1949

NEW ZEALAND

STATE HYDRO-ELECTRIC DEPARTMENT

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

MR. SPEAKER,—

My last statement surveyed the post-war position of electric-power supply in New Zealand and traversed the reasons governing the policy of the Government in this regard.

During the year under review the whole subject has been fully and freely discussed, particularly during the annual Conference of the Electric-power Boards and Supply Authorities' Association. This interchange of information has lead to a better understanding of the nature of the problems confronting the whole electric-supply industry. It is pleasing to record that the Supply Authorities generally endorsed the policy of proceeding with the construction of the major hydro-electric projects with the utmost speed.

The understanding and continued support of all sections of the community is very necessary during the time which must elapse until the supply of electric power can be considered secure from the vagaries of the weather and the vicissitudes of operating plant at high load levels.

The addition of further generating plant at Kaitawa and Waitaki, combined with improved hydraulic conditions, resulted in a much better standard of service, while the revised Electricity Control Order transferred the maximum of discretionary power to the local authorities.

My thanks are due to the Power Supply Authorities and to their consumers for the great measure of co-operation they are giving in complying with the directions issued from time to time. It will be realized that any directions given for the purpose of electricity control are designed to protect the community from the possibility of emergency power cuts, and it is the desire of the Government that the power available shall be distributed equitably at all times. As, without doubt, new consumers are entitled to share the available supply, all consumers are called upon to exercise restraint in the usage of power so that, by avoiding waste, the benefits of this great amenity may be enjoyed by all.

The progress of the various hydro-electric works is reviewed subsequently in this statement, but it is opportune to state once again that the power-supply position in the North and South Islands will depend upon the date of operation of the Maraetai, Roxburgh, and Cobb projects, and the return to satisfactory conditions hinges upon their speedy completion.

Major factors affecting the rate of building are man-power and the supply of construction materials. Efforts are being made to augment the number of skilled artisans and construction workers, while the steel position shows general improvement, except in the case of Australian steel. The temporary shortage of cement is causing some difficulties at present, but I am confident that this can be overcome, so that the works may proceed without interruption from this cause.

The question of letting overseas construction contracts is also under active consideration, but this problem is complicated by the present international conditions, and, in the meantime, the works are being pushed ahead so that, in any event, no time may be lost.

Although the investigation of further hydro-electric schemes is proceeding more rapidly than ever before to determine the order in which the schemes should be developed, this feature of the work is being expanded still further as the information is required at the earliest possible date.

In the North Island, where the sum total of the sources of hydro-electric energy is not so large as in the South Island, the question of further supply, after the complete development of hydro-electric power, is receiving close study. The most attractive possibility seems to lie in the development of power from geo-thermal steam. Power from such steam has been utilized in Italy, but it is not yet clear whether local conditions will make a similar development possible in this country. To push the investigation of this problem, my colleague the Hon. the Minister in Charge of the Department of Scientific and Industrial Research has established a small advisory committee of the Council of Scientific and Industrial Research to deal with the general problem and policy associated with the investigation of geo-thermal sources. The problem is not an easy one, but the answer must be found.

Apart from the generating-stations, much progress has been made with extensions to the transmission system, which conveys the power throughout the length and breadth of the land, and some general comment on this subject is given later.

Many people have taken the opportunity of visiting the various hydro-electric works during the year, and they cannot fail to have been impressed by the evidence of the immense works now in active construction. Such visits do a great deal of good, and are to be encouraged, but it is not possible for many to undertake the journeys involved. To help to convey some impression of what is going on it is hoped that the majority of people will be able to view a short film in technicolour descriptive of activities in the field of electric supply. This film, entitled "Projects for Power," should be available later in the year.

FINANCIAL RESULTS

In my last statement a brief summary was given of the financial results for the year ended 31st March, 1948, and the audited accounts and balance-sheet for that year were published in parliamentary paper B–1 [Pt. IV], 1948.

In section 8 of the Finance Act, 1948, the statutory loans redemption charge was reduced from 1 per cent. to ½ per cent., and the deficiency in the amounts previously set aside was deemed to be extinguished.

The following is a summary of the results (unaudited) for the year ended 31st March, 1949. The audited accounts and balance-sheet will again appear in B–1 [Pt. IV]:—

	£	£
Revenue	3,661,414	
Operating-costs	1,714,975	
Gross profit		£1,946,439
Capital charges—		
Interest	1,095,034	
Depreciation	306,400	
		1,401,434
Taxation reserve		177,455
Loans redemption (statutory charge)		356,393
Balance to general reserve		11,157
		£1,946,439

CAPITAL STATEMENT

	£
Total capital invested	46,327,821
Less works under construction, stocks, surveys, &c.	13,333,527
Net operating capital	£32,994,294

NEW WORKS

In this section a general account is given of the progress on new works being carried out by both the State Hydro-electric Department and the Ministry of Works. In consequence, this information is not repeated in my statement as Minister of Works.

(1) GENERATING PLANTS: NORTH ISLAND

At *Kaitawa*, the second 16,000 kW. generator went into service in October, 1948. It was then possible to install the governor gear on the first unit, replacing locally built equipment. With both machines then available, a start was made on the sealing of the natural barrier through which water from Lake Waikaremoana has penetrated since the lake was first formed. This work is progressing satisfactorily and a substantial measure of control should be attained by the end of this year.

At *Maraetai*, the Waikato River is now flowing through the diversion tunnel and the two coffer-dams are being completed. The task of dewatering the dam-site will soon commence, and once this has been accomplished the completion of this huge undertaking will be within measurable distance. The supply of steel for the penstocks has now been arranged for and it is anticipated that the first unit will be ready for operation by the end of 1951.

At *Whakamaru*, the investigation work has progressed far enough to permit the preliminary designs to be put in hand. The preparation of the specifications and the first stages of construction can soon begin. Parts of this job will be put in hand shortly, and the major construction will follow on as the Maraetai scheme approaches the time of operation.

(2) GENERATING PLANTS: SOUTH ISLAND

At *Waitaki*, the fifth 15,000 kW. unit went into operation in March, 1949. It is desirable that a further two 15,000 kW. units should be added to this station, but this will involve an addition to the power-house. The ways and means of doing this work are still being studied, and it has been established that the full length of the spillway must be retained, so that any additions will have to be made on the Otago side of the present station. Such an addition, together with the control of Lakes Tekapo and Pukaki, would do much to help the South Island power-supply during the years immediately preceding the operation of the Roxburgh Station and would also enable the required maintenance to be done on the hard-worked generating-machines.

At *Waipori*, the Dunedin City Corporation has decided to construct two new stations totalling 11,000 kW., and the Government has arranged with the City Corporation to pool the output of these stations until Roxburgh is ready. To this extent, then, these stations, although not Government owned, form part of the general scheme.

At *Tekapo*, steady progress has been made on the 25,000 kW. project and it is anticipated that the machine will be ready for operation by the end of 1950 in readiness for the winter of 1951.

At *Pukaki*, good progress has been made on the building of the main dam and a contract has been let for the construction of the concrete spillway. Arrangements have been made with the contractor for the early completion of the west wall of the spillway so that the main dam can be completed. When that is done, the spillway section can be protected by raising part of the coffer-dam and thus make possible further storage in Lake Pukaki without having to wait for the completion of the spillway itself.

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The possibility of adding a generating-unit at Pukaki has been investigated, but the results show that the scheme would require the use of so much labour and material as to rule it out for the time being. The same effort put into the speeding-up of Roxburgh would be much more effective and very much more economical.

At *Roxburgh*, the site for the new 320,000 kW. station has finally been located at Tamblyn's Orchard and a start has been made on the actual construction. The investigations so far carried out have fully justified the decision to concentrate on the Clutha scheme rather than on the upper Waitaki project. The latter scheme still requires much more geological investigation and, for the same power output, the Waitaki project would need more than double the quantity of materials for the construction of the dam.

The initial installation of plant at Roxburgh is planned to be 160,000 kW., or half the final capacity, so that the remaining four machines can be added as the demand requires without involving any further major construction work. Without making provision for any special industries requiring large blocks of electric power, it is anticipated that the full capacity will be utilized by 1962, and this clearly illustrates the necessity for embarking upon such a large scheme at this stage. Carrying out the work in the normal way, it is estimated that, provided the requisite working force can be obtained, the project could be in operation by 1955, but the prospect of improving upon this date by suitable contracting procedure is receiving close attention by the Government.

At *Cobb*, satisfactory progress is being made in the construction of the dam and the extensions to the power-station. The new extension is planned to be almost twice the size of the present plant and, depending upon the arrival of the necessary generating equipment, is scheduled for operation in 1952. Endeavours have been made to expedite the delivery of this plant, and the supply of steel for the new penstock has been promised from Britain.

It is estimated that a further generating-station will be needed by 1956, and investigations in the Lake Rotoroa district are being pushed with the object of deciding upon a suitable scheme.

3. Transmission Lines

After the falling-off of supplies of steel from Australia, the Government took active measures to secure supplies for the fabrication of transmission-line towers, and the steel for the more urgent works is now assured. In addition, a contract for the supply of fabricated steel towers was placed in Britain. Under these circumstances, the prospects are much brighter for the proper expansion of the transmission system to cope with the increasing power demand.

Tower-erection is already in progress on the 220 kV. lines in the North Island and the first circuit is scheduled for completion in 1951 to coincide with the coming into operation of the generating equipment at Maraetai. Meanwhile, in the South Island, surveys of the 220 kV. and 110 kV. lines to transmit power from Roxburgh to Christchurch, Dunedin, and Gore are in progress, the general routes having been already decided.

Good progress is being made on the 66 kV. line linking the Nelson-Marlborough area with the main South Island power systems, and it is expected that the southern portion, taking supply to the Buller Electric-power Board, will be ready in 1952. The late delivery of materials has been the cause of some delay.

As supplies of Australian hardwoods are becoming increasingly difficult to obtain, alternative types of material must be found for future work.

4. Substations

Three major substations in the North Island at Otahuhu, Bunnythorpe, and Haywards are being built in connection with the transmission of power at 220 kV. Each of these stations is a major work in itself and good progress is being made. In the South

Island a similar substation will be located near Christchurch at the termination of the 240-mile line from Roxburgh. In addition to these stations, work is proceeding at literally dozens of the existing substations where extensions are taking place to cope with the increased loading.

This, then, is the general picture of the work going on all over the country, representing an effort of which we can be justly proud. If we have not all the power we would like, at least we are well on the way towards overcoming the shortage. The men on the job are doing their best, and to them I wish to express the appreciation of the Government. There is no doubt whatever in my mind about the successful outcome of the struggle.

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.

APPENDICES

APPENDIX A—ANNUAL REPORT OF THE GENERAL MANAGER FOR THE YEAR ENDED 31ST MARCH, 1949

The GENERAL MANAGER to the Honourable MINISTER IN CHARGE.

Wellington, 7th July, 1949.

SIR,—

Pursuant to section 15 of the State Supply of Electrical Energy Act, 1917, I have the honour to present herewith my annual report of all operations of the State Hydro-electric Department for the year ended 31st March, 1949.

As from 1st April, 1948, the Ministry of Works became responsible for the carrying-out of preliminary investigations and for the design and construction of the civil engineering works associated with hydro-electric development by the State. A further provision, consequent upon the above, is that the Ministry of Works also acts as consultant to the State Hydro-electric Department on matters of a civil engineering nature.

This report therefore differs from previous reports and the details of civil engineering work will now be found in the Ministry of Works report.

Some important changes were made in the financial structure of the State Hydro-electric Department designed to enable the Department to make full provision for complying with its statutory obligations. The bulk supply tariff schedule was amended to provide an estimated additional 7½ per cent. in revenue, while the rate of loan redemption was changed to coincide with present-day conditions. These changes are reflected in the results as disclosed by the balance-sheet for the year's operations.

Improved hydraulic conditions and the commissioning of additional plant made the supply conditions somewhat better than those experienced in the previous years.

ELECTRICITY CONTROL

Throughout the North and South Islands the emergency which could be brought about by a season of abnormally low river flow may be superimposed on the long-term shortage of power. Therefore the Electricity Control Order gazetted in April, 1948, gives every Electric Supply Authority legal powers to limit consumption within allocations and to reduce load in emergencies. Subject to certain provisos, each

Authority may decide how to restrict new load or to limit or reduce the consumption of existing consumers. This decentralization has lead, as was expected, to restrictions varying between predominantly rural and urban districts. Consumers experiencing certain restrictions have tended to criticize the absence of such restrictions in a neighbouring area, but uniform restrictions would not necessarily produce the results required nor equitably distribute the burden of conserving electricity.

The general problem of limiting new load each year is being considered, and may be the subject of later submissions.

Compared with the difficult conditions experienced in the North Island during the winters of 1945, 1946, and 1947, and in the South Island for a period in 1947, the supply position showed a marked improvement during 1948, mainly because better hydraulic conditions prevailed.

NORTH ISLAND

In April, 1948, the first 16,000 kW. generator was brought into operation at Kaitawa, followed in October by the second unit of similar capacity. At Karapiro the third unit of 30,000 kW. was put on load in June. This additional capacity enabled the North Island system peak load to be carried without difficulty, the winter peak being 396,200 kW., compared with 343,900 kW. in 1947.

Rainfall above average in the lake catchment areas during April and May improved hydraulic conditions. The reduction of 5 per cent. below allocations effected on the 14th March, 1948, and increased to 15 per cent on the 30th March, was progressively relaxed, and by the 24th May it was possible to return to normal allocations. From the beginning of January, 1948, to the 14th March the consumption was 10·5 million units above allocations. The restrictions between the 14th March and the 23rd May reduced consumption by 26·25 million units, or 8½ per cent. below the normal allocation. If the allocation had not been exceeded during the early part of the year, the average reduction necessary in April and May would have been under 5 per cent. While appreciable, a 5-per-cent. reduction might well be tolerated without serious upset to domestic or industrial electricity users. This emphasizes the desirability of a steady and sustained effort to limit consumption to the allocation, rather than having drastic power cuts for short periods to remedy a position made even more difficult by excess consumption.

Owing to the improved hydraulic conditions the units saved in April and May were returned to the consumers. By the 26th September the total consumption had exceeded the allocation to date for the proportion of the calendar year. The weekly rate of consumption was then averaging about 8 per cent. above allocation, and the lake-levels at Taupo and Waikaremoana were falling. As it was essential for storage to be built up in the summer months in preparation for the following year, Supply Authorities were advised that, for the remainder of the calendar year, consumption should be reduced to the allocations. By the end of December total consumption had exceeded the allocation for the calendar year by 36 million units, or 2¼ per cent., equivalent to nearly 3 ft. of storage in Lake Waikaremoana.

At the beginning of January, 1949, the level at Lake Taupo was 1,176·4 ft., compared with 1,175·7 ft. at the corresponding time last year, and at Lake Waikaremoana, 2,005·8 ft., compared with 1,994·6 ft. The increase in generating capacity and the improved storage position at Lake Taupo and Lake Waikaremoana made possible an increased allocation for the calendar year 1949 of 4 per cent. above that fixed for the previous year, corresponding to an estimated generation of 1,945 million units.

During January to March, rainfall at Taupo was 92 per cent. of the long-term average. By the end of March the level had fallen only 8 in. and 75 per cent. of the controlled storage remained available, compared with only 17 per cent. at the same date last year. At Lake Waikaremoana the January to March rainfall was only 66 per cent. of the average, and by the end of March the level had fallen to 2,000·6 ft. Even so, there was nearly 12 ft. more storage available than at the corresponding date last year.

Every effort is being made to conserve storage, and unless the hydraulic position deteriorates considerably there is every prospect of the demand for the winter of 1949 being met satisfactorily.

Of particular importance to consumers is the adoption by some Supply Authorities of a change in the methods of keeping within their allocations. Last winter several Supply Authorities put quota rationing schemes into effect, and in February, 1949, others adapted quota schemes to the particular conditions in their areas. In previous years excess consumption had been checked by power cuts, whereas the quota rationing scheme is planned to avoid such drastic means by giving each consumer a quota of units each month. The quota may be used by each consumer to suit his personal needs, and ensures that every consumer reduces consumption so that new consumers can receive a share of the power available. Although there are comparatively few of these schemes operating, they do plan that power is distributed equitably and, moreover, that it is available at all hours of the day and night. Their success may be measured by the fact that at the end of February, when quota rationing was getting under way, the excess consumption of all Supply Authorities was 2·76 per cent., whereas at the end of March it had fallen to 2·13 per cent., and by the end of April had been reduced to 1·56 per cent.

SOUTH ISLAND

In the South Island no special restrictions were imposed throughout the year. An average allocation of 5-per-cent. increase on the unit consumption in 1947 was allowed, but favourable hydraulic conditions made it possible to meet the actual increase of 10·8 per cent. Allocations were not enforced during January to March, 1949, and will not be needed until river flows fall and storage must be drawn upon, when any restrictions required until the seasonal spring rise in September can be determined.

As it will be essential for load increase to be limited until the new station at Roxburgh is in operation, the Electric-power Boards and Supply Authorities' Association set up a Power Shortage Advisory Committee representing the various Supply Authorities to assist the Electricity Controller in fixing power allocations. The Committee first met in March, 1949, and again in April. As high river flows are continuing, no special restrictions have been necessary to date. However, on the 27th April each Supply Authority was notified of its basic allocation for the year, and that the weekly allocation would be a plus or minus percentage on this when any restrictions might be determined.

The fifth 15,000 kW. unit at Waitaki was put into operation in March, 1949.

MARLBOROUGH-NELSON

In the Marlborough-Nelson district the average load increase during the next four years should be restricted to about 10 per cent. per annum. A Power Shortage Advisory Committee has been appointed and is considering how the future load can be kept within the supply.

The addition of 20,000 kW. to the generating-capacity of the Cobb Power-station, planned to come into operation in 1952, will then relieve the position.

NORTH ISLAND SYSTEM

A. SYSTEM OPERATION AND LOAD DESPATCH

1. Load

The maximum half-hourly load on the system was 396,200 kW. carried between 1700 and 1730 hours on Tuesday, the 20th July, 1948. Low frequency did not occur during the peak periods as happened last year, when the half-hourly peak wa 343,900 kW. between 1700 and 1730 hours on Monday, the 2nd July, 1947.

The highest Saturday peak was 334,200 kW. between 1730 and 1800 hours on the 17th July, 1948. Last year the peak was 302,000 kW. between 1730 and 1800 hours on 19th July, 1947.

The highest Sunday peak was 324,200 kW. between 1130 and 1200 hours on the 22nd August, 1948, compared with 288,700 kW. between 1200 and 1230 hours on the 10th August, 1947.

The greatest weekly generation was 42,648,800 units during the week ended Sunday the 22nd August, 1948, an increase of 9·4 per cent. on last year's figure of 38,969,000 units. The maximum generation on any one day was 6,430,100 units on Wednesday, the 18th August, 1948 (last year, 5,969,000 units), an increase of 7·7 per cent. The highest Saturday generation was 5,715,000 units on 31st July, 1948 (last year, 5,389,000 units), an increase of 6·05 per cent. The highest Sunday generation was 5,431,500 units on 22nd August, 1948 (last year, 4,923,000 units), an increase of 10·03 per cent.

The total system generation by all plants in the North Island for the financial year ended 31st March, 1949, was 1,936 million, compared with 1,778 million units for the previous year, an increase of 8·9 per cent. The system units generated by Government-owned plants only, plus units purchased from Supply Authorities, were 1,868 million units for the year ended 31st March, 1949, compared with 1,718 million units for the previous year, an increase of 8·7 per cent.

Generation details by Government plants plus units purchased for resale (compared with 1947-48) are as follows:—

Station.	Year Ended 31st March, 1949.			Year Ended 31st March, 1948.		
	Maximum Kilowatts.	Units Generated.	Annual Load Factor.	Maximum Kilowatts.	Units Generated.	Annual Load Factor.
			Per Cent.			Per Cent.
Arapuni	151,000	742,468,000	56·2	152,500	725,660,000	54·5
Horahora*	..	..	..	11,100	721,000	74·5
Karapiro	96,200	488,667,000	58·0	67,200	349,568,000	59·4
King's Wharf	27,600	40,147,000	16·6	28,700	40,006,000	15·9
Mangahao	21,900	114,109,000	59·5	21,300	86,558,000	46·5
Penrose	..	2,011,000	..	..	1,762,000	..
Piripaua	118,900	131,133,000	35·7†	100,200	165,492,000	47·8
Tuai		198,627,000			252,308,000	
Kaitawa		40,623,000			..	
	..	1,757,785,000	..	..	1,622,075,000	..
Auxiliary and standby stations—						
Evans Bay		68,250,000			49,514,000	
Kourarau		3,371,000			3,358,000	
New Plymouth		15,619,000			14,527,000	
Onehunga		1,007,000			1,762,000	
Opunake		1,866,000			1,477,000	
Palmerston North		3,280,000			1,992,000	
South Taranaki		1,185,000			1,025,000	
Taumarunui		3,567,000			3,606,000	
Tauranga		7,339,000			7,413,000	
Wilson's		1,865,000			3,000,000	
Other miscellaneous		3,106,000			8,660,000	
Total units generated and purchased		1,868,240,000			1,718,409,000	

* Shut down 4th April, 1947. † Kaitawa not in full service until October.

2. Reliability of Supply

There were 223 faults, 43 of which caused no interruption to supply. Lightning was responsible for 72, or approximately 32 per cent., of the total number of faults.

A detailed analysis of interruptions is shown in the following table. These do not include prearranged shutdowns due to load control:—

Description.	Year Ended 31st March, 1948.	Year Ended 31st March, 1949.		
		Number.	Duration.	Distributing Authorities Affected.
			h. m.	
1. 110 kV. lines: Defects	2	15	7 13	14
2. 110 kV. lines: External causes	6	17	3 40	18
3. 33kV., 50kV., or 66 kV. lines: Defects	2	17	29 19	8
4. 33kV., 50kV., or 66 kV. lines: External causes	2	5	1 33	6
5. 6·6 kV. or 11 kV. lines: Defects	10	5	12 19	1
6. 6·6 kV. or 11 kV. lines: External causes	1	1	6 12	4
7. Lightning	29	72	18 48	25
8. Storms: Nature of trouble not found	2	..	..	..
9. 110 kV. apparatus	7	2	0 48	1
10. 33 kV., 50 kV., or 66 kV. apparatus	6	6	5 39	7
11. 5kV., 6·6 kV., 11kV., or 22kV. apparatus	8	8	39 55	6
12. Generators or synchronous condensers	4	..	..	..
13. Relays	12	5	0 45	2
14. Control circuits and batteries	4	..	..	..
15. Operation: Mistakes	12	10	4 10	12
16. Operation: Accidents	4	9	0 39	9
17. Faults and overloads on consumers' system	..	..	..	..
18. Other causes	32	31	20 47	15
19. Cause unknown	24	20	1 46	10
Totals	167	223	153 33	..

B. OPERATION AND MAINTENANCE

1. Power-stations

King's Wharf.—In addition to normal survey and inspection, hydraulic tests were successfully carried out by the Marine Department. During the shutdown period extensive overhaul and extra maintenance were undertaken. The steam range for boilers 7–10 gave further trouble by developing leaks which necessitated welding. Investigation of severe vibration in No. 10 machine disclosed shed rotor blades, and the turbine is out of service pending the arrival of a new rotor. Holes were drilled in the covers of flumes to eliminate air pressure caused by sea-wave action at times of abnormally high winds and seas. The new coal-loader operated successfully. A crushing and screening plant for lump coal was constructed, installed, and is now in continuous service.

Contracts for grit-arresters and ash-handling equipment were let, and delivery is due in 1950. The Auckland Electric-power Board removed a considerable quantity of its equipment, and most of the obsolete equipment which was sold has been removed.

Coal consumed was 48,864 tons, deliveries amounting to 58,307 tons, and 90 tons were sold under orders from the Mining Controller. Of the coal received, 20,519 tons came from the South Island and 37,788 tons from the North Island. The stock in hand at 31st March, 1949, was 11,472 tons.

Penrose.—The three Diesel engines were completely dismantled for inspection by the Inspector of Machinery. A magnetic test by the Department of Scientific and Industrial Research of a suspected hair crack in No. 1 engine crankshaft produced a negative result. All crankshafts were passed as fit for service.

Huntly.—The Mines Department completed dismantling the plant in September and transferred it to the west coast of the South Island.

Arapuni and Karapiro.—Lake Taupo Control: The rainfall in the Lake Taupo area for the year was 70·34 in., compared with 66·17 in. for 1947–48.

The level of Lake Taupo at the beginning of the year was 1,172·75 ft. which rose to 1,176·74 ft. early in December, and only fell to 1,175·45 ft. by the 31st March, 1949.

Arapuni: A new stator for No. 8 generator arrived in July and was put into service in December. No. 6 generator has been shut down since 17th February, to replace the temporary 25,000 b.h.p. turbine runner by a new 30,000 b.h.p. runner that was originally ordered for this machine in June, 1939. The cast-iron downstream bend pipes of Nos. 7 and 8 bypass butterfly valves were replaced by new mild-steel bend pipes on account of erosion and cavitation.

Karapiro: Turbine efficiency tests were carried out on No. 1 generating-unit in November. A chlorinating plant for the village water-supply was installed in January. Cables were laid for the village reticulation and street-lighting, and supply to the village was changed over from a temporary 50/11 kV. bank to the 110/11 kV. bank in January. The Cambridge Electric-power Board metering was changed over from Leamington to Karapiro on 1st January.

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							
1	7,660	87·44	1,100	12·56	..	..	100·00
2	7,585	86·59	1,130	12·90	41 (*a*)	4 (*b*)	99·49
3	7,633	87·13	1,127	12·87	..	..	100·00
4	7,741	88·37	1,019	11·63	..	..	100·00
5	7,051	80·49	1,709	19·51	..	..	100·00
6	6,160	70·32	1,592	18·17	1,008 (*c*)	..	88·49
7	6,978	79·66	1,753	20·01	29 (*d*)	..	99·67
8	5,538	63·22	1,424	16·26	1,798 (*e*)	..	79·48
Karapiro							
1	6,474	73·90	1,497	17·09	789 (*f*)	..	90·99
2	7,391	84·37	1,038	11·85	331 (*g*)	..	96·22
3	6,397	87·97	875	12·03	..	..	100·00(*h*)

NOTES.—(*a*) Shut down on 6th and 7th April for maintenance work on the 6 kVA. pendulum-drive generator. (*b*) Fault on D.C. cable of 6 kVA. pendulum-drive generator, 8th March. (*c*) Shut down on 17th February to replace a temporary turbine runner by the permanent runner. (*d*) Shut down on 19th October for repairs to main butterfly valve bypass. (*e*) Shut down from 1st November to 31st December to install a new stator and winding, and from 3rd to 17th February to fit a new sealing-hose to the main butterfly valve. (*f*) Shut down from 9th February to 9th March for examination. (*g*) Shut down from 14th to 28th March for examination. (*h*) Running-times are taken from 2nd June, 1948.

Waikaremoana.—The main lake-level improved rapidly, reaching a maximum level of 2,007·2 ft. early in December, the hydraulic position thus comparing more than favourably with the previous year.

Annual rainfall of 101·3 in. showed a definite increase over the 1947–48 total of 86·1 in.

Tuai: Abnormally heavy rains on 14th May caused a sudden rise in the streams feeding Lake Whakamarino, bringing down large quantities of debris, which necessitated constant attention at the Pipipaua intake screens. A major slip caused the break-away of approximately 60 ft. of the Mangaone Stream concrete piping.

No. 1 governor control became erratic on the 19th December, and after adjustments were made remained in service until a complete overhaul was undertaken in March.

The changeover of the headgates Nos. 1, 2, and 3 from D.C. to A.C. control was commenced.

Piripaua: In May a large slip at the back of the power-house carried away six lengths of the 6 in. emergency pipe-line. Short lengths of wood found their way past the intake screens, causing reduction in loads and the breakage of numerous turbine gate safety links. The rotor of No. 5 generator was removed on the 29th November for an examination of loose iron in the stator. After repairs had been effected, No. 5 generator was placed on short-circuit dry out, finally going on to commercial load on the 14th December.

Kaitawa: In April, No. 7 machine was tested and put on load, with a limit of 10,000 kW. until such time as the balance of the governor parts arrived in February. In October the 16,000 kW. No. 6 machine was tested and put on load. Initially when both machines were in operation debris was carried through the tunnels to the top of the penstocks and several shutdowns had to be arranged to clear the large pieces of bush timber and rubble.

In July a fault developed in the stator of No. 7 unit, requiring the replacement of twelve coils of the generator winding.

During the summer, advantage of load conditions was taken to overhaul the machines while the interior of the tunnels and penstocks were repainted where timber and rubble had caused havoc to the initial painting.

Generator-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	6,872	78·45	1,530	17·46	355	3	95·91
2	6,308	72·01	2,112	24·11	339	1	96·12
3	4,812	54·93	3,730	42·58	218	..	97·51
Piripaua							
4	6,228	71·09	2,226	25·41	304	2	96·59
5	5,931	67·70	2,209	25·22	619	1	92·92
Kaitawa							
6	2,410	56·10	1,368	31·84	517	1	87·94
7	4,542	53·46	1,709	20·12	1,677	568	73·58

Mangahao.—The year's rainfall at No. 1 dam, being 123·77 in., was somewhat better than the previous year's 110·26 in. At No. 2 dam it was 118·73 in., at No. 3 dam 88·52 in., and at the power-station 53·00 in. Water spilled to waste over No. 2 dam in twenty-one weeks of the year.

The disperser valve grillage at No. 1 dam became so blocked with timber in March, 1949, that the dam had to be emptied and the trees removed with a winch. Opportunity was taken to sluice mud away from the channel leading to the bypass gate.

The last set of manganese bronze buckets was received and fitted, so that all five turbines have been rebucketted within the last four years. A fire in the tap-changing compartment of one of the Horowhenua regulators was successfully dealt with before much damage was done.

Generator-running times were :—

Machine 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	8,242	94·1	315	3·6	203	..	97·7
2	8,050	91·8	241	2·8	469	..	94·6
3	8,450	96·4	294	3·4	16	..	99·8
4	8,422	96·1	315	3·6	21	2	99·7
5	8,437	96·3	304	3·5	19	..	99·8

2. Substations

Normal conditions obtained throughout the year, the following incidents only being worthy of special mention :—

(a) 110 kV.

Mangamaire.—A 1,000 k.VA. transformer was replaced by the 1,500 kVA. transformer from Greytown and transferred to Woodville.

The 1,500 kVA. synchronous condenser was transferred to the Auckland district.

Dannevirke.—The 1,500 kVA. synchronous condenser was transferred to the Auckland district.

A 1,500 kVA. transformer was transferred temporarily to Waipawa Substation and another ex-Mangahao installed. After a brief period on load this failed, and was railed to Napier for a complete overhaul. This reduced the capacity of the station to 1,500 kVA., causing the Dannevirke Electric-power Board to transfer part of its loading to the Woodville area.

Waipawa.—Two 1,500 kVA. transformers were removed in turn for overhaul and provision of Buchholz protection. A transformer from Dannevirke was used as the spare.

Bunnythorpe.—Work necessary to take power from the new Tuai–Bunnythorpe 110 kV. lines was carried out.

Khandallah.—The additions necessary to give supply to the second circuit on the Central Park 110 kV. line were made.

(b) 50 kV.

Edgecumbe.—An earthquake caused a substation outage in October and cracked all the cottage chimneys.

Karapiro.—This temporary 50/11 kV. substation was shut down in January. Some of the equipment, including transformers, will be used at Whakamaru.

Maraetai.—A flashover on an 11 kV. A.B.S. caused an outage of over six hours on Boxing Day.

Waikino.—The synchronous condenser 11 kV. O.C.B. was badly damaged in April by a flashover due to a rat getting into the cubicle.

(*c*) *General*

Voltage control has improved in the far northern districts following the installation of the first condenser at Kaitaia, and further improvement is to be expected when the second machine is brought into service.

Operation of Power Board feeder switches for load restriction entailed considerable overtime being worked by substation operators.

3. Transmission and Distribution

Several outages occurred during the year. Mostly they were occasioned by fires, lightning, and other normal causes. The following incidents only are of interest:—

(*a*) *110 kV. Lines*

Arapuni–Ongarue.—One conductor was severed by a ·303 rifle bullet.

Woodville–Greytown.—On the 7th April a pole was broken off at ground-level during a north-westerly gale, causing an interruption to the whole system.

Woodville–Napier.—One pole was split by lightning from 10 ft. below the crossarm.

Khandallah–Mangahao.—Three outrages of interest occurred; one was caused by bird-droppings on the insulators, one by the misuse of a metallic tape near the line, and another by a child shooting a wire over the line with an arrow. The persons concerned were not injured.

(*b*) *50 kV. Lines*

Bombay–Kerepeehi.—New wire was spliced in at several points. A good many strands had been found broken by vibration and abrasion and insulators were beginning to split due to corrosion of the pin thimbles.

Hamilton–Huntly.—After many years of satisfactory service, the original insulators are now beginning to deteriorate fairly rapidly and are being replaced.

Karapiro–Hamilton.—The Karapiro – Mystery Creek section was cut out in February and is to be dismantled.

(*c*) *11 kV. Lines*

Hutt Nos. 1 and 2 lines have been completely re-insulated, following the large number of failures of the original insulators fitted in 1925.

(*d*) *General*

The intense growth of gorse on lines in the vicinity of Wellington cannot be economically controlled by slasher work, and patrol tracks were bulldozed through in a number of places.

The Karapiro–Leamington–Hautapu double-circuit 11 kV. line of 8 miles and the substation at Hautapu were taken over by the Cambridge Electric-power Board on 1st January.

4. Communications

The supervisory control systems have operated satisfactorily. Noise-correction work on the North Auckland line has been completed as far as Maungatapere. Alarm and communication facilities at a number of substations were modernized.

Reconstruction of the Masterton–Woodville telephone-line continued, and a resurvey of the Napier–Waipawa section is being carried out. A new exchange was put into service at the Palmerston North office.

5. Test Department

Installation tests were made on all major new equipment, including switchgear and transformers, a 30,000 kW. generator at Karapiro, two 16,000 kW. generators at Kaitawa, a 24,000 kVA. stator winding at Arapuni, reactance relays, pilot-wire relays, and power-line carrier relays.

A 1,500 kVA. condenser at Kaitaia required extensive test work before installation. Faulty operation of pilot wire and restricted earth leakage protection was investigated. A travel time recorder was designed and constructed for O.C.B. adjustment, and further work done on the manufacture of pneumatic closing-gear for Khandallah 11 kV. switches.

6. Plant and Motor-vehicles

Plant.—During the year essential equipment was installed at the Penrose Garage and at the Palmerston North workshops. A travelling workshop has proved most useful for the repair and overhaul of equipment in the field in the Hamilton district. Although not yet fully equipped, the new workshop at the Taradale Road Depot, Napier, is being used. The larger substations are now all equipped with power-driven lawn-mowers.

Vehicles.—The transport position is still difficult owing to the age and condition of vehicles, necessitating heavy maintenance. During the year six trucks were taken over from the Army and sixteen chassis were received. Three of these are being fitted with five-passenger cabs to afford greater all-weather protection for linemen. The lack of new cars and commercial sedans to replace worn-out vehicles and to meet the expanded needs of the system gives rise to considerable concern. Difficulties in supply are appreciated, but the stage is fast being reached where this lack will have serious repercussions in the efficiency of over-all operation.

C. CONSTRUCTION

1. Power-stations

Arapuni.—A new 30,000 b.h.p. turbine runner is being fitted to No. 6 generating-unit to replace a temporary one.

Karapiro.—The third 30,000 kW. generating-unit was completed and first put on commercial load in May, 1948.

Maraetai.—For progress on the civil engineering construction see Ministry of Works report.

All generating-equipment is now stored in New Zealand ready for installation when the power-house is built.

Kaitawa.—No. 7 generating-unit was placed on load early in April, 1948, and No. 6, with its attendant switchgear, was put into operation in October.

2. Substations

(*a*) *220 kV.*

Otahuhu.—Utilizing a barge, 80-ton floating crane, and the 50-ton Dyson trailer, three condenser stators and rotors were transported from Auckland wharves to a temporary storage building at Otahuhu. Two hundred and twenty-seven 70 ft. piles were cast and driven for the condenser-building foundations and fifty-eight similar piles for transformer foundations. Sewerage and drainage was completed, and eight of the first set of fifteen houses for the permanent village reached an advanced stage of construction.

Bunnythorpe.—The Ministry of Works completed the railway siding, which was put into service on 9th May, completed the 680 ft. by 12 ft. wide traverser track except for the rails, practically completed the storm-water drainage, built one oil interceptor tank, erected and put into operation the sewage-treatment plant, and built all forty-one 110 kV. tower foundations, sixteen of the 220 kV. foundations, and one 110 kV. O.C.B foundation.

The contractor started work on the control and condenser building on the 25th October and is making fair progress.

The twelve 110 kV. O.C.B.s previously positioned on their pads were lined up ready for operation and three were dried out and filled with oil.

Haywards.—The remainder of the land required for the site was proclaimed, giving a total area of approximately 34¼ acres. The Ministry of Works has been engaged on drainage and earthworks since July, 1948, and has completed the major portion.

(*b*) *110 kV.*

Henderson.—The installation of standard control panels proceeded. A 5 mVA. transformer bank ex-Belmont was temporarily installed. Erection of the new 110 kV. A.B.S. and isolators for the future 110 kV. Maungatapere line was completed.

Hamilton No. 2.—Installation of two 10,000 kVA. 110/11 kV. banks of transformers is proceeding. Two new 110 kV. O.C.B.s have been assembled and a new 50 kV. steel structure was erected. Owing to a shortage of steel the contractor was unable to recommence work on the new switch-room building until January.

Ongarue.—A new 11 kV. O.C.B. for the Wairere tie-line was installed in August.

Waihou.—Some trouble is being experienced with the sinking of the foundations of the workshop building and investigations are being made by the Ministry of Works into the causes.

Greytown.—A local service transformer was installed and new 11 kV. switchgear was commissioned.

Mangamaire.—New 11 kV. switchgear was commissioned.

Woodville.—Installation of H.T. switchgear and a 1,000 kVA. transformer from Mangamaire is proceeding. A temporary point of supply to Dannevirke Electric-power Board was given on 25th July, 1948.

Masterton.—The second 4,500 kVA. transformer bank ex-Hawera was commissioned. A new D.C. panel was also put into service.

Waverley.—A new substation is to be erected to provide a further point of supply for the Wanganui-Rangitikei Electric-power Board. The land has been proclaimed.

Longburn.—The 11 kV. switchgear was received and preparations for construction commenced.

Pahautanui.—New 11 kV. switchgear was commissioned.

(*c*) *50 kV.*

Belmont.—The standard panel installation was almost completed.

Maungatapere.—Three 50/11 kV. transformer units, an O.C.B., and a 22/50 kV. booster were installed for the temporary supply to Whangarei Borough Council.

Kaitaia.—The No. 1 1,500 kVA. condenser and control equipment installation was completed and a 10-ton crane was erected.

Hangatiki.—A second 1,500 kVA. bank of transformers was installed in place of a 750 kVA. bank.

Kerepeehi.—The new 11 kV. switchgear was commissioned in April, 1949. The 50 kV. lightning-arrester was replaced.

Tauranga.—A site has been selected for this substation, which is to provide a further point of supply for the Tauranga Electric-power Board.

Te Awamutu.—Further new 11 kV. 10-panel switchgear was commissioned. Arrangements have been made to increase the transformer capacity by adding two 500 kVA. three-phase transformers.

Te Puke.—The second 2,250 kVA. bank and booster transformer from Waihou and a new 11 kV. switchgear were put into service.

Whakamaru.—Preparations are being made for the erection of 1,500 kVA. 50/11 kV. substation. At present this area is supplied at 11 kV. over the Maraetai–Whakamaru 50 kV. line.

Gisborne.—Plans of the proposed Gisborne Substation were completed. The outgoing 50 kV. line to Tokomaru Bay was located eastwards as far as the coast.

(*d*) *General*

Attention has been given to accommodation requirements at the various substations and a number of new cottages have been completed and occupied.

At Kotemaori, Bombay, and Maungatapere arrangements have been made to secure additional land for necessary expansion.

3. Transmission and Distribution

(*a*) *220 kV. Lines*

Whakamaru–Otahuhu.—Steelwork for the stubs and first sections of towers arrived and construction commenced on the east line, but as yet only two complete towers have been erected.

Whakamaru–Maraetai.—The first sections of eleven of the twenty-five towers required for the west tie-line were erected. Two lines were surveyed from the power-house site at Maraetai to the outdoor station.

Whakamaru–Bunnythorpe.—Plan work on the route was continued. Track-formation and tree-felling has been carried on and construction camps built at Mangaweka and Kimbolton. The Ministry of Works completed the roading in the Waiouru area.

Linton Steel Depot.—The depot received 3,569 tons of tower steel and despatched 621 tons. The large quantity retained is due to the lack of certain parts required to complete tower sections.

(*b*) *110 kV. Lines*

Otahuhu–Henderson.—Preliminary location was completed.

Henderson–Maungatapere.—Route plans were completed. Supplies were received from Canada and stored at the Sylvia Park Depot.

Arapuni–Penrose.—Route plans were completed for the deviation to Otahuhu and new lines were surveyed and plotted to avoid the proposed Tamaki Airport site.

Bunnythorpe–Tuai.—This line was connected to the Tuai–Woodville lines at Dannevirke and near Tuai on 1st May. The last section was livened to Bunnythorpe on 29th October, 1948.

Khandallah - Central Park.—The second circuit was energized on 16th March, 1949. A start was made on the transferring of the existing western circuit from the single circuit to the new double-circuit towers.

(*c*) *50 kV. Lines*

Maungatapere–Dargaville.—Detailed survey work was completed, route plans completed, and pole-stacking sites secured.

Te Puke - Tauranga–Aongatete.—Detailed survey was commenced in October.

(d) General

Work was continued on the reticulation of the Mangakino and Whakamaru areas. By extension of the existing 11 kV. lines more settlers were given supply in the Waikaremoana area.

Sixty-ton gantries were erected in the railway yards at Ngahauranga and Paekakariki Stations and used during the transport of the Bunnythorpe condenser parts.

Investigation of the routes of the deviations of lines required when the Hayward Substation goes into service were made.

4. Communications

The installation of the Claudelands–Penrose three-channel carrier-telephone system was completed, finalizing the major North Island carrier network and providing vastly improved facilities for load-despatch work.

Further circuit improvements were effected by the installation of two single-channel power-line carrier systems between Bunnythorpe and Tuai, and an open-wire single-channel carrier system between Tuai and the Napier office.

Survey commenced on the proposed Whakamaru–Bunnythorpe telephone-line.

Emergency power-supplies for the operation of communication equipment were arranged.

A water-level radio transmitter was installed at Turangi in September. This equipment transmits the level of the Tongariro River to the system control office at Hamilton every six hours, and so shows any variation in the flow of this river into Lake Taupo.

5. General

Proposals have been made for necessary additions and alterations to the Napier District Office.

Office accommodation at Auckland was materially improved when 500 square feet of space occupied by the Auckland Electric-power Board was relinquished.

The rearrangement of Palmerston North office following vacation of the wing previously occupied by the Ministry of Works is under way. A temporary stores building of 2,400 square feet was erected in the Palmerston North yard.

At the Taradale Road Depot, Napier, a workshop, blacksmith's shop, store, petrol-tanks, and four cottages have been completed, while work is well advanced on another store, cottage, carpenter's shop, and pump-house.

SOUTH ISLAND SYSTEM

A. SYSTEM OPERATION AND LOAD DESPATCH

1. Load

The maximum half-hourly demand on the combined interconnected system, which includes the Dunedin City Corporation plants and other auxiliaries, was 166,188 kW. at 1700 hours on Wednesday, 21st July, 1948, an increase of 3·4 per cent. on the previous year's peak of 160,700 kW.

The total generation for the combined system was 819 million units, an increase of 10·4 per cent. on the previous year's output of 742 million units. The greatest weekly generation was 16,976,973 units (previous year, 16,177,871) during the week ending 25th July, and the highest daily generation was 2,683,617 units (previous year 2,591,713) on Wednesday, 21st July, 1948.

As was the case in 1947, considerable difficulty was experienced in 1948 in maintaining adequate coal-supplies for auxiliary stations.

General hydraulic conditions and the additional storage available in Lakes Pukaki and Mahinerangi enabled the year to pass without the application of severe restrictions.

At 31st March, 1949, 120,000,000 units were held in storage in Lakes Coleridge, Pukaki, Mahinerangi, and Monowai, as compared with 96,000,000 units at 31st March, 1948.

Generation details of the interconnected system (compared with 1947–48) are as follows :—

Station.	Year Ended 31st March, 1949.			Year Ended 31st March, 1948.		
	Maximum Kilowatts.	Units Generated.	Annual Load Factor.	Maximum Kilowatts.	Units Generated.	Annual Load Factor.
			Per Cent.			Per Cent.
Arnold	3,300	24,913,600	86·2	3,500	23,995,900	78·0
Coleridge	42,440	126,723,510	34·1	39,840	109,909,170	31·4
Dobson (oil) ..	..	443,370	..	..	3,083,550	..
Highbank	28,000	178,561,650	72·8	28,000	184,797,390	75·1
Monowai	6,500	34,894,650	61·3	6,700	28,323,700	48·2
Waitaki	82,920*	370,443,410	61·4*	68,580	326,523,430	54·2
Departmental totals	..	735,980,190	..	..	676,633,140	..
Dunedin City (all stations) ..		69,782,514			54,605,191	
Invercargill City		1,755,480†			1,567,590	
Kanieri Electric Co.		3,679,000†			2,691,625	
Westland Power		1,181,496†			742,688	
Others		6,960,910†			5,273,536	
Grand total		819,339,590			741,513,770	

* Waitaki maximum demand, 68,300 kW., and units, 354,810,740, to 20th March, 1949. No. 5 unit in service, 21st March, 1949. † Provisional.

2. Reliability of Supply

Although 222 faults were experienced, there were no general system outages.

The following analysis does not include prearranged shutdowns. 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.

Description.	Year Ended 31st March, 1948.	Year Ended 31st March, 1949.		
		Number.	Duration.	Distributing Authorities Affected.
			h. m.	
1. 110 kV. lines : Defects	8	2	15 58	13
2. 110 kV. lines : External causes	7	5	0 51	3
3. 66 kV. and 33 kV. lines : Defect	27	12	10 49	3
4. 66 kV. and 33 kV. lines : External causes ..	8	8	15 34	13
5. 11 kV. lines : Defects	74	79	81 20	1
6. 11 kV. lines : External causes	38	42	50 19	7
7. Lightning	9	7	25 20	8
8. Storms : Nature of trouble not found	18	22	10 33	1
9. 110 kV. equipment	5	1	7 41	..
10. 66 kV. and 33 kV. equipment	7	8	0 43	1
11. 33 kV., 11 kV., or 6·6 kV. equipment	9	20	11 24	5
12. Generators	..	1	0 07	7
13. Turbines	..	..	..	..
14. Diesel-oil engines	..	..	..	..
15. Relays	..	..	..	..
16. Control circuits and batteries	..	..	..	..
17. Operation : Mistakes	3	5	1 56	4
18. Operation : Accidents	..	..	..	..
19. Faults and overloads on consumers' system ..	2	2	0 07	2
20. Other causes	..	..	..	..
21. Causes unknown	17	8	4 28	1
Totals	232	222	237 10	..

B. OPERATION AND MAINTENANCE

1. Power-stations

Coleridge.—Owing to favourable rainfalls the lake-level fell to 1,663·96 ft. only by the 24th September, this being a decided improvement on the previous year. Overflow level, 1,673·5 ft., reached by 12th December, was maintained until after 31st March, 1949.

A new record maximum half-hourly demand of 42,440 kW. was recorded at 1200 hours on 7th March, 1949. This peak was an overload of 23 per cent. on the station rated capacity of 34,500 kW.

Heavy expenditure was incurred on maintenance at the Harper intake, the work including fairly extensive repairs to the main diversion groyne and renewal of apron nets along east side of the long groyne. Willows were planted along the banks of the lake outlet channel.

The new bridge built by the Ministry of Works over the Ryton River was opened for traffic in June.

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	5,723	65·3	2,996	34·2	41	..	99·5
2	5,285	60·3	2,604	29·7	871	..	90·0
3	4,995	57·0	2,756	31·5	1,009	..	88·5
4	1,895	21·6	6,647	75·9	218	..	97·5
5	1,743	19·9	5,878	67·1	1,139	..	87·0
6	1,468	16·8	5,348	61·0	1,944	..	77·8
7	1,786	20·4	6,650	75·9	324	..	96·3
8	3,242	37·0	5,491	62·7	27	..	99·7
9	3,465	39·6	5,163	58·9	132	..	98·5

Waitaki.—The average river flow during the year was 12,800 cusecs, compared with 9,625 cusecs during the previous year. The highest river flow since the station commenced operating was recorded on 3rd November, 1948, when, with 6 ft. of water going over the crest of the dam, the computed total river flow at the peak of the flood was 75,500 cusecs. A second high flood occurred in February, when a peak flow of 43,000 cusecs was recorded on the 24th. The lowest weekly average flow was 4,479 cusecs during the week ended 19th September.

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	7,570	86·4	1,172	13·4	18	..	99·8
2	7,362	84·0	1,395	15·9	3	..	99·9
3	5,749	65·6	3,008	34·3	3	..	99·9
4	5,520	63·0	3,210	36·6	30	..	99·6
5*	227	89·7	26	10·3	..	..	100·0

* No. 5 unit became available for routine full-load running on 21st March, 1949.

Highbank.—Although water for irrigation was drawn from the head-race continuously from 4th October onwards, an average of 21,689 units was generated per hour of running during the year.

Excessive wind-blown rubbish in the headrace continues to cause trouble at the screens. The new mechanical screen-cleaner installation should make routine screen-cleaning less arduous, but the screens will still require regular and frequent attention to prevent excessive fouling because of the small screen area provided.

Much maintenance work on the hydraulic equipment was brought about by the sand and silt in the water. Also, the necessity of draining the headrace through the machine when dewatering is required for the annual overhaul results in heavy silt deposits being left in the turbine and the tailrace. The station was shut down for annual overhaul from 22nd November to 8th December. The turbine runner, which showed considerable wear due to erosion by sand, was welded and ground.

A weir was built in the tailrace by the Ministry of Works to reduce the water velocity and consequent erosion. Considerable erosion of the river-banks in the vicinity of the station took place, and protective work is being carried out by the Ministry of Works.

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	8,233	94·0	117	1·3	410	..	95·3

Arnold.—The river flow was sufficient to enable the station to operate continuously at or above full load except for a period between 17th and 24th September, when the output was reduced from 3,000 kW. to 2,800 kW.

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	7,686	87·7	566	6·5	508	..	94·2
2	8,386	95·7	50	0·6	324	..	96·3

Monowai.—The normal operation of the station was interrupted by ten faults due to surges on the line, two line faults one of which was accidentally caused during testing, and by a prearranged shutdown.

The rainfall for the year was 57·38 in., an increase of 13·25 in. on last year. Floods occurred in November and March, and water ran to waste during these months.

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	6,377	72·8	2,327	26·6	56	..	99·4
2	6,647	75·8	2,064	23·6	49	..	99·4
3	5,955	68·0	2,699	30·8	69	37	98·8

Dobson.—The Diesel station ran as required until September, when the discovery of cracks in three of the four main engine crankshafts reduced the engine availability to one.

Owing to the antiquity of the engines, replacing major parts presented a difficult problem, but arrangements have now been made for the supply of these parts.

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	82	0·9	1,808	20·6	6,870	..	21·5
2	..	..	..	..	8,760	..	0·0
3	221	2·5	8,539	97·5	..	..	100·0
4	103	1·2	3,579	40·8	5,078	..	42·0

2. Substations

(*a*) *110 kV.*

Operations at 110 kV. substations were normal.

(*b*) *66 kV.*

Invercargill.—Extensive trouble was experienced with the two voltage-regulators, there being numerous breakdowns, which are the subject of special reports. A similar regulator was borrowed from Milton Substation and the two damaged ones repaired.

Ohai.—An operational error caused damage to the regulator, which was repaired.

(*c*) *General*

Three equipment failures were associated with the heat wave in February, but there is no actual evidence that the heat wave was a contributing factor.

3. Transmission and Distribution

(*a*) *110 kV. Lines*

Glenavy–Oamaru.—Two large horse-shoe boulder groynes to protect the towers on the north and south banks of the Waitaki River were completed.

(*b*) *66 kV. Lines*

Coleridge–Hororata–Christchurch.—The Coleridge–Hororata lines are in urgent need of major overhaul. The overhaul of the Hororata–Christchurch No. 1 line was completed.

Coleridge–Otira–Arahura.—A total interruption to West Coast supply was caused by an overhead earth-wire on Mount Philistine ridge breaking during stormy weather. River erosion continues to give trouble, and further piling and protection work was done.

Arahura–Dobson.—A total interruption of the West Coast supply occurred when lightning broke two poles near Kararo.

(*c*) *General*

On 110 kV., 66 kV., and 33 kV. lines a total of 96,311 insulators were tested by buzz-stick and the 381 units found defective were replaced.

(*d*) *Distribution*

Southland.—Approximately 49 miles of 11 kV. extension were erected to supply 614 new consumers.

The Gore Borough Council 3·3 kV. to 11 kV. conversion was completed.

4. Communications

Radio tests were carried out with V.H.F. 152 megacycle frequency-modulated equipment and 100 megacycle A.M. equipment. Tests were also carried out with mobile radio equipment.

5. Test Department

Relays were installed and commissioning tests carried out on new equipment. Fifty-three Buchholz relays for both the North and South Islands were assembled and tested. Additional metering was installed at Belfast and Lyttelton Harbour Board, and switchgear for Makarewa and Ocean Beach Freezing-works tested and checked after installation.

6. Plant and Motor-vehicles

Plant.—Reorganization of the Central Depot and Workshop at Addington has been commenced. Some new machine tools were received there, but further equipment, especially new lathes, is urgently required. Three new tractors, two with hole-digging attachments, were received during the year.

Vehicles.—There are 152 motor-vehicles at present in service in the South Island. Many of the vehicles are old and in very poor condition. Three new cars, 4 new trucks, and 2 old trucks were received during the year. The need for new vehicles is urgent.

C. CONSTRUCTION

1. Power Stations

Waitaki.—The installation of the fifth 15,000 kW. generating-unit and associated equipment, commenced last year, was completed and handed over for routine full-load operation on 21st March, 1949.

Dobson.—The installation of the second 5 mVA. 66/11 kV. T.C.O.L. transformer bank was completed on 29th June.

Tekapo.—Various items of equipment, including the 175-ton crane, main transformer bank, and a shipment of generator core plates were received.

For civil construction details refer to the Ministry of Works report.

Roxburgh, Pukaki, and Benmore (Formerly Known as Black Jacks Point).—Refer to Ministry of Works report.

2. Substations

(*a*) *220 kV.*

Islington.—The location of this substation was confirmed, and surveys made of an area of approximately 65 acres to be purchased.

(*b*) *110 kV.*

Hororata.—Two 110 kV. 1,000 mVA. O.C.B.s ex-Penrose were commissioned to replace O.C.B.s of insufficient breaking-capacity.

Ashburton.—A contract for the extension of the switchroom has been let.

Oamaru.—Tenders were called for the extension of the switchroom.

Halfway Bush.—Some switchgear and the first three transformer units for 20 mVA. banks were received.

An extension of the switchroom has been completed. Excavation and levelling for the outdoor structure extensions is practically complete.

Edendale.—Installation of the 11 kV. switchgear was completed.

(*c*) *66 kV.*

Addington.—A new 20 mVA. 66/11 kV. transformer bank was commissioned on the 24th February. This installation brings the 66/11 kV. transformer capacity up to its planned maximum of 80 mVA.

Methven.—The 5 mVA. 66/11 kV. T.C.O.L. transformer bank, 11 kV. indoor switchgear, auto earth-switch, and ancillary equipment were commissioned on the 3rd October.

Arahura.—Installation of the new 5 mVA. 66/11 kV. T.C.O.L. transformer bank is nearly completed.

Reefton.—The location was finalized for a new substation to provide an additional point of supply for the Grey Electric-power Board.

Invercargill.—A large bulk store was erected.

(*d*) *33 kV.*

Harewood.—A new 3 mVA 33/11 kV. T.C.O.L. transformer bank was commissioned on the 5th December.

3. Transmission Lines

(*a*) *220 kV. Lines*

Roxburgh–Islington.—A start was made on the detailed survey.

(*b*) *110 kV. Lines*

Oamaru–Palmerston – Half-way Bush.—The detailed survey of the route of the second line was carried out and plans completed.

Gore–Invercargill.—The first section from Gore to Edendale was almost completed. On the Edendale–Invercargill section 58 of the 183 structures required have been erected, but work has been held up temporarily owing to a shortage of material.

Gore–Roxburgh.—This survey is almost completed.

(*c*) *66 kV. Lines*

Highbank–Methven.—The line was put into service on the 3rd October, 1948.

Coleridge–Otira.—Surveys and plans were made for a 2-mile deviation along the Bealey River, where it is proposed to erect piled structures in the river-bed because of the unstable nature of the present hillside location.

Islington–Papanui.—The detailed location of the route for these lines was determined.

Winton–Monowai.—Reconstruction of a section of the line commenced.

(d) 11 kV. Lines

Addington–Jerrold Street.—A fourth 0·2 square inch underground cable was installed, and put into service on 9th March, 1949.

4. Communications

New exchanges were installed at Highbank, Glenavy, and Arahura. Construction continued on the new trunk circuits between Addington and Glenavy, and was completed on the Addington–Hororata line. An open-wire single-channel carrier system between Gore and the Invercargill office was tested and put into service. New circuits were put into service between Addington and the Christchurch office.

On the Tekapo–Timaru line, 20 miles of line between Burke's Pass and Albury were constructed, completing erection of this line. A telephone line from Otematata to Benmore was constructed.

Work proceeded on the installation of the emergency radio stations at Addington, Lake Coleridge, and Waitaki.

5. General

At Invercargill, alterations are in progress to provide extended accommodation for the workshops, carpenters' and paint shops, and additional storage space.

Some relief for office accommodation in the Christchurch office was obtained by taking over further space in the New Zealand Express Co., Ltd., building.

NELSON-MARLBOROUGH SECTION

A. SYSTEM OPERATION AND LOAD DESPATCH

1. Load

The maximum half-hourly demand on the system was 12,586 kW. on Wednesday, 18th August, at 0930 hours. This was 26 per cent. higher than the previous year's peak of 9,996 kW. The increase in the units generated was 24·9 per cent. The maximum number of units generated in any one week was 1,394,769 for the week ended 25th July, 1948 (last year 1,152,995). The system annual load factor was 59 per cent.

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

Station.	Year Ended 31st March, 1949.			Year Ended 31st March, 1948.		
	Maximum Kilowatts.	Units Generated.	Annual Load Factor.	Maximum Kilowatts.	Units Generated.	Annual Load Factor.
Cobb	11,920	60,238,600	Per Cent. 58	9,690	45,975,500	Per Cent. 54
Auxiliary and standby stations—						
Waihopai		2,749,936			1,603,480	
Other miscellaneous		2,002,296			4,448,854	
Total units generated and purchased		64,990,832			52,027,834	

The units generated by the auxiliary and standby stations represent 7·3 per cent. of the total, compared with 12 per cent. during the previous year.

2. Reliability of Supply

A severe lightning storm on 23rd October caused four interruptions to supply between 0125 hours and 0303 hours. On 28th March a total shutdown of Cobb Power-station for thirty-nine minutes was caused by the operation of the butterfly valve in the pipe-line, presumably due to the operation of the differential water-pressure relay. All four machines were on load at the time.

The following table gives an analysis of both accidental and pre-arranged shutdowns :—

Faults and Shutdowns on Departmental System

Description.	Year Ended 31st March, 1948 (Total).	Year Ended 31st March, 1949.			
		Accidental.	Prearranged.	Duration.	Distribution Authorities Affected.
				h. m.	
1. 66 kV. lines : Defects	3	..	2	2 17	1
2. 66 kV. lines : External causes	..	..	2	12 31	1
3. 11 kV. lines : Defects	1	..	..	..	..
4. 11 kV. lines : External causes	..	2	..	2 03	..
5. Lightning	1	4	..	0 58	3
6. Storms	2	..	..	..	..
7. 6·6 kV. apparatus	1	..	..	..	..
8. 11 kV. or 33 kV. apparatus	1	4	26	44 28	3
9. 66 kV. apparatus	2	1	..	0 05	1
10. Generators	..	..	..	..	..
11. Relays	1	4	..	2 24	3
12. Control circuits and batteries	..	..	..	..	..
13. Operation : Mistakes	..	..	..	..	..
14. Operation : Accidents	..	..	..	..	..
15. Faults and overloads on consumers' systems	..	15	..	10 17	2
16. Other causes	7	..	..	..	..
17. Causes unknown	..	3	..	0 11	1
Totals	19	33	30	75 14	..

B. OPERATION AND MAINTANENCE

1. POWER-STATIONS

Cobb.—The peak load carried by the Cobb generators was 11,920 kW. at 1730 hours on Tuesday, 20th July. The annual load factor for the station was 58 per cent.

To reduce the possibility of flood damage the level of Lake Halley was lowered and maintained 6 ft. below crest level from the end of June until the middle of November.

The annual rainfall was 76·64 in., compared with 92·21 in. for 1947–48.

The spears, nozzles, and turbine buckets of all the machines were repaired. The main valves also required some repairs, and the governor and bearing oil-pumps were overhauled.

The following table shows the running-times of the various machines :—

Machine-running Times

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 ..	6,676	76·3	1,730	19·7	354	..	96·0
2 ..	6,890	78·7	1,430	16·3	435	5	95·0
3 ..	6,839	78·1	1,753	20·0	166	2	98·1
4 ..	6,705	76·5	1,736	19·8	319	..	96·3

Stoke Diesel Station.—As additional storage was available in the Cobb Valley, the station generated 168,540 units, which was only 21·8 per cent. of last year's generation. The badly-needed overhaul is still held up for necessary parts. The machine-running times were No. 1 machine, 276 hours (53,990 units); No. 2 machine, 285 hours (114,550 units).

2. Substations

66 kV.

Upper Takaka.—A severe lightning storm shattered a bushing on the 66 kV. O.C.B. Flying porcelain damaged a second bushing.

3. Transmission and Distribution

11 kV.

One outage was due to the jib of an earth-boring tractor contacting the 11 kV. and phone lines on the Cobb Dam section and another was due to a pole head being broken during construction operations.

4. Communications

Faults were mostly due to high winds and fires. Poles subject to flood damage near Blenheim had protective rock groynes built around them.

Successful radio communication was established between Cobb Power-station, Lake Cobb, Lake Sylvester, and Nelson. On one occasion radio was the only means of communication between Nelson and Cobb.

5. Testing

New apparatus was tested. Recording equipment and alarm systems were installed.

6. Plant and Motor-vehicles

Plant.—Two new and one second-hand tractors were received.

Vehicles.—Transport relies on a fleet of vehicles, most of which are well over ten years old and have seen hard service in both the Department and the Army. During the year a few second-hand vehicles were received from other districts for transmission-line-construction work. Two new 20–30 cwt. chassis arrived.

C. CONSTRUCTION

1. Power-station

Construction of the main dam at Cobb has been commenced by the Ministry of Works.

A number of small lakes in the Cobb Valley were controlled to provide additional storage. The work included cutting access tracks, carting material to the lakes, laying pipe-lines fitted with control valves, and building dams, all of which was done under arduous conditions.

2. Substations

66 kV.

Stoke.—The existing Diesel house is being extended to accommodate four more Diesel-driven auxiliary alternators each of 500 kVA. capacity. This will increase the capacity of the standby plant at Stoke from 937 kVA. to 2,937 kVA.

Blenheim.—Preparations were made for installing a 5,000 kVA. voltage regulating transformer.

3. Transmission and Distribution

Stoke–West Coast Lines.—Construction camps were set up at Inangahua, Mackley Siding, and Mawheraiti, and pole dumps have been formed. On the Inangahua section, 115 acres of bush have been felled, 9¼ miles of access tracks have been formed, and fifty-four structures have been erected. Thirty acres of bush were felled on the Inangahua–Waimangaroa section. Hole-digging and pole-erecting in the Pakihi swamp land has to proceed simultaneously and is proving difficult.

4. General

The workshop building was completed during the year. A motor service depot is being built and extensions to the main office building are planned.

DESIGN AND PROJECT PLANNING

(*a*) Hydraulic and Structural Sections

See report of Ministry of Works

(*b*) Electrical Section

Power-stations.—Detailed drawings of the cabling for Maraetai have been prepared so that the necessary ducts can be incorporated in the building. Drawings of the outdoor station have been completed, and details of earthing and lighting worked out. The Whakamaru Switching-station, earthing, lighting, and control board details have been finalized, and a preliminary design of power-house dimensions and number of machines made.

Efficiency tests were carried out at Karapiro and a report is being prepared. New governor oil-pumps and motors were ordered for Nos. 1–4 units, Arapuni, and tenders called for carbon-dioxide fire-prevention equipment. Alterations to drawings for Tuai and Kaitawa necessitated by the commissioning of Kaitawa were brought up to date.

Design work on Cobb extensions was advanced a further stage, the control room layout designed, and a specification for the outdoor station prepared after the design was completed.

Extensions consisting of four units, together with fuel-handling and water cooling and purifying equipment, were designed for Stoke Diesels.

Design work on Waitaki No. 5 unit and that necessary to bring the protection on Nos. 1 and 2 units into line with the rest of the station was completed. Gate-control equipment, including Diesel generating-sets, were designed and ordered for Pukaki. Manufacturers' drawings were checked, and cabling and local service power supply designed for Tekapo. A substation layout to conform to altered site requirements was designed for Roxburgh.

General work included the analysis of tenders and the consolidation of power-station design data.

Substations.—During the year preliminary layout drawings for Tauranga and Haywards were prepared, and design work for Edgecumbe, Lichfield, Longburn, Fernhill, and Edendale was well advanced. The substation previously known as Gisborne is now called Patutahi, and preliminary layouts for the new Gisborne Substation have been investigated. It will be erected nearer the town as a second point of supply to the Poverty Bay Electric-power Board. Detail design work for extensions at Half-way Bush and for the new 110/11 kV. substation at Invercargill is almost complete.

Contracts have been let for transformer banks for Dargaville, Penrose, Bombay, Hawera, Upper Hutt, and Lichfield, and for all main items of equipment for Haywards: for switch-gear and steelwork, Bombay, Upper Hutt, Upper Takaka, and Stoke; for three regulating transformers, 22 kV. current-limiting reactor, and metal-clad switchgear for Penrose; control boards for Upper Takaka, Half-way Bush, and Stoke; 11 kV. control panels and switchgear for Ongarue and Khandallah; and for a 10 mVA. synchronous condenser and metering equipment for Stoke.

Specifications were prepared and orders placed for switchgear and steelwork and transformer banks for Maungatapere and for starting metal-clad switchgear for Hororata No. 2 condenser. Tenders were called for 220 kV. and 110 kV. switchgear structures, 110 kV. switchgear, 220 kV. and 110 kV. lightning-arresters for Haywards, 7·5 mVA. 50/11 kVA. transformer bank for Gisborne, and for ten 66 kV. O.C.B.s for Addington.

Arrangements were made to increase the transformer capacity at Kaikohe temporarily.

Extensions to the 11 kV. switchgear at Kaitaia are planned to permit the synchronous condensers to run from 11 kV. bus when the two 2,250 kVA. transformer banks are transferred from Takapuna.

A 50/11 kV. substation is planned at Wellsford as a fifth point of supply to the Waitemata Electric-power Board.

Priority over Bunnythorpe was given to Otahuhu Substation, and every effort is being made to finalize the design work at an early date. Designs were prepared for automatic starting and control equipment for No. 2 synchronous condensers at Hororata.

In addition to the above, studies were made of the possible voltage conditions on the South Island transmission system before commissioning the 220 kV. lines, and of the voltage conditions on the southern end of the North Island system with a view to improved operation of the Khandallah synchronous condensers.

Communications.—Planning of communication requirements in projected substations was advanced in step with the substation design. Equipment required for these substations and other installations has been placed on order. This includes a number of automatic-telephone exchanges.

All design and detailed drawings in connection with the South Island radio network have been finalized.

Further mobile radio tests have been carried out in the Southland area using both F.M. and A.M. V.H.F. equipment of the most modern design. From the results the particular requirements of the Southland network can be determined.

An additional single-channel open-wire system was installed experimentally in the Gisborne–Tuai joint-use telephone-line. This may provide an economical solution to the problem of the existing poor quality of many lines of this type.

Special facilities to aid load-despatch work were installed at Addington on test service so that the final design can be based on operating experience.

Further planning for the load-control telemetering system has been undertaken and additional automatic water-level indicators have been placed on order.

Equalizer networks were designed to replace expensive filters on open-wire carrier systems.

Relay Protection.—The results of critical surveys of relay protection for North and South Islands systems will shortly be implemented. At present the over-all ratio of correct fault clearances to the total number of operations is approximately 80 per cent. With the alterations already carried out, this figure should approach 95 per cent.

Orders have been placed for all protective relays required for the North Island 220 kV. and associated 110 kV. systems. Tenders were called for power line carrier current relays, but it was decided to order directional distance relays of a type proving highly satisfactory on existing 110 kV. circuits.

Relay protection of large power transformers was investigated and notes issued following correlation of reports and tests from all districts. Previous short-circuit calculation assumptions were corrected and figures provided for circuit-breaker applications, earthing-system design, &c., at various substations. A new D.C. network analyser incorporating 150 elements and capable of representing at one set-up the whole of the future North or South Islands transmission-line systems was designed to facilitate voltage studies as well as short-circuit calculations.

The inductive effects of short-circuits on our transmission lines in the communication circuits of the Post and Telegraph and New Zealand Railway Departments were studied, particularly for proposed lines. Negotiations regarding routing were started with these Departments.

Miscellaneous work included a study of possible effects of various forms of centralized remote-control schemes; conducting, on behalf of the British Electrical and Allied Industries Research Association, a questionnaire on performance of H.T. fuses on departmental and Power Supply Authority lines; and research on the effectiveness of surge-arresters in power-transformer installations.

(*c*) Transmission Section

Contracts were placed in Great Britain for towers for the Stoke–Waimangaroa–Blackwater 66 kV. line and for the Bunnythrope–Haywards 220 kV. line.

Specifications were drawn and tenders invited for steel towers and insulators for Whakamaru–Otahuhu and Whakamaru–Bunnythrope 220 kV. No. 2 lines.

Close contact was maintained with the contractors for the supply of towers for the first 220 kV. lines from Whakamaru to Otahuhu and Bunnythrope. Lengthy negotiations were carried out to ensure adequate supplies of raw materials for the contract, which covers the supply of more than 9,000 tons of fabricated towers. Mechanical tests were carried out on one tower of each of the four types included in the contract; the results being satisfactory. Approximately 3,500 tons of tower parts have been delivered by the contractors and are held in the depot at Linton, but due to lack of certain sections no complete towers are available for erection, except the four test towers. Designs were completed of special piled and slab foundations for use in swamps on the Whakamaru–Otahuhu 220 kV. line and details were supplied to districts for the execution of the work.

Wire-stringing tensions for various loading conditions, and insulator deflections and mechanical loading of supports for various lines, were investigated and charts supplied for use in the field.

Possible routes were investigated for the proposed 220 kV. lines from Roxburgh to Islington, with particular attention to snow conditions to be expected in the high country.

There was little improvement in the material-supply position, which is still causing grave delays in the line-construction programme. Delays are particularly noticeable in the supply of steel fittings and of Australian hardwood poles and crossarms.

REGULATIONS, LINES INSPECTION, ETC.

The electric lines and works of twenty-six Electrical Supply Authorities were inspected.

All the licences held by the Westport Borough Council were assigned to the Buller Electric-power Board, and those previously held by the Westport-Stockton Coal Co., Ltd., and Westport Coal Co., Ltd., were vested in the Minister of Mines.

The Murchison County Council was granted a licence to extend operations, and the Ketetahi Timber Milling Co., Ltd., a licence to commence operations. Two small Supply Authorities had their licences revoked and new ones issued, and two other small Authorities were granted licences.

The extension and redefinition of the boundaries of the Waitomo and Wairere Electric-power Districts was completed during the year.

An Order in Council authorized the development of the resources of the Clutha River and its tributary lakes and streams for hydro-electric purposes.

The following licences and permits to use water for the purpose of generating electricity and/or to erect and use electric lines were issued, revoked, or assigned :—

	Supply Authorities.	Private Individuals.
Electric lines—		
Licences—		
Issued	9	5
Assigned	4	..
Revoked	4	3
Use of water-power—		
Licences—		
Issued	..	4
Assigned	..	3
Revoked	1	1
Permits—		
Issued	..	1
Revoked	..	1
Combined electric lines and water-power licences—		
Issued	3	5
Assigned	1	6
Revoked	..	4
Permits to carry out wiring-work in connection with private plants : Issued	..	217

Fifty-seven Electric Supply Authorities gave notice of their intention to make a total of 641 extensions to their electric lines.

Four thousand three hundred and sixty-five broken wires and 278 broken poles were reported by Authorities. The principal causes of the wires being broken were : trees, 1,067 (24·4 per cent.) ; contact, 1,203 (27·6 per cent.) ; gale, 1,001 (22·9 per cent.) ; vibration, 133 (3 per cent.) ; pole hit by vehicle, 165 (3·8 per cent.) ; vehicles equipped with cranes, &c., 105 (2·4 per cent.).

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

	Year Ended 31st March, 1949.			Year Ended 31st March, 1948.		
	Fatal.	Non-fatal.	Total.	Fatal.	Non-fatal.	Total.
Child (up to seven years inclusive)	1	3	4	6	2	8
Commercial (shops, offices, &c.)	..	..	..	..	1	1
Domestic (includes hotels, boardinghouses, &c.)	4	5	9	1	5	6
Electrical linemen	2	13	15	..	9	9
Electrical worker (other than linemen)	..	6	6	3	6	9
General public	1	1	2	1	3	4
Industrial (factories, workshops, &c.)	1	7	8	1	..	1
Other trades	2	1	3	..	5	5
Other workers	2	3	5	..	6	6
Painters	..	1	1	..	1	1
Plumbers	..	1	1	..	1	1
Telephone linemen	..	..	..	1	1	2
Young persons (over seven but not over fifteen years)	2	2	4	2	2	4
Total	15	43	58	15	42	57
Mechanical (fall from pole, &c.)	..	4	4	2	1	3
Stock	1	..	1	2	..	2

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

—	Year Ended 31st March, 1949.	Year Ended 31st March, 1948.
Accessories	4	2
Appliances	8	3
Contact between aerial conductors	3	3
Contact between metal conduit and composition gas-pipe	2	..
Fittings	..	1
Fixed wiring (sub-mains and sub-circuits)	5	1
Flexible cables and cords	1	1
Improper use of appliances (irons, radiators, urns, and ovens, &c., left switched on)	6	7
Rodents	2	4
Service mains	1	..
Substations	..	1
Switchboards (wiring behind and accessories on)	3	12
Total	35	35

REGISTRATION OF ELECTRICAL WIREMEN

Examinations were held for electrical wiremen, electrical servicemen, radio servicemen, radio experimenters, and luminous-discharge-tube installers. One thousand two hundred and fifty sat the wiremen's and 610 the servicemen's examinations, a total of 1,860. For the first time maximum marks were obtained in the wiremen's written examination, which has been held twice yearly since 1926. This was achieved by two candidates at the same examination.

New registrations during the year totalled 506—312 electrical wiremen and 194 limited registrations.

Seventy-five 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. The Registration Board agreed that exemption from the Board's practical examination could not be granted for these tradesmen, but the holders of certificates for certain examinations conducted by the City and Guilds of London Institute would be exempted from the written examination.

After considering the requirements of registration, suggestions for inclusion in the proposed Dominion apprenticeship order were made to the Dominion Commission of Apprenticeship. The proposed schemes for all New Zealand Railways Department's electrical apprentices and for the training of apprentices during their term of service in the Army were approved by the Board.

Provision was made for limited registration for the installation and maintenance of x-ray and electro medical equipment.

The Registration Board nominated the Registrar as its representative on the New Zealand Trades Certification Board established under the Trades Certification Act, 1948.

As a result of a purge, 951 names were removed from the registers of electrical wiremen and limited registration. One hundred and eighty of these names had been restored at the 31st March, 1949.

PERSONNEL

At the 31st March, 1949, a total of 4,754 employees were engaged on hydro-electric work. Of these, 2,311 were directly employed by this Department and the remaining 2,443 were on construction under the immediate control of the Ministry of Works.

The total under the control of the State Hydro-electric Department comprised 1,716 on operation and maintenance and 595 on construction.

On the 31st March, 1949, Mr. A. C. Owen retired from the position of District Electrical Engineer, Palmerston North, and I wish to place on record my appreciation for the long and faithful service he has given to the Department.

Mr. L. F. Withers was appointed Assistant General Manager on the 26th July, 1948.

The shortage of design staff, combined with inadequate working-space, has not made matters any easier in Head Office, Wellington, while housing-conditions in all the main district centres have made the transfer of staff a most difficult and distressing task. Running equipment at full load continuously has demanded a high standard of service on the operating side, and the fullest co-operation of all members of the staff, often under very adverse conditions, was required to overcome the considerable difficulties encountered during the year.

For the full measure of loyal support given by all members of the State Hydro-electric Department staff, and by their associates in the Ministry of Works, it is my duty and privilege to record grateful thanks.

Much has been done, but much yet remains to be done, to make available an adequate supply of electrical power, upon which the development of New Zealand so largely depends.

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, 1949

The CHAIRMAN to the HONOURABLE MINISTER IN CHARGE.

Wellington, 10th May, 1949.

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 third annual report for presentation to Parliament.

GENERAL

It is now slightly more than two years since the Council first commenced to consider applications for subsidies to meet part of the annual costs of supplying electricity to the people situated in the unreticulated and sparsely-settled parts of the country. To date the Council has approved subsidies being paid on 1,050 route-miles of line. The total annual subsidy provisionally amounts to £27,098, and the estimated capital cost of constructing the lines is £528,111. Altogether 27 Electric Supply Authorities in the North and South Islands are constructing lines under the subsidy scheme, and 1,743 new consumers will receive an electric supply when the work already approved is completed.

At the end of last year 77 miles of subsidized line had been built. During the year under review an additional 122 miles were completed, bringing the total length of subsidized lines which have been put into operation to 199 route-miles. There are, of course, a number of miles of line in excess of this figure which are in operation but which have not yet been costed and therefore cannot appear in the statistics quoted here. Compared with the position last year, there has been an improvement in the progress made in building lines, but shortages of materials and skilled labour are still causing delay.

For the purpose of computing subsidies, the Council has adopted higher standard capital costs than those previously used. The new standards were based upon the recommendations of the Electric-power Boards and Supply Authorities' Association, and vary according to the conditions to be met. They are not directly comparable with the previous standards of £350 a mile for single-phase lines and £450 a mile for three-phase lines. The increase, however, is of the order of 15 per cent. As a large proportion of the lines approved for subsidy had not been commenced and would have to meet present-day costs when built, the Council decided that, where necessary, the higher standards should be applied to the applications previously approved. The Supply Authorities were therefore invited to resubmit their applications for consideration on the new standard cost basis, but were asked to refrain from doing so unless they considered it was essential for higher subsidies to be granted. The Council is pleased to report that only six of the Supply Authorities applied, the remaining Authorities being agreeable to meet any anticipated deficiencies of revenue from their general funds.

In May, inspections were made of unreticulated districts in the Buller, Grey, North Canterbury, Malvern, Banks Peninsula, Springs-Ellesmere, Ashburton, South Canterbury, Waitaki, Otago, Teviot, and the Otago Central Electric-power Boards and Southland Electric-power Supply; in July, visits were paid to the Auckland and Waitemata Electric-power Boards, and districts were inspected in the areas of the Bay of Islands, North Auckland, Franklin, Thames Valley, Central Waikato, Te Awamutu, Waitomo, Wairere, King-country, and the Manawatu–Oroua Electric-power Boards. This completed the inspections, which commenced last year, of the districts in both the North and South Islands where rural lines may be subsidized. These visits added appreciably to the Council's knowledge of the difficulties of many of the Boards in reticulating the remote rural areas, and the numerous meetings with settlers and members of the Boards gave the Council the opportunity of removing any misapprehensions regarding the Council's functions and the objects of the rural subsidy scheme.

The delays which have been experienced in constructing lines have resulted in a surplus accumulating in the Rural Reticulation Fund which can be used for granting subsidies in excess of the annual income from levies. For the reasons reported upon last year it is still not possible to determine when or by how much the annual levy of one-quarter of 1 per cent. should be increased. On present indications the funds available to the Council from the present levy will be sufficient for a considerable amount of the new work yet to be authorized.

APPLICATIONS FOR SUBSIDIES

Fifty-six applications were received from seventeen Power Boards, including applications for reconsideration of the provisional subsidies granted last year. Subsidies were approved covering the building of 392 miles of line giving supply to 554 new consumers at an estimated capital cost of line construction of £238,762. The subsidies provisionally granted averaged 5·9 per cent. of the estimated capital cost, which is within the $7\frac{1}{2}$ per cent. maximum allowed under the Act. The density of consumers in the districts to be reticulated is about five to every three miles of line. Details of these applications are given in Table I, and the consolidated position for the first three years of the subsidy scheme is given in Table II.

TABLE I—SUMMARY OF APPLICATIONS APPROVED IN THE YEAR ENDED 31ST MARCH, 1949

Supply Authority.	Number of Applications.	Route Miles.	Number of Consumers.	Estimated Capital Cost.	Provisional Subsidy, Per Annum.
				£	£
*Ashburton Electric-power Board ..	2	16·5	23	6,505	203
*Bay of Islands Electric-power Board ..	1	4·1	6	1,620	89
Banks Peninsula Electric-power Board..	1	15·9	13	7,469	541
*Central Hawkes Bay Electric-power Board	1	3·1	3	1,698	127
*Central Waikato Electric-power Board ..	4	18·4	44	11,322	511
Franklin Electric-power Board ..	2	2·3	7	1,355	21
Grey Electric-power Board	1	9·0	14	4,984	150
Marlborough Electric-power Board ..	1	1·8	2	596	12
*North Auckland Electric-power Board ..	15	64·2	136	33,318	1,530
*North Canterbury Electric-power Board	3	17·5	20	8,494	621
Otago Electric-power Board	1	37·2	33	16,225	989
*Poverty Bay Electric-power Board ..	1	81·0	67	60,000	4,330
Southland Electric-power Supply ..	6	28·3	32	13,109	959
Tararua Electric-power Board ..	2	1·9	2	674	45
*Wairarapa Electric-power Board ..	2	70·0	107	59,544	3,449
Waitaki Electric-power Board ..	11	10·9	23	5,249	165
*Waitomo Electric-power Board ..	2	10·6	22	6,600	353

* Three 1946–47 applications from Ashburton were amended in 1948–49. One 1947–48 application from Bay of Islands was amended in 1948–49. One 1946–47 application from Central Hawkes Bay was amended in 1948–49. Two 1946–47 applications and one 1947–48 application from Central Waikato were amended in 1948–49. One 1946–47 application and four 1948–49 applications from North Auckland were amended in 1948–49. One 1947–48 application from North Canterbury was amended in 1948–49. One 1946–47 application from Poverty Bay was amended in 1948–49. Two 1947–48 applications from Wairarapa were amended in 1948–49. Two 1947–48 applications from Waitomo were amended in 1948–49.

TABLE II—CONSOLIDATION OF APPLICATIONS APPROVED AS AT 31ST MARCH, 1949

Number of Supply Authorities	27
Number of applications	149
Route-miles of line	1,050
Number of consumers	1,743
Estimated capital cost	£528,111
Provisional subsidy per annum	£27,098
Average subsidy (per cent.)	5·1

TABLE III—SUBSIDIZED LINES CONSTRUCTED AND CONSUMERS CONNECTED IN THE YEAR ENDED 31ST MARCH, 1949

	Number of Applications.	Route-miles of Line.	Number of Consumers Connected.	Actual Capital Cost.
				£
Bay of Islands Electric-power Board ..	3	54·80	131	22,957
Dannevirke Electric-power Board ..	6	10·63	11	5,874
Franklin Electric-power Board	5	13·64	15	7,843
Malvern Electric-power Board	5	4·20	7	1,814
Manawatu-Oroua Electric-power Board ..	1	10·31	14	8,060
North Auckland Electric-power Board ..	3	6·94	12	3,136
Southland Electric-power Supply ..	1	8·66	21	4,867
Wairoa Electric-power Board	1	9·50	57	6,352
Waitaki Electric-power Board	7	4·71	9	2,925

Figures in Table III subject to adjustment when final returns are received.

TABLE IV—CONSOLIDATION OF SUBSIDIZED LINES CONSTRUCTED AS AT 31ST MARCH, 1949

Number of Supply Authorities	15
Number of applications	62
Route-miles of line	199
Number of consumers connected	454
Actual capital cost of lines	£100,643

PAYMENT OF SUBSIDIES

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

No subsidies were paid in the year ended 31st March, 1948.

TABLE V—SUBSIDIES PAID IN THE YEAR ENDED 31ST MARCH, 1949

	£
Ashburton Electric-power Board	353
Central Hawkes Bay Electric-power Board	115
Malvern Electric-power Board	6
Marlborough Electric-power Board	12
Southland Electric-power Supply	318
Waitaki Electric-power Board	22

TABLE VI—RURAL RETICULATION FUND AS AT 31ST MARCH, 1949

	£ s. d.	£ s. d.
Cash balance in Fund at 1st April, 1948		48,428 5 3
Receipts from annual levy	25,238 9 10	
Interest on investments	922 10 10	
		26,161 0 8
		74,589 5 11
Subsidies paid during year	826 0 0	
Administration costs and expenses	641 19 10	
		1,467 19 10
Cash balance at 31st March, 1949		73,121 6 1
Sundry creditor—Electric Supply Account: Administration costs and expenses		310 6 5
Net balance in Fund at 31st March, 1949		£72,810 19 8

In accordance with the provisions of the Act, the term of office of the three members of the Council representing the Electric Supply Authorities expired in March, 1949. Mr. H. V. Murray and the Hon. R. Masters were again nominated by the Electric-power Boards and Supply Authorities' Association, and have accepted appointment for a further period. It is gratifying to me as Chairman that Mr. Murray and Mr. Masters were again appointed, as continuity of service and knowledge in the problems confronting the Council is most desirable. Mr. W. P. Glue, of Christchurch, has been appointed to the Council as the third member representing the Supply Authorities. He takes the

seat of Mr. M. E. Lyons, who was not eligible for reappointment. The Council desires to record their appreciation of the very real assistance Mr. Lyons has given at all times in the deliberations of the Council. He was most sincere in his desire to see the Act fully implemented and to do all in his power to hasten the reticulation of the sparsely-settled parts of the country.

I would repeat my appreciation of the help given by Mr. F. T. M. Kissel in continuing to act as Chairman during the visits of the Council to the various electric supply areas.

I have, &c.,

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

Chairman.

Approximate Cost of Paper.—Preparation, not given; printing (1,433 copies), £120

By Authority: R. E. OWEN, Government Printer, Wellington.—1949.

Price 1s.]