SALONIKA

ELECTRIC DISTRIBUTION OPERATIONS

PART OF REPORT ON

ELECTRIC POWER PROGRAM

KINGDOM OF GREECE

FOR

ECONOMIC COOPERATION ADMINISTRATION

WASHINGTON, D. C.

EBASCO SERVICES INCORPORATED

NEW YORK

OCTOBER 1949

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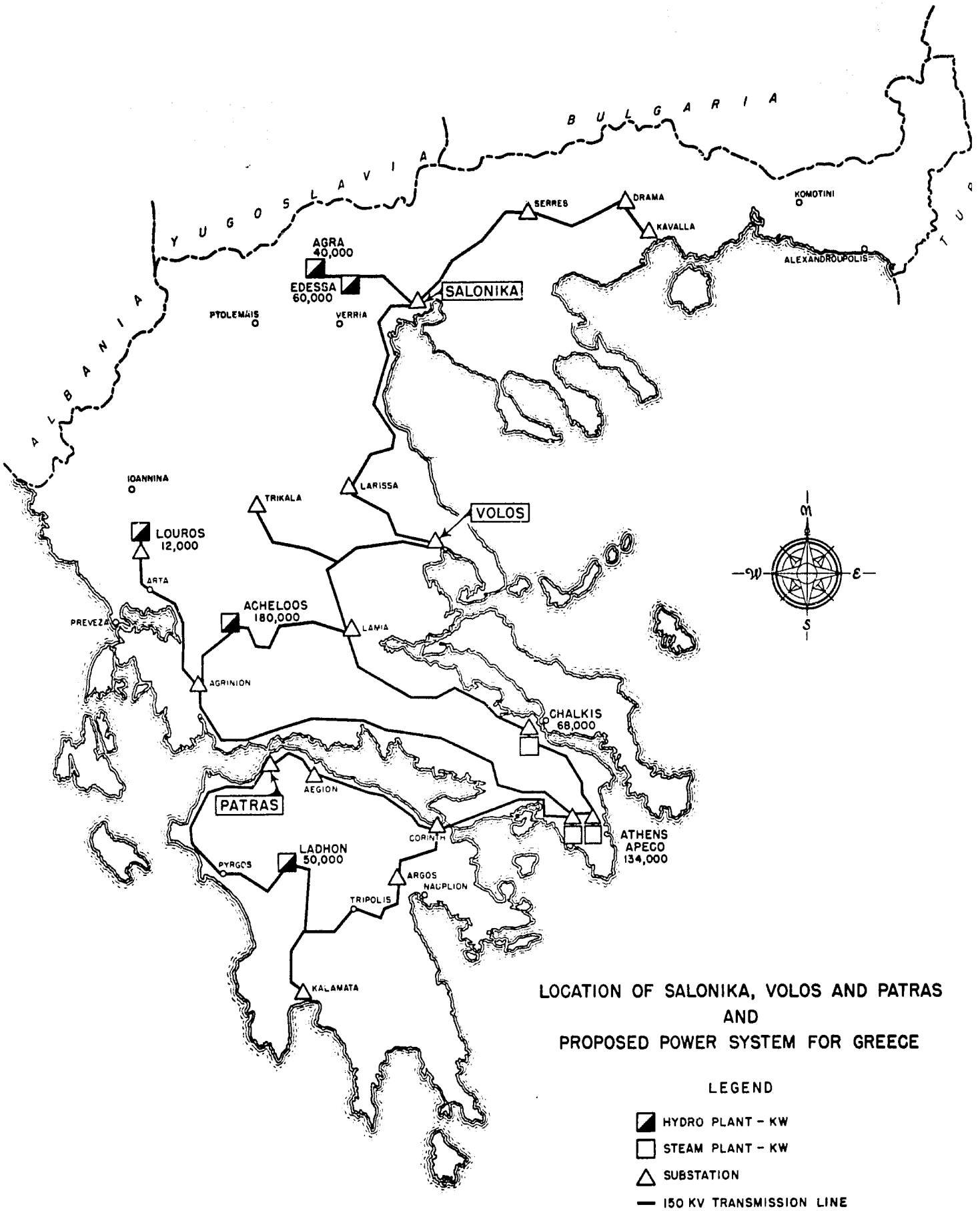


LOCATION OF SALONIKA, VOLOS AND PATRAS
AND
PROPOSED POWER SYSTEM FOR GREECE

LEGEND

- HYDRO PLANT - KW
- STEAM PLANT - KW
- SUBSTATION
- 150 KV TRANSMISSION LINE

KILOMETERS

MILES

NOTE

PROPOSED POWER SYSTEM FROM INTERIM REPORT JUNE 1949 AND AMENDMENT OCT. 1949.

I - SUMMARY

A - PURPOSE AND SCOPE

1 - ECA-Ebasco Contract

The Economic Cooperation Administration, Washington D C engaged Ebasco Services Incorporated under Technical Assistance Contract TA-40-1 to conduct field investigations and prepare reports recommending an Electric Power Program for the Kingdom of Greece. The scope of the major engineering and economic investigations was specified to be comprehensive in character and to embrace related phases of the proposed Power Development Program. In effect all of the major engineering and production problems were to be analyzed, starting with the source of primary energy and concluding with the delivery of electric energy to the ultimate consumer.

2 - Interim Report of June 1949

An Interim Report, dated June 1949, and an amendment thereto, dated October 1949, have been submitted to ECA. Basic recommendations were made for the construction of a modern interconnected and integrated power system utilizing the indigenous resources - hydro and lignite - for its energy supply and a high voltage transmission network for transmitting the electric power to load centers. In the ultimate plan practically all of the existing isolated power systems, large and small, (except those on the islands) would be coordinated into the interconnected system.

The Interim Report should be reviewed and the system development plans recommended therein be given full consideration in conjunction with this report on Distribution Operations. Likewise the final report on the Electric Power Program which will cover the recommended system development plans in greater detail must be studied carefully to be certain that all future distribution operations are coordinated for the entire country.

3 - Investigation of Distribution Operations

As a part of the overall investigation and report, Ebasco was requested to conduct field surveys and to make recommendations with

respect to possible improvements to electric distribution operations in the cities of Salonika, Volos and Patras. The studies and recommendations were to cover (a) present conditions, (b) operations until the interconnected power system facilities would be constructed, and (c) the transition of these distribution systems into the major system. Likewise all major operation functions were to be analyzed including (a) present ownership (b) management (c) organization (d) accounting practices (e) rates (f) commercial policies (g) engineering practices and (h) operation and maintenance.

The conditions found and the problems encountered in the three cities covered by the assignment were considered to be similar in many respects as well as indicative of the general conditions in the many isolated utility companies throughout Greece. These companion reports on Salonika, Patras and Volos operations can therefore serve the additional purpose of being used as guides in organizing the operations in similar distribution centers in Greece.

In general, the isolated utilities, whether located in Salonika under government control, in Patras under municipal control or in Volos as privately-owned are similar in basic respects and should follow similar basic operations practices for maximum economy. Furthermore in the future interconnected power system all major distributing centers occupy similar relative positions.

With respect to the proposed power system, it will provide sources of energy derived from hydroelectric and lignite-burning steam-electric plants to replace the present oil-consuming Diesel engines. Transmission facilities are to be provided to transmit the energy to major load centers, for distribution to ultimate customers. Thus at each distributing center substation there will be an ample supply of power which is derived from indigenous energy sources. This will replace the local generation, which now requires fuel, lubricating oil and spare parts that can be purchased only with foreign exchange. The operation of Diesel-driven generators, will be discontinued under normal conditions and many of the units may be available for removal to the islands and to isolated locations which may not be served initially from the interconnected power system.

With respect to the individual organizations and operating properties, they are to be integrated into the overall coordinated system and any one of the following combinations may result: (a) the distributing system may continue operation as an individual company purchasing energy from the system, or (b) the generation, and distribution systems may be integrated into a major power system, or (c) the individual company may become a unit in the integrated system operating under the direction of a coordinating committee.

It might appear that the ownership and organization of the components of the proposed power system would affect the recommendations pertaining to the individual distribution systems. This is not necessarily the case, as the primary function of the distribution system is to serve the individual consumers. Furthermore it is immaterial as far as organization is concerned whether power is taken from an isolated plant or from the interconnected power system.

Each local distribution system operation, in the future, will undoubtedly be enlarged in scope and magnitude as facilities are extended to serve contiguous territory. Organizations and practices established at this stage should take the future into account and be uniform in order to promote efficiency in the distribution of energy throughout Greece.

The importance of distribution as a component of the overall electric system and its effect upon the cost of service to the consumer cannot be overemphasized. First, the investment in the present and proposed distribution systems in Greece will approximate 30 to 40 per cent of the total system investment (a lower than normal percentage because of the large investment in the proposed hydro stations). Fixed charges are therefore very important. Second, operation and maintenance costs for the distribution system are higher than for the transmission system or power plants, exclusive of fuel, because of the proportionately greater amounts of necessary labor and general expense. Third, extravagances in design and abuses in operation can be and frequently are practiced in connection with the operation of distribution systems. This apparently is the case in several of the operations in Greece.

Taking the above factors to account, it is very important that government policies with respect to codes, taxes, regulations and similar matters be sound, equitable and designed to promote economy. Also, management and operation of the distribution systems must be efficient to attain maximum economy. The general and specific recommendations which follow are directed toward the adoption of practices which should result in efficiency and economy in the distribution of electrical energy, considering all of Greece as a coordinated operation.

B - GENERAL RECOMMENDATIONS

The general recommendations which follow are for the purpose of affecting improvements and changes (a) in present government regulations and procedures to make it possible to plan, design and operate the distributing systems efficiently and (b) in the local organizations and practices to attain adequate service at the lowest possible costs.

The overall recommendations, applicable to Salonika, Volos, Patras and other isolated distribution system operations, are:

1 - The Greek Code, governing mechanical and electric installations, be revised and modernized to permit electric installations in homes, factories, towns, etc in line with the more liberal practices found in the United States and other countries.

2 - The existing system of regulations covering the securing of spare parts be liberalized in order to facilitate maintenance and repair of existing equipment.

3 - High taxation on imported spare parts be abolished as an aid in encouraging proper maintenance and repair of vitally needed apparatus.

4 - A simple uniform system of accounting be established for operating utilities so that comparable and accurate accounts of operations will be kept.

5 - A basis be established for a reasonable evaluation of utility property.

6 - The practice of providing unrecorded or free service to preferred customers be discontinued as it is an undesirable practice that results in higher rates to paying customers.

7 - The extensive use of underground cables in distribution system be studied in view of the general use of overhead construction in the United States. Underground cable installations are expensive and place an unnecessary cost burden on the distribution system.

8 - Programs be initiated for the development of managerial personnel, engineers, designers, draftsmen and operators necessary to assist in the construction work and to participate in the ultimate operation of the electric system.

9 - Consideration be given to the establishment of factories, preferably not operated by the power companies, located at strategic points in Greece with the required organization to manufacture concrete poles and similar material suitable for use in the distribution systems.

10 - Operating organizations and operating practices in each of the major distributing centers be revamped in line with the recommendations for Salonika, Patras and Volos.

11 - The rate formula established by the Greek government be continued unchanged during the interim period until power is available from the interconnected system. After detailed study, a completely new rate structure should be designed for use when power is available from the proposed system. Such a rate structure should be so designed to recover the operating costs of an efficiently managed system, produce an adequate return on system investment, and encourage the maximum and most efficient use of the available power supply.

12 - Full advantage should be taken of every applicable up-to-date practice developed in the United States and Europe to secure the best results in attaining the objectives covered by recommendations 1 to 11. Advice and supervision from some central competent organization covering all distribution system operations in Greece will be required to accomplish uniformity and overall economy.

C - SPECIFIC RECOMMENDATIONS FOR SALONIKA

In addition to the general recommendations in Section B which apply to distribution systems and electric service in all of Greece, there are listed below recommendations which are applicable to the Salonika operations. Some of the specific and general recommendations are so interrelated that they cannot be put into effect independently. However, it is believed that adoption of the recommendations will materially improve operations and will serve to prepare the organization and physical property for the increased load that can be supplied when power from the hydro and lignite fuel resources is available in quantity. Furthermore it is very important that every improvement be adopted promptly in order that costs can be determined for distribution operations that are placed on an economic and efficient basis. This is necessary because distribution costs are a large component of the cost of service to the ultimate customer which costs must be added to the delivered cost of the power and energy from the system. Without complete cost data equitable and compensatory rates cannot be established.

The recommendations that follow are grouped under (1) Distribution Operations, (2) Production Operations, (3) Rates, (4) Tramways Operations, (5) Organization.

1 - DISTRIBUTION OPERATIONS

a - Change from Direct-Current to Alternating-Current Distribution

The low voltage direct-current distribution system in the city of Salonika is obsolete in design and inadequate from a capacity standpoint for distributing energy in the quantities required over the 710 km of distribution system. The investment necessary to expand the low voltage distribution system to provide adequate service under existing load conditions would be excessive for the results obtained and would be prohibitive if expansion to meet future requirements is considered.

Market analyses and load forecasts indicate that a rather substantial increase in the use of electricity will be possible when economic

and reliable service is provided. Refer to Interim Report on Electric Power and Water Utilization Program, page 44.

To meet the immediate and future needs in the city of Salonika it is recommended that the existing low voltage direct-current system be replaced with a modern alternating-current system in which the energy is distributed to the load areas at 15,000 volts, 3-phase 50-cycles with transformation directly to the utilization voltage of 220/380. Service to the ultimate customer is provided from the secondary 220/380-volt system over relatively short distances. The resulting system of distribution has (a) low investment per kilowatt of load capacity; (b) inherently lower electrical losses for comparable investment than a low voltage direct-current system; (c) the capability of being expanded readily and economically to provide for future growth; (d) simplicity of design.

The changeover from direct current to alternating current is not a simple problem to be accomplished as a single operation but involves a series of steps that can be taken over a period of time. The following program outlines the steps for orderly execution of the changeover to produce a system that will meet the present and future requirements in Salonika and to provide the best possible service in the interim period before energy is available from the proposed power system.

Step 1 involves the necessary planning and design engineering to produce a detailed layout of the proposed electric circuits in Salonika for the changeover program and in addition a plan that is suitable for economic and orderly expansion as the load grows.

Step 2 is the initiation of the changeover program consisting of segregating 2400 kw of alternating-current generation available at Stations B and C to supply a 15,000-volt feeder system to selected sections in Salonika which are to be changed over to 220/380-volts a-c. Existing conductors now carrying direct current in the selected areas can be isolated from the direct-current system and used as secondary circuits to carry alternating current to the customers.

Step 3 embraces the period of operation in which the system will be supplied from alternating-current generators serving

selected areas, and from direct-current generators supplying the reduced area direct-current system. Preparations must be made during this period to change the supply source from the local generating stations to the interconnected power system.

Step 4 - When plans for the power supply from the interconnected system are completed, primary 15,000-volt feeders, stepdown transformers, and meters are to be installed in the direct-current area so that rapid changeover to alternating current can be effected when the energy from the power system is available in Salonika.

b - Planning Procedure

The proposed alternating-current system to replace the direct-current system is to receive its energy from a transformer substation located in Salonika at 15,000-volts 3-phase 50-cycles and the design of the distribution system is to be based on the power supply from the interconnected power system.

The program of changeover from direct current to alternating current will involve (1) planning and design engineering for the alternating-current system (2) installation of 15,000-volt feeders, transformers, meters and changeover in selected areas to alternating-current service in order to initiate the program (3) installation of additional 15,000-volt feeders and equipment for completing the changeover to alternating current to match the time when power will be available from the interconnected system.

The immediate results will be improved service in the areas that are changed to alternating current, reduction in the load on the existing direct-current system by an amount equal to the kilowatts that have been changed to alternating current and the possibility of increasing the service to customers by amounts equivalent to the reduced losses on the direct-current system and amounts changed to alternating-current service.

During the interim period when both alternating-current and direct-current systems are in operation considerable discretion must be observed in selecting the loads that are to be supplied by each system

and especially the load added to the direct-current system to avoid further changeover costs when power is available from the proposed power system.

To accomplish the desired results it is specifically recommended that:

1 - The general planning of the proposed distribution system that involves fundamental system design, general circuit layout and standards of engineering and construction be directed by a competent engineering organization that is familiar with the distribution problems and experienced in the details of design.

2 - Designs, selection of equipment, materials, etc be coordinated with the standardized practices being recommended for all of Greece.

3 - The 2400-kw of alternating-current generators in Stations B and C be used to provide energy to an alternating-current feeder system to selected areas in Salonika to improve service and increase the capacity of the distribution system to carry the existing load requirements.

4 - The presently available 10,000-volt transformers be used at the power stations to supply the new alternating-current feeders and that they operate temporarily at 10,000 volts. All new stepdown transformers serving customers be of 15,000-volt primary rating with 10,000-volt taps.

5 - The total peak load on the system be limited to approximately 10,000 kw during the interim period until alternating-current energy is available from the interconnected system.

6 - The two other small electric utility systems in Salonika be integrated with the Salonika system to produce a single, uniform and more efficient operating unit.

7 - The characteristics of additional loads be studied and consideration be given to loads that can be supplied off peak as the

existing generating capacity is capable of producing much greater quantities of kilowatt-hours than are produced at this time.

8 - The minimum amount of capital be invested in the direct-current system during this interim period and that careful selection and control be practiced in adding load to the direct-current system to prevent unnecessary expenditure in the ultimate plan of total changeover to alternating-current.

9 - Safety practices be initiated in order to protect employees and the public during the changeover period and later under the system expansion and normal maintenance programs.

10 - The heavy construction work and related phases of the changeover from direct-current to alternating-current distribution be done to the maximum possible extent on a contract basis rather than to increase the present organization to carry out the changeover program.

11 - The distribution organization be regrouped as indicated in the proposed organization chart included in this section and that the activities not directly related to distribution functions be transferred to the proper departments as outlined in Section D of the Discussion section.

12 - The job classifications and personnel requirements be reviewed and all excess personnel be discontinued.

2 - PRODUCTION OPERATIONS

The existing Stations A, B and C, with proper repairs and maintenance of apparatus, will supply the combination alternating- and direct-current system under present load conditions and until such time as the energy is supplied from the alternating-current interconnected system. To provide adequate service at minimum costs from these stations during this period, it is recommended that:

a - A well directed maintenance program be initiated in generating Stations A, B and C to restore a selected group of Diesel-

driven generating units to 2400 kw alternating-current and 6310 kw direct-current capacity as listed in the chart in the Discussion section.

b - The practice be discontinued of installing in shore stations the Diesel-driven units taken from the floating stations.

c - The operation of the floating stations, consisting of five mine sweepers be discontinued as an adjunct to Stations A, B and C as rapidly as the units in these stations are repaired and that the operating forces on the mine sweepers be discontinued.

d - The supervision of Stations A, B and C be delegated to a skilled superintendent having broad experience in the operation of Diesel-electric stations.

e - The loading of engines in Stations A, B and C be scheduled and coordinated to secure minimum oil consumption and efficient overall operation.

f - Superchargers, lubricating oil filters, air filters, expansion joints, water treating equipment and by-pass piping, and mufflers as covered in detail in the Discussion section be installed to improve operating efficiency and decrease maintenance.

g - Thermometers, pyrometers, and repair parts for forced oil pumps as covered in detail under the Discussion section be provided and installed to improve operation of the generating units.

h - The personnel requirements for the generating stations be scrutinized in line with detailed analyses and recommendations presented in the Discussion section of this report.

3 - RATES

The rates charged for electric service in Salonika are very high because of excessive energy losses and abnormally high payroll expenses that are passed on to the consumer through the use of the rate formula. However, the rates can be reduced by adoption of the recommendations relating to operating economies.

It is recommended that:

a - Economies and efficiency improvements be put into effect promptly in order to reduce the rates charged for electric service to the lowest practicable levels.

b - No change be made in the rate formula during the interim period until power is available from the interconnected system.

c - For future operations modern rate structures should be adopted. These rate structures should, and probably can, be practically uniform in design throughout Greece for comparable classes of service.

4 - TRAMWAY OPERATIONS

Analysis of the financial and operating statements of the tramway department discloses a very heavy yearly deficit. In fact, the tramway department losses are greater than earnings of the electric department. It is recommended that:

a - Careful analysis of the tramway's operations be made with the view of improving efficiency, performance and increasing rates to place the operation on a profitable basis.

b - For maximum efficiency the transportation business should be disposed of rather than permitting it to become a possible burden on the electric department.

5 - ORGANIZATION

The organization pattern in use at the time of the survey is quite satisfactory. However, additions to the supervisory staff and rearrangement of the functional duties of others should be made; the results of surveys and analyses indicate predominate weakness in the Salonika organization in that adequate supervision, engineering and coordination in the design, operation and maintenance of the property are not provided. To meet immediate and future needs, it is recommended that the organization be revised in accordance with the proposed organization chart immediately following in this Summary section. For reference, a

chart of the present organization is also included. Referring to the proposed organization chart, it will be noted that each important function in the operation of the Company is to have a responsible department head reporting to the Director General. Several of these department heads correspond to the existing arrangement and, in general, their functions need not be modified materially.

The recommendations which follow cover the major changes, both in the personnel and functions, which are considered important for improved efficiency.

To accomplish the desired results, it is recommended that:

a - The functions of the Director General be directed toward the overall business management of the organization to:

1 - Work with the representatives of the Ministry of Transport to establish broad policies for guidance and control of the Company operations, to develop a sound financial structure and to develop an organization capable of operating the property efficiently.

2 - Guide the functions of the several department supervisors to insure that the policies established are followed and are efficiently administered.

b - The position of general superintendent be established to relieve the Director General of detail responsibility of supervising engineering, production, and distribution of electric energy. The general superintendent shall report to the Director General and be responsible for production, distribution, and service and shall supervise the functioning of:

1 - The chief engineer - responsible for (a) planning and design of the distribution system including conversion from direct current to alternating current with advice of experienced consultants, (b) preparing design and construction standards to be used for system extensions and reconstruction, (c) preparing and maintaining system

maps and records, (d) supervising the engineering phases of generating station operation and maintenance.

2 - Distribution superintendent - responsible for the efficient operation and maintenance of the distribution system and service to customers.

3 - Production superintendent - responsible for the efficient operation of the power plants until such time that power is available from the interconnected system and the generating stations can be discontinued as a major function.

c - The position of commercial manager be established reporting to the Director General to:

1 - Promote and direct all commercial functions including load growth, the many problems involving service encountered during the changeover period, and later, when energy is supplied from the interconnected system, the active promotion of the sale of electric energy.

2 - Direct contractual relationship of the Company with its customers.

3 - Represent the Company in its business relations with government officials, appliance dealers, contractors, customers, finance organizations and the public.

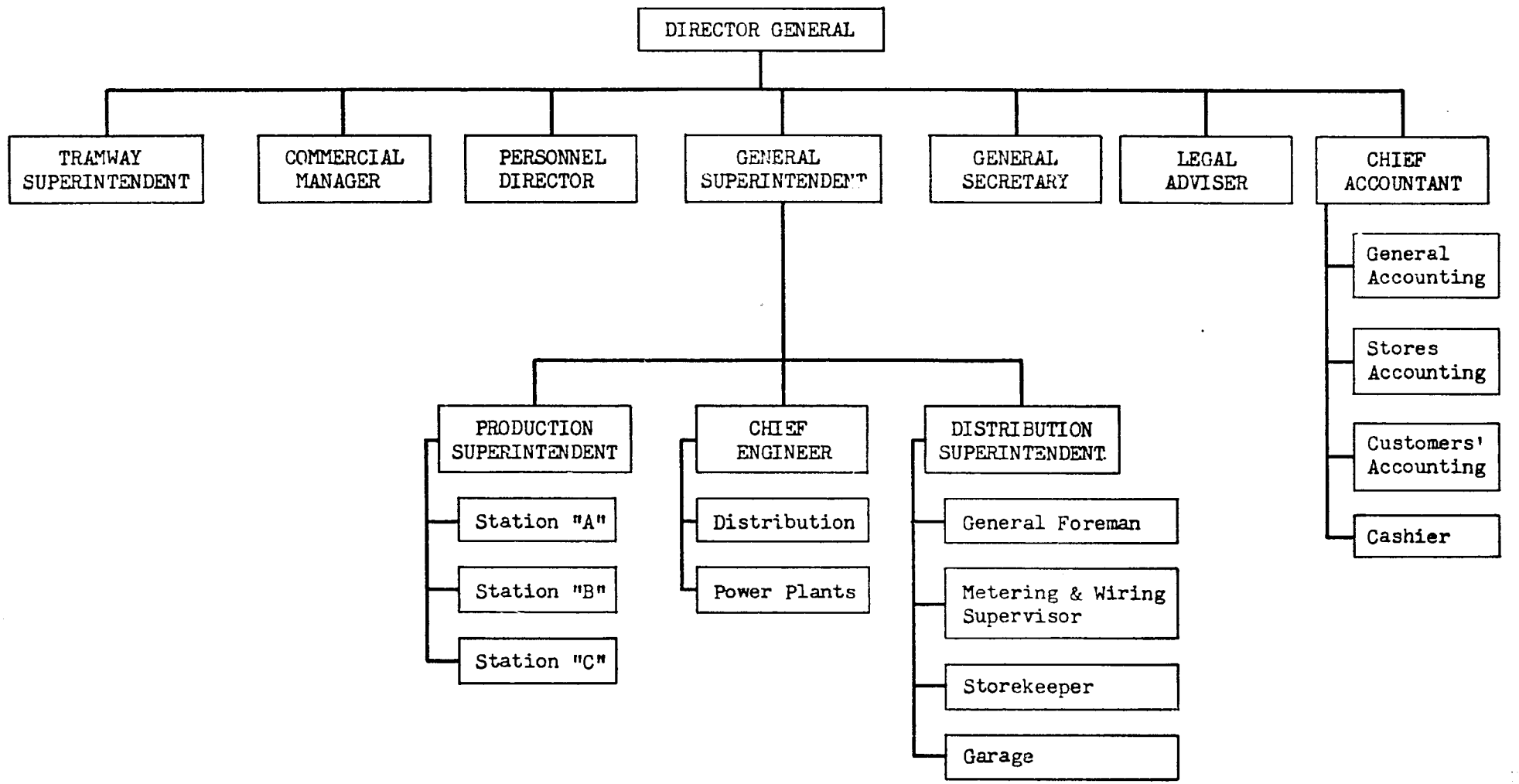
d - The position of chief accountant be established, reporting to the Director General, to direct all accounting functions. In addition to the normal duties performed by the accounting department, specific emphasis should be given to:

1 - Production of records on a time schedule and of specific value in controlling operations and in evaluating the performance of individual departments.

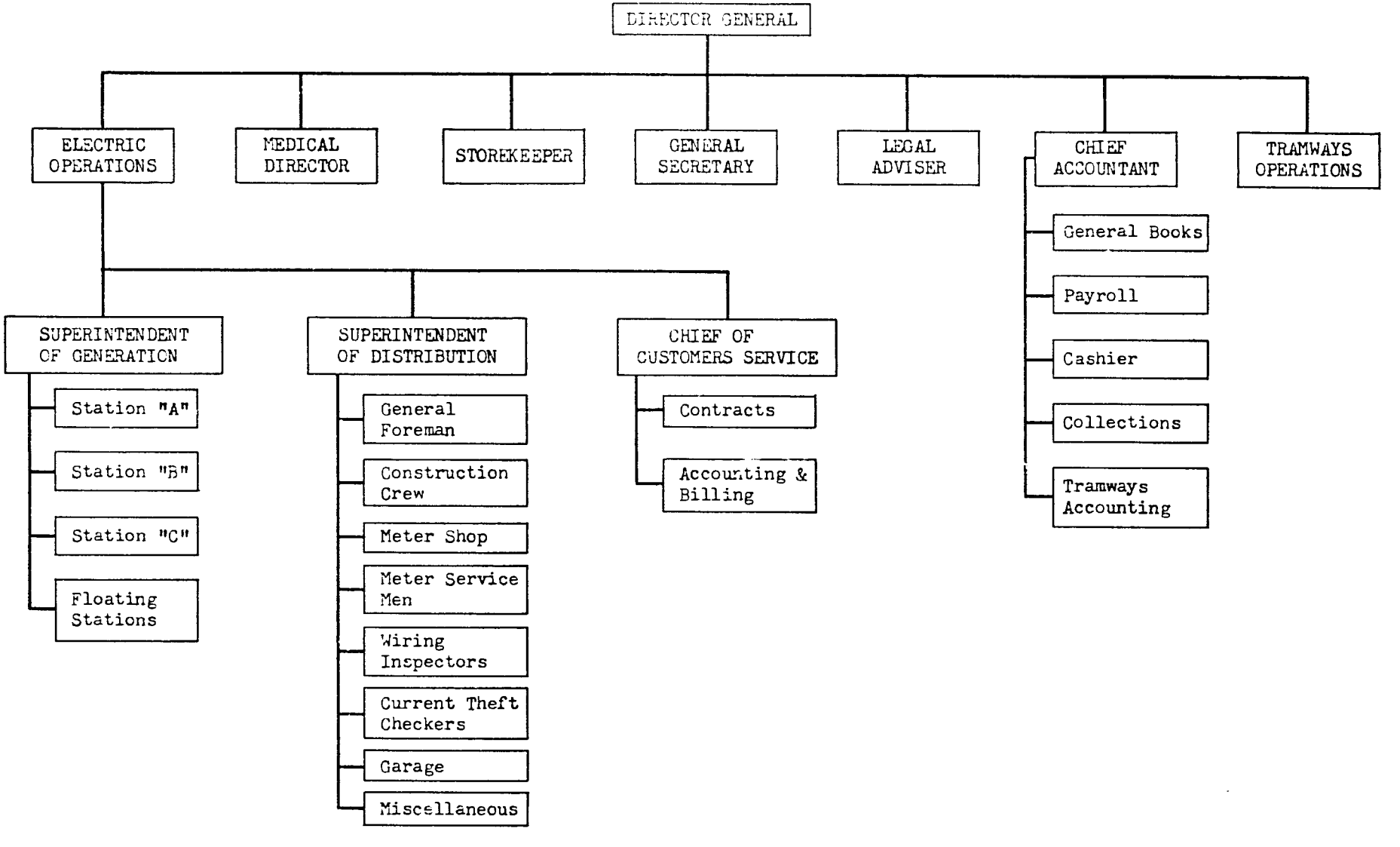
2 - Reduction of accounting costs by the installation of modern mechanized equipment.

3 - Analyzing and control of personnel to fit the job requirements.

PROPOSED ORGANIZATION
SALONIKA TRAMWAYS AND ELECTRIC COMPANY



PRESENT ORGANIZATION
SALONIKA TRAMWAYS AND ELECTRIC COMPANY



II DISCUSSION

II - DISCUSSION

A - SALONIKA - ELECTRIC SERVICE

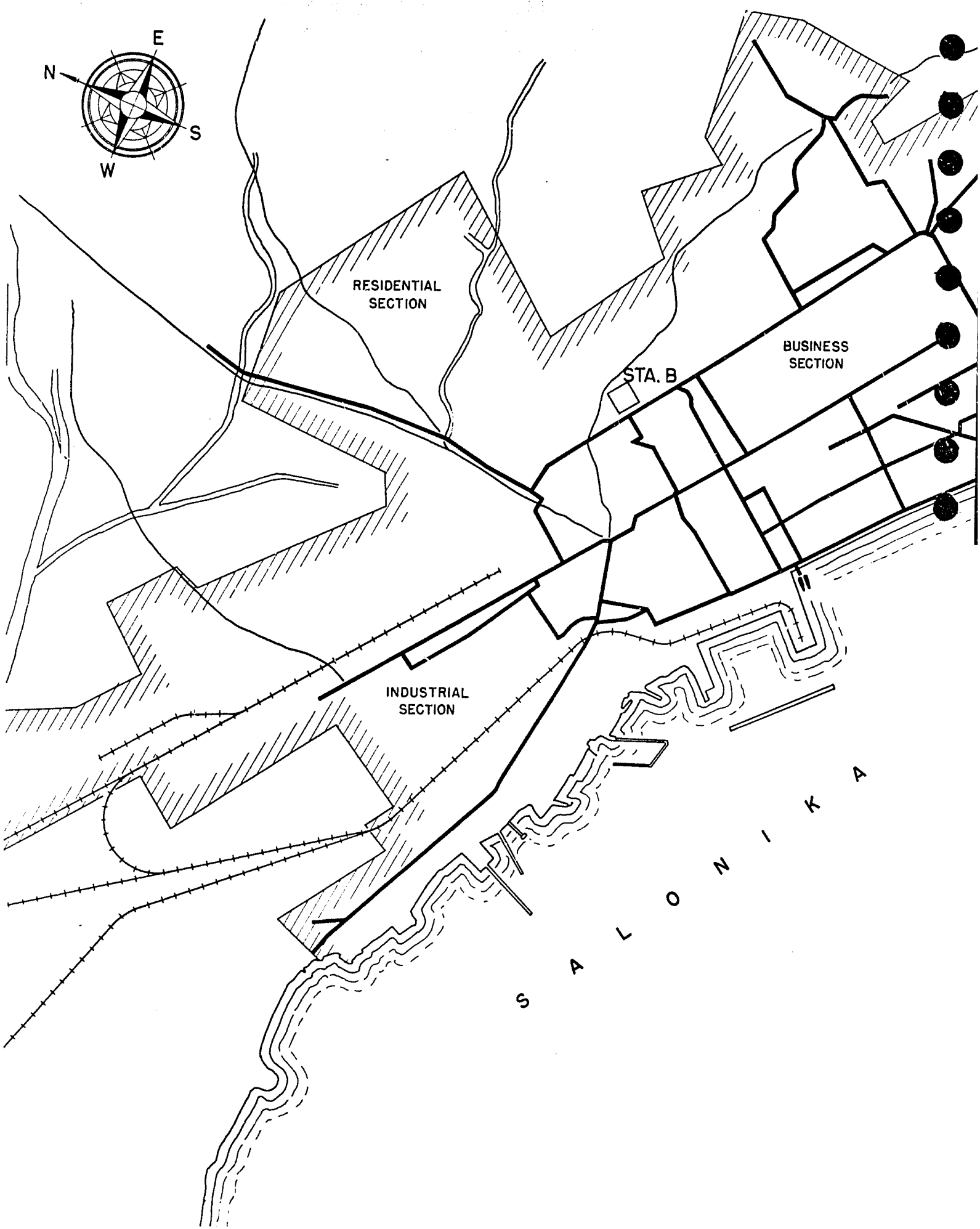
1 - Introduction

Salonika, second largest city in Greece, has a population of approximately 315,000 people, and is located on Salonika Bay in north-central Greece. Excellent harbor facilities are in operation. Rail connections are available to European countries and repair of the lines to Athens, capital of Greece, is being completed. Salonika serves as a distribution center for Northern Greece which is predominantly agricultural in its nature. However, there are industrial areas outside Salonika and certain areas in Salonika are referred to as Industrial Sections.

Electric service is provided by the Salonika Tramways and Electric Company whose direct-current distribution system covers the major portion of the area. However, in the Neapolis and Calamaria sections alternating-current service is provided by small privately owned operating companies, serving approximately 5100 customers, representing 20 per cent of all customers and 10 per cent of all energy sold. The Salonika Tramways and Electric Company is the major factor in the electric service field and discussions will deal only with that company.

Compagnie des Tramways et d'Eclairage Electrique de Salonikue was organized in 1892 under Turkish laws. Belgian financial interest acquired the property and franchise in 1929 and operated the tramway and electric systems until October 2 1940 when the property and franchises were acquired by the Greek government under agreement to pay 70,805,002 Belgian francs over a 31-year period, from 1940, in addition to a consideration for the net current position. Four semi-annual installments totalling 1,246,668 francs have been paid, leaving a debit balance of 69,558,334 francs of which 11,932,584 have matured and are unpaid as of December 31 1948.

The Company is controlled by a council of six members, appointed by the Greek Ministry of Transport with detail operation under the Director General.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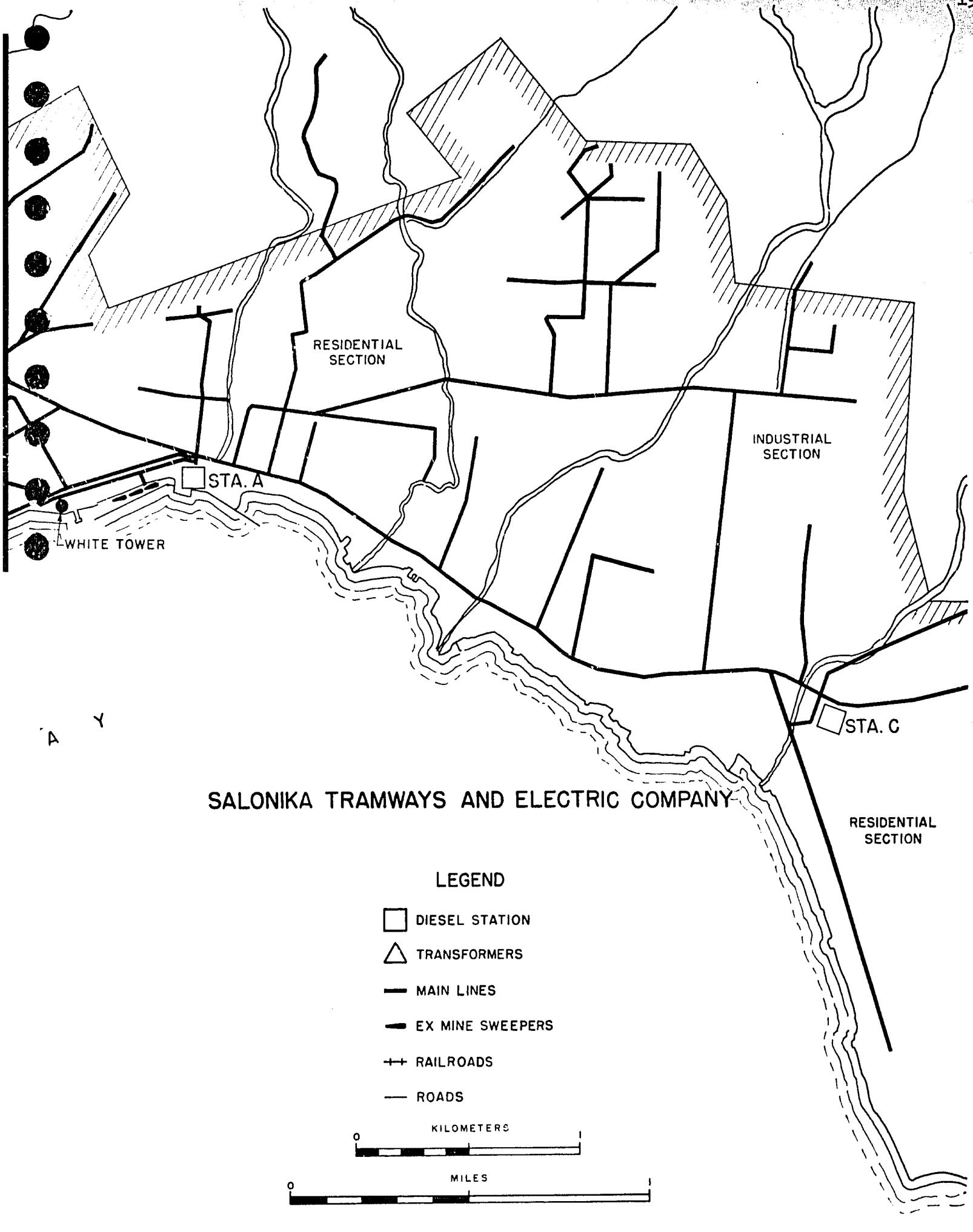


SALONIKA TRAMWAYS AND ELECTRIC COMPANY

The company operates an electric department consisting of three stationary and two floating Diesel-electric generating stations and associated distribution system. Generating capacity as of June 1949 is as shown below:

Stations	Total Capacity - Kw		
	Rated	Operating	Potential
Stationary	11,140	5,905	10,380
Floating	11,360	5,680	11,360
Total	22,500	11,585	21,740

Peak load for 1948 was 6500 kw. Gross generation was 20,705,000 kwh, 40 per cent of which was generated by the floating plants with a system load factor of 36 per cent.

The company operates a tramway department consisting of direct-current driven rolling stock, and tracks and trolleys to provide transportation in limited areas of Salonika. Energy for trolley operation is provided from the Diesel engine driven generating stations operated by the electric department. Detailed analysis of the functions and operations of the tramway department are not considered to be a part of this report.

B - FINANCIAL AND ACCOUNTING

1 - Financial Position December 31 1948

The financial records of the Company are closed on the basis of the fiscal year ending March 31. The accounting work in connection with the closing for the fiscal year ended March 31 1949 had not been completed at the time of the examination, therefore, this report covers the review of the financial position at December 31 1948 and the results of operations for the calendar years 1946, 1947 and 1948.

The financial position of the Company at December 31 1948, adjusted to reflect liability for Christmas bonus applicable to year 1948, is summarized as follows: *

	Drachmae		
Investment in electric and tramway plant		8,743,980,364	
Less - reserve for depreciation		762,000,000	7,981,980,364
Current assets - less current liabilities			3,431,994,606
Total			11,413,974,970
Less - property purchase obligations		7,929,650,076	
Less - amounts collected from customers for repayment of rehabilitation loan		2,942,913,624	10,872,563,700
Net Equity of Government			541,411,270
Represented by -			
Original Capital Contribution		864,580,056	
Advances from Government		3,144,000,000	
Total		4,008,580,056	
Less - Surplus (deficit)	1,559,768,163		
Less - Capital Adjustment	1,907,400,623	3,467,168,786	541,411,270

* Detail financial statements will be found in the Appendix.

In March 1947, the drachma liability under the long-term obligations due Compagnie des Tramways et d'Eclairage Electrique de Salonique, payable in Belgian francs, was restated on the basis of the exchange rate of 114 drachmae to the franc. The book value of utility plant account and the original capital contribution made by the Greek government to the enterprise was restated at the same time. The investment in utility

plant was revalued on the basis of the estimated depreciated cost of the property multiplied 37 times in conformity with the revaluation formula for limited liability companies authorized by the Greek government in 1946. The original capital contributed to the enterprise by the Greek government was also multiplied 37 times under this formula. The adjustment of the above accounts resulted in a net debit adjustment of drachmae 1,907,400,623 which is carried in capital adjustment account.

The summary of the financial position of the Salonika utility operations of the Greek government indicates a loss of drachmae 3,467,168,786 in the government's equity since the beginning of operations in 1940 after giving effect to liability for Christmas bonus applicable to year 1948 and after deduction of debit balance in capital adjustment account arising from revaluation of March 1947. A potential credit to the equity of the government is available in the amount of drachmae 2,942,913,624 collected from electric customers to cover repayment of rehabilitation loans. The Greek government has not indicated disposition of the credits arising from these collections.

2 - Operating Results 1946-1948

a - Electric and Tramway Operations

A summary of the results of electric and tramway operations for the years 1946, 1947 and 1948 is shown in the following tabulation:

	Drachmae		
	1948	1947	1946
Net Revenues from Operations - Before Provision for Depreciation - Electric	3,975,803,905	2,503,457,417	775,500,355
Tramway	(4,265,162,946)	(2,898,956,334)	(1,321,180,070)
Net Loss Before Depreciation	(289,359,041)	(395,498,917)	(545,679,715)
Provision for Depreciation	416,000,000	346,000,000	-
Net Loss After Provision for Depreciation	(705,359,041)	(741,498,917)	(545,679,715)

( ) indicates red figure

The review of the results of operations for the years 1946, 1947 and 1948 shows continuous and increasing losses from tramway operations which are offset in part by the increased net revenues from electric operations.

Operating results for the three-year period under review reflects the effect of inflation on operating costs, resulting in frequent sharp increases in wage rates and special allowances to employees to meet rising living costs as well as heavy increases in costs of fuel oil, lubricants, operating and maintenance materials, employees welfare and other costs.

The results of operations for the years 1947 and 1948, as shown in this report, reflect adjustments to charge operations of the year 1947 with retroactive wage increase and Christmas bonus applicable to that year, which were paid in 1948 and charged to 1948 operations, also to charge 1948 operating expenses with Christmas bonus for year 1948 paid in January 1949 and charged to expenses of the latter year.

Tramway operations for the three years 1946-1948, resulted in aggregate losses of drachmae 8,485,299,350 before provision for depreciation while net revenues from electric operations amounted to drachmae 7,254,761,677, resulting in net losses from both operations of drachmae 1,230,537,673 for the three-year period before provision for depreciation, and net losses of drachmae 1,992,537,673 for the period after provision for depreciation.

Losses from operations during the years 1946-1948 have been met by advances from the Greek government and from amounts collected from customers for the purpose of repayment of rehabilitation loans.

b - Electric Operations

The results of electric operations for the years 1946, 1947 and 1948 are summarized as follows:

	Drachmae		
	1948	1947	1946
Operating Revenues, Including Interdepartmental Transfers	14,276,875,398	8,882,308,597	4,030,316,674
Operating Expenses and Maintenance	10,301,071,493	6,378,851,180	3,254,816,319
% of Operating Revenues	72.14	71.8	80.8
Net Operating Revenues Before Provision for Depreciation	3,975,803,905	2,503,457,417	775,500,355

Net revenues from electric operations, before provision for depreciation of drachmae 3,975,843,905 for the year 1948 was equal to 59.3% of the gross book value of electric utility plant at December 31 1948.

Revenues from sales of electricity to the public, kilowatt-hour sales and customer statistics for the three-year period under review are summarized as follows:

	1948	1947	1946
Revenues from Sales of Electricity to the Public * - drachmae	13,258,498,539	8,336,073,766	3,775,668,398
Kilowatt-hour Sales	10,570,778	9,130,869	6,773,962
Average Revenue per Kilowatt-hour Sold - drachmae	1,254	913	557
Average Number of Customers for Year	20,543	19,895	19,371
Kilowatt-hour Sales per Average Customer	515	459	350

* Does not include energy sales to the Tramway Department.

Revenues from sales of electricity for 1948 increased drachmae 4,684,406,485 or 56 per cent over 1947. The increase in revenues from energy sales resulted from an increase of 15.8 per cent in kilowatt hours sales and 34.9 per cent in average rate per kilowatt-hour sold during the year. A total of 21,847 customers were being served as of December 31 1948, which represented a gain of 2655 customers or 13.8 per cent for the three-year period.

Electricity used in tramway operations is charged to this department on the basis of the regular commercial rates for comparable blocks of power.

Electric operating expenses for the years 1946, 1947 and 1948 are summarized as follows:

	Drachmae		
	1948	1947	1946
Production	7,085,987,379	4,317,351,909	2,344,005,650
Distribution	1,548,597,520	1,069,795,721	458,522,202
Customers' Accounting and Collecting	975,257,594	631,185,701	294,722,416
Administrative and General - Apportioned	691,229,000	360,517,849	157,566,051
Total	10,301,071,493	6,378,851,180	3,254,816,319

Electric operating expenses for 1948 increased drachmae 3,922,220,313 or 61.5 per cent over 1947. The increase in operating expenses for 1948 over 1947 was accounted for chiefly by increases in salaries and wages, employees welfare costs, and prices of fuel oil and lubricants.

The major elements of electric operating expenses for 1948 were as follows:

	Drachmae
Salaries and Wages	4,565,165,463
Holiday Bonus	441,836,750
Pensions and Other Employees Benefits	734,520,992
Total Employment Costs	5,741,523,205
Fuel Oil	2,881,602,710
Lubricants	732,558,299
Maintenance - Materials	439,755,880
Payroll Taxes - Apportioned	60,533,761
Uncollectible Accounts	45,422,294
Operating Supplies and Other Expenses	399,675,344
Total Electric Operating Expenses	10,301,071,493

Salaries and wages amounted to 44.3 per cent and total employment costs including holiday bonuses, pension and other employee welfare costs amounted to 55.7 per cent of total electric operating costs for 1948. Departmental operating costs include the various employee welfare costs which amounted to 25.8 per cent of direct payroll costs for the year 1948. This results in higher departmental operating expenses in comparison with other utilities as the usual practice is to charge employees welfare costs to general and administrative expenses.

A schedule of operating expenses, by departments is submitted in the financial statements included in this report.

c - Tramway Operations

A summary of the results of tramway operations for the years 1946-1948 is shown below:

	Drachmae		
	1948	1947	1946
Transportation Revenues	5,464,116,900	3,246,023,000	2,244,197,730
Operating and Maintenance Expenses	8,601,742,958	5,475,144,468	3,102,272,633
Taxes - Gross Receipts	867,316,006	515,237,631	356,218,516
Contributions to Public Welfare Funds	260,220,882	154,597,235	106,886,651
Total Operating Expenses and Taxes	9,729,279,846	6,144,979,334	3,565,377,800
Net Revenues from Operation Before Depreciation	(4,265,162,946)	(2,898,956,334)	(1,321,180,070)
% Operating Expenses and Taxes to Operating Revenues	179.3	189.3	158.9
Revenue Passengers Carried	19,057,598	19,221,889	15,638,060
Average Revenue Per Revenue Passenger Carried	287	169	144
Operating Expenses and Taxes Per Revenue Passenger Carried	511	320	228

( ) Indicates red figure

The above summary shows that the increase in tramway fares has not kept pace with the increase in operating costs resulting in increasing operating deficits for each successive year of the period.

As of December 31 1948, the regular adult fare in effect was 300 drachmae, which had been increased by successive stages of 50 drachmae each, from a fare of 100 drachmae as of the beginning of the year 1946.

A comparative statement of tramway operating results for the years 1946 to 1948 inclusive, is included among the financial statements submitted with this report.

Tramway operating expenses for the year 1948 are analyzed by the major elements of costs as shown below:

	Drachmae	
Salaries and Wages		5,355,861,732
Other Employment Costs		
Holiday Bonus	583,617,550	
Pensions	723,759,178	
Medical Aid	252,172,392	
Social Security	17,768,184	
Other Compensation	46,742,215	1,624,059,519
Total Employment Costs		6,979,921,251
Electric Power Purchased		959,321,445
Maintenance Materials		426,996,899
Stationery and Printing		69,967,493
Taxes - Included in General Management Expenses Apportioned		39,984,523
Other Expenses		125,551,347
Total		8,601,742,958

Direct salaries and wages amounted to 62.3 per cent and total employment costs amounted to 81.1 per cent of total operating expenses for the year. Total employment costs of drachmae 6,979,921,251 was equal to 129 per cent of total revenuew for the year. Electric power is transferred from the electric department to the tramway department at a special rate, page 82.

Taxes and other contributions to the Greek government included gross receipts tax equal to 20 per cent of gross revenues after deduction for contribution to pension and welfare funds and such gross receipts taxes. Contributions to the public pension and welfare funds are made on the basis of 3 per cent of gross revenues to each fund after deductions for such contributions and gross receipts taxes. Total taxes and other contributions to government for the year 1948 amounted to drachmae 1,167,501,411 and was equal to 21.4 per cent of operating revenues.

3 - Accounting

a - Organization and Procedures

Responsibility for the accounting records and procedures of the Company is divided between the chief accountant and the head of the

customers' service department, both of whom report direct to the director general. The chief accountant is responsible for the general accounting and payroll records and for the cash receipts and disbursements of both tramway and electric departments and exercises some degree of functional supervision over the accounting for warehouse materials and tramway revenues. The head of the customers' service department has supervision over customers' accounting and billing, applications and contracts for service and meter reading.

b - General Accounting

The general accounting records are handwritten and maintained in heavy bound volumes with transactions of one year recorded in a single volume. The only mechanical office equipment in use consists of an old-style manually-operated Monroe calculating machine and an old desk-type adding machine which are shared by the customers' accounting, cashiers and other departments.

All underlying records for revenues, payroll, warehouse, automobile accounting are closed as of the last day of the month. Monthly reports on results of operations are not available until six to eight weeks after the close of the month.

The general accounting department is furnished with monthly reports on payroll, warehouse receipts and issues, customers' billing and collections, tramway revenues, fuel consumption and other transactions from the various departments for entry in the general records. The chief accountant, with the assistance of four sub-accountants, maintain the general accounting records and prepare the monthly reports of operating results.

Payrolls are computed on a monthly basis, with advance payment of wages made on the 11th and 21st of the month with final amounts due paid on the first of the following month. Basic payroll data are assembled by departmental timekeepers and forwarded to the payroll department for preparation of payrolls. Authorization of employment and wage rates is approved by the director general and monthly payrolls are certified by the chief accountant and department heads and approved by the

Director General. Payroll records are maintained by four employees with part time assistance of other employees at closing time.

Stores accounting records are prepared in the warehouse. Requisitions on stores are required by company procedure to be signed by the director general but in practice only larger requisitions are signed by him with smaller items being signed for by foremen. The operation of the stores accounting system is inadequate in that physical inventories supervised by the chief accountant are not taken at regular intervals and adjustment made for variations from book inventory. The chief accounting officer should have more direct control over stores records and the taking of stores inventories.

General accounting, payroll and stores records appear to be economically operated and are adequate considering the methods employed with the exception of inadequate stores control. Better overall accounting control should result from the appointment of a chief accounting officer having supervision of all accounting records and procedures instead of the present dual accounting organization.

The introduction of more office equipment and the streamlining of certain general accounting methods should expedite the preparation of monthly reports but it is doubtful if any considerable reduction in personnel could be effected as the general accounting department appears to be doing an efficient job with the means available.

The classification of balance sheet items is not in sufficient detail to furnish adequate information in regard to the financial position of the Company. The entire investment in generating equipment is maintained in one sub-plant account, while the investment in distribution system is segregated on the basis of central system, laterals and high tension lines. Separate sub-plant accounts should be maintained for the investment in engines, generators, accessory electric equipment and miscellaneous power plant equipment while the investment in distribution system should be segregated by separate accounts for poles and fixtures, overhead conductor, underground conduit and conductor, line transformers, meters and street lighting system. Accounts receivable should be

segregated as to amounts due from customers for service, employees and others while the single account for all current liabilities should be subdivided to show separately, liabilities under accrued taxes, customers' deposits, accrued pensions and other employees' welfare expenses, advances from government and sundry creditors.

Electric operating expenses, are classified by three general groups: (1) production expenses (2) distribution expenses and (3) joint administrative expenses apportioned. A fourth group of operating expenses should be provided for all costs in connection with billing and accounting for electric revenues, contracts and applications for electric service, meter reading and collection of accounts in order to provide a better control over this group of operating costs, which are now being charged to distribution expenses.

Employees' welfare costs including pensions, holiday bonuses, medical and other employee benefits which account to approximately 25 per cent of direct payroll costs are charged to the various departmental operations. While this practice results in a more complete record of costs by departments it is contrary to the usual practice of electric utilities, which is to classify these expenses under the general and administrative group of expenses.

Monthly accruals are made for most of the major items of expenses with the exception that bonuses paid employees at Christmas and at Easter, equal to one and one-half months salary, are charged to operating expenses of the month in which payment is made. Monthly accruals should be made for these expenses in order to provide a better allocation of costs to periods.

The classification of production expenses appears to be adequate with the exception that the single account for station labor should be segregated to show (1) labor costs in connection with operation of engines including generators (2) electrical equipment and (3) miscellaneous station labor. Separate accounts should be provided for labor and materials in connection with maintenance of engines, generators, accessory electric equipment, miscellaneous power plant equipment and station structures.

The present classification of distribution costs does not provide sufficient information in regard to costs of operation of the distribution system. The accounts for salaries and labor include salaries and wages of employees engaged in accounting for and collection of revenues from electric service which should be classified under a separate group of expenses for customers' accounting and collecting expenses. Separate accounts should be provided for salaries and expenses of employees supervising the operation of the distribution system, maintenance of distribution system, maps and records, operation of overhead lines, operation of underground system, removing and resetting meters and of line transformers and operation of street lighting system. Distribution system maintenance should be segregated to show separately the salaries and expenses of maintenance supervisors and of labor, materials and other costs of maintenance of overhead system, underground system, line transformers, meters and street lighting system.

Salaries and expenses of general officers, medical staff, general accounting, secretarial, warehouse, purchasing and other employees, including pensions and other welfare costs applicable to such employees, legal expenses, contributions, operation and maintenance of general office building, and other expenses common to both tramway and electric operations are classified under general management and office expenses and apportioned monthly on the basis of 70 per cent to electric and 30 per cent to tramway department. The ratio of apportionment of these expenses to departments is approximately equal to a composite of the ratios of operating revenues, operating expenses and investment in plant and appears to be equitable.

c - Customers' Accounting and Collecting

The handling of customers' applications and contracts, meter reading, billing and accounting for revenues from electric service is performed by the customers' service department, the head of which reports to the Director General. Three subdivisions of this department are maintained for the billing and accounting, applications and contracts, and meter reading functions. The collection of accounts from

customers and the maintenance of records of amounts due from customers is handled by the customers' collections department which is under the supervision of the chief accountant.

The preparation of bills to customers, analysis of revenues and records of amounts due from customers is done entirely by hand. Addressograph equipment was acquired during 1948 but the use of these addressograph plates in the preparation of customers' bills was abandoned due to the large number of changes in addresses.

Collections of accounts from customers are slow and the large amount of delinquent accounts result in retarding the customers' accounting routine and increases the cost of handling customers' accounts.

A total of 83 persons are employed in connection with customers' accounts, on the basis of 21,847 customers served at December 31 1948, represents an average of 263 customers per customers' accounting employee. Customers' accounting expenses of drachmae 975,257,594 for the year 1948 was equal to drachmae 44,640 per average customer served as of the end of the year.

The costs of handling customers' accounts are much higher than such costs found for comparable Greek electric utilities.

Substantial economies may be realized in connection with the customers' accounting and collection functions of the Company. The use of mechanical billing equipment in connection with the preparation of bills to customers, revenue analysis and of customers' register sheets should result in a substantial reduction in personnel as compared to the number required by the present manual methods. Use should be made of the addressograph equipment owned by the Company in transcribing customers' name, address and serial number to customers' bills in place of the present practice of doing this by hand. Accounting routines could be improved and some records simplified or discontinued which should result in the further reduction in manhours required. A more vigorous collection policy should improve collections and reduce the amount of work in handling delinquent accounts.

The present personnel of the customers' accounting department and the estimated number of employees required to handle customers' accounts under mechanized methods is set forth below:

	Present	Proposed
General Supervision	2	1
Applications and Contracts	4	2
Billing and Accounting		
Supervision	1	1
Billing - Addressograph	27)	5
Accounting	)	4
Meter Reading		
Supervision	1	1
Meter Readers	15	11
Collections		
Supervision	1	1
Collectors	16	11
Office collections, control of collections, posting collections to customers' accounts, maintain public service accounts etc	16	7
Total	83	44

The number of employees required in the handling of customers' accounts after introduction of mechanical methods and simplification of present records and procedures should not exceed 44 and result in the reduction of 39 employees in this department. This reduction in personnel is estimated to result in annual savings in direct payroll of approximately drachmae 346,000,000 and total annual savings of approximately drachmae 445,000,000, after giving effect to the reduction in pensions, holiday bonuses and other employee welfare costs.

The reduction of customers' accounting employees to 44 would represent an average of 496 customers handled per employee based on number of customers served December 31 1948. One Greek electric utility serving fewer customers than Salonika was found to have one customers' accounting employee per 555 average customers while the Athens-Piraeus Company reported an average of 639 customers per customers' accounting employee.

C - GENERATING STATIONS

1 - Introduction

Three stationary Diesel-electric stations (A, B, C) and five ex-naval mine sweepers supply electric energy to the System of the Salonika Tramways and Electric Company. These stations have installed a total of 38 engine-generator units with a total nameplate rating of 22,500 kw. The units are of various ages (1914-1947), types and sizes. The condition of the equipment is from inoperative and not worthy of repair to fairly good.

In June 1949 there were 23 units operating with a total capability of 11,585 kw. This capability is only about one-half the total nameplate rating because:

a - Units were out of service due to breakdown and spare parts were not available for repair.

b - Output from operating units was decreased due to damage to superchargers or other mechanical failures.

The June status of all units is shown by the tabulation facing this page.

In general, there appears to be a serious lack of technical supervision which has resulted in (a) poorly designed installations, (b) improperly planned maintenance programs, and (c) operation of the stations as individual rather than closely coordinated units of the system.

It is evident that there is a tendency to use newly acquired units from the mine sweepers in lieu of properly utilizing existing equipment.

Operating expenses are high, due mostly to inefficient practices in operation and to the employment of excessive numbers of personnel.

2 - Generating Units

a - Station "A"

The original equipment in Station A was installed about 1912, and consisted of "A" frame-type air injection Diesel engines of

European manufacture. Later additions included a large low speed solid injection engine and two smaller European engines. In 1948, a Diesel-generator unit was removed from the mine sweeper "Gorgon," and installed at Station A as No. 9 unit. A second mine sweeper unit is being installed (Unit No. 10).

Engines No. 1, 4 and 6 are in fair condition and are suitable for continued operation. These units should be maintained and operated as required.

Engine No. 2 was removed before World War II.

Engine No. 3 is a heavy-duty machine of fairly advanced design, but out of service because the crankshaft is broken. It is understood that the management does not plan to repair this engine, although a new crank-throw is available for engine repair.

It is recommended that this unit be held in reserve and that repairs to the unit be made only in event it is necessary to increase the total station capacity due to load growth above the anticipated 8710-kw peak as shown on the tabulation facing page 34.

Engine No. 5 is damaged and disassembled and expensive parts are required to make it suitable for operation. Repair of this engine is not justified.

Engine No. 7 is a modern machine. The crankshaft is broken and the unit has been abandoned. Repair of this unit is not justified.

Engine No. 8 is a modern German engine in good condition, though small for use in this station. Its use, however, should be continued.

Engines No. 9 and 10 are modern marine Diesels which were removed from the mine sweepers. These engines are not economical to operate, and are not suitable for base load stationary service due to being designed for naval purposes where maximum power and minimum space and weight features were desired. Consequently, it is not recommended that more of these units be installed ashore.

All generators in Station A are direct-current machines.

b - Station "B"

The original equipment of Station B was installed about 1924 and consisted of three air injection Diesel engines built by the Carels Company of Ghent, Belgium. About 1931, a fourth engine, of the same make but of more advanced design, was installed. In 1947, three small, semi-portable, American engine-generator units were furnished by "UNRRA."

The design of Engines No. 1, 2 and 3 is obsolete but, considering their age and difficulties in obtaining repair parts, they have been maintained in exceptionally good condition. With replacement of a few parts, the units will be suitable for several years of additional service.

Engine No. 4 is a solid-injection engine, built in Belgium and with the exception of the cylinder heads and a few minor parts appears to be in good condition. Attempts to make new heads in Greece were unsuccessful. The engine is shut down, waiting delivery of parts from Belgium.

Engines No. 5, 6 and 7 are modern American Diesels, designed to operate with exhaust gas turbine-driven superchargers. These superchargers are delicate machines which require skilled maintenance and proper cooling. Two of the superchargers were wrecked and removed. Engines No. 6 and 7, which are now operating without the superchargers at reduced capacity, should be brought to full capacity by the addition of new superchargers. Engine No. 5 requires minor repairs. Adjustments which were being made at time of inspection will not be entirely satisfactory until minor repair parts are obtained.

Direct-current generators are coupled to Engines No. 1, 2, 3 and 4. Alternating-current generators, with mercury vapor rectifiers, are provided for Units No. 5, 6 and 7 and at the present time all power is distributed as direct current.

c - Station "C"

The original equipment of Station C was installed about 1914, and consisted of two German Diesel-generator units. In 1947 two

modern American engines were installed and in 1948 a unit was removed from the mine sweeper and installed ashore. Installation of a second mine sweeper unit is now underway.

Engine No. 1 is an obsolete machine in poor working condition. It is understood that this unit is operated when required and can be maintained in operating condition for standby duty.

Engine No. 2 is similar to No. 1 but is not worth the cost of repairs.

Engines No. 3 and 4 are modern American machines designed to operate with superchargers. These engines were poorly installed and have been poorly maintained. The units are now operating at reduced capacities as the superchargers have been wrecked and removed. It is recommended that new superchargers be installed.

Engines No. 5 and 6 are marine Diesels, removed from naval vessels and are similar to No. 9 and 10 of Station A. The engines were not designed for base load stationary service and therefore are not economical in their operation.

With exception of No. 3 and 4, all generators are direct-current machines. No. 3 and 4 are alternating-current generators, rated 400 volts, 3 phase, 50 cycles. Mercury vapor rectifiers are provided for connection to the direct-current distribution system; however, some power is distributed as alternating current.

d - Floating Stations

Five ex-naval mine sweepers are used to supplement the three stationary Diesel-electric stations. These vessels were built about 1943, for the United States Navy, were transferred to the British Navy who in turn transferred them to the Greek Navy. They are known by the English names: "Combattant," "Jasper," "Florized," "Steadfast" and "Gorgon." Three were received in 1947 and two in 1948. Three of the vessels are moored near Station A; the other two are at a pier near the center of the city.

Each vessel has four main Diesel-generator units to furnish power to direct-current propulsion motors. Two of the main direct-current engine-generator units have been removed from the "Steadfast" and two from the "Gorgon," for installation in shore Stations A and C. Although it is understood that the management plans to remove two units from each of the other three vessels for installation in stationary plants, it is not recommended that additional units be removed in view of their unsuitability for shore installations. In addition, the capacity will not be required when repairs are made to existing shore equipment.

The combined rated capacity of the 16 units aboard the vessels is 11,360 kw. Shore connections are arranged to carry the capacity of eight generators only, two on each of four vessels. Consequently, the present usable capacity is that of eight units, or 5680 kw. This capacity will not be required when repairs are made to shore equipment and elimination of vessels is recommended.

3 - Cooling Systems

The engines in the three stationary generating stations are cooled by open evaporative systems, consisting of cooling towers and spray ponds. Water from the engines is cooled in the towers or spray ponds and returned to the engines. Evaporation, wind loss and leakage are replaced by untreated makeup obtained from the city water system.

Analysis of the water being used indicated a hardness of 260 parts per million and, when concentrated by evaporation, results in heavy scale deposits on heat transfer surfaces of the engines. As a consequence, there have been frequent failures in the newer high speed engines where heat transfer rates are high, and excessive maintenance problems on all engines.

Although closed circuit cooling systems using soft clean water should have been provided originally, it is not considered that installation of this equipment for all engines is justified in view of the fact that the use of the stations will soon be reduced or discontinued when the proposed power system is placed in operation. However, it is

recommended that all makeup water be treated. The most practical solution is to install water softeners at each station with meters and test equipment to insure proper operations. This equipment is simple to operate and operators can be easily trained in its use.

The new Buckeye engines (No. 5, 6 and 7) at Station B and the Worthington engines (No. 3 and 4) at Station C were originally provided with closed circuit cooling systems but these systems were soon rendered inoperative through use of untreated water. These five engines should have their cooling systems reconditioned and restored to closed circuit operation using treated water.

The General Motors engines removed from the mine sweepers and installed in Stations A and C were provided with closed circuit cooling systems, but they have been installed so as to utilize the open station system for cooling purposes. These engines should be restored to closed circuit cooling system operation using treated water.

The engines aboard the mine sweepers are cooled by their original marine-type closed cooling systems.

Cooling towers are in poor condition and spray ponds are poorly designed. These factors result in excessive loss of water. In order to reduce water consumption rate by approximately 40 per cent and improve engine operating temperatures, it is recommended that towers be repaired, spray ponds rearranged, with part of the warm water to the cooling tower bypassed in order to raise the temperature of inlet water to the engines.

4 - Fuel Oil

The fuel oil used in these stations is of a very high grade. A lower grade, costing 18 per cent less, could have been used in all of the older slow speed engines; however, use of the lower grade fuel is not recommended as additional equipment would be required which cannot now be justified.

Fuel is delivered by tank truck to small storage tanks at the shore stations. From the storage tanks, the oil is pumped to elevated "day" tanks and is fed by gravity to the engines. This syste was common

practice at the time the original air injection engines were installed, but the injection systems of the newer engines were not designed for gravity feed. The use of this arrangement should be discontinued as possibility of serious damage and interference with the proper functioning of the newer engines is introduced.

Although the type of fuel used should carry little or no impurities, the worn condition of engine fuel equipment indicates that filters or centrifugal purifiers should have been used and, as a result, it is recommended that suitable filtering and purification equipment be provided.

5 - Lubricating Oil

The lubricating oil used is imported and distributed in drums without trade names or other markings to indicate the grade or purpose for which the oil is intended. Drums with two different markings were being used in similar engines. The oil in one drum was classes as "a medium quality Diesel-engine oil" and the other was a " medium grade automobile oil." Both were of too high viscosity for the engines in which they were used, but it is possible that other characteristics of these oils were satisfactory. The drums should be clearly marked to indicate grade and use.

With exception of some cartridge-type filters furnished with the newer engines and two small bag filters which are inadequate, lubricating oil purification equipment was not provided.

Lack of adequate lubricating oil purification equipment, together with the use of unsuitable oil, contributes to rapid wear of the engines and excessive oil consumption. It is therefore recommended that suitable lubrication oil be supplied and adequate purification equipment be installed.

6 - Auxiliary Equipment

Air intake filters are not provided, with the exception of a few for the newer engines. Consequently, atmospheric dust has been drawn into the cylinders, with resulting rapid engine wear. It is recommended that air intake filters be provided for all engines.

At Stations A and C exhaust pipes of the newer engines were installed without expansion joints to relieve the engine manifold and superchargers from vibration and thermal expansion stresses. Flexible metal hoses provided for this purpose were installed in the muffler tail pipes where they served no useful purpose. It is recommended that suitable connection be made to prevent pipe breakage.

At Station B, expansion joints were provided for supercharger exhausts but the piping connections were so designed and arranged that the superchargers were not properly protected. The arrangement and size of exhaust pipes result in excessive back pressure, and piping arrangements should be improved. Concrete pits are used for mufflers, and one pit serves as a common muffler for three engines. This obsolete and hazardous practice should be discontinued.

The only mechanical instruments in use were those for the newer engines and air pressure gages on the older machines. Many of the thermometers and gages were damaged. Adequate and accurate instruments are essential to efficient and safe operation. Procurement and installation of adequate instruments are recommended.

7 - Output and Loads

The three stationary stations and five floating vessels (ex-mine sweepers), produced a gross total of 20,705,000 kwh during the year. 1948. Station service power was 4-1/2 per cent of the gross, leaving a net system output of 19,780,000 kwh. Of the gross generation, approximately 5 per cent was produced by Station A, 36 per cent by Station B, 19 per cent by Station C and 40 per cent by the five mine sweepers. Chart 1 shows monthly production for each stationary plant and for the floating plants as a group. The greatest production occurred in December with monthly production in June and July being only about 51 per cent of that for December.

Typical system load curves, for summer and winter, are shown on Chart 2. Included are a typical summer day (June 16 1948) and a typical winter day (December 2 1948) load curves. It is understood

that the typical summer peak load was 4500 kw and that the maximum recorded peak load of 6500 kw was in the winter. Consequently the generating capacity requirements should be considered in relation to this peak demand of 6500 kw.

Maximum peak loads occur in the evening after twilight and daytime peak loads occur in midmorning which are 60 to 80 per cent of evening peaks. The load curve for December 2 1948 taken for analysis of operations is representative of typical winter conditions when maximum generating capacity is required. Actual distribution of load between stations for December 2 is shown on Chart 3. Load curves for each of the three stationary stations, for this same day, are shown on Charts 4, 5 and 6 and Chart 7 shows a similar curve for the floating stations. These charts also show monthly gross production of the stations for the year 1948.

The curves indicate that none of the stations were operating at loads that approached capacity. Station A with an actual capacity of 2115 kw and a potential capacity of 4555 kw carried a peak load of slightly over 800 kw and all generating units were out of service for about nine hours. During the month of August this station produced no energy. The mine sweepers also operated at a low load factor and a very low capacity factor. Load factors at Stations B and C were higher, but both could have carried more load.

Total generating capacity available in 1948 to carry these loads was approximately 10,000 kw including the approximate 4500-kw capacity of the shore stations. The load curve shown on Chart 3 indicates that it would have been possible to eliminate all but one of the mine sweepers and that it would need to be operated for one shift only. During the summer of 1948 the shore stations could have carried all loads and, if the units that were already installed in shore stations in 1948 had been repaired, the mine sweepers would have been unnecessary. It is appreciated that repair parts were not available in 1947-48 for repair of the older engines; however, the claim that it was more economical to install available marine engines in the shore stations rather

than repair existing engines is subject to serious question. If the claim is accepted, then it would seem that the marine units should have been removed when the first vessels were received in 1947. Considering the equipment installed ashore, continued operation of the mine sweepers is not required for present and anticipated load during the period of changeover to alternating-current distribution and receipt of energy from the Interconnected System. Elimination of the vessels and their operating personnel is recommended.

A possible load distribution for the three shore stations to carry all load is illustrated by Chart 8.

8 - Personnel

Labor, for operation and maintenance, represents the largest item of expense in operation of the stations. A total of 278 men are employed and the total payroll expense for 1948 was more than three billion drachmae which included charges for mutual aid fund, pensions, social security, holiday bonuses accidents and extra compensation. Although accounting records indicate that 93 per cent of labor costs are charged to operation and remainder to maintenance, job assignments and observation of plant work indicate that about 70 per cent of manhours should be charged to operation and 30 per cent to maintenance.

In Station A, 113 men are employed of the 278 total although this station has the lowest production. Load conditions at Station A, as shown on Chart 4, should require operation of one engine-generator unit for 17 hours and a second unit for about 9 hours a day. For the remainder of the day all generating equipment would be idle. Such a condition did exist in the winter of 1948 when the load was greatest. In summer less operation is required and records indicate that in August 1948 the station produced no power. Operating under these conditions it would seem that operating and maintenance crews of Station A need be little more than a "skeleton" force. Considering the fact, however, that Station A is the dispatching center of the system and that the supervision and shops of this station also serve the floating stations, it is estimated that no more than 29 men should have been required

for supervision, switchboard operation, peak load and standby operation of generating units, maintenance and gate watchmen during 1948.

In Station B, 80 men are employed which is about double the number that can be efficiently employed. It appears that separate groups of operators and maintenance men are assigned to the Carels engines (No. 1 to 4 inclusive) and to the Buckeye engines (No. 4, 5 and 6), resulting in considerable duplication of personnel. It is also understood that operating personnel assist in maintenance and that mechanics, electricians and helpers substitute for operators when the regular men are on vacation. Consequently it is difficult to determine the exact number that should be charged to each function, but operation and maintenance assignments are approximately as follows:

	Station B Operating Staff			
Shifts	11 PM to 7 AM	7 AM to 3 PM	3 PM to 11 PM	Relief
Generating Units Required	2	3 to 4	3 to 5	-
Chiefs of Watch	1	1	1	1
Switchboard Operators	2	2	2	2
Engine Operators	4	6	6	4
Oilers & Pump Operators	4	5	5	4
Totals per Watch	11	14	14	11
Total Shift Assignments		50 men		
Superintendent		1		
Watchmen and Guards		9		
Clerks and Storekeeper		3		
Employee in Army		1		
Total Operation			64 men	
Maintenance Mechanics		3		
Machinists and Blacksmith		3		
Maintenance Electricians		2		
Helpers and Apprentices		8		
Total Maintenance			16 men	
Total Employees, Station B			80 men	

For the early morning and day watches, average load conditions at Station B require operation of only two engine-generator units and maximum loads require no more than three. It is appreciated that, in their present condition, two of the Buckeye engines can carry little

more than half rated load, but the arrangement of these engines is such that one man can operate all three. The Carels engines No. 1, 2 and 3 require more attention but one man for each engine in operation (including the chief of watch) should be adequate. Pumps and other auxiliary equipment do not require the attention of an additional man. On this basis, the crew for each of these two shifts should consist of: a chief of watch, a switchboard operator, two engine operators and one oiler or helper. This makes a total of five men.

For the evening peak loads, from 5 PM to 9 PM, four or five units should be operated, requiring two additional operators or helpers or a total of seven men for this shift. Five men will be required for the relief of the shift operators.

Four gate watchmen including one relief man should be adequate. If additional guards are required for military or political reasons, they should not be charged to plant operating costs. One clerk, a storekeeper, and the plant superintendent will result in a total of 29 men chargeable to operation.

It is understood that a former employee now in the army is paid by the Company and charged to station costs. If such payment is required, it should be considered as general expense and should not be charged to the operation of the station.

Maintenance personnel should consist of the foreman, two mechanics, an electrician, a machinist, a blacksmith or welder and four helpers. This results in a total of 39 men for operation and maintenance of the station under present load conditions.

At Station C, 23 men are employed. Considering the type of equipment and loads, this plant can be operated by three men per shift with a fourth man on the evening shift. With relief operators, maintenance mechanics and the superintendent, the total should not exceed 17 men. Because of the location of the station in the yard of the street railway shop, no guards or watchmen are required.

At the five "floating" stations 62 men are employed on operation and maintenance. During the winter load conditions two generators in each of three vessels were operated two shifts each day. Two units in a fourth vessel were operated during the evening peak load only.

Assuming that it was necessary for the floating stations to carry the total load shown on Chart 7, it would have been necessary to operate only three vessels (six units) during the evening peak and only three generator units, on two of the vessels during the day. This schedule would have required an operating and maintenance personnel of not more than 42 men.

The total number of personnel believed to have been necessary for operating the three stationary and five floating stations in 1948 is 126 employees. This number when compared with the 278 employees on the payroll in 1948 indicates considerable overstaffing.

9 - Maintenance

During inspection of Station A, a number of mechanics were employed in the installation of a Diesel-generator unit which had been removed from the floating stations, but no important maintenance work appeared to be in progress. In view of the light duty on the equipment at this station, little maintenance work should be required.

In Station B routine clearing and adjustment of pistons connecting rod bearings and cylinder liners was in progress. The machine shop was occupied in repair and manufacture of minor parts for the older engines. The shop was well equipped and the work was well directed and executed. There were, however, considerably more men available and assigned to the work than could be efficiently employed.

In Station C a number of men were installing a Diesel-generator unit which had been removed from the floating stations and routine maintenance was in progress. An excessive number of men were assigned to the job and the quality of work was not as good as at Station B.

No important maintenance work was in progress in the floating stations.

Exact maintenance labor costs could not be determined because of the apparent practice of charging the salaries of most maintenance employees to operation. It is estimated, however, that 84 of the 278 employees of the stations are actually assigned to maintenance of buildings, engines, auxiliaries and electrical equipment.

Early failures of superchargers and other parts of the new engines can to a large extent be traced to lack of experience of operating and maintenance personnel. The men were unfamiliar with the new units, but apparently were competent to repair the older engines. Experience has been gained through a series of costly failures and the personnel at Station B appear to be competent to maintain the new machines.

The engines are of foreign manufacture and replacement parts must be imported. Procurement of these materials has been seriously delayed by the complications encountered in foreign trade. The maintenance problems have been made difficult by the lack of repair parts. Insofar as possible, parts are made or repaired in the station shop. Some larger parts have been procured from local foundries and machine shops, but results were unsatisfactory.

The mine sweeper engines and the new engines at Stations B and C were provided with a large stock of replacement parts when received. The stock is now being exhausted and is not being replaced.

10 - Station Service

Energy required for auxiliary equipment and other uses at Station A was 11.4 per cent of gross generation, mostly due to low load factor operation. In the floating stations it was 7 per cent due to low load factor operation and the number of auxiliary loads inherent in operation of vessels. Improvements resulting in additions to auxiliary equipment of Station A would increase station service loads, but operation at higher load factor resulting from elimination of floating stations would result in a decrease in the percentage of auxiliary power consumption related to total generation and would compare with the percentages secured in Stations B and C, which are 2.3 and 1.4 respectively and considered normal for these stations.

11 - Operating Expenses

Operating expenses include fuel, lubricating oil, personnel for operation and maintenance, cooling water, miscellaneous supplies and power consumed for station service.

a - Fuel

The fuel price to the Company in 1948 varied from 390,000 to 525,000 drachmae per metric ton. The average was 452,000 drachmae. The price in March 1949 was 550,000 drachmae, or $7.30 per U S barrel, at an exchange rate of 10,000 drachmae per dollar. The percentage breakdown of the March 1949 price is approximately as follows: 56-1/2 for cif cost, 9 for delivery from ship to generating stations, 25 for obvious taxes, and remaining 9-1/2 for hidden taxes and other artificial costs.

Average 1948 fuel consumption was 307 grams, or about 12,900 Btu per gross kilowatt-hour. Consumption and heat rates of the individual stations in 1948 were:

	Grams/gross kwh	Btu/gross kwh
Station A	368	15,800
Station B	264	11,300
Station C	278	11,900
Floating Stations	356	15,200
Averages	307	12,900

Considering the type of engines operated at Station B, the above performance is exceptionally good. Engines operated at Station C should have had a slightly better performance, but with the marine engines installed, no future improvement should be expected in the average for this station. The very poor economy of Station A and the floating stations is obviously due to poor operating load factor.

Fuel consumption can be reduced by elimination of the mine sweepers, by reduction in station service requirements, by operation at higher load factor and by repairing existing engines. The elimination of the mine sweepers will automatically reduce total station service requirements and increase the load factor of the three shore stations. Repair of the superchargers of four engines will improve load factors and will materially increase the fuel economy of these units.

b - Lubricating Oil

Lubricating oil prices varied during 1948, but the average was 3800 drachmae per kilogram. The oil was procured through government

channels and analysis of the price paid is more difficult to make than for fuel oil. However, on basis of New York prices for March 1949, it is estimated that a lubricant of suitable grade, free of import taxes, could be delivered to the Salonika stations for 2100 drachmae per kilogram. From this it is apparent that taxes and other artificial costs were in excess of 47 per cent of the amount actually paid for the lubricating oil.

More important than the high cost per kilogram is the excessive consumption of lubricating oil. The average was 9.3 grams per gross kilowatt-hour produced in 1948. Consumptions of individual stations were:

	Grams/gross kwh	Kwh/gallon
Station A	13.4	254
Station B	7.1	478
Station C	4.8	708
Floating Stations	13.0	262
Averages	9.3	366

Oil consumption in the different types of engines vary widely and a direct comparison of stations is not practical. As an average for the equipment of all stations a consumption of 4.6 grams per kilowatt-hour, or a production of approximately 750 kilowatt-hours per gallon should be expected.

To reduce lubricating oil consumption, it will be necessary to use suitable oil, purification equipment and tests to determine when used oil should be discarded.

Improved operating load factor and the repair of supercharging equipment will result in lower lubricating oil consumption per unit generated, due primarily to the fact that lubricating oil consumption is more nearly proportional to engine hours than to load.

c - Personnel

Under present summer load conditions, units now in operation in shore stations are adequate. By the time loads increase, the

third and fourth ex-mine sweeper units should be in operation in Stations A and C and the floating stations will not be required. Consequently, the total number of employees can be reduced to 99 or 36 per cent of the present number.

For comparison with present practice, it is proposed that the following assignments of personnel be made at Station B:

Operation	Proposed Station B Personnel			
Shifts	11 PM to 7 AM	7 AM to 3 PM	3 PM to 11 PM	Relief
Units in Operation	2	4 or 5	5 or 6	-
Chief of Watch	1	1	1	1
Switchboard Operator	1	1	1	1
Engine Operators	2	3	4	3
Oilers	1	2	2	2
Totals	5	7	8	7
Total Shift Assignments		27 men		
Station Superintendent		1		
Clerk and Storekeeper		1		
Watchmen (incl relief)		4		
Total Operation			33 men	
Maintenance				
Chief Mechanic		1		
First Class Mechanics		3		
Electrician		1		
Machinist and Blacksmith		2		
Helpers and Apprentices		4		
Total Maintenance			11 men	
Total Personnel, Station B			44 men	

This is an increase of five men, as compared with the number estimated to be required under present load conditions, but is 36 less than are actually employed.

On the same basis, it is estimated that Stations A and C will require not more than 35 and 18 men respectively. With two supervisory employees, the total will be:

Station A	35 men
Station B	44
Station C	18
Supervisory	2
Total	99 men

Most of the employees not required would be in the lower salary grades and it would be desirable to offer higher salaries to the permanent personnel to attract better class of workmen to these positions. Consequently, it is not expected that total payroll expense could be reduced in direct proportion to number of employees. In consideration of these factors, it is estimated that the payroll, with incidental payroll expenses, would be 1,260,000,000 drachmae per year or 41 per cent of the 1948 costs. This estimate is based on the assumption that general wage levels will be the same as the average for 1948. This condition will probably not exist but the assumption provides a basis for making comparisons.

d - Maintenance

Proper repair of existing engines will be expensive, but will result in economies of operation. The necessary work can be done, with a reduction of 70 per cent in the number of maintenance employees.

If engines are properly maintained, an increase in the apparent expenditures for repair parts should be expected. Repair materials and tools for auxiliary and electrical equipment and building maintenance are estimated at a cost of 4500 drachmae per rated kilowatt per year of main units in operation. If it is considered that the larger Carels engines of Station A and one of the Sulzer engines of that station will not be required, the total capacity to be maintained will be 8710 kw. At 4500 drachmae per kilowatt, the estimated annual repair material cost would be 389,000,000 drachmae. This amount will not provide for existing "deferred maintenance," but should be adequate as an average, spread over a period of time equal to the average life of the equipment.

e - Miscellaneous

Water consumption in 1948 was about 40 per cent in excess of the amount that should be expected with existing types of cooling systems, due to the design and condition of the cooling systems, the tendency to overcool the engines, hardness of the water and lack of adequate water treatment. Water consumption can be reduced by repairing facilities, revising operating methods and by using treated water.

Other miscellaneous costs for all stations were 26 drachmae per kilowatt-hour and were highest in Station A and the floating stations. In Stations B and C these costs averaged 1.3 drachmae per kilowatt-hour. A detailed analysis of miscellaneous costs was not made, but for Stations B and C they do not appear to be unreasonable in view of operating conditions. With improved load factor operation, miscellaneous costs, other than water, should be reduced to about one drachma per kilowatt-hour.

f - Estimated Economies

Tables have been prepared to show comparisons of 1948 actual operating expenses and estimated operating expenses for 1948 set forth in the preceding pages of this report. To make the estimated expenses reasonably comparable with actual costs for the year 1948, it has been assumed that net production in kilowatt-hours is the same and that wage levels, fuel, water and miscellaneous material prices are the same as the 1948 average, with lubricating oil and repair materials priced at March 1949 levels. On this basis the estimated annual operating expenses are 4,694,400,000 drachmae or 237 drachmae per net kilowatt-hour. This is about 34 per cent less than the actual 1948 expenses. Details of the estimates of the individual stations are shown on Tables I, II, III and IV, pages 54 - 57, together with actual costs. Table V, page 58, lists the totals for all stations.

12 - Costs

It has been recommended that the equipment in Stations A, B and C be repaired and restored to first-class condition to improve the reliability of performance and to decrease the costs of operation. Many of the units are in fair operating condition and only normal maintenance is required. The costs of normal maintenance are provided for by the rate formulae in use, and therefore it is assured that sufficient money is available to provide normal maintenance.

The availability of generating units in the floating stations that are in good operating condition and have a supply of spare parts

available has to a certain extent in the past solved the difficulties of securing repair parts for the stationary units; therefore, there are units in Stations A, B and C that are in need of major repairs before they can be considered as efficient base load units.

It is estimated that $30,000 will be required for maintenance of equipment that is considered to be greater than so-called normal maintenance. The estimate is not in detail as it must be checked carefully before the program is undertaken and includes only the necessary expense to (a) correct poor layout and installation of equipment, (b) provide instruments, (c) repair and correct water cooling systems, (d) provide water softening apparatus, and (e) purchase superchargers for modern engines that are operating without superchargers. The repairs to Unit No. 3 in Station A should be deferred until it is evident that the capacity of the unit will be needed to carry the system peak load. It is not evident at this time that the unit will be needed.

The costs of the step-up transformers and switching rearrangements in Stations B and C have been included in the costs of establishing 2400 kw of alternating-current distribution as outlined in Section D.

TABLE I
SALONIKA STATION "A"
1948 ACTUAL OPERATING EXPENSES
COMPARED WITH
ESTIMATED EXPENSES UNDER RECOMMENDED CONDITIONS

	Actual	Estimated
Gross Generation, kwh	994,977	5,660,000
Station Service	11.4%	3%
Net Generation, kwh	881,901	5,490,000
Fuel Oil, grams/gross kwh	368	300
Fuel Oil, Metric Tons	366	1,700
Fuel Oil Cost, Drachma/Ton	456,000	452,000
Lubricating Oil, grams/gross kwh	13.4	6.5
Lubricating Oil, Kilograms	13,309	36,800
Lubricating Oil Cost, Drachma/Kg	4,710	4,500
Operating and Maintenance Labor, Men	113	35
Annual Costs, Thousands of Drachmae		
Fuel	166,480	768,000
Lubricating Oil	62,723	165,500
Operating Labor	1,023,020*	356,000
Maintenance Labor	36,908*	103,000
Maintenance Materials and Tools	50,231	127,000
Water, Treatment and Misc Supplies	17,006	21,700
Total, thousands drachmae per year	1,356,368	1,541,200
Per Kilowatt-Hour (gross), Drachmae:		
Fuel	168	136
Lubricating Oil	63	29
Operating Labor	1,028**	63
Maintenance Labor	37**	18
Maintenance Material	50	22
Water and Miscellaneous	17	4
Per gross kwh	1,364 drachmae	1 272 drachmae
Per net kwh	1,538 drachmae	281 drachmae

* These labor costs are from accounting records and include taxes, bonuses etc.

** Plant records indicate that about 40% of personnel are assigned to maintenance. On this basis, operating labor should have been 639 drachmae and maintenance labor 426 drachmae per kwh.

TABLE II
SALONIKA STATION "B"
1948 ACTUAL OPERATING EXPENSES
COMPARED WITH
ESTIMATED EXPENSES UNDER RECOMMENDED CONDITIONS

	Actual	Estimated
Gross Generation, kwh	7,413,973	9,270,000
Station Service	2.3%	2.3%
Net Generation, kwh	7,244,558	9,055,000
Fuel Oil, grams/gross kwh	264	265
Fuel Oil, Metric Tons	1,932	2,460
Fuel Oil Cost, Drachma/Ton	445,000	452,000
Lubricating Oil, grams/gross kwh	7.1	4
Lubricating Oil, Kilograms	51,079	37,100
Lubricating Oil Cost, Drachma/Kg	3,570	4,500
Operating and Maintenance Labor, Men	80	44
Annual Costs, Thousands of Drachmae		
Fuel Oil	859,768	1,110,000
Lubricating Oil	182,429	167,000
Operating Labor	801,079*	438,000
Maintenance Labor	93,892*	142,000
Maintenance Materials and Tools	217,188	133,000
Water, Treatment and Misc Supplies	30,530	36,200
Total, thousands drachmae per year	2,184,886	2,026,200
Per Kilowatt-Hour (gross), Drachmae:		
Fuel	117	120
Lubricating Oil	25	18
Operating Labor	109**	47
Maintenance Labor	13**	15
Maintenance Materials and Tools	30	14
Water and Miscellaneous	4	4
Per gross kwh	298 drachmae	218 drachmae
Per net kwh	302 drachmae	224 drachmae

* These labor costs are from accounting records and include taxes, bonuses etc.

** Plant records indicate that about 20% of personnel are assigned to maintenance. On this basis, operating labor should have been 97 drachmae and maintenance labor 24 drachmae per kwh.

TABLE III
SALONIKA STATION "C"
1948 ACTUAL OPERATING EXPENSES
COMPARED WITH
ESTIMATED EXPENSES UNDER RECOMMENDED CONDITIONS

	Actual	Estimated
Gross Generation, kwh	3,962,680	5,310,000
Station Service	1.4%	1.4%
Net Generation, kwh	3,906,065	5,235,000
Fuel Oil, grams/gross kwh	278	278
Fuel Oil, Metric Tons	1,105	1,475
Fuel Oil Cost, Drachma/Ton	502,000	452,000
Lubricating Oil, grams/gross kwh	4.8	3.8
Lubricating Oil, Kilograms	19,267	19,650
Lubricating Oil Cost, Drachma/Kg	3,670	4,500
Operating and Maintenance Labor, Men	23	18
Annual Costs, Thousands of Drachmae		
Fuel Oil	506,751	667,000
Lubricating Oil	70,461	88,500
Operating Labor	283,394*	170,000
Maintenance Labor	27,288*	51,500
Maintenance Materials and Tools	14,458	129,300
Water, Treatment and Misc Supplies	17,646	20,700
Total, thousands drachmae per year	919,998	1,127,000
Per Kilowatt-Hour (gross), Drachmae:		
Fuel	128	125
Lubricating Oil	18	17
Operating Labor	72**	32
Maintenance Labor	7**	10
Maintenance Material	4	24
Water and Miscellaneous	4	4
Per gross kwh	233 drachmae	212 drachmae
Per net kwh	236 drachmae	215 drachmae

* These labor costs are from accounting records and indicate taxes, bonuses etc.

** Plant records indicate that about 30% of personnel are assigned to maintenance. On this basis, operating labor should have been 55 drachmae and maintenance labor 24 drachmae per kwh.

TABLE IV
SALONIKA FLOATING GENERATING STATIONS (5 EX-MINE SWEEPERS)
1948 ACTUAL OPERATING EXPENSES
COMPARED WITH
ESTIMATED EXPENSES UNDER RECOMMENDED CONDITIONS

	Actual	Estimated
Gross Generation, kwh	8,333,702	*
Station Service	7%	
Net Generation, kwh	7,747,535	
Fuel Oil, grams/gross kwh	356	
Fuel Oil, Metric Tons	2,968	
Fuel Oil Cost, Drachma/Ton	454,000	
Lubricating Oil, grams/gross kwh	13.0	
Lubricating Oil, Kilograms	108,819	
Lubricating Oil Cost, Drachma/Kg	3,830	
Operating and Maintenance Labor, Men	62	
Annual Costs, Thousands of Drachmae		
Fuel Oil	1,348,604	
Lubricating Oil	416,945	
Operating Labor	770,661**	
Maintenance Labor	30,466**	
Maintenance Materials and Tools	25,794	
Water, Treatment and Misc Supplies	32,265	
Total, thousands drachmae per year	2,624,735	
Per Kilowatt-Hour (gross), Drachmae:		
Fuel	162	
Lubricating Oil	50	
Operating Labor	92***	
Maintenance Labor	4***	
Maintenance Material	3	
Water and Miscellaneous	3	
Per gross kwh	314 drachmae	
Per net kwh	339 drachmae	

* No estimate of proposed expenses was made, in view of recommendation that operation of these stations be discontinued.

** These labor costs are from accounting records and include taxes, bonuses etc.

*** Plant records indicate that about 26% of personnel are assigned to maintenance. On this basis, operating labor should have been 71 drachmae and maintenance labor 25 drachmae per kwh.

TABLE V
SALONIKA GENERATING STATIONS
COMBINED 1948 ACTUAL OPERATING EXPENSES
ESTIMATED EXPENSES UNDER RECOMMENDED CONDITIONS

	Actual	Estimated*
Gross Generation, kwh	20,705,332	20,240,000
Station Service	4.5%	2.3%
Net Generation, kwh	19,780,059	19,780,000
Fuel Oil, grams/gross kwh	307	278
Fuel Oil, Metric Tons	6,370	5,635
Fuel Oil Cost, Drachma/Ton	452,000	452,000
Lubricating Oil, grams/gross kwh	9.3	4.6
Lubricating Oil, Kilograms	192,474	93,550
Lubricating Oil Cost, Drachma/Kg	3,800	3,800
Operating and Maintenance Labor, Men	278	99
Annual Costs, Thousands of Drachmae		
Fuel Oil	2,881,602	2,545,000
Lubricating Oil	732,558	421,000
Operating and Maintenance Labor and Supervision	3,066,708	1,260,500
Maintenance Materials and Tools	307,671	389,300
Water and Miscellaneous Supplies	97,447	78,600
Total, thousands drachmae per year	7,085,987	4,694,400
Per Kilowatt-Hour (gross), Drachmae:		
Fuel	139	126
Lubricating Oil	35	21
Operating and Maintenance Labor	148	62
Maintenance Material	15	19
Water and Miscellaneous	5	4
Per gross kwh	342 drachmae	232 drachmae
Per net kwh	358 drachmae	237 drachmae

* Estimated expenses are for the three shore stations only since it is proposed that use of the floating stations be discontinued.

CHART 1

SALONIKA TRAMWAYS & ELECTRIC COMPANY
MONTHLY KILOWATT HOUR PRODUCTION OF GENERATING STATIONS
1948

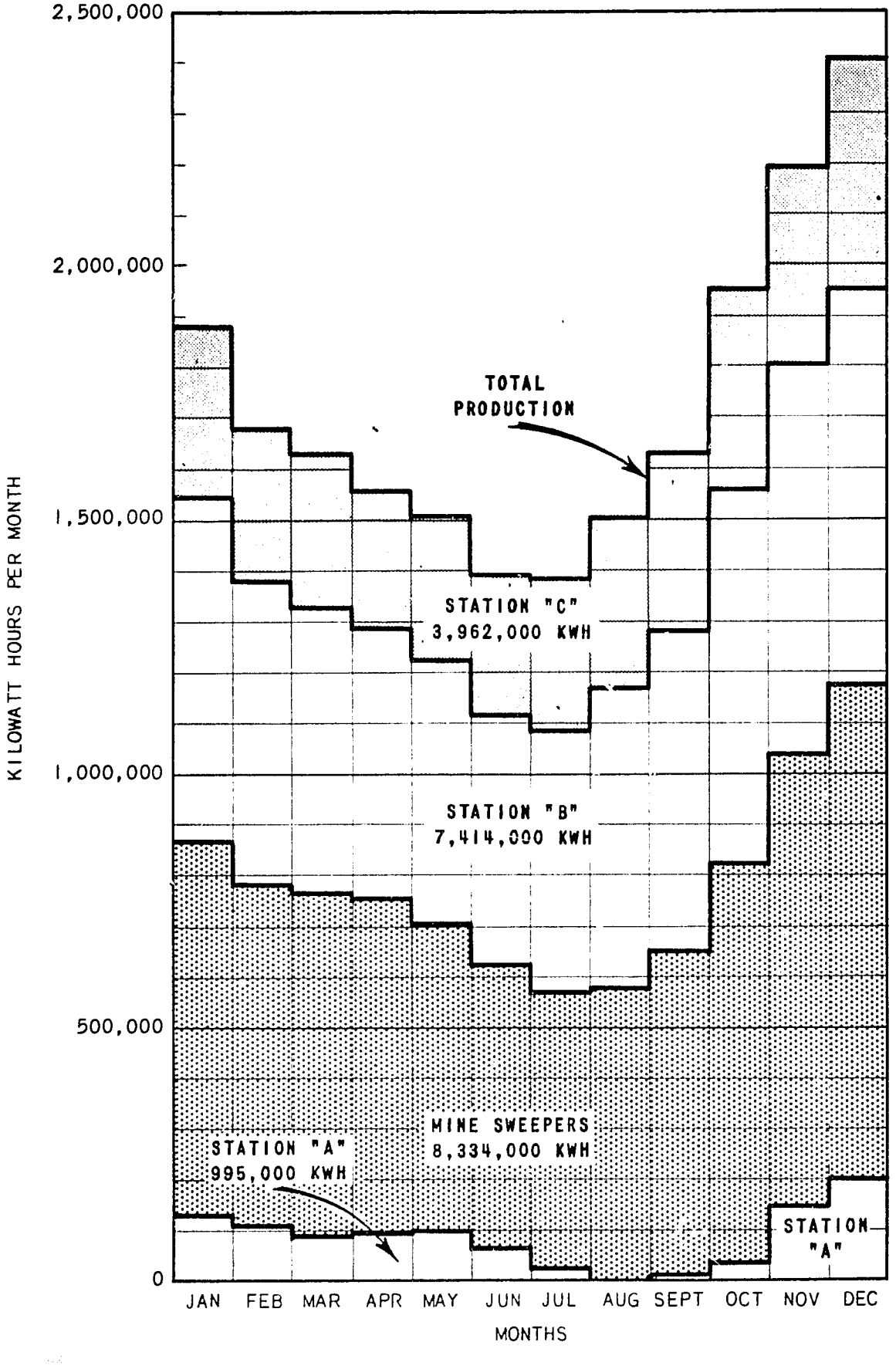


CHART 2

SALONIKA TRAMWAYS & ELECTRIC COMPANY
TYPICAL SUMMER & WINTER
DAILY LOAD CURVES

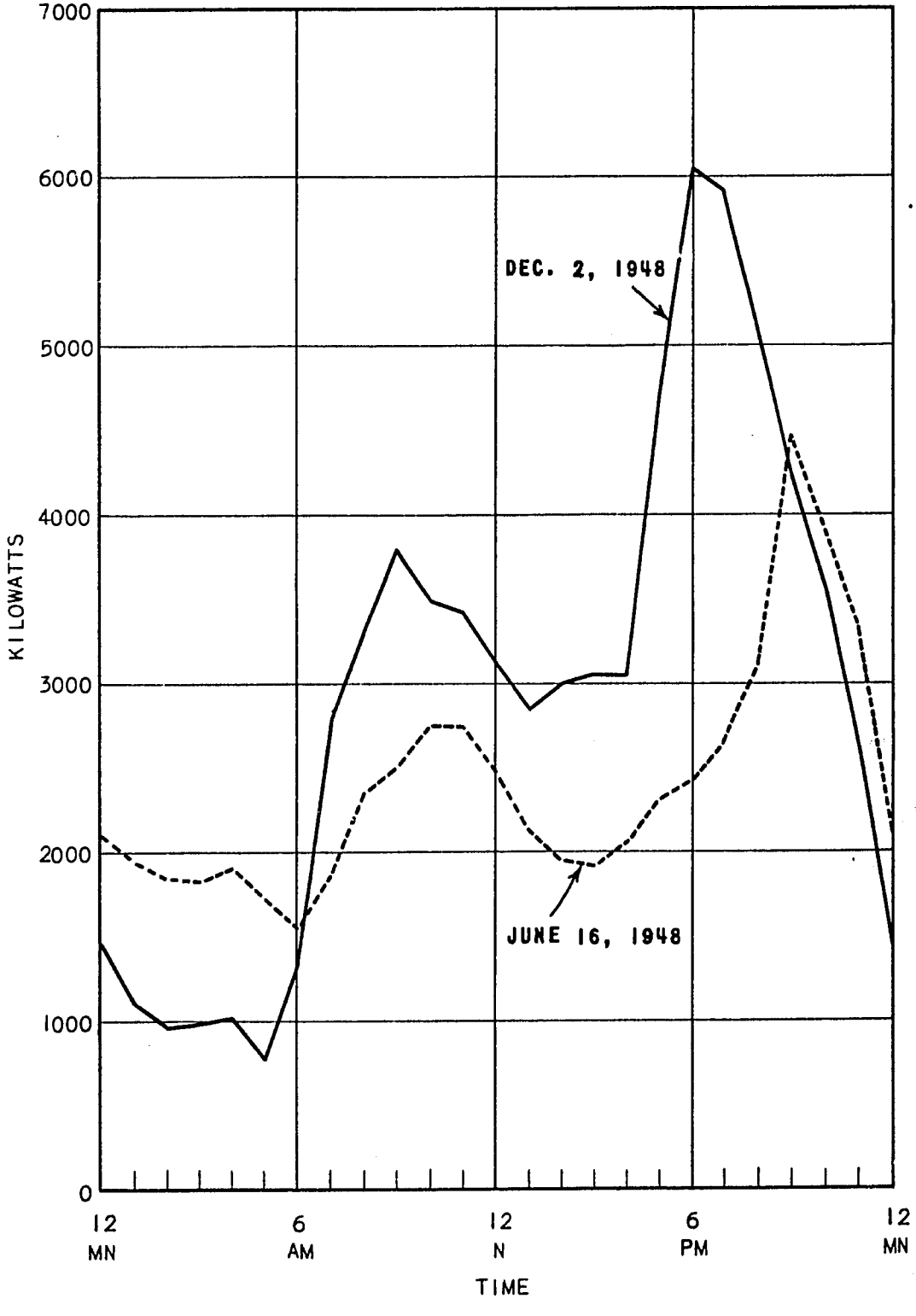


CHART 3

SALONIKA TRAMWAYS & ELECTRIC COMPANY
STATION LOAD CURVES
DECEMBER 2, 1948

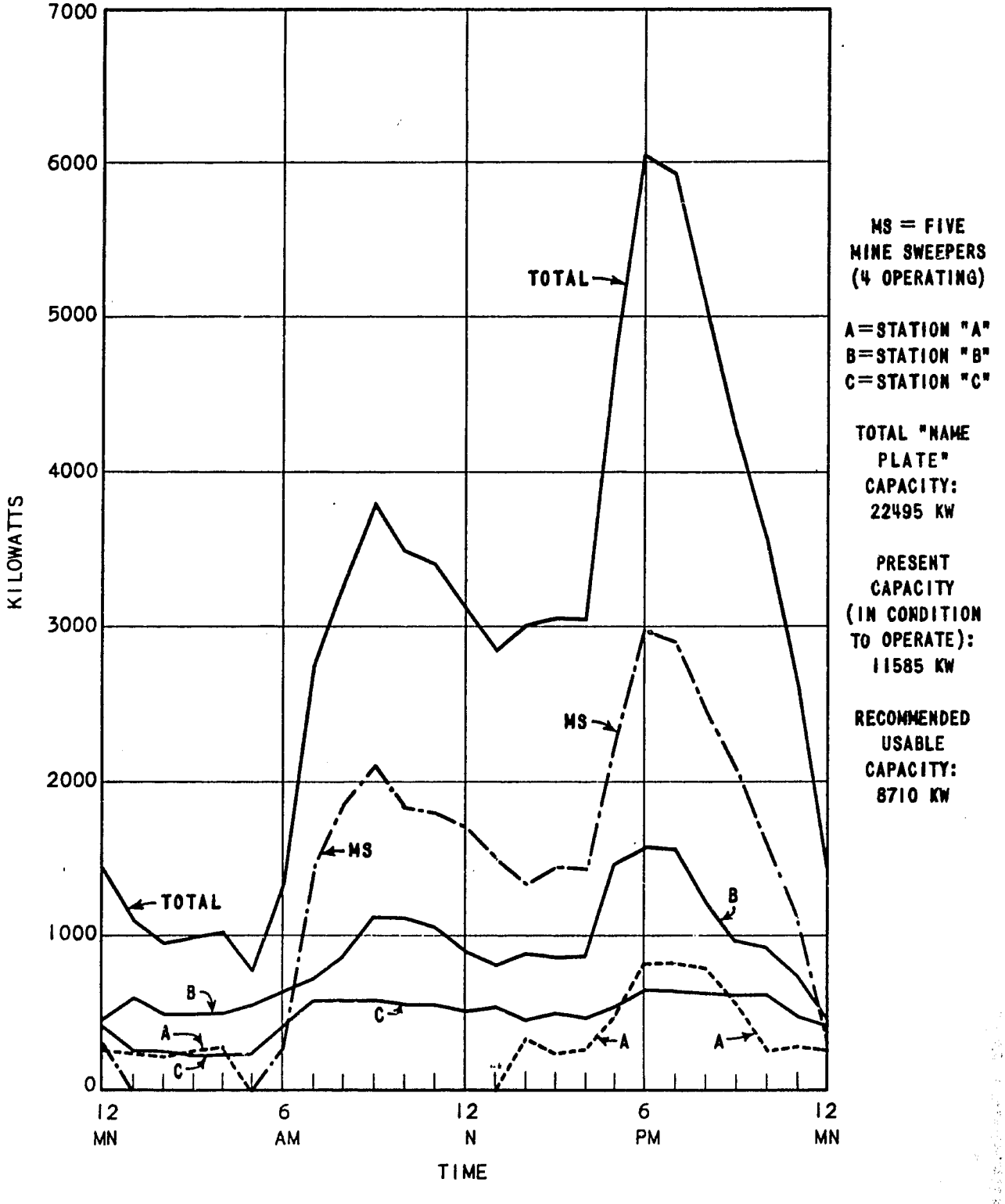
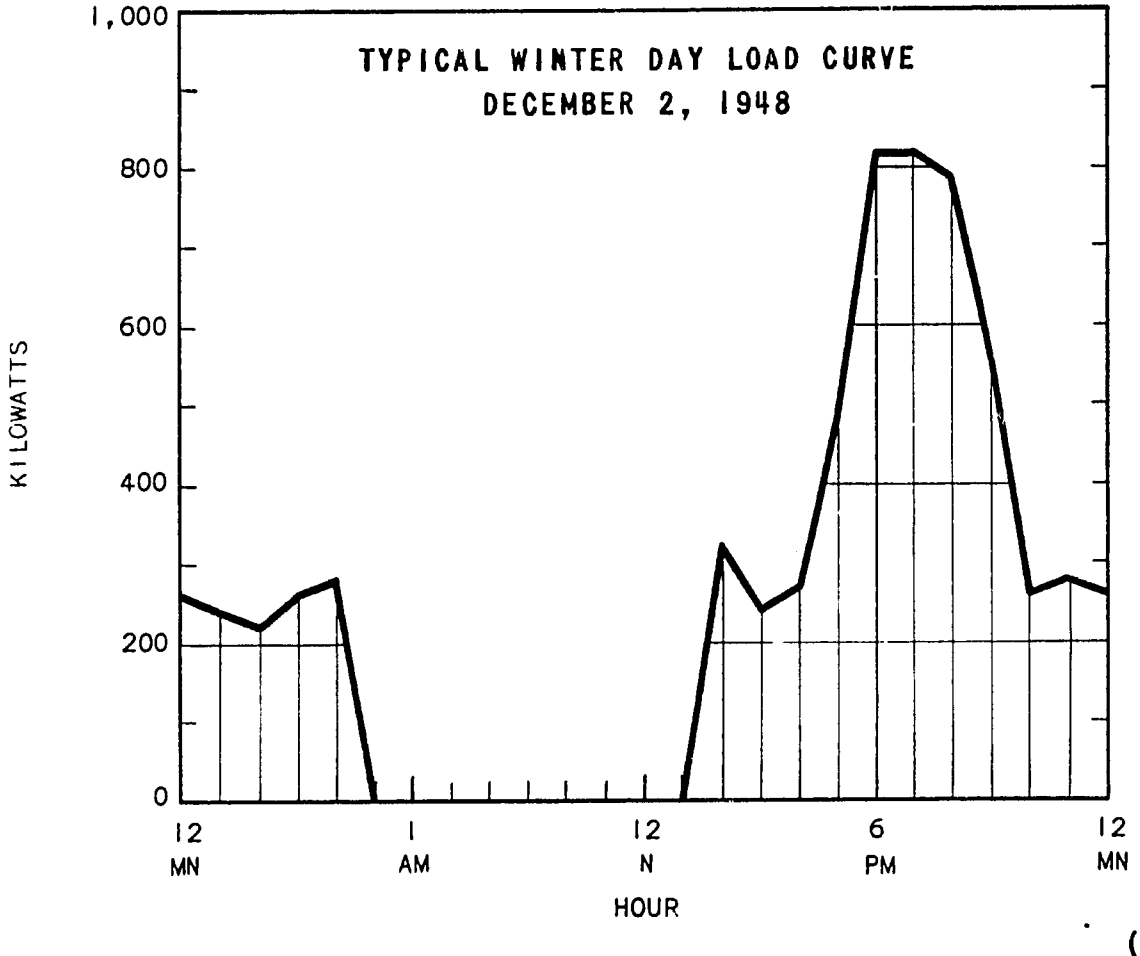


CHART 4

SALONIKA TRAMWAYS & ELECTRIC COMPANY
DIESEL-ELECTRIC STATION "A"
DAILY & ANNUAL LOAD CURVES - 1948



TOTAL "NAME PLATE" CAPACITY 5065 KW

PRESENT CAPACITY (IN CONDITION TO OPERATE) 2115 KW

RECOMMENDED USABLE CAPACITY 2885 KW

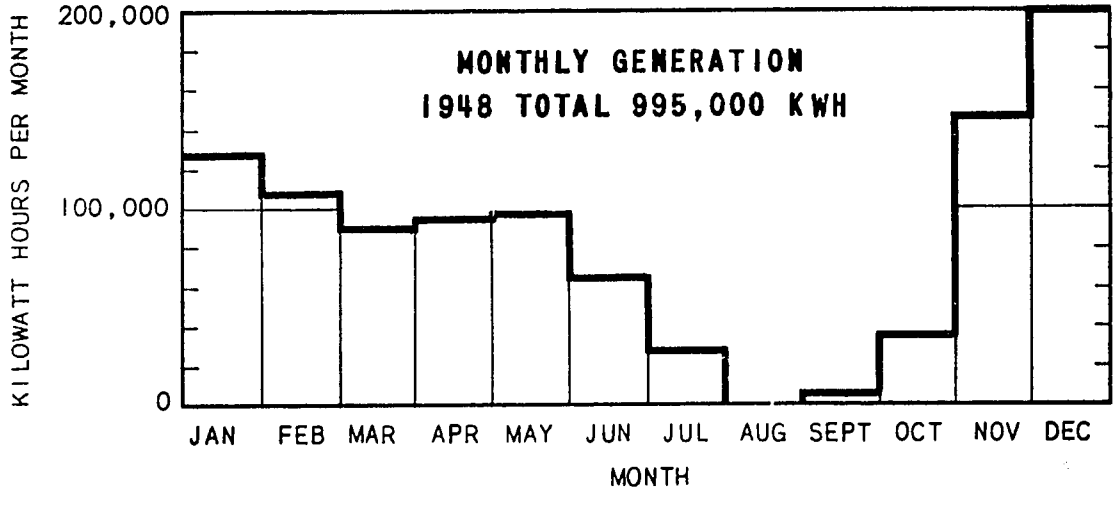
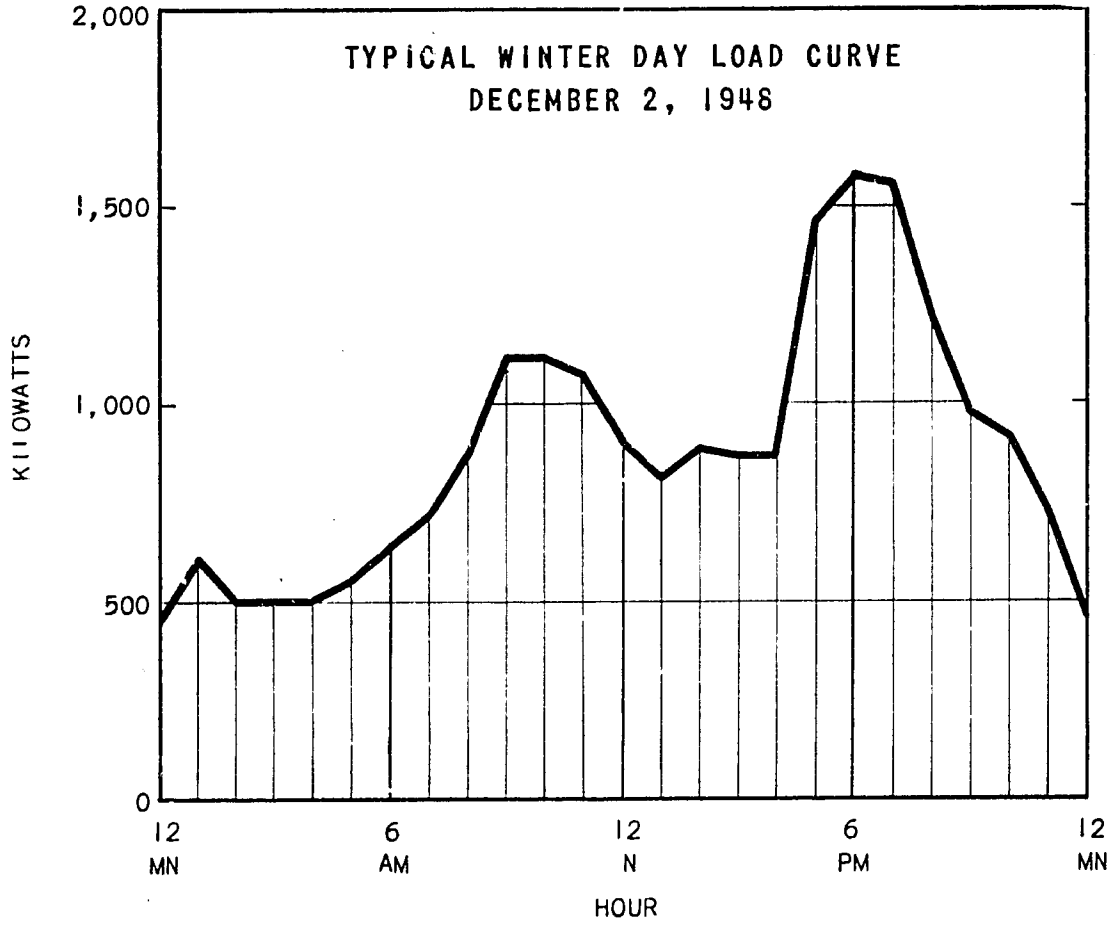


CHART 5

SALONIKA TRAMWAYS & ELECTRIC COMPANY
DIESEL - ELECTRIC STATION "B"
DAILY & ANNUAL LOAD CURVES - 1948



TOTAL "NAME PLATE" CAPACITY 2955 KW

PRESENT CAPACITY (IN CONDITION TO OPERATE) 2110 KW

RECOMMENDED USABLE CAPACITY 2955 KW

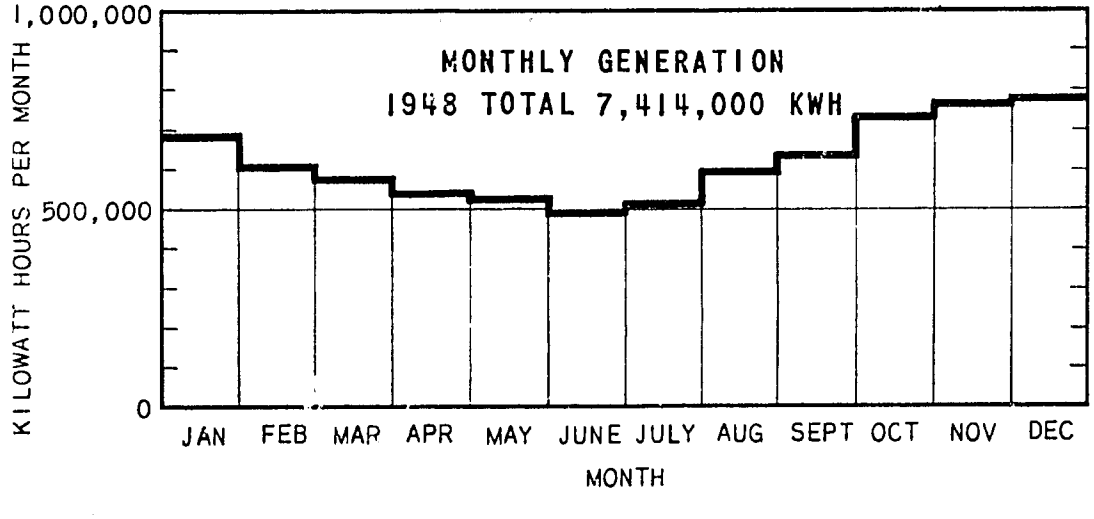
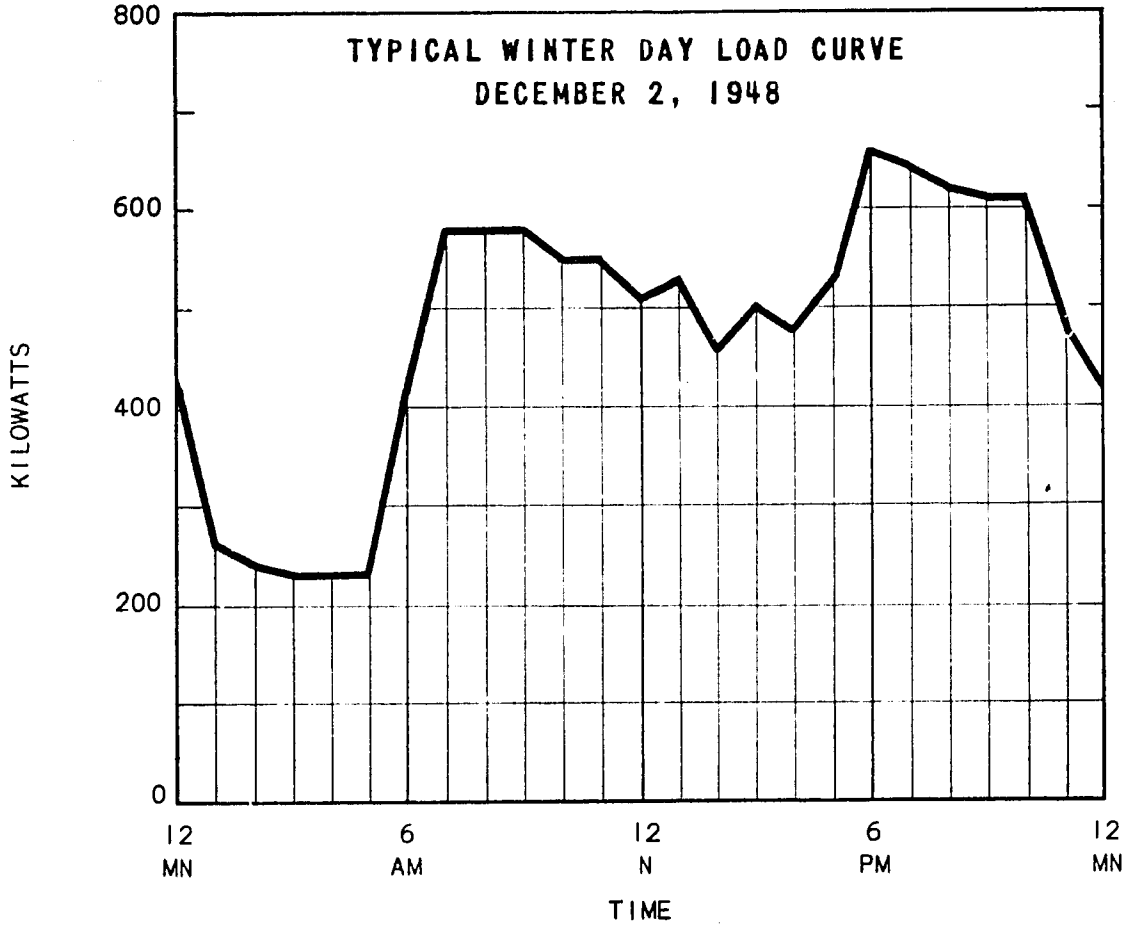


CHART 6

SALONIKA TRAMWAYS & ELECTRIC COMPANY
DIESEL-ELECTRIC STATION "C"
DAILY & ANNUAL LOAD CURVES - 1948



TOTAL "NAME PLATE" CAPACITY 3120 KW

PRESENT CAPACITY (IN CONDITION TO OPERATE) 1680 KW

RECOMMENDED USABLE CAPACITY 2870 KW

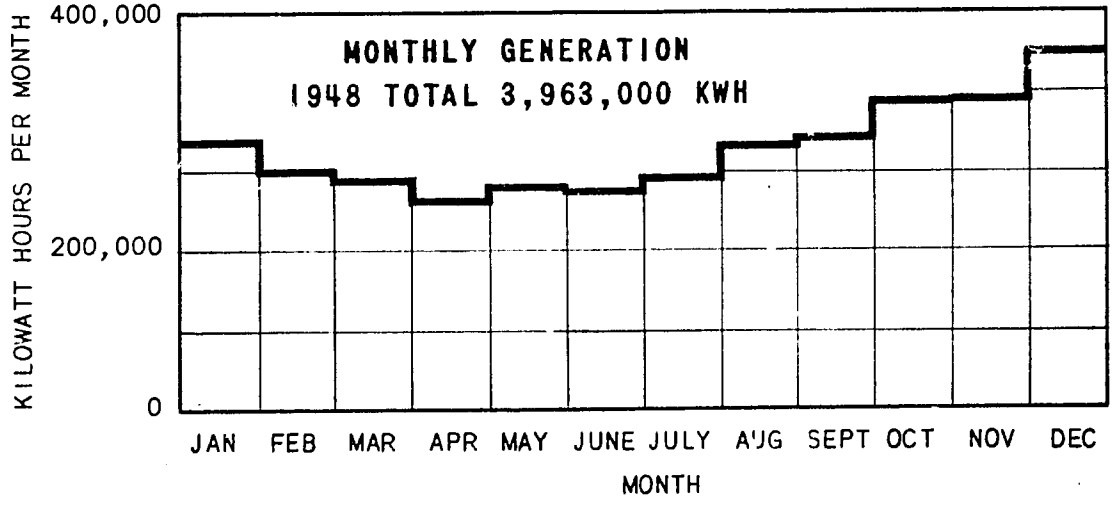
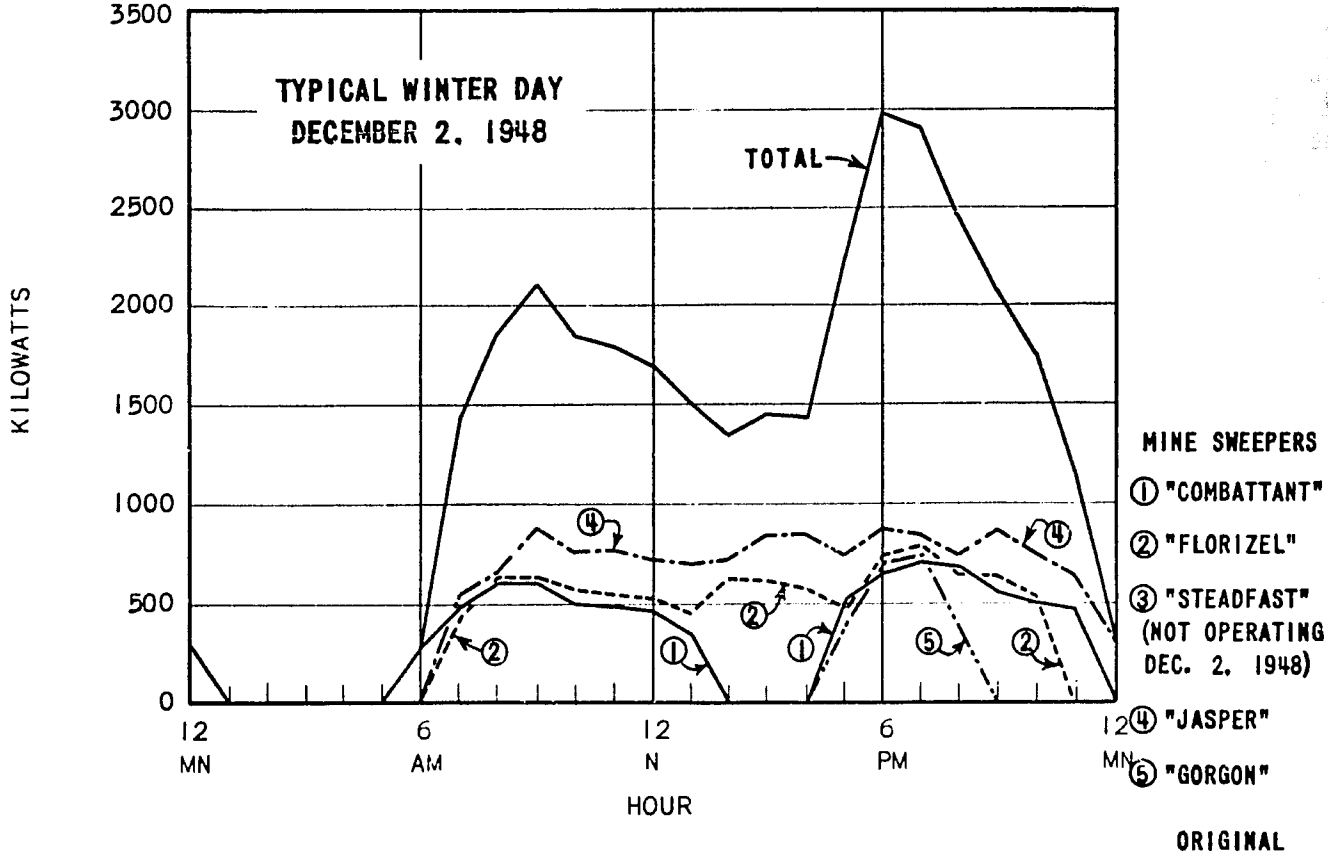


CHART 7

SALONIKA TRAMWAYS & ELECTRIC COMPANY
EX-NAVAL MINE SWEEPERS
DAILY & ANNUAL LOAD CURVES - 1948



ORIGINAL CAPACITY 2840 KW, EACH TOTAL, AFTER REMOVAL OF FOUR, 710 KW UNITS 11360 KW (JUNE 3, 1949)

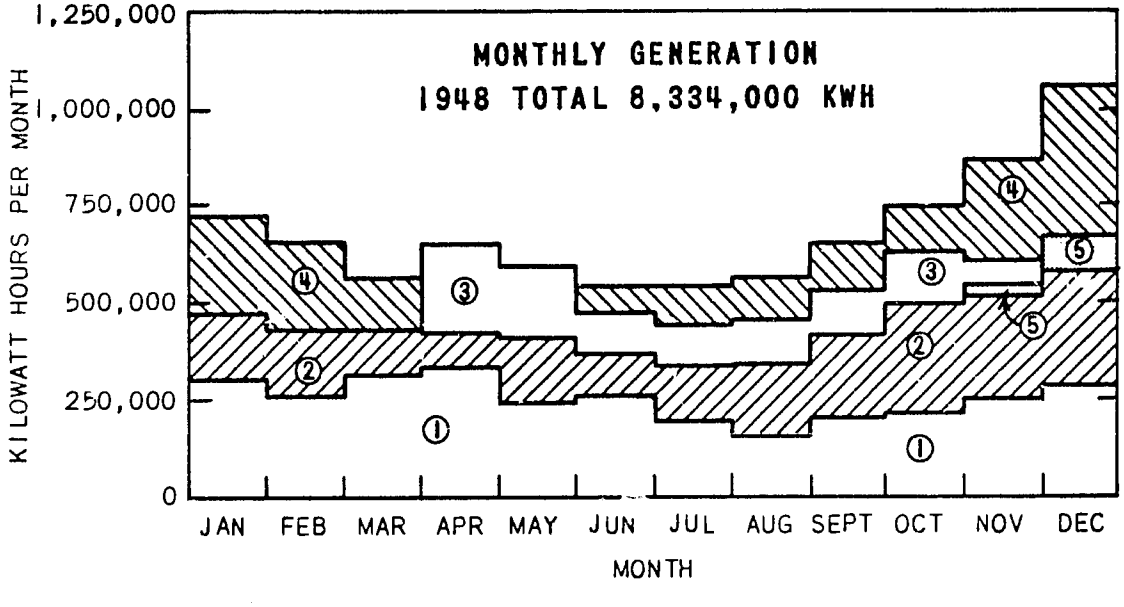
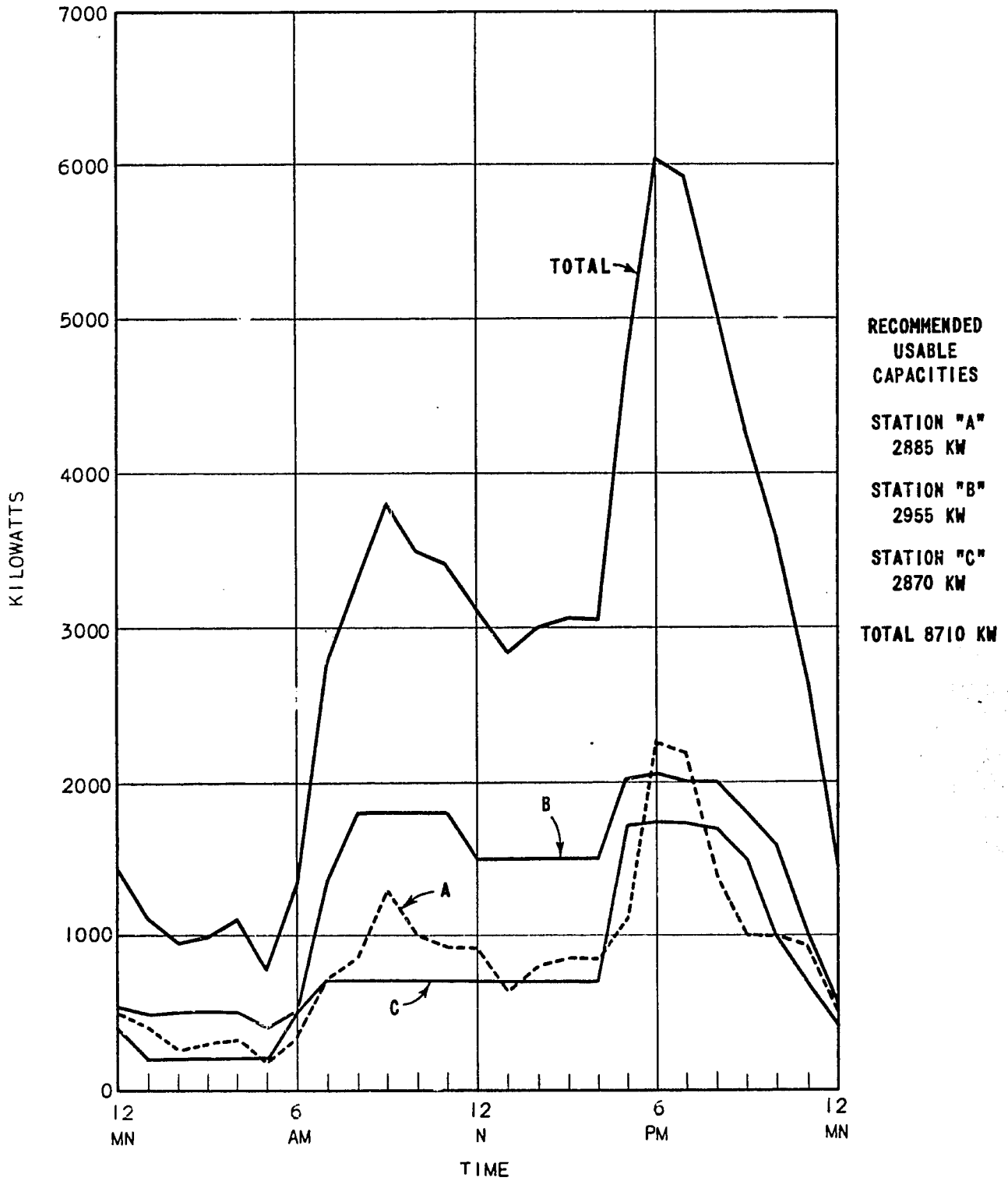


CHART 8

SALONIKA TRAMWAYS & ELECTRIC COMPANY
DIESEL-ELECTRIC STATIONS

PROPOSED LOAD DISTRIBUTION
FOR LOAD CONDITION OF DECEMBER 2, 1948



D - DISTRIBUTION

1 - Introduction

The distribution system of the Salonika Tramways and Electric Company provides 220/440-volt direct-current electric service throughout most of the city of Salonika with the exception of two small sections known as Neapolis and Kalamaria which are supplied with alternating current by privately-owned companies.

The area served extends 10 kilometers (6 miles) along Salonika Bay and about 2.5 kilometers (1.5 miles) inland. There are about 22,000 metered customers and the Company estimates that an additional 7000 customers are receiving electric service through these same meters.

There are approximately 710 kilometers (441 miles) of distribution lines. The main circuits vary in size from 1000 square millimeters (2,000,000 circular mils copper equivalent) to 50 square millimeters (1/0) and the branch circuits from 25 square millimeters (No. 3) to 16 square millimeters (No. 6).

In 1948 the maximum demand on the Salonika Tramways and Electric Company system as measured at the power plants was 6500 kw. The load served was limited by the capacity of the direct-current distribution system, and not by the capacity of available generation. The Company is now operating 2400 kw of alternating-current generation and is converting this for direct-current distribution. It is proposed that during the interim period before power is available from the interconnected system that facilities be installed to distribute this 2400 kw as al ernating-current service. By judicious selection of the areas of Salonika to be included in this initial changeover, line losses can be reduced and the total capacity of alternating-current and direct-current distribution can be increased during the interim period to about 10,000 kw. This amount of generation is now available.

In the interim period, it may not be possible to supply all prospective customers who request service or to meet all requests for increased service to present customers. This will apply particularly

system in Salonika. The design should be predicated on receiving energy from the proposed interconnected power system at 15,000 volts 50 cycles three phase grounded neutral, and secondary distribution at 220/380 volts three phase four wire. The construction standards should be in accordance with the best present day practices. Underground construction should not be used except in locations where overhead lines are entirely impossible in order to avoid unnecessary investment.

Maximum system capability during the interim period can be derived by using the existing 2400 kw of alternating-current generation as the nucleus for the new system. There are three 400-kw units at Station B and two 600-kw units at Station C. An underground and overhead 10-kv primary distribution circuit has been practically completed from a short distance west of Station B, passing near the site of the proposed transmission substation, and through the south end of Salonika to Station C. One 640-kva 10,000 - 220/380-volt three-phase transformer has been installed at Station B to feed the 10-kv primary circuit, and another similar transformer has been installed at a textile mill, not previously served, to step down the primary voltage for service to the mill and the surrounding area. The estimated maximum demand of the mill is 400 kw. In March 1949 it was indicated that two 500-kva and one 320-kva similar transformers would be purchased.

It is recommended that the above transformers be used to step up the voltage of the alternating-current generators at Stations B and C. It is further recommended that an additional total of 3500 kva of transformer capacity be purchased for distribution use. These transformers should be in 75-kva and 100-kva three-phase sizes and in order that they can be used later on the proposed 15-kv distribution system, they should be 15,000 - 220/380 volts with a 10,000-volt tap.

The present direct-current distribution circuits in the converted areas would be utilized, with a minimum of reconstruction, as secondaries of the proposed alternating-current system. Most of the present branch line conductors are 16 square millimeters (No. 6) to 25 square millimeters (No. 3) in size and are suitable for secondary

distribution. Certain large main line conductors can be used elsewhere or salvaged. The areas northeast of Station B and southeast of Station C are the two sections which should be changed over to alternating-current operation first.

During the interim period the direct-current generators should be used to serve the areas immediately adjacent to the stations and to feed the remaining direct-current network. This removal of 2400 kw of alternating-current load from the direct-current network will permit it to serve a total of approximately 7600 kw in its remaining area and at somewhat improved voltage conditions. A total system load of 10,000 kw can be carried on the two systems.

The cost of providing this 2400 kw of alternating-current distribution facilities above that already expended, but not including the changeover of customers' utilization equipment, is estimated to be approximately $400,000. Detailed estimates have not been prepared since design details are not a part of this investigation. Also the diversion of the cost as between U S dollars and drachmae has not been made.

In anticipation of alternating-current service to all of Salonika from the proposed transmission network the following work should be accomplished before this service becomes available. However work on the program cannot be initiated until final plans for the power system are developed and construction of the distribution system must be coordinated with those plans.

a - Construct the 15-kv primary circuits necessary to provide complete coverage of the city.

b - Install the necessary alternating-current meters on customers' premises for later connections.

c - Rebuild and rearrange the existing direct-current lines while in service for later use as alternating-current secondaries.

d - Install the 15,000 - 220/380-volt transformers for later connection.

The estimated cost of this latter phase in preparing for the changeover is approximately $1,500,000. This does not include any allowance for customers' utilization equipment.

3 - Practices and Methods

Standard designs and construction practices have not been developed for use in the distribution department. The work is conducted and executed according to the judgment and experience of the workman in charge. This is not conducive to uniform practice or economy, nor are advancements in practices and methods adopted. Modern designs and construction specifications should be adopted as the basis for the reconstruction and development of the system.

The basis for design and construction of all work is the Greek Electric Code which is excessively restrictive in matter of strength, clearance, and the economical use of materials. It is recognized that suitable revision of these rules constitutes an extensive study; however, serious consideration should be given by the proper Ministries of the Government and local operating companies to revisions and improvements in the interest of developing a modern, efficient and economical system.

There is no joint use of pole lines with telephone construction, and it is quite evident that considerable economy can be effected through the application of the joint use principles which have been so extensively practiced in the United States. The existing Greek Code is seriously restrictive on this point.

It is true that, because of the narrow streets and overhanging balconies, adequate clearance is a real problem but, with judicious use of extension arm construction, underground installations can generally be avoided. In many cases existing lines could have been built overhead with complete safety. With proper design, it should be possible to avoid the installation of wires within reach of house windows. There has been a considerable amount of theft of current because of the convenience with which the wires now attached to houses can be tapped.

Transformer sizes should be selected on the basis of loading at 85 per cent of their rated capacity at time of installation. Units

should be capable of operation at 20 per cent or even greater overloads for short periods. Temperature indicators should be installed permitting periodic checks of the loads on transformers, and a set of records should be maintained so that planned supervision of their performance can be accomplished.

Meters rented to customers number 7000 to 8000; the remainder are customer owned. The 2000 meters used by power customers are tested every six months; the remainder are tested only at time of complaint or upon suspicion of theft. New meters are tested and adjusted to within plus or minus 3-1/2 to 4 per cent accuracy, others to plus or minus 5 per cent, as required by law. Very few spare parts are carried in stock, purchases being made as required from local dealers. All major meter repairs are referred to outside electricians. The standard mounting for meters is on marble slabs. Some of the older installations are on wooden boards, but are being replaced as occasion permits. These practices are not in accord with modern procedures and do not permit efficient operation. Therefore it is recommended that the Company own and maintain all meters, periodically check and maintain these devices on a program of inspecting and testing larger power meters once a year and the smaller residential meters every eight years, and that meter installations be standardized to obtain minimum investment and operating costs.

Since there is cement in Greece, and there are no suitable woods or metals available, extensive use of concrete poles is recommended. The manufacture of these poles should preferably be carried on by an independent concern engaged in construction work.

A serious lack of maintenance is evidenced by the deteriorated condition of many poles, conductors and related equipment. The tools and equipment used for construction and maintenance are inadequate and are in poor physical condition.

It is recommended that the following equipment be provided:

1 - Three-ton line truck
with pole derrick and winch

1 - 1-1/2-ton line truck
with pole derrick and winch

2 - 3/4-ton line trucks

2 - Ladder cars

4 - Small passenger cars

2 - Small meter service cars

Some of the existing vehicles may be rehabilitated and accessories added rather than purchasing all of the above new. The four small passenger cars are recommended to expedite the work of the supervisory personnel and the two meter cars should have padded containers for the use of the meter service department. As the operations of the company are expanded, additional vehicles will be required. Transportation for the working supervisors and specialists is now provided by tramways, bus or truck with the result that inadequate supervision of working crews is attained. These methods of transportation should be continued to the maximum possible degree because of the cost of automotive equipment and the gasoline required for operation.

Safety belts are used by linemen when working on overhead structures. Rubber safety gloves, without leather protectors, are used to some extent. Protective covering of live lines is not practiced. The haphazard use of rubber protectors, the deteriorated condition of safety belts and total lack of danger signs and barriers around construction work indicates a serious lack of appreciation of elementary safety precautions as general safety rules are not followed in construction and maintenance programs.

All work should be done from written orders prepared by authorized persons. Such a procedure establishes a permanent record of what was done, shows the time and materials used, and facilitates proper accounting. In a similar fashion, all new line extensions should be made from instructions written on properly designed line extension forms which include an estimate of the cost and a sketch showing how the work is to be done.

It is recommended that outside contractors be engaged for major new construction work. This kind of work is irregular in extent and this procedure should be more economical.

4 - Distribution Department Organization

The activities of the distribution department are under the direction of the distribution superintendent who reports to the Director General. Directly under the distribution superintendent are the general line foreman, meter shop, meter service men, theft of current checkers, wiring inspectors, tramway construction crew, motor vehicle department and other miscellaneous personnel.

The general line foreman has supervision over the line crews, trouble men, and the crews which maintain the overhead trolley system.

Five crews construct and maintain the lines of the distribution system. Two of these are assigned to work on the main overhead lines, one to the underground system, and two to branch overhead lines, service runs and new meter installations. The trouble men operate in three shifts to correct trouble and investigate complaints that are telephoned to the Company. They install some of the small meters and travel by tramways, bus or light trucks when available. There are two crews which operate in two shifts to maintain the overhead trolley system of the tramways amounting to about 12 kilometers (7.5 miles) of line.

The meter shop is responsible for the repair and testing of the meters. Only those which have failed or are suspected of erroneous recording are tested and major repairs are referred to outside electricians. There are several groups which service the meters in the field. These include meter readers, meter sealers who inspect new installations, disconnect men who disconnect the service of delinquent accounts, uncovered meter checkers who investigate any meters that are reported to have been tampered with, and those who remove and replace meters in connection with the removal or restoration of service other than new installations. Most of the men whose work involves meters travel on tramways or buses.

A group polices the system looking for theft of current cases, and another group inspects new building wiring to determine if it complies with the Greek Electric Code. This latter group also checks for theft of current.

The tramways construction crew maintains the tracks of the tramways. Occasionally it does construction work for the distribution department and laborers from this group assist distribution line crews when required.

The motor vehicle department maintains the few trucks. There is a miscellaneous group of janitors, telephone operators, watchmen and receptionists.

This present organization is shown in the chart on page 17 The organization is materially overstaffed, apparently the result of a political patronage p licy. The job classifications in effect indicate the desire to provide individual pay rates rather than to correlate the rate of pay with the job value. It is recommended that job classifications be established on a sound basis and that personnel be limited to actual requirements.

Supervision is inadequate from an engineering and experience standpoint in the day by day direction of operating crews and there is a serious lack of engineering talent in the organization to plan the system design and to supervise the engineering phases of installation and maintenance. Wage rates appear to be too low to attract competent and efficient supervision. It is recommended that wages for key supervisors be studied with the objective of establishing rates suitable to attract men of greater capabilities and broader experience.

The distribution department now performs functions not ordinarily associated with distribution. To eliminate these functions not directly related to distribution, it is recommended that (a) meter readers and bill collectors be transferred to the customers billing department, (b) janitors, telephone operators and other employees whose activities are of a general nature be transferred to the general office department, and (c) all employees working on the maintenance of tracks be transferred to the tramways department.

Distribution operations are not receiving proper and adequate engineering attention for good economy and in addition to the planning, design and other strictly engineering functions, it is recommended that the engineering department study and recommend proper tools, equipment, work methods, and construction standards; prepare line extension instructions, estimates, drawings, and technical statistics; be responsible for voltage checks, transformer load studies, and the investigation of certain customer complaints; be responsible for distribution system maps and records, including primary circuit maps showing switching points, conductor sizes, configuration, and transformer sizes, detailed pole locations and secondary maps; prepare record cards for each transformer and each pole so that information can be readily obtained regarding pole and transformer replacements and keep such other records and data as are necessary to the efficient operation of the distribution department. All maps and records must be kept currently up to date to be effective and revisions must be issued promptly to all parties concerned. They can be very helpful in the proper preparation of work orders and line extension requisitions.

5 - Proposed Organization

With the above general realignment of functions the resulting distribution department organization's activities will be directed entirely to the general problem of energy distribution under the guidance of a distribution superintendent responsible to the general superintendent. It is recommended that the functions within the department be grouped as follows:

a - A line and trouble section under the supervision of a general foreman assisted by a clerk who will be available at his office telephone, and whose duties will include liaison between the crews and the storeroom regarding materials, supervision of the accounting classification of work performed, time sheets, reports, and all other clerical matters of the crews. He should also prepare routine maintenance work orders and be responsible for the records of the general foreman's office. This section would be subdivided into:

i - A heavy pole and underground crew consisting of a foreman, a lineman, and three helpers to be used chiefly for types of work which require a minimum of technical skill. Only one lineman is included, and the number of helpers can be varied according to daily requirements. Extra helpers can be drawn from other groups. It should be mentioned that the prevalent method of underground cable installation does not include handmade splices, and therefore, skilled cable splicers are not required. A heavy line truck with pole-hoisting booms and power winch, and a two-wheeled pole trailer should be provided.

ii - A heavy overhead crew consisting of a foreman, three linemen and three helpers designed for running line extensions, or maintenance work of major proportions where considerable skilled help is required.

iii - Two light overhead or service crews, each consisting of two linemen and a helper, can effectively be used for smaller line extensions, the installation of services, and other lighter work not requiring the number of men proposed for the heavy crew and yet requiring greater skill than provided by the pole and underground crew. This crew can also be used for light maintenance work. One of the helpers in each of the line crews will also act as truck driver and field clerk. In this latter capacity, he will be responsible for the preparation of the time sheets, and the necessary clerical work in connection with the work orders and line extension forms used by these crews in the execution of their work.

iv - Five trouble men who will be linemen of the highest classification and capable of making emergency repairs. It is recommended that one be assigned to the day shift, two to the early evening shift, one to the night shift, and one relief man who may double with the single-man shifts when not

required as a relief. Biweekly rotation of these shift men has been found desirable. As fill-in work, these men can do light maintenance or other suitable work of a routine nature, including street light inspection. Ladder cars assigned to this group will facilitate a much wider and faster coverage of the territory. The ladder cars should be adequately stocked with suitable emergency material. Telephone contact with headquarters should be maintained at frequent intervals. Members of the supervisory and engineering force should be available on call in rotation 24 hours a day for advice and assistance. Arrangements should be made so that, when approaching storms or other causes of serious trouble become apparent, appropriate men off duty will telephone the service dispatcher and declare themselves available if needed.

v - Four service dispatchers. Trouble calls, complaints, line clearance for safety, telephonic reports of all outside activities, communications between and with generating stations, calls from customers served at primary voltage regarding switching or other operating functions, and other matters relating to system operations, should be routed through the service dispatcher's telephone desk. Older linemen of preretirement age can effectively be used as service dispatchers. Their mature judgment and experience has been found most helpful in handling emergency situations expeditiously. They should maintain a concise but complete record of all calls on an appropriately designed log sheet. It is expected that one man per shift with a relief man will be sufficient. As with the trouble men, the relief man can double with the others when not required in his relief capacity; biweekly rotation of the shifts may be advisable, and emergency help should be provided during times of unusual emergency.

b - A meter and wiring section under competent supervision which will direct all activities relating to the installation, removal and servicing of meters, customers' wiring inspection service

and theft of current checking. A clerk should be assigned to this department who will function in a manner similar to the one assigned to the general foreman's office. This section should consist of three groups:

i - A meter service group consisting of three power meter men and four residential meter men to do all field work involving meters, with the possible exception of such emergency calls as are made by the trouble men. Power meters are generally more complicated than those used for residential and commercial service and, for this reason, two classes of meter men are recommended, power meter men requiring higher skill and residential meter men requiring lesser ability. Men of this group are also able during their rounds to investigate theft of current activities.

ii - A meter shop group consisting of one power meter tester, two residential meter testers and a helper to do all the testing except periodic routine tests of the more complicated power meters made by the meter service group, calibration and servicing of meters and other instruments belonging to the Company. An adequate stock of spare parts should be maintained to take advantage of the benefits to be derived from quantity purchasing. Adequate space and testing equipment for a meter shop should be provided.

iii - Three wiring inspectors whose duties include the inspection and approval of customers' wiring installations prior to the connection of service, and installations of additional utilization equipment by existing customers. They are in a favorable position to detect theft of current. Very possibly one or more of these inspectors can from time to time devote their full time to this latter work.

c - A garage crew consisting of two mechanics and two helpers who will be responsible for the maintenance of all motor vehicles owned by the Company.

d - A stores group consisting of a storekeeper, a clerk and a helper to have jurisdiction over and be responsible for the stocks of all materials and unassigned equipment to be used by the Company.

E - RATES

1 - Statement of Rates

Rates for electric service in Salonika are determined in accordance with the rate formula established by the Greek government. To the basic rates determined by the formula there are added various amounts to cover meter rental, taxes, reconstruction expense, loan repayment, pension fund contributions, etc, as illustrated by the tabulation for the month of February 1949 on the facing page.

2 - Salonika Rate Level

Salonika rates in 1948 were higher than in either of the other two cities investigated even though the tax burden was materially less because of the absence of any municipal taxes applicable to electric bills. Average kilowatt-hour sales per customer are substantially higher than in Volos which should tend to result in a lower rate level.

The rates were unnecessarily high for the following reasons:

a - Operating expenses, particularly with respect to payroll, were much higher than would have been required for the efficient operation of the property.

b - Energy lost and unaccounted for was very high, 37 per cent of power plant output. Losses presumably include large amounts of unrecorded service, either deliberately supplied free of charge or stolen in addition to the abnormal losses on the direct-current distribution system.

c - The amounts added to base rates include an item of 10 per cent of base rate for the employees' pension fund. This is in addition to 12 per cent of payroll paid to the fund by the Company and recovered from customers in the base rate for energy, plus 6 per cent of payroll paid by the employees. Total payments to the fund were 45 per cent of payroll.

If the economies and other operating changes recommended in the sections dealing with accounting, generation and distribution had

been made in 1948, and if unrecorded service had been regularly metered and billed, Salonika rates would have been reduced 29 per cent and customers would have saved 5,646,000,000 drachmae in comparison with the rates actually in effect during the year. In addition, the earnings of the Company would have been increased by 1,372,000,000 drachmae for the year.

The foregoing reductions in rates and increase in earnings would come about as follows:

a - Decreases in operating expenses recommended in other sections of this report may be summarized as follows:

Department	Decrease in Expense (Millions of Drachmae)		
	Payroll	Other	Total
Generation	1,806	586	2,392
Distribution & Engineering	453	(145)	308
Accounting & General	400	-	400
Total	2,659	441	3,100
( ) indicates red figure			

b - Through the operation of the rate formula any reduction in payroll is passed directly to the customers in the form of reduced rates. Therefore, the recommended reduction of 2,659 million drachmae in payroll would mean a corresponding reduction in base rate revenue. To base rate revenue there is added an average of 34.6 per cent to cover taxes, loan amortization, and pension fund. Total saving to customers would be 2,659 million drachmae decrease in base rate plus 34.6 per cent for taxes and other additions assessed on a percentage basis, or 3,640 million drachmae.

c - The reduction of 586 million drachmae in "Other" generation expense represents savings in fuel and lubricating oil through more economical operation. Rates are not affected by fuel economy (but only by the price paid per ton of fuel oil) and therefore this entire saving would be retained by the Company as increased earnings. The recommended increase in distribution expense for additional motor vehicles would also not be passed on to customers and would

result in decreased earnings of 145 million drachmae. The net result of these two changes in expense other than payroll would be an increase of 441 million drachmae in the earnings of the Company.

d - A reduction in unrecorded service with a corresponding increase in energy sales has the dual effect of (a) reducing the rates as a result of increasing the number of kilowatt-hour sales over which total expenses exclusive of fuel and lubricants are spread, and (b) increasing the Company's earnings as a result of increasing the number of kilowatt-hours to which the fuel element of the rate formula may be applied.

e - Records of the Company show energy lost and unaccounted for as 37 per cent of generating station output. It is improbable that more than 25 per cent was actual physical loss, the remaining 12 per cent being unrecorded service. If the unrecorded service had been regularly metered and billed, base rates would have been reduced 10.5 per cent or by 1490 million drachmae and total payments by the customers who paid for their service would have been reduced 1490 million drachmae plus 34.6 per cent for taxes and other items or 2006 million drachmae.

f - Applying the fuel element of the rate formula to additional energy sales, equivalent to 12 per cent of generating station output, would result in an increase of 931 million drachmae in the net earnings of the Company.

Following is a summary of the foregoing effects:

	Millions of Drachmae	
	Reduction in Rates (Payments by Customers)	Increase in Net Earnings of Company
Reduction of operating expenses	3,640	441
Regularly metering and billing present unrecorded service	2,006	931
Total	5,646	1,372

If the present 10 per cent addition to certain of the base rates for the pension fund were eliminated, payments by customers would be further decreased to the extent of 873 million drachmae.

3 - The Rate Formula

a - Formula

Electric service rates outside the Athens area are determined by formula established by the Greek government and administered by the Ministry of Transport.

The Greek rate formula in its basic form is stated as follows:

$$\left.\begin{array}{l}\text{Rate per kwh}\\ \text{for a particular}\\ \text{class of business}\end{array}\right) = K\left(\frac{S + P}{M} + 250\right) + 0.8\,\frac{T}{1000}$$

1 - K is a factor depending upon the class of business.

2 - S is an allowance for maintenance and depreciation.

3 - P is the payroll and related payroll expenses.

4 - M is the total of kilowatt-hour sales to the various classes of business multiplied by the corresponding values of K.

5 - The item of "250" is an allowance to cover general expenses and profit.

6 - $0.8\,\frac{T}{1000}$ is an allowance to cover the cost of fuel and lubricating oil based on the cost of fuel oil in drachmae per metric ton.

The first term in the formula is intended to produce income per kilowatt-hour to recover costs of supplying service including payroll, maintenance and depreciation, taxes assessed against the Company, general expenses and profit. The second term determines the charge per kilowatt-hour to recover the cost of fuel and lubricating oil which is applied uniformly to all sales regardless of volume or class of business.

A base rate, for each class of service is established from use of the formula; however, the base rate does not represent billing to the ultimate customer as taxes, rehabilitation loan repayment, meter rental, etc are added in various amounts.

The monies accrued from application of the base rate to kilowatt-hours sold plus meter rental charge are accounted for as "revenue" to the utility. All other collections from customers are treated as receipts for the account of the various taxing authorities or other agencies.

Following is a description of the various elements of the formula:

K is a factor depending upon the class of business. There are certain authorized variations in the values of this factor but the ones most frequently used are as follows:

Class of Business	K
Private lighting	1.00
Public lighting	0.80
Small industry	0.65
Large industry	0.45
Irrigation	0.45

K is important element of the formula. The values in use appear to have been determined by the Minister of Transport on the basis of advice from his staff and advice from managers of utility enterprises. It is probable that the values were determined on the basis of historical rate levels more than on considerations of cost, value of service, or average load factors for the various classes of service.

K does not represent the relative rate level paid by the various classes of customers as it does not apply to the fuel or second term of the formula. Thus, for example, the rate per kilowatt-hour corresponding to a value of K = 0.45 is approximately 60 per cent of the rate for which K = 1.0.

S is an allowance for maintenance and depreciation. 3.5 per cent of plant investment is allowed for depreciation and 2.0 per cent for maintenance. In order to adjust for the inflation of the Greek currency, the prewar plant investment is multiplied by 40 in applying the 3.5 per cent for depreciation and by 100 in applying the 2.0 per cent for maintenance. For postwar investments in plant additions, the basic percentages are applied without multiplying factors.

The basic percentages used for depreciation and maintenance are only moderately higher than the corresponding average values prevailing in the United States and presumably agree reasonably well with physical requirements. A member of the staff of the Ministry of Transport has recommended increasing the multiplying factor for inflation adjustment. While the presentation indicates that the cost of materials has increased substantially more than indicated by the multiplying factors, it did not undertake to demonstrate the overall need of an increase in utility revenues. The need of such increased revenue is not apparent for the companies investigated but may possibly be for smaller ones.

P is the total payroll and related payroll expenses such as holiday bonuses, social security taxes, pension fund contributions, etc. Also included are certain miscellaneous items less clearly related to payroll such as cost of fortifying power plants, contributions for the municipal security force, capital tax levied by the Greek government, price paid for fuel oil in excess of standard tariff, etc.

The inclusion of total payroll and related payroll expenses in the formula as an operating expense is a factor that has a definite bearing on the base rate that is charged for electric service under the formula; (a) there is no measure of the limits to which payroll can be increased and still be considered a necessary expenditure to perform the duties of managing, engineering and operating a utility and (b) payroll for maintenance and repair is included in the total payroll giving in effect a dual allowance for maintenance and repair expense.

M is the sum of the kilowatt-hour sales to the several classes, multiplied by the corresponding values of K. That is, it is kilowatt-hour sales for private lighting multiplied by 1.0, plus sales for public lighting times 0.8, plus small industry sales times 0.65, etc.

The item "250" in the formula is an allowance to cover general expenses and profit. This item has been increased from time to time, to the extent that the value in effect was considered inadequate, but no information was available to indicate the basis on which its adequacy was judged.

The last part of the formula, $0.8 \frac{T}{1000}$, is intended to cover the cost of fuel and lubricating oil. It is based on the cost of fuel oil in drachmae per ton, "T," and on an allowance of 0.8 kg (1764 lb) of fuel oil per kilowatt-hour sold. The portion of the formula that deals with fuel and lubricating oil allowance is too high for large operations and may be too low for small operations.

b - Comments on Rate Formula

It is perhaps striving for oversimplification of a complex problem to attempt to design a single formula that would permit the present power companies in Greece, regardless of size, location or the economic conditions of the territory served, to operate at a reasonable profit. Unless the formula were extraordinarily complex, it would almost certainly result in more revenue than necessary for some companies and less than necessary for others.

Pricing of electric energy cannot be reduced to an exactness based on economic fundamentals alone, as political, social and business considerations are important. However, a price structure must be built on an economic foundation if it is to perform its function. In pricing electric service, there are two general principles that should be adhered to if overall good is to accrue to producer and user.

First, the rates as a whole should produce an income sufficient to result in an adequate return on the capital invested which should be sufficient to attract additional capital to the enterprise, when needed.

Second, the rates to the various classes of customers should be adjusted to result in the maximum sale of energy at the lowest possible cost to the consumer.

Inflationary periods make the addition of a third factor necessary; namely, the ability to adjust rapidly the price charged for electric service as costs and property values change.

1 - Adequacy of Revenue Under Formula

The formula appears to produce somewhat more adequate revenue for the companies located in the three largest cities outside

the Athens area but it is possible that it does not produce enough revenue for certain of the smaller companies.

2 - Rates and Rate Structure

The incentive of management to operate efficiently under the terms of the formula is greatly reduced by the ease with which the formula permits increasing rates as a means of passing excessive payroll expenditures along to customers. This is almost unavoidable if the formula is to have sufficient flexibility to keep pace with wide fluctuations in costs. At the present time, the demand for electric service is so great that the problem is one of producing and delivering energy at any price without the necessity of developing markets. As the power supply more nearly approaches the demand for service, the possibility of passing along unnecessary costs will be limited to some extent by the refusal of customers to take service at excessively high rates. At that time the pricing of electric service to result in the maximum sales of energy at lowest possible cost to the consumer presents a problem of rate structure. Rate structure is concerned with the forms of the rates and the suitability of those forms to the requirements of the various classes of customers to be served.

The Greek rate formula is not specifically restricted to any one form of rate but general practice results almost exclusively in the use of the so-called straight-line rate. Of all rate forms in general use today, the straight-line rate is the one least suited to result in the maximum sale of energy at the lowest cost to the consumer.

The straight-line rate and various other rate forms are discussed below in great detail.

c - Inflation Adjustment

The rate formula is well suited to making the necessary prompt adjustment in rates to compensate for currency inflation and price fluctuations. This one feature is of sufficient value to have justified the use of the formula during the disturbed economic conditions of the past several years.

d - Month-to-Month Fluctuations

In theory, rates are determined each month on the basis of the cost and sales data for that month. Even under a fixed price level, this would result in month-to-month fluctuation of the rate level. Not only would the rates fluctuate, but the fluctuations would be in the wrong direction. For example, in the off-peak season of the year, the reduced volume of kilowatt-hour sales and the relatively stable level of costs would result in an increased rate - at the time when it might be desirable and feasible to reduce rates in an effort to increase the volume of sales. Also, the uncertainty in customers' minds resulting from a constantly fluctuating rate level could scarcely fail to have a depressing influence on energy sales. As a practical matter, the formula is not applied literally in this respect. All three of the companies visited, and presumably most others as well, take steps to smooth out these seasonal variations in rates and to permit changes in rate level to become effective only to the extent that they may be necessitated by longer-term changes in costs or sales volume.

It should be noted, however, that there is no uniform method in use for smoothing out these month-to-month fluctuations. At best, it involves complex computations and, although time was not available to examine the computations in detail, it appeared that in some cases the resulting rates, averaged over a period of several months, were somewhat higher than they would have been under strict application of the rate formula. The Ministry of Transport is aware of the practical necessity of eliminating the month-to-month fluctuations but, although the basis of calculation is generally reported to the Ministry, the reports are not complete and the Ministry is nowhere near adequately staffed to check them in detail.

e - Rate Forms

The rate form most commonly used in connection with the rate formula is the straight-line rate which provides a uniform charge per kilowatt-hour regardless of the number of kilowatt-hours used of the customer's demand or load factor.

The straight-line rate is not well suited to encouraging the fullest possible use of service or to producing the lowest average rate per kilowatt-hour for a given class of service. In a community in which the average sales per customer are low, straight-line rates will necessarily be high. However, if the average sales per customer in such a community were to double, the cost to the utility company of providing the service would not increase in anywhere near the same proportion. Consequently, for such increased use, the Company can afford to offer a substantially reduced rate. If the increased use were made equally by all customers, a reduced straight-line rate might be suitable. However if, as is more usually the case, substantial increases in use of service are to be made by relatively few customers if the additional service is available at a low enough price, the objective cannot be attained with straight-line rates.

Rate forms in common use today that are useful in encouraging increased use of service may be grouped under two general types: block rates and demand-and-energy rates.

An example of a block rate is as follows:

> 1500 drachmae per kilowatt-hour for the first 10 kilowatt-hours per month
>
> 1000 drachmae per kilowatt-hour for the next 15 kilowatt-hours per month
>
> 500 drachmae per kilowatt-hour for all additional kilowatt-hours used per month

In applying this type of rate, a customer who used 50 kwh in one month would be billed for 10 kwh at 1500 drachmae, 15 kwh at 1000 drachmae and 25 kwh at 500 drachmae. With this form of rate, substantial reductions in price may be made for increased use of service without reducing the price to those customers who make very limited use.

In Salonika, use is made of the so-called "step" rate by which all energy used by a single customer is billed at a single rate per kilowatt-hour but the rate per kilowatt-hour is determined by the number of kilowatt-hours used. For example, in the rate for private power, if a customer used less than 200 kwh, the rate per kilowatt-hour would be

1490 drachmae per kilowatt-hour (in February 1949) but if the customer used between 201 and 500 kwh, the rate for all kilowatt-hours used, including the first 200, would be 1424 drachmae per kilowatt-hour. Step rates have certain technical disadvantages and have generally been superseded by block rates.

Demand-and-energy rates may take a number of different forms. The simplest form is as follows:

25,000 drachmae per month per kilowatt of demand
500 drachmae per kilowatt-hour

The energy (or the demand) portion of a demand-and-energy rate may, if desired, consist of two or more blocks, as follows:

25,000 drachmae per month per kilowatt demand
700 drachmae per kilowatt-hour, first 500 kilowatt-hours used per month
350 drachmae per kilowatt-hour for all additional kilowatt-hours used per month

Or the demand charge may be derived by varying the number of kilowatt-hours in a given block as follows:

1,000 drachmae per kilowatt-hour, first 50 kwh used per month per kilowatt of demand
500 drachmae per kilowatt-hour for all additional kilowatt-hour used per month

Demand-and-energy rates are useful in encouraging customers to operate at a high monthly load factor. In order to be most useful, however, they must be carefully designed to meet the requirements of the classes of service to which they are to be applied.

Another factor to be taken into account in designing a rate structure is the minimum monthly bill. The Salonika Company applies minimum bills as authorized by the Ministry of Transport - charging for a minimum of 2 kwh for residential service and a minimum of 4 kwh for nonresidential private lighting service. In general it would appear that minimum bills two to three times as high as those now in effect would more equitably distribute the total cost of providing service and would be otherwise in the public interest.

4 - Continued Use of Rate Formula

It is recommended that the rate formula be continued in use unchanged during the interim period until power is available from the interconnected system.

When power becomes available from the interconnected system it is recommended that a new rate structure be adopted embodying block-rate and demand-and-energy rate schedules suitable for the various classes of service. If the economic conditions of the country are sufficiently stable at that time, it is recommended that the rate formula be completely abandoned. Rates should then be designed to cover efficient management and operating expenses and to produce a reasonable return on invested capital and to encourage the fullest use of the available power supply. If economic conditions are not sufficiently stable at that time, an appropriately modified rate formula might be continued in effect temporarily as a basis for the proposed rate structure.

III ANALYSIS OF OPERATIONS

III - ANALYSIS OF OPERATIONS

A - INTRODUCTION

By American standards, electric rates in Greece are very high. There are many factors contributing to this high rate level. To some extent the factors affecting the rate level are within the control of management; to some extent the high rate level is the result of actions by local and national governmental agencies; and to a considerable extent the rate level is a reflection of the general economic condition of the country as a whole and of the individual communities.

The following general analysis of the operations of the utilities serving the cities of Salonika, Volos, and Patras is concerned primarily with factors affecting the rate level, showing the influence of each and indicating steps to be taken to enhance the contribution of the electric utility industry to the economic welfare of the country. In general, it is shown that the three factors - management, government, and general economic conditions - are about equally responsible for the present high level of rates.

B - OPERATING EXPENSE ANALYSIS

The operating expenses are the greatest single factor that enters into the determination of the base rate charged for electricity.

	1948 - Drachmae		
	Revenue	Operating Expense	%
Salonika	14,276,875,398	10,301,071,493	72.14
Volos	3,480,513,805	2,611,672,590	75.00
Patras	5,239,745,701	5,141,355,217	98.10

	1948 - Drachmae		
	Operating Expense	Payroll Expense	%
Salonika	10,301,071,493	5,471,523,205	53.0
Volos	2,611,672,590	1,166,359,960	44.6
Patras	5,141,355,219	2,312,038,486	45.0

Payroll expenses are the greatest single factor entering into operating expense. Control of payroll is therefore a necessity in administering operating expense.

The individual analysis of accounting, generating, distributing and general expenses in Salonika, Volos and Patras indicate that all three companies are over-staffed. The excessive payroll in Salonika is indicative of a practice which appears to be the result of government policy to relieve unemployment by over-manning operations, rather than an indication of inefficiency of local management. If basic rates are to approach a reflection of necessary costs, payrolls must be reduced by the elimination of personnel not required in the efficient operation of the plant.

Moderate savings in the use of fuel oil (5 to 18 per cent) and substantial savings (40 to 50 per cent) in the use of lubricating oil could be made by more competent and alert administration in the three companies. Such savings would reduce foreign exchange required for oil imports and increase the profits of the individual companies, but would not affect the rate, due to the nature of the formula by which rates are determined.

A decrease in the prices paid for fuel and lubricating oil would decrease the rate level and, because of the nature of the rate formula, would decrease slightly the income of the individual companies.

Fuel and lubricating oil costs per kilowatt-hour generated are very high. While the company managements could reduce this cost by roughly 10 to 20 per cent, a much more substantial part of the fuel cost is the result of government policy. The prices paid for fuel and lubricating oil are controlled by formula established by the government and result in high prices for the following reasons:

1 - Included are substantial taxes, the amounts of which could not be exactly determined but are at least 25 per cent of the selling price in the case of fuel oil and at least 30 per cent on lubricating oil.

2 - Included are what appear to be excessive allowances for overhead and handling charges.

3 - Included are in the case of fuel oil, a "State balancing account and coal subsidy" by virtue of which the larger cities are obliged to pay a part of the cost of delivering oil to the smaller "up country" communities.

4 - In the case of fuel oil, the price structure is based on small-quantity delivery and thereby denies to the larger users the price benefit of large-quantity delivery that would be obtainable in a free market.

The following tabulation of various operating expense ratios will serve as a comparison of the three companies. Corresponding figures for the United States are supplied not as a standard of comparison but rather as a partial explanation of wide differential existing in rates prevailing in the two countries.

	Salonika	Volos	Patras	U S
Production Expense				
Drachmae per kilowatt-hour Net Generated	363	289	178	
Drachmae per kilowatt-hour Sold	577	419	246	50
Distribution Expense				
Drachmae per Customer	73,592	42,176	49,408	104,700
Drachmae per kilowatt-hour Sold	124	161	59	15
Customers' Accounting & Collection Exp				
Drachmae per Customer	46,346	14,882	25,084	40,100
Drachmae per kilowatt-hour Sold	78	57	30	5
Administrative & General Expense				
Per cent of Operating Revenue	3.0	9.9	19.7	6.5
Drachmae per kilowatt-hour Sold	55	142	121	10

In the cases of distribution expense and customers' accounting expense, the correct unit to use in comparing efficiencies of operation is the expense per customer. Expenses per kilowatt-hour are included only to show the effect on current rate levels. Thus, it will be noted that,

whereas distribution expense per customer in the United States is more than twice as great as in Volos or Patras, the amount of such expense that must be recovered for each kilowatt-hour sold is only one-fourth as much in the United States as in Patras and less than one-tenth as much as in Volos because of the substantially greater average kilowatt-hour sales per customer in the United States.

To whatever extent management is responsible for high operating costs, including those items that affect only the individual company's profits as well as those affecting the rate level, the cause appears to lie in the inadequate supervision of workers and in the inexperience of operators, technicians, and supervisors in the operation, and particularly the maintenance, of Diesel engines.

C - ENERGY LOSSES

Whenever electrical energy is delivered by wires from one point to another some of it is lost as heat. The amount of this loss can be minimized by appropriate selection of transmission and distribution voltages, sizes of conductors, size and spacing of transformers, and other engineering consideration, but it cannot be entirely eliminated. In the United States, losses average about 10 per cent of the output of power plants. The losses for Volos and Patras would be expected to be somewhere between 12 and 15 per cent, and for Salonika, where the power supply is direct current, and distribution is at low voltage, losses should not exceed 25 per cent. Losses reported by the three companies are as follows:

	Losses Reported	Excess Over Maximum Expected
Salonika	36.9	11.9
Volos	21.4	6.4
Patras	27.8	12.8

The "excess over maximum expected" is very probably not actual physical loss. It is better classified as "unrecorded service," service that is either supplied free of charge or is stolen. The three companies studied

could well afford to be more aggressive in preventing theft of energy. No investigation was made of the legal remedies available to the companies in such cases. If local ordinances are not adequate in this respect it would be in the public interest to strengthen them. To the maximum extent possible, the deliberate supplying of service free of charge should be stopped.

The effects of "unrecorded service," whether deliberately supplied free of charge or the result of theft, is two-fold. It increases the rate level to the customers who pay for their service and it decreases the profits of the individual companies.

D - ANALYSIS OF TAXES

Following is an analysis of taxes paid (in thousands of drachmae) by the three companies in 1948. This tabulation is not presented as being either exact or complete. The amounts of some of the taxes, such as those applicable to fuel oil and particularly to lubricating oil, could only be approximated. The total tax burden undoubtedly exceeds the amounts shown.

1948 Taxes in Thousands of Drachmae			
Taxes Applicable to	Salonika	Volos	Patras
Customers' Bills	1,910,700	770,260	1,110,700
Fuel Oil	720,400	165,250	435,700
Lubricating Oil	unknown	40,050	73,450
Operations	60,500	83,050	150,500
Total	2,691,600**	1,058,610	1,770,350
Per cent of Billing*	13.8	22.5	25.5
Per Kilowatt-hour Sold (Drachmae)	217	320	156

*"Billing" is the total amount paid by the customer, including taxes and other added charges.
** Does not include taxes on lubricating oil.

Corresponding figures for the United States are 18.3 per cent of Billing and 0.3¢ (30 drachmae) per kilowatt-hour sold. While the tax burden, in per cent of billing, is only moderately greater, and in Salonika is somewhat less than in the United States, taxes per kilowatt-

hour sold in Patras are five times, in Salonika seven times, and in Volos more than ten times as great as in the United States.

Most of the excise taxes applicable to electric service bills in Greece are levied as a percentage of base rate which is a much more desirable form of tax than those levied as a fixed amount per kilowatt-hour. With the percentage type of tax, the amount per kilowatt-hour decreases as the basic rate decreases although the total amount of the tax may increase if the decrease in the basic rate per kilowatt-hour is such as to stimulate the use of electric service.

As previously shown, in the analyses of the individual companies, there is considerable variation in the amounts and the nature of taxes added to base rate to establish customers' billing. The variation with respect to these three companies, appears to be less pronounced than throughout the country as a whole. It is suggested that an improvement in tax policy could be made by establishing country-wide uniformity in taxes to be apportioned between national and local taxing authorities on some reasonable basis with the total not exceeding 15 per cent of the amount paid by customers for the service.

E - ANALYSIS OF PLANT ACCOUNT

The valuation of Electric Utility Plant (the value of power plants, distribution systems, and other items of fixed capital) has a distinct bearing on the rate level. That is, if construction has been uneconomical or if valuations have been otherwise unduly inflated, there will be a definite tendency toward a high rate level.

The plant accounts of the three cities studied are definitely not responsible for the high level of rates currently being charged for electric service.

The amounts currently shown on the balance sheets of the Salonika, Volos, and Patras companies for Electric Utility Plant appear to be low. There are three possible explanations for this condition, namely:

1 - Although all three companies have revalued their plant accounts because of the inflation of the drachma, such write-ups may have been insufficient to fully compensate for such inflation.

2 - In some cases the balance sheets may reflect partially depreciated plant accounts rather than the original cost adjusted for inflation.

3 - Distribution Plant, which in all cases appears unusually low, is influenced to varying extents by the policies of the individual companies in requiring customers to contribute to the cost of line extensions.

It is not believed that the low plant values can be accounted for to any extent by economical standards of construction. The reverse appears to be the case, as inspection of these properties leads to an expectation of higher unit costs than those generally prevailing elsewhere.

1 - Ratio of Plant Account to Billing

In the United States, investment in electric utility plant is approximately 3.74 times the annual billing. In the three Greek cities the ratio is as shown below.

	Thousands of Drachmae			
	Valuation Basis Drachmae per Pound Sterling	Electric Utility Plant	Electric Operating Billing*	Ratio Plant to Revenue
Salonika	18,700	6,697,990	19,056,879	0.35
Volos	32,100	4,072,249	4,713,414	0.86
Patras	20,000	3,636,040	6,954,452	0.52

* Billing as used in this tabulation includes taxes and other added charges to make ratios comparable to that quoted for the United States.

It might be argued that billing is higher in relation to plant account in the Greek cities than in the United States because the Greek rates are so much higher. While this may have some influence, it is no where near sufficient to account for an investment per drachma of billing

in Salonika of only 9 per cent, Volos only 23 per cent, and Patras only 14 per cent of the average prevailing in the United States. This will be brought out more fully below where it is shown that the production plant investment per kilowatt of plant capacity and the distribution plant investment per customer are far below the averages prevailing in the United States.

2 - Production Plant Investment per Kilowatt of Plant Capacity

Statistics on 51 electric utilities in the United States having internal combustion power plants varying in capacity from 1000 to 20,585 kw show an average production plant investment of $145.61 (1,456,100 Drachmae) per kilowatt of capacity, based on costs at the time the equipment was installed. Corresponding figures for the three Greek companies are as follows:

Company	Valuation Basis (Drachma/Pound)	Production Plant* (000 Drachma)	KW Rated Plant Capacity	Investment per Kw (000 Drachma)	Per cent of U S Unit Investment
Salonika	18,700	4,874,247	11,140(a)	438	30
			22,500(b)	217	15
Volos	32,100	1,700,853	1,925	884	61
Patras	20,000	1,785,252	6,566(c)	272	19

* Approximate. Includes allocations of certain jointly used property.

(a) Rated capacity of stationary plants only.

(b) Includes floating stations. It is not known whether anything is included in plant account for these units.

(c) Excludes one unit being installed. Includes 3500 kw of hydro capacity.

With respect to investment in power plant capacity, Volos, which has the highest valuation basis, probably comes somewhere near showing the true historical value adjusted for inflation, being 61 per cent of the U S average. Patras appears definitely low, even giving consideration to the low valuation basis. If the Salonika plant account includes nothing for the floating plants, adjustment to 32,100 drachmae per pound would show a value only 15 per cent lower than Volos.

3 - Distribution Plant Investment per Customer

While distribution plant will vary to some extent with load density, it is more nearly proportionate to the number of customers served. In the United States, 66 companies, each serving less than 25,000 customers, have an average distribution plant investment of $156 (1,560,000 Drachmae) per customer, based on costs at the time the equipment was installed. Corresponding figures for the three Greek cities are as follows:

Company	Valuation Basis (Drachma/Pound)	Distribution Plant* (000 Drachma)	Number of Customers (12-31-48)	Investment per Customer (000 Drachma)	Per cent of U S Unit Investment
Salonika	18,700	1,565,767	21,847	72	5
Volos	32,100	2,267,453	13,018	174	11
Patras	20,000	1,787,833	13,684	131	8

* Approximate. Includes allocations of certain jointly used property.

It is hardly conceivable that the foregoing figures represent the actual historical distribution system investments adjusted for currency inflation. The Volos investment, which is the largest of the three, is only 11 per cent of the average for the U S companies. Practices with regard to requiring customers to contribute to the cost of line extensions vary between the three companies and the individual company's policies have varied with time. Apparently all three companies have always, in general, required some contribution, and one or more of them have, at times, required the prospective customer to pay the entire cost of extending the distribution system to serve him. It is possible therefore, but by no means probable, that the amounts now shown on the companies' books as distribution plant represent the total investment made by the Company, excluding the portion paid for by the customer.

F - ANALYSIS OF GENERAL FACTORS

There are a number of physical factors that have great bearing on the overall economics of the electric utility business. Some of these are fully within the control of management while others are more dependent upon the economic conditions of the country and the individual community. Some of the more important of these are discussed below.

1 - Kilowatt-hour Sales per Customer

One of the most important factors affecting the rate level is the average number of kilowatt-hours sold per customer. Many of the elements of the cost of supplying electric service are entirely independent of the number of kilowatt-hours supplied. Others increase only slightly with kilowatt-hour sales. As an example, the sum of distribution expense, customers' accounting and collection expense, and administrative and general expense would probably increase very little, if any, if the number of customers remained constant but the kilowatt-hour sales per customer doubled. For Patras, these three items amounted, in 1948, to 176,476 drachmae per customer or 210 drachmae per kilowatt-hour sold. Assuming no increase in these expenses, doubling the sales per customer would result in a saving, in these three items of cost alone, of 105 drachmae per kilowatt-hour or 23 per cent of the base-rate revenue. The saving in these three items of operating expense is by no means the total saving that would result from doubling the energy sales per customer. A more complete analysis of all factors involved would indicate a reduction in rate level in the neighborhood of 40 per cent.

To a great extent, kilowatt-hour sales per customer are a reflection of the economic development of the community. Obviously if there is no industry in the community, it would be impossible to secure a large volume of industrial business, and similarly, if the earnings of the people of the territory served are so low that they cannot afford to purchase appliances that use electricity, no amount of managerial ability or aggressiveness can greatly increase the sale of electrical energy.

Up to the limit of the economic capacity of the community, however, kilowatt-hour sales per customer are definitely within the control of management. The steps to be taken to increase energy sales are first, to adopt a rate structure that will encourage, and make economically feasible, the increased use of service, and second, to promote aggressively the fullest possible use of the service.

With respect to the aggressive promotion of the sale of their service, none of the companies appear, at present, to be well organized

or to be making much progress. There is some evidence, however, that before the war some progress was being made in this respect. At present, the company managements appear to be entirely concerned with the technical and engineering aspects of their operations and much too little concerned with the business or commercial aspects.

2 - Load Factor and Diversity

System load factor is of even greater importance than kilowatt-hour per customer in determining the cost of supplying electric service. Load factor is a measure of the kilowatt-hour produced in a day, year, or other period of time in relation to the system load in kilowatts, and is usually expressed as a percentage.

Salonika and Volos, which have the highest rates, had load factors for 1948 of about 35 per cent. Patras, with the lowest rates, had a load factor of 44 per cent. The Patras load factor is highest because the load is more diversified. A much larger percentage of sales are for industrial purposes, and the kilowatt-hour sales per residential customer are about twice as great in Patras as in either of the other two cities.

System load factor can be improved through rate and sales promotional policies designed to give special encouragement to classes of business that are predominantly off peak. In all three cities the peak load occurs during the evening in the winter months. System annual load factor therefore could be increased by serving proportionately more summer-time load or day-time load at any time during the year.

STATISTICAL COMPARISON
ELECTRIC UTILITY OPERATIONS IN
SALONIKA - VOLOS - PATRAS - 1948

Item No.	Item	Salonika	Volos	Patras
1	Population of Area Served	315,000 (1)	69,000	93,000
2	Number of Customers (Average for Year)	20,915 (2)	12,613	13,435
3	Population per Customer	15.1(6)	5.5	6.9
4	Generating Capacity - Kw	11,585 (3)	1,880	5,800 (4)
5	Peak Load - Kw	6,500	1,550	4,100
6	- % of Capacity	56	82	71
7	Kwh Gross Generated	20,705,332	4,432,440	15,868,780
8	Annual Load Factor	36.3	32.6	44.1
9	Kwh Net Generated - Total	19,780,059	4,343,800 (5)	15,687,000
10	- Diesel	19,780,059	4,343,800	10,428,000
11	- Hydro	-	-	5,259,000
12	Kwh Purchased	0	186,000	0
13	System Input (9) + (12)	19,780,059	4,529,800	15,687,000
14	Company Use	37,939	238,160	- (7)
15	Losses - Kwh	7,323,989	987,458	4,356,183
16	- % of System Input	37.0	21.8	27.8
17	Kwh Sales - Total	12,418,131	3,304,182	11,330,817
18	- Per Capita	39.4(8)	47.9	121.8
19	- Per Customer	594	262	843
20	Kwh Sales - Private Lighting - Per Customer	296	117	166
21	- % of Total	43.2	40.5	17.3
22	- Street Lighting - Per Capita	1.4	3.3	5.8
23	- Industrial	2,534,681	1,446,700	7,399,875
24	- Per Capita	8.0	21.0	79.6
25	- Per Customer	1,685	1,453	15,071
26	- % of Total	20.4	43.8	65.3
27	Total "Revenue" (Thousands of Drachmae) (9)	14,028,522	3,467,150	5,302,191
28	- per Kwh Sold - Drachmae	1,130	1,049	468
29	- per Customer - Drachmae	670,740	274,887	394,655
30	Total "Payments for Service" (Thousands of Drachmae) (10)	19,264,502	4,713,494	6,954,452
31	- per Kwh Sold - Drachmae	1,551	1,430	614
32	- per Customer - Drachmae	921,085	373,701	517,637
33	Total Payments for Private Lighting (Thousands of Drachmae)	10,844,744	2,520,829	2,635,714
34	- per Kwh Sold - Drachmae	2,023	1,882	1,344
35	- per Customer - Drachmae	599,621	219,546	223,422
36	Total Payments for Industrial Service (Thousands of Drachmae)	3,532,049	1,508,066	3,105,159
37	- per Kwh	1,393	1,042	420
38	Production Expense*	7,085,987	1,403,152	2,770,388
39	- per Kwh Net Generated**	358	323	177
40	- per Kwh Sold**	571	425	245
41	Fuel Cost*	2,881,603	661,006	1,742,737
42	- per Kwh Diesel Net Generated**	146	152	167
43	- per Kwh Sold**	232	201	154
44	Fuel and Lubricating Oil Cost*	3,614,261	794,537	1,987,567
45	- per Kwh Diesel Net Generated**	183	183	191
46	- per Kwh Sold**	291	240	175
47	Purchased Power Cost*	-	128,846	-
48	- per Kwh Purchased**	-	693	-
49	Production Expense - Excluding Fuel, Lubricants, Purchased Power*	3,471,726	479,767	782,821
50	- per Kw Station Capacity**	299,674	255,196	134,969
51	- per Kwh Net Generated**	176	110	50
52	- per Kwh Sold**	280	145	69
53	Distribution Expense*	1,548,598	510,825	663,796
54	- per Customer**	74,042	40,500	49,408
55	- per Kwh Sold**	125	155	59
56	Customers Accounting and Collection Expense*	975,258	187,706	337,008
57	- per Customer**	46,630	14,882	25,084
58	- per Kwh Sold**	79	57	30
59	Administrative and General Expenses*	691,229	467,696	1,370,163
60	- % of Revenue	4.9	13.5	25.8
61	- per Kwh Sold**	56	142	121
62	Total Operating Expenses*	10,301,071	2,611,673	5,141,355
63	- % of Revenue	73.4	75.3	97.0
64	Total Payroll and Related Expenses*	5,741,372	1,166,360	2,312,038
65	- % of Operating Expenses	55.7	44.7	45.0

* Thousands of Drachmae

** Drachmae

NOTES APPLYING TO STATISTICAL COMPARISON
SALONIKA - VOLOS - PATRAS

1 - 315,000 is the estimated population of metropolitan Salonika but not the population of the area served by the Electric Company since some 5100 customers in the same area are served by the Neapolis and Calamaria companies.

2 - Number of customers as reported by the Electric Company is 20,915. There are, however, a large number of indirect customers (informally reported to be as high as 7000) because of the shortage of meters.

3 - Total generating capacity in Salonika is 22,500 kw. Capacity in condition to operate at time of inspection (June 1949) was 11,585 kw.

4 - Wintertime capacity after completion of repairs and installation under way in June 1949.

5 - Estimated gross generation was 4,432,440 kwh. Station service estimated to be 2 per cent of gross.

6 - Population per customer based on the reported customers of the Electric Company only. When the 5100 customers of the Neapolis and Calamaria companies are included, the population per customer would be decreased to 12.1.

7 - Except for station service, no energy was reported as Company use by Glafkos.

8 - If Neapolis and Calamaria sales are included, total per capita sales in Salonika would be approximately 42.

9 - "Revenue" is base rate billing and meter rental but excludes excise taxes and other added charges.

10 - "Total Payments for Service" include "Revenue," taxes, load repayments and all other amounts paid by customers for service.

APPENDIX

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

BALANCE SHEET - DECEMBER 31 1948

(In Drachmae)

Assets			
Utility Plant (See Note 1)			
Tramway Plant		2,045,987,830	
Electric Plant		6,697,992,534	
Total Utility Plant			8,743,980,364
Current Assets			
Cash on Hand		463,726,071	
Cash in Banks		248,659,590	
Accounts Receivable			
Customers - Service - Note 2	2,718,672,185		
Government and Municipal - Service - Note 2	1,592,300,784		
Employees - Note 2	722,632,436		
Other	399,693,379	5,433,298,784	
Materials and Supplies			
Operating, Maintenance and Construction Materials	751,557,610		
Fuel Oil and Lubricants	190,486,529	942,044,139	
Total Current Assets			7,087,728,584
Total Assets			15,831,708,948
Liabilities and Capital			
Long-Term Debt (Note 3)			
Property Purchase Obligations - Due Serially 1949-1971 Payable in Belgian Francs, (69,558,334) (including matured and unpaid installments BF 11,932,584)			7,929,650,076
Current Liabilities			
Taxes Accrued		1,124,221,886	
Employees Christmas Bonus Accrued		658,489,000	
Due Employees Pension and Other Funds		1,168,186,051	
Customers' Deposits		447,420,450	
Sundry Creditors		257,416,591	
Total Current Liabilities			3,655,733,978
Reserve for Depreciation of Utility Plant - Note 4			762,000,000
Amounts Collected from Customers for Repayment of Rehabilitation Loans - Note 5			2,942,913,624
Equity of Greek Government			
Original Capital Contribution - Note 6		864,580,056	
Advances from Government		3,144,000,000	
		4,008,580,056	
Less:			
Surplus (Deficit) (Note 7)	1,559,768,163		
Capital Adjustment Account - Debit - Note 8	1,907,400,623	3,467,168,786	
Net Equity of Greek Government			541,411,270
Total Liabilities and Capital			15,831,708,948

The accompanying Notes to Financial Statements should be considered in conjunction with the above statement

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

COMPARISON OF INCOME STATEMENTS - COMBINED OPERATIONS

Calendar Years 1948, 1947 and 1946

(In Drachmae)

	1948	1947	1946
Operating Revenue			
Electric	14,276,875,398	8,882,308,597	4,030,316,674
Transportation	5,464,116,900	3,246,023,000	2,244,197,730
Total Operating Revenues	19,740,992,298	12,128,331,597	6,274,514,40[illegible]
Operating Revenue Deductions			
Operating Expenses and Taxes (Note 9)			
Electric	10,301,071,493	6,378,851,180	3,254,816,319
Tramway	9,729,279,846	6,144,979,334	3,565,377,800
Total Operating Expenses and Taxes	20,030,351,339	12,523,830,514	6,820,194,119
Provision for Depreciation (Note 4)	416,000,000	346,000,000	-
Total Operating Revenue Deductions	20,446,351,339	12,869,830,514	6,820,194,119
Net Revenues from Operations	(705,359,041)	(741,498,917)	(545,679,715)

( ) indicates red figure

The accompanying Notes to Financial Statements should be considered in conjunction with the above statement.

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

COMPARISON OF INCOME STATEMENTS - ELECTRIC DEPARTMENT

Calendar Years 1948, 1947 and 1946

(In Drachmae)

	1948	1947	1946
Electric Operating Revenues:			
Energy Sales to Public	13,020,480,451	8,336,073,766	3,775,668,398
Interdepartmental Transfers -			
Tramways Department	959,321,445	497,281,619	230,554,020
General Offices	10,334,974	4,493,468	4,716,693
Total Sales and Interdepartmental	13,990,136,870	8,837,848,853	4,010,959,111
Miscellaneous Operating Revenues (Note 10)	238,018,088	-	-
Meter Rentals	48,720,440	44,459,744	19,357,563
Total Operating Revenues	14,276,875,398	8,882,308,597	4,030,316,674
Electric Operating Expenses:			
Production Expenses	7,085,987,379	4,317,351,909	2,344,005,650
Distribution Expenses	1,548,597,520	1,069,795,721	458,522,202
Customers' Accounting and Collecting Expenses	975,257,594	631,185,701	294,722,416
Administrative and General Expenses - Apportioned	691,229,000	360,517,849	157,566,051
Total Operating Expenses	10,301,071,493	6,378,851,180	3,254,816,319
Net Revenues from Operation before Provision for Depreciation of Property	3,975,803,905	2,503,457,417	775,500,355

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

DEPARTMENTAL OPERATING EXPENSES - ELECTRIC DEPARTMENT - AS RECLASSIFIED

Calendar Years 1948, 1947 and 1946

(In Drachmae)

	1948	1947	1946
Production Expenses:			
Salaries - Supervision	86,510,089	63,518,612	30,583,413
Station Labor	2,175,829,849	1,671,783,453	606,452,566
Engine Fuel	2,881,602,708	1,222,035,143	681,270,080
Lubricants	732,558,298	363,728,565	271,696,019
Water	42,901,957	17,961,541	12,645,272
Tools Expense	25,600,118	13,059,499	17,187,303
Maintenance - Labor	147,162,172	186,296,827	100,910,386
Maintenance - Material	282,070,806	268,945,504	292,879,919
Holiday Bonus	243,418,800	135,826,400	65,351,244
Pensions	283,529,294	165,519,040	76,422,345
Medical Expenses	85,633,956	44,758,782	26,849,997
Social Security	28,537,665	33,047,120	13,903,402
Employees' Uniforms	-	16,140,945	4,519,660
Accident Expense	79,500	1,423,610	1,331,549
Extra Compensation, Overtime, Etc	16,005,000	1,675,000	2,186,000
Miscellaneous Generating Expenses	54,547,167	42,695,968	27,965,614
Rental of Dredges	-	68,935,900	44,897,300
Cost of Moving Dredge	-	-	66,953,581
Total Generating Expenses	7,085,987,379	4,317,351,909	2,344,005,650
Distribution Expenses:			
Salaries - Supervision	174,626,667	112,576,153	58,187,618
Labor - Operation and Maintenance	831,306,515	623,239,278	240,354,502
Materials - Operation and Maintenance	53,445,770	88,639,401	23,046,061
Tools Expense	9,356,050	7,435,402	3,021,087
Holiday Bonus	88,105,100	71,855,300	33,449,522
Pensions	125,740,680	63,048,907	35,331,208
Medical Expenses	38,867,087	13,872,611	12,471,289
Social Security	7,376,422	5,679,549	2,769,350
Employees' Uniforms	-	8,163,024	4,036,817
Accident Expenses	710,000	566,790	239,628
Extra Compensation, Overtime, Etc	26,227,400	28,112,162	13,929,064
Miscellaneous Distribution Expenses	49,252,857	10,045,964	24,067,511
Maintenance - Building and Furniture - Labor	97,104,355	19,624,395	4,901,822
Maintenance - Building and Furniture - Materials	46,478,617	16,936,785	2,716,723
Total Distribution Expense	1,548,597,520	1,069,795,721	458,522,202

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

DEPARTMENTAL OPERATING EXPENSES - ELECTRIC DEPARTMENT - AS RECLASSIFIED

Calendar Years 1948, 1947 and 1946

(In Drachmae)

	1948	1947	1946
Customers' Accounting and Collecting Expenses:			
Supervision	66,065,000	44,298,000	20,442,000
Contracts	28,042,000	18,516,000	9,000,000
Meter Reading	101,100,000	64,535,000	36,312,000
Collecting	269,000,000	169,946,000	82,800,000
Billing and Accounting	228,300,000	144,112,000	68,100,000
Holiday Bonus	86,563,400	55,175,900	22,340,600
Pensions, Medical, Social Security	118,464,900	76,419,200	34,306,600
Stationery and Printing	32,300,000	18,000,000	12,000,000
Uncollectible Accounts	45,422,294	40,183,601	9,421,216
Total Customers' Accounting and Collecting Expenses	975,257,594	631,185,701	294,722,416
Administrative and General Expense - Apportioned	691,229,000	360,517,849	157,566,051
Summary			
Production Expenses	7,085,987,379	4,317,351,909	2,344,005,650
Distribution Expenses	1,548,597,520	1,069,795,721	458,522,202
Customers' Accounting and Collecting Expenses	975,257,594	631,185,701	294,722,416
Administrative and General Expense - Apportioned	691,229,000	360,517,849	157,566,051
Total Departmental Operating Expenses - Electric	10,301,071,493	6,378,851,180	3,254,816,319

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

COMPARISON OF INCOME STATEMENTS - TRAMWAY DEPARTMENT

Calendar Years 1948, 1947 and 1946

(In Drachmae)

	1948	1947	1946
Transportation Revenues	5,464,116,900	3,246,023,000	2,244,197,730
Operating Expenses and Taxes			
Operation and Maintenance			
Conducting Transportation	2,956,976,281	1,509,813,572	959,824,250
Electric Power Purchased	959,321,445	497,281,619	237,887,612
Maintenance - Overhead Lines	167,392,351	124,438,022	89,107,617
Maintenance - Rolling Stock	1,991,025,476	1,102,383,472	811,630,720
Maintenance - Roadway	396,979,479	263,500,725	172,367,332
General	1,646,348,399	1,622,686,811	661,889,052
Administrative and General - Apportioned	483,699,527	355,040,247	169,566,050
Total Operating Expenses	8,601,742,958	5,475,144,468	3,102,272,633
Taxes - Gross Receipts	867,316,006	515,237,631	356,218,516
Contributions to Public Pension and Welfare Funds	260,220,882	154,597,235	106,886,651
Total Operation Expenses and Taxes	9,729,279,846	6,144,979,334	3,565,377,800
Net Revenues from Operation before Provision for Depreciation	(4,265,162,946)	(2,898,956,334)	(1,321,180,070)

( ) indicates red figure

SALONIKA TRAMWAYS AND ELECTRIC COMPANY

NOTES TO FINANCIAL STATEMENTS

1 - Utility plant is stated on the basis of a revaluation made in March 1947, under which estimated construction cost of plant at date property was acquired from the Belgian interests was multiplied 37 times in conformity with the formula for revaluation of fixed assets of limited liability companies as provided under Royal Decree published in Official Gazette No. 273 of September 9 1946. Book value of electric plant was increased by drachmae 4,578,180,592 as a result of this revaluation adjustment.

2 - Accounts due from electric customers represent approximately three months average billings in the case of private customers and approximately six months average billings for government and municipal customers. Collections appear to be slow but the Company states that no unusual losses are anticipated. No reserve is provided for losses on uncollectible accounts but accounts are written off against current operations as they are determined to be worthless. Amounts due from employees are being collected through payroll deductions.

3 - Represents amount owed to Companie Des Tramways et d'Eclairage Electrique de Salonique under agreement dated October 2 1940 for transfer of tramway and electric properties in Salonika to the Greek government. Under this agreement, the above Company was to be paid the sum of 70,805,002 Belgian francs over a period of 31 years. Installments due 1941 and 1942 aggregating 1,246,668 francs have been paid, leaving a balance unpaid at December 31 1948 of 69,558,334 francs, of which, installments in the amount of 11,932,584 francs were matured and unpaid. This debt, payable in Belgian francs, is carried in local currency at the exchange ratio of drachmae 114 to one Belgian franc, representing a total liability in drachmae of 7,929,650,076 at December 31 1948.

4 - Balance in Reserve for Depreciation of Utility Plant represents provisions made for the reserve for the fiscal years ending March 31 1947 and 1948. The Company is currently providing for the reserve on the basis of 5 per cent of book value of depreciable property as of the end of the fiscal year. The reserve balance of drachmae 762,000,000 as of December 31 1948 was equal to 8.7 per cent of book value of utility plant as of that date.

5 - Under authority granted by the Greek Ministries of Finance and Transport, the Company collected from its electric customers over the period July 1946 to December 31 1948 the sum of drachmae 2,942,913,624 for the purpose of providing funds for the repayment of rehabilitation loans. Collections were made at the rate of 15 per cent of the base electric bill prior to October 20 1948, when, upon instructions from the government, the amount was reduced to 7 per cent. The government has not indicated the eventual disposition of this amount.

6 - The original capital contribution of the Greek government to the state operated tramway and electric system in Salonika was restated in March 1947 upon instructions from the Greek Ministry of Transport in connection with the restatement of the Belgian obligations and of the plant accounts as of that date. Under the formula submitted by the Ministry, the original capital of drachmae 22,826,488 contributed during the years 1941 - 1943 was multiplied 37 times which, together with a subsequent capital contribution of drachmae 20,000,000, brought the book value of original capital to drachmae 864,580,056 as of December 31 1948.

7 - Balance of deficit in surplus account at December 31 1948, per books of Company of drachmae 901,279,163, adjusted to reflect charge to 1948 operations of drachmae 658,489,000 for Christmas bonus paid in January 1949.

8 - Represents the net debits arising from revaluation made in March 1947 under which property purchase obligations payable in Belgian francs, original capital made by Greek government and the utility plant account were restated on basis of instructions of the Greek Ministry of Transport. Royal Decree, for the readjustment of balance sheets, dated July 7 1948, provides that debit balances in the capital adjustment account shall be deducted from the reserve capital of the Company.

9 - Operating Expenses for the years 1947 and 1948. As shown in this statement, reflect adjustments to charge operations of the year 1947 and credit 1948 operations with retroactive wage increase and Christmas bonus applicable to the year 1947, which were paid in 1948 and charged to 1948 operations, also to charge 1948 operations with Christmas bonus for year 1948 paid in January 1949, and charged to expenses of the latter year.

10 - Represents surcharge of 2 per cent applied to customers' base bills to cover reconstruction charges. Amounts collected prior to May 1948 were credited to operating revenues by the Company, while subsequent collections were credited to pension funds. Costs of reconstruction and extraordinary maintenance were charged to operating expenses of the current period.