1948

NEW ZEALAND

STATE HYDRO-ELECTRIC DEPARTMENT

STATEMENT BY THE HON. R. SEMPLE, MINISTER IN CHARGE OF THE STATE HYDRO-ELECTRIC DEPARTMENT

MR. SPEAKER,—

In my last statement an account was given of the difficulties in the field of electric supply in the post-war years. During the year under review the same conditions were in evidence, but nevertheless, and in spite of the adverse factors, work was advanced to such an extent that the power position was materially improved in both Islands.

In the North Island the completion of two of the three 30,000 kW. units at Karapiro and the near completion of the Upper Waikaremoana Station at Kaitawa were chiefly responsible for the improvement.

In the South Island the provision of an amount of temporary storage at Pukaki gave a measure of relief to the main system, while the temporary storage at Cobb made a great difference to the supply in the Nelson-Marlborough districts.

However, once again a dry period came in the North Island, extending over a period of five months, first at Waikaremoana and later at Taupo.

Normal rainfall recommenced in March, 1948, at Waikaremoana, and in April, 1948, at Taupo, after which there was the usual period of delayed run-off before the storage in the lakes began to improve.

The shortage of water was aggravated by shortage of both coal and oil for the steam-stations at Auckland and Wellington during the early part of 1948.

The shortage of oil fuel is world wide, and there is no reliable information as to the possible duration, or ultimate extent, of the shortage. The event, however, does serve to emphasize the importance of keeping our country's vital power supply independent of imported fuels to the greatest possible extent. The fact that sufficient oil fuel is not available for even the relatively small amount of steam-generating plant now in the country is very disturbing, as it practically rules out any large-scale use of this fuel in New Zealand for future power generation.

Coal-supplies, for one reason or another, have not been equal to requirements, and attention is drawn to the fact that this condition is not peculiar to New Zealand. Any criticism in this regard would only be of use, if, at the same time, a remedy were suggested.

The fact remains that a regular quantity of coal is not available, and this must arouse grave doubts as to the advisability of the use of coal-burning plants where a better alternative is more readily available.

Other countries without water-power resources look with envy upon the immense water-power potential of New Zealand which only awaits development in order to place this country beyond the possibility of power-shortages for a considerable time to come.

The Government is being constantly urged to either develop small power schemes or to allow various local bodies to do so, but under present-day conditions it would be manifestly unwise to meddle with these schemes now. The development of a small power scheme can only be of local benefit if supply from the main system is not available, and in such cases licences have been granted. Apart from such cases, the schemes must be properly investigated, designed, and built in accordance with the national needs and then operated so that the power developed is made available for the general power pool.

Clearly it must be recognized that because a hydro-electric site happens to be located within the area of a particular local body that does not constitute any reason why people in that area should have a prior claim to the power so developed.

Conceding this point, then the criterion must be whether the development will benefit the whole community. Under the present circumstances I would state unhesitatingly that with the prevailing shortage of man-power and materials it would not be for the good of the community to allow such schemes to be proceeded with until freedom from power shortages is obtained by the early completion of the major works in hand.

Investigation of power sites is being pushed ahead and expanded as rapidly as possible in order to gauge the power potential. This information is necessary in order to shape future policy, but for at least another decade I am of the opinion that the power requirements of New Zealand can, and should be, met by the development of the major hydro-electric resources.

At the same time that this investigation of hydro-electric sites is being prosecuted, the Department of Scientific and Industrial Research has undertaken the investigation of the possibility of making use of geo-thermal steam.

This alternative is attractive provided the conditions are such as to render the development of electric power from natural steam an economic and technical possibility.

The task of developing hydro-electric power in time to overtake the normal increase in demand and to restore the essential margin necessary for reliable operation is a very formidable one. Plant is in short supply the world over, largely due to shortages of the necessary raw materials. Added to this the manufacturing countries are all experiencing a lack of man-power and of factory space with which to cope with an unprecedented demand for power-generating machinery. The generating-equipment for a hydro-electric station involves the importation of approximately one-third of the value of plant required to produce the same output by steam, and it is the expressed wish of the United Kingdom authorities that the requirements of New Zealand should not seriously encroach upon the field of steam-electric plant which is vital to the domestic needs of the United Kingdom. It will thus be seen that the present world economic situation affords even greater reason for the policy of hydro-electric-power development in New Zealand.

For hydro-electric plants the majority of the work must be done with our own labour and materials, and calls for the willing co-operation of all those who have to design and build these works. In this connection the recent hold-up of work in the Waikato is regrettable from all points of view, and the success or failure of our efforts to overcome the power shortage will largely depend upon the degree of reason which can be brought to bear upon the industrial problems of this country.

Electric-power supply is a vital necessity in modern times as the whole economic life of our country depends upon the provision of an adequate supply, and I feel entitled to ask for the active assistance of all members of the community in our efforts to accomplish this task.

Until the shortages are overcome the consumers of electric power can do much to alleviate the more harmful effects by exercising voluntary restraint upon the usage of power. Recent experience shows how great this benefit can be and how severe can be the result of disregarding this very sound advice.

FINANCIAL RESULTS

In my last statement a brief summary was given of the financial results for the year ended 31st March, 1947, and the audited accounts and balance-sheet for that year were published in parliamentary paper B.–1 [Pt. IV], 1947.

In section 4 of the Finance Act (No. 2), 1947, the separate North and South Island schemes were, for accounting purposes, amalgamated into one scheme so that one statement of financial results now covers the whole of New Zealand.

The following is a summary of the results (unaudited) for the year ended 31st March, 1948. The audited accounts will again appear in B.–1 [Pt. IV]:—

	£	£
Total capital invested	40,608,979	
Works under construction, stocks, &c.	12,196,688	
Net operating capital	28,412,291	
Revenue	3,258,647	
Operating costs	1,459,321	
Gross profit		1,799,326
The capital charges are—		
Interest	1,072,227	
Depreciation	263,054	
		1,335,281
Leaving a balance of		£464,045

After paying income and social security taxes (£165,760) assessed for 1946–47, and allowing for net accumulated losses (£106,609), there is £191,676 left to meet the current year's loans redemption charge of £517,533, thus increasing the arrears to £1,166,535 at 31st March, 1948.

NEW WORKS

Good progress has been made with the new works during the year, but the delivery of plant and materials is still subject to long and unpredictable delays. One very disturbing factor is the shortage of supplies of steel for all purposes, and every effort is being made to secure steel from all available sources.

At *Karapiro* the second 30,000 kW. machine went into operation in September, 1947, while the third machine, due to the late arrival of turbine parts, was not ready until May, 1948. The station has been fully loaded on occasions, and has made a great difference to the North Island supply position.

At *Waikaremoana* the first 16,000 kW. unit at Kaitawa was put into temporary operation in April, 1948, thus enabling the full use of the two lower Waikaremoana stations at a time when they were most needed.

The final parts for the Kaitawa turbines have now arrived in New Zealand, and both units should be available in July, 1948.

The work of sealing the flow through the natural barrier is now in hand, but is not expected to be completed before the end of 1949.

Maraetai.—The scheduled date for completion still remains at early in 1951, but the attainment of this goal depends upon the working-conditions as well as on the supply of materials, particularly steel.

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Once the diversion tunnel is completed, early in 1949, then the task of dewatering the dam-site can begin.

When that stage is completed it will be possible to give a firm estimate of the time required for completion of the job.

Whakamaru.—Investigations are nearly completed, and it is expected that the design work and purchase of plant will soon be put in hand.

Investigation work is being carried out at Waipapa and Atiamuri on the Waikato, and reconnaissance work has been done in connection with the Kaituna and Rangitaiki schemes in the Bay of Plenty area.

In the South Island work has proceeded on the *Cobb scheme.* A small dam was built to give temporary storage and has proved a great boon during dry periods. The construction of the main dam and the installation of two 10,000 kW. units now on order is not expected to be completed before the end of 1951. Here again steel is required to the extent of 1,000 tons for the penstock alone.

Rotoroa.—A topographic survey has been made and is being studied preparatory to intensive investigation. This scheme involves a long tunnel, so that the provision of equipment and personnel for this class of work is likely to be a controlling factor.

Tekapo.—It is expected that the tunnel will hole through before the end of 1948, but it is not anticipated that the plant will be ready to run before the end of 1950.

Here again the supply of reinforcing-steel for the power-house is holding up progress.

Pukaki.—The construction of an earth coffer-dam and the provision of sluice-gates during the year made a great difference to the power position in the South Island. Work is now proceeding on the construction of the earth dam and spillway, which may be completed late in 1949.

Waitaki Fifth Unit.—Although all the parts have not yet left the works, the fifth 15,000 kW. is under erection at Waitaki. Efforts are being made to have the unit in operation by the end of 1948.

Roxburgh.—River studies have shown that it is absolutely necessary to impound water and secure control of the outflow of Lakes Wakatipu, Wanaka, and Hawea for the operation of the 320,000 kW. development, and also the outflow of Lake Wanaka has to be controlled at an early stage in the construction of the scheme to establish control of flood-waters at the Roxburgh dam site.

It is estimated that, provided labour and materials can be made available in sufficient quantity, the work will take at least six and a half years. Under these conditions it is unlikely that the initial operation of the plant could commence before 1955.

In view of this there would be a shortage of electric power in the South Island after 1953 unless steps were taken to bridge this gap. The problem is being studied in order to determine the best means of meeting this situation, and a decision must be reached at a very early date.

At the same time that the above work is going on in connection with the generating-plants, new substations and transmission-lines are in course of erection. Here again the supply of steel is a dominating factor, particularly in relation to the transmission-line towers. Strenuous efforts are being made to secure the necessary quantity required.

The overall picture is one of immense difficulties being dealt with in a determined and courageous manner, and I must express my appreciation of the unflagging efforts that are being made to restore the supply of electric power to normal.

APPENDIX

Further information relating to the past year's working is included in the attached report by the General Manager, while the annual report of the Rural Electrical Reticulation Council is also appended.

The close of the financial year marked the retirement of the General Manager of the State Hydro-electric Department, Mr. F. T. M. Kissel, and it is appropriate that I should place on record the appreciation of the Government of the long period of arduous and unselfish service so ably rendered by Mr. Kissel.

As Minister in Charge of the Department, I formed a very high regard for the unswerving courage and outstanding ability of Mr. Kissel in his chosen field of work, and it is pleasing to record that his faithful service has resulted in the bestowal of the Companionship of the Imperial Service Order.

The new General Manager is Mr. A. E. Davenport, formerly Chief Electrical Engineer of the State Hydro-electric Department.

APPENDICES

APPENDIX A.—ANNUAL REPORT OF THE GENERAL MANAGER FOR THE YEAR ENDED 31ST MARCH, 1948

The GENERAL MANAGER to the Honourable MINISTER IN CHARGE.

Wellington, 10th June, 1948.

SIR,—

Pursuant to section 15 of the State Supply of Electrical Energy Act, 1917, I have the honour to present herewith my first annual report of all operations of the State Hydro-electric Department for the year ending 31st March, 1948.

It will be appreciated that during the year under review the Department was under the control of Mr. F. T. M. Kissel, who retired from the position of General Manager on the 31st March, 1948. Mr. Kissel had acceded to a request to remain with the Department for an extra year to enable the new organization of the Department to be consolidated. During the same period it was thus made possible for me to visit overseas manufacturers of electrical plant in order to ascertain the position regarding present and future deliveries of plant for New Zealand.

In the interests of paper economy, the report is again condensed, and various statistical tables have been omitted.

ELECTRICITY CONTROL

As reported last year, the abnormally dry weather conditions which prevailed in the North Island in January, February, and March, 1947, and the heavy consumption of power in the same period, resulted in storage at Lake Taupo and Lake Waikaremoana being drawn upon prematurely.

By the second week of April less than one-sixth of the control storage remained at Lake Taupo, and at Waikaremoana the lake was 21 ft. below full. At Taupo the average rainfall over the lake catchment area in April and May was below average but better than in the preceding three months, and this small improvement, together with the reduced consumption of electricity following the 5-per-cent. reduction in allocations first imposed on the 13th March, and extended to a 20-per-cent. reduction on the 20th March, resulted in a slow but steady recovery in storage. In April the first machine at Karapiro was supplying power to the system, and this materially helped. Following heavy rains in June storage recovered rapidly, and by the middle of July Lake Taupo was almost full.

The dry weather conditions broke early at Waikaremoana, good rains in April and again in May resulting in a steady recovery in lake-level.

By the middle of May the improvement in the hydraulic conditions made it possible to increase the allocations of electricity, and a month later the emergency restrictions were removed, the original allocations of power being restored in full.

In the twelve weeks during which the emergency restrictions applied the generation of electricity was reduced by 31·4 million units below the amount generated in the corresponding period of 1946. In the three months January to March, 1947, the electricity generated was 35·7 million units above that of the corresponding quarter of 1946, but almost two-thirds of this increase was accounted for by the consumption of power being above allocations. If consumption had not exceeded the allocations from January to March, some emergency restriction would still have been necessary in the succeeding months, but the severity of the restrictions would have been much less.

The second 30,000 kW. unit at Karapiro was put on test in September, and every effort was made to keep Lake Taupo full so that by the following winter advantage could be taken of the increased value of the storage. Lake Waikaremoana was drawn upon heavily, and at the end of December Taupo was nearly four-fifths full. Provided average hydraulic conditions obtained in the following months, it was expected that an average increase in load of about 5 per cent. above that of 1947 could be carried.

The Electric Supply Authorities were therefore advised in December of their individual allocations of power for the following twelve months. In previous years the authorities had been allowed each week the units consumed in the corresponding week of the past year, plus a given percentage increase. The power shortages in the past two or three winters had partly been caused by actual consumption in the summer months being substantially above the allocations given. For the calendar year of 1948, therefore, the total amount of units made available to each Authority was allocated week by week so as to meet the seasonal changes in demand met in the particular Supply Authority's area. The application of this changed basis of allocations would call for some limitations being placed on consumption in both the summer and winter months, but was calculated to obviate drastic restrictions and compulsory power cuts.

In the first seven weeks of the calendar year 1948 the consumption of power was nearly 4 per cent. above allocations, with a corresponding excessive draw upon storage. The Supply Authorities were informed of the position and advised that, unless the consumption of power was held to within the allocations, serious reductions in load might have to be made in the winter months. Rainfall in the Waikaremoana catchment for the four months November to February had been only 44 per cent. of the long-term average, and at Taupo during February only 23 per cent. In March advice was received that the winter requirements of oil fuel for the Evans Bay Power-station would be cut from April onward from 3,000 tons to only 1,000 tons a month.

The combination of those conditions made it necessary to plan ahead on the assumption that the dry weather would continue until the winter. Despite warnings to reduce load, the consumption above allocations showed no useful decrease. On the 11th March, therefore, instructions were issued for load to be reduced by 5 per cent. below the allocations, and on the 30th March this reduction was extended to 15 per cent.

In the South Island the Supply Authorities connected to the Coleridge-Waitaki-Waipori-Monowai system were informed in February 1947 that, provided average hydraulic conditions were experienced, an average increase of 7½ per cent. in load could be met. Until the end of February, and in spite of the dry weather which was generally being experienced, Lake Coleridge storage was full, and flows in the Waitaki River were above the full-load capacity of the Waitaki Power-station. However, the adverse weather conditions continued, rainfall in the Lake Coleridge water-shed averaging only 47 per cent. of the long-term average for the five months January to May, and in the Waitaki catchment only 31 per cent. over the same period. River flows fell below average and storage had to be drawn upon prematurely.

By the end of May the total available storage had been reduced by almost two-thirds, and, in view of the possibility of the adverse hydraulic conditions continuing until the seasonal spring rise about September, no alternative remained but to impose restrictions on the use of power. The Supply Authorities were instructed on the 30th May to reduce load. On the 4th June the Electricity Control (South Island) Order 1947 was gazetted, and on the following day the authorities concerned were directed to reduce the weekly consumption of units by 30 per cent. below consumption in the corresponding week of 1946. The Order gave the authorities power to limit load as they thought fit, with certain provisions relating to the maintenance of a sufficient supply of electricity for farming and certain other essential requirements.

The severity of the restrictions remained for a comparatively short time. A series of westerly depressions broke the drought, and the net allocations were increased progressively. By the 22nd August it became possible to advise the Supply Authorities that until further notice an increase of 3 per cent. above consumption in the corresponding period of 1946 could be met.

For the first quarter of 1948 the allocations were changed to the consumption of units in the corresponding weeks of 1947, plus 5 per cent.

The effect of short-term dry periods upon the power-supply emphasizes the necessity for pushing ahead with the hydro-electric works in hand without any avoidable delay. The emergency shortages of power may keep recurring during dry periods until the new stations are available to create a margin even during dry seasons.

In the meantime it is likewise necessary to have the willing co-operation of the consumers in order that the available power may be distributed where it is most needed, and so as to avoid interruptions to essential services, whether in the home, on the farm, or in industry. Only in this way can the effects of the shortage of power be tempered to the consumer.

NORTH ISLAND ELECTRIC-POWER SYSTEM

A. SYSTEM OPERATION AND LOAD DESPATCH

1. Load

The maximum half-hourly load on the system was 343,900 kW. This occurred on Wednesday, 2nd July, between 17.00 and 17.30 hours. Last year the half-hourly peak was 314,800 kW., on Monday, 18th November, 1946, between 17.00 and 17.30 hours.

The highest Saturday peak was 302,000 kW. between 17.30 and 18.00 hours on 19th July, 1947. Last year the half-hourly peak was 281,300 kW. between 17.30 and 18.00 hours on 8th June and 29th June, 1946.

The highest Sunday peak was 288,700 kW. between 12.00 and 12.30 hours on 10th August, compared with 267,900 kW. between 11.30 and 12.00 hours on 29th September last year.

The greatest weekly generation was 38,969,000 units on the week ending 24th August, 1947 (last year 35,630,000 units), an increase of 9·4 per cent. The maximum units on any one day was 5,969,000 (last year 5,567,000). This occurred on Wednesday, 29th

October, 1947, and represented an increase of 7·2 per cent. The highest Saturday output was 5,389,000 units on 9th August, 1947 (last year 4,819,000), an increase of 8·5 per cent.

The highest Sunday output was 4,923,000 units on 10th August, 1947 (last year 4,474,000), an increase of 10·0 per cent.

The total system units generated by all plants in the North Island for the financial year ending 31st March, 1948, was 1,778,000,000 compared with 1,718,000,000 last year, an increase of 3·5 per cent. The system units generated by Government-owned plants only plus units purchased from Supply Authorities were 1,718,400,000 units for the year ending 31st March, 1948, compared with 1,656,300,000 units last year, an increase of 3·9 per cent.

From 13th March, 1947 (just before the beginning of the year), until Friday, 20th June, 1947, all Supply Authorities were required to reduce consumption to below their allocations. After 20th June each Authority was required to keep within an allocation which allowed about a 3-per-cent. increase in consumption on the previous years. In mid-December each Supply Authority was given a new allocation for 1948 which was estimated would allow an average increase in load of about 5 per cent. above that of 1947. Due to unfavourable hydraulic conditions, it was again necessary to reduce consumption, and on 11th March, 1948, directions were issued to keep consumption to 5 per cent. below the revised allocation, and this reduction was extended to 15 per cent. on the 30th March.

The system voltage was increased by raising Arapuni and Karapiro 110 kV voltage 5 per cent. on Monday, 22nd March, 1948, and Mangahao and Waikaremoana voltage 5 per cent. on Wednesday, 24th March, 1948.

Generation details by Government plants plus units purchased for resale (compared with 1946–47) are as follows :—

Station.	Year ended 31st March, 1948.			Year ended 31st March, 1947.		
	Maximum Kilowatts.	Units generated.	Annual Load Factor.	Maximum Kilowatts.	Units generated.	Annual Load Factor.
			Per Cent.			Per Cent.
Arapuni	152,500	725,660,000	54·5	150,000	786,185,000	59·8
Horahora*	11,100	721,000	74·5	12,500	88,235,950	80·6
Karapiro	67,200	349,568,000	59·4	..	..	..
King's Wharf	28,700	40,006,000	15·9	33,009	47,582,495	16·4
Mangahao	21,300	86,558,000	46·5	21,000	113,582,000	61·7
Penrose	..	1,762,000	..	..	9,089,920	..
Piripaua	100,200	165,492,000	47·8	44,000	182,872,510	47·4
Tuai		252,308,000		63,900	290,697,366	51·9
	..	1,622,075,000	..	..	1,518,245,241	..
Auxiliary and standby stations—						
Evans Bay		49,514,000			86,618,160	
Kourarau		3,358,000			2,973,397	
New Plymouth		14,527,000			16,156,070	
Onehunga		1,762,000			2,941,330	
Opunake		1,477,000			1,633,599	
Palmerston North		1,992,000			5,407,422	
Poverty Bay		1,796,000			1,796,220	
South Taranaki		1,025,000			1,112,024	
Taumarunui		3,606,000			3,230,100	
Tauranga		7,413,000			7,244,415	
Wilson's		3,000,000			2,962,000	
Other miscellaneous		6,864,000			6,029,847	
Total units generated and purchased		1,718,409,000			1,656,314,025	

* Shut down 4th April, 1947.

2. Reliability of Supply

There were 167 faults, 37 of which caused no interruption to supply. Several faults were cumulative, affecting more than one district. Some of these were due to the system being overloaded.

A detailed analysis of interruptions is shown on the following table. These do not include pre-arranged shutdowns due to load rationing:—

Description.	Year ended 31st March, 1947: Number.	Year ended 31st March, 1948.		Distributing Authorities affected.
		Number.	Duration.	
			h. m.	
1. 110 kV. lines: Defects	6	2	0 8	..
2. 110 kV. lines: External causes	6	6	1 30	4
3. 33 kV., 50 kV., or 66 kV. lines: Defects	11	2	1 23	1
4. 33 kV., 50 kV., or 66 kV. lines: External causes	13	2	0 30	2
5. 6·6 kV. or 11 kV. lines: Defects	3	10	48 46	3
6. 6·6 kV. or 11 kV. lines: External causes	2	1	5 29	1
7. Lightning	49	29	13 12	21
8. Storms: Nature of trouble not found	2	2	0 2	1
9. 110 kV. apparatus	2	7	203 37	5
10. 33 kV., 50 kV., or 66 kV. apparatus	9	6	0 24	4
11. 5 kV., 6·6 kV., 11 kV., or 22 kV. apparatus	30	8	5 24	6
12. Generators or synchronous condensers	1	4	11 58	..
13. Relays	5	12	0 46	7
14. Control circuits and batteries	10	4	0 6	2
15. Operation: Mistakes	6	12	0 54	10
16. Operation: Accidents	7	4	0 4	6
17. Faults and overloads on consumers' system	..	..	..	..
18. Other causes	82	32	13 54	23
19. Cause unknown	17	24	2 45	10
Totals	261	167	310 52	106

B. OPERATION AND MAINTENANCE

1. Power-stations

King's Wharf.—There was a fairly consistent demand on the station throughout the year. The oil-pump of No. 14 turbine gave trouble, which resulted in extensive repair work, including the replacement of shafts, bushes, and all driving-wheels. It was also necessary to rebuild the governor and its associated driving-gear. During the test run of the repaired turbine the lagging caught fire, due to an accumulation of oil. The services of the city brigade were necessary when the supply of chemical fire-fighting equipment, which had proved adequate for similar outbreaks in the past, became exhausted, but no damage was suffered by the plant. Severe vibration in No.12 turbine resulted in an investigation, which disclosed several rotor-blades shed, and the body blading and a delivery nozzle in bad condition. Pending the arrival of ordered spare parts, including a new rotor, the unit was made serviceable by the removal of the balance of the blades on the defective wheel. A cracked thrust-collar and several sets of pads were replaced in No. 11 turbine, the oil changed, the inlet flume drained, cleaned out, and extensive repair work carried out on a faulty construction joint. While the flume was dry the opportunity was taken to install the valve and bend for No. 10 circulating pump. All boilers were inspected and passed by the Marine Department. Specifications have been issued for oil-firing and ash-handling, and tenders analysed for grit-arresters. Coal consumed was 50,020 tons, deliveries amounting to 49,291 tons, and 104 tons were sold under orders from the Mining Controller. Of the coal received, 33,210 tons came from the South Island and 16,081 tons from the North Island. The stock in hand at 31st March, 1948, was 1,335 tons.

Arapuni and Karapiro.—Generator-running times were as follows:—

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In demand (Hours).	
Arapuni Power-station							
1	6,639	75·58	763	8·69	1,382 (*a*)	..	84·27
2	7,978	90·82	804	9·15	..	2 (*b*)	99·97
3	7,903	89·97	881	10·03	..	..	100·00
4	7,277	82·84	637	7·25	870 (*c*)	..	90·09
5	6,607	75·22	1,968	22·40	209 (*d*)	..	97·62
6	6,367	72·48	1,952	22·22	..	465 (*e*)	94·70
7	6,685	76·10	1,881	21·41	218 (*f*)	..	97·51
8	5,976	68·03	1,942	22·11	..	866 (*g*)	90·14
Karapiro Power-station							
1 (*h*)	7,677	92·44	616	7·42	11 (*i*)	..	99·86
2 (*j*)	4,338	94·14	269	5·84	1 (*k*)	..	99·98

NOTES.—(*a*) Shut down from 19th January, 1948, to 16th March, 1948, for overhaul. (*b*) Breakdown of 11 kV. generator cable on 14th October, 1947. (*c*) Shut down 14th January, 1947, to 6th May, 1947, to fit a new stator-winding and to change the turbine-runner; and on 26th November, 1947, to recompound a faulty 11 kV. cable-box. (*d*) Shut down 3rd to 7th October for cleaning as stator-winding was covered with oil; 2nd to 4th December for repairs to servo-motor; and 3rd to 5th January to repair a broken guide-vane link. (*e*) Breakdown of stator-winding on 11th September, 1947; repairs completed on 30th September, 1947. (*f*) Shut down 22nd to 23rd May to shift the field rheostat; and 8th to 15th December to clean the stator-winding. (*g*) Breakdown of stator-winding on 12th October, 1947; repairs completed on 17th November, 1947. (*h*) Commenced regular operation on 21st April, 1947. (*i*) Shut down on 9th August, 1947, to remove a spanner found wedged under guide-vane; and on 27th November, 1947, to repair a broken guide-vane link. (*j*) Commenced regular operation on 22nd September, 1947. (*k*) Shut down on 28th February, 1948, to repair a broken guide-vane link.

Arapuni.—The low-tension winding of a transformer in an 11/110 kV. bank, developed a fault in July; it was replaced by a spare winding. The original 18,000 kVA. stator winding on No. 4 generator was replaced by a new 23,500 kVA. winding in May.

Karapiro.—Very little trouble has been experienced since the station was put into regular operation on 21st April, 1947. Large quantities of pumice, weed, and timber continue to collect on the screens, necessitating frequent cleaning. The bearing temperatures of Nos. 1 and 2 generating-units were reduced several degrees by removing sixteen springs from the leading and outer edges of each thrust-pad, and the temperature of the auxiliary turbine thrust-bearing was reduced by installing a cooling water service.

Horahora.—As mentioned in my report for the previous year, this station was permanently shut down on 4th April, 1947, and a considerable quantity of equipment was salvaged before the power-house was submerged by the rising waters of the newly-formed Karapiro Lake. Most of the other departmental buildings have since been removed, and the remainder, consisting of five cottages, will be shifted as soon as sites are available for them elsewhere.

Huntly.—Owing to the amount of coal available being insufficient to run the steam-plants at both Huntly and King's Wharf, Auckland, the Huntly plant was not run during the year. It was recently sold to the Mines Department, and is now being dismantled for removal to the West coast of the South Island.

Waikaremoana.—The greatly reduced lake-level made the continuous operation of the temporary siphons difficult. With the assistance of a compressor (acting as a vacuum-pump) the output of two siphons was maintained at a flow of approximately 60 cusecs. Previous recorded outputs of a single siphon varied from 280 cusecs at high lake-level to 200 cusecs at low level.

On the 30th March the downward trend of the lake-level was halted at 1,988·9 ft., the lowest level ever obtained.

The major slip adjacent to No. 3 pipe-line continued to show movement, and it was not until the latter part of the year that a removal of the lower part of the slip was commenced.

During January, February, and March, the opportunity was taken to completely overhaul No. 3 main machine. This maintenance work had had to be postponed from the previous year owing to the power situation. In conjunction with this overhaul No. 3 penstock, 3,450 ft. in length and with a diameter varying from 78 in. to 66 in., was sand-blasted and painted internally with coal-tar paint. A roading alongside the penstock had been built to facilitate this work.

Extensive alterations were made to the test switches on the control board at the Tuai Power-station. New networks were fitted to Nos. 3 and 5 machine voltage-regulators. The governor-locking solenoid and associated equipment of both Nos. 4 and 5 machines was removed.

Satisfactory service was obtained from all machines.

Generating-running times were as follows for the year :—

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
Tuai							
1	7,061	80·39	1,388	15·80	333	2	96·19
2	7,086	80·67	1,429	16·27	265	4	96·94
3	5,637	64·17	1,223	13·92	1,855	69	78·09
Piripaua							
4	5,870	66·83	2,486	28·30	424	4	95·13
5	5,840	66·49	2,473	28·15	421	50	94·64

Mangahao Power-station.—The rainfall for the year at No. 1 dam was 110·26 in., compared with 188·74 in. and 198·05 in. in the previous two years. At No. 2 dam the rainfall was 104·29 in., at No. 3 dam 79·55 in., and at the power-house 47·94 in.

The annual load factor dropped to 46 per cent. on a maximum load of 21,300 kW.

Extensive cleaning and painting of steelwork at all dams was carried out.

On 24th November the surge-chamber gates tripped, due to a sustained overload when Tuai tripped out, and the pipe-lines emptied.

All five turbine governors were completely overhauled and the oil renewed.

Two more sets of bronze buckets were received. One set was fitted to No. 3 turbine, and this completed the change to new buckets on the three 6,000 kVA. units. The other set is reamed ready for fitting to No. 2 turbine.

Generator-running times were as follows :—

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
1	8,274	94·2	475	5·4	35	..	99·6
2	8,304	94·5	434	4·9	46	..	99·4
3	8,168	93·0	396	4·5	220	..	97·5
4	8,369	95·3	404	4·6	11	..	99·9
5	8,363	95·2	413	4·7	8	..	99·9

A contract has been let for the supply of replacement gates for the by-pass tunnel of No. 1 dam. Negotiations are in hand for a contract for similar gates for No. 2 dam.

2. Substations

(*a*) *110 kV.*

Penrose.—During a starting-up operation of No. 2 condenser a transition resistance exploded, but the equipment was restored to service with a minimum of delay. Further trouble was experienced with overheating of contacts in 22 kV. switchgear, and a very complete report was forwarded to the manufacturers. As a consequence new contacts are being supplied.

The new system of distance impedance relay protection functioned satisfactorily, with the exception of a few troubles with contacts, which has been taken up with the manufacturers.

Roskill.—This substation is now supervisory controlled from Penrose, and the new equipment has operated satisfactorily. In view of past experience of damage to transformer-banks by lightning, co-ordination gaps were fitted to the bushings of the associated line O.C.B.s to prevent a reoccurrence of the trouble.

Henderson.—All 11 kV. O.C.B. moving contact assembly bolt-heads were insulated to prevent flashover. Co-ordination gaps were fitted to line O.C.B. bushes.

Bombay.—Short circuits occurred between the tapping leads in two transformers in a 110/50 kV. bank in May.

Waihou.—Two outages of the 110/50 kV. bank were caused in October and November by birds carrying nesting-material on to the 50 kV. structure.

Greytown.—The dismantling of old buses and metering-equipment was completed.

Dannevirke.—The dismantling of the condenser was commenced. On the 2nd October there was an interruption to supply of five minutes duration, due to a flashover on the transformer terminals.

Napier.—The overhaul of the east bank lightning-arrester was completed.

Stratford.—Long-standing condensation trouble in the switch-room has been cured by use of more internal heat with a fan to direct warm air from the ceiling to the floor.

Hawera.—Reports and estimates for provision of water-supply, sewerage, and site-drainage were obtained. The Power Board's comprehensive rearrangement of its terminal supports greatly improved the site. The rapid deterioration of post-insulators led to the decision to reinsulate the structures.

Wanganui.—The 10 MVA. transformer-bank was restored to service.

Bunnythorpe.—The longitudinal buses on the structure were duplicated in readiness for the coming of the Tuai direct transmission-line.

Ohakune.—The three-phase transformer unit suffered breakdown by overheating due to defective iron insulation, and is still under repair. It was replaced by a similar unit.

Central Park.—The tap changing on load gear for No. 1 transformer-bank was put into operation. The operator's residence was completed and occupied.

(*b*) *50 kV.*

Takapuna.—The telephone surge-tube arrester has been fitted external to the switch-room as a precautionary measure against fire.

Horahora.—A 50/11 kV. transformer giving temporary supply to some houses broke down in May.

Huntly.—No. 1, 11 kV. O.C.B. was damaged by lightning in October.

Mamaku.—All load on this 150 kVA. substation was transferred to Ngongotaha in December, and the substation was dismantled.

Matamata.—Two 11 kV. C.T.s were damaged by lightning in May.

Rotoiti.—All load was transferred to Ngongotaha, and the 200 kVA. substation was shut down for dismantling on 1st April, 1947.

Te Awamutu.—A bird caused a flashover on a 50 kV. lightning-arrester in December.

Waikino.—A 50 kV. O.C.B. bushing failed in May, an 11 kV. C.T. was damaged by lightning in June, three 11 kV. wall bushings were shattered by a flashover in August, and a rat caused a flashover on the 11 kV. bus in January.

Waiotahi.—The original two-unit post-insulators on the 50 kV. structure were replaced by single-unit insulators.

Wairoa.—The old substation was completely dismantled, and four M.V. 50 kV. transformer units were despatched to Auckland.

(*c*) *General*

Owing to several complaints of low voltage in the northern districts, boosters were installed at Kaitaia and Kaikohe, and an induction-regulator at Maungatapere.

3. Transmission and Distribution

(*a*) *110 kV. Lines*

Arapuni–Penrose.—Line 1 was fouled in June by a telephone-line which was being dismantled, and was damaged by lightning in October and February. Owing to the pumice banks of Karapiro Lake collapsing near the towers, two new towers were erected farther back from the lake.

Hamilton–Waihou.—A tree growing under the line caused outages on 5th and 7th May.

Woodville–Greytown.—Heavy rains causing flood conditions necessitated extra patrols.

Tower-earth tests on the Mount Bruce section were taken.

Woodville–Bunnythorpe (Pohangina River).—Tower-earth resistances were taken. The insulators on the east circuit were cleaned.

Woodville–Napier (East and West).—The overhaul of the west line was continued by the maintenance group stationed at Woodville.

Special attention during flood conditions was given to two poles on the Dannevirke–Woodville section of the line. These poles were ultimately piled.

Bunnythorpe–Mangahao.—Erosion in the bed of the Manawatu River exposed the poles supporting one structure and made necessary the addition of more bracing.

Bunnythorpe–Ongarue.—Because a deep slip on a papa spur exposed tower-foundations, a new tower with its grillage extended into the papa had to be built.

(*b*) *50 kV. Lines*

Henderson–Kaitaia.—High winds in the north were responsible for faults due to telephone-wires contacting transmission-lines. At several stations new protective relays were installed by the test department in order to increase the reliability of supply.

Waikino–Aongatete.—Outages were caused by one end of an earthing-strap coming adrift from a pole in June, and by the failure of an insulator in March.

Hamilton–Karapiro.—Outages were caused by lightning in June, and by a haystacker in December.

Horahora–Karapiro.—This line has been dismantled.

Edgecumbe–Te Puke.—Outages were caused by lightning in April, and by a piece of bark from a gum-tree in June.

Tuai–Gisborne.—The overhaul and refitting of this line was proceeded with. Hooks were replaced by clevises at light points of support on the west line to Ruakituri.

The by-passed section of line at Waerenga-o-kuri was dismantled.

Tuai–Wairoa.—The section of the line to the old substation was disconnected and dismantled.

Pole-testing was completed, and defective poles were replaced.

(*c*) *11 kV. Lines*

Karapiro–Hautapu.—Lightning caused an outage and damaged the metering-equipment at Leamington in June. A conductor broke at Leamington in August.

Ohura–Tatu.—This single-circuit line, 6·19 miles, in length, was taken over by the King-country Electric-power Board on 1st September, 1947.

(*d*) *General*

Birds nesting on the structures continue to be troublesome, but experiments have been carried out with a view to preventing their activities.

Three scrub fires under the 110 kV. lines caused flashovers and damage to conductors. On the 110 kV., 50 kV., and 11 kV. lines lightning caused flashovers which damaged poles and insulators or conductors and resulted in several outages.

Damage to insulators by rifle fire continues to occur in widely-separated parts.

4. Communications

The Takapuna–Belmont and the more recently-installed Penrose–Roskill supervisory control performed satisfactorily. Noise-correction work was carried out on the Henderson–Tahekeroa section of line with good results. Radio is in use as an alternative means of communication between substations, and the two 50-watt base stations and mobile units in the field have functioned well.

A check is being made of all transposition joints on the Arapuni–Penrose telephone-line. The first six miles of the Stratford line at Arapuni were rebuilt along a new route, part of it on the Maraetai line, and the bush section of the line at Tangarakau was rebuilt prior to commencing carrier operations.

The northern section of the Napier–Woodville telephone-line was overhauled. Approximately 24 miles of the Woodville–Dannevirke section of the line were reconstructed. The galvanized wire in use was replaced by No. 6 B. and S. copperweld.

Two M108, Mark 2, transceivers were used on the Tuai–Bunnythorpe line-construction. Excellent results were reported.

A start was made to overhaul all system telephones from Napier to the south. All telephones from Napier to Woodville have been overhauled.

Carrier equipment from Khandallah to Bunnythorpe and Claudelands has been in service since June, 1947.

The telephone-line gang completed its overhaul of lines in Taranaki and started on the Bunnythorpe–Napier section. Major deviations of telephone-lines were made at Bunnythorpe to clear them from construction work in progress and to facilitate their entry into the new substation.

5. Test Department

Installation tests were carried out on new equipment. This included switchgear at various substations, booster transformers, 50 kV. automatic earthing-switches, new transformer banks, a new stator-winding on No. 4 generator at Arapuni, various items of equipment for Karapiro, Tuai, and Piripaua; and the new equipment installed at Kaitawa.

Tests of new distance protection relays have been carried out, and panels for them are at present being constructed. At Palmerston North the engraving-machine continued in great demand for the production of labels, and experimental apparatus for de-aerating filtered oil was made up.

Various items of laboratory equipment have arrived from overseas, and others have been constructed which, together with an increase of staff, have greatly facilitated work at Auckland.

6. Plant and Motor-vehicles

Plant.—New tractors arrived during the year, but line-maintenance work still requires new tractors fitted with winches and blades. Three new concrete-mixers also were received. The demand for plant, including pumps, compressors, and tools, has been met reasonably well despite the difficult situation still existing. Workshop plant replacements for Tuai, and new plant for the Napier Depot, have been on order a long time, but there is no prospect of early delivery. The transfer of the Bay View vehicle repair depot to Taradale Road will allow for greater facilities there. A noteworthy addition for transport of heavy machinery to power-stations and substations is the Dyson Trailer, capable of carrying 50 tons.

Vehicles.—Difficulty is still being experienced in meeting the heavy demand for transport, and, although a few were delivered during the year, more new vehicles are needed. Some 2-ton trucks were taken over from the Army authorities, but more have yet to come. As the average age of vehicles is increasing, maintenance is heavy, and this, together with a lack of spare parts, causes delay.

C. CONSTRUCTION

1. Power-stations

Karapiro.—No. 1 30,000 kW. generating-unit was first put on commercial load on 10th April, 1947, but the guide-bearing gave trouble and the machine was not put into regular operation on full load until 21st April. No. 2 generator was completed in September, and was put into regular operation on full load on the 21st of that month. Work on No. 3 generator neared completion.

Maraetai.—Work was continued on the sealing of access roads, erection of accommodation and community buildings in Mangakino Village, excavation of the power-house site and dam-abutments, and excavation and lining of the diversion tunnel and the gate and lift-shafts. During the year 685 ft. of tunnel was excavated to full size, and 450 ft. of barrel lined, excluding the invert. An additional 450 ft. of arch lining was completed. All this work was carried out by the Public Works Department.

Whakamaru.—Investigations to determine the nature of the foundations for the dam and other structures were continued and are nearing completion.

Waipapa and Atiamuri.—Preliminary survey work was carried out. Arrangements are in hand for drilling to commence at Atiamuri.

Kaitawa.—Steady progress was maintained with the installation of Nos. 6 and 7 generating-units. During April, 1948, it was possible to run No. 7 machine on test and later to contribute 10,000 kW. to the system loading. The non-arrival of governor parts prevented full machine running.

The main work undertaken by the Public Works Department was the removal of the rock barrier between the intake and the lake. Advantage was taken of the low level of the lake to expedite this work, which has been substantially completed, and particularly successful.

2. Substations

(*a*) *220 kV.*

Otahuhu.—Work on the substation-site has been chiefly preliminary preparation for construction. Temporary quarters for workers and construction buildings are well established. The sewerage system which will serve both temporary and permanent inhabitants is close to completion. A start was made on the condenser-building foundations. The outdoor-station site has been levelled, and drainage work is proceeding. Investigation and levelling work was carried out in connection with landing-stage on Tamaki River for transporting heavy equipment from the Auckland wharves.

Bunnythorpe.—Work done by the Public Works Department consists of the completion of 75 per cent. (about 8,000 ft.) of the sub-surface drainage, 25 per cent. (279 ft.) of the traverser track, 65 per cent. (38 chains) of the spur railway-line, and twelve 110 kV. O.C.B. pads. Work has commenced on the sewerage plant. Periodical shortages of cement and of sewerage- and water-pipes have delayed progress. The specification for the main and control buildings was prepared and quantities taken off by a quantity surveyor.

The contractor for the new village handed over four of the twelve buildings.

Various construction buildings and a combined transmission-line and substation camp have been erected. Nine 110 kV. O.C.B.s have been erected (except for insertion of bushings), and the remaining three positioned on their pads.

Haywards.—Proclamation plans covering a total area of 34 acres 2 roods 14·67 perches have been prepared, and of this an area of 22 acres 0 roods 33·29 perches has actually been taken.

(*b*) *110 kV.*

Penrose.—All 110 kV. O.C.B.s were replaced by equipment of higher rupturing-capacity. The switches removed from service were forwarded on for use in other substations.

Roskill.—For Kaitaia two 1,500 kVA. transformer-banks for the new condenser installation were modified to enable Buchholz protection to be fitted.

Henderson.—Construction work proceeded on extra-high-tension panels for the modernization of the switchboard.

Hamilton.—New 11 kV. switchgear and new transformers for two 10,000 kVA. 110/11 kV. banks have arrived. Concrete pads have been put down for the transformers, and a start has been made on the new switch-room building, but this work has been delayed by a shortage of steel. A new operator's cottage was completed in October.

Waihou.—A second 5,000 kVA. 50/11 kV. transformer-bank was put into service on 11th August, 1947.

Greytown.—The new 5,000 kVA. transformer-bank and switchgear was put into service on the 12th December.

Masterton.—A 4,500 kVA. bank of transformers was received. The capacity of this station is to be raised to 9,000 kVA.

On the 20th February one house was handed over by the Housing Division of Public Works Department.

Mangamaire.—New 11 kV. switchgear was installed. One 1,500 kVA. transformer was received from Greytown and put into service.

Woodville.—Three 110 kV. O.C.B.s were replaced by higher-rupturing capacity O.C.B.s.

Two staff cottages are in the course of construction at this station.

Dannevirke.—During November a new house was taken over from the Housing Division.

Waipawa.—One house was constructed by the Housing Division.

New Plymouth (projected).—The land for this site was proclaimed.

Waverley (projected).—Instructions have been given for the proclamation of the land.

Marton.—The new 11 kV. switchgear in the new switch-room was commissioned on 10th August, 1947.

Longburn (projected).—The land for this site was proclaimed.

Pahautanui.—The new switch-room building has been completed. The 11 kV. switchgear, which arrived in bad condition, was cleaned and put into good order, and a start was made with its installation.

Khandallah.—The new 20 M.V.A. synchronous condenser was put into service on 10th September, 1947. Subsequently it was found necessary to rebalance it as vibrations affected communications apparatus. Land was acquired for staff housing and a contract let for five houses.

Upper Hutt.—The erection of the new 11 kV. switchgear in the new switch-room was practically finished (commissioned on 7th April, 1948).

Maungatapere.—A site for the new substation was selected, contour survey made, and investigation made for water supply.

(*c*) *50 kV.*

Takapuna.—The necessary protection was completed, and the two-line O.C.B.s, Henderson–Takapuna, were put into service.

Tahekeroa.—A new 11 kV. panel was installed.

Mareretu.—Arrangements were made with the Public Works Department to undertake construction of a water-supply scheme involving the building of a dam and associated works.

Maungatapere.—An induction regulator was installed.

Kaikohe.—An automatic booster was installed.

Kaitaia.—The concrete pads were prepared to receive the 1,500 kVA. banks for the condenser installation. An automatic booster was installed.

Aongatete.—New 11 kV., seven-panel, metal-clad switchgear was put into service on 12th October, 1947.

Hangatiki.—A 1,500 kVA. 50/11 kV. transformer bank from Edgecumbe was put into service with the existing 750 kVA. bank on 22nd June, 1947, and two new 1,500 kV. booster transformers were put into service in July, together with an additional 11 kV. feeder O.C.B. and a 50 kV. automatic earthing-switch. The erection of a new 50 kV. steel structure and switchgear was completed, and the old structure was dismantled.

Kerepeehi.—The 11 kV. switchgear was by-passed and dismantled in March, and the installation of new 11 kV. nine-panel, metal-clad switchgear is in progress.

Lichfield.—A second 1,000 kVA., 50/11 kV. three-phase transformer was put into service on 27th July, 1947. Buchholz relays have been fitted to the transformers.

Matamata.—New 11 kV., seven-panel, metal-clad switch-gear ordered for Addington was erected, and the old switchgear was dismantled. Three of the new panels were connected up in May, two in June, and one in September. The erection of an additional panel is proceeding.

Te Awamutu.—The installation of new 11 kV., ten-panel, metal-clad switchgear, together with a bus-sectionalizing unit, was completed, and the old switchgear was dismantled. Five of the new panels were put into service in July, and three in April (1948). A 3,000 kVA. booster-transformer was put into service on 10th August, 1947.

Te Puke.—A second 2,250 kVA. 50/11 kV. transformer-bank and a booster-transformer from Waihou are being installed and will soon be ready for service. The new 11 kV., seven-panel, metal-clad switchgear will be put into service in place of the temporary switchgear at the same time as the second transformer-bank.

Waikino.—The old 11 kV. switchgear on supply to the Power Board was replaced by new, four-panel, metal-clad switchgear on 1st December, 1947.

Waiotahi.—The 1,500 kVA. 50/11 kV. transformer-bank was replaced by a 3,000 kVA. bank from Hamilton on 24th August, 1947. In November the switchgear D.C. tripping was changed from 32 volts to 12 volts, and a 50 kV. automatic earthing-switch was installed.

Waiuku.—The temporary 11 kV. switchgear was replaced by new seven-panel, metal-clad switchgear on 31st August, 1947.

Dargaville.—A site was selected, contoured, and plan prepared.

3. Transmission and Distribution

(*a*) *220 kV. Lines*

Whakamaru–Otahuhu.—The preparation of the 3-chain tracings was completed for the east circuit, and the survey of both lines is practically complete. Construction camps have been erected at Waerenga, Gordonton, Bruntwood, and Arohena. Work is proceeding on tree-felling and the formation of access roads.

Whakamaru–Bunnythorpe.—The survey of the west line is complete, and the east-line survey is proceeding. An access road was formed around the west side of Lake Taupo. Camps have been built at Tihoi and Turangi. Fair progress has been made by the Public Works Department with road metalling and bridging in the Waiouru area.

The construction camp at Bunnythorpe has been completed, buildings for Mangaweka and Kimbolton camps acquired, and these camps laid out. Land for the permanent line depot at Mangaweka was acquired. Instructions were given for the erection of the first buildings.

Whakamaru–Maraetai.—The survey of both tie-lines is complete. A camp has been built at Mangakino.

Bunnythorpe–Haywards.—Survey of this line by one party has progressed slowly. A total of 9 miles of the east line and 49 miles of the west has been profiled. Plan work is proceeding.

Linton Steel Depot.—This depot has been established for receiving and issuing the steel for the North Island's 220 kV. system. It is estimated that 18,000 tons of tower components will be handled. Land has been leased and laid out ready to receive the 9,000 tons comprising the first contract. Mobile cranes and other plant have come to hand.

(*b*) *110 kV. Lines*

Henderson–Maungatapere.—A detailed survey has been completed and material schedule prepared. Route plans are practically completed. Construction camps were erected.

Arapuni–Otahuhu and Otahuhu–Penrose.—Detailed survey and plans were completed and a material schedule prepared.

Karapiro–Hamilton.—The east circuit was put into service to supply Karapiro on 29th March, 1947, and both lines were brought into service when Karapiro Power-station was put on commercial load in April.

Tuai–Bunnythorpe.—In spite of delays due to non-arrival of conductor cable and jointing-sleeves, steady progress was made towards the completion of this line. Steel-tower erection was completed in March.

Khandallah – Central Park (Second Circuit).—All towers have been taken to site, and seven erected.

(*c*) *50 kV. Lines*

Maungatapere–Dargaville.—Route of new line located.

Arapuni–Matamata.—A short tie-line was erected near Horahora in April to connect up the Matamata line to the Arapuni line after Horahora was cut out.

Tuai–Gisborne. The deviation of the section of the line at Waerenga-o-kuri, which was subsiding through heavy rains and flooding, was completed.

(*d*) *General*

Mangakino–Reticulation.—Work was continued on the reticulation of the construction works and village. Two more distribution transformers, one 300 kVA. and the other 75 kVA., were installed. Over two hundred and seventy house services have been completed.

4. Communications

Arapuni–Claudelands Telephone-line.—The remainder of the multi-circuit line from Arapuni to Karapiro was completed and put into service, and the old line was dismantled.

Arapuni–Maraetai Telephone-line.—This line was completed.

Maraetai–Whakamaru Telephone-line.—Survey work is in progress.

Channel Carrier System.—A three-channel carrier service between Claudelands and Bunnythorpe was installed. Similar equipment is being installed between Claudelands and Penrose. A carrier lateral line from Puketaha to Hamilton has been surveyed.

A manual exchange was installed at Kaitawa.

The main supervisory protection cabinet for Tuai was completed and installation of a thirty-line telephone switchboard commenced.

Telephone-line-protection cabinets for Masterton, Woodville, Mangamaire, and Greytown were assembled and installed.

A survey of the relocation of line on the Woodville–Masterton system telephone-line was completed.

Two twenty-line telephone switchboards were installed at Penrose.

5. General

At the Kotemaori patrol station one cottage was completed, and six transit houses were built in the Auckland district.

An area of 10 acres has been secured at Taradale Road, one and a half miles from Napier, as a plant depot, main store, carpenters' shop, and general maintenance depot. The Public Works Department is developing a site of 8 acres in conjunction with this Department and is carrying out the general levelling, roading, and drainage. The area is reticulated for power. The store was practically completed, as well as a stores office and caretaker's cottage. Other works in progress are a cable-store and a transit cottage.

SOUTH ISLAND SYSTEM

A. SYSTEM OPERATION AND LOAD DESPATCH

1. Load

The maximum half-hourly demand on the Department's generating-stations was 133,590 kW. at 17·00 hours on 29th May, as compared with 128,745 kW. the previous year.

The combined system maximum demand, which includes the Dunedin City Corporation plants and other auxiliaries, was 160,700 kW. at 17·00 hours on 29th May, an increase of 4·4 per cent. on the previous year's peak.

The greatest weekly generation for the combined system was 16,177,871 units for week ending 1st June (previous year 15,807,533); and the highest daily generation was 2,591,713 on 29th May (previous year 2,496,615). Rationing was introduced on 30th May, 1947, when a reduction of 20 per cent. was called for, and this was increased to 30 per cent. on 5th June. The restriction was progressively lifted to 20 per cent. on 23rd June, 10 per cent. on 18th July, basic allocation on 8th August, 3 per cent. above basic on 22nd August, and 5 per cent. above on 15th December.

Difficulty was experienced in maintaining adequate coal-supplies for auxiliary stations.

An additional system interconnecting 15,000 kW. transformer-bank was commissioned at Halfway Bush in November to enable summer surplus water-power at Waitaki to be further converted into winter storage at Waipori. This conservation of Waipori power contributed to the reduction of approximately 41,000,000 units in Waipori generation as compared with the previous year. Storage in Lake Mahinerangi at 31st March, 1948, was approximately 19,000,000 units more than at 31st March, 1947.

Generation details of complete interconnected system (compared with 1946–47) are as follows:—

Station.	Year ended 31st March, 1948.			Year ended 31st March, 1947.		
	Maximum Kilowatts.	Units generated.	Annual Load Factor.	Maximum Kilowatts.	Units generated.	Annual Load Factor.
			Per Cent.			Per Cent.
Arnold	3,500	23,995,900	78·0	3,200	22,511,800	80·3
Dobson (oil) ..	..	3,083,550	..	..	3,268,240	..
Coleridge	39,840	109,909,170	31·4	38,980	142,279,330	41·8
Highbank	28,000	184,797,390	75·1	28,500	109,113,090	43·7
Monowai	6,700	28,323,700	48·2	6,600	28,689,050	49·6
Waitaki	68,580	326,523,430	54·2	67,980	342,237,950	57·5
Departmental totals	..	676,633,140	..	..	648,099,460	..
Dunedin City (all stations)	..	54,605,191	..	..	93,900,243	..
Invercargill City ..	..	1,576,590	..	..	1,576,090	..
Kanieri Electric Co. ..	..	7,858,128	..	..	5,398,140	..
Westland Power, Ltd.	..	2,518,080	..	..	2,023,200	..
Others	..	5,275,486	..	..	2,324,005	..
Grand total ..	..	748,466,615	..	..	753,321,138	..

2. Reliability of Supply

There was a total of 232 faults. Of these, 4 were general system outages for periods of up to 10, 17, 14, and 23 minutes respectively, affecting a majority of consumers.

The duration given refers generally to the period of outage of the line or equipment concerned; the periods of interruption to consumers were usually shorter.

The following analysis does not include prearranged shutdowns.

Description.	Year ending 31st March, 1947.	Year ending 31st March, 1948.		
		Number.	Duration.	Distributing Authorities affected.
			h. m.	
1. 110 kV. lines: Defects	2	8	38 15	20
2. 110 kV. lines: External causes	3	7	1 17	7
3. 66 kV. lines: Defects	8	27	19 00	8
4. 66 kV. lines: External causes	1	8	18 48	16
5. 11 kV. lines: Defects	69	74	45 56	3
6. 11 kV. lines: External causes	41	38	27 22	7
7. Lightning	30	9	5 05	8
8. Storms: Nature of trouble unknown	8	18	12 38	1
9. 110 kV. equipment	2	5	25 53	5
10. 66 kV. equipment	3	7	8 45	5
11. 33 kV., 11 kV., or 6·6 kV. equipment	4	9	6 51	1
12. Generators	..	..	..	..
13. Turbines	1	..	..	..
14. Diesel-oil engines	..	..	..	..
15. Relays	..	..	..	..
16. Control circuits and batteries	1	..	..	..
17. Operation: Mistakes	1	3	0 40	5
18. Operation: Accidents	6	..	..	..
19. Faults and overloads on consumers' system	24	2	0 35	1
20. Other causes	8	..	..	..
21. Cause unknown	24	17	7 21	3
Totals	236	232	218 26	90

B. OPERATION AND MAINTENANCE

1. Power-stations

There were no serious defects or failures of permanent equipment. Two interruptions to supply from Waitaki were caused by failure of switchgear temporarily in service during alterations. Below average rainfalls were experienced until June. Rainfalls for the whole year were below those of the previous year.

Coleridge.—Owing to prolonged dry weather, and in particular the absence of north-west rain, the lake-level fell rapidly from 1,669·82 ft. at 31st March to 1,662·45 ft. on 7th June. Rationing of power and subsequent wet weather retrieved the position. The lake was filled to overflow level (1,673·5 ft.) by 9th November, remained full until the middle of February, and stood at 1,671·07 ft. at the 31st March, 1948.

Comprehensive overhauls of Nos. 2 and 3 generating-units were carried out, the work done including the welding of cavitated runners and the fitting of new sets of fabricated guide-vanes. A general overhaul of No. 4 unit was completed.

Machine-running Times

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
1	4,741	54·0	3,428	39·0	615	..	93·0
2	4,933	56·2	3,036	34·5	815	..	90·7
3	4,694	53·4	3,163	36·1	927	..	89·5
4	1,290	14·7	6,497	73·9	997	..	88·6
5	1,195	13·5	6,758	77·0	831	..	90·5
6	1,346	15·3	7,197	82·0	241	..	97·3
7	1,317	15·0	7,419	84,5	48	..	99·5
8	2,465	28·1	5,641	64·2	678	..	92·3
9	2,825	32·2	5,889	67·0	70	..	99·2

Waitaki.—The average river flow during the year was 9,625 cusecs, as compared with 10,942 cusecs during the previous year. The highest flow recorded was 41,400 cusecs, on 28th December, 1947. The minimum weekly average flow was 3,630 cusecs during the week ending 8th June, 1947.

Work was commenced on the installation of the fifth generating-unit.

Machine-running Times

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In demand (Hours).	
1	7,425	84·5	1,307	14·9	52	..	99·4
2	7,345	83·6	1,413	16·1	26	..	99·7
3	4,864	55·4	3,894	44·3	26	..	99·7
4	4,436	50·5	4,332	49·3	16	..	99·8

Highbank.—Despite continuous use of water for irrigation from September onwards, the supply from the Rangitata River was consistently maintained.

While there has been some reduction in the amount of general refuse brought down, excessive wind-blown debris in the headrace continues to cause trouble at the screens. The completion of the fixed structure for a mechanical screen-cleaner will make routine cleaning less arduous. Silt and sand occasioned a large proportion of the maintenance work. The station was shut down for six days at Easter for headrace cleaning and power-house overhaul.

The main unit slip-rings continued to give trouble, running hot and wearing brushes excessively, until the original brushes were replaced in July with a more suitable grade.

Machine-running Times

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
1	8,480	96·6	151	1·7	153	..	98·3

Arnold.—The river flow was maintained at or above continuous full-load requirements, except for a slight reduction in the station output for a period of twelve days in December.

The repair and reconditioning of No. 2 machine was completed in April, work done including the fitting of new gates and main gate-ring connecting-links, replacement of the steel thrust-bearing-cooling water-pipes in copper, conversion of fittings to brass, and changing of the transformer cooling-water suction from the manhole cover to the scroll-case.

Machine-running Times

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
1	8,184	93·2	359	4·1	241	..	97·3
2	8,049	91·6	77	0·9	658	..	92·5

Monowai.—The normal operation of the station was interrupted by six faults due to fires on the transmission line and three faults due to surge on the lines.

The rainfall for the year was 44·13 in. Floods occurred in December.

Machine-running Times

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
1	5,385	61·3	3,348	38·1	51	..	99·4
2	5,600	63·8	3,136	35·7	48	..	99·5
3	5,194	59·1	3,534	40·2	56	..	99·4

Dobson.—The Diesel station was called on to run as an auxiliary station, from April till August.

The overhaul of No. 1 engine was commenced in February. No. 2 engine has been out of service since the failure of a compressor cylinder and piston in April, 1947, the overhaul of No. 3 engine was commenced in November and completed in February, and on completion of its overhaul, No. 4 engine was put into service in June, but was withdrawn at the end of July following the loosening of a pinion on the vertical drive to the cam-shaft. A head overhaul of this engine was completed in September and the repaired cam-shaft was fitted in November.

Machine-running Times

Generator No.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In demand (Hours).	
1	1,173	13·4	6,050	68·8	1,561	..	82·2
2	49	0·6	535	6·1	8,200	..	6·7
3	1,058	12·0	5,015	57·1	2,711	..	69·1
4	372	4·2	3,732	42·5	4,680	..	46·7

2. Substations

(a) *110 kV.*

Palmerston.—An outage occurred when, owing to incorrect alignment of the transformer tap-changing equipment, the tap-changers on two units overran the last tap on a very low primary voltage. On the type of tap-changing equipment concerned there is no individual external indication of the tap in operation on each unit.

Gore.—Supply was interrupted seven times, the longest interruption of 3 hours 4 minutes being due to the failure of a bushing on the bus-coupler during testing. Five were due to the failure of the 110 kV. supply and one to a failure of the 110–66 kV. auto-transformer bank.

Milton.—The supply was interrupted three times, two of the interruptions being due to faults outside the area, and one occurred whilst testing.

(b) *66 kV.*

Addington.—An interruption of 42 minutes in supply to the northern 33 kV. area occurred when insulators were damaged by a flash-over during buzz-stick testing.

Invercargill.—Supply was interrupted on twelve occasions, the longest of 17 minutes' duration being due to a fault outside the area; one through a faulty lightning-arrester, six due to overload and line faults, and one due to an unknown cause.

One of the regulating transformers failed in service, a flashover occurring in the tap-changing mechanism box, rupturing bushings and severely damaging contacts. Repairs were made by the workshop staff.

Ohai.—The new substation came into operation during the year and has operated satisfactorily.

Winton.—One regulator and the "B" bank of transformers were thoroughly examined and transferred to Ohai Substation, leaving Winton with 2,250 kVA. transformer capacity in place of 4,500 kVA.

(c) *33 kV.*

All substations operated satisfactorily.

(d) *General*

On substations 10,656 insulators were tested by buzz-stick, and 68 found defective were replaced. Of the defective insulators, 18 were located at Glenavy, 13 at Waitaki, and 10 at Oamaru.

3. Transmission and Distribution

(a) *110 kV. Lines*

On the Ashburton–Timaru lines an outage on both lines occurred when an aerial earth wire on the Rangitata River towers broke during a heavy north-west gale and fouled the phase-conductors. When a boy climbed a tower at the Temuka River crossing, contacted a conductor, and was electrocuted, a brief interruption to supply occurred.

On the Glenavy–Oamaru lines further protection work is being carried out at the Waitaki River crossing.

(b) *66 kV. Lines*

Outages were caused by a variety of faults, including a gorse fire, leakage over an insulator resulting in the burning of the pole, a ground fire which damaged conductors, cutting of lines by a rock off a hillside, breaking of a span by snow, and several presumed due to lightning.

On the Otira–Arahura lines a deviation of approximately two and a half miles was constructed to avoid a section threatened by the Teremakau River.

(*c*) *Lines: General*

On 110, 66, and 33 kV. lines a total of 65,900 insulators were tested by buzz-stick, and the 321 units found defective were replaced.

(*d*) *Distribution*

Southland.—A busy year has been experienced on distribution-lines, despite a shortage of materials and labour. Nearly 50 miles of 11 kV. extensions were constructed to connect new consumers.

The work of changing over Gore Borough from 3·3 to 11 kV. using concrete poles is nearing completion. The rerouting and rebuilding of South Invercargill reticulation and changing from 3·3 to 11 kV. is still under construction.

For most of the year all the available distribution gangs were engaged on line-extensions. The reticulation of Haldane and Tussock Creek settlements were completed, and the Happy Valley reticulation construction commenced; subsidies for these lines have been granted by the Rural Electrical Reticulation Council. Shortage of labour and materials prevents many prospective consumers from being supplied with power.

(*e*) *Consumers, Southland Retail Supply*

Of the 10,947,889 units sold directly by the Department for industrial purposes, freezing-works used 41·678 per cent., coal-mines 22·594 per cent., minor industries 17·960 per cent., lime-works 14·510 per cent., and saw-mills 3·255 per cent.

In the last five years, despite unavoidable restrictions and shortages of essential appliances and materials, the number of units used by the Department's retail domestic consumers increased by 59 per cent.

The year's increase in consumers supplied directly by the Department in Southland was 467, bringing the total up to 13,908 in the retail area of supply, in which there are now 10,661 electric motors in use, 3,000 electric ranges, and 2,071 electric water-heating installations. About 75 per cent. of the new consumers were in country areas. Some 860 electric motors were connected for the first time.

4. Communications

Three mobile radio units have been installed in faults-trucks. Temporary base stations were installed and radio tests were carried out.

5. Test Department

Relays were installed and commissioning tests carried out in connection with new installations.

Switchgear, relay, metering, and voltage regulating panels were designed, made up, and installed at Kaitangata to control the 625 kVA. turbo-alternator belonging to the Kaitangata Coal Co., and commissioning tests carried out on the alternator and equipment.

A method of testing employing current up to 25,000 amperes was developed and applied to air-break switches of 600 amperes rating for 11, 110, and 220 kV. circuits.

Following the disastrous fire which destroyed a large business block in Christchurch, a report was made on the electric supply. This report involved considerable testing and investigating, and the lengthy attendance, evidence, and cross-examination of the Testing Engineer at the Royal Commission of Inquiry.

6. Plant and Vehicles

Plant.—The three old tractors gave satisfactory performance, and a new one was received. The workshop plant at Addington is old and badly worn, but was usefully employed on repairs and making-up of equipment.

Vehicles.—The older vehicles are in poor condition and 10 of the 149 vehicles in use are worn out and cannot be put into regular service, whilst others are in poor condition. New vehicles are urgently required to provide adequate and efficient transport.

C. CONSTRUCTION

1. Power-stations

Coleridge.—Good progress was made on the reconstruction programme, and the three major units were connected direct to transformers. The remaining two transformer-banks were changed over to outdoor service. The three lines to Hororata were changed over to the new structure.

Waitaki.—Work was commenced on the installation of the fifth 15,000 kW. unit. The suction liner has been fitted into position and levelled, and the lower foundation ring bolted to it ready for welding. Preparations are being made for the concreting of the machine foundations.

Highbank.—The 66 kV. O.C.B. controlling the new line to Methven was installed.

Dobson.—The switching structure was extended, and the first of two new 5 mVA. T.C.O.L. transformer-banks was installed and put into service in November. The installation of the second new bank is proceeding.

Pukaki.—The permanent sluice-gates and temporary dam having been completed, use of the lake for storage was commenced in February. The temporary rock-filled dam, with a maximum height of 40 ft., was constructed by the Public Works Department and is the up-stream coffer dam for the construction of the permanent dam. Some rolled fill work has been done for the permanent dam, as well as a considerable quantity of spillway excavation.

Tekapo.—The Public Works Department completed about two-thirds of the tunnel, and excavations for the tail-race and power-house foundations were nearly completed.

2. Substations

(*a*) *220 kV.*

Islington.—Surveys were made of a tentative site at Islington for the proposed Christchurch terminal of the 220 kV. lines from Roxburgh.

(*b*) *110 kV.*

Hororata.—A 66 kV. O.C.B. was reconditioned and installed to control the new fourth line to Addington.

Temuka.—The 11 kV. indoor switchgear was installed and commissioned on 7th December, feeding to the South Canterbury Power Board's new 11 kV. six-pole terminal structure.

Half-way Bush.—Pending receipt of the two 20 mVA. transformer-banks and switchgear on order, a 15 mVA. bank supplying direct to the Dunedin City Corporation's Ward Street Substation, was installed to supplement the existing 10 mVA. bank. The Half-way Bush – Milton 110 kV. line was reterminated on the north side of the outdoor structure, the 15 mVA. bank, 110 and 33 kV. O.C.B.s, 33 kV. metering unit, and control equipment were installed, and commissioned on 13th November.

(*c*) *66 kV.*

Addington.—To provide urgently required office accommodation for the load-despatch personnel, the linemen's quarters at Waipara were transferred to Addington, altered, reconditioned, and provided with the necessary services and equipment, including a newly-designed large-scale system mimic diagram.

Arahura.—The installation of the new 5 mVA. T.C.O.L. transformer-bank was commenced.

Ohai.—Rebuilding was completed and a 2,250 kVA. bank of transformers and regulator were installed.

Methven.—The 66 kV. outdoor structure has been erected and transformer foundation pads constructed. The 5 mVA. T.C.O.L. transformer-bank ex Dobson was overhauled at Addington and delivered to site. Installation of transformers, indoor 11 kV. switchgear, and control equipment is proceeding.

Papanui.—Land was acquired at Greer's Road, Papanui, for the proposed new major substation to serve the northern part of the Christchurch metropolitan area.

(*d*) *33 kV.*

Southbrook.—An additional O.C.B. was installed, to control the line to Culverden.

3. Transmission lines

A possible route for the proposed Roxburgh–Christchurch 220 kV. line was investigated. A start was made on construction of the first section from Gore to Edendale of the Gore–Invercargill 110 kV. line, and a camp was almost completed at Edendale. The line survey of the Gore–Roxburgh 110 kV. line was almost completed.

Thirty-two miles of new line were completed on the Hororata–Addington 66 kV. line, and in the Sockburn area the three existing lines were reconstructed to form, with the new line, two double-circuit suspension sections. The 12·42 miles of the Highbank-Methven 66 kV. line were constructed, but is not in service pending completion of the Methven Substation. Possible routes for the proposed multi-circuit steel-tower lines from the Christchurch 220 kV. terminal to Addington, Papanui, and North Canterbury are being investigated.

Four and a half miles of line on concrete poles were constructed from Kaitangata to Stirling to connect a 500 kW. steam auxiliary station at Kaitangata Coal-mines to the main system via the Otago Electric-power Board's system.

4. Communications

The new line from Addington to Hororata is nearly completed, and on the south trunk building of a new line from Addington to Glenavy is proceeding.

Provision of emergency radio communication between vital points is in hand.

NELSON-MARLBOROUGH SECTION

A. SYSTEM OPERATION AND LOAD DESPATCH

1. Load

The maximum half-hourly demand on the system was 9,996 kW. on Friday, 25th July, at 10.00 hours. This is 21 per cent. higher than the previous year's peak of 8,240 kW., while the increase in units generated was 26½ per cent. The maximum number of units generated in any one week was 1,152,995 for the week ended 6th July, 1947. The system annual load factor was 59 per cent., and of the total units generated 6·7 per cent. were not accounted for.

Units generated (compared with those for the previous year) were as follows :—

Station.	Year ended 31st March, 1948.	Year ended 31st March, 1947.	Percentage Increase.
Cobb Power-station	45,975,500	36,530,900	26
Auxiliary and standby stations ..	6,052,334	4,612,120	31
Total units	52,027,834	41,143,020	26½

Units generated by the standby and auxiliary stations, mainly during dry weather periods, represent 12 per cent. of the total. The completion and filling of the temporary earth dam at Cobb during December was of great advantage when dry weather set in early in the new year. By the third week of February, 1948, this temporary dam was two-thirds empty, and of the total storage (including lakes in the valley) of almost 2,500,000 units over half had been used. All demands were met without restrictions, and a reserve of approximately 500,000 units remained in storage on 27th March, when heavy rain restored all water-levels. Though the position was met satisfactorily, additional storage will be necessary to meet similar weather conditions with future increased load. The units drawn from storage during January to March totalled approximately 2,155,000.

2. Reliability of Supply

The most serious interruptions were due to storms, and during one on 7th August, 1947, the 66 kV. line was broken and pole structures damaged at Riwaka. The alternative arrangements made to carry the load during the shutdown of the Cobb Station for the stone trap installation on 26th December were quite satisfactory until the sudden storm in the late afternoon put the system out of order. Although the Stoke–Blenheim 66 kV. line failed, the Marlborough Board was not inconvenienced, as the standby plants were already in operation.

An analysis of both accidental and prearranged shutdowns is set out below :—

Faults and Shutdowns on Departmental System

Description.	Year ended 31st March, 1947.	Year ended 31st March, 1948.			
		Accidental.	Prearranged.	Duration.	Distribution Authorities affected.
				h. m.	
1. 66 kV. lines : Defects	2	2	..	3 25	3
	..	..	1	0 16	1
2. 66 kV. lines : External causes ..	3	..	..	..	..
3. 11 kV. lines : Defects	1	..	1	2 29	..
4. 11 kV. lines : External causes ..	2	..	..	..	..
5. Lightning	1	1	..	0 05	2
6. Storms	16	2	..	11 1	3
7. 6·6 kV. apparatus	3	1	..	0 34	1
8. 11 kV. or 33 kV. apparatus ..	7	..	1	0 25	..
9. 66 kV. apparatus	1	..	2	3 42	1
10. Generators	..	..	..	..	..
11. Relays	1	..	1	1 11	1
12. Control circuits and batteries ..	..	..	..	..	..
13. Operation : Mistakes	..	..	..	..	..
14. Operation : Accidents	..	..	..	..	..
15. Faults and overloads on consumers' systems	..	..	..	..	..
16. Other causes	6	6	..	1 46	3
	..	..	1	19 20	..
17. Causes unknown	1	..	..	..	..
Totals	44	12	7	46 14	15

B. OPERATION AND MAINTENANCE

1. Power-stations

Cobb.—The peak load carried by the Cobb generators was 9,690 kW. at 17.30 hours on Thursday, 26th June, 1947, the annual load factor for the station being 54 per cent.

The annual rainfall was 91·21 in., compared with 73·005 in. for 1946–47.

A stone-trap was fitted to the pipeline in December, and during the station shutdown the opportunity was taken to inspect the tunnel and to overhaul and check the station switchgear and transformers.

The spears, nozzles, and turbine buckets have showed signs of the punishment received from gravel passing through them, and the C.B. valves have also required attention.

The following table shows the running-times of the various machines.

Generator.	Time on Load.		Time Idle.		Time under Repair.		Percentage Availability for Service.
	Hours.	Percentage.	Hours.	Percentage.	Not in Demand (Hours).	In Demand (Hours).	
1 ..	5,580	63·5	3,136	35·7	47	21	99·2
2 ..	5,147	58·5	3,090	35·2	521	26	93·7
3 ..	5,753	65·5	2,885	33·0	122	24	98·4
4 ..	5,710	65·0	3,006	34·2	46	22	99·2

Stoke Diesel Stations.—Running as required for standby purposes, the station generated 775,560 units, 17 per cent. more than last year. The machines are badly in need of overhaul, which is still held up pending the arrival of further necessary parts. Machine-running times were: No. 1 machine, 1,285 hours (215,790 units); No. 2 machine, 1,273 hours (523,770 units).

2. Substations

All apparatus operated satisfactorily.

3. Transmission and Distribution

(*a*) *66 kV.*—One failure was due to flashover of a string of insulators near Upper Takaka, and another to the burning of a pole in the Stoke–Blenheim 66 kV. line. The most serious trouble occurred on 7th August, when, during a storm, a tree broke the 66 kV. line, wrecking a double-pole concrete structure and damaging others, near Riwaka.

(*b*) *11 kV.*—Faults were mostly of a minor nature except that from 28th March for over thirty-six hours the power-house – dam line was out as the result of storm and flood damage.

4. Communications

There was a number of telephone faults, mostly due to storm damage. On 26th December a severe storm put both the Department's and the Post and Telegraph circuits out.

5. Testing

Much work was occasioned in connection with the new transformer installations at various substations.

6. Plant and Motor-vehicles

The arrival of one new sedan car did little to alleviate the transport position, and the difficulty of carrying on satisfactorily is increasing. Six new Cletrac tractors, with various equipment, arrived.

C. CONSTRUCTION

1. Power-station

The most important work was the building at Cobb of the temporary earth dam by the Public Works Department. The social hall building was completed. Plans for a dam at Lake Sylvester have been prepared, and the formation of a tractor-track to the lake is well under way.

2. Substations

Stoke.—The installation of a new 6,000 kVA. T.C.O.L. transformer-bank and controls was completed and put into service on 13th May.

Motupipi.—The 3,750 kVA. transformer-bank, ex Stoke, was installed and put into service in June.

Motueka.—The 2,250 kVA. transformers from Motupipi were installed and went into service in June. A 2,250 kVA. 11,000-volt regulating-transformer was put into service on 23rd January.

Blenheim.—A 66/33 kV. 5,000 kVA. transformer-bank, ex Addington Substation, was dried out, installed, and put into operation on 9th October.

3. Transmission and other Lines

Stoke – West Coast Line.—All plans and surveys, including necessary deviations, were completed, and materials began to arrive. Some bush-clearing contracts have been let.

Second Cobb – Stoke Line.—Survey and plans for the line have been completed.

4. Workshop

The Nelson workshop building is still in the hands of the contractors, but the 30 ton overhead travelling crane and other workshop equipment is being installed.

DESIGN AND PROJECT PLANNING

(*a*) Hydraulic Section

Karapiro.—The checking of ground-water levels in the vicinity of the dam, with special reference to the valley of the Karapiro Stream, continued. Conditions are now stable, and only periodic inspections need be made.

Maraetai.—Almost all detailed designs have been under action. Design for the diversion tunnel and spillway, and drawings of the main penstocks, were practically completed, and it is hoped to call tenders soon for the main spillway gate and the penstocks. Several drawings of the dam were completed which involved detailed investigation of the effects of cooling mass concrete. Work on this is now well advanced, and detailed procedures for cut-off and consolidation groutings having been decided, the necessary drawings and specifications were issued. Design and investigation work was done on the main intake gates, screen structures, &c., which are particularly big structures requiring very careful analysis. The Department of Scientific and Industrial Research assisted with hydraulic model tests to enable detailed studies of the spillway to be nearly completed. The Department has been asked to make tests on special features of the intake gates.

Whakamaru.—Investigations proceeded, and proposals for this station are nearly completed. Final design work should commence soon.

Waipapa and Atiamuri.—Investigation has been pushed ahead on further sites on the Waikato at Waipapa and Atiamuri. Topographical and geophysical surveys have been carried out, and preparations are in hand to drill the sites. Access roads and camps have been established.

Waikaremoana.—The last stage of design for the upper development was completed—namely, the sealing of the leaks in the lake margin—and the actual work commenced.

Cobb.—As final investigations on the site determined without doubt that a concrete dam could not be built, but that an earth dam would be satisfactory, design work proceeded. Details of the necessary diversion works and final spillway were nearly completed. The design work for the earth dam is being done in close collaboration with the Soil Survey section of the Department of Scientific and Industrial Research.

Highbank.—As trouble has been experienced with screen-cleaning due to large quantities of material which float down the race, a screen-cleaner was designed to reduce the present labour involved, and this is now being installed.

Tekapo.—Design work progressed on the intake, surge chamber, penstocks, and the various gates required. Tenders for the penstock and steel tunnel-liners should be called very soon.

Pukaki.—The sluice structure contract was completed, and by building the upstream coffer dam it was possible to store water for winter supply. The design and drawing of the remaining features—namely, the earth dam and spillway—were completed. To complete the design of these major jobs within the limited time available the design of other works had to be delayed to some extent.

Black Jack's Point.—Surveys were completed and are being studied. Preliminary work for foundation investigation was done, including a suspension bridge across the Waitaki River for access to the site.

Clutha River.—A comprehensive study has been made of the whole Clutha River catchment area and a report is being prepared. At the site of the proposed development above Roxburgh, the investigation of the foundation conditions by means of bores, shafts, and drives under the river was practically completed, and similar work was done at the outlet to Lake Wanaka.

General Investigation.—Engineering reconnaissances have been carried out on the Kaituna, Rangitaiki, and Tarawera Rivers and minor sites in the North Island. In the South Island surveys were carried out at Lakes Rotoiti and Rotoroa preparatory to investigation of major development in the Nelson lake district. In conjunction with a mission from an overseas company interested in the manufacture of aluminium, reconnaissance was carried to a further stage in the southern sounds. An aerial survey was put in hand of the whole area involved in the potential development at Deep Cove.

Hydrology.—Routine records were kept and studies made of hydrological conditions in both Islands.

(*b*) Structural Section

Structural drawings of the Maraetai power-house were completed for work up to the generator-floor level, and design of the superstructure is in hand. Complete drawings for the lift-shaft, penthouse, and adits were prepared. The shaft is approximately 200 ft. deep, and, although required as a permanent feature, has been designed to transport workmen rapidly to and from the main working area.

Design and drawings were completed for the Tekapo power-house foundations and superstructure, and drawings are well in hand for the secondary concrete required for the installation of the machines.

As information from the manufacturers became available, plans for the installation of the fifth unit at Waitaki were put in hand.

For the 220 kV. Otahuhu Substation it was decided that the large building to house the 80-ton crane and the four 30,000 kVA. synchronous condensers should be founded on piles. Drawings and specifications were prepared and a contract let for the making and driving of long, reinforced-concrete piles. Plans were also issued for the installation of sub-surface and oil-drainage schemes.

Complete plans and specifications were finalized for the construction of the synchronous condenser and control buildings at Bunnythorpe, and tenders are being called for this work. Design of the structural work required in the outdoor station area proceeded, and some drawings and specifications were issued. Two gantries were designed for lifting heavy machinery during transport to Bunnythorpe Substation. Plans for the development of the Haywards substation site were advanced.

Design and specifications were completed for construction of the control and switch-rooms at Hamilton No. 2 Substation, and also for extensions to three smaller substations. Design work proceeded on the buildings for three further substations.

(*c*) Electrical Section

Power-stations.—Finality was reached on the layout of the 220 kV. equipment at Maraetai, and a start made on detail drawings. For the Whakamaru switching-station drawings are being prepared showing the arrangement of the 220 kV. switchgear cables and piping.

Design work for Karapiro was practically completed, and drawings issued for the permanent village 400 v. reticulation, street lighting, and fire-alarm system.

Provision was made for installing additional voltage regulators on the A.C. and D.C. auxiliaries at Arapuni, and, after consideration, equipment was ordered for converting units 1–4 to closed-circuit cooling.

The drawings for Tuai were brought into conformity with the extensive alterations made. Consideration was given to modifying the lubrication arrangements for the Piripaua main units. Problems raised by the proposed mounting of outdoor type 110 kV. O.C.B.s on the upper floors of the Mangahao Power-station were investigated.

Further design work was done for the Cobb River extensions, special consideration being given to the layout of the outdoor station in view of the confined space.

For Waitaki, design work for the installation of No. 5 unit was practically completed, and proposals drawn up for modifications to the 110 kV. switchgear, and the protective and voltage regulation systems of No. 1 and No. 2 units.

Data was prepared for the specification of the Roxburgh main units and transformers.

General work included a survey of load growth and generating-capacity for both North and South Islands. Tenders were analysed and orders placed for test equipment to bring the Department's test laboratories into line with modern standards.

The installation of 4–400 kW. Diesel-driven generators at Stoke was investigated.

Substations.—Design was finalized, specifications prepared, tenders called, and orders placed for the following: transformer-banks at Ongarue, Lichfield, Waipawa, Mangamaire, and Stoke; a second transformer-bank at New Plymouth and Wanganui; all major items of equipment at Longburn and Fernhill; cranes at Ongarue, Edgecumbe, Mangamaire, Stoke, Invercargill, and Maungatapere; switchgear and steelwork at Kaikohe, Edgecumbe, Lichfield, Te Awamutu, Waverley, and Half-way Bush; switchgear-cubicle at Te Kiri; regulating-transformer at Stoke; second synchronous condenser at Hororata; and O.C.B.s and transformers for Half-way Bush.

Designs were advanced sufficiently to enable tenders to be called for transformer-banks at Mauntatapere, Bombay, Hawera, and Haywards; switchgear and steelwork for Maungatapere, Bombay, Upper Takaka, and Stoke; O.C.B.s 220 kV. air-break switches and synchronous-condenser at Haywards; E.H.T. control board for Invercargill, Stoke, and Upper Takaka; and a synchronous-condenser and metering-equipment at Stoke.

Detailed design work was well advanced for Otahuhu, Bunnythorpe, Half-way Bush, and Invercargill Substations.

Increase of transformer-capacity was planned for Kaikohe, Te Awamutu, and Huntly.

Arrangements were made for the installation of two 1,500 kVA. synchronous condensers at Kaitaia to improve voltage on the North Auckland 50 kV. system. After trouble with the existing 11 kV. switchgear at Henderson and Takapuna Substations, it was decided to modernize the equipment, and quotations were called.

Major extensions were planned at Penrose, and tenders were called for a transformer-bank, regulating-transformers, and a current-limiting reactor. Plans were advanced for part replacement of switchgear and for new metering-equipment for Auckland Electric-power Board supply.

Quotations were obtained for modification of some 11 kV. switchgear ex Hamilton to be made suitable for use at Edgecumbe and Lichfield.

Modifications and extensions to existing 11 kV. switchgear at Hawera were investigated.

At Half-way Bush arrangements were made for the temporary installation of a 15 mVA. transformer-bank until the two 20 mVA. banks on order can be installed. This enabled the Dunedin City Council to take up to 25 mVA. from the system as hydraulic conditions permitted, thereby allowing for storage in the Mahinerangi Dam to be increased.

Communications.—Prototype walkie-talkie type radio transceivers were made available for transmission-line construction purposes and proved very satisfactory. Base-station radios were installed and used in conjunction with mobile and walkie-talkie type transceivers. These provided adequate service for normal traffic and line-gang control during the overhaul of the Henderson–Kaitaia telephone circuit. Extensive field-work was carried out for the ultimate provision of a mobile radio service in Southland, while radio equipment ordered for emergency stations at certain South Island power-stations came to hand and is being installed.

The installation of three-channel carrier telephone systems between Khandallah–Bunnythorpe and Bunnythorpe–Claudelands was completed, and installation of a similar system between Claudelands and Penrose put in hand. This necessitated exhaustive line and terminal tests, and provision was made for the inclusion of twelve telegraph channels in the same systems. Initial work was carried out for the installation of single-channel carrier systems between Napier office – Tuai and Gore–Invercargill office.

Detailed design and layout drawings of communication equipment were prepared for a number of substations in both Islands. Supervisory control-equipment was installed for the control of Roskill Substation from Penrose Substation. Basic planning for the provision of a comprehensive telemetering system for load control was commenced and some equipment ordered.

Protection.—Compilation of data for protective relay installations throughout the North and South Islands was completed, and as a result, co-ordination of transmission-line relay settings for the North Island was put in hand. The South Island is to be similarly considered.

Short-circuit calculations undertaken included those for faults at 11 kV. bus-bars in both Islands, and miscellaneous work to assist in substation and power-station relay and switchgear applications.

Several inductive co-ordination calculations were undertaken in connection with negotiations with the Post and Telegraph and Railways Departments as a factor in determining transmission-line routes.

Relay protection schemes were designed and equipment ordered for protection of the 50 mVA. auto-transformers at Bunnythorpe and Otahuhu Substations.

Analyses were made of system interruptions.

(*d*) Transmission-lines

Contracts were placed for the towers, insulators, and conductors for the Henderson–Maungatapere 110 kV. line.

Specifications were drawn and tenders invited for the Stoke–Waimangaroa–Blackwater 66 kV. line, and for the Bunnythorpe–Haywards 220 kV. line No. 1. Contracts were placed for the insulators and conductors for both lines, and tenders for the towers for both are under consideration.

Close contact was maintained with the contractors for the supply of the towers for the 220 kV. lines from Whakamaru to Bunnythorpe and Otahuhu. Delays in the establishment of the tower fabricating and galvanizing plant and in the receipt of raw materials resulted in no deliveries being made. A complete standard suspension tower was fabricated by the contractors. Difficulties were encountered in the assembly of the tower, and departmental officers worked in close collaboration with the contractors' engineers in a revision of the design drawings of the tower parts. The test tower is now assembled and ready for the tests. A start was made on the design of special swamp foundations for the Whakamaru–Otahuhu 220 kV. line.

Specifications were drawn and tenders invited for the poles, cross-arms, hardware, insulators, and conductors for the Gore–Roxburgh 110 kV. line.

Designs were completed and tenders called for special items of construction equipment, including aluminium-alloy gin poles, wiring-blocks, and earthing-clamps.

Investigations were made of wire-stringing tensions, insulator deflections, and the mechanical loadings of the supports for various lines, and charts were supplied to the Districts for use in the field.

The material supply position is causing grave delays in the line-construction programme. The prospects for the supply of steel towers, insulators, and copper wire are not hopeful; for the supply of steel-cored aluminium wire fairly good.

REGULATIONS, LINES INSPECTION, ETC.

The first election for members of the Buller Electric-power Board took place, and the Board is now preparing to commence operations. The electric works of the Te Puke Borough Council were purchased by the Tauranga Electric-power Board, and the area of the borough was brought within the Tauranga Electric-power District.

The Bay of Islands Electric-power Board absorbed several small supply authorities, and Fox Glacier Hydro-electric, Ltd., a small new Supply Authority, was granted a licence to commence operations.

The electric lines and works of fifty-four electrical supply authorities were inspected.

The following licences and permits to use water-power and/or to erect and use electric lines were also issued, revoked, or assigned :—

	Electric-supply Authorities.	Private Individuals.
Electric Lines—		
Licences—		
Issued	9	3
Assigned		3
Revoked		1
Permits issued		1
Use of Water Power—		
(*a*) To generate electricity—		
Licences—		
Issued	1	5
Assigned		3
Revoked	1	2
Permits—		
Issued		7
Assigned		1
(*b*) To drive machinery—		
Permit issued		1
Combined electric lines and water-power licences—		
Issued		6
Assigned		3
Revoked		4
Permits to carry out wiring work in connection with private plants : Issued		147

Fifty-five Electric Supply Authorities gave notice of their intention to make a total of 622 extensions to their electric lines.

There were 3,695 broken wires and 256 broken poles reported by Authorities. The principal causes of the wires being broken were : trees, 1,112 (30·1 per cent.) ; contact, 1,054 (28·5 per cent.) ; gale, 450 (12·2 per cent.) ; vibration, 144 (3·9 per cent.) ; pole hit by vehicle, 127 (3·4 per cent.) ; binder failure, 93 (2·5 per cent.).

The following table shows the number of electrical accidents reported compared with the previous year :—

	Year ended 31st March, 1948.			Year ended 31st March, 1947.		
	Fatal.	Non-fatal.	Total.	Fatal.	Non-fatal.	Total.
Child (up to seven years inclusive)	6	2	8	2	3	5
Commercial (shops, offices, &c.)	..	1	1	..	..	..
Domestic (hotels, boardinghouses, &c.)	1	5	6	1	3	4
Electrical linemen	..	9	9	1	5	6
Electrical worker (other than linemen)	3	6	9	2	4	6
General public	1	3	4	4	3	7
Industrial (factories, workshops, &c.)	1	..	1	..	1	1
Other trades	..	5	5	2	5	7
Other workers	..	6	6	2	..	2
Painters	..	1	1	..	..	..
Plumbers	..	1	1	..	..	..
Telephone linemen	1	1	2	2	2	4
Young persons (over seven but not over fifteen years)	2	2	4	..	1	1
Total	15	42	57	16	27	43
Mechanical (fall from pole, &c.)	2	1	3	..	..	..
Stock	2	..	2	23	..	23

The following table shows the number of electrical fires reported compared with the previous year :—

—	Year ended 31st March, 1948.	Year ended 31st March, 1947.
Accessories	2	..
Appliances	3	2
Contact between aerial conductors	3	..
Contact between steel conduit and composition gas-pipe	..	3
Fittings	1	..
Fixed wiring (sub mains and sub circuits)	1	..
Flexible cables and cords	1	1
Improper use of appliances (irons, radiators, urns, and ovens left switched on)	7	5
Rodents	4	2
Service mains	..	3
Substations	1	2
Switchboards (wiring behind and accessories on)	12	9
Total	35	27

REGISTRATION OF ELECTRICAL WIREMEN

Examinations were held for electrical wiremen, electrical servicemen, radio servicemen, radio experimenters, and cinematograph-operators.

The total number of candidates who sat these examinations was 2,197. Of this number, 1,396 sat the wiremen's examinations and 801 the servicemen's examinations.

New registrations during the year totalled 531—300 electrical wiremen and 231 limited registrations. The number of registrations continues to show a steady progressive increase over previous years, and 300 electrical wiremen constitutes a record number of registrations for any one year.

Twenty-six provisional licences were issued to persons arriving in New Zealand from Great Britain and Australia ; the greater proportion were issued to tradesmen assisted under the present immigration scheme.

Following collaboration with the authorities concerned, the Registration Board agreed to grant limited registration to technicians and mechanicians employed by the Post and Telegraph Department and the Broadcasting Service.

During the year further consideration was given to the proposed amendments to the Electrical Wiremen's Registration Act, and the draft proposals were circulated to interested parties for comment.

PERSONNEL

At the 31st March, 1948, a total of 4,666 employees were engaged on hydro-electric works. Of these, 2,253 were directly employed by this Department and the remaining 2,413 were on construction under the immediate control of the Public Works Department.

The total under the control of the State Hydro-electric Department comprised 1,586 on operation and maintenance and 667 on construction.

It is with deep regret that I have to report the death on 8th October, 1947, of Mr. Roy Gregor MacGibbon, District Electrical Engineer, Christchurch, after a prolonged illness.

The post-war years are proving very difficult and place a heavy burden upon us all, while the present situation is a challenge which we must accept.

In the past the loyal support and willing service given by all members of the Department have formed a tradition of which we are justly proud; and in the present troublesome times the same team spirit is of major importance. By fostering this deep underlying feeling of service we can best play our part and then be able to look forward with confidence to a future from which the clouds of war are lifted and in which power shortages have no place.

I have, &c.,

A. E. DAVENPORT, B.E., M.I.E.E.,
General Manager.

APPENDIX B.—ANNUAL REPORT OF THE RURAL ELECTRICAL RETICULATION COUNCIL FOR THE YEAR ENDED 31st MARCH, 1948

The CHAIRMAN to the Honourable MINISTER IN CHARGE

Wellington, 18th May, 1948.

SIR,—

In accordance with the requirements of section 21 of the Electricity Act, 1945, the Rural Electrical Reticulation Council has the honour to submit its second annual report for presentation to Parliament. The report covers the period from 1st April, 1947, to 31st March, 1948.

GENERAL

The Council has to date provisionally approved subsidies being paid on a total of 893 miles of line, but so far only 77 miles have been built. This rate of progress is disappointingly slow, but difficulty is being experienced in obtaining the necessary line materials. It is hoped that in the ensuing year the actual work of building subsidized lines will be speeded up. In the case of some Power Boards rural reticulation work is held up until existing distribution lines are reconstructed to allow extensions to be made. This heavying-up of lines is not a matter for subsidies, but accounts for labour and material being diverted from the building of new line extensions.

As reported last year, for the purpose of computing subsidies, it has been the policy of the Council to standardize the capital costs at a maximum of £350 a route-mile for a single-phase line and £450 a mile for three-phase. In adopting this policy the Council has not expected that the costs would be the same in all areas, and therefore somewhat higher standards have been allowed in special cases. Since these standards were fixed in September, 1946, costs have risen, and representations have been made for the standards to be increased. The Council has consequently invited the Electric-power Boards and Supply Authorities' Association to make recommendations after examining the present costs of new rural distribution lines.

At the request of the Electric-power Boards and Supply Authorities' Association the Council has commenced to visit the districts in which rural line extensions may be subsidized. In the course of a two-week tour finishing in February, inspections were made of the unreticulated districts of the Wairarapa, Tararua, Dannevirke, Central Hawke's Bay, Wairoa, Poverty Bay, and the Tauranga Electric-power Boards; and shortly before Easter visits were made to the Golden Bay, Waimea, and the Marlborough Electric-power Boards. Problems were discussed with all the Boards, and numerous deputations were received from settlers awaiting a supply of electricity. The local knowledge gained by the Council of the widely varying types of country yet to be reticulated will be of great assistance, and it is hoped that the discussions held with the Boards will benefit them as much as they benefited the Council. It was found that there was some misapprehension

by the settlers and even by some of the Power Board members as to the purposes to which the funds could be put. The Council found it necessary to again make clear what was mentioned in last year's report—namely, that the fund was for the purpose of subsidizing the annual revenue from lines giving supply to consumers who would be unlikely to receive supply under ordinary conditions—and that it was not intended that the fund should be utilized to reduce the cost of electricity to those new consumers below the cost to consumers in somewhat similar circumstances in districts already reticulated. Prior to the passing of the Act in December, 1945, the average expenditure per consumer incurred by the Power Boards was about £60, and even the comparatively rural areas had five or six consumers to the mile of line. The intention of the rural electrical reticulation scheme is to make a supply of power available in areas where the density is about two consumers or even less to the mile. Under present conditions the expenditure per consumer in the areas contemplated as coming within the scope of the subsidy scheme might be several times that of a few years ago, when the major part of the Power Board reticulation was being erected. To obtain an annual revenue of 15 per cent. on a line costing £400 a mile would be comparatively easy if there were five or six consumers on the line, but much more difficult where the density is two consumers or less. These are the conditions the subsidy scheme is intended to meet. Taking the case of one consumer to the mile of line costing £400, even if the Council subsidized up to its legal maximum of 7½ per cent., the prospective consumer would himself have to guarantee at least £30 a year. If the density were less than one to a mile, or the cost of constructing the line more than £400, the amount of the guarantee would have to be correspondingly increased.

Other problems noticed were the difficulties in arriving at an equitable assessment of guarantees, the cost of cross-country service lines, and the extent to which consumers should be grouped in separate applications. These matters are receiving further consideration.

The indications are that, as applications continue to come in, the consumer density will tend to decrease, and the need for subsidies will increase. This would suggest that it may be necessary at a later date to ask for an increase in the rate of levy which is at present fixed under the Act to a maximum of one-quarter of 1 per cent. of the revenues received from sales of electrical energy. What this increase should be it is impossible to determine at the moment. The presence of electricity in the new areas will facilitate subdivision, thereby increasing the revenue from sales of electricity, with the distinct possibility of some of the lines no longer requiring subsidies and so releasing moneys for other extensions.

A further point was the question of assistance to very isolated small communities or individuals where it would be quite uneconomic to connect them to the general system, but where, nevertheless, the advantages of electricity would be of great value and very much appreciated. At present it is considered that the limit of extending supply from the general system will be reached with a density of consumers of 0·5 per route mile. Although it does not appear that provision for subsidy in this connection is provided in the Act, the question will certainly arise later, and it is being given consideration by the Council.

APPLICATIONS FOR SUBSIDIES

Thirty-five applications were received from ten Power Boards, including nine applications for reconsideration of the provisional subsidies granted last year. Subsidies were approved covering the building of 386 miles of line, giving supply to 664 new consumers at an estimated capital cost of £181,389. The subsidies provisionally allowed were 4·8 per cent. of the estimated capital cost, which is within the 7½ per cent. maximum allowed under the Act. The density of consumers in the areas to be reticulated is about one and a half to every mile of line. Details of these applications are given in Table I below, and the consolidated position for the first two years of the subsidy scheme is given in Table II.

TABLE I.—SUMMARY OF APPLICATIONS APPROVED IN THE YEAR ENDED 31ST MARCH, 1948

Supply Authority.	Number of Applications.	Route Miles.	Number of Consumers.	Estimated Capital Cost.	Provisional Subsidy, per Annum.
				£	£
Bay of Islands Electric-power Board ..	10	107·8	215	42,516	1,759
Franklin Electric-power Board ..	2	4·6	9	2,871	115
Malvern Electric-power Board	1	61·6	69	27,682	1,938
Marlborough Electric-power Board ..	3	39·3	91	22,101	946
*North Canterbury Electric-power Board	2	11·1	14	4,320	289
Tararua Electric-power Board	3	3·8	5	1,920	124
†Tauranga Electric-power Board ..	7	18·7	54	8,324	153
‡Wairarapa Electric-power Board ..	2	77·2	106	48,145	2,525
Wairere Electric-power Board	2	46·8	75	16,040	697
Waitomo Electric-power Board ..	3	15·1	26	7,470	280

*One 1946–47 application from North Canterbury was amended in 1947–48.
†Seven 1946–47 applications from Tauranga were amended in 1947–48.
‡One 1946–47 application from Wairarapa was amended in 1947–48.

TABLE II.—CONSOLIDATION OF APPLICATIONS APPROVED AS AT 31ST MARCH, 1948

Number of Supply Authorities	25
Number of applications	115
Route-miles	893.3
Number of consumers	1,509
Estimated capital cost	£421,548
Provisional subsidy per annum	£19,337

SUBSIDIZED LINES CONSTRUCTED

TABLE III.—SUBSIDIZED LINES CONSTRUCTED AND CONSUMERS CONNECTED IN THE YEAR ENDED 31ST MARCH, 1948

	Number of Applications.	Route-miles of Line.	Number of Consumers.	Actual Capital Cost.
				£
Ashburton Electric-power Board	14	24·86	42	7,564
Central Hawke's Bay Electric-power Board	1	3·17	3	1,698
Dannevirke Electric-power Board	5	10·19	19	6,135
Malvern Electric-power Board	1	0·61	1	214
Marlborough Electric-power Board ..	2	18·73	75	13,182
North Canterbury Electric-power Board ..	1	0·59	1	314
Southland Electric-power Supply ..	2	11·37	19	4,464
Tararua Electric-power Board	1	0·55	1	183
Waitaki Electric-power Board	3	2·04	3	895
Waitomo Electric-power Board	1	5·37	16	3,219

PAYMENT OF SUBSIDIES

The subsidies granted in the first instance are based upon estimates, and are therefore provisional, being subject to possible adjustments when the actual capital costs and annual revenues are known.

To date no subsidized lines have been operated for one year, and no payments of subsidies have been made.

TABLE IV.—RURAL RETICULATION FUND AS AT 31ST MARCH, 1948

	£	s.	d.	£	s.	d.
Cash balance brought forward, 1st April, 1947 ..	23,398	16	7			
Receipts from annual levy	24,391	6	3			
Interest on investments	993	16	11			
				48,783	19	9
Administration costs and expenses				355	14	6
Cash balance, 1st April, 1948				48,428	5	3
Sundry creditor—Electric Supply Account: Administration costs and expenses ..				100	0	0
Net balance in Fund, 1st April, 1948				£48,328	5	3

The operations for the year under review took place under the chairmanship of Mr. F. T. M. Kissel, who retired from his official duties at 31st March, 1948. As the new Chairman, I find it impossible to join the Council on its scheduled tours in both Islands, but Mr. Kissel has kindly consented to act as Chairman for this purpose. I would like to acknowledge the very real assistance which this will be.

I have, &c.,

A. E. DAVENPORT, B.E., M.I.E.E.,

Chairman.

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