

ALWAYE CENTRE.

Year.	*Item No.*	*Particulars.*	*Amount.*	
			Rs.	
1116	1.	L. T. services, Alwaye 40 Nos. ...	1000	
	2.	Street lights, Alwaye 40 Nos. ...	600	
	3.	L. T. service, Parur 20 Nos. ...	500	
	4.	Street lights Parur 20 Nos. ...	300	
	5.	L. T. lines extension at Alwaye 5 miles ...	12000	
			——	14400
		Total ...		14400
1117	1.	L. T. lines 2 miles at Alwaye ...	5000	
	2.	40 Nos. single phase and 2 Nos 3 phase L. T. services at Alwaye ...	1100	
	3.	1 mile L. T. line at Parur ...	2500	
	4.	21 L. T. services at Parur, single and three phase ...	550	
	5.	20 Nos. street lights at Parur ...	300	
	6.	5 miles 11 K. V. lines from Sri Chithra Mills to Edapally ...	25000	
	7.	1 No. step down transformer for Edapally ...	3000	
	8.	2 miles L. T. distribution lines for Edapally ...	6000	
	9.	22 L. T. services, single and 3 phase at Edapally ...	600	
	10.	7 miles 11 K. V. lines from Alwaye to Pallikara ...	35000	
	11.	2 No. step down transformers at Pallikara ...	4000	
	12.	3 miles L. T. distribution lines at Pallikara ...	8000	
	13.	2 Nos. single phase and 2 Nos. 3 phase L. T. services at Pallikara ...	600	
	14.	8 miles 11 K. V. lines from Alwaye to Ankamali and Kaladi ...	40000	
	15.	4 Nos. step down transformers for stepping down for supply to tile factories Ankamali and Kaladi ...	12000	
	16.	2 miles L. T. lines at Ankamali and Kaladi ...	5000	
	17.	14 Nos. single phase and 3 phase services ...	450	
		Total ...	——	14910

ALWAYE CENTRE.—(*contd.*)

Year.	*Item No.*	*Partculars.*	*Amount.* Rs.	
1118	1.	L. T. lines 1 mile at Alwaye ...	2500	
	2.	L. T. services--40 Nos. single phase and 2 nos. 3 phase at Alwaye. ...	1100	
	3.	20 Nos. street lights at Alwaye ...	300	
	4.	20 Nos. L. T. services at Parur ..	500	
	5.	20 Nos. street lights at Parur ...	300	
	6.	4 Nos. L. T. services at Edapally...	100	
	7.	Extension of single phase L. T. lines at Kaladi ...	400	
	8.	4 Nos. L. T. services at Ankamali and Kaladi ...	100	
			——	5300
		Total ...		
1119	1.	1 mile L. T. lines at Alwaye ...	2500	
	2.	40 Nos. single phase and 2 Nos. 3 phase services at Alwaye ...	1100	
	3.	1 mile L. T. lines at Parur ...	2500	
	4.	20 Nos. single phase services at Parur ...	500	
	5.	5 Nos. L. T. services at Eda-Pally ...	125	
	6.	5 Nos. L. T. services single and 3 phase at Kaladi and Ankamali	200	
			——	6925 or
		Total ...		7000
1120	1.	40 Nos. services at Alwaye ...	1000	
	2.	20 Nos. street lights at Alwaye ...	300	
	3.	1 mile L. T. lines at Parur ...	2500	
	4.	20 Nos. L. T. services at Parur ...	500	
	5.	20 Nos. street lights at Parur ...	300	
			——	4600
1121— 1125	1.	40 Nos. L. T. services at Alwaye .	1000	
	2.	20 Nos. street lights at Alwaye ...	300	
	3.	1 mile L. T. lines at Parur ...	2500	
	4.	20 Nos. services at Parur ...	500	
	5.	20 Nos. street lights at Parur ...	300	
	6.	5 Nos. services at Edapally ...	150	
	7.	Extension of L. T. lines at Kaladi ...	400	
	8.	4 Nos. L. T. services at Kaladi...	100	
			——	5250

Abstract of estimate for capital expenditure for Pallom Centre 1116—1125.

Year.	*Item No.*	*Particulars.*	*Amount.* Rs.	
1116	1	4 Miles of L. T. lines at Pallom, Changanacherry and suburbs ...	10000	
	2	60 Nos. L. T. services at Pallom, Changanacherry, Chingavanom, Puthupally etc. ...	1200	
	3	250 Nos. street lights for above area...	5000	
	4	4 Nos. step down plants for rural and other supply in the above area ...	8000	
	5	8 Miles 11 K. V. lines ...	40000	
	6	4 Miles of L. T. lines in the Thiruvella centre ...	8000	
	7	4 Nos. step down transformer in the above area ...	8000	
	8	30 Nos. L. T. service for do. ...	900	
	9	60 Nos. street lights in the above area ...	1200	
	10	15 Miles 11 K. V. lines in the punja fields ...	63000	
	11	15 Nos. step down transformers and services in punja area	15000	
			———	160,300
				or
1117	1	H. T. lines, Changanacherry, Pallom, Chingavanam etc., 4 miles...	20000	160,000
	2	H. T. transformer stations and services for above area Nos. 3 ...	6000	
	3	6 Miles L. T. lines in above area ...	12000	
	4	120 Nos. L. T. services for do. ...	2400	
	5	100 Nos. street lights for do. ...	2000	
	6	5 Miles 11 K. V. lines to Vaikom from punja lines ...	25000	
	7	2 Nos. step down transformers for Vaikom ...	4500	
	8	6 Miles L. T. lines for Vaikom ...	18000	
	9	L. T. services, single and 3 phase for Vaikom and street lights 80 Nos. ...	4400	
	10	5 Miles 11 K. V. lines from Kottayam to Athirampuzha and Mannanam ...	25000	
	11	2 Nos. step down transformers for do. ...	5000	
	12	2 Miles L. T. lines do. ...	4000	

Year.	*Item No.*	*Particulars.*	*Amount.*
			Rs.
1117	13	33 L. T. single and 3 phase services do. ...	900
	14	3 Miles 11 K. V. lines from Athirampuzha to Ettumanoor ...	15000
	15	One No. step down transformer for Ettumanoor ...	2000
	16	2½ Miles L. T. lines for Ettumanoor...	5500
	17	22 Nos. L. T. single and 3 phase services for Ettumanoor ...	600
	18	11 Miles 11 K. V. lines from Ettumanoor to Palai and Punnapra ...	55000
	19	2 Nos. step down plant at Palai and Punnapra ...	6000
	20	4 Miles L. T. lines at Palai and Punnapra ...	15000
	21	100 L. T. services single phase and 3 Nos. L. T. 3 phase services at Palai and Punnapra . .	2725
	22	12 Miles 11 K. V. lines from Thiruvalla to Chengannoor and sugarcane area ...	60000
	23	8 Nos. step down transformers and 3 phase services in the area covered by the above lines ...	16000
	24	6 Miles L. T. distribution lines in Chengannoor and other areas ...	12000
	25	90 Nos. services ...	2700
	26	100 Nos. street lights at Chenganoor and Thiruvalla ...	2000
	27	Miscellaneous items for Thiruvalla and Chengannoor area ...	3600
	28	10 miles 11 K. V. lines in Punja area ...	50000
	29	15 Nos. step down transformers and service to pumps in the above area ...	15000
	30	10 miles L. T. lines in the above area ...	25000
	31	25 Nos. L. T. services ...	750
	32	Miscellaneous items for punja area ...	12000
			———430075
			or 430000

Year.	Item No.	Particulars.	Amount.
			Rs.
1118	1.	4 miles of 11 K. V. lines in the Changanacherry and Kottayam suburbs ...	20000
	2.	3 Nos. step down transformers for do. ...	6000
	3.	5 miles L. T. lines for do ...	10000
	4.	100 Nos, L. T. services for do ...	2000
	5.	80 Nos. street lights for do ...	1600
	6.	20 Nos. services for Vaikam and suburbs ...	500
	7.	5 Nos. services for Ettumanoor ...	125
	8.	10 Nos. services for Athirampuzha and Mannanam ...	250
	9.	1 mile 11 K. V. lines to tile factory at Punnapra ...	5000
	10.	1 No. step down transformer at Punnapra ...	1000
	11.	5 miles 11 K. V. lines for supply to Kozhenchery and premises from the Thiruvalla system ...	25000
	12.	5 Nos. step down transformers and services for Thiruvalla area ...	10000
	13.	3 miles L. T. lines for Kozhenchery...	6000
	14.	80 Nos. L. T. services for do ...	2400
	15.	60 Nos. street lights for do ...	1200
	16.	10 miles 11 K. V. lines in punja area ...	50000
	17.	8 Nos. step down transformers and services for do ...	10000
	18.	3 miles L. T. lines ...	7500
	19.	25 Nos L. T. services for do ...	750
			159325 or 160000
1119	1.	2 miles of L. T. lines in Changanachery, Pallom-Kottayam area ...	10000
	2.	3 Nos. step down transformers for do ...	6000
	3.	5 miles L. T. lines in the above area ...	10000
	4.	100 Nos. L. T. services for do ...	2000
	5.	30 Nos. street lights for do ...	600
	6.	5 Nos. L. T. services at Ettumanoor ...	125

Year.	Item No.	Particulars.	Amount.	
	7.	3 miles 11 K. V. lines in the Thiruvalla, Chengannoor and Kozhenchery area	Rs. 15000	
	8.	5 Nos. step down transformers do	10000	
	9.	2 miles L. T. lines do.	4000	
1119	10.	80 Nos. L. T. services do.	2400	
	11.	60 Nos. street lights do.	1200	
	12.	5 miles 11 K. V. lines in the punja area	25000	
	13.	5 Nos. step down plant do.	5000	
	14.	2 miles L. T. lines for do.	5000	
	15.	10 Nos. services for do.	300	
	16.	Miscellaneous works, Vaikom	1100	
				97725 or 97700
1120	1.	2 miles 11 K. V. lines in the Changanachery and Pallom areas	10000	
	2.	1 No. step down plant for do.	2000	
	3.	5 miles L. T. lines for do.	10000	
	4.	100 Nos. L. T. services for do.	2000	
	5.	30 Nos. street lights for do.	600	
	6.	Miscellaneous works at Vaikom and suburbs	1500	
	7.	1 mile 11 K. V. line in the Thiruvalla and Chengannur area	5000	
	8.	1 No. step down station for do.	2000	
	9.	2 miles L. T. lines for do.	4000	
	10.	40 Nos. L. T. services for do.	1200	
	11.	60 Nos. street lights for do.	1200	
	12.	2 miles 11 K. V. lines in the punja area	10000	
	13.	3 Nos. step down transformers	3000	
	14.	2 miles L. T. lines	5000	
	15.	10 Nos. services	300	
				57800
1121-1125	1.	1 mile 11. K. V. line in the Changanachery Pallom area	5000	
	2.	3 Nos. step down transformers for do.	6000	
	3.	11 miles L. T. lines in the above area	22000	
	4.	300 Nos. L. T. services for do.	6000	

ear.	Item No.	Particulars.	Amount.
			Rs.
	5.	30 Nos. street lights for do. ...	600
	6.	5 miles 11 K. V. lines in Thiruvalla Chengannoor and Kozhenchery area ...	25000
	7.	5 Nos. step down transformers for do. ...	10000
	8.	7 miles L. T. lines for above ...	14000
	9.	160 Nos. L. T. services for do. ...	4800
	10.	30 Nos. street lights in do. ...	600
	11.	5 miles 11 K. V. lines in punja area	25000
	12.	7 Nos. step down plant do, ...	7000
	13.	5 miles L. T. lines for do. ...	12500
	14.	20 Nos. services single phase ...	600
			139100

Abstract of estimate for capital expenditure Mavelikara Centre.

1116—1125.

Year.	*Item No.*	*Particulars*	*Amount* Rs.	
116	1	2 Nos. step down transformer in the Mavelikara area ...	4000	
	2	3 miles L. T. lines for distribution in the above area ...	7500	
	3	30 Nos. L. T. services for above ..	900	
	4	25 Nos. street lights at Haripad ...	500	
	5	1 No. step down transformer in the Kayamkulam area ...	2000	
	6	7 miles H. T. lines for extension from Kayamkulam ...	35000	
	7	2 miles L. T. lines ...	5000	
	8	40 Nos. L. T. services ...	1200	
	9	15 Nos. street lights ...	300	
				56400
1117	1	8 miles H. T. lines for supply in the direction of Noornad ...	40000	
	2	3 Nos. step down transformers for supply enroute ...	6000	
	3	4 miles distribution lines ...	8000	
	4	100 Nos. L. T. services in the above area ...	3000	
	5	80 Nos. street lights ...	1600	
	6	7 miles extension of 11 K. V. lines for supply in the Karunagapally area ...	35000	
	7	2 Nos. step down transformers in the above area ...	4000	
	8	3 miles L. T. lines do. ...	6000	
	9	50 Nos. L. T. services ...	1500	
	10	50 Nos. street lights in towns enroute ...	1000	
				106100
1118	1	4 miles further extension of 11 K. V. lines to Noornad ...	20000	
	2	2 Nos. step down stations enroute ...	4000	
	3	2 miles L. T. lines ...	4000	
	4	60 Nos. L. T. services ...	1800	
	5	30 Nos. street lights ...	600	
	6	2 miles 11 K. V. linesfor extension in the direction of Chavara from Karunagapally ...	10000	
	7	1 No. step down station ...	2000	
	8	3 miles L. T. lines ...	6000	

Year.	Item No.	Particulars	Amount Rs.	
	9	50 Nos. services ...	1500	
	10	45 Nos. street lights ...	900	50800
1119	1	2 miles 11 K. V. lines in the Noornad area ...	10000	
	2	2 Nos. step down transformers ...	4000	
	3	2 miles L. T. lines and street lights...	4600	
	4	60 Nos. L. T. services ...	1800	
	5	1 mile 11 K. V. line in the coastal area near Karunagapally ...	5000	
	6	1 No. step down plant ...	2000	
	7	2 miles L. T. lines and street lights...	4600	
	8	40 Nos. L. T. services ...	1200	
1120				33200
	1	Extension of 11 K. V. lines in the Noornad area mile ...	5000	
	2	L. T. lines and street lights 1 mile ...	2600	
	3	60 Nos. services ...	1800	
	4	L. T. lines in the Karunagapally area ...	2600	
	5	L. T. services do. ...	1200	
				13200
1121-1125	1	Miles 2, 11 K. V. lines in the Thottapally area ...	9000	
	2	Step down plant do. 2 Nos. ...	4000	
	3	L. T. lines, 2 miles in the above area ...	4000	
	4	L. T. services in the Noornad and Thottapally area 180 Nos. ...	5400	
	5	Street lights extension 120 ...	2400	
	6	Extension of L. T. lines in the Kayamkulam and Karunagapally area 3 miles ...	6000	
	7	L. T. services in the above area 160 Nos. ...	3600	
	8	Street lights 30 Nos. ...	600	
				35000

Abstract of estimate for capital expenditure —Alleppey Centre including Sherthallai and Punnapra and also extensions to Kuthiathodu and Ambalapuzha.

Year.	*Item No.*	*Particulars.*	*Amount.* Rs.	
1116	1	H. T. lines—2 miles for extension of supply lines from Sherthallai to Kuthiathode and near by area ...	10000	
	2	Step down station and 3 phase service Nos. 2 ...	4000	
	3	H. T. services and metering equipment 3 Nos. in Alleppey ...	6000	
	4	10 miles L. T. distribution in Alleppey and Sherthallai area ...	30000	
	5	L. T. services 300 Nos. ...	15000	
	6	100 Nos. street lights ...	2000	
				67000
1117	1	4 miles 11 K. V. lines for extension of H. T. supply ...	20000	
	2	1 No. step down transformer ...	2000	
	3	4 Nos. H. T. services ...	8000	
	4	6 miles L. T. distribution lines ...	15000	
	5	200 Nos. L. T. services ...	10000	
	6	50 Nos. street lights ...	1000	
				56000
1118	1	6 miles 11 K. V. distribution lines ...	30000	
	2	1 No. step down transformer ...	2000	
	3	3 Nos. H. T. services and metering...	6000	
	4	6 miles L. T. lines ...	15000	
	5	150 Nos. services L. T. ...	7500	
	6	50 Nos. street lights ...	1000	
				61500
1119	1	8 miles 11 K. V. lines ...	40000	
	2	2 Nos. step down stations ...	4000	
	3	3 Nos. H. T. services and metering ...	6000	
	4	6 miles L. T. distribution lines ...	15000	
	5	150 Nos. L. T. services ...	7500	
	6	50 Nos. street lights ...	1000	
	7	Miscellaneous items ...	3500	
				77000
1120	1	4 miles 11 K. V. lines ...	20000	
	2	1 No. step down transformer ...	2000	

Year.	*Item No.*	*Particulars.*	*Amount.*	
			Rs.	
	3	2 Nos. H. T. services and metering ..	4000	
	4	4 miles L. T. distribution lines ...	10000	
	5	150 Nos. L. T. services ...	7500	
	6	50 Nos. street lights ...	1000	
				44500
1121	1	15 miles 11 K. V. lines ..	75000	
—	2	3 Nos. step down transformers ...	6000	
1125	3	10 Nos. H. T. services and metering equipment ...	20000	
	4	15 miles L. T. distribution lines ...	37500	
	5	400 services ...	18500	
	6	200 Nos. street lights ...	4000	
				161000

Abstract of estimate for capital works at Kundara and Quilon

Year.	Item No.	Particulars.	Amount Rs.	
1116	1	One No. metering cubicle for A. D. Cotton Mills at Quilon ...	3000	
	2	11 K. V. cable lines and equipment for supply of power to Messrs. Harrisons and Crosfield's workshops at Quilon ...	11000	
	3	2¼ miles 11 K. V. lines for supply of power to saw mills of Bhanu Asan and Raghavan Asan Mundakal and also to Empire tile works at Eravipuram ...	10000	
	4	One No. step down transformer for do. ...	2000	
	5	L. T. lines for do. ...	2000	
	6	3 Nos. 3 phase services for do. ...	500	
	7	60 service connections in the Quilon area ...	1500	
	8	11 K. V. step down station and L. T. lines for supply of power to Travancore Minerals new factory at Neendakara ...	2000	
	9	Do. to Messrs. Hopkins & Williams near Neendakara ...	1500	
	10	10 Nos. service connection to domestic consumers at Kilikollur ...	250	
	11	1½ miles L. T. 3 phase lines and service connection to Messrs. Pierce Leslie's Cashewnut factory at Kundara ...	2000	
	12	10 Nos. service connections to private consumers at Kundara ...	250	
	13	1 Furlong L. T. lines for service to Manovilasom tile works at Mundakkal, Quilon ...	300	
	14	Service connection to small industries at Kilikollur including a small oil mill ...	500	
	15	Service connection to tin factory of Messrs. P. Govindan & Sons Kilikollur ...	300	
				37100
1117	1	Strengthening L. T. feeder to Messrs. Lakshmi Flower Mills Big Bazar, Quilon ...	100	

Year.	Item No.	Particulars.	Amount.	
			Rs.	
1117	2	Service connection to Achuthan Maistrie's Auto Workshops ...	50	
	3	3 furlongs. cable and step down transformer for service connection to S. M. V. tile works, Quilon ...	3000	
	4	H. T. services to Messrs. Associated Minerals Corporation near Neendakara ...	1500	
	5	Strengthening L. T. service lines to Mr. K. K. Padmanabhan's saw mills at Kilikollur ...	100	
	6	Service connection and supply to Gomathi oil mills, Quilon ...	4000	
	7	Strengthening L. T. lines and service connection to Messrs. William Goodacre & Sons coir factory, Quilon ...	400	
	8	H. T. service connection to and metering to Messrs. Thomas Stephen & Sons tile factory, Quilon ...	1500	
	9	200 Nos. service connections at Quilon Kilikollur etc. ...	6000	
	10	Miscellaneous works to cater for the increased load in Chavara area ...	500	
	11	Distribution at Karunagapally and supply of power to Messrs. Hopkins & Williams pumping plant at Karunagapally ...	10000	
				27150
1118	1	20 miles 11 K. V. line and metering equipment for supply to Punalur Paper Mills ...	100000	
	2	Step down transformer at Kottarakara ...	2000	
	3	5 miles distribution lines at Kottarakara ...	12000	
	4	Service connections single and 3 phase at Kottarakara ...	1000	
				115000

Year.	*Item No.*	*Particulars.*	*Amount.*	
			Rs.	
1119	1.	11 K. V. service connection and metering equipment at Messrs. T. V. Krishna Aiyar's Textile Mills, Kundara ...	6000	
	2.	Strengthening of L. T. Feeders as required ...	2000	
	3.	Service connections single and 3 phase in the Quilon, Kundara, Kilikollur and Chavara area—80 Nos. ...	2000	
				10000
1120	1.	Strengthening of L. T. feeders and service lines in the Kundara Quilon and other areas ...	8000	
	2.	Service connections single and 3 phase ...	2000	
				10000
1121 to 1125	1.	Service connections single phase, 3 phase and H. T. ...	10000	
				10000

Abstract of estimate for capital expenditure extension to Peermade.

Year.	*Item No.*	*Particulars.*	*Amount.*	
			Rs.	
1119	1.	30 miles of 66 K. V. single circuit lines on T. W. poles from Pallom to Mundakayam at Rs. 10000 per mile ...	300000	
	2.	10 miles of double circuit 11 K. V. lines from Mundakayam to Peermade at Rs. 15000 per mile (7/·136 conductor) ...	150000	
	3.	Step down plant consisting of 2 Nos. 66/11 K. V. transformers, 2000 K. V. A. necessary switch gear etc., at Mundakayam including necessary alterations at Pallom and substation and other buildings at Mundakayam ...	300000	
	4.	11 K. V. substation equipment and buildings at Peermade ...	75000	
	5.	11 K. V. lines 25 miles for distribution at Mundakayam and Peermade ...	125000	
	6.	11 K. V. step down plant and metering equipment for Mundakayam and Peermade 15 Nos. ...	60000	
	7.	Miscellaneous works ...	25000	
			———	1035000
1120				
	1.	25 miles 11 K. V. lines for distribution at Mundakayam and Peermade ...	125000	
	2.	15 Nos. 11 K. V. step down transformers and metering equipment for do. ...	60000	
	3.	Miscellaneous works ...	10000	
			———	195000
1121 to 1125	1.	25 miles 11 K. V. lines for Peermade and Mundakayam distribution ...	125000	
	2.	15 Nos. step down transformers and metering equipment for do. ...	60000	
	3.	Miscellaneous works ...	10000	
			———	195000

Abstract of estimate for P. H. E. Project 2nd and final stage of development for supply to Aluminium Factory and other developments

Year.	*Item No.*	*Particulars.*	*Amount.*	
		ELECTRICAL WORKS 1ST STAGE.	Rs.	
		Total development consisting of 66 K. V. and other swith gear equipment at Alwaye, 66 K. V. double circuit lines from Alwaye to Aluminium Factory metering equipment. One No. 8825 K. V. A. 66 K. V. transformer and switch gear at Pallivasal, Rearrangement of 11 K. V. gear etc. ...	5,40,000	
		Civil works preliminary for Kundala Valley reservoir divided as below	1,00,000	
			6,40,000	
1116				3,00,000
1117				3,40,000
	1	2nd and final stage. Electrical works consisting of 3 Nos. 8825 K. V. A. generating sets. 2 Nos. 66 K. V. outdoor transformers and necessary switch gear at Pallivasal, 51 miles of 66 K. V. double circuit lines 7/136 conductors to Alwaye, and switch gear for control of the limes at Alwaye, purchase of meter and relay testing equipment, tools and plant, construction testing laboratory etc, ...	40,50,000	
	2	Civil works consisting of 1 No. 30" and one No. 42" pipe lines Kundala valley storage reservoir etc. and taking over K. D. H. P. Plant ...	99,00,000	
			1,39,50,000	
		DIVIDED AS BELOW,		
1118			25,00,000	25,00,000
1119			35,00,000	35,00,000
1120			25,00,000	25,00,000
1121to 1125			54,50,000	54,50,000

Abstract of estimate for extension of 66 K. V. Supply to Trivandrum.

Year.	*Item No.*	*Particulars.*	*Amount.* Rs.	
1119	1	40 Miles 66 K. V. double circuit transmission lines from Kundara to Trivandrum at Rs. 21,000 per mile ...	8,40,000	
	2	Step down plant consisting of 2-2000 K. V. A. transformers, 66 and 11 K. V. switch gear and also additional equipment for Kundara station ...	3,60,000	
				12,00,000
1120 to 1125	1	30 miles of 11 K. V. lines from Trivandrum to Thackalai ...	1,50,000	
	2	3 Nos. step down transformers for use at Balaramapuram, Neyattinkara and Kuzhithura ...	10,000	
	3	6 miles L. T. lines for distribution in the above area ...	18,000	
	4	120 Nos. L. T. services for the above area ...	3,600	
	5	Miscellaneous items ...	400	
				1,82,000

Abstract of estimate for supply of power to Cochin State.

Year.	*Item No.*	*Particulars.*	*Amount.*	
1117	1	9 miles of 11 K. V. double circuit lines from Alwaye to Edapally...	81,000	
	2	Metering and control equipment for Frontier (Edapally) and Alwaye.	37,000	
	3	4 miles 11 K. V. lines to Chowara Double Circuit ...	36,000	
	4	Metering for Chowara ...	3,000	
				1,57,000
1118	1	12 miles of 33 K. V. double circuit lines from Alwaye to Chalakudy (Cochin State boundary) Rs. 18,000 per mile ...	2,16,000	
	2	Rearrangement at Alwaye and 33 K. V. metering ...	1,24,000	
				3,40,000

Abstract of estimate for other Industries.

Year.	*Item No.*	*Particulars.*	*Amount.*
1121 to 1125	1	5 miles of 11 K. V. lines for supply to factories ...	Rs. 25,000
	2	5 Nos' 11 K. V. service and metering equipment Rs. 20,000 each ...	1,00,000
			1,25,000

APPENDIX 6.

P. H. E. Project-Statement of connected Load, 1116—1125 M. E.
(1940—1950).

No.	Name of Centre.	Connected Load in Kilo-Watts.					
		1116	1117	1118	1119	1120	1121—1125
1	Pallivasal Centre	1,707	1,707	1,800	1,800	1,800	2,500
2	Kothamangalam	45	135	260	325	420	800
3	Alwaye Centre	480	780	800	860	925	970
4	Pallom	1,020	1,950	2,570	3,150	3,500	4,800
5	Mavelikara	250	490	640	820	900	1,120
6	Alleppey and Sherthalai	700	1,080	1,600	2,450	3,000	4,100
7	Kundara and Quilon	2,600	3,300	3,720	3,970	4,220	4,780
8	Aluminium Factory	..	7,500	7,500	7,500	15,000	15,000
9	Trivandrum Extn :	..	..	..	2,000	2,100	2,300
10	Peermade Extn :	..	..	..	700	1,000	1,550
11	Cochin State M. D. (Maximum Demand)	..	800	1,500	1,900	2,150	3,500
12	Other Industries	..	..	..	..	..	5,000
	Total	6,802	17,742	20,390	25,475	35,010	46,420
	M. D.	3,000	8,500	9,000	11,000	22,000	29,000