
CENTRAL ELECTRIC LIGHT AND POWER STATIONS

PART I.—STATISTICAL

PART II.—TECHNICAL

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

PART I.—STATISTICAL.

CHAPTER I.

INTRODUCTION AND GENERAL EXPLANATIONS.

Class of stations included.—The statistics for central electric stations represent all stations which furnish electrical energy for light, power, and heat; for manufacturing, mining, and other commercial enterprises; for private dwellings; and for public uses, such as lighting streets, parks, etc. The statistics for electric stations operated by electric railways are included whenever it was practicable to secure a separate report for the central station work. No reports were required for electric stations operated by mining companies, factories, hotels, etc., which consume all current generated, nor for those operated by the Federal Government and state institutions. Neither were reports required for stations that were idle or in course of construction. The canvass did not cover Alaska, Hawaii, the Philippines, or Porto Rico, therefore the statistics are confined to continental United States.

Number of central electric stations.—The number of central electric stations reported, 5,221, is considerably less than the number reported in commercial directories. This apparent discrepancy is due to the fact that in collecting the census statistics when a number of plants were operated under the same ownership it often was impracticable to secure a separate report for each, and therefore a single report was made to cover the operations of all and they were counted as one plant. In preparing the directories apparently each plant is treated as a separate unit. Although the number of stations in this report is less than the number accounted for in the directories, this difference is due to the census definition of the term "station," which may represent a single electric station or a number of stations which have been combined under the same ownership. These combinations embrace stations of varying characteristics as to primary power, generating and line equipment, and character of service. They have in common, however, the practice of disposing of electrical energy, either direct to consumers for light, heat, or power, or in bulk to some other public-service corporation. All or only a part of the stations embraced in a combination may have generating equipment, or the combination

may embrace several generating stations which send the electrical energy over transmission lines to a single distributing center.

From year to year more or less of the central electric stations are merged with electric railways. These stations, nevertheless, are properly enumerated in the directories as separate stations, but are included in the census reports as a part of the electric railway industry except when separate reports can be prepared for the electric light and power departments.

Centralization.—The tendency toward centralization of ownership of electric stations noticeable in 1907 is even more pronounced in 1912.

Central electric stations reported at one census are sometimes combined and reported with electric railways at another census to an extent which actually destroys the comparability of the statistics in certain particulars for the individual states and, although it may not be perceptible, necessarily affects the total for the United States. The rapid development of the hydroelectric stations, many of which send current over long transmission lines, taking no cognizance of state boundaries, is another disturbing factor in the presentation of comparative statistics for the different states.

Commercial and municipal stations.—Central electric stations are divided into two groups—commercial and municipal. The commercial stations are those operated by individuals, firms, and corporations as distinguished from stations operated by municipalities.

The municipal stations often extend their operations into the commercial field and sell electricity to the general consumer.

Purely electric and composite stations.—Central stations are further classified as "purely electric" and "composite." The purely electric stations embrace those engaged solely in the generation and sale of electrical energy. The composite electric stations include those operated by companies which carry on other industries in connection with the stations, such as the manufacture of gas, the operation of waterworks, electric railways, ice plants, and other commercial enterprises. In some cases a company had but one system

of accounts, rendering it impracticable to obtain exact statistics covering the operations of the central electric station. If the outside business was merely incidental to the operations of the central station the report was accepted, with or without the other business, in accordance with the system of accounting used by the reporting company. In cases where the outside business was of importance, careful estimates were obtained, so that the statistics would represent only the operations of the electric station. In connection with this latter class of station, however, it was sometimes impracticable satisfactorily to segregate the items on the balance sheet, and in such cases this inquiry, therefore, covers both the electrical and other business.

When income was reported for steam heating, usually from surplus steam, no attempt was made to segregate this business from that of electric station work; and, since the sale of electrical supplies and the wiring of buildings, etc., forms a part of the business of many companies, such income was included. Income of this character, however, is invariably reported as income from "All other sources."

Free service included as income.—It frequently happens that no cash income is derived by municipal stations for electrical energy used for lighting streets and public buildings. In order, however, that the income shown in this report might correspond approximately to the total consumption of electrical energy for all stations, the schedule required that the income for service of this character furnished by municipal stations be estimated on the basis of what would have been charged for similar service by commercial companies in near-by localities. Commercial companies sometimes rendered free service in consideration of franchise or other privileges, and the income for this service also was estimated in like manner and included in the total.

Comparison with prior censuses.—A partial census of the central electric stations was made in connection with the census of manufactures of 1890. It was found possible, however, to canvass only the state of New York and the city of St. Louis. The results, therefore, are too incomplete for comparison with later censuses. The first complete census of the industry was taken in 1902, and comparative statistics are confined to that year, 1907, and 1912. Substantially the same form of schedule was used at these

three censuses. In formulating the schedule for 1912, however, it was deemed advisable to omit some of the subinquiries used at prior censuses because the statistics secured from these inquiries were not entirely satisfactory. The most important change affecting the comparability of the statistics relates to the number of persons employed. For the censuses of 1902 and 1907 the average number employed during the entire year was reported; the schedule of 1912 called for the number employed on September 16, and if statistics were not available for that day or month, data were obtained for the nearest representative or normal day. For the majority of establishments it was impossible to obtain a correct average of the number employed during the entire year, and it was believed that obtaining the number on a specified day would result in greater uniformity, also that this number would not vary greatly from the average number if the average was correctly computed. In many instances it is difficult to classify the employees according to the work upon which they are engaged, and in preparing the schedule for the census of 1912 it was decided to attempt only two groupings of employees, namely, salaried employees and wage earners.

There was considerable variation in reporting the number of lamps in public buildings. Some central stations considered the lamps in theaters, churches, schools, and similar buildings as installed in public buildings; others limited the number of this class to those installed in municipal buildings only. The income received from lighting municipal buildings is not, therefore, comparable with the number of lamps reported for public buildings.

There is no uniform system of accounts employed by all central electric stations, and it was difficult to obtain financial statistics on a uniform basis for all establishments enumerated. The National Electric Light Association has devised a system of accounts which it is endeavoring to have adopted by all stations. This system of accounts was followed as closely as possible in devising the schedule for the census of 1912. The schedule includes certain details in regard to financial transactions which were not shown definitely at prior censuses, and a much more satisfactory report in this respect has been made than was possible heretofore.

CHAPTER II.

DEVELOPMENT OF THE INDUSTRY.

Summary for 1912.—Table 1 is a summary for the central electric stations included in the census of 1912. It shows the principal facts ascertained at this census, and distinguishes two classes of stations: (1) Commercial central electric stations, those which are conducted by corporations, companies, and individuals; and (2) municipal electric stations, those which are operated by municipalities. It also shows the proportion that the totals for each of these classes of stations form of the total for all.

Table 1	Total.	Commercial stations.	Municipal stations.	PER CENT OF TOTAL.	
				Com-mercial.	Muni-cipal.
Number of stations.....	5,221	3,659	1,562	70.1	29.9
Total income.....	\$302,115,599	\$278,896,610	\$23,218,989	92.3	7.7
Light, heat, and power, including free service.....	\$236,980,858	\$204,317,150	\$32,663,708	92.1	7.9
All other sources.....	\$15,134,741	\$14,579,460	\$555,281	96.3	3.7
Total expenses, including salaries and wages ¹	\$234,419,478	\$217,502,313	\$16,917,165	92.8	7.2
Total number of persons employed.....	79,335	71,395	7,940	90.0	10.0
Total horsepower.....	7,523,648	6,969,320	559,328	92.6	7.4
Steam engines and steam turbines—					
Number.....	7,844	5,820	2,024	74.2	25.8
Horsepower.....	4,946,532	4,539,866	406,666	91.8	8.2
Water wheels—					
Number.....	2,933	2,664	269	90.8	9.2
Horsepower.....	2,471,081	2,340,820	130,261	94.7	5.3
Gas and oil engines—					
Number.....	1,116	833	283	74.6	25.4
Horsepower.....	111,035	88,634	22,401	79.8	20.2
Kilowatt capacity of dynamos.....	5,134,689	4,706,012	368,677	92.8	7.2
Output of stations, kilowatt hours.....	11,532,963,006	10,995,436,276	537,526,730	95.3	4.7
Estimated number of lamps wired for service:					
Arc.....	505,395	413,544	91,851	81.8	18.2
Incandescent and other varieties.....	76,507,142	69,449,293	7,057,849	90.8	9.2
Stationary motors served:					
Number.....	435,472	413,578	21,895	95.0	5.0
Horsepower capacity.....	4,130,619	3,966,328	164,291	96.0	4.0

¹ In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation and charges for sinking fund, and all other expenses incident to operation and maintenance.

The income, horsepower of the prime movers, and the kilowatt capacity of dynamos are three important factors determining the magnitude of the central station industry. It appears from Table 1 that for the year 1912 the municipal stations reported a very small proportion of each of these items, the percentages being 7.7 for income, 7.4 for primary horsepower, and 7.2 for dynamo capacity. The commercial stations, therefore, largely predominated in the industry.

The municipal stations, however, show larger proportions for some of the other items contained in the table. Among the most conspicuous may be mentioned the number of stations, 29.9 per cent; the horsepower of gas and oil engines, 20.2 per cent; and

number of arc lamps, 18.2 per cent. On the other hand, the municipal stations reported only 4.7 per cent of the kilowatt hour output for the year, and but 4 per cent of the horsepower of stationary motors served.

The statistics for the central stations do not represent the entire production and utilization of electrical energy. To arrive at the aggregate, it is necessary to consider also the electric railways, telephone and telegraph lines, electric police-patrol and fire-alarm systems, and isolated electric plants. All of these industries are engaged in the utilization of electric current in what may be termed commercial enterprises. Statistics for the total gross income are available for all of them except municipal police-patrol and fire-alarm systems and isolated electric plants. This gross income for the year 1912 amounted to \$1,201,168,106, of which \$302,115,599 was reported for central electric stations, \$579,208,430 for electric railways, \$255,081,234 for telephone systems, and \$64,762,843 for telegraph systems (see table, p. 11).

Isolated electric stations.—Although, as stated in Chapter I, no attempt was made to collect statistics concerning isolated electric plants which are operated primarily for the benefit of their owners, for furnishing light or power for their factories, hotels, or other enterprises, the number and magnitude of these stations should necessarily be considered in connection with statistics showing the development of the central station industry. Some of these isolated stations that were excluded from the census are much larger than many of the central stations for which statistics are included. With the exception of the municipal stations, it was intended to confine the canvass for the census of 1912 to stations which make a business of disposing of electric current for commercial purposes, since it was impracticable within the time and means available to make a thorough canvass of all isolated plants. However, the special agents engaged in the field work collected reports from a few isolated plants, and some reports for such plants were secured by mail. These reports include a few stations of considerable magnitude, and while the data for them can in no sense be considered as an indication of the number or the magnitude of the operations of the isolated electric stations omitted from the canvass, nevertheless the figures for the 121 plants thus reported may be of interest, and they are summarized in the following statement:

Number of establishments.....	121
Total primary horsepower.....	102,187
Kilowatt capacity of dynamos.....	68,466
Estimated number of lamps wired for service, all varieties.....	152,958

The 121 isolated plants covered by the above statement were operated in connection with a variety of industries, establishments, and institutions, such as mining, lumber mills, gristmills, hotels, office buildings, land improvement companies, cotton and woolen mills, schools, and colleges. The data cover but a small fraction of the isolated electric plants in the United States, and are representative of such plants more as an indication of the character of the establishments for which statistics have been excluded from the census than as an evidence of their capacity for the generation of electricity.

Central station work of electric railways.—Of the several electrical industries, electric railways is the one most closely identified with central electric stations. A number of electric railway companies were engaged in the sale of electric current for light and power, having special departments for such work, and were able, therefore, to make complete separate reports for this service. The statistics covered by the reports for such companies are included with those for central electric stations. In 1912 there were 169 electric railways that operated light and power plants for which they were unable to make separate reports.

The statistics for the central station work of these 169 plants are placed in comparison, in Table 2, with those of a similar character in 1907 and 1902.

Table 2 shows that while the number of electric railways doing central station work for which they could not prepare complete census reports has increased during the decade, there is a still greater increase in their importance. The total income for the light and power departments of these companies during 1912 amounted to \$31,515,582, as compared with \$6,469,726 in 1902, an increase of \$25,045,856, or 387.1 per cent. In addition, there were a number of electric railway companies which were not able to furnish statistics of electric service of the character given

in Table 2, but nevertheless reported an income from the sale of current amounting to \$5,515,475. Some of the electric current was sold to other electric railway companies, but the larger portion was used for light and power in enterprises not connected with the railways. Combining the income from the sale of current by companies which had electric light and power departments with that for those not having such departments, the total income amounts to \$36,500,030 in 1912, as compared with \$7,703,574 in 1902.

Table 2

	ELECTRIC LIGHT AND POWER DEPARTMENTS OF ELECTRIC RAILWAY COMPANIES.			
	1912	1907	1902	Per cent of increase: 1902-1912
Number of stations.....	169	177	118	43.2
Gross income.....	\$31,515,582	\$17,291,824	\$6,469,726	387.1
Electric service.....	\$30,984,555	\$16,576,555	\$6,271,815	384.0
All other sources.....	\$531,027	\$715,269	\$197,911	168.3
Estimated number of lamps wired for service:				
Arc.....	55,586	80,102	33,863	64.1
Incandescent and other varieties.....	9,109,890	4,574,480	1,442,685	531.5
Stationary motors:				
Number.....	(2)	20,468	10,049	.....
Horsepower.....	(2)	158,923	35,688	.....
Meters on consumption circuits, number.....	(2)	213,886	56,601	.....

¹ Exclusive of the estimated value of free service, amounting to \$66,051.
² Not reported.

Comparison of central electric stations and gas plants.—The manufacture of illuminating gas and the production of electricity for light and power virtually have the same field of operation, and with certain limitations they come in direct competition. For this reason a comparison of the statistics for the two industries is instructive as indicating the changes in the relative importance of each. The statistics for the central electric stations and the manufacture of illuminating gas as reported at the last three censuses of these industries are presented in Table 3, which follows:

COMPARATIVE SUMMARY—CENTRAL ELECTRIC STATIONS AND GAS PLANTS: 1912, 1907, AND 1902.

Table 3	CENTRAL ELECTRIC STATIONS.			GAS PLANTS.			PER CENT OF INCREASE.					
	1912	1907	1902	1909	1904	1899	Central electric stations.			Gas plants.		
							1902-1912	1907-1912	1902-1907	1899-1909	1904-1909	1899-1904
Number of stations or plants.....	5,221	4,714	3,620	1,296	1,019	577	44.2	10.8	30.2	47.8	27.2	16.2
Cost of construction and equipment.....	\$2,175,678,266	\$1,096,913,622	\$504,740,352	\$915,536,792	\$725,035,204	\$567,000,506	331.0	98.3	117.3	61.5	26.3	27.9
Gross income ²	\$302,115,599	\$175,642,338	\$85,700,605	\$166,814,371	\$125,144,945	\$75,716,693	252.5	72.9	104.9	120.3	33.3	65.3
From sale of electric current or gas.....	\$286,980,858	\$169,614,691	\$84,186,605	\$138,615,309	\$112,662,568	\$69,432,582	240.9	69.2	101.5	99.6	23.0	62.3
From all other sources.....	\$15,134,741	\$6,027,647	\$1,514,000	\$28,199,062	\$12,482,377	\$6,284,111	899.7	151.1	298.1	348.7	125.9	98.6
Total number of persons employed.....	79,335	47,632	30,326	50,730	39,972	28,363	161.6	66.6	57.1	78.9	26.9	40.9

¹ Capital invested—owned and borrowed.
² Exclusive of the income reported by the electric light and power departments of electric railways, as follows: In 1912, \$31,515,582; in 1907, \$17,291,824; and in 1902, \$6,469,726.

Although the statistics for the two industries in Table 3 do not cover the same years, they represent the results of three censuses taken at five-year intervals, the respective census years being sufficiently near together for the purpose of general comparison. They do not, of course, show exactly the relative

importance of the industries because of the absence of statistics for isolated plants, which are of much greater importance in the electrical industry than in the manufacture of gas.

The percentages of increase for central electric stations are about double what they are for the gas

industry. This condition is due largely to the fact that the electrical industry in 1902 was practically in its infancy, whereas the gas industry in 1899 was well established. The income from the sale of electric current increased by 240.9 per cent during the decade ending with 1912, as compared with an increase of 99.6 per cent in the income from the sale of gas. Of the total combined income of the two industries for the earliest years shown, that reported by the electrical industry formed 54.8 per cent and that for the gas industry 45.2 per cent, while for the last years shown the corresponding percentages were 67.4 and 32.6, respectively. In addition to the income for electric stations, the corresponding item reported by electric railway companies should be considered. This amounted to \$36,500,030 for 1912, thus increasing the total gross receipts from the sale of current to \$323,480,888. This total, however, includes receipts from the sale of current to other public-service corporations, amounting to \$31,019,660 for central stations and \$7,580,535 for electric railways, or \$38,600,195 in all. The elimination of this duplication from the total reduces the gross receipts from the sale of current in 1912 to \$284,880,693.

Central electric stations and population.—A comparison of the number of central electric stations, their equipment, and their output with the population is one of the most satisfactory methods of illustrating the development of the industry. The advances made in long-distance transmission of electricity and its application to industrial processes in rural districts as well as in cities have stimulated the development of central stations. These advances have made it possible for the population of a much larger area to obtain the advantages of electric service. At the same time central stations are naturally established in localities from which a large population can be served most economically. A correct comparison of the population and central station work should be confined to the population within the actual radius of the service. It is impossible, however, to establish such a radius, and therefore in Table 4 the statistics for number of stations, horsepower of prime movers, kilowatt capacity of dynamos, output of stations, and number of lamps are compared with the entire population of the United States and the geographic divisions for 1912, 1907, and 1902.

CENTRAL ELECTRIC STATIONS—RELATION OF LEADING ITEMS TO POPULATION, BY GEOGRAPHIC DIVISIONS: 1912, 1907, AND 1902.

DIVISION. ¹	Cen-sus.	Popu-lation. ²	NUMBER OF STATIONS.			HORSEPOWER OF ENGINES AND WATER WHEELS. ³		KILOWATT CAPACITY OF DYNAMOS.		OUTPUT OF STATIONS, KILOWATT HOURS.		LAMPS. ⁴			
			Total.	Com-mer-cial.	Muni-cipal.	Amount.	Per 1,000 popu-lation.	Amount.	Per 1,000 popu-lation.	Amount.	Per 1,000 popu-lation.	Arc.		Incandescent.	
												Estimated number.	Per 1,000 popu-lation.	Estimated number.	Per 1,000 popu-lation.
United States..	1912	95,545,336	5,221	3,659	1,562	7,528,648	79	5,134,689	54	11,532,963,006	120,707	505,395	5.3	76,484,096	800
	1907	85,532,761	4,714	3,462	1,252	4,098,188	48	2,709,225	32	5,862,276,737	88,538	555,713	6.5	41,445,997	485
	1902	78,576,436	3,620	2,805	815	1,845,048	23	1,212,235	15	2,507,051,115	31,906	385,698	4.9	18,194,044	232
North Atlantic.....	1912	26,946,884	1,037	878	159	2,748,561	102	1,893,700	70	4,427,877,840	164,319	226,264	8.4	30,051,802	1,115
	1907	23,779,013	1,070	920	150	1,534,586	65	1,054,528	44	2,483,106,227	104,424	242,320	10.2	17,187,474	723
	1902	21,778,196	913	810	103	814,728	37	517,549	24	1,269,331,001	58,284	169,554	7.8	8,561,205	393
South Atlantic.....	1912	12,586,562	512	308	204	621,114	49	412,779	33	679,856,425	54,014	21,389	1.7	3,886,979	309
	1907	11,574,988	390	232	158	295,265	26	195,309	17	266,437,175	23,018	27,103	2.3	1,915,725	166
	1902	10,770,414	251	176	75	92,641	9	62,301	6	102,990,575	9,562	17,183	1.6	611,001	57
North Central.....	1912	30,683,662	2,337	1,464	873	2,292,749	75	1,580,700	52	3,240,559,539	105,612	178,902	5.8	26,918,022	877
	1907	29,026,645	2,095	1,368	727	1,219,916	42	805,012	28	1,462,114,001	50,371	204,248	7.0	14,289,544	492
	1902	27,087,206	1,706	1,178	528	539,969	20	375,514	14	645,062,113	23,814	145,529	5.4	6,176,919	228
South Central.....	1912	17,890,901	837	587	250	449,294	25	308,411	17	461,612,464	25,802	38,010	2.1	5,432,834	304
	1907	16,368,558	679	513	166	244,422	15	165,969	10	257,387,610	15,725	39,794	2.4	2,697,115	165
	1902	14,651,535	404	323	81	117,192	8	82,269	6	152,905,350	10,504	23,320	1.6	1,022,298	70
Western.....	1912	7,437,327	498	422	76	1,416,930	191	939,099	126	2,723,056,738	366,134	40,830	5.5	10,194,459	1,371
	1907	4,783,557	480	429	51	803,999	168	488,407	102	1,393,231,724	291,254	42,248	8.8	5,376,139	1,124
	1902	4,289,085	346	318	28	280,818	65	174,612	41	335,762,076	78,283	30,112	7.0	1,822,621	425

¹ See page 25 for states composing the several geographic divisions.

² Bureau of the Census estimates.

³ Includes capacity of auxiliary engines, amounting to 65,823 horsepower in 1907 and 14,454 horsepower in 1902.

⁴ Exclusive of "Other varieties," *Nernst, vacuum, vapor, etc.*, 23,046 in 1912, and 162,338 in 1907. Also exclusive of 275,079 lamps in 1907 used by the central stations to light their own properties, these lamps being included in 1912 and 1902, though not separately reported.

As might be expected, the largest numbers of central electric stations, with correspondingly high figures for primary horsepower and kilowatt capacity of dynamos, are found in the most populous sections. This is well illustrated by the totals for the North Atlantic and the North Central divisions, which combined represented 62.2 per cent of the estimated population in 1902 and 60.3 per cent in 1912. These two divisions reported 73.4 per cent of the total primary horsepower in 1902

and 67 per cent in 1912; and of the kilowatt capacity of the dynamos, 73.7 per cent and 67.7 per cent, respectively. For the South Atlantic and the South Central divisions, however, the proportion of population was practically double the proportions for these two items.

In the Western division the general rule as to the proportion of electrical equipment to population does not hold. This division, which had 5.5 per cent of the

population in 1902 and 7.8 per cent in 1912, reported for these two years, respectively, of the primary horsepower, 15.2 per cent and 18.8 per cent; and of the kilowatt capacity of the dynamos, 14.4 per cent and 18.3 per cent. The Western division had, in 1912, but 7,437,327 inhabitants; or 7.8 per cent of the total population of the United States, as compared with 26,946,884, or 28.2 per cent, for the North Atlantic; 12,586,562, or 13.2 per cent, for the South Atlantic; 30,683,662, or 32.1 per cent, for the North Central; and 17,890,901, or 18.7 per cent, for the South Central division; and yet the Western division, the smallest of the five in population, was third in all of the main factors of central station equipment and first in all of the proportions shown per 1,000 population, except for arc lamps, in respect to which this division was third.

It is noticeable in this connection that the proportions per 1,000 population for arc lamps, for the United States and for each of the geographic divisions, which had increased from 1902 to 1907, decreased from 1907 to 1912. For each of the other factors mentioned there was an increased proportion from census to census.

Commercial and municipal stations combined.—The statistics for the central electric station industry as a whole, commercial and municipal stations combined, as reported at the censuses of 1912, 1907, and 1902, are presented in Table 5. This table shows the percentages of increase for the decade and for the two five-year periods.

The 5,221 central stations shown in Table 5 should not be accepted as the number of separate plants. As explained in the introduction, the census reports in some instances include statistics for a number of plants operated under the same ownership, and reports for such combination of stations have been considered and treated as reports for single stations. There was, however, an increase in the number of central stations, but a much greater gain in the magnitude of their operations, during the decade ending with 1912. The most notable increases are those in primary horsepower, kilowatt capacity of the dynamos, the output of the stations, and the horsepower capacity of the stationary motors served. The percentages of increase were more pronounced during the five years ending with 1907. During this period the gross income of central stations increased by 104.9 per cent, as compared with 72 per cent for the five years from 1907 to 1912, and 252.5 per cent for the decade.

The income reported for 1912 exceeded that for 1902 by \$216,414,994. Of this increase, \$202,794,253, or 93.7 per cent, represents receipts from electric service, and \$13,620,741, or 6.3 per cent, from all other sources, such as steam heating, profits on merchandise sales, rentals, etc.

During the decade primary power increased by 5,683,600 horsepower, or 308 per cent, while the

dynamo capacity increased by 3,922,454 kilowatts, or 323.6 per cent, and the output of stations by 9,025,911,891 kilowatt hours, or 360 per cent.

Table 5

	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS.					
	1912	1907	1902	Per cent of increase. ¹		
				1902-1912	1907-1912	1902-1907
Number of stations ²	5,221	4,714	3,620	44.2	10.8	30.2
Commercial.....	3,659	3,462	2,805	30.4	5.7	23.4
Municipal.....	1,562	1,252	815	91.7	24.8	53.6
Total income ³	\$302,115,599	\$175,642,338	\$35,700,605	252.5	72.0	104.9
Light, heat, and power, including free service.....	\$286,980,858	\$169,614,691	\$34,136,605	240.0	60.2	101.5
All other sources.....	\$15,134,741	\$6,027,647	\$1,514,000	89.7	151.1	298.1
Total expenses, including salaries and wages ⁴	\$234,419,478	\$134,196,911	\$68,081,375	244.3	74.7	97.1
Total number of persons employed.....	79,335	47,632	30,326	161.6	66.6	57.1
Total horsepower.....	7,528,648	4,098,188	1,845,048	308.0	83.7	122.1
Steam engines and steam turbines ⁵ —						
Number.....	7,844	8,054	6,295	24.6	-2.6	27.9
Horsepower.....	4,946,532	2,693,273	1,394,395	254.7	83.7	93.1
Water wheels—						
Number.....	2,933	2,481	1,390	111.0	18.2	78.5
Horsepower.....	2,471,081	1,349,087	438,472	463.6	83.2	207.7
Gas and oil engines—						
Number.....	1,116	463	165	576.4	141.0	180.6
Horsepower.....	111,035	55,828	12,181	811.5	98.9	358.3
Kilowatt capacity of dynamos.....	5,134,689	2,709,225	1,212,235	323.6	89.5	123.5
Output of stations, kilowatt hours.....	11,532,963,006	5,862,276,737	2,507,051,115	360.0	96.7	133.8
Estimated number of lamps wired for service:						
Arc.....	505,395	562,795	385,698	31.0	-10.2	45.9
Incandescent and other varieties.....	76,507,142	41,876,332	18,194,044	320.5	82.7	130.2
Stationary motors served:						
Number.....	435,473	167,184	101,064	330.9	160.5	65.4
Horsepower capacity.....	4,130,619	1,649,026	438,005	843.1	150.5	276.5

¹ A minus sign (-) denotes decrease.

² The term "station" as here used may represent a single electric station or a number of stations operated under the same ownership.

³ Exclusive of \$36,500,030 in 1912, \$20,093,302 in 1907, and \$7,703,574 in 1902, reported by street and electric railway companies as income from sale of electric current for light or power or from sale of current to other public-service corporations.

⁴ In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.

⁵ Includes auxiliary engines.

⁶ Includes, for purposes of comparison, 7,032 arc and 267,997 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912 and 1902.

Commercial central electric stations.—As shown by Table 1, the commercial central electric stations largely predominate over the municipal stations in number and capacity. Table 6 is a comparative summary of the statistics for commercial central stations as reported for 1912, 1907, and 1902.

The commercial stations represent such a large proportion of the industry that the conditions prevailing in them are necessarily reflected in the totals for both classes of stations. The percentages of increase, therefore, harmonize with those shown in Table 5 for both classes of stations. The gross income derived by commercial stations from the sale of electricity and from other sources combined, in 1912, was more than three and one-half times that reported for 1902. The horsepower of the engines and water wheels, the kilowatt capacity of the dynamos, and the output of stations increased more than threefold during this period.

Table 6

	COMMERCIAL CENTRAL ELECTRIC STATIONS.					
	1912	1907	1902	Per cent of increase. ¹		
				1902-1912	1907-1912	1902-1907
Number of stations....	3,659	3,462	2,805	30.4	5.7	23.4
Total income.....	\$278,896,610	\$161,630,339	\$78,735,500	254.2	72.6	105.3
Light, heat, and power, including freeservice..	\$264,317,150	\$156,000,257	\$77,349,749	241.7	69.4	101.7
All other sources.....	\$14,579,460	\$5,630,082	\$1,385,751	952.1	159.0	306.3
Total expenses, including salaries and wages ²	\$217,502,313	\$123,880,291	\$62,835,388	246.1	75.6	97.2
Total number of persons employed.....	71,395	42,066	26,909	165.3	69.7	56.3
Total horsepower.....	6,969,320	3,776,837	1,685,020	313.6	84.5	124.1
Steam engines and steam turbines ³ —						
Number.....	5,820	6,268	5,199	11.9	-7.1	20.6
Horsepower.....	4,539,866	2,408,351	1,246,542	264.2	88.5	93.2
Water wheels—						
Number.....	2,664	2,328	1,308	103.7	14.4	78.0
Horsepower.....	2,340,820	1,318,740	427,254	447.9	77.5	208.7
Gas and oil engines—						
Number.....	833	385	147	466.7	116.4	161.9
Horsepower.....	88,634	49,746	11,224	689.7	78.2	343.2
Kilowatt capacity of dynamos.....	4,766,012	2,500,209	1,098,855	333.7	90.6	127.5
Output of stations, kilowatt hours.....	10,995,436,276	5,572,813,949	2,311,146,676	375.8	97.3	141.1
Estimated number of lamps wired for service:						
Arc.....	413,544	479,260	334,903	23.5	-13.7	48.1
Incandescent and other varieties..	69,449,293	437,786,435	16,616,593	318.0	83.8	127.4
Stationary motors served:						
Number.....	413,578	162,677	99,102	317.3	154.2	64.2
Horsepower capacity.....	3,966,328	1,617,337	434,681	812.5	145.2	272.1

¹ A minus sign (-) denotes decrease.
² In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.
³ Includes auxiliary engines.
⁴ Includes, for purposes of comparison, 6,487 arc and 239,418 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912 and 1902.

Ownership of commercial central electric stations.—Changes in the form of ownership of commercial central stations are an interesting feature of the development of the industry. The statistics in Table 7, which follows, show the importance of the different forms of ownership of commercial stations as reported for the censuses of 1912 and 1907, together with the percentages of increase in the totals for each.

The preponderance and growing importance of stations under corporate form of ownership are clearly shown by this table. Practically all of the large commercial stations are owned by incorporated companies. The 2,779 stations reported for this form of ownership in 1912, however, contain a number of small plants, many of which are smaller than some of those operated by individuals or firms. Except in the case of gas and oil engines, which are peculiarly adapted to the requirements of the small station, the percentages of increase for the several items were greatest for stations under corporate ownership. In 1912 the stations owned by corporations and which constituted three-fourths of the total number (75.9 per cent) reported 98.4 per cent of the total income, 98.1 per cent of the horsepower, 98.1 per cent of the dynamo capacity, and 99.1 per cent of the kilowatt-hour output shown for all stations. Not only do the operations of the stations owned by individuals and firms represent a comparatively small proportion of the central station business, but there was a decrease in their proportion of the essential features of the industry in 1912, as compared with 1907, together with an actual falling off in their number.

COMMERCIAL CENTRAL ELECTRIC STATIONS, BY CHARACTER OF OWNERSHIP: 1912 AND 1907.

Table 7

	TOTAL.		INDIVIDUAL.		FIRM.		INCORPORATED. ¹		PER CENT OF INCREASE. ²			
	1912	1907	1912	1907	1912	1907	1912	1907	Total.	Individual.	Firm.	Incorporated.
Number of stations.....	3,659	3,462	587	609	293	298	2,779	2,555	5.7	-3.6	-1.7	8.8
Total income.....	\$278,896,610	\$161,630,339	\$2,931,706	\$2,371,467	\$1,575,096	\$1,473,134	\$274,389,808	\$157,780,738	72.6	23.6	6.6	73.9
Light, heat, and power.....	\$264,317,150	\$156,000,257	\$2,812,178	\$2,262,102	\$1,517,129	\$1,408,139	\$259,987,843	\$152,330,016	69.4	24.3	7.7	70.7
All other sources.....	\$14,579,460	\$5,630,082	\$119,528	\$109,365	\$57,967	\$69,995	\$14,401,965	\$5,450,722	159.0	9.3	-17.2	164.2
Total expenses, including salaries and wages.....	\$217,502,313	\$97,037,961	\$2,155,032	\$1,615,426	\$1,109,031	\$1,021,788	\$214,238,250	\$94,400,747	124.1	33.4	8.5	126.9
Total number of persons employed.....	71,395	42,066	1,097	1,034	676	634	69,722	40,398	69.7	6.1	-9.1	72.6
Total horsepower.....	6,969,320	3,776,837	87,455	74,668	48,404	47,025	6,833,461	3,655,144	84.5	17.1	2.9	87.0
Steam engines (including turbines): ³												
Number.....	5,820	6,268	479	555	255	296	5,086	5,417	-7.1	-13.7	-13.9	-6.1
Horsepower.....	4,539,866	2,408,351	57,234	52,340	29,717	30,669	4,452,915	2,325,342	88.5	9.4	-3.1	91.5
Water wheels:												
Number.....	2,664	2,328	198	209	100	103	2,366	2,016	14.4	-5.3	-2.9	17.4
Horsepower.....	2,340,820	1,318,740	22,141	18,751	14,151	14,957	2,304,528	1,285,032	77.5	18.1	-5.4	79.3
Gas and oil engines:												
Number.....	833	385	192	83	110	37	531	265	116.4	131.3	197.3	100.4
Horsepower.....	88,634	49,746	8,080	3,577	4,536	1,399	76,018	44,770	78.2	125.9	224.2	69.8
Kilowatt capacity of dynamos.....	4,766,012	2,500,209	60,023	44,315	29,577	28,511	4,676,412	2,427,383	90.6	35.4	3.7	92.7
Output of stations, kilowatt hours.....	10,995,436,276	5,572,813,949	60,058,813	43,103,493	37,951,228	41,357,746	10,897,426,235	5,488,352,710	97.3	39.3	-8.2	98.6
Estimated number of lamps wired for service: ⁴												
Arc.....	413,544	472,773	3,360	5,758	1,471	3,021	408,713	463,994	-12.5	-41.6	-51.3	-11.9
All other varieties.....	69,449,293	37,547,017	806,976	737,219	449,826	406,471	68,102,491	36,403,327	85.0	21.7	10.7	87.1

¹ In 1912 includes 7 stations classed as "other forms of ownership," and in 1907 two such stations, in order to avoid the disclosure of individual operations.
² A minus sign (-) denotes decrease.
³ Includes auxiliary engines.
⁴ In 1907 exclusive of 275,079 lamps used by the central stations to light their own properties. Lamps used for such service were not reported separately in 1912.

Municipal central electric stations.—Although, as shown by Table 1, the municipal electric stations form a comparatively small proportion of the total central electric station industry, nevertheless this class

of stations has been increasing rapidly during the past decade. The statistics for them, as reported at the censuses of 1912, 1907, and 1902, are summarized in Table 8.

Table 8 MUNICIPAL CENTRAL ELECTRIC STATIONS.

	1912	1907	1902	Per cent of increase.		
				1902-	1907-	1902-
				1912	1912	1907
Number of stations.....	1,562	1,252	815	91.7	24.8	53.6
Total income.....	\$23,218,989	\$14,011,999	\$6,965,106	233.4	65.7	101.2
Light, heat, and power, including free service.....	\$22,663,708	\$13,614,434	\$6,836,856	231.5	66.5	99.1
All other sources.....	\$555,281	\$397,565	\$128,249	333.0	39.7	210.0
Total expenses, including salaries and wages ¹	\$16,917,165	\$10,316,620	\$5,245,987	222.5	64.0	96.7
Total number of persons employed.....	7,940	5,586	3,417	132.4	42.7	62.9
Total horsepower.....	559,323	321,351	160,028	249.5	74.1	100.8
Steam engines and steam turbines ²						
Number.....	2,024	1,786	1,096	84.7	13.3	63.0
Horsepower.....	406,666	284,922	147,853	175.0	42.7	92.7
Water wheels.....						
Number.....	269	153	82	228.0	75.8	86.6
Horsepower.....	130,261	30,347	11,218	1,061.2	329.2	170.5
Gas and oil engines.....						
Number.....	283	78	18	1,472.2	262.8	333.3
Horsepower.....	22,401	6,082	957	2,240.8	268.3	535.5
Kilowatt capacity of dynamos.....	368,677	209,016	113,380	225.2	76.4	84.3
Output of stations, kilowatt hours.....	537,528,730	289,402,788	195,904,439	174.4	85.7	47.8
Estimated number of lamps wired for service:						
Arc.....	91,851	* 83,535	50,795	80.8	10.0	64.5
Incandescent and other varieties.....	7,057,849	* 4,089,897	1,577,451	347.4	72.6	159.3
Stationary motors served:						
Number.....	21,896	4,507	1,962	1,016.0	385.8	129.7
Horsepower capacity.....	164,291	31,689	3,324	4,842.6	418.4	853.3

¹ In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.
² Includes auxiliary engines.
³ Includes, for purposes of comparison, 595 arc and 28,579 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912 and 1902.

Table 8 shows exceptionally large percentages of increase during the decade in the horsepower of water wheels, gas and oil engines, and stationary motors served by municipal stations. These percentages, however, are based on comparatively small figures and are apt to be misleading. Except in the case of the number of stations, number of arc lamps, and horsepower of gas and oil engines, more than nine-tenths of the various items covered in Table 8 are reported by commercial stations. The relative importance of the commercial and municipal stations in 1912, 1907, and 1902 is shown by the following statement:

PER CENT OF TOTAL, COMMERCIAL AND MUNICIPAL STATIONS.

	Commercial.			Municipal.		
	1912	1907	1902	1912	1907	1902
	Number of stations.....	70.1	73.4	77.5	29.9	26.6	22.5
Total income.....	92.3	92.0	91.9	7.7	8.0	8.1
Light, heat, and power, including free service.....	92.1	92.0	91.9	7.9	8.0	8.1
All other sources.....	96.3	93.4	91.5	3.7	6.6	8.5
Total expenses, including salaries and wages.....	92.8	92.3	92.3	7.2	7.7	7.7
Total number of persons employed.....	90.0	88.3	88.7	10.0	11.7	11.3
Total horsepower.....	92.6	92.2	91.3	7.4	7.8	8.7
Steam engines and steam turbines.....	91.8	89.4	89.4	8.2	10.6	10.6
Water wheels.....	94.7	97.8	97.4	5.3	2.2	2.6
Gas and oil engines.....	79.8	89.1	92.1	20.2	10.9	7.9
Kilowatt capacity of dynamos.....	92.8	92.3	90.6	7.2	7.7	9.4
Output of stations, kilowatt hours.....	95.3	95.1	92.2	4.7	4.9	7.8
Estimated number of lamps wired for service:						
Arc.....	81.8	85.2	86.8	18.2	14.8	13.2
Incandescent and other varieties.....	90.8	90.2	91.3	9.2	9.8	8.7
Stationary motors served:						
Number.....	95.0	97.3	98.1	5.0	2.7	1.9
Horsepower capacity.....	96.0	98.1	99.2	4.0	1.9	0.8

Considerable interest attaches to the increase in number and capacity of municipal stations. The establishment of such stations, as a rule, has been brought about by public vote, because of the inability to establish and operate a commercial station, or because of dissatisfaction with the service furnished by such a station. Of particular significance, therefore, is the change in the form of ownership from private to municipal, or vice versa. This feature is developed in Table 9, which shows the number of municipal stations in 1912 and 1907, with the net numerical increase during the five years, and summarizes the several changes which have brought about the total increase. The figures are shown separately for the nine geographic divisions of the United States.

Table 9 NUMBER OF MUNICIPAL CENTRAL ELECTRIC STATIONS AND INCREASE, BY GEOGRAPHIC DIVISIONS: 1907 TO 1912.

DIVISION. ¹	Number of stations.			New stations since 1907.	From commercial stations in 1907 to municipal in 1912.	From municipal stations in 1907 to commercial in 1912.	Active municipal stations in 1907 that were out of business or not operated in 1912.
	1912	1907	Numerical increase.				
United States.....	1,562	1,252	310	301	106	80	17
New England.....	57	51	6	6	1	1	.....
Middle Atlantic.....	102	99	3	10	1	7	1
East North Central.....	474	453	21	34	26	30	2 9
West North Central.....	399	274	125	109	31	13	2
South Atlantic.....	204	158	46	60	14	14	4
East South Central.....	128	109	19	18	6	5	.....
West South Central.....	122	57	65	61	18	3	1
Mountain.....	39	20	19	15	5	1	.....
Pacific.....	37	31	6	8	4	6	.....

¹ See page 25 for states composing the several geographic divisions.
² Includes 4 municipal stations that since 1907 have been merged with other municipal stations.

There was a numerical increase of 310 in the number of municipal stations reported for 1912 as compared with 1907, while, as shown by Table 6, there was an increase of only 197 in the number of commercial stations. However, the practice of including in census reports data for a number of commercial stations operated under the same ownership, as explained in Chapter I, does not prevail in the case of municipal stations. Therefore the number of such stations (1,562) reported for 1912 is practically the number of separate plants in operation during that year. The great increase in the number of municipal stations is due to the fact that there were 301 reported for 1912 that had been built since 1907. There was an additional increase of 9 stations, brought about by the difference between the number of stations (106), on the one hand, whose ownership had changed from commercial in 1907 to municipal in 1912, and, on the other hand, 80 stations which had changed in the opposite direction, from municipal to commercial, and 17 that had gone out of business during the period between the censuses or were not reported as in operation in 1912. The West South Central geographic division

shows the largest percentage of increase in the number of stations during the five-year period covered by the table, but the largest numerical increase (125) is shown for the West North Central division.

Municipal stations, by population groups of cities.—The statistics for commercial central stations can not be shown for cities, because in many instances these stations furnish current to two or more communities as well as to the surrounding territory, and also because a number of these stations are located outside the corporate limits of cities and furnish electricity to the surrounding regions irrespective of political subdivisions. Although such conditions prevail to some

extent among the municipal stations, it is not believed to be of sufficient consequence to affect materially the general accuracy of the statistics for cities grouped according to the population of the cities.

In Table 10, therefore, detailed statistics are given for municipal electric stations by population groups of cities for 1912, 1907, and 1902.

By far the most numerous class of stations consists of those in places of less than 5,000 population. There were 1,327 of these stations in 1912, or 85 per cent of all municipal stations, compared with 671, or 82.3 per cent, in 1902—a gain during the decade of 656, or 97.8 per cent.

MUNICIPAL CENTRAL ELECTRIC STATIONS, BY POPULATION OF CITIES IN WHICH LOCATED AND BY GEOGRAPHIC DIVISIONS: 1912, 1907, AND 1902.

DIVISION ¹ AND POPULATION GROUP.	Census.	Number of stations.	Cost of construction and equipment.	INCOME.			Total expenses.	Total primary horse-power.	KILOWATT CAPACITY OF DYNAMOS.			Output of stations, kilowatt hours.	ESTIMATED NUMBER OF LAMPS WIRED FOR SERVICE.	
				Total.	Electric service.	All other sources.			Total.	Direct current, constant voltage and amperage.	Alternating and poly-phase current.		Arc.	Incandescent and all other varieties.
Total	1912	1,562	\$77,065,144	\$23,218,989	\$22,663,708	\$555,281	\$16,917,165	559,328	368,677	44,564	324,113	537,526,730	91,851	7,057,849
	1907	1,252	42,879,447	14,011,999	13,614,434	397,565	29,167,188	321,351	209,016	45,998	163,023	289,462,788	82,940	4,061,818
	1902	815	22,020,473	6,965,105	6,836,856	128,249	24,741,182	160,028	113,380	45,727	67,653	105,904,439	50,795	1,577,451
Under 5,000....	1912	1,327	31,349,806	11,026,579	10,678,780	347,799	8,412,993	257,384	172,705	25,808	146,902	186,294,678	23,069	3,895,703
	1907	1,081	21,476,667	7,631,842	7,337,260	294,582	5,298,119	194,172	130,174	27,355	102,819	146,906,359	30,888	2,722,519
	1902	671	11,074,008	3,621,023	3,538,468	82,555	2,620,167	96,282	64,650	20,679	43,971	105,518,293	19,611	1,094,946
5,000 but under 25,000.	1912	189	15,953,305	6,014,722	5,861,287	153,435	4,103,721	128,506	91,696	7,030	84,666	127,432,560	19,976	2,010,446
	1907	142	9,726,310	3,466,142	3,389,192	76,950	2,128,859	75,975	48,107	7,708	40,399	78,788,119	23,033	954,532
	1902	121	5,605,178	1,765,000	1,732,897	32,103	1,212,636	40,123	28,966	10,492	18,474	56,286,059	15,701	391,645
25,000 but under 100,000.	1912	31	8,304,604	2,822,984	2,792,212	30,772	2,032,825	91,327	62,341	2,371	59,970	65,898,060	15,537	652,059
	1907	17	4,833,033	1,414,810	1,408,521	6,289	778,358	25,768	14,812	3,407	11,405	29,815,562	9,549	329,286
	1902	13	1,563,931	455,204	455,149	55	315,139	7,713	5,394	2,819	2,575	8,929,900	4,800	66,840
100,000 but under 500,000.	1912	7	8,559,566	1,584,082	1,575,596	8,486	1,095,607	47,255	27,064	844	26,220	61,120,808	12,576	368,118
	1907	6	2,760,310	736,276	716,532	19,744	373,750	12,616	8,250	6,010	17,819,478	8,393	43,036	
	1902	6	1,607,803	441,235	427,699	13,636	255,606	6,085	4,263	2,869	1,394	9,543,807	4,544	21,620
500,000 and over	1912	8	12,897,863	1,770,622	1,755,833	14,789	1,272,019	34,856	14,871	8,516	6,355	96,840,624	20,693	131,523
	1907	6	4,092,705	762,929	762,929	.....	588,102	12,825	7,673	5,283	2,390	16,133,270	11,077	11,945
	1902	4	2,179,553	682,643	682,643	.....	337,634	9,825	10,107	8,868	1,239	15,626,380	6,139	2,400
NORTH ATLANTIC.....	1912	159	9,616,877	3,226,157	3,136,497	89,660	2,475,506	77,698	54,031	5,055	48,976	68,625,617	11,704	1,052,379
	1907	150	7,838,995	2,308,082	2,266,506	41,576	1,406,815	56,580	35,325	5,503	29,822	48,861,638	12,320	704,783
	1902	103	3,942,139	1,089,531	1,075,283	14,248	768,353	26,657	17,885	5,559	12,326	28,469,646	7,846	272,212
Under 5,000.....	1912	107	3,425,265	1,060,570	1,021,488	39,082	779,273	25,661	16,831	963	15,868	18,676,158	2,709	446,864
	1907	107	3,088,388	872,150	845,774	26,376	567,090	24,240	16,103	1,676	14,427	17,742,732	3,546	398,265
	1902	68	1,697,447	392,586	384,109	8,477	294,739	13,967	8,528	1,614	6,914	12,624,636	2,387	151,985
5,000 but under 25,000	1912	43	3,835,433	1,426,777	1,379,337	47,440	1,070,210	32,084	22,508	2,240	20,268	26,971,971	4,202	461,575
	1907	38	3,025,195	897,546	882,346	15,200	571,386	21,049	12,892	2,197	10,695	19,182,675	5,345	255,339
	1902	31	1,510,923	424,886	419,115	5,771	318,692	9,615	6,917	2,117	4,800	10,983,988	3,464	104,902
25,000 and over ³	1912	9	2,356,179	738,810	735,672	3,138	626,023	19,953	14,692	1,852	12,840	22,977,488	4,793	143,940
	1907	5	1,725,412	538,386	538,386	.....	268,339	11,291	6,330	1,630	4,700	11,936,281	3,429	51,179
	1902	4	733,769	272,059	272,059	.....	154,922	3,075	2,440	1,828	612	4,861,022	1,995	15,325
SOUTH ATLANTIC.....	1912	204	7,134,097	2,851,941	2,827,057	24,884	2,045,927	66,845	45,063	1,717	43,346	49,325,343	8,192	853,837
	1907	158	4,076,042	1,621,309	1,574,043	47,266	1,051,602	36,542	22,759	3,620	19,139	30,300,397	7,529	403,016
	1902	75	1,561,938	583,162	577,479	5,683	385,412	12,410	8,469	2,843	5,626	17,072,971	4,230	107,764
Under 5,000.....	1912	168	3,626,102	1,351,844	1,341,649	10,195	1,008,405	29,945	19,934	994	18,940	19,220,900	2,621	457,360
	1907	142	2,973,020	1,072,023	1,027,220	44,803	726,425	25,119	17,349	1,775	15,574	18,283,131	4,650	294,683
	1902	62	920,726	333,335	328,776	4,559	240,438	8,070	5,215	1,372	3,843	10,349,782	2,010	68,843
5,000 but under 25,000 ⁴	1912	33	1,512,941	847,744	833,055	14,689	496,823	18,600	12,359	403	11,956	13,197,804	3,003	233,555
	1907	13	476,510	230,343	227,880	2,463	137,415	4,950	3,183	568	2,615	4,563,870	1,715	43,903
	1902	13	641,212	249,827	248,703	1,124	144,974	4,340	3,254	1,471	1,783	6,723,189	2,220	38,921
25,000 and over ⁵	1912	3	1,995,054	652,353	652,353	.....	540,699	18,300	12,770	320	12,450	16,906,639	2,568	162,922
	1907	3	626,530	318,943	318,943	.....	187,762	6,473	2,227	1,277	950	7,453,396	1,164	64,480

¹ See page 25 for states composing the several geographic divisions.

² Exclusive of interest on bonds, etc.

³ Includes, in 1912, 1 station of the "500,000 and over" group; in 1907, 1 station of the "100,000 but under 500,000" group and 1 station of the "500,000 and over" group; and in 1902, 2 stations of the "100,000 but under 500,000" group; in order that the operations of individual stations may not be disclosed.

⁴ Includes 2 stations of the "25,000 but under 100,000" group in 1902.

⁵ Includes, in 1912, 1 station of the "100,000 but under 500,000" group; and in 1907, 1 station of the "500,000 and over" group.

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

MUNICIPAL CENTRAL ELECTRIC STATIONS, BY POPULATION OF CITIES IN WHICH LOCATED AND BY GEOGRAPHIC DIVISIONS: 1912, 1907, AND 1902—Continued.

Table 10—Continued.

DIVISION ¹ AND POPULATION GROUP.	Census.	Number of stations.	Cost of construction and equipment.	INCOME.			Total expenses.	Total primary horse-power.	KILOWATT CAPACITY OF DYNAMOS.			Output of stations, kilowatt hours.	ESTIMATED NUMBER OF LAMPS WIRED FOR SERVICE.	
				Total.	Electric service.	All other sources.			Total.	Direct current, constant voltage and amperage.	Alternating and poly-phase current.		Arc.	Incandescent and all other varieties.
NORTH CENTRAL.....	1912	873	\$42,212,002	\$11,656,482	\$11,314,999	\$341,483	\$8,589,329	265,159	176,380	33,419	142,961	309,367,765	59,620	3,625,088
	1907	727	22,955,162	7,403,015	7,142,752	260,263	5,072,384	176,221	115,990	32,717	83,273	159,005,189	52,327	2,207,744
	1902	528	13,872,245	4,397,509	4,308,879	88,630	2,938,805	102,895	73,169	33,282	39,887	127,865,521	33,595	1,014,120
Under 5,000.....	1912	762	16,025,643	6,099,894	5,872,939	226,955	4,695,449	141,037	96,263	20,584	75,679	107,842,471	14,668	2,303,517
	1907	636	11,306,559	4,178,706	3,992,505	186,201	2,999,451	110,320	73,973	20,864	53,109	81,262,275	18,351	1,628,268
	1902	449	7,151,667	2,306,828	2,338,038	58,790	1,736,342	62,994	42,472	15,034	27,438	68,683,634	13,314	770,658
5,000 but under 25,000.	1912	86	7,840,799	2,727,047	2,652,500	74,547	1,836,070	58,042	43,028	3,466	40,162	64,838,060	10,657	1,005,320
	1907	76	4,828,705	1,829,198	1,775,195	54,003	1,127,782	40,166	26,042	4,383	21,659	43,628,086	13,544	522,346
	1902	67	3,145,001	1,009,166	992,917	16,249	658,289	24,123	16,843	6,981	9,862	35,277,472	9,699	226,772
25,000 but under 100,000.	1912	15	2,445,701	736,946	715,438	21,508	503,821	19,545	13,505	890	12,615	20,359,104	6,625	145,395
	1907	6	665,888	200,438	200,123	315	136,986	3,875	2,735	1,380	1,355	5,521,786	2,755	16,572
	1902	4	302,811	87,817	87,762	55	61,575	1,778	989	765	224	2,545,510	1,349	1,100
100,000 but under 500,000.	1912	3	2,976,238	447,667	443,983	3,684	411,328	14,575	10,054	654	9,400	21,534,962	8,919	45,606
	1907	5	2,177,490	472,801	453,057	19,744	260,168	9,720	6,037	1,277	4,760	13,487,582	6,801	32,943
	1902	4	1,092,313	221,055	207,519	13,536	144,965	4,175	2,758	1,633	1,125	5,732,525	3,094	13,190
500,000 and over....	1912	7	12,314,621	1,044,928	1,630,139	14,789	1,142,061	31,960	12,930	7,825	5,105	94,793,168	8,751	125,250
	1907	4	3,976,520	721,872	721,872	.....	547,997	12,140	7,203	4,813	2,890	15,105,460	10,876	7,615
	1902	4	2,179,553	682,643	682,643	.....	337,634	9,825	10,107	8,869	1,238	15,626,380	16,139	2,400
SOUTH CENTRAL.....	1912	250	8,256,749	2,870,011	2,831,077	38,934	2,080,541	67,576	44,645	4,146	40,499	54,562,006	7,898	653,383
	1907	166	4,259,121	1,640,608	1,609,032	31,576	1,070,069	36,440	25,133	3,840	21,293	34,365,978	7,188	353,833
	1902	81	1,582,336	566,146	554,208	11,938	403,246	14,548	10,393	2,764	7,629	17,484,135	3,644	108,521
Under 5,000.....	1912	223	5,364,162	1,740,004	1,706,105	33,899	1,392,422	44,271	29,784	3,035	26,749	28,687,220	2,518	442,800
	1907	152	3,046,244	1,133,925	1,104,549	29,376	788,106	27,510	18,415	2,772	15,643	23,272,368	3,578	286,321
	1902	68	920,481	364,251	354,350	9,901	261,938	8,908	5,862	1,485	4,377	10,517,220	1,552	78,623
5,000 but under 25,000.	1912	21	1,513,443	606,193	601,158	5,035	437,880	14,010	9,536	921	8,615	15,395,262	1,899	164,153
	1907	10	705,552	321,549	310,349	2,200	182,000	5,625	3,815	615	3,300	6,861,650	1,680	63,388
	1902	9	364,730	142,742	140,705	2,037	103,559	3,320	2,783	694	2,089	5,233,720	1,054	27,365
25,000 and over ²	1912	6	1,379,144	523,814	523,814	.....	250,239	9,295	5,325	190	5,135	10,479,524	3,481	46,340
	1907	4	507,325	185,134	185,134	.....	99,813	3,305	2,903	553	2,350	4,231,960	1,930	4,124
	1902	4	283,175	59,153	59,153	.....	37,740	2,320	1,748	585	1,163	1,733,195	1,034	2,583
WESTERN.....	1912	76	9,845,419	2,614,398	2,554,078	60,320	1,725,862	82,050	48,558	227	48,331	55,645,999	4,437	873,162
	1907	51	3,750,127	1,038,985	1,022,101	16,884	566,318	15,568	9,809	313	9,496	16,929,586	3,576	391,942
	1902	28	1,061,765	328,757	321,007	7,750	245,366	3,518	3,464	1,279	2,185	5,012,166	1,484	74,884
Under 5,000.....	1912	67	2,308,634	774,267	736,599	37,668	537,444	16,470	9,893	227	9,666	11,867,929	553	245,072
	1907	44	1,062,474	375,038	367,212	7,826	216,957	6,983	4,334	268	4,066	6,345,853	763	114,982
	1902	24	374,687	134,023	133,195	828	86,710	2,343	2,573	1,174	1,399	3,343,021	348	24,837
5,000 and over ³	1912	9	7,536,785	1,840,131	1,817,479	22,652	1,188,418	65,580	38,665	.....	38,665	43,778,070	3,884	628,090
	1907	7	2,687,653	663,947	654,889	9,058	349,361	8,585	5,475	45	5,430	10,583,733	2,813	276,960
	1902	4	687,078	194,734	187,812	6,922	158,656	1,175	891	105	786	1,669,145	1,136	49,997

¹ See page 25 for states composing the several geographic divisions.

² Includes 2 stations of the "100,000 but under 500,000" group in 1912.

³ Includes, in 1912, 2 stations of the "25,000 but under 100,000" group and 1 station of the "100,000 but under 500,000" group; in 1907, 2 stations of the "25,000 but under 100,000" group; and in 1902, 1 station of the "25,000 but under 100,000" group.

In 1912 the municipal stations in cities of less than 5,000 population reported 47.5 per cent of the total income, 46 per cent of the primary power, 46.8 per cent of the total kilowatt capacity of dynamos, 34.7 per cent of the output of stations, 25.1 per cent of the arc lamps, and 55.2 per cent of the incandescent lamps. These proportions are all considerably less than the corresponding percentages for 1907 and 1902. For most of these items there are decreasing proportions for the several population groups in the order of their arrangement in Table 10. Of the five geographic divisions, the totals for the North Central are by far the largest. This division contained 873 of the municipal stations, or 55.9 per cent of the total number reported for that year; and the income of the stations

in this division from the sale of electricity and other sources formed 50.2 per cent of the total income in 1912 and 63.1 per cent in 1902. The power of the prime movers reported by the stations in this division formed 47.4 per cent and 64.3 per cent, respectively, of the primary power reported for 1912 and 1902, 47.8 per cent and 64.5 per cent of the dynamo capacity, 57.6 per cent and 65.3 per cent of the kilowatt-hour output, 64.9 and 66.1 per cent of the number of arc lamps, and 51.4 and 64.3 per cent of the number of incandescent lamps. In every case the proportion reported by the municipal stations in the North Central division was less in 1912 than in 1902. This decreased proportion is largely accounted for by the increased percentages for the South Central and Western divisions.

Purely electric and composite stations.—As stated in the introduction, central electric stations have been classified as purely electric and composite. The purely electric stations embrace those operated entirely as electrical enterprises, and the composite those operated in connection with other industries or services.

Table 11 (p. 26) presents a comparative summary of these two classes of stations for 1912, 1907, and 1902.

Although for all the items shown in Table 11, except the number of steam engines in 1912, the purely electric stations reported more than one-half of the total for the two classes combined, both in 1912 and 1902, the proportions for these stations decreased materially during the decade. A comparison of the totals for the two classes of stations as reported at the censuses of 1902 and 1912 indicates a decided increase in the importance of the composite stations. During the decade 1902 to 1912 the total income for the purely electric stations increased \$100,582,448, or 171.6 per cent, and that for the composite stations \$115,832,546, or 427.5 per cent. Considering the two classes of stations in the same order and for the same period, the increase in expenses was \$75,850,757, or 163.8 per cent, and \$90,487,346, or 415.7 per cent; in primary power, 2,760,161 horsepower, or 222.2 per cent, and 2,937,893 horsepower, or 499.4 per cent; in capacity of the dynamos, 2,016,373 kilowatts, or 246.3 per cent, and 1,906,081 kilowatts, or 484.5 per cent; in output of stations, 4,765,446,680 kilowatt hours, or 259.5 per cent, and 4,260,465,211 kilowatt hours, or 635.6 per cent; in number of arc lamps, 6,224, or 2.5 per cent, and 113,473, or 85.1 per cent; and in number of incandescent lamps, 26,117,551, or 213.2 per cent, and 32,195,547, or 541.5 per cent. In every instance the percentages of increase for these totals were greater for the composite stations.

That the purely electric stations lost ground during the decade is further emphasized by the decreases in the percentages of the several totals reported for these stations in 1902 and 1912, respectively, as follows: The

income, from 68.4 per cent to 52.7 per cent; the expenses, from 68 per cent to 52.1 per cent; the horsepower, from 67.9 per cent to 53.2 per cent; the kilowatt capacity of dynamos, from 67.5 per cent to 55.2 per cent; the output of stations, kilowatt hours, from 73.3 per cent to 57.2 per cent; the number of arc lamps, from 65.4 per cent to 51.2 per cent; and the number of incandescent lamps, from 67.3 per cent to 50.1 per cent.

In a number of the tables in this report the statistics are presented by geographic divisions. In most of the tables the states are grouped into nine grand divisions, but in a few of the tables it was necessary to present the totals by the five divisions used in 1907 in order that the figures might be comparable with those for prior censuses.

From Map 1 (p. 27) and the following list of states, by geographic divisions, the states in each division can readily be determined, whether the division grouping be that adopted for 1912 or that used in 1907.

NORTH ATLANTIC DIVISION.	NORTH CENTRAL DIVISION.	SOUTH CENTRAL DIVISION—contd.
<i>New England:</i> Maine. New Hampshire. Vermont. Massachusetts. Rhode Island. Connecticut.	<i>East North Central:</i> Ohio. Indiana. Illinois. Michigan. Wisconsin.	<i>West South Central:</i> Arkansas. Louisiana. Oklahoma. Texas.
<i>Middle Atlantic:</i> New York. New Jersey. Pennsylvania.	<i>West North Central:</i> Minnesota. Iowa. Missouri. North Dakota. South Dakota. Nebraska. Kansas.	WESTERN DIVISION. <i>Mountain:</i> Montana. Idaho. Wyoming. Colorado. New Mexico. Arizona. Utah. Nevada.
SOUTH ATLANTIC DIVISION. Delaware. Maryland. Dist. Columbia. Virginia. West Virginia. North Carolina. South Carolina. Georgia. Florida.	SOUTH CENTRAL DIVISION. <i>East South Central:</i> Kentucky. Tennessee. Alabama. Mississippi.	<i>Pacific:</i> Washington. Oregon. California.

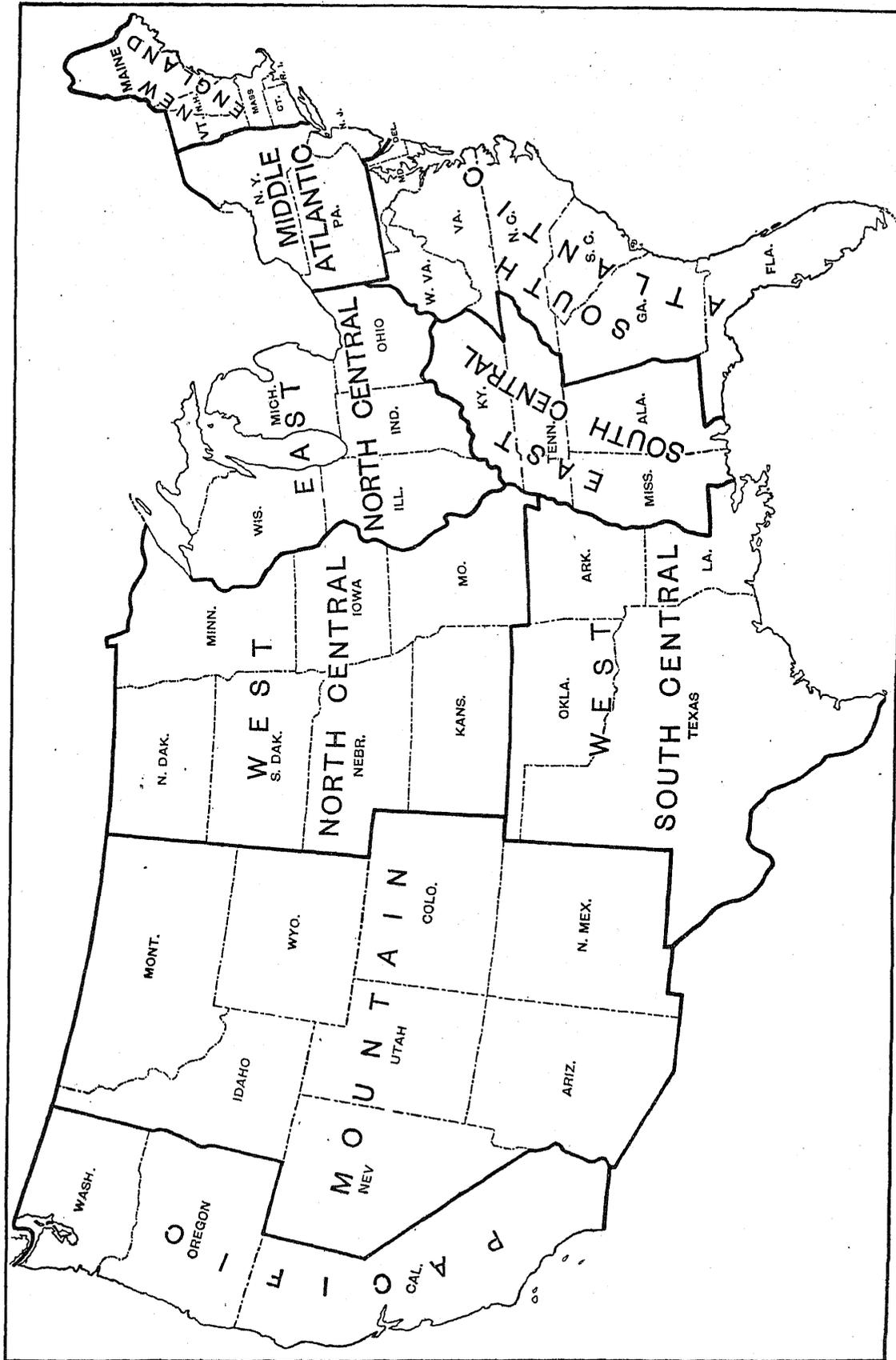
CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

PURELY ELECTRIC AND COMPOSITE CENTRAL ELECTRIC STATIONS—COMMERCIAL AND MUNICIPAL:
1912, 1907, AND 1902.

Table 11	Census.	Aggregate.	PURELY ELECTRIC STATIONS.			COMPOSITE STATIONS.		
			Total.	Commercial.	Municipal.	Total.	Commercial.	Municipal.
Number of stations.....	1912	5,221	2,772	2,209	563	2,449	1,450	999
	1907	4,714	2,648	2,127	521	2,066	1,335	731
	1902	3,620	2,139	1,759	380	1,481	1,046	435
Per cent of increase, 1902-1912.....		44.2	29.6	25.6	48.2	65.4	38.6	129.7
Cost of construction and equipment.....	1912	\$2,175,678,266	\$1,128,330,859	\$1,105,111,379	\$23,219,480	\$1,047,347,407	\$993,501,743	\$53,845,664
	1907	\$1,006,913,622	\$662,926,914	\$630,437,274	\$23,489,640	\$433,986,708	\$414,596,901	\$19,389,807
	1902	\$504,740,352	\$334,161,724	\$320,580,333	\$13,571,391	\$170,588,628	\$162,139,646	\$8,449,082
Per cent of increase, 1902-1912.....		331.0	237.7	244.7	71.1	514.0	512.7	537.3
Total income.....	1912	\$302,115,599	\$159,185,854	\$151,515,738	\$7,670,116	\$142,929,745	\$127,380,872	\$15,548,873
	1907	\$175,642,338	\$107,974,921	\$101,222,267	\$6,762,654	\$67,667,417	\$60,408,072	\$7,259,345
	1902	\$85,700,605	\$58,603,406	\$54,455,737	\$4,147,669	\$27,097,199	\$24,279,763	\$2,817,436
Per cent of increase, 1902-1912.....		252.5	171.6	178.2	84.9	427.5	424.6	451.9
Light, heat, and power.....	1912	\$286,980,858	\$152,593,215	\$145,118,667	\$7,474,548	\$134,387,643	\$119,198,483	\$15,189,160
	1907	\$169,614,691	\$104,620,574	\$98,056,838	\$3,572,736	\$64,985,117	\$57,943,419	\$7,041,698
	1902	\$84,186,605	\$57,470,597	\$53,394,158	\$4,076,439	\$26,716,008	\$23,955,591	\$2,760,417
Per cent of increase, 1902-1912.....		240.9	165.5	171.8	83.4	403.0	397.6	450.2
All other sources.....	1912	\$15,134,741	\$6,592,639	\$6,397,071	\$195,568	\$8,542,102	\$8,182,389	\$359,713
	1907	\$6,027,647	\$3,345,347	\$3,165,429	\$179,918	\$2,682,300	\$2,464,653	\$217,647
	1902	\$1,514,000	\$1,132,809	\$1,061,579	\$71,230	\$381,191	\$324,172	\$57,019
Per cent of increase, 1902-1912.....		899.7	482.0	502.6	174.6	2,140.9	2,424.1	530.9
Total expenses, including salaries and wages.....	1912	\$234,419,478	\$122,164,546	\$116,416,962	\$5,747,584	\$112,254,932	\$101,085,351	\$11,169,581
	1907	\$175,642,338	\$70,238,037	\$71,411,336	\$4,826,701	\$57,958,874	\$52,468,955	\$5,489,919
	1902	\$68,081,375	\$46,313,789	\$43,292,764	\$3,021,225	\$21,767,586	\$19,642,024	\$2,224,662
Per cent of increase, 1902-1912.....		244.3	163.8	168.9	90.3	415.7	417.3	402.0
Total number of persons employed.....	1912	79,335	40,117	37,635	2,482	39,218	33,760	5,458
	1907	47,632	27,524	24,968	2,566	20,108	17,098	3,010
	1902	30,325	19,609	17,741	1,868	10,717	9,168	1,549
Per cent of increase, 1902-1912.....		161.6	104.6	112.1	32.9	265.9	268.2	252.4
Total horsepower.....	1912	7,528,648	4,002,523	3,828,169	174,354	3,526,125	3,141,151	384,974
	1907	4,098,188	2,473,311	2,324,293	149,018	1,624,877	1,452,544	172,333
	1902	1,830,594	1,242,362	1,151,520	90,842	588,232	519,881	68,351
Per cent of increase, 1902-1912.....		311.3	222.2	232.4	91.9	499.4	504.2	463.2
Steam engines and steam turbines: ²								
Number.....	1912	7,844	3,379	2,767	612	4,465	3,053	1,412
	1907	8,054	4,169	3,467	702	3,885	2,801	1,084
	1902	5,930	3,572	3,053	519	2,358	1,817	541
Per cent of increase, ³ 1902-1912.....		32.3	-5.4	-9.4	17.9	80.4	68.0	161.0
Horsepower.....	1912	4,946,532	2,486,304	2,347,253	139,051	2,460,228	2,192,613	267,615
	1907	2,693,273	1,583,978	1,459,569	124,409	1,109,295	948,782	160,513
	1902	1,379,941	891,139	809,249	81,890	488,802	423,674	65,128
Per cent of increase, 1902-1912.....		258.5	179.0	190.1	69.8	403.3	417.5	310.9
Water wheels:								
Number.....	1912	2,033	1,657	1,548	109	1,276	1,116	160
	1907	2,481	1,575	1,491	84	906	837	69
	1902	1,390	957	896	61	433	412	21
Per cent of increase, 1902-1912.....		111.0	73.1	72.8	78.7	194.7	170.9	661.9
Horsepower.....	1912	2,471,081	1,454,976	1,429,148	25,828	1,016,105	911,672	104,433
	1907	1,349,087	863,885	842,072	21,813	485,202	476,668	8,534
	1902	438,472	344,827	336,029	8,798	93,645	91,225	2,420
Per cent of increase, 1902-1912.....		463.6	321.9	325.3	193.6	985.1	899.4	4,215.4
Gas and oil engines:								
Number.....	1912	1,116	667	555	112	440	278	171
	1907	463	295	262	33	168	123	45
	1902	165	86	83	3	79	64	15
Per cent of increase, 1902-1912.....		576.4	675.6	568.7	3,633.3	468.4	334.4	1,040.0
Horsepower.....	1912	111,035	61,243	51,768	9,475	49,702	36,866	12,836
	1907	55,828	25,448	22,652	2,796	30,390	27,094	3,286
	1902	12,181	6,396	6,242	154	5,785	4,982	803
Per cent of increase, 1902-1912.....		811.5	857.5	720.3	6,052.6	760.7	640.0	1,509.7
Kilowatt capacity of dynamos.....	1912	5,134,689	2,835,178	2,714,920	120,258	2,299,511	2,051,092	248,419
	1907	2,709,225	1,670,814	1,574,286	96,528	1,038,411	925,023	112,488
	1902	1,212,235	818,805	753,021	65,784	393,430	345,834	47,596
Per cent of increase, 1902-1912.....		323.6	246.3	260.5	82.8	484.5	493.1	421.9
Output of stations, kilowatt hours.....	1912	11,532,963,006	6,602,195,516	6,443,664,607	158,530,909	4,930,767,490	4,551,771,669	378,995,821
	1907	5,862,276,737	3,880,087,887	3,734,978,340	145,100,647	1,982,188,850	1,837,835,609	144,353,241
	1902	2,507,051,115	1,836,748,836	1,716,909,602	119,839,234	670,302,279	594,237,074	76,065,205
Per cent of increase, 1902-1912.....		360.0	259.5	275.3	32.3	635.6	666.0	398.3
Estimated number of lamps wired for service:								
Arc.....	1912	505,395	258,631	223,865	34,766	246,764	189,679	57,085
	1907	555,713	334,286	286,080	48,206	221,427	186,693	34,734
	1902	385,698	252,407	219,409	32,998	133,291	115,494	17,797
Per cent of increase, 1902-1912.....		31.0	2.5	2.0	5.4	85.1	64.2	220.8
Incandescent and other varieties.....	1912	76,507,142	38,366,469	35,871,656	2,494,813	33,140,673	33,577,637	4,563,036
	1907	41,608,335	24,449,473	22,733,334	1,718,139	17,158,892	14,813,683	2,345,179
	1902	18,194,044	12,248,918	11,463,050	785,868	5,945,126	5,153,543	791,583
Per cent of increase, 1902-1912.....		320.5	213.2	212.9	217.5	541.5	551.5	476.4
Stationary motors served:								
Number.....	1912	435,473	241,209	233,311	7,898	194,264	180,267	13,997
	1907	107,184	97,758	95,472	2,286	69,426	67,205	2,221
	1902	101,064	(*)	(*)	(*)	(*)	(*)	(*)
Per cent of increase, 1902-1912.....		330.8	(*)	(*)	(*)	(*)	(*)	(*)
Horsepower capacity.....	1912	4,130,619	2,311,509	2,258,131	53,378	1,819,110	1,708,197	110,913
	1907	1,649,026	1,077,484	1,061,190	16,294	571,542	556,147	15,395
	1902	438,005	(*)	(*)	(*)	(*)	(*)	(*)
Per cent of increase, 1902-1912.....		843.1	(*)	(*)	(*)	(*)	(*)	(*)

¹ Exclusive of auxiliary engines with a total capacity of 14,454 horsepower.² Includes auxiliary engines in 1912 and 1907.³ A minus sign (-) denotes decrease.⁴ Figures not available.

MAP 1.—GEOGRAPHIC DIVISIONS AS DEFINED BY THE BUREAU OF THE CENSUS.



CHAPTER III.

PRIMARY POWER EQUIPMENT.

Kind of power included.—The primary power equipment as reported for census purposes in 1912 includes steam engines, steam turbines, gas and oil engines, and water wheels. The number and capacity of each of these four kinds of machines were reported separately. Practically the same information was reported for 1907 and 1902, except that steam turbines, which were shown separately in 1907 and 1912, were included with steam engines in 1902, and auxiliary engines, that were shown separately in 1902 and 1907, were not reported separately in 1912. The enlargement of the primary power equipment of existing stations, the construction of new stations of large horsepower capacity, and the installation of generating and consuming appliances of higher efficiency and economy, together with the extension of transmission lines, no doubt have

caused the abandonment of the generating equipment of many small stations. This is apparent from the fact that the number of stations which reported no generating equipment in 1912 was 507, or 9.7 per cent of the 5,221 stations reporting, while in 1907, of the 4,714 stations reporting, there were but 227, or 4.8 per cent, which reported no generating equipment.

During the five years from 1907 to 1912 there was a great change in the character of the primary power equipment of electric stations. The steam turbine has largely supplanted the reciprocating engine, particularly in the larger stations.

Table 12 gives comparative data relating to the number and horsepower of the various kinds of primary power machines installed in central electric stations and electric railway plants for 1912, 1907, and 1902.

CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—NUMBER, KIND, AND HORSEPOWER OF PRIMARY POWER MACHINES: 1912, 1907, AND 1902.

Table 12	TOTAL.		KIND OF POWER.									
			Total steam. ¹		Steam engines.		Steam turbines.		Gas and oil engines.		Water wheels and turbines.	
	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.
Total:												
1912.....	14,588	11,193,699	10,108	8,116,086	8,611	3,598,830	1,497	4,517,256	1,164	135,225	3,316	2,942,388
1907.....	14,635	6,618,011	11,422	5,104,800	10,793	3,751,986	629	1,352,814	504	72,163	2,709	1,441,048
1902.....	10,661	3,204,333	8,932	2,702,602	8,932	2,702,602	(?)	(?)	180	14,106	1,540	487,625
Central stations:												
1912.....	11,893	7,528,648	7,844	4,946,532	6,809	1,892,076	1,035	3,054,456	1,116	111,035	2,933	2,471,081
1907.....	10,998	4,008,188	8,054	2,693,273	7,677	1,875,863	377	817,410	463	55,828	2,481	1,349,087
1902.....	7,850	1,845,048	6,295	1,394,395	6,295	1,394,395	(?)	(?)	165	12,181	1,390	438,472
Electric railways:												
1912.....	2,695	3,665,051	2,264	3,169,554	1,802	1,706,754	462	1,462,800	48	24,190	383	471,307
1907.....	3,637	2,519,823	3,368	2,411,527	3,116	1,876,123	252	535,404	41	16,335	228	91,961
1902.....	2,811	1,359,285	2,637	1,308,207	2,637	1,308,207	(?)	(?)	15	1,925	159	49,153
PER CENT OF INCREASE.²												
Total:												
1902 to 1912.....	36.8	249.3	13.2	200.3	-3.6	33.2	-----	-----	546.7	858.6	114.1	508.4
1907 to 1912.....	-0.3	69.4	-11.5	59.0	-20.2	-4.1	138.0	233.9	131.0	87.4	22.4	104.2
1902 to 1907.....	37.3	106.5	27.9	88.9	20.8	38.8	-----	-----	180.0	411.6	74.9	195.5
Central stations:												
1902 to 1912.....	51.5	308.0	24.6	254.7	8.2	35.7	-----	-----	576.4	811.5	111.0	463.6
1907 to 1912.....	8.1	83.7	-2.6	83.7	-11.3	0.9	174.5	273.7	141.0	93.9	18.2	83.2
1902 to 1907.....	40.1	122.1	27.9	93.1	22.0	34.5	-----	-----	180.6	358.3	78.5	207.7
Electric railways:												
1902 to 1912.....	-4.1	169.6	-14.1	143.3	-31.7	30.5	-----	-----	220.0	1,156.6	140.9	853.9
1907 to 1912.....	-25.9	45.4	-32.8	32.4	-42.2	-0.0	83.3	173.2	17.1	48.1	68.0	412.5
1902 to 1907.....	29.4	85.4	27.7	84.3	18.2	43.4	-----	-----	173.3	748.6	43.4	87.1

¹ Includes auxiliary engines.

² In 1902 steam turbines were included with steam engines.

³ A minus sign (-) denotes decrease.

The total horsepower capacity of engines in central electric stations and electric railway plants combined was 11,193,699 in 1912, compared with 3,204,333 in 1902, a gain of 7,989,366 horsepower, or 249.3 per cent, during the decade. The central electric stations show the greater gain during this period, reporting an increase of 5,683,600, or 71.1 per cent of the total increase in horsepower.

The total number of engines reported by both branches of the industry increased 3,927, or 36.8 per cent, during the decade. This increase was confined exclusively to the central stations, which increased 4,043 in number, or 51.5 per cent. The number of such machines reported by the street railways, on the other hand, decreased by 116, or 4.1 per cent, during the 10 years.

The increase in the number of engines has not kept pace with that in horsepower, because of the installation of larger units of power. In 1912 the average horsepower capacity per machine was 767, compared with 452 in 1907 and 301 in 1902. The greater increase in the average capacity per machine is shown for electric railway plants. The average horsepower capacity per unit for these stations was 1,360 in 1912, compared with 693 in 1907 and 484 in 1902. In central stations the corresponding average horsepower capacity per unit was 633 in 1912, 373 in 1907, and 235 in 1902.

DIAGRAM 1.—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, BY CHARACTER OF POWER: 1912.

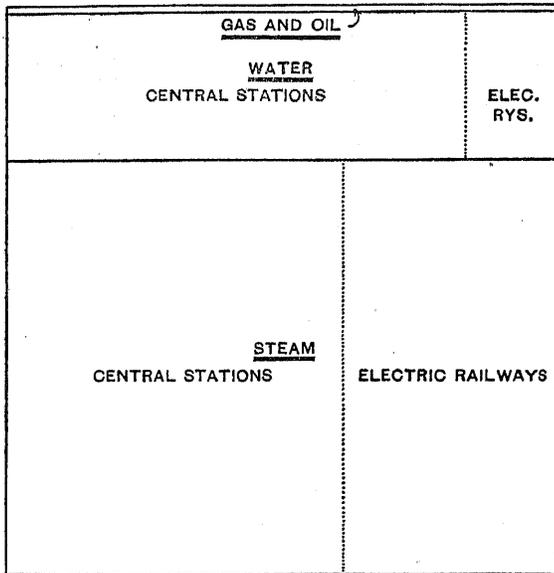
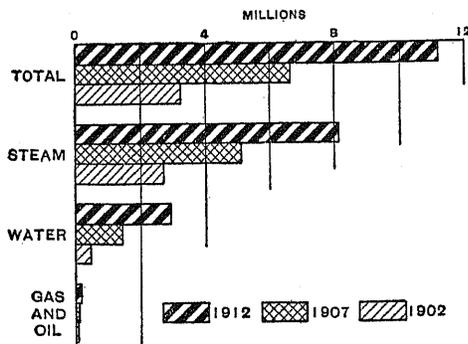


DIAGRAM 2.—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, BY CHARACTER OF POWER: 1912, 1907, AND 1902.



Steam was the most important factor in the development of electrical energy at the three censuses. In the railway plants it formed 86.5 per cent of the total primary power reported in 1912, while in 1907 it represented 95.7 per cent, and in 1902, 96.2 per cent. Steam power held the same relative importance in the central electric stations in 1912 as in 1907, namely, 65.7 per cent, as compared with 75.6 per cent in 1902.

Internal-combustion engines represented 1.2 per cent of the total horsepower in 1912, 1.1 per cent in

1907, and four-tenths of 1 per cent in 1902. The average horsepower per engine was 116 in 1912, 143 in 1907, and 78 in 1902. The central stations reported 82.1 per cent of the total horsepower reported for this class of engines in 1912, 77.4 per cent in 1907, and 86.4 per cent in 1902. They also reported by far the greater number of these engines at each of the three censuses, the proportions being 95.9 per cent in 1912, 91.9 per cent in 1907, and 91.7 per cent in 1902.

Water wheels and water turbines were second in importance in 1912, 1907, and 1902, as to both number and horsepower, increasing 114.1 per cent in number and 503.4 per cent in horsepower during the decade. The corresponding increases between 1907 and 1912 were 22.4 per cent and 104.2 per cent. In 1902 water power represented 15.2 per cent of the total primary horsepower, but in 1907 the proportion had increased to 21.8 per cent and in 1912 to 26.3 per cent. The percentage which water power represented of the total primary horsepower in central electric stations was practically the same in 1912 and 1907, being 32.8 per cent and 32.9 per cent, respectively, while in 1902 it was only 23.8 per cent of the total. Water wheels and water turbines, which represented 3.6 per cent of the total primary horsepower of the electric railway stations in 1902 and 1907, increased to 12.9 per cent in 1912.

DIAGRAM 3.—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, BY STATES: 1912.

[States with more than 40,000 horsepower.]

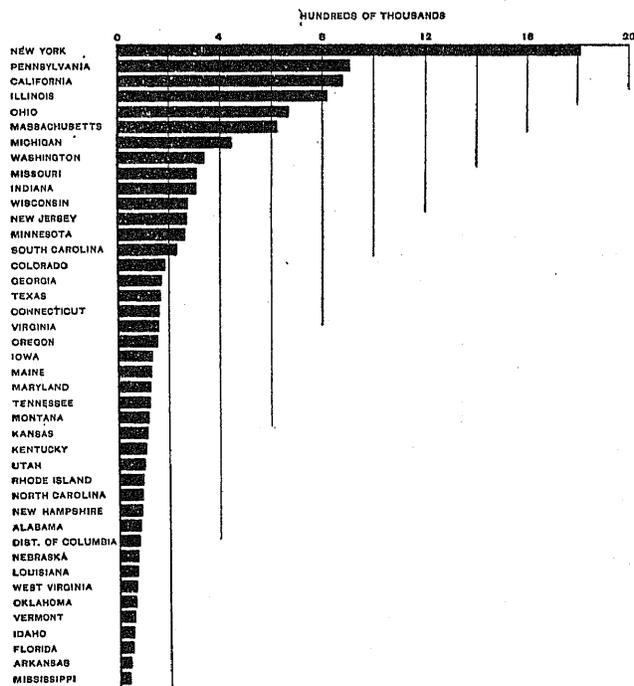


Table 13 gives statistics of the primary power equipment of commercial and municipal stations for 1912, 1907, and 1902.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER, KIND, AND HORSEPOWER OF PRIMARY POWER MACHINES: 1912, 1907, AND 1902.

Table 13

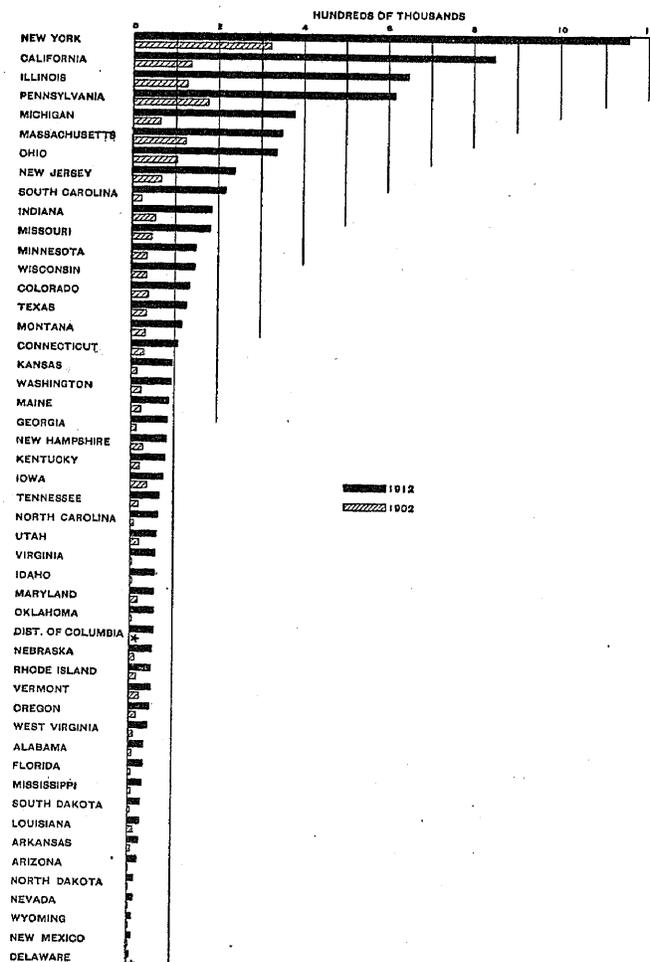
CLASS OF STATIONS.	TOTAL.		KIND OF POWER.										
			Total steam. ¹		Steam engines.		Steam turbines.		Gas and oil engines.		Water wheels and turbines.		
	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	
Total:													
1912.....	11,893	7,528,648	7,844	4,946,532	6,800	1,892,076	1,035	3,054,456	1,116	111,035	2,933	2,471,081	
1907.....	10,998	4,098,188	8,054	2,693,273	7,677	1,375,863	377	817,410	463	55,823	2,481	1,349,087	
1902.....	7,650	1,845,048	6,295	1,394,395	6,295	1,394,395	(2)	(2)	165	12,181	1,300	438,472	
Commercial:													
1912.....	9,317	6,909,320	5,820	4,539,866	4,808	1,585,583	922	2,954,283	833	88,634	2,664	2,340,820	
1907.....	8,981	3,776,837	6,208	2,408,351	5,920	1,010,326	348	798,025	385	49,746	2,328	1,318,740	
1902.....	6,654	1,685,020	5,199	1,246,542	5,199	1,246,542	(2)	(2)	147	11,224	1,308	427,254	
Municipal:													
1912.....	2,576	559,328	2,024	406,666	1,911	306,493	113	100,173	283	23,401	269	130,261	
1907.....	2,017	321,351	1,786	284,922	1,757	265,637	29	19,385	78	6,082	153	30,347	
1902.....	1,196	160,028	1,096	147,853	1,096	147,853	(2)	(2)	18	957	82	11,218	
PER CENT OF INCREASE. ³													
Total:													
1902 to 1912.....	51.5	308.0	24.6	254.7	-8.2	35.7	174.5	273.7	576.4	811.5	111.0	463.6	
1907 to 1912.....	8.1	83.7	-2.6	83.7	-11.3	0.9	164.9	270.2	141.0	98.9	18.2	83.2	
1902 to 1907.....	40.1	122.1	27.9	93.1	22.0	34.5	174.5	273.7	180.6	358.3	78.5	207.7	
Commercial:													
1902 to 1912.....	40.0	313.6	11.9	264.2	-5.8	27.2	164.9	270.2	466.7	680.7	103.7	447.9	
1907 to 1912.....	3.7	84.5	-7.1	83.5	-17.3	-1.5	164.9	270.2	116.4	78.2	14.4	77.5	
1902 to 1907.....	35.0	124.1	20.6	93.2	13.9	2.2	164.9	270.2	161.9	343.2	78.0	208.7	
Municipal:													
1902 to 1912.....	115.4	249.1	84.7	176.0	74.4	107.3	416.8	416.8	1,472.2	2,240.8	228.0	1,081.2	
1907 to 1912.....	27.7	74.1	13.3	42.7	8.8	15.4	280.7	416.8	262.8	263.3	75.8	329.2	
1902 to 1907.....	68.6	100.8	63.0	92.7	60.3	79.6	280.7	416.8	333.3	535.5	86.6	170.5	

¹ Includes auxiliary engines.

² In 1902 steam turbines were included with steam engines.

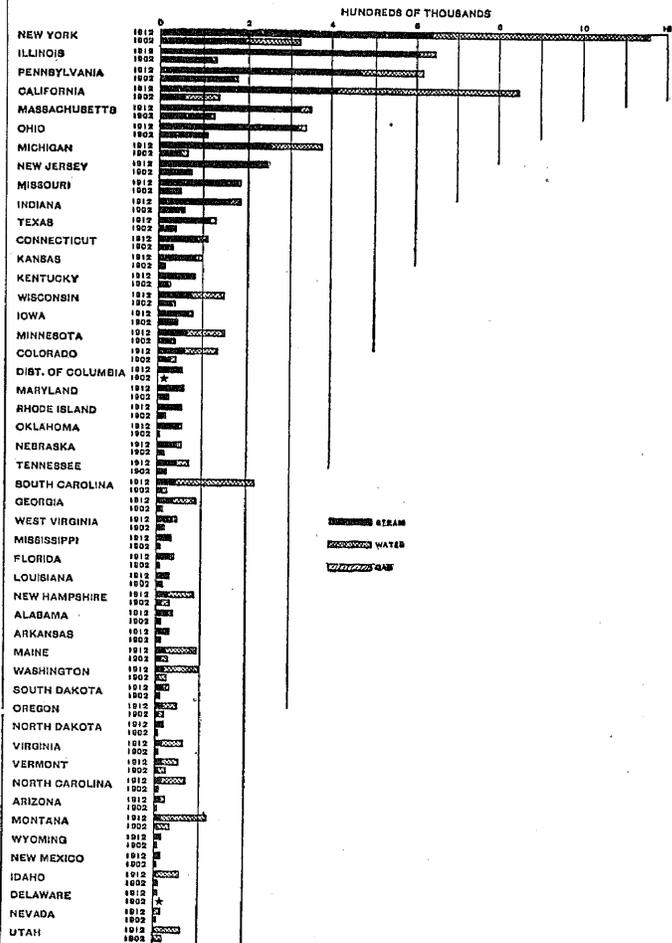
³ A minus sign (-) denotes decrease.

DIAGRAM 4.—CENTRAL ELECTRIC STATIONS—PRIMARY POWER, BY STATES: 1912 AND 1902.



* DIST. OF COLUMBIA AND DELAWARE COMBINED IN 1902; SEPARATE FIGURES NOT AVAILABLE.

DIAGRAM 5.—CENTRAL ELECTRIC STATIONS—PRIMARY POWER—STEAM, WATER, AND GAS—BY STATES, RANKED ACCORDING TO STEAM POWER: 1912 AND 1902.



* DIST. OF COLUMBIA AND DELAWARE COMBINED IN 1902; SEPARATE FIGURES NOT AVAILABLE.

The total horsepower capacity of the primary power machines in central electric stations increased 5,683,600, or 308 per cent, between 1902 and 1912, and of this increase 3,552,137 horsepower, or 62.5 per cent, was contributed by steam power. The great development of the steam turbine in recent years is indicated by the fact that, while there was a gain of 2,253,259 in the horsepower of steam engines and steam turbines combined between 1907 and 1912, the horsepower of steam turbines alone increased during the same period by 2,237,046, or 99.3 per cent of the total increase.

The horsepower increase reported for water wheels and turbines between 1902 and 1912 was 2,032,609, or 463.6 per cent, constituting 35.8 per cent of the total increase for all kinds of primary horsepower during the same period.

Of the two classes of stations, the commercial shows by far the greater amount of horsepower and the larger increase since 1902. In 1912 the primary power equipment of this class represented 92.6 per cent of the total, compared with 92.2 per cent in 1907 and 91.3 per cent in 1902.

Number of different kinds of prime movers.—Although most of the central stations reported but one class of primary power, a number used two or more varieties of prime movers. Table 14 shows the number of commercial and municipal stations reporting each class of machines at the censuses of 1912, 1907, and 1902.

KIND OF POWER.	Census.	Number of stations.		
		Total.	Com- mer- cial.	Municipal.
Steam engines.....	1912 1907 1902	3,529 3,704 3,100	2,338 2,606 2,356	1,191 1,098 744
Steam turbines.....	1912 ¹ 1907 1902	454 187 (¹)	388 170 (¹)	66 17 (¹)
Gas and oil engines.....	1912 1907 1902	713 294 101	518 238 86	195 56 15
Water wheels and turbines.....	1912 1907 1902	1,035 910 580	915 821 530	120 89 50
Auxiliary engines.....	1912 1907 1902	(²) 328 201	(²) 282 175	(²) 46 26

¹ In 1902 steam turbines were included with steam engines.
² Not reported separately.

The total of the number of stations as given in Table 14 exceeds the actual number of central electric stations reported, since a station which had two or more different kinds of primary power would be reported under each class.

Auxiliary engines, which were no doubt included as a part of the primary power equipment of the central stations, were not reported separately for 1912 as

they were in 1907 and 1902. These engines are chiefly of the reciprocating class, and those reported in 1907 and 1902 should be included with steam engines for purposes of comparison. A comparison, on this basis, of the stations reporting steam engines shows 3,529 stations in 1912, 4,032 in 1907, and 3,301 in 1902. Of the total number of central stations, the proportion equipped with reciprocating engines was smaller at each succeeding census, as follows: In 1902, 91.2 per cent; in 1907, 85.5 per cent; and in 1912, 67.6 per cent. On the other hand, there was an increase both in number and in percentage for every other type of engine. The percentage of stations with steam turbines was 4 in 1907 and 8.7 in 1912. This type of engine was not reported separately in 1902. The percentage of stations equipped with gas and oil engines increased from 2.8 in 1902 to 6.2 in 1907 and 13.7 in 1912, while for stations reporting water wheels the proportion increased from 16 per cent in 1902 to 19.3 per cent in 1907 and 19.8 per cent in 1912.

In connection with the numbers of the different kinds of machines, it is instructive to consider the size of the average station as determined by the horsepower of the prime movers, and also the average size of the different varieties of machines. Table 15 gives, for the various kinds of primary power machines in commercial and in municipal stations, the average horsepower per station and per machine for 1912, 1907, and 1902.

KIND OF POWER.	Total.			Commercial.			Municipal.		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Total power:	1,442	869	510	1,905	1,091	601	358	257	196
Per station.....	633	373	235	748	421	253	217	159	134
Per machine.....									
Steam engines and steam turbines:	631	365	233	780	427	253	201	165	139
Steam engines—	536	489	445	678	593	523	257	240	198
Per station.....	278	265	233	324	301	253	160	157	139
Per machine.....									
Steam turbines—	6,728	4,371	(¹)	7,614	4,694	(¹)	1,518	1,140	(¹)
Per station.....	2,951	2,168	(¹)	3,204	2,293	(¹)	886	668	(¹)
Per machine.....									
Gas and oil engines:	156	190	121	171	209	131	115	109	64
Per station.....	99	121	74	106	129	78	79	78	53
Per machine.....									
Water wheels and turbines:	2,388	1,483	756	2,558	1,606	806	1,086	341	224
Per station.....	843	544	315	879	566	327	484	198	137
Per machine.....									
Auxiliary engines:	(²)	201	72	(²)	228	78	(²)	33	32
Per station.....	(²)	78	40	(²)	83	41	(²)	21	23
Per machine.....									

¹ In 1902 steam turbines were included with steam engines.
² Not reported separately.

The total average horsepower per station and per machine for each of the various kinds of primary power increased at each census, with the exception that for gas and oil engines there was a decrease in both respects from 1907 to 1912. This decrease is due to the abandonment of several exceptionally large engines of this type that were in use in 1907 on the Pacific coast. The total average horsepower per station for

all machines increased by 932, or 182.7 per cent, from 1902 to 1912. The corresponding increase in the average per station for commercial plants during the same period was 1,304 horsepower, or 217 per cent, and for municipal stations 162 horsepower, or 82.7 per cent.

Steam power.—In the statistics given in Table 16, relative to the number and horsepower of steam engines and steam turbines, grouped according to horse-

power, for commercial and municipal stations, for 1912, 1907, and 1902, the respective groups are not representative of the entire steam equipment of the stations classified according to horsepower. Stations reporting steam power of the largest units, for instance, often require, in addition, smaller engines for various kinds of work, and this in a measure accounts for the large number of engines in the group of the smallest horsepower.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—STEAM ENGINES AND STEAM TURBINES, BY HORSEPOWER CAPACITY: 1912, 1907, AND 1902.

Table 16 CLASS OF STATIONS.	TOTAL.		ENGINES GROUPED ACCORDING TO HORSEPOWER.							
			500 horsepower or under.		Over 500 and under 2,000 horsepower.		2,000 and under 5,000 horsepower.		5,000 horsepower and over.	
	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.
Total:										
1912.....	7,844	4,946,532	6,329	1,061,370	1,042	978,551	204	845,381	179	2,031,230
1907.....	7,206	2,627,450	6,248	1,035,583	747	661,746	148	407,695	63	522,426
1902.....	5,930	1,379,941	5,451	849,336	427	381,055	52	149,550	(¹)	(¹)
Commercial:										
1912.....	5,820	4,539,866	4,399	795,351	961	904,288	281	808,997	179	2,031,230
1907.....	5,492	2,344,032	4,584	794,205	699	625,006	146	402,395	63	522,426
1902.....	4,870	1,232,923	4,407	715,418	411	367,955	52	149,550	(¹)	(¹)
Municipal:										
1912.....	2,024	406,666	1,930	296,019	81	74,263	13	36,384		
1907.....	1,714	283,418	1,604	241,378	48	36,740	2	5,300		
1902.....	1,060	147,018	1,044	133,918	16	13,100				
STEAM ENGINES.										
Total:										
1912.....	6,809	1,892,076	6,136	1,037,655	565	508,373	92	240,794	16	105,254
1907.....	6,829	1,810,040	6,183	1,018,566	557	489,094	70	186,280	19	115,500
1902.....	5,930	1,379,941	5,451	849,336	427	381,055	52	149,550	(¹)	(¹)
Commercial:										
1912.....	4,898	1,585,583	4,252	752,702	538	486,833	92	240,794	16	105,254
1907.....	5,144	1,540,007	4,535	781,673	520	462,554	70	186,280	19	115,500
1902.....	4,870	1,232,923	4,407	715,418	411	367,955	52	149,550	(¹)	(¹)
Municipal:										
1912.....	1,911	306,493	1,884	284,953	27	21,540				
1907.....	1,685	264,033	1,648	236,893	37	27,140				
1902.....	1,060	147,018	1,044	133,918	16	13,100				
STEAM TURBINES.²										
Total:										
1912.....	1,035	3,054,456	193	53,715	477	470,178	202	604,587	163	1,925,976
1907.....	377	817,410	65	17,017	190	172,052	78	221,415	44	406,926
Commercial:										
1912.....	922	2,954,283	147	42,649	423	417,455	180	568,203	163	1,925,976
1907.....	348	793,025	49	12,532	179	162,452	76	216,115	44	406,926
Municipal:										
1912.....	113	100,173	46	11,066	54	52,723	13	36,384		
1907.....	29	19,385	16	4,485	11	9,600	2	5,300		

¹ Included in "2,000 and under 5,000 horsepower." The class "5,000 horsepower and over" was not called for at the census of 1902.
² Steam turbines were included with steam engines in 1902.

Table 17 gives the percentages of increase for the census periods in the several groups shown in Table 16.

The increases that have taken place in the horsepower of the larger types of steam engines are especially noticeable. Between 1902 and 1912 the horsepower of steam engines and steam turbines combined increased by 3,566,591, or 258.5 per cent, and of this horsepower increase 2,727,061 was reported for engines with a capacity of 2,000 horsepower and over. The horsepower reported for the engines of 2,000 horsepower and over formed 58.2 per cent of the total horsepower in 1912, compared with but 10.8 per cent in 1902. In 1912 the total capacity of engines of 5,000 or more horsepower per unit was 2,031,230, or 41.1 per cent

of the total, compared with 522,426 horsepower, or 19.9 per cent of the total reported in 1907. The commercial stations reported the most marked gains in the large units of power, showing an increase from 12.1 per cent for the class of 2,000 and over in 1902 to 62.6 per cent in 1912, with a corresponding decrease in the proportion for the engines of less than 2,000 horsepower from 87.9 per cent of the total steam power in 1902 to 37.4 per cent in 1912. Engines of 5,000 horsepower and over were not reported separately in 1902, being included with those of 2,000 horsepower and over. In 1907 and 1912, when this class was shown separately, all such engines were reported by the commercial stations.

PRIMARY POWER EQUIPMENT.

Table 17

STEAM ENGINES AND STEAM TURBINES, PER CENT OF INCREASE:¹ (BASED UPON TABLE 16).

CLASS OF STATIONS.	Engines grouped according to horsepower.									
	TOTAL.		500 horsepower or under.		Over 500 and under 2,000 horsepower.		2,000 and under 5,000 horsepower.		5,000 horsepower and over.	
	Number	Horsepower.	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.
Total:										
1902-1912.....	32.3	258.5	16.1	28.5	144.0	156.8	465.4	465.3	(?)	(?)
1907-1912.....	8.9	88.3	1.3	5.4	39.5	47.9	98.6	107.4	184.1	288.8
1902-1907.....	21.5	90.4	14.6	21.9	74.9	73.7	184.6	172.6	(?)	(?)
Commercial:										
1902-1912.....	19.5	268.2	-0.2	11.2	133.8	145.8	440.4	441.0	(?)	(?)
1907-1912.....	6.0	93.7	-4.0	0.1	37.5	44.7	92.5	101.0	184.1	288.8
1902-1907.....	12.8	90.1	4.0	11.0	70.1	69.9	180.8	169.1	(?)	(?)
Municipal:										
1902-1912.....	90.9	176.6	84.9	121.0	406.2	466.9	.....	.....	(?)	(?)
1907-1912.....	18.1	43.5	16.0	22.6	68.8	102.1	550.0	586.5	.....	.....
1902-1907.....	61.7	92.8	59.4	80.2	200.0	180.5	.....	.....	(?)	(?)
STEAM ENGINES.										
Total:										
1902-1912.....	14.8	37.1	12.6	22.2	32.3	33.4	76.9	61.0	(?)	(?)
1907-1912.....	-0.3	4.5	-0.8	1.9	1.4	3.8	31.4	29.3	-15.8	-8.9
1902-1907.....	15.2	31.2	13.4	19.9	30.4	28.5	34.6	24.6	(?)	(?)
Commercial:										
1902-1912.....	0.6	28.6	-3.5	5.2	30.9	32.3	76.9	61.0	(?)	(?)
1907-1912.....	-4.8	2.6	-6.2	-3.7	3.5	5.2	31.4	29.3	-15.8	-8.9
1902-1907.....	5.6	25.4	2.9	9.3	26.5	25.7	34.6	24.6	(?)	(?)
Municipal:										
1902-1912.....	80.3	108.5	80.5	112.8	68.8	64.4	.....	.....	(?)	(?)
1907-1912.....	13.4	16.1	14.3	20.3	-27.0	-20.6	.....	.....	.....	.....
1902-1907.....	59.0	79.6	57.9	76.9	131.2	107.2	.....	.....	(?)	(?)
STEAM TURBINES.³										
Total:										
1907-1912.....	174.5	273.7	196.9	215.7	151.1	173.3	159.0	173.1	270.5	373.3
Commercial:										
1907-1912.....	164.9	270.2	200.0	240.3	136.3	157.0	148.7	162.9	270.5	373.3
Municipal:										
1907-1912.....	289.7	416.8	187.5	146.7	390.9	449.2	550.0	586.5	.....	.....

¹ A minus sign (-) denotes decrease.
² Included in "2,000 and under 5,000 horsepower." The class "5,000 horsepower and over" was not called for at the census of 1902.
³ Steam turbines were included with steam engines in 1902.

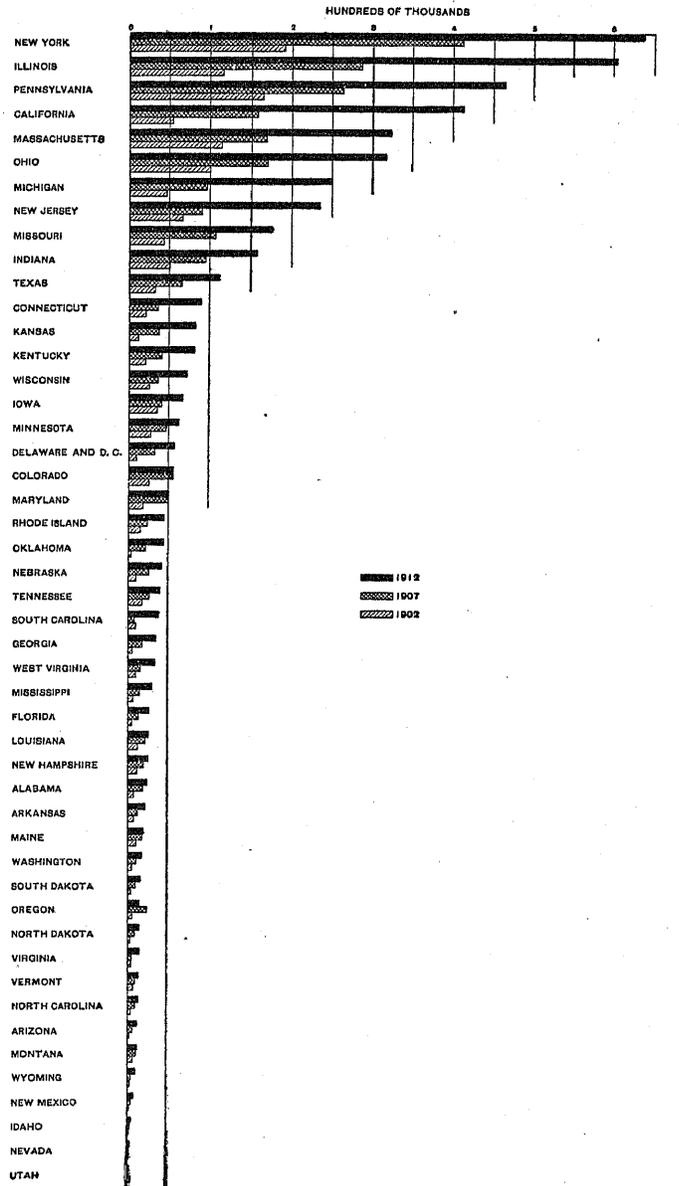
The steam engine.—The horsepower reported for the reciprocating engines at the several censuses shows the result of the advance in the use of the turbine. Everything else being equal as to economy of operation and maintenance, as well as general efficiency, the matter of space occupied per horsepower is a powerful factor in favor of the turbine. A single illustration will suffice. The area occupied by a turbogenerator of 3,500 kilowatt capacity in one central station is 918 square feet, and it generates approximately eighteen times as much power as the old reciprocating engine per unit of space occupied.

There was a substantial increase in horsepower between 1902 and 1912 for all classes of reciprocating engines in both commercial and municipal stations, but a comparison of the totals for 1907 with those for 1912 furnishes a better index of late conditions in respect to horsepower. In the five years from 1907 to 1912 the total horsepower of the reciprocating engines in commercial and municipal stations combined increased only 82,036, or 4.5 per cent. Those

of this class having 500 horsepower and under increased by 19,089 horsepower, or 1.9 per cent; those of over 500 and under 2,000 horsepower increased by 18,679 horsepower, or 3.8 per cent; while those of 2,000 but less than 5,000 horsepower increased by 54,514 horsepower, or 29.3 per cent. The tendency to discontinue the installation of this class of engine where the largest units of power are required is shown by the fact that reciprocating engines with a horsepower capacity of 5,000 or over decreased by 10,246 horsepower, or 8.9 per cent, during the five years.

The commercial stations reported 89.3 per cent of the total horsepower of all classes of reciprocating engines in 1902, 85.4 per cent in 1907, and 83.8 per cent in 1912.

DIAGRAM 6.—CENTRAL ELECTRIC STATIONS—STEAM POWER, BY STATES: 1912, 1907, AND 1902.



About nine-tenths of the total number of reciprocating engines in use were of 500 horsepower and under in 1912, 1907, and 1902, for both commercial and municipal stations. In 1912, of the total number of engines of 500 horsepower and under, 69.5 per cent were reported by the commercial stations and 30.5 per cent by the municipal stations.

The steam turbine.—Separate data were not collected for steam turbines at the census of 1902, but they were included in the totals for steam engines. For commercial and municipal stations combined, from 1907 to 1912, the horsepower of the steam turbines increased by 2,237,046, or 273.7 per cent. In 1912 the horsepower of turbines of 500 horsepower and under constituted 1.8 per cent of the total for turbines, compared with 2.1 per cent in 1907. The proportion of those having a capacity of over 500 and under 2,000 horsepower decreased from 21 per cent in 1907 to 15.4 per cent in 1912; the next class, those with a horsepower capacity of 2,000 but less than 5,000, decreased from 27.1 per cent in 1907 to 19.8 per cent in 1912. The proportion for turbines of 5,000 or more horsepower increased from 49.8 per cent in 1907 to 63.1 per cent in 1912. Each of the several classes of turbines, however, shows a considerable actual increase in number and horsepower from 1907 to 1912.

All states, with the exception of Delaware and Utah, reported turbines in 1912. Five states—Illinois, New York, California, Pennsylvania, and Massachusetts—combined reported 56.4 per cent of the total turbine horsepower in 1912 and 58.4 per cent in 1907.

Water power.—One of the most important matters affecting the electrical industries is the use of water as a primary power. The development in electrical appliances for converting water power into electric energy, which by transmission lines is made available over large areas, together with the economy of production, indicates a continued increase in this form of primary power and a probability that it will to a still greater extent take the place of primary power derived by the use of fuel. In connection with the statistics for water power it is proper to state that the totals for 1912 include the report for a company which showed no electrical equipment but simply water power amounting to 156,000 horsepower. A separate report under a different name was made covering the generation of current and other electrical features. In 1907 a single report covered both phases of the industry; therefore the two reports in 1912 were included in order to preserve the comparability of the figures. The operation of several central stations under the same ownership—a characteristic feature of this industry—renders it difficult to present accurate totals of the generating equipment for the individual states. The statistics for stations in one state are in some instances included in the combined report for a company reporting in another state. A notable instance of this character occurs in the statistics for Nevada. A primary power plant and generating station located

in California, within a few miles of the Nevada state line, has been credited to Nevada because the current is all distributed and the office of the company is located in the latter state. The map, however (p. 37), shows this plant as located in California, at the source of power.

DIAGRAM 7.—CENTRAL ELECTRIC STATIONS—WATER POWER, BY STATES: 1912, 1907, AND 1902.

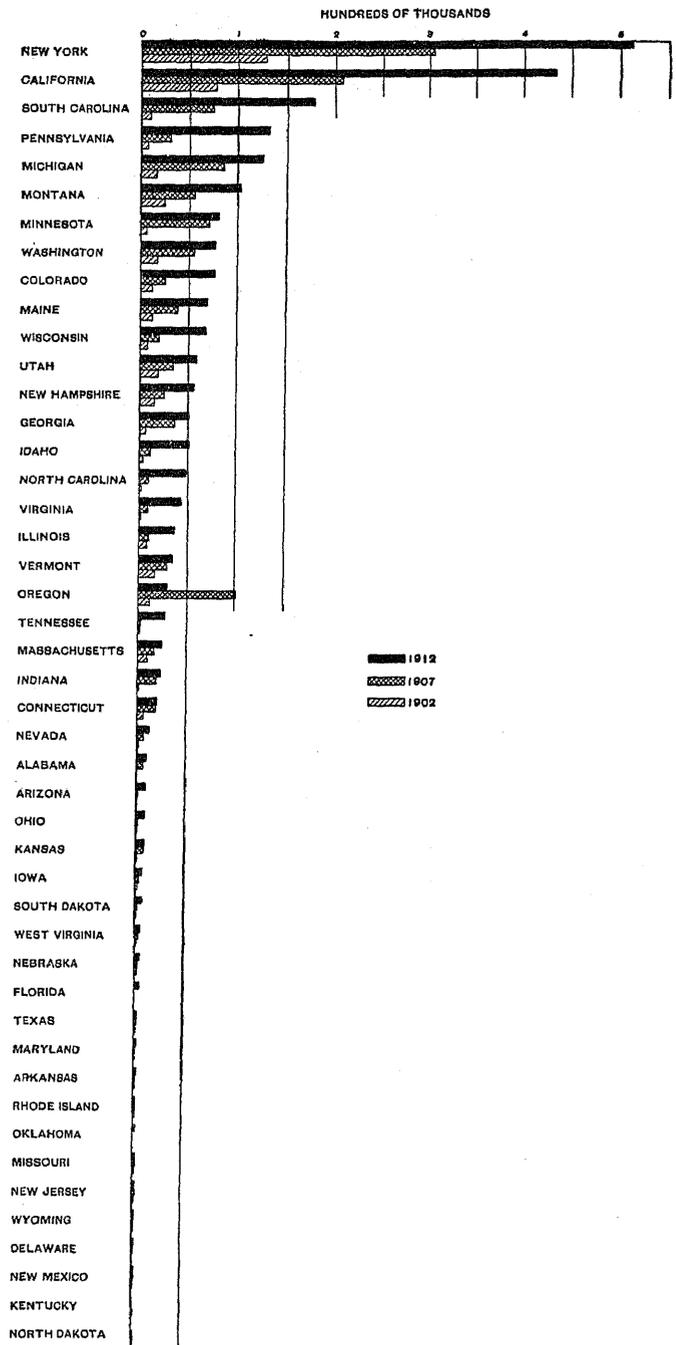


Table 18 gives the number of water wheels and water turbines, grouped by their horsepower capacity, for commercial and municipal stations, for 1912, 1907, and 1902.

The total water power increased 2,032,609 horsepower, or 463.6 per cent, from 1902 to 1912. In 1912 and 1907 water wheels and water turbines contributed

approximately one-third of the total primary power of central stations. As in the case of steam power, the greatest increase took place in the large units. Water turbines with a capacity of 5,000 or more horsepower

increased by 754,286 or 222 per cent, between 1907 and 1912, this increase forming 67.2 per cent of the total increase in water power for central stations during that period.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—WATER WHEELS AND TURBINES, BY NUMBER AND HORSEPOWER CAPACITY: 1912, 1907, AND 1902.

CLASS OF STATIONS.	TOTAL.		MACHINES GROUPED ACCORDING TO HORSEPOWER.							
	Number.	Horsepower.	500 horsepower or under.		Over 500 and under 2,000 horsepower.		2,000 and under 5,000 horsepower.		5,000 horsepower and over.	
			Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.
Total:										
1912.....	2,933	2,471,081	1,995	333,795	638	594,440	147	448,760	153	1,094,086
1907.....	2,481	1,349,087	1,910	320,636	405	357,671	111	330,980	55	339,800
1902.....	1,390	438,472	1,192	174,559	166	156,613	32	107,300	(1)	(1)
Commercial:										
1912.....	2,664	2,340,820	1,797	298,674	576	554,100	144	441,960	147	1,046,086
1907.....	2,328	1,318,740	1,761	296,689	403	355,671	109	326,580	55	339,800
1902.....	1,308	427,254	1,112	164,981	164	154,973	32	107,300	(1)	(1)
Municipal:										
1912.....	269	130,261	198	35,121	62	40,340	3	6,800	6	48,000
1907.....	153	30,347	149	23,947	2	2,000	2	4,400		
1902.....	82	11,218	80	9,578	2	1,640				
PER CENT OF INCREASE.										
Total:										
1902-1912.....	111.0	463.6	67.4	91.2	284.3	279.6	359.4	318.2		
1907-1912.....	18.2	83.2	4.4	4.1	57.5	66.2	32.4	35.6	178.2	222.0
1902-1907.....	78.5	207.7	60.2	83.7	144.0	128.4	246.9	208.5		
Commercial:										
1902-1912.....	103.7	447.9	61.6	81.0	251.2	257.5	350.0	311.9		
1907-1912.....	14.4	77.5	2.0	0.7	42.9	55.8	32.1	35.3	167.3	207.9
1902-1907.....	78.0	208.7	58.4	79.8	145.7	129.5	240.6	204.4		
Municipal:										
1902-1912.....	228.0	1,061.2	147.5	266.7	3,000.0	2,359.8				
1907-1912.....	75.8	329.2	32.9	46.7	3,000.0	1,917.0	50.0	54.5		
1902-1907.....	86.6	170.5	86.2	150.0	0.0	22.0				
PER CENT DISTRIBUTION.										
Total:										
1912.....	100.0	100.0	68.0	13.5	21.8	24.1	5.0	18.2	5.2	44.3
1907.....	100.0	100.0	77.0	23.8	16.3	26.5	4.5	24.5	2.2	25.2
1902.....	100.0	100.0	85.8	39.8	11.9	35.7	2.3	24.5	(1)	(1)
Commercial:										
1912.....	100.0	100.0	67.5	12.8	21.6	23.7	5.4	18.9	5.5	44.7
1907.....	100.0	100.0	75.6	22.5	17.3	27.0	4.7	24.8	2.4	25.8
1902.....	100.0	100.0	85.0	38.6	12.5	36.3	2.4	25.1	(1)	(1)
Municipal:										
1912.....	100.0	100.0	73.6	27.0	23.0	31.0	1.2	5.2	2.2	36.8
1907.....	100.0	100.0	97.4	78.9	1.4	6.6	1.3	14.5		
1902.....	100.0	100.0	97.6	85.4	2.4	14.6				

¹ Included in "2,000 and under 5,000 horsepower." The class "5,000 horsepower and over" was not called for at the census of 1902.

At all three censuses the commercial stations reported more than nine-tenths of the total water-power capacity, and in 1912, of the total power of water turbines with a capacity of 2,000 or more horsepower, 96.4 per cent was reported by these stations.

Water power was reported as used for the generating of electricity in every state, with the exception of Kentucky, Louisiana, Mississippi, North Dakota, and the District of Columbia.

The water power reported for New York, California, South Carolina, Pennsylvania, Michigan, and Montana combined was 1,483,280 horsepower, or 60 per cent of the total for the United States. These states contained some of the largest units reported, the number of wheels or turbines reported forming only 39 per cent of the total number. The average horsepower per unit was 843 for the United States, while in California the average was 2,108 horsepower. The six states mentioned were the only states for which

100,000 or more horsepower was reported in 1912. The decrease in Oregon from 102,052 horsepower in 1907 to 29,802 in 1912 is due to the acquirement by electric railway companies since 1907 of some of the large central stations. The statistics for these stations, therefore, are lost to the central station branch of the industry and are included in the report on electric railways for 1912. Combining the statistics for the two industries for the United States brings out the fact that from 1907 to 1912 the capacity of all water wheels increased by 1,501,340 horsepower, or 104.2 per cent.

Hydroelectric stations.—Estimates of the total water-power capacity of the United States, developed and undeveloped, vary widely. Including storage basins, the water-power capacity has been estimated at upward of 200,000,000 horsepower. It is deemed preferable, however, in presenting estimates of the water-power capacity of the United States, to exclude that of storage. In round numbers, the capacity of the

streams, exclusive of storage, is estimated at from 27,000,000 minimum horsepower, at times of drouth or low water, to 52,000,000¹ maximum. The practical utility of the excess of power at times when the streams are at high water or swollen by floods seems too uncertain, however, to be used as a fair basis of capacity. Of the two estimates, therefore, it appears safer to accept the minimum, 27,000,000, as representing the dependable water horsepower, exclusive of storage, developed and undeveloped, in the United States.

The development of the water-power resources of the country received a tremendous impetus with the advances made in electrical science. This power formerly was of local utility only, and its application is still in some measure thus restricted. Water power now, however, may be used locally to develop electric current which can be transmitted long distances to cities, towns, and isolated manufacturing plants. The electric current thus becomes available in large or small quantities for use not only as mechanical power, by means of the electric motor, but also for heat and light.

The term "hydroelectric" is generally applied to central stations of considerable magnitude. Water power was reported for 1,035 central stations for 1912, and although a majority of them also reported other power, there were 496 stations in 1912 that reported water power only. Water power once installed is conceded to be the most economical to operate, and it may be assumed, therefore, that when other primary power is added to this equipment it is generally for emergency purposes, such as the failure of the water supply, breakdowns, or repairs.

There were 225 stations for each of which the water power reported for 1912 amounted to 1,000 or more horsepower, and these have been tabulated separately as representing the hydroelectric stations. The map on page 37 shows the location of these stations. Table 19 summarizes the statistics for these stations and places them in comparison with those for all central stations.

The combined water power for the stations outside of what is represented by those of 1,000 or more horsepower amounted to only 182,685 horsepower, or 7.4 per cent of the total water power for all central electric stations in 1912. The 225 hydroelectric stations shown in Table 19 form only 4.3 per cent of the total number of central stations, and yet it will be seen from the table that they reported 42.2 per cent of the aggregate horsepower, 92.6 per cent of the water power, 38 per cent of the dynamo capacity, 50.8 per cent of the kilowatt-hour output, 31.1 per cent of the horsepower of stationary motors, 42.4 per cent of the cost of construction and equipment, and 24.1 per cent of the income.

¹ Report of the Commissioner of Corporations on water-power development in the United States: 1912.

Table 19

	CENTRAL ELECTRIC STATIONS: 1912.		
	Total.	Stations reporting water power of 1,000 horsepower and over.	
		Number or amount.	Per cent of total.
Number of stations.....	5,221	225	4.3
Cost of construction and equipment.....	\$2,175,678,266	\$922,954,341	42.2
Total income.....	\$302,145,599	\$72,717,582	24.1
Light, heat, and power, including free service.....	\$286,980,858	\$66,852,631	23.3
All other sources.....	\$15,134,741	\$5,864,951	38.8
Total expenses, including salaries and wages.....	\$234,419,478	\$56,342,064	24.0
Total number of persons employed.....	79,335	17,160	21.6
Total horsepower.....	7,528,648	3,170,244	42.2
Steam engines and steam turbines:			
Number.....	7,844	520	6.6
Horsepower.....	4,946,532	885,162	17.9
Water wheels and turbines:			
Number.....	2,933	1,552	52.9
Horsepower.....	2,471,081	2,288,396	92.6
Gas and oil engines:			
Number.....	1,116	19	1.7
Horsepower.....	111,035	5,686	5.1
Kilowatt capacity of dynamos.....	5,134,689	1,951,397	38.0
Output of stations, kilowatt hours.....	11,532,963,006	5,859,307,943	50.8
Estimated number of lamps wired for service:			
Arc.....	505,395	62,624	12.4
Incandescent and other varieties.....	76,507,142	13,403,893	17.5
Stationary motors served:			
Number.....	435,473	73,645	16.9
Horsepower.....	4,130,619	1,283,760	31.1

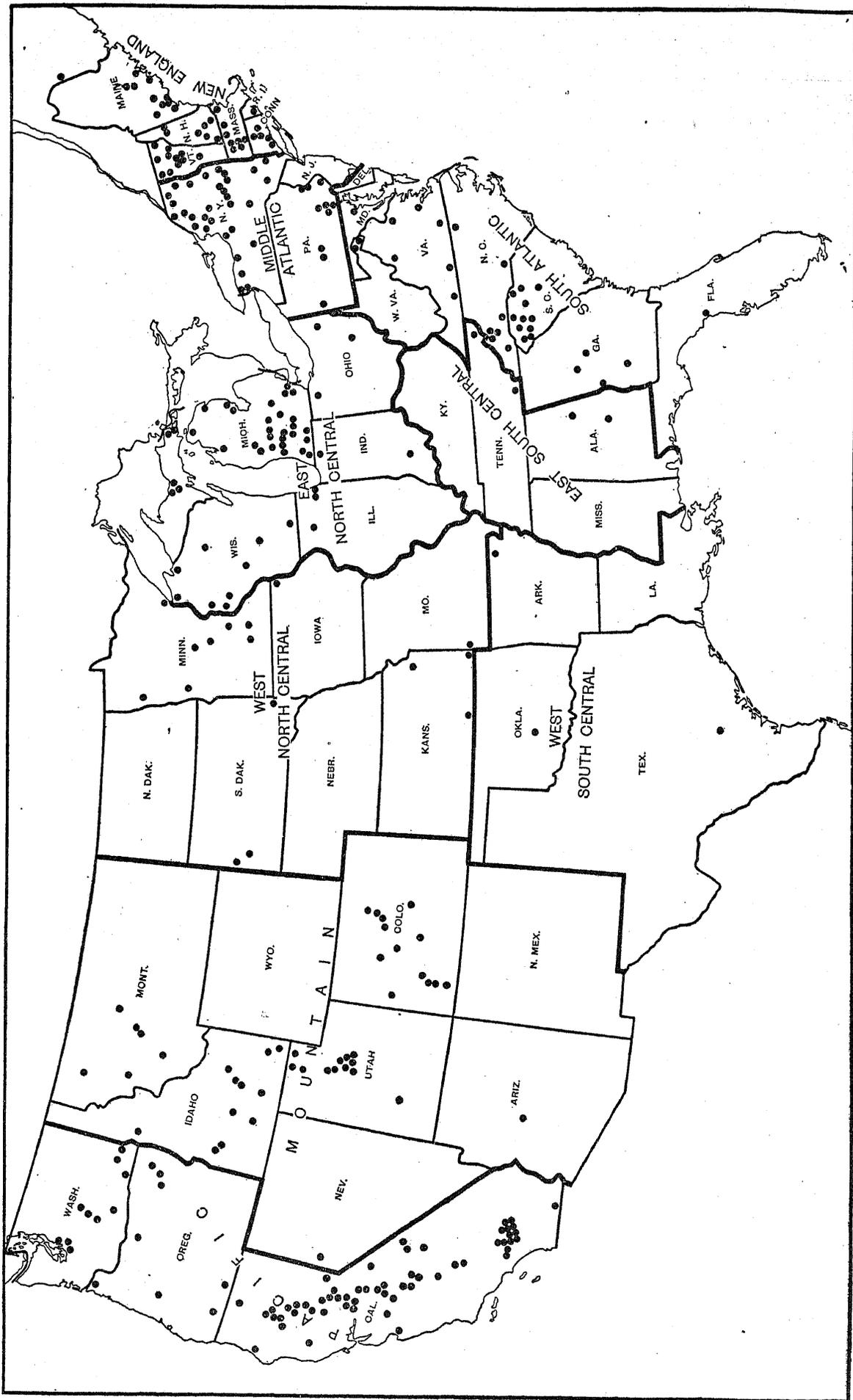
There are some companies that operate two or more plants in each of which, or in all combined, the water power exceeded 1,000 horsepower. Each such company included the statistics for all its plants in a single report which was counted as representing one station. For this reason the 225 stations should not be accepted as the number of separate plants of the class indicated.

A considerable part of the business of stations of this character is the sale of electricity in bulk, since of the total number of lamps reported by all central stations those reported by the hydroelectric stations formed but 12.4 per cent of the arcs and 17.5 per cent of the incandescents. Again, while the hydroelectric stations reported 23.3 per cent of the total income for electric service for all central stations, they reported 46 per cent of the total income for current sold to other public service corporations.

Table 20 (p. 38) presents detailed power statistics for the hydroelectric stations reporting water power of 1,000 or more horsepower, by geographic divisions and states, for 1912.

This table shows that in five of the geographic divisions the water power of the hydroelectric stations amounted to more than 200,000 horsepower. In the Middle Atlantic states it amounted to 614,396 horsepower, or 26.8 per cent of the total; in the Pacific states, to 525,567, or 23 per cent; in the South Atlantic states, to 323,081, or 14.1 per cent; in the Mountain states, to 296,034, or 12.9 per cent; and in the East North Central states, to 228,602, or 10 per cent. The four remaining divisions combined reported 300,716 horsepower, or 13.2 per cent.

MAP 2.—LOCATION OF HYDROELECTRIC CENTRAL STATIONS REPORTING WATER POWER OF 1,000 HORSEPOWER OR MORE, BY GEOGRAPHIC DIVISIONS: 1912.



CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

HYDROELECTRIC STATIONS REPORTING WATER POWER OF 1,000

Table 20		DIVISION AND STATE.	Number of stations.	Cost of construction and equipment.	INCOME.					
					Aggregate.	Electric service.				All other income.
						Total.	Light, heat, and power.	Sale of electric current to other public service corporations.	Estimated value of free service.	
1	UNITED STATES.....	236	\$922,954,341	\$72,717,582	\$66,862,631	\$52,445,534	\$14,269,708	\$137,389	\$5,864,951	
GEOGRAPHIC DIVISIONS:										
2	New England.....	40	55,612,714	7,509,541	7,000,257	5,769,650	1,179,433	51,124	509,284	
3	Middle Atlantic.....	39	127,457,618	11,538,580	9,238,299	6,520,607	2,711,572	6,120	2,300,281	
4	East North Central.....	29	102,470,585	12,164,623	11,179,326	8,601,917	2,570,668	6,741	985,297	
5	West North Central.....	16	38,657,925	4,432,394	4,124,859	3,402,522	629,047	3,200	307,535	
6	South Atlantic.....	30	55,767,646	2,990,998	2,930,024	1,578,558	1,338,186	13,280	60,974	
7	East South Central.....	4	30,828,000	480,867	470,357	221,261	248,846	250	10,510	
8	West South Central.....	3	539,369	70,715	69,363	69,135	.....	228	1,352
9	Mountain.....	32	164,975,643	7,665,587	7,043,061	6,108,526	903,122	31,413	622,526	
10	Pacific.....	32	346,654,841	25,864,277	24,797,085	20,083,358	4,688,784	24,943	1,067,192	
NEW ENGLAND:										
11	Maine.....	9	16,533,547	1,440,825	1,181,052	929,826	251,564	502	267,873	
12	New Hampshire.....	7	9,444,366	1,148,253	1,053,353	603,178	450,175	.....	94,900
13	Vermont.....	11	6,863,716	678,170	657,570	583,927	23,240	50,412	20,591	
14	Massachusetts.....	7	7,395,591	1,668,369	1,648,793	1,628,685	20,108	.....	19,578
15	Rhode Island and Connecticut.....	6	15,375,494	2,564,924	2,468,580	2,024,034	434,396	150	106,344	
MIDDLE ATLANTIC:										
16	New York.....	30	89,409,903	9,328,380	7,124,772	5,514,488	1,605,539	4,745	2,203,603	
17	Pennsylvania.....	9	38,047,715	2,210,200	2,113,527	1,006,119	1,106,033	1,375	96,673	
EAST NORTH CENTRAL:										
18	Ohio and Indiana.....	5	11,986,199	1,268,196	1,239,211	963,332	274,708	1,171	28,985	
19	Illinois.....	3	37,398,019	4,327,160	3,618,732	3,376,049	239,533	3,150	708,428	
20	Michigan.....	13	39,441,726	5,845,270	5,606,566	4,085,583	1,518,563	2,420	238,704	
21	Wisconsin.....	8	13,644,641	723,997	714,817	176,953	537,864	.....	9,180
WEST NORTH CENTRAL:										
22	Minnesota, Iowa, and Missouri.....	10	22,132,484	3,794,840	3,518,053	2,931,003	586,360	690	276,787	
23	South Dakota.....	3	7,758,185	463,170	441,772	422,894	16,378	2,500	21,398	
24	Kansas.....	3	8,767,256	174,384	165,034	138,025	26,309	100	9,350	
SOUTH ATLANTIC:										
25	Maryland, Virginia, and West Virginia.....	9	9,666,636	417,109	415,436	364,590	40,666	10,180	1,673	
26	North Carolina.....	5	8,739,185	300,377	280,682	177,527	103,155	.....	17,601
27	South Carolina.....	11	21,791,806	1,624,275	1,614,817	639,842	971,875	3,100	10,947	
28	Georgia and Florida.....	5	15,500,019	649,237	619,039	396,599	222,490	.....	30,753
EAST SOUTH CENTRAL:										
29	Tennessee and Alabama.....	4	30,828,000	480,867	470,357	221,261	248,846	250	10,510	
WEST SOUTH CENTRAL:										
30	Arkansas, Oklahoma, and Texas.....	3	539,369	70,715	69,363	69,135	.....	228	1,352
MOUNTAIN:										
31	Montana.....	4	62,667,126	3,265,835	2,708,869	2,633,768	74,441	660	557,016	
32	Idaho.....	10	29,532,755	1,173,500	1,148,092	962,890	162,645	22,557	25,408	
33	Colorado.....	10	45,044,966	1,483,697	1,455,133	1,027,904	426,208	1,021	28,564	
34	Arizona and Nevada.....	3	18,485,461	631,004	675,335	643,474	31,861	.....	5,669
35	Utah.....	5	9,245,335	1,061,501	1,055,632	840,490	207,967	7,175	5,869	
PACIFIC:										
36	Washington.....	6	18,193,923	2,207,308	2,146,921	2,077,130	57,440	12,351	60,387	
37	Oregon.....	4	16,521,752	653,701	637,074	623,342	9,232	4,500	16,627	
38	California.....	22	311,939,166	23,003,268	22,013,090	17,382,886	4,622,112	8,092	990,178	

PRIMARY POWER EQUIPMENT.

HORSEPOWER OR MORE, BY GEOGRAPHIC DIVISIONS AND STATES: 1912.

Total expenses, including salaries and wages.	Total number of persons employed.	PRIMARY POWER.												
		Aggregate.		Steam engines.										
				Total.		500 horsepower or under.		Over 500 and under 2,000 horsepower.		2,000 and under 5,000 horsepower.		5,000 horsepower and over.		
		Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	
\$66,342,064	17,160	2,091	3,179,244	329	205,033	227	59,507	76	65,966	23	57,060	3	22,500	1
5,235,075	1,758	359	286,988	59	27,300	41	12,775	18	14,525					2
8,100,824	2,305	401	706,171	81	48,100	57	18,050	18	17,550	6	12,500			3
10,310,318	4,317	455	472,544	81	26,343	65	11,142	14	11,041	2	4,160			4
3,354,565	934	119	144,430	22	10,675	19	5,725	2	1,450	1	3,500			5
1,924,679	587	184	345,770	10	3,390	8	1,640	2	1,750					6
509,649	148	17	36,480	3	1,740	2	890	1	850					7
55,208	27	15	5,985	1	650			1	650					8
5,958,205	1,329	212	314,799	20	6,585	17	3,585	3	3,000					9
20,893,541	5,755	329	866,077	52	80,250	18	5,700	17	15,150	14	36,900	3	22,500	10
1,082,656	392	133	70,154	20	7,500	18	6,100	2	1,400					11
642,649	210	61	52,942	8	4,925	4	1,750	4	3,175					12
435,883	176	41	30,379	5	2,200	4	1,450	1	750					13
1,195,862	420	54	61,643	6	3,225	4	1,075	2	2,150					14
1,878,025	560	70	71,870	20	9,450	11	2,400	9	7,050					15
6,421,585	1,896	313	564,984	65	42,033	41	11,983	18	17,550	6	12,500			16
1,679,239	409	88	141,187	16	6,067	16	6,067							17
999,076	274	93	49,732	4	2,350	1	350	3	2,000					18
3,356,189	1,749	148	87,402	56	10,540	54	8,500	2	2,040					19
5,387,908	2,191	153	277,510	13	12,453	5	1,292	9	7,001	2	4,160			20
567,145	103	61	57,900	5	1,000	5	1,000							21
2,737,144	614	78	90,884	17	5,775	15	4,325	2	1,450					22
400,963	99	21	16,276	2	800	2	800							23
216,458	221	20	37,270	3	4,100	2	600			1	3,500			24
315,794	159	45	52,786	4	1,600	3	600	1	1,000					25
259,398	116	24	46,790	4	790	4	790							26
752,590	210	81	186,869											27
596,897	102	34	59,325	2	1,000	1	250	1	750					28
509,649	148	17	36,480	3	1,740	2	890	1	850					29
55,208	27	15	5,985	1	650			1	650					30
1,936,818	373	62	107,795	7	1,125	7	1,125							31
1,213,662	227	45	49,159	1	150	1	150							32
1,529,887	331	58	83,805	11	5,010	8	2,010	3	3,000					33
411,796	149	14	21,340											34
866,042	249	33	52,700	1	300	1	300							35
1,483,080	813	45	81,940	4	1,300	3	550	1	750					36
560,400	272	25	25,250	4	2,350	2	800	2	1,550					37
18,850,061	4,670	259	758,887	44	76,600	13	4,350	14	12,850	14	36,900	3	22,500	38

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

HYDROELECTRIC STATIONS REPORTING WATER POWER OF 1,000

Table 20—Continued.		PRIMARY POWER—continued.											
		Steam turbines.										Gas and oil engines.	
		Total.		500 horsepower or under.		Over 500 and under 2,000 horsepower.		2,000 and under 5,000 horsepower.		5,000 horsepower and over.		Total.	
		Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.	Num-ber.	Horse-power.
1	UNITED STATES.....	191	680,129	8	1,705	94	95,295	53	162,482	36	420,647	19	5,686
	GEOGRAPHIC DIVISIONS:												
2	New England.....	39	89,879			22	25,564	13	40,613	4	23,702	2	450
3	Middle Atlantic.....	27	43,675	2	500	18	13,982	5	14,193	2	15,000		
4	East North Central.....	51	216,533			29	31,313	10	35,780	12	149,440	4	1,066
5	West North Central.....	17	38,703	4	670	8	7,366	3	6,667	2	24,000	7	2,135
6	South Atlantic.....	11	18,999			5	5,666	6	13,333			1	300
7	East South Central.....	1	1,340			1	1,340						
8	West South Central.....											2	295
9	Mountain.....	9	12,180	2	535	4	3,045	3	8,000				
10	Pacific.....	36	253,820			7	6,419	13	43,896	16	208,505	3	1,440
	NEW ENGLAND:												
11	Maine.....	2	3,420			1	670	1	2,750				
12	New Hampshire.....											2	450
13	Vermont.....	6	5,201			5	5,201						
14	Massachusetts.....	10	37,053			9	10,173	6	20,183	1	6,702		
15	Rhode Island and Connecticut.....	16	44,200			7	9,520	6	17,680	3	17,000		
	MIDDLE ATLANTIC:												
16	New York.....	15	30,925	2	500	8	7,065	3	8,360	2	15,000		
17	Pennsylvania.....	12	12,750			10	6,917	2	5,833				
	EAST NORTH CENTRAL:												
18	Ohio and Indiana.....	9	18,866			5	4,466	4	14,400			1	466
19	Illinois.....	15	40,200			10	10,730	2	6,030	3	23,440	2	550
20	Michigan.....	26	156,797			13	16,447	4	15,350	9	120,000		
21	Wisconsin.....	1	670			1	670					1	50
	WEST NORTH CENTRAL:												
22	Minnesota, Iowa, and Missouri.....	4	3,650			4	3,650					6	1,985
23	South Dakota.....	9	9,053	4	670	2	1,715	3	6,667				
24	Kansas.....	4	26,000			2	2,000			2	24,000	1	150
	SOUTH ATLANTIC:												
25	Maryland, Virginia, and West Virginia.....	4	6,000			2	2,000	2	4,000			1	300
26	North Carolina.....												
27	South Carolina.....	5	9,999			2	2,666	3	7,333				
28	Georgia and Florida.....	2	3,000			1	1,000	1	2,000				
	EAST SOUTH CENTRAL:												
29	Tennessee and Alabama.....	1	1,340			1	1,340						
	WEST SOUTH CENTRAL:												
30	Arkansas, Oklahoma, and Texas.....											2	295
	MOUNTAIN:												
31	Montana.....	3	6,500	1	500			2	6,000				
32	Idaho.....												
33	Colorado.....	6	5,680	1	35	4	3,645	1	2,000				
34	Arizona and Nevada.....												
35	Utah.....												
	PACIFIC:												
36	Washington.....	5	7,335			3	2,669	2	4,666				
37	Oregon.....												
38	California.....	31	251,485			4	3,750	11	39,230	16	208,505	3	1,440

1 Contains 4,104 lamps of other varieties (Nernst, vacuum, vapor, etc.).

PRIMARY POWER EQUIPMENT.

HORSEPOWER OR MORE, BY GEOGRAPHIC DIVISIONS AND STATES: 1912—Continued.

PRIMARY POWER—continued.										DYNAMOS.		Output of station (kilowatt hours) generated during year.	ESTIMATED NUMBER OF LAMPS W I R E D F O R SERVICE.		STATIONARY MOTORS SERVED.		
Water wheels and turbines.										Number.	Kilo-watts.		Arc.	Incandescent and other varieties.	Number.	Horse-power.	
Total.		500 horsepower or under.		Over 500 and under 2,000 horsepower.		2,000 and under 5,000 horsepower.		5,000 horsepower and over.									
Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.	Number.	Kilo-watts.	Output of station (kilowatt hours) generated during year.	Arc.	Incandescent and other varieties.	Number.	Horse-power.	
1,552	2,288,396	633	162,693	619	582,857	150	493,760	150	1,049,086	1,925	1,951,397	5,859,397,943	62,624	13,403,893	73,645	1,283,769	1
259	169,359	156	37,333	88	81,926	13	40,100	2	10,000	327	195,630	411,094,646	8,295	1,436,941	10,594	100,847	2
293	614,396	113	33,679	102	99,417	24	65,800	54	415,500	423	359,215	1,399,488,481	11,305	1,261,849	8,937	110,080	3
319	228,602	169	41,027	124	86,375	24	86,800	2	14,400	327	294,092	787,211,604	9,083	3,052,072	15,820	143,971	4
73	92,917	44	9,179	22	16,238	5	49,500	2	18,000	100	87,545	212,978,506	4,624	861,129	6,229	77,296	5
162	323,081	40	12,071	69	75,110	17	46,500	36	189,400	183	213,873	485,867,328	2,206	156,669	2,974	100,952	6
13	33,400	8	2,340	4	2,700	5	21,600	5	21,600	24	25,375	55,770,810	819	78,468	231	4,484	7
12	5,040	8	2,340	4	2,700	5	21,600	5	21,600	13	2,740	1,335,375	104	11,511	168	1,257	8
183	296,034	45	11,016	104	111,218	20	71,800	14	102,000	204	183,446	758,364,280	3,538	648,623	4,757	170,598	9
238	525,567	58	16,048	93	98,073	42	111,660	40	299,786	324	589,481	1,747,286,913	22,650	5,896,631	23,935	574,284	10
111	59,234	72	13,989	35	29,845	2	5,400	2	10,000	98	47,296	106,028,123	1,120	232,261	1,555	25,624	11
51	47,567	31	8,467	12	11,100	8	28,000	8	28,000	53	37,765	90,297,891	1,144	118,336	710	7,494	12
31	22,978	13	5,216	17	15,762	1	2,000	1	2,000	41	17,042	43,598,562	493	177,270	1,092	15,913	13
32	21,360	17	4,341	13	12,319	2	4,700	2	4,700	76	43,512	60,819,611	3,439	427,726	3,172	20,899	14
34	18,220	23	5,320	11	12,900	11	12,900	11	12,900	59	50,015	110,350,459	2,099	481,348	4,065	30,917	15
233	492,026	94	23,517	67	66,709	24	65,800	48	331,000	331	261,000	1,081,292,900	9,744	971,934	7,668	84,458	16
60	122,370	19	5,162	35	32,708	35	32,708	0	84,500	92	98,215	318,195,581	1,561	289,915	1,269	25,622	17
79	28,050	72	18,850	7	9,200	7	9,200	7	9,200	34	28,850	71,213,325	1,212	152,212	2,105	19,162	18
75	36,112	27	6,082	48	30,030	48	30,030	48	30,030	142	49,602	175,375,156	4,418	1,023,935	3,780	28,384	19
111	108,260	34	9,915	63	40,345	12	43,600	2	14,400	110	181,585	436,971,110	3,081	1,834,830	9,515	92,330	20
64	56,180	36	6,180	6	6,800	12	43,200	12	43,200	41	34,055	103,652,013	372	41,090	420	4,095	21
51	79,474	35	7,224	11	9,250	3	45,000	2	18,000	64	52,558	138,486,277	4,026	761,513	5,324	62,718	22
10	6,423	10	6,423	10	6,423	10	6,423	10	6,423	24	11,897	17,200,554	472	78,113	720	10,313	23
12	7,020	9	1,955	1	565	2	4,500	2	4,500	12	23,090	57,291,675	126	21,503	185	4,265	24
36	44,886	15	4,616	14	11,270	3	9,000	4	20,000	42	35,665	29,035,776	1,654	107,894	512	7,473	25
20	46,000	4	1,500	8	6,500	2	5,000	6	33,000	26	32,431	55,725,300	110	12,361	527	19,070	26
76	176,870	11	4,130	35	39,640	8	18,700	22	114,400	86	109,877	333,633,641	321	28,450	355	36,335	27
30	55,325	10	1,825	12	17,700	4	13,800	4	22,000	29	35,900	67,472,611	121	7,964	1,080	33,074	28
13	33,400	8	2,340	4	2,700	5	21,600	5	21,600	24	25,375	55,770,810	819	78,468	231	4,484	29
12	5,040	8	2,340	4	2,700	5	21,600	5	21,600	13	2,740	1,335,375	104	11,511	168	1,257	30
52	100,170	11	3,157	26	26,613	9	34,400	6	36,000	61	68,920	371,799,054	1,602	287,089	1,462	71,059	31
44	49,009	16	3,584	24	22,425	2	6,000	2	17,000	38	31,024	105,914,621	1,084	183,856	1,287	19,836	32
41	73,115	15	3,815	19	17,300	2	8,000	5	44,000	60	37,167	144,364,518	498	140,852	957	26,240	33
14	21,340	2	60	9	12,280	3	9,000	3	9,000	10	13,500	58,977,145	321	24,593	594	18,246	34
32	52,400	1	400	26	32,600	4	14,400	1	5,000	35	32,835	77,308,942	33	32,253	457	35,217	35
36	73,305	17	4,005	9	9,500	3	6,800	7	53,000	35	47,005	62,233,028	4,180	625,275	1,739	22,950	36
21	22,900	2	800	18	17,100	1	5,000	1	5,000	31	19,120	35,993,935	679	171,854	632	8,630	37
181	429,362	39	11,243	71	71,473	39	104,860	32	241,786	258	523,356	1,649,059,950	17,891	5,099,502	21,564	542,704	38

Six of the individual states reported upward of 100,000 water horsepower each, ranking as follows: New York, 492,026 horsepower, or 21.5 per cent of the total water power; California, 429,362, or 18.8 per cent; South Carolina, 176,870, or 7.7 per cent; Pennsylvania, 122,370, or 5.3 per cent; Michigan, 108,260, or 4.7 per cent; and Montana, 100,170, or 4.4 per cent—these six states combined reporting 62.4 per cent of the total water power of the hydroelectric stations.

In addition to the 2,288,396 water horsepower shown for the central electric stations that reported 1,000 or more water horsepower each, there are a number of hydroelectric stations of 1,000 or more horsepower capacity of water wheels or turbines included among the street and electric railway plants. The total reported by such companies was 461,513 horsepower, making a grand total for the two classes of stations in 1912 of 2,749,909 water horsepower, or 93.5 per cent of the total water power reported by the central stations and electric railways combined.

Gas and oil engines.—Internal-combustion engines were reported for 713 central stations in 1912, compared with 294 stations in 1907 and 101 in 1902. Table 21 shows the number and horsepower of the internal-combustion engines reported for commercial and municipal plants, respectively, for 1912, 1907, and 1902, also the per cent of the number and horsepower in each class of stations, and per cent of increase.

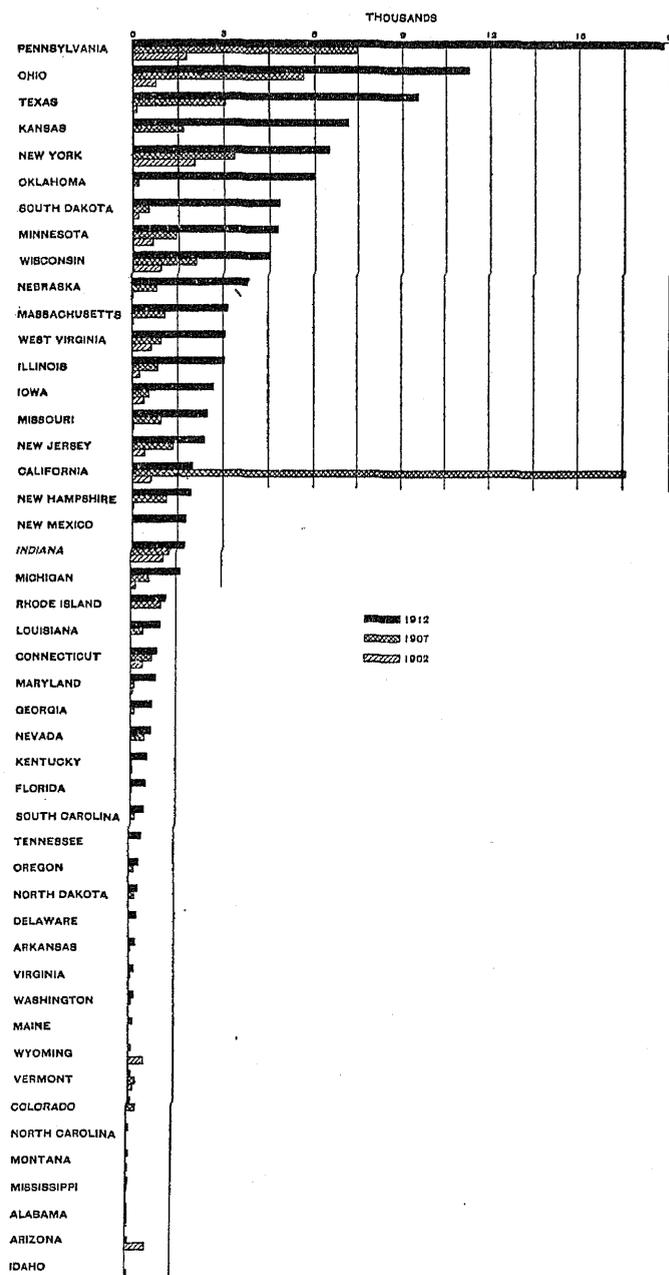
20.2 per cent. Of the total primary power of all kinds for municipal stations (559,328 horsepower), that for gas and oil engines formed but 4 per cent, and yet of the total primary power of these internal-combustion engines for all central stations the proportion reported by the municipal stations was much greater than that for either steam or water.

The utilization of internal-combustion engines in central stations is of comparatively recent origin. In 1902 there were 165 of these engines, and they formed only 2.1 per cent of the total of prime movers in central stations, while their horsepower formed seven-tenths of 1 per cent of the total power. Notwithstanding an increase in the number of these machines to 1,116, or 9.4 per cent of all prime movers, their horsepower was equal to only 1.5 per cent of the total for all classes of primary power in 1912.

DIAGRAM 8.—CENTRAL ELECTRIC STATIONS—GAS AND OIL ENGINES, HORSEPOWER, BY STATES: 1912, 1907, AND 1902.

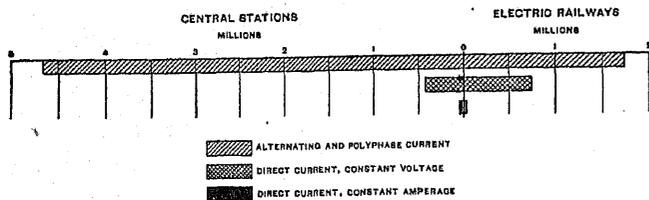
CLASS OF STATIONS.	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—GAS AND OIL ENGINES: 1912, 1907, AND 1902.			
	Gas and oil engines.		Per cent of total.	
	Number.	Horsepower.	Number.	Horsepower.
Total:				
1912.....	1,116	111,035	100.0	100.0
1907.....	403	55,328	100.0	100.0
1902.....	165	12,181	100.0	100.0
Commercial:				
1912.....	833	88,634	74.6	79.8
1907.....	385	49,746	83.2	89.1
1902.....	147	11,224	89.1	92.1
Municipal:				
1912.....	283	22,401	25.4	20.2
1907.....	78	6,082	16.8	10.9
1902.....	18	957	10.9	7.9
PER CENT OF INCREASE.				
Total:				
1902-1912.....	576.4	811.5		
1907-1912.....	141.0	98.9		
1902-1907.....	180.6	358.3		
Commercial:				
1902-1912.....	466.7	689.7		
1907-1912.....	116.4	78.2		
1902-1907.....	161.9	343.2		
Municipal:				
1902-1912.....	1,472.2	2,240.8		
1907-1912.....	262.8	208.3		
1902-1907.....	333.3	535.5		

Although there are a number of large internal-combustion engines in use, the average horsepower per machine is much smaller than that of either steam or water. The horsepower reported for gas and oil engines in 1912 was 111,035, compared with 12,181 in 1902. Of the total horsepower reported in 1912, 88,634 horsepower, or 79.8 per cent, was reported by commercial stations, while municipal stations reported 22,401, or



the total kilowatt capacity for the two branches of the industry combined, the alternating-current machines reported 83.7 per cent in 1912 and 43.1 per cent in 1902, and the direct-current dynamos (the two types combined) 16.3 per cent and 56.9 per cent, respectively.

DIAGRAM 9.—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—KILOWATT CAPACITY OF DYNAMOS: 1912.



Although there was an increase in the capacity of the direct-current constant-voltage dynamos in both central stations and electric railway plants during the decade, a better index of later conditions pertaining to the use of this dynamo is furnished by a comparison of the totals for 1907 and 1912. The central stations reported an increase of 23,202 kilowatts, or 5.7 per cent, between 1907 and 1912, but for the electric railways there was a decrease of 209,951 kilowatts, or 22.3 per cent. The proportion which the kilowatt capacity of the constant-voltage dynamos formed of the capacity of all types for central stations and electric railway plants combined was 15.2 per cent in 1912, compared with 30.4 per cent in 1907 and 50 per cent in 1902. The corresponding percentages for central stations were 8.4, 15, and 27.2, and for plants operated by electric railways, 29.2, 54.6, and 80.7, respectively.

In 1902 and 1907 the schedule used for electric railways did not distinguish between the direct-current constant-voltage dynamo and the direct-current constant-amperage, reporting both classes as direct-current machines. In making a comparison, therefore, of the total capacity of these dynamos both classes should be combined. Such a comparison for 1902 and 1912 shows an increase of 42,088 kilowatts, or 3.5 per cent, during the decade.

The alternating-current dynamos showed the largest actual and percentage gain between 1902 and 1912 and also between 1907 and 1912. The total capacity of the machines of this type increased 5,490,070 kilowatts, or 603.8 per cent, from 1902 to 1912. Of this increase, 3,924,895 kilowatts, or 71.5 per cent, was contributed by the central stations. Between 1907 and 1912 the total increase was 3,395,703 kilowatts, or 113.1 per cent, of which 2,439,426 kilowatts, or 71.8 per cent, was contributed by the central electric stations. The increasing use of alternating-current dynamos is demonstrated by the proportions of the total kilowatt capacity for these machines in the several census years. For all stations combined these proportions were 83.7 per cent in 1912, 67.8 per cent

in 1907, and 43.1 per cent in 1902. For the central stations the corresponding percentages were 90.8, 82, and 60.7, while for the electric railways they were 69.3, 45.4, and 19.3, respectively.

There were 12,597 dynamos of all kinds reported for the 5,221 central stations covered by the census of 1912. This would make an average of more than two machines for each station.

Table 23 gives for commercial and municipal central electric stations the numbers which reported the several classes of dynamos for 1912, 1907, and 1902.

Table 23

KIND OF DYNAMO.	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER OF STATIONS, BY KIND OF DYNAMO: 1912, 1907, AND 1902.			
	Census.	Total.	Commercial.	Municipal.
Direct current, constant voltage.....	1912 1907 1902	1,500 1,588 1,447	1,165 1,273 1,195	335 315 252
Direct current, constant amperage.....	1912 1907 1902	219 542 1,160	148 342 864	71 200 296
Alternating and polyphase current.....	1912 1907 1902	3,729 3,446 2,634	2,562 2,524 2,069	1,167 922 565

The total number of stations shown in this table is in excess of the actual number of stations reported, since a single station having two or more different kinds of dynamos is reported under each class.

From 1902 to 1912 there was an increase of 53, or 3.7 per cent, in the number of stations reporting direct-current constant-voltage dynamos, but a decrease of 88, or 5.5 per cent, between 1907 and 1912. For the commercial stations, the number reporting the direct-current constant-voltage dynamos decreased slightly during the decade. The municipal stations showed an increase in the number reporting this class of dynamos at each succeeding census.

The elimination of direct-current constant-amperage dynamos as generators of electricity is emphasized by the rapid and continuous decrease in the number of stations so equipped. The total number of stations using this type of dynamo decreased 941, or 81.1 per cent, from 1902 to 1912. Commercial stations decreased 716, or 82.9 per cent, and municipal stations 225, or 76 per cent, during the same period.

On the other hand, the number of stations equipped with alternating dynamos increased by 1,095, or 41.6 per cent, during the decade. Of this increase, the commercial stations show 493, or 45 per cent, and municipal stations 602, or 55 per cent. The percentage of increase for the commercial stations during the decade was 23.8 per cent, and for the municipal stations it was 106.5 per cent.

The increase that has taken place in the average capacity of all classes of dynamos at each census since 1902 is clearly demonstrated in Table 24, which gives, for commercial and municipal central electric stations, for the different kinds of dynamos, the average

kilowatt capacity per station and per machine for 1912, 1907, and 1902.

Table 24
COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—AVERAGE KILOWATT CAPACITY OF DYNAMOS, PER STATION AND PER MACHINE

KIND OF DYNAMO.	Total.			Commercial.			Municipal.		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
	Total kilowatt capacity— Average capacity— Per station..... Per machine.....	983 408	575 223	335 97	1,302 484	722 256	392 103	236 134	167 87	139 62
Direct current, constant voltage: Average capacity— Per station..... Per machine.....	286 126	256 110	228 86	342 141	298 120	262 92	94 55	85 52	70 42
Direct current, constant amperage: Average capacity— Per station..... Per machine.....	200 59	149 48	126 41	209 60	181 50	136 40	182 57	96 44	95 48
Alternating and polyphase current: Average capacity— Per station..... Per machine.....	1,250 552	645 326	280 144	1,693 667	816 384	323 156	278 166	177 113	120 82

or 193.4 per cent, between 1902 and 1912. For the commercial stations the total average capacity per station increased 910 kilowatts during the decade, and the corresponding increase for municipal stations was 97 kilowatts.

The average kilowatt capacity per station for each of the three groups of dynamos shows a greater or less increase at each census. The average for the alternating and polyphase current dynamos shows the greatest increase per station, 970 kilowatts, from 1902 to 1912.

From 1902 to 1912 the average capacity of all dynamos increased 310 kilowatts. Of the three classes of dynamos, the average capacity per machine for the alternating and polyphase current dynamo, for all stations, shows the greatest and the only pronounced increase during the decade—408 kilowatts, or 283.3 per cent.

Table 25 presents, for commercial and municipal electric stations, the number and kilowatt capacity of the three classes of dynamos for 1912, 1907, and 1902.

The total average capacity per station, for all classes of dynamos combined, increased 648 kilowatts,

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER, KIND, AND KILOWATT CAPACITY OF DYNAMOS: 1912, 1907, AND 1902.

Table 25

CLASS OF STATIONS.	TOTAL.		KIND OF DYNAMOS.					
	Number.	Kilowatt capacity.	Direct current, constant voltage.		Direct current, constant amperage.		Alternating and polyphase current.	
			Number.	Kilowatt capacity.	Number.	Kilowatt capacity.	Number.	Kilowatt capacity.
Total:								
1912.....	12,597	5,134,689	3,401	429,662	745	43,828	8,451	4,661,199
1907.....	12,173	2,709,225	3,680	406,460	1,685	80,992	6,808	2,221,773
1902.....	12,484	1,212,235	3,823	330,065	3,539	145,866	5,122	736,304
Commercial:								
1912.....	9,837	4,766,012	2,821	398,046	518	30,880	6,498	4,337,086
1907.....	9,778	2,500,209	3,169	379,706	1,246	61,753	5,303	2,058,750
1902.....	10,662	1,068,855	3,405	312,509	2,957	117,695	4,300	668,651
Municipal:								
1912.....	2,760	368,677	580	31,616	227	12,948	1,953	324,113
1907.....	2,395	209,016	511	26,754	439	19,239	1,445	163,023
1902.....	1,822	113,380	418	17,556	582	28,171	822	67,653
	PER CENT OF INCREASE. ¹							
Total:								
1902-1912.....	0.9	323.6	-11.0	30.2	-78.9	-70.0	65.0	533.1
1907-1912.....	3.5	89.5	-7.6	5.7	-55.8	-45.9	24.1	109.8
1902-1907.....	-2.5	123.5	-3.7	23.1	-52.4	-44.5	32.9	201.7
Commercial:								
1902-1912.....	-7.7	333.7	-17.2	27.4	-82.5	-73.8	51.1	548.6
1907-1912.....	0.6	90.6	-11.0	4.8	-58.4	-50.0	21.2	110.7
1902-1907.....	-8.3	127.5	-6.9	21.5	-57.9	-47.5	24.7	207.9
Municipal:								
1902-1912.....	51.5	225.2	38.8	30.1	-61.0	-54.0	137.6	379.1
1907-1912.....	15.2	76.4	13.5	18.2	-48.3	-32.7	35.2	98.8
1902-1907.....	31.4	84.3	22.2	52.4	-24.6	-31.7	75.8	141.0

¹ A minus sign (-) denotes decrease.

The total kilowatt capacity of the dynamos installed in central electric stations increased 3,922,454 kilowatts, or 323.6 per cent, from 1902 to 1912. Of this increase, 3,667,157, or 93.5 per cent, was contributed by the commercial stations.

The total capacity of the direct-current constant-voltage dynamos increased 99,597 kilowatts, or 30.2 per cent, in the 10 years, of which increase the commercial stations contributed 85.8 per cent.

On the other hand, the capacity of the direct-current, constant-amperage dynamos decreased 102,038 kilowatts, or 70 per cent, during the same period. Of this decrease, 86,815 kilowatts, or 85.1 per cent, is shown for the commercial stations. The tendency to eliminate this latter type of dynamo is demonstrated by the fact that the total kilowatt capacity of constant-amperage dynamos in commercial and municipal stations combined constituted only nine-tenths of 1

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

per cent of the total reported for all types of dynamos in 1912, compared with 3 per cent in 1907 and 12 per cent in 1902.

The total capacity of the alternating-current dynamos in all central electric stations increased 3,924,895 kilowatts, or over 500 per cent, from 1902 to 1912. In 1902 the total kilowatt capacity of alternating dynamos located in commercial and municipal stations combined represented 60.7 per cent of the total capacity for all classes of dynamos; in 1907 this proportion was 82 per cent; and in 1912, 90.8 per cent. The kilowatt capacity of the alternating-current dynamos reported

by commercial stations formed 60.8 per cent of the kilowatt capacity for all kinds of dynamos in 1902, 82.3 per cent in 1907, and 91 per cent in 1912, while for municipal stations the corresponding proportions were 59.7 per cent, 78 per cent, and 87.9 per cent.

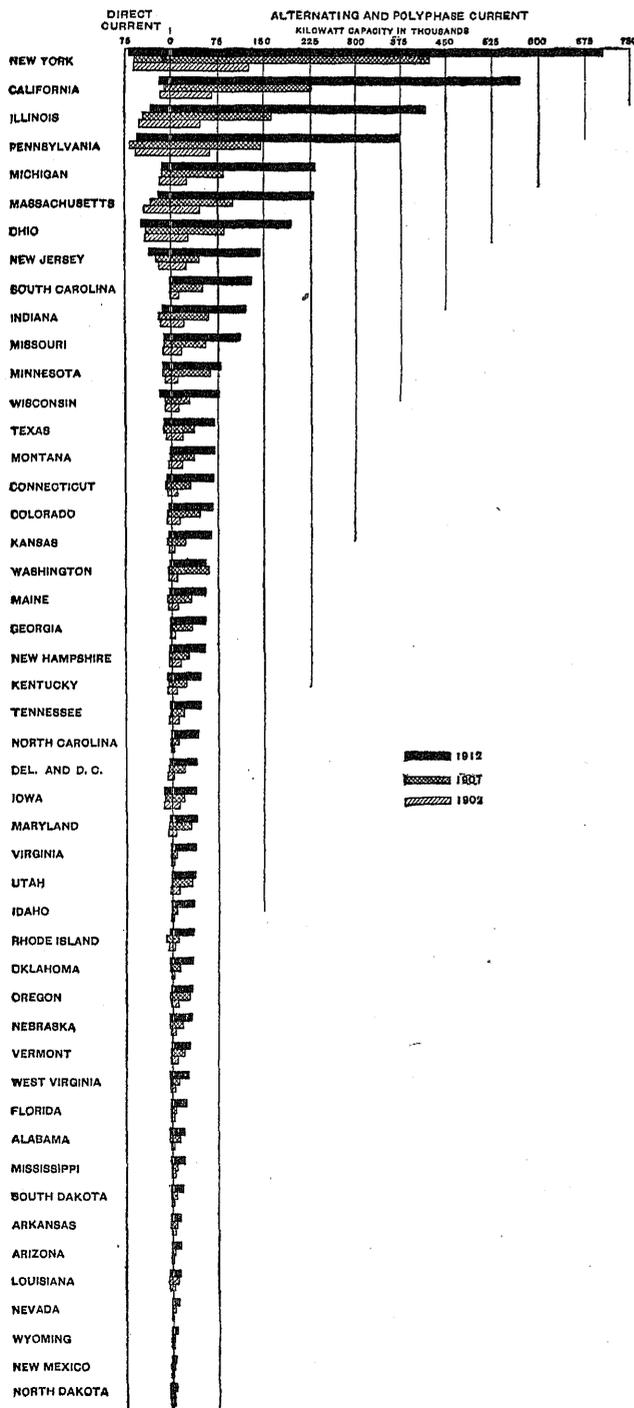
Next to the output of the stations, the capacity of the generating equipment and the increase from census to census furnish a measure of the growth of the electrical industries. In Table 26 this growth is shown, as indicated by dynamo capacity of all central electric stations, by geographic divisions and states, for 1912, 1907, and 1902.

CENTRAL ELECTRIC STATIONS—TOTAL KILOWATT CAPACITY OF DYNAMOS, BY GEOGRAPHIC DIVISIONS AND STATES: 1912, 1907, AND 1902.

Table 26 DIVISION AND STATE.	TOTAL KILOWATT CAPACITY OF DYNAMOS.			Actual increase: 1902-1912	Per cent of increase: 1902-1912	PER CENT DISTRIBUTION.		
	1912	1907	1902			1912	1907	1902
UNITED STATES.....	5,134,689	2,709,225	1,212,235	3,922,454	323.6	100.0	100.0	100.0
GEOGRAPHIC DIVISIONS:								
New England.....	514,889	289,388	162,789	352,100	216.3	10.0	10.7	13.4
Middle Atlantic.....	1,378,811	765,140	354,760	1,024,051	288.7	26.9	28.2	29.3
East North Central.....	1,176,528	559,760	275,569	900,959	326.9	22.9	20.7	22.7
West North Central.....	404,172	245,252	99,945	304,227	304.4	7.9	9.1	8.2
South Atlantic.....	412,779	195,309	62,301	350,478	562.6	8.0	7.2	5.1
East South Central.....	150,042	77,059	39,327	110,715	281.5	2.9	2.8	3.2
West South Central.....	158,369	88,910	42,932	115,437	268.9	3.1	3.3	3.5
Mountain.....	261,119	151,032	65,952	195,167	295.9	5.1	5.6	5.5
Pacific.....	677,980	337,375	108,660	569,320	523.9	13.2	12.5	9.0
NEW ENGLAND:								
Maine.....	58,757	39,290	15,291	43,466	284.3	11.4	13.6	9.4
New Hampshire.....	57,768	31,917	17,777	39,991	225.0	11.2	11.0	10.9
Vermont.....	29,468	21,854	11,442	18,026	157.5	5.7	7.6	7.0
Massachusetts.....	252,732	135,924	90,624	162,108	178.9	49.1	47.0	55.7
Rhode Island.....	38,509	21,040	12,139	26,370	217.2	7.5	7.3	7.6
Connecticut.....	77,655	39,363	15,516	62,139	400.5	15.1	13.6	9.5
MIDDLE ATLANTIC:								
New York.....	772,030	482,081	187,252	584,778	312.3	56.0	63.0	52.8
New Jersey.....	179,477	70,566	46,120	133,357	289.2	13.0	9.2	13.0
Pennsylvania.....	427,304	212,543	121,388	305,916	252.0	31.0	27.8	34.2
EAST NORTH CENTRAL:								
Ohio.....	244,182	126,533	69,811	174,371	249.8	20.8	22.6	25.3
Indiana.....	135,801	81,576	38,144	97,657	256.0	11.5	14.6	13.8
Illinois.....	449,917	209,226	100,320	349,597	348.5	38.2	37.4	36.4
Michigan.....	247,789	101,714	44,176	203,613	460.9	21.1	18.2	16.0
Wisconsin.....	98,839	40,711	23,118	75,721	327.5	8.4	7.3	8.4
WEST NORTH CENTRAL:								
Minnesota.....	93,502	78,516	20,999	72,503	345.3	23.1	32.0	21.0
Iowa.....	53,237	32,056	24,886	28,351	113.9	13.2	13.1	24.9
Missouri.....	122,786	68,467	32,100	90,686	282.5	30.4	27.9	32.1
North Dakota.....	10,824	5,819	2,042	8,782	430.1	2.7	2.4	2.0
South Dakota.....	20,032	10,046	2,910	17,122	588.3	5.0	4.1	2.9
Nebraska.....	34,586	20,041	8,412	26,174	311.2	8.6	8.2	8.4
Kansas.....	69,205	30,307	8,596	60,609	705.1	17.1	12.4	8.6
SOUTH ATLANTIC:								
Delaware, District of Columbia, and Maryland.....	87,137	62,956	21,639	65,498	302.7	21.1	32.2	34.8
Virginia.....	40,512	9,195	3,827	36,685	5.9	9.8	4.7	6.1
West Virginia.....	29,772	14,726	6,985	22,787	326.2	7.2	7.5	11.2
North Carolina.....	43,099	13,911	4,141	38,958	4.1	10.4	7.1	6.6
South Carolina.....	132,408	51,271	13,390	119,018	888.9	32.1	26.3	21.5
Georgia.....	56,232	35,446	7,620	48,612	638.0	13.6	18.1	12.2
Florida.....	23,619	7,804	4,699	18,920	402.6	5.7	4.0	7.5
EAST SOUTH CENTRAL:								
Kentucky.....	54,062	29,140	15,012	39,050	260.1	36.0	37.8	38.2
Tennessee.....	49,640	20,911	14,736	34,904	236.9	33.1	27.1	37.5
Alabama.....	24,477	17,124	4,473	20,004	447.2	16.3	22.2	11.4
Mississippi.....	21,863	9,854	5,106	16,757	328.2	14.6	12.8	13.0
WEST SOUTH CENTRAL:								
Arkansas.....	16,335	9,678	6,024	10,311	171.2	10.3	10.9	14.0
Louisiana.....	19,169	15,175	7,781	11,388	146.4	12.1	17.1	18.1
Oklahoma.....	38,301	15,499	3,019	35,282	1168.7	24.2	17.4	7.0
Texas.....	84,564	48,558	26,108	58,456	223.9	53.4	54.6	60.8
MOUNTAIN:								
Montana.....	74,398	39,602	22,055	52,343	237.3	28.5	26.2	33.4
Idaho.....	35,656	7,082	2,774	32,882	1185.4	13.7	4.7	4.2
Wyoming.....	8,212	3,208	1,831	6,381	348.5	3.1	2.1	2.8
Colorado.....	71,668	53,130	21,808	49,860	228.6	27.4	35.2	33.1
New Mexico.....	7,981	3,789	986	709.4	709.4	3.1	2.5	1.5
Arizona.....	14,756	4,939	1,811	12,945	714.8	5.7	3.3	2.7
Utah.....	37,935	33,692	13,923	24,012	172.5	14.5	22.2	21.1
Nevada.....	10,513	5,690	764	9,749	1276.0	4.0	3.8	1.2
PACIFIC:								
Washington.....	57,283	66,308	13,679	43,604	318.8	8.4	19.7	12.6
Oregon.....	32,416	32,587	11,165	21,251	190.3	4.8	9.7	10.3
California.....	588,281	238,480	83,816	504,465	601.9	86.8	70.7	77.1

Table 26 furnishes a comprehensive idea of the growth of the central electric station industry in the different geographic divisions and states. Of the total kilowatt capacity reported for the United States in 1912, four of the geographic divisions combined, namely, the Middle Atlantic, East North Central, Pacific, and New England, ranking in the order named, contributed 73 per cent. The South Atlantic division, which reported but 8 per cent of the total kilowatt capacity in 1912, showed the greatest per cent of increase during the decade, and New England the smallest per cent.

DIAGRAM 10.—CENTRAL ELECTRIC STATIONS—KILOWATT CAPACITY OF DYNAMOS, BY STATES: 1912, 1907, AND 1902.



Considering the relative importance of the different geographic divisions as measured by their proportions of the total, they were practically the same at all three censuses. The only change in their relative positions took place between the South Atlantic and West North Central divisions. The former, occupying fifth place in 1902, dropped to sixth in 1907, but regained fifth place in 1912, while the West North Central, which was sixth in importance in 1902, in 1907 advanced to fifth place, but in 1912 dropped back again to the sixth position.

Among the states, New York and California combined reported an actual increase in capacity of 1,089,243 kilowatts, or 27.8 per cent of the total increase for the United States, between 1902 and 1912. In addition to these two states, seven states, namely, Illinois, Pennsylvania, Michigan, Ohio, Massachusetts, New Jersey, and South Carolina, each reported an increase during the decade of 100,000 or more kilowatts in the dynamo capacity of their central stations. The combined increase for these nine states was 2,537,223 kilowatts, or 64.7 per cent of the total increase for the United States.

It appears from these figures that during the decade the remaining 39 states, together with the District of Columbia, reported a total actual increase in dynamo capacity of 1,385,231 kilowatts, or 35.3 per cent of the increase for all states combined.

Exceptionally large actual increases in dynamo capacity are shown during the decade for several of the states, among which may be mentioned New York, with 584,778 kilowatts; California, 504,465 kilowatts; Illinois, 349,597 kilowatts; and Pennsylvania, 305,916 kilowatts. Of these four states, the largest rate of increase is shown for California, 601.9 per cent. There are a number of states, however, for which larger percentages of increase are shown, but the stations were generally small or the industry but slightly developed in 1902, and, with the exception of South Carolina, none of them had a capacity of 100,000 kilowatts or more in 1912. The largest percentage of increase from 1902 to 1912 (1,276) was for Nevada, for which state the capacity increased from 764 kilowatts to 10,513 kilowatts.

As a further illustration of the growth in the dynamo capacity of the central stations, Table 27 gives for these stations their number, arranged in groups according to the total kilowatt capacity of the dynamos, by geographic divisions, for 1912 and 1907.

Of the total kilowatt capacity of dynamos in central electric stations in 1912, the Middle Atlantic division reported 26.9 per cent, the East North Central 22.9 per cent, the Pacific 13.2 per cent, and New England 10 per cent of the total for the United States. These four geographic divisions combined reported 73 per cent of the total for the United States in 1912 and 72.1 per cent in 1907. These four divisions also reported 78.7 per cent of the dynamo capacity for stations having a capacity of 5,000 kilowatts and

over, compared with 78.4 per cent in 1907. This table emphasizes the growth of stations having a dynamo capacity of over 5,000 kilowatts. The total capacity of dynamos of this class increased 2,177,429, or 152 per cent, during the five-year period 1907-1912, this gain forming 89.8 per cent of the total increase for the dynamos of all groups combined. The total kilowatt capacity for this class formed 70.3 per cent of the entire dynamo equipment in central electric sta-

tions in 1912, compared with 52.9 per cent in 1907. Six of the nine geographic divisions show a decreased capacity for the smallest class of dynamos, and there was a decrease of 12,030 kilowatts, or 4.6 per cent, during the five-year period in their total for the United States. The tendency toward the use of dynamos of larger capacity is evidenced by the fact that the percentages of increase are greater for these classes than for the smaller ones.

CENTRAL ELECTRIC STATIONS—NUMBER, BY DYNAMO CAPACITY AND BY GEOGRAPHIC DIVISIONS: 1912 AND 1907.

Table 27	DIVISION. ¹	Census.	STATIONS GROUPED ACCORDING TO DYNAMO CAPACITY.														Stations having no generating equipment (number).
			TOTAL.		Under 200 kilowatts.		200 and under 500 kilowatts.		500 and under 1,000 kilowatts.		1,000 and under 2,000 kilowatts.		2,000 and under 5,000 kilowatts.		5,000 kilowatts and over.		
			Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	
	United States.....	1912	5,221	5,134,689	2,902	250,571	948	278,505	337	228,885	214	301,495	152	404,993	161	3,610,240	507
	1907	4,714	2,709,225	3,038	262,601	821	246,015	269	182,664	169	228,313	115	356,821	75	1,432,811	227	
	Per cent of increase ²	10.8	89.5	-4.5	-4.6	15.5	13.2	25.3	25.3	26.6	32.1	32.2	30.3	114.7	152.0	123.3	
	New England.....	1912	368	514,889	102	9,609	64	20,300	39	27,255	36	50,260	26	79,047	24	328,418	77
	1907	365	289,388	147	13,760	74	24,544	41	27,867	35	50,415	22	66,725	9	106,077	37	
	Per cent of increase ²	0.8	77.9	-30.6	-30.2	-13.5	-17.3	-4.9	-2.2	2.9	-0.3	18.2	18.5	166.7	209.6	108.1	
	Middle Atlantic.....	1912	609	1,378,811	249	23,823	144	43,851	66	46,037	43	61,815	36	108,018	32	1,095,267	99
	1907	705	765,140	334	31,928	150	46,459	72	50,424	41	52,574	28	82,889	18	500,866	62	
	Per cent of increase ²	-5.1	80.2	-25.4	-25.4	-4.0	-5.6	-8.3	-8.7	4.9	17.0	28.6	30.3	77.8	118.7	59.7	
	East North Central.....	1912	1,260	1,176,528	723	64,843	241	70,782	76	50,290	54	75,376	30	96,947	30	818,290	106
	1907	1,295	559,760	906	79,935	229	66,357	70	47,633	34	41,158	22	66,334	13	258,343	21	
	Per cent of increase ²	-2.7	110.2	-20.2	-18.9	5.2	6.7	8.6	5.6	58.8	83.1	36.4	46.1	130.8	216.7	404.8	
	West North Central.....	1912	1,077	404,172	760	60,340	166	47,739	54	36,761	16	23,532	12	36,515	12	199,285	57
	1907	800	245,252	621	51,556	117	34,327	25	15,714	13	17,798	5	15,420	7	110,437	12	
	Per cent of increase	34.6	64.8	22.4	17.0	41.9	39.1	116.0	133.9	23.1	32.2	140.0	136.8	71.4	80.5	375.0	
	South Atlantic.....	1912	512	412,779	278	24,825	107	31,313	28	18,953	17	22,394	13	35,747	15	279,547	54
	1907	390	195,309	250	22,180	90	26,663	11	7,655	10	13,758	8	21,634	7	103,419	14	
	Per cent of increase	31.3	111.3	11.2	11.9	18.9	17.4	154.5	147.6	70.0	62.8	62.5	65.2	114.3	170.3	285.7	
	East South Central.....	1912	330	150,042	216	18,522	60	19,499	15	10,900	8	11,384	6	17,712	8	72,025	8
	1907	284	77,059	219	19,304	46	13,285	7	4,961	3	4,795	6	23,524	1	11,100	2	
	Per cent of increase ²	16.2	94.7	-1.4	-4.5	50.0	46.8	114.3	119.7	166.7	137.4	.....	-24.7	700.0	548.9	300.0
	West South Central.....	1912	507	168,369	362	30,697	87	23,769	24	15,175	11	16,007	9	30,172	5	42,549	9
	1907	395	88,910	311	23,625	52	15,187	13	8,865	8	12,125	6	18,608	2	10,500	3	
	Per cent of increase	28.4	78.1	16.4	29.9	67.3	56.5	84.6	71.2	37.5	32.0	60.0	62.1	150.0	305.2	200.0	
	Mountain.....	1912	250	261,119	107	9,791	44	13,674	24	14,996	18	25,556	8	21,200	15	175,902	34
	1907	219	151,032	119	9,975	32	9,931	20	13,302	9	12,807	10	31,067	6	73,950	23	
	Per cent of increase ²	14.2	72.9	-10.1	-1.8	37.5	37.7	20.0	12.7	100.0	99.5	-20.0	-31.8	150.0	137.9	47.8	
	Pacific.....	1912	248	677,980	105	8,121	26	7,578	11	8,518	11	15,171	12	39,635	20	598,957	63
	1907	261	337,375	131	10,248	31	9,262	10	6,243	16	22,583	8	30,620	12	258,119	53	
	Per cent of increase ²	-5.0	101.0	-19.8	-20.8	-16.1	-18.2	10.0	35.4	-31.2	-33.7	50.7	29.4	66.7	132.0	18.9	

¹ See page 25 for states composing the several geographic divisions.

² A minus sign (-) denotes decrease.

Number of stations without generators.—The economy and dependability of the generation of electrical energy by large stations and the continued extension of transmission lines enable them to supply electric current to the smaller stations at a price which has made it desirable for many stations to discontinue the use of their generating equipment and to purchase current. In addition to this matter of economy of operation, no doubt another reason for the abandonment of the generating equipment of a number of plants was the concentration of stations under a single ownership.

In Table 28 are given the numbers of commercial and municipal stations that reported no generating equipment, by geographic divisions, for 1912.

In 1912 almost one-tenth (9.7 per cent) of the 5,221 central electric stations were without generating equipment. In 1907, of the 4,714 stations, 227, or 4.8 per cent, were without generators, and in 1902, of the

3,620 stations, there were 78, or 2.2 per cent, without such equipment. In 1912 the proportion of stations without generators was greater for the commercial than for the municipal stations, 10.8 per cent and 7.2 per cent, respectively. A summary of these figures is significant of the growth of the number of central electric stations reporting no generators. The proportion of stations which purchased all of the current used formed 2.2 per cent of the total number of stations in 1902, 4.8 per cent in 1907, and 9.7 per cent in 1912.

Of the several geographic divisions, the Pacific, which reported 4.8 per cent of the total number of stations, and the New England, which reported 7 per cent, show the largest proportions of stations without generating equipment, 25.4 and 20.9 per cent, respectively, of the totals for those divisions, while the East South Central and West South Central, which reported

GENERATING EQUIPMENT AND OUTPUT OF ST

6.3 and 9.7 per cent of all stations, had the smallest proportions without generators, 2.4 and 1.8 per cent of their respective totals.

Table 28

TOTAL NUMBER OF COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS AND NUMBER HAVING NO GENERATING EQUIPMENT, BY GEOGRAPHIC DIVISIONS: 1912.

DIVISION. ¹	Total.				Number of stations.			
	All stations.		No generating equipment.		Commercial.		Municipal.	
	Number.	Per cent of total.	Number.	Per cent of total.	Total.	No generating equipment.	Total.	No generating equipment.
United States.....	5,221	100.0	507	100.0	3,659	394	1,562	113
New England.....	368	7.0	77	15.2	311	61	57	16
Middle Atlantic.....	669	12.8	99	19.5	567	92	102	7
East North Central.....	1,260	24.1	106	20.7	786	81	474	24
West North Central.....	1,077	20.6	57	11.4	678	38	399	20
South Atlantic.....	512	9.8	54	10.7	308	31	204	23
East South Central.....	330	6.3	8	1.6	202	6	128	2
West South Central.....	507	9.7	9	1.8	385	7	122	2
Mountain.....	250	4.8	34	6.7	211	28	39	6
Pacific.....	248	4.8	63	12.4	211	50	37	13

¹ See page 25 for states composing the several geographic divisions.

Output of stations in kilowatt hours.—It is impracticable to show relative figures for the capacity of dynamos as associated with the output of stations, since there is no way to determine from the census returns the number of hours the dynamos were operated or the varying conditions, from peak load to but a fraction thereof. Neither is it possible to determine the average price per kilowatt hour from the income shown for electric service. The kilowatt-hour output represents the current as recorded at the switchboard, which is considerably in excess of the amount delivered for consumption; and in addition the recorded output includes an indeterminable amount of current taken by the stations for their own uses, for which no income is received. Again, there is a duplication of income for current which is bought and resold. Current is frequently taken for distribution and sale by the subsidiary stations of the company producing it at prices per kilowatt hour which are often matters of book-keeping, but which, in a sense, constitute a duplication of income for the same current.

It is doubtless true, however, that the equipment of all generating stations is in accordance with the demands made upon them for electrical energy; and probably no data, therefore, furnish a better idea of the growth of the industry than the figures showing the kilowatt-hour output of all stations from 1902 to 1912.

Table 29 gives for central electric stations and electric railways the kilowatt-hour output of generating stations for 1912, 1907, and 1902.

The total current generated during 1912 amounted to approximately seventeen and one-half billion kilowatt hours, an increase of 268.8 per cent for the decade and 65.6 per cent between 1907 and 1912, in contrast

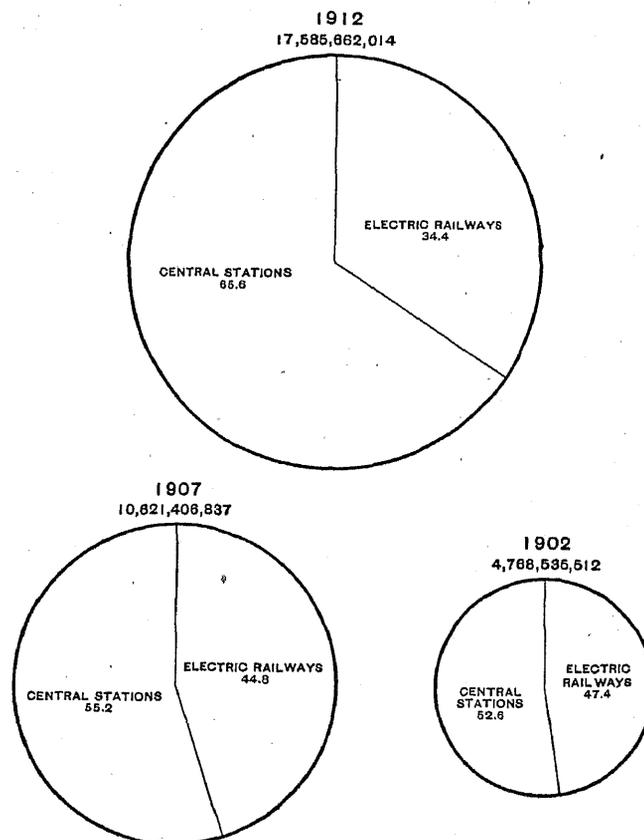
with an increase of 122.7 per cent between 1902 and 1907.

Table 29

CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—OUTPUT OF GENERATING STATIONS.

	1912	1907	1902
KILOWATT HOURS.			
Total.....	17,585,662,014	10,621,406,837	4,768,535,512
Central stations.....	11,532,963,006	5,862,276,737	2,507,051,115
Commercial.....	10,995,436,276	5,572,813,949	2,311,146,676
Municipal.....	537,526,730	289,462,788	195,904,439
Electric railways.....	6,052,699,008	4,759,130,100	2,261,484,397
PER CENT OF TOTAL.			
Central stations.....	65.6	55.2	52.6
Commercial.....	62.5	52.5	48.5
Municipal.....	3.1	2.7	4.1
Electric railways.....	34.4	44.8	47.4
PER CENT OF INCREASE.			
	1902-1912	1907-1912	1902-1907
Total.....	268.8	65.6	122.7
Central stations.....	360.0	96.7	133.8
Commercial.....	375.8	97.3	141.1
Municipal.....	174.4	85.7	47.8
Electric railways.....	167.6	27.2	110.4

DIAGRAM 11.—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—KILOWATT-HOUR OUTPUT: 1912, 1907, AND 1902.



CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

In 1902 central electric stations generated 52.6 per cent of the current, while electric railways produced 47.4. The corresponding figures for 1907 were 55.2 per cent and 44.8 per cent, and in 1912 central stations reported 65.6 per cent of the total, while the proportion for electric railways had dropped to 34.4 per cent. Of the entire output of central stations, the proportion for the municipal stations has decreased at each succeeding census, forming 7.8 per cent of the total in

1902, 4.9 per cent in 1907, and 4.7 per cent in 1912. The per cent of increase in the output of the central electric stations during the decade 1902-1912 (360) was more than double that shown for the electric railways (167.6).

Table 30 shows the output of the central electric stations in kilowatt hours, by geographic divisions and states, for 1912, 1907, and 1902, together with the actual and the percentage of increase for the decade.

CENTRAL ELECTRIC STATIONS—OUTPUT OF GENERATING STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1912, 1907, AND 1902.

DIVISION AND STATE.	OUTPUT OF STATIONS (KILOWATT HOURS).				
	1912	1907	1902	Actual increase: 1902-1912	Per cent of increase: 1902-1912
UNITED STATES.....	11,532,963,006	5,862,276,737	2,507,051,115	9,025,911,891	360.0
GEOGRAPHIC DIVISIONS:					
New England.....	879,272,535	473,802,067	247,727,501	631,545,034	254.9
Middle Atlantic.....	3,548,605,305	2,009,304,180	1,021,603,500	2,527,001,805	247.4
East North Central.....	2,527,984,097	1,075,933,354	475,097,910	2,052,886,187	432.1
West North Central.....	712,595,442	386,180,647	169,984,203	542,611,239	319.3
South Atlantic.....	679,856,425	266,437,175	102,990,575	576,865,850	560.1
East South Central.....	227,664,808	118,631,967	73,760,870	153,913,929	208.7
West South Central.....	233,947,656	138,755,643	80,154,471	153,793,185	191.9
Mountain.....	845,393,882	381,032,187	145,780,112	699,613,770	479.9
Pacific.....	1,877,662,856	1,012,199,537	189,981,964	1,687,680,892	888.3
NEW ENGLAND:					
Maine.....	117,092,565	66,136,651	21,987,700	95,104,865	432.5
New Hampshire.....	126,593,970	55,258,921	27,377,793	99,216,177	362.4
Vermont.....	59,552,977	29,923,333	22,374,060	34,178,917	152.8
Massachusetts.....	380,254,294	219,425,607	125,813,392	260,440,902	207.0
Rhode Island.....	62,106,528	35,651,323	23,436,435	38,670,093	165.0
Connecticut.....	130,672,201	67,406,232	26,738,121	103,934,080	383.7
MIDDLE ATLANTIC:					
New York.....	2,175,048,634	1,452,222,471	701,769,716	1,473,278,918	209.9
New Jersey.....	383,891,504	140,527,522	78,739,456	305,152,048	397.6
Pennsylvania.....	989,665,167	416,554,167	241,094,328	748,570,839	310.5
EAST NORTH CENTRAL:					
Ohio.....	399,101,309	217,311,924	127,437,383	271,663,926	213.2
Indiana.....	236,944,000	130,263,693	75,585,498	161,358,507	213.5
Illinois.....	1,160,900,306	467,657,328	161,543,646	999,356,660	612.4
Michigan.....	525,615,508	208,154,199	80,564,630	445,050,878	552.4
Wisconsin.....	215,402,974	52,646,210	29,966,758	185,436,216	618.8
WEST NORTH CENTRAL:					
Minnesota.....	186,045,055	87,579,431	40,258,632	145,786,423	362.1
Iowa.....	67,106,647	37,729,072	36,506,425	30,600,222	84.0
Missouri.....	232,828,793	147,328,446	57,450,731	175,378,032	305.3
North Dakota.....	12,298,553	8,229,765	5,850,115	6,448,438	110.2
South Dakota.....	24,703,754	13,615,015	4,256,007	20,447,747	450.4
Nebraska.....	56,299,682	31,958,739	12,315,775	43,983,907	357.1
Kansas.....	133,252,988	59,740,179	13,326,518	119,926,470	899.9
SOUTH ATLANTIC:					
Delaware.....	3,412,319	4,714,074	2,794,520	617,799	22.1
Maryland ¹	23,629,117	47,868,675	22,128,125	1,500,992	6.8
District of Columbia.....	40,953,449	25,829,448	15,077,352	25,876,097	171.6
Virginia.....	28,724,684	10,208,360	6,879,243	21,845,441	317.6
West Virginia.....	42,344,796	24,871,317	11,355,905	30,988,891	272.9
North Carolina.....	70,552,737	13,171,681	3,351,346	62,201,391	744.8
South Carolina.....	356,771,757	68,696,424	18,426,763	338,344,994	1,836.2
Georgia.....	87,571,815	59,311,202	9,911,243	77,660,572	783.6
Florida.....	25,805,751	11,765,994	8,066,078	17,829,673	221.0
EAST SOUTH CENTRAL:					
Kentucky.....	75,593,179	37,232,623	27,835,614	47,757,565	171.6
Tennessee.....	75,544,893	34,847,956	24,472,632	51,072,261	203.7
Alabama.....	48,602,553	30,846,764	11,616,707	36,985,846	318.4
Mississippi.....	27,924,183	15,704,624	9,825,926	18,098,257	184.2
WEST SOUTH CENTRAL:					
Arkansas.....	17,786,660	11,519,316	9,965,997	7,820,669	78.5
Louisiana ²	18,328,080	26,421,316	17,474,261	853,819	4.9
Oklahoma.....	48,824,097	24,985,903	3,825,763	44,998,334	1,176.2
Texas.....	149,008,819	75,829,108	48,888,450	100,120,369	204.8
MOUNTAIN:					
Montana.....	379,212,617	137,379,261	36,435,766	342,776,851	940.8
Idaho.....	115,812,292	9,577,583	5,018,149	110,794,143	130.8
Wyoming.....	11,580,567	5,499,084	3,898,285	7,692,282	193.2
Colorado.....	165,196,068	123,275,212	60,177,084	105,018,984	174.5
New Mexico.....	9,027,824	4,614,349	2,637,810	6,390,014	242.2
Arizona.....	32,960,084	9,392,302	3,682,045	29,298,039	800.0
Utah.....	86,034,658	61,672,661	32,467,063	54,177,595	166.9
Nevada.....	44,969,772	29,621,730	1,508,910	43,460,862	168.0
PACIFIC:					
Washington ²	71,414,473	237,785,236	19,722,262	51,692,211	262.1
Oregon ²	58,789,342	92,807,992	17,531,660	41,267,682	235.3
California.....	1,747,459,041	661,600,309	152,728,042	1,594,730,999	1,044.2

¹ The decrease from 1907 to 1912 is due to the fact that one of the largest companies in Maryland, which generated the current used in 1907, purchased from outside the state most of that used in 1912.

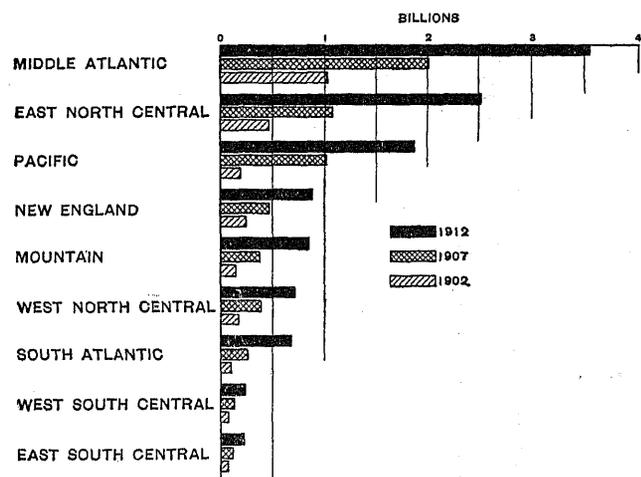
² The decrease from 1907 to 1912 is due to the fact that companies which were included among the central stations in 1907 have since that date been taken over by the railways and included with them in the report for the electric railway industry in 1912.

Comparing the output of central stations for 1912 with that for 1902, there was an increase of 9,025,911,891 kilowatt hours, or 360 per cent, in the amount of electricity produced annually.

The proportions of the total output reported for the different geographic divisions show considerable variation at the several censuses. The percentages of the total output for five of the divisions were less in 1912 than in 1902, as follows: The proportion for the New England division decreased from 9.9 per cent in 1902 to 7.6 per cent in 1912; the Middle Atlantic, from 40.7 to 30.8; the West North Central, from 6.8 to 6.2; the East South Central, from 2.9 to 2; and the West South Central, from 3.2 to 2 per cent. On the other hand, the proportions for the remaining divisions increased during the decade—that for the East North Central, from 19 per cent in 1902 to 21.9 per cent in 1912; the South Atlantic, from 4.1 to 5.9; the Mountain, from 5.8 to 7.3; and the Pacific, from 7.6 to 16.3, the increase for this division being little short of phenomenal.

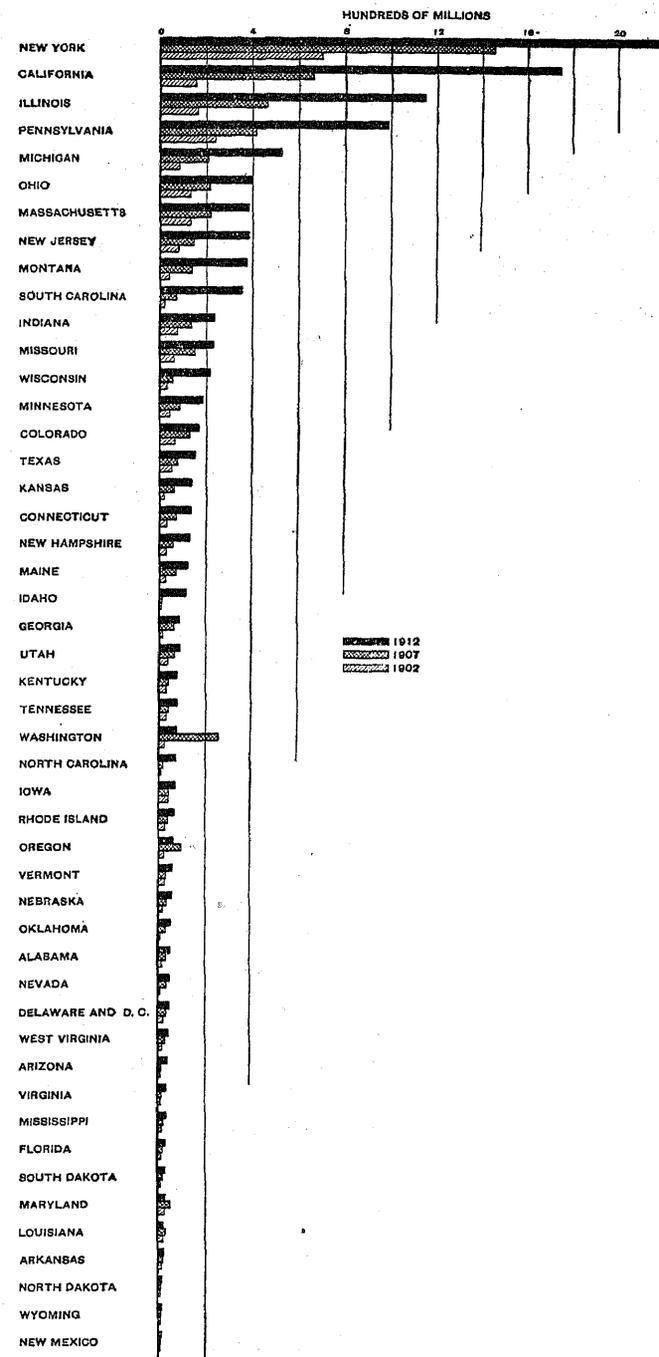
Of the total actual increase, the Middle Atlantic division reported 2,527,001,805 kilowatt hours, or 28 per cent; the East North Central division 2,052,866,187 kilowatt hours, or 22.7 per cent; and the Pacific division 1,687,680,892 kilowatt hours, or 18.7 per cent; these three divisions combined reporting an actual increase during the decade of 6,267,548,884 kilowatt hours, or 69.4 per cent of the total. The smallest proportion of the actual increase from 1902 to 1912 is shown for the West South Central division, with 153,793,185 kilowatt hours, or 1.7 per cent of the total.

DIAGRAM 12.—CENTRAL ELECTRIC STATIONS—KILOWATT-HOUR OUTPUT, BY GEOGRAPHIC DIVISIONS: 1912, 1907, AND 1902.



Exceptionally large proportions of increase in the output of stations during the decade 1902-1912 are shown for South Carolina, Oklahoma, California, Montana, Kansas, Arizona, Georgia, and North Carolina, in the order named. The totals shown in the table for these states are eloquent as indicating the growth therein of the electrical industries.

DIAGRAM 13.—CENTRAL ELECTRIC STATIONS—KILOWATT-HOUR OUTPUT, BY STATES: 1912, 1907, AND 1902.



The presentation of state totals of output of the central electric stations would be the best indication of the growth in the central station industry were it not for the fact, previously referred to, that central electric stations at one census may at another census be combined and reported with electric railways to an extent which might impair the comparative value of such figures. A noticeable instance of this kind took place in Washington, for which state the output was 257,785,236 kilowatt hours in 1907 and only 71,414,473 in 1912. Precisely the same condi-

tions existed in Louisiana and Delaware, for which states there was a decrease in the output between 1907 and 1912. Another decrease from 1907 to 1912 is shown for Maryland. In this latter instance, however, the decreased output was due to the fact that one of the largest stations in the state, which in 1907 generated the current consumed, in 1912 purchased it from a station located in Pennsylvania.

Purchased current.—Not until the census of 1912 did the schedule used by the Census Office call for the amount of electric current purchased, and statistics

of this character, therefore, are confined to that year. In a very few instances some of the current purchased was generated in Canada, the most notable case being that for a company in New York state which reported the purchase of a large amount of current generated in that country.

Table 31 gives for central electric stations and electric railways the number of kilowatt hours of purchased current, the amount paid for such current, and the average cost per kilowatt hour, by geographic divisions, for 1912.

CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PURCHASED CURRENT, KILOWATT HOURS, AND AMOUNT PAID FOR PURCHASED CURRENT, BY GEOGRAPHIC DIVISIONS: 1912.

DIVISION. ¹	TOTAL.			CENTRAL ELECTRIC STATIONS.			ELECTRIC RAILWAYS.		
	Purchased current, kilowatt hours.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).	Purchased current, kilowatt hours.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).	Purchased current, kilowatt hours.	Amount paid for purchased current. ²	Average cost per kilowatt hour (cents).
United States.....	5,580,821,386	\$42,620,874	0.8	2,613,502,605	\$18,074,344	0.7	2,967,318,781	\$24,546,530	0.8
New England.....	232,382,012	2,818,501	1.2	136,821,236	1,394,330	1.0	95,560,776	1,424,171	1.5
Middle Atlantic.....	1,884,722,386	13,778,379	0.7	989,404,314	5,982,590	0.6	895,318,072	7,795,789	0.9
East North Central.....	1,073,512,511	9,584,184	0.9	276,742,512	2,933,041	1.0	796,769,999	6,651,143	0.8
West North Central.....	383,187,448	3,945,449	1.0	183,535,438	2,135,944	1.1	199,632,010	1,809,505	0.9
South Atlantic.....	656,623,987	3,207,015	0.5	407,716,658	1,831,265	0.4	248,907,329	1,375,750	0.5
East South Central.....	57,811,414	507,933	0.9	15,948,772	131,697	0.8	41,862,642	376,236	0.9
West South Central.....	92,487,788	952,253	1.0	38,763,468	311,664	0.8	53,724,320	640,589	1.2
Mountain.....	259,796,097	1,590,136	0.6	188,201,530	1,032,516	0.5	71,594,567	557,620	0.8
Pacific.....	940,317,743	6,237,024	0.7	376,368,677	2,321,297	0.6	563,949,066	3,915,727	0.7

¹ See page 25 for states composing the several geographic divisions.

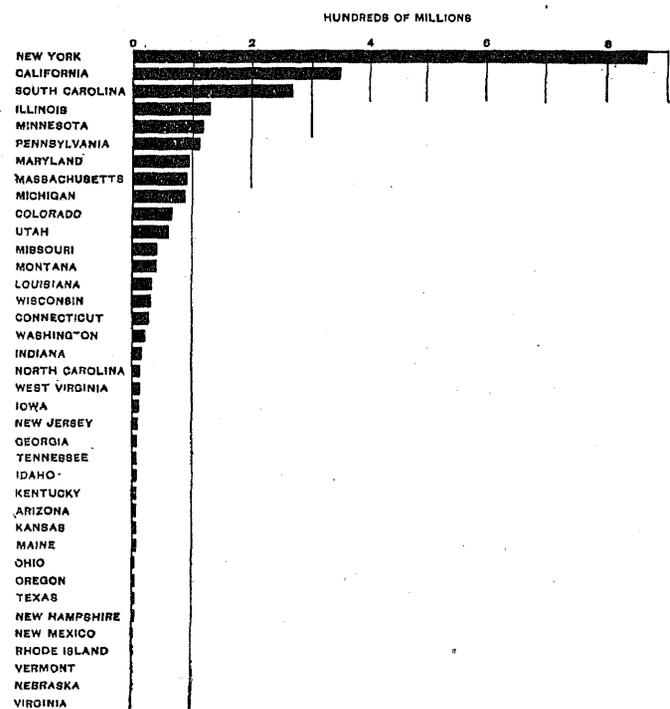
² Includes a small amount paid for power other than electric

In considering the amounts paid per kilowatt hour for current in the different geographical divisions, several conditions should be borne in mind. The rate for any given section is often greatly influenced by the interchange of current between two divisions of the same company, as from the lighting division to the railway division, or vice versa. Again, the output of many large generating plants is sold at the switchboard to distributing companies organized for sales purposes. In such instances the price per kilowatt may be less than the prevailing price for current in the same locality. Notwithstanding these conditions, there is a close harmony between the cost figures for central stations and those for electric railways in the same geographic divisions. In this connection it might be well to mention that the construction of large generating stations makes the purchasing of current more economical and hence more general for a considerable number of the smaller stations that originally were equipped with generating machinery.

The lowest average cost per kilowatt hour, namely, four-tenths of 1 cent, was reported by the electric stations in the South Atlantic group of states, and the electric railways in the same division reported the lowest average cost for electric railways, five-tenths of 1 cent. The highest average cost per kilowatt hour for the central electric stations was reported by the states of the West North Central division, $1\frac{1}{10}$ cents, and the highest average cost shown for railways was

in the New England group, $1\frac{5}{10}$ cents. The latter geographic division also shows the highest average cost per kilowatt hour, 12 mills, for both classes of stations combined.

DIAGRAM 14.—CENTRAL ELECTRIC STATIONS—PURCHASED CURRENT, KILOWATT HOURS, BY STATES: 1912.



Central stations and electric railways combined.— Previous tables have shown separately the primary power, the dynamo capacity, and the output of stations for central electric stations and electric railways combined, for the United States, but it is deemed important that these totals, which so largely represent the generating equipment of the two industries combined, be brought together in a single table and presented for the different states and geographic divisions. Table 32, therefore, gives for central stations and electric railways combined the primary power equipment, kilowatt capacity of dynamos, and output of stations, by geographic divisions and states, for 1912 and 1907.

Of the several geographic divisions, the three which showed the greatest actual increase in primary power are as follows: Middle Atlantic, 1,063,906 horsepower, or 55.2 per cent; East North Central, 1,041,757 horsepower, or 70.7 per cent; and Pacific, 696,261 horsepower, or 102 per cent. In dynamo capacity the East North Central division led in actual increase, with 779,949 kilowatts, or 79.9 per cent, followed by the Middle Atlantic, with 709,086 kilowatts, or 53 per cent, and the Pacific, with 483,283 kilowatts, or 117.7 per cent.

In the output of stations the ranking order of these three divisions in actual increase was Middle Atlantic, East North Central, and Pacific. The rates of increase

for these divisions were 46 per cent, 70.5 per cent, and 117.3 per cent, respectively.

During the five-year period 1907–1912 New York, California, Illinois, and Pennsylvania, in the order named, showed the largest actual increase in total primary horsepower and in the capacity of dynamos, but for these states the percentage of increase was greatest for California. For New York the increase in primary power was 673,725 horsepower, or 59.1 per cent, and for California it was 435,571 horsepower, or 97.7 per cent. In dynamo capacity New York increased 422,890 kilowatts, or 53.3 per cent, and California 329,868 kilowatts, or 116.6 per cent. Of these four states, in the output of stations, California leads in the actual increase, 985,255,952 kilowatt hours, and also in the per cent of increase, 127.4. In actual increase of output New York, Pennsylvania, and Illinois follow in the order named, but for the rate of increase the order is changed somewhat, as follows: Pennsylvania, with 68.1 per cent; Illinois, with 64.2 per cent; and New York, with 39.4 per cent.

A number of states show percentages of increase during the five-year period that are greater than those shown for the four states named, but the totals for these states are comparatively small. The states embraced in the Mountain division may be mentioned as an illustration.

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

COMPARATIVE SUMMARY—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, DYNAMO CAPACITY, AND OUTPUT OF STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1912 AND 1907.

Table 32	DIVISION AND STATE.	Census.	PRIMARY POWER.						KILOWATT CAPACITY OF DYNAMOS.			Total output of stations, kilowatt hours.	
			Total horse-power.	Steam engines and steam turbines.		Gas and oil engines.		Water wheels.		Total.	Direct current.		Alternating current.
				Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.				
	UNITED STATES.....	1912 1907	11,193,699 6,618,011	10,108 11,422	8,116,086 5,104,800	1,164 504	135,225 72,163	3,316 2,709	2,942,388 1,441,048	7,642,755 4,432,641	1,243,365 1,428,954	6,399,390 3,008,687	17,585,662,014 10,621,406,837
	GEOGRAPHIC DIVISIONS:												
	New England.....	1912 1907	1,157,132 718,499	885 1,126	903,604 566,829	55 39	10,017 6,823	563 520	243,511 144,847	820,628 501,427	210,017 240,073	610,611 260,754	1,555,814,478 1,015,385,019
	Middle Atlantic.....	1912 1907	2,991,020 1,927,114	1,961 2,478	2,291,573 1,561,260	192 118	33,939 17,137	595 532	665,508 348,717	2,047,134 1,338,048	340,876 449,593	1,708,258 888,455	5,371,253,169 3,679,460,449
	East North Central.....	1912 1907	2,515,706 1,473,949	2,627 3,137	2,183,091 1,318,501	224 123	26,710 12,725	703 610	305,905 142,723	1,756,368 976,419	342,488 371,929	1,413,880 604,490	3,995,158,144 2,343,163,832
	West North Central.....	1912 1907	929,220 577,054	1,513 1,538	766,922 468,027	424 97	29,578 7,336	272 200	132,720 101,691	641,343 379,206	113,222 113,895	528,121 265,311	1,209,359,546 888,555
	South Atlantic.....	1912 1907	1,004,038 552,496	945 950	587,888 374,427	60 31	11,373 6,520	385 266	404,777 171,549	682,325 367,195	79,616 89,764	602,709 277,431	1,074,027,912 643,771,881
	East South Central.....	1912 1907	354,338 218,799	616 603	315,628 210,492	13 3	1,080 60	47 29	37,630 8,247	241,347 147,736	48,286 48,286	193,061 103,812	476,150,487 298,426,946
	West South Central.....	1912 1907	344,799 206,039	890 813	318,767 199,287	153 59	17,354 3,690	35 24	8,678 3,062	242,617 136,856	48,608 51,604	194,009 85,252	425,302,675 258,425,302
	Mountain.....	1912 1907	518,721 261,597	306 337	179,637 112,244	20 13	2,695 856	313 231	336,389 148,498	317,176 175,220	17,089 22,677	300,087 152,543	980,641,612 446,471,639
	Pacific.....	1912 1907	1,378,725 682,464	365 440	568,976 293,733	23 21	2,479 17,017	403 297	807,270 371,714	893,817 410,534	43,163 44,895	850,654 365,639	2,497,953,991 1,149,660,340
	NEW ENGLAND:												
	Maine.....	1912 1907	129,773 78,226	89 115	34,136 31,459	3	135	199 164	95,502 46,766	89,991 52,947	17,387 14,755	72,604 38,192	171,241,221 95,270,975
	New Hampshire.....	1912 1907	88,330 50,414	64 70	27,306 23,095	11 8	1,905 1,115	117 103	59,119 26,204	60,503 34,637	4,796 6,112	55,707 28,525	131,950,020 68,209,739
	Vermont.....	1912 1907	53,018 44,016	54 50	17,996 12,589	2 4	95 205	111 107	39,927 31,222	36,212 26,729	3,372 4,776	32,840 21,953	63,420,652 34,056,513
	Massachusetts.....	1912 1907	623,576 387,422	467 620	591,515 365,216	27 17	5,872 3,797	70 73	26,189 18,409	450,236 275,116	136,786 154,537	313,450 120,670	838,789,192 589,133,532
	Rhode Island.....	1912 1907	95,349 57,071	37 70	91,784 53,808	5 4	1,125 1,000	13 16	2,440 2,263	70,109 41,840	13,959 23,681	56,150 18,159	124,222,051 93,410,987
	Connecticut.....	1912 1907	162,086 101,351	174 201	140,867 80,662	7 6	885 706	53 57	20,334 19,983	113,577 70,158	33,717 36,812	79,860 33,346	226,191,342 145,303,273
	MIDDLE ATLANTIC:												
	New York.....	1912 1907	1,813,529 1,139,804	781 912	1,273,422 819,079	70 32	9,186 5,290	436 356	530,921 315,435	1,216,336 793,446	140,143 226,994	1,076,193 566,452	3,374,050,343 2,420,974,919
	New Jersey.....	1912 1907	268,612 185,537	266 335	264,683 182,415	21 11	2,360 1,323	18 22	1,569 1,794	203,209 137,298	49,560 48,866	153,649 88,432	417,089,681 318,320,064
	Pennsylvania.....	1912 1907	908,879 601,773	884 1,231	753,468 559,766	95 75	22,393 10,519	141 124	133,018 31,488	627,689 407,304	151,173 173,733	476,416 233,571	1,580,104,145 940,165,466
	EAST NORTH CENTRAL:												
	Ohio.....	1912 1907	670,347 415,256	787 899	648,155 406,091	95 55	11,502 5,878	38 26	10,690 3,287	477,903 282,182	136,646 126,940	341,263 155,236	1,011,186,644 667,104,385
	Indiana.....	1912 1907	307,423 196,967	446 507	281,468 176,066	19 15	2,040 1,295	90 83	23,915 19,606	228,748 136,666	26,610 35,800	202,138 100,776	454,911,393 274,795,437
	Illinois.....	1912 1907	820,411 497,492	691 974	774,807 484,991	35 19	3,042 870	105 86	42,562 11,631	576,288 334,045	112,163 138,379	464,125 195,666	1,549,487,964 943,581,414
	Michigan.....	1912 1907	445,462 241,052	389 440	309,382 154,711	27 11	1,626 603	262 249	134,454 85,738	291,535 139,638	31,311 37,428	259,724 102,210	649,339,814 318,743,484
	Wisconsin.....	1912 1907	272,063 123,182	314 317	169,279 96,642	48 23	8,500 4,079	208 166	94,284 22,461	181,894 83,888	35,264 33,286	146,630 50,602	330,232,329 138,939,112
	WEST NORTH CENTRAL:												
	Minnesota.....	1912 1907	261,694 173,055	262 267	154,767 89,691	54 22	4,755 1,423	124 83	102,172 81,936	173,070 113,434	17,922 18,672	155,148 94,762	275,281,155 189,029,610
	Iowa.....	1912 1907	133,593 79,039	374 369	123,906 74,692	52 11	2,653 564	58 44	7,029 3,833	96,210 56,078	28,172 27,379	68,038 28,699	150,640,398 79,979,727
	Missouri.....	1912 1907	308,035 202,938	371 452	303,661 199,973	22 13	2,472 973	5 5	1,902 2,002	214,931 129,572	42,199 41,713	172,732 87,859	500,619,707 375,903,548
	North Dakota.....	1912 1907	16,249 10,527	75 61	15,931 10,222	8 2	318 205	..... 1	..... 100	11,024 6,093	4,807 4,063	6,217 2,030	12,334,553 8,261,885
	South Dakota.....	1912 1907	27,748 12,984	50 52	16,003 10,251	86 10	4,832 528	15 12	6,613 2,205	20,032 10,046	2,492 1,488	17,540 8,558	24,703,754 13,615,015
	Nebraska.....	1912 1907	71,293 42,102	168 154	61,577 38,308	91 17	3,832 845	44 19	5,884 2,954	48,011 28,041	8,985 9,655	39,026 18,386	95,169,030 52,026,421
	Kansas.....	1912 1907	110,608 56,359	212 183	91,077 44,895	111 22	10,711 2,803	26 36	8,820 8,661	78,065 35,942	6,645 10,925	69,420 25,017	150,610,949 87,825,217

COMPARATIVE SUMMARY—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, DYNAMO CAPACITY, AND OUTPUT OF STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1912 AND 1907—Continued.

DIVISION AND STATE.	Census.	PRIMARY POWER.						KILOWATT CAPACITY OF DYNAMOS.			Total output of stations, kilowatt hours.	
		Total horse-power.	Steam engines and steam turbines.		Gas and oil engines.		Water wheels.		Total.	Direct current.		Alternating current.
			Number.	Horse-power.	Number.	Horse-power.	Number.	Horse-power.				
SOUTH ATLANTIC:												
Delaware.....	1912	24,901	42	23,825	3	250	8	826	10,095	4,975	11,150	25,840,778
	1907	14,800	47	14,515			5	285	12,408	7,767	4,641	12,238,788
Maryland.....	1912	125,638	112	121,592	8	823	25	3,223	91,364	16,077	75,287	36,758,346
	1907	118,531	150	117,054	5	130	13	1,347	74,708	17,963	56,745	153,451,176
District of Columbia.....	1912	77,230	24	77,230					57,058	8,458	48,600	116,923,806
	1907	38,290	42	38,290					27,727	8,627	19,100	66,006,336
Virginia.....	1912	160,489	125	93,905	3	185	92	66,399	116,496	12,040	104,456	145,024,065
	1907	82,482	138	55,046	5	960	69	26,476	55,951	23,112	34,839	94,939,273
West Virginia.....	1912	68,925	132	59,804	24	3,085	14	6,036	49,767	11,980	37,787	102,198,976
	1907	42,891	118	37,989	12	1,275	11	3,627	31,294	9,869	21,425	64,729,936
North Carolina.....	1912	93,713	118	81,882	5	1,680	76	60,151	61,339	4,059	57,330	88,701,305
	1907	33,108	116	20,296			52	12,812	23,746	4,317	19,429	33,969,179
South Carolina.....	1912	230,606	84	51,596	3	455	88	178,555	140,986	4,878	136,108	365,575,958
	1907	103,731	86	20,111	1	150	58	83,470	64,663	3,373	61,290	96,312,449
Georgia.....	1912	170,832	195	84,625	5	3,720	71	82,487	112,841	9,976	102,865	142,082,277
	1907	93,880	155	48,108	2	3,140	50	42,132	60,438	11,494	48,944	94,637,017
Florida.....	1912	51,704	113	43,429	9	1,175	11	7,100	36,329	7,173	29,156	50,922,414
	1907	25,283	98	23,018	6	865	8	1,400	16,260	5,242	11,018	27,487,727
EAST SOUTH CENTRAL:												
Kentucky.....	1912	108,227	188	107,651	6	576			69,867	16,149	53,718	149,408,553
	1907	71,409	192	71,394	1	15			48,210	17,420	30,781	90,658,286
Tennessee.....	1912	122,361	164	94,166	4	445	32	27,750	85,090	15,213	70,477	157,305,115
	1907	68,385	165	67,145			14	1,240	46,718	11,922	34,796	98,498,291
Alabama.....	1912	83,403	122	73,504	2	19	15	9,880	57,277	13,967	43,310	131,557,661
	1907	52,619	114	45,592	1	20	15	7,007	36,024	11,842	24,482	78,954,853
Mississippi.....	1912	40,347	142	40,307	1	40			28,513	2,957	25,556	37,879,158
	1907	26,386	132	26,361	1	25			16,784	3,031	13,753	30,315,510
WEST SOUTH CENTRAL:												
Arkansas.....	1912	42,604	134	39,343	5	221	10	3,040	30,442	6,610	23,832	42,625,641
	1907	24,494	125	24,182	1	12	1	300	17,012	5,714	11,298	27,867,049
Louisiana.....	1912	70,910	118	69,920	9	990			52,059	21,372	30,687	104,591,816
	1907	66,723	171	66,303	3	420			41,678	23,865	17,813	93,441,254
Oklahoma.....	1912	63,597	204	55,196	39	6,266	7	2,135	45,931	4,895	41,036	65,217,369
	1907	24,423	117	24,223	2	200			16,999	3,420	13,579	26,993,403
Texas.....	1912	167,088	434	154,308	100	9,877	18	3,703	114,185	15,731	98,454	212,867,349
	1907	90,399	400	84,579	53	3,058	23	2,762	61,167	18,605	42,562	110,123,596
MOUNTAIN:												
Montana.....	1912	117,230	39	13,500	1	75	67	103,655	75,468	2,705	72,763	381,012,617
	1907	69,967	33	12,980			62	56,987	40,402	3,210	37,192	137,379,261
Idaho.....	1912	56,375	14	4,525			63	51,870	35,656	126	35,530	115,812,292
	1907	13,694	19	2,202			37	11,492	7,082	147	6,935	9,577,588
Wyoming.....	1912	11,596	45	10,162	1	100	11	1,334	8,212	1,077	7,135	11,580,567
	1907	5,125	34	4,360			6	765	3,208	1,003	2,205	5,499,084
Colorado.....	1912	182,536	122	100,251	1	80	72	82,205	101,860	10,241	91,119	263,111,504
	1907	104,217	164	76,457	4	300	52	27,460	66,764	14,104	52,660	165,385,828
New Mexico.....	1912	11,015	32	8,428	9	1,770	9	817	7,081	876	7,105	9,027,824
	1907	5,728	30	5,215			6	513	4,894	1,655	3,239	5,519,914
Arizona.....	1912	22,675	35	13,375			4	9,300	15,151	991	14,160	33,645,484
	1907	7,746	32	6,926	3	70		750	5,063	901	4,162	9,611,342
Utah.....	1912	101,874	13	27,186			74	74,088	62,835	735	62,100	121,481,552
	1907	48,140	21	3,869			55	44,271	42,117	1,597	40,520	83,876,892
Nevada.....	1912	15,420	6	2,210	8	670	13	12,540	10,513	333	10,175	44,969,772
	1907	6,980	4	235	6	485	9	6,200	5,680	60	5,630	29,621,730
PACIFIC:												
Washington.....	1912	341,701	83	71,895	3	165	107	269,641	209,913	10,808	199,105	510,822,535
	1907	109,661	114	48,553	2	90	31	61,018	94,987	12,869	82,118	283,302,190
Oregon.....	1912	155,465	72	49,829	9	334	88	105,302	71,156	5,249	65,907	228,398,346
	1907	126,515	66	24,531	6	182	72	102,052	32,667	3,957	28,710	92,880,992
California.....	1912	881,559	210	447,252	11	1,980	208	432,327	612,748	27,106	585,642	1,758,733,110
	1907	445,983	200	220,599	13	16,745	174	208,644	282,880	28,069	254,811	773,477,158

CHAPTER V. LINE EQUIPMENT.

Central stations and electric railways.—In addition to the number of lamps, the line equipment covered by the statistics includes stationary motors and meters for recording the current consumed.

There are other equipment and features of line construction, such as miles of wire, miles of duct for underground work, and number of transformers.

Statistics concerning these were collected at prior censuses, but were found to be so unreliable that such inquiries were omitted from the schedule for 1912.

The features of line equipment covered by the census of 1912 are given in Table 33, for central stations and electric railways, for 1912, 1907, and 1902.

CENTRAL ELECTRIC STATIONS AND STATIONS OPERATED IN CONNECTION WITH ELECTRIC RAILWAYS—LINE EQUIPMENT: 1912, 1907, AND 1902.

[The statistics for electric railways in the following table are for central electric stations operated in connection with electric railways for which complete separate reports could not be secured, hence the full statistics for them have been included with those for electric railways. The statistics shown for these stations represent only the electric light and power departments.]

Table 33	ESTIMATED NUMBER OF LAMPS WIRED FOR SERVICE.									STATIONARY MOTORS SERVED.		Number of meters on consumption circuits.
	Arc.			Incandescent.			Other varieties—Nernst, vapor, etc.			Number.	Horse-power.	
	Total.	Public.	Com-mercial.	Total.	Public.	Com-mercial.	Total.	Public.	Com-mercial.			
Total:												
1912.....	560,981	388,592	172,389	85,557,819	2,152,612	83,405,207	59,213	1,743	57,470	435,473	4,130,619	3,617,189
1907.....	635,815	318,819	316,996	45,991,836	866,851	45,124,985	190,979	6,090	184,889	187,652	1,807,949	1,897,803
1902.....	419,561	229,403	190,158	19,636,720	474,686	19,162,043	(¹)	(¹)	(¹)	111,113	473,693	639,290
Central stations:												
1912.....	505,305	351,858	153,537	76,484,096	2,033,831	74,450,265	23,046	912	22,134	435,473	4,130,619	3,617,189
1907.....	555,713	289,391	266,322	41,445,997	808,693	40,637,304	162,338	5,716	156,622	167,184	1,649,026	1,683,917
1902.....	385,698	211,725	173,973	18,194,044	455,660	17,738,384	(¹)	(¹)	(¹)	101,064	438,005	582,639
Electric railways:												
1912.....	55,586	36,734	18,852	9,073,723	118,781	8,954,942	36,167	831	35,336	(²)	(²)	(²)
1907.....	80,102	29,428	50,074	4,545,839	58,158	4,487,681	28,641	374	28,267	20,468	158,923	213,886
1902.....	33,863	17,678	16,185	1,442,685	19,026	1,423,659	(¹)	(¹)	(¹)	10,049	35,688	56,601
	PER CENT OF INCREASE.¹											
Total:												
1902 to 1912.....	33.7	69.4	-9.3	335.7	353.5	335.3	.....	.....	.....	291.9	772.0	465.8
1907 to 1912.....	-11.8	21.9	-45.6	86.0	143.3	84.8	-69.0	-71.4	-68.9	132.1	128.5	90.6
1902 to 1907.....	51.5	39.0	66.7	134.2	82.6	135.5	.....	.....	.....	68.9	281.7	196.9
Central stations:												
1902 to 1912.....	31.0	66.2	-11.7	320.4	346.3	319.7	.....	.....	.....	330.9	843.1	520.3
1907 to 1912.....	-9.1	21.6	-42.3	84.5	151.5	83.2	-85.8	-84.0	-85.9	160.5	150.5	114.8
1902 to 1907.....	44.1	36.7	-53.1	127.8	77.5	129.1	.....	.....	.....	65.4	276.5	189.0
Electric railways:												
1902 to 1912.....	64.1	107.8	16.5	528.9	524.3	529.0	.....	.....	.....	.....	.....	.....
1907 to 1912.....	-30.6	24.8	62.8	99.6	104.2	99.5	26.3	122.2	25.0	.....	.....	.....
1902 to 1907.....	136.5	66.5	213.1	215.1	205.7	215.2	.....	.....	.....	103.7	345.3	277.9

¹ Not reported separately.

² Not reported.

³ A minus sign (-) denotes decrease.

The general use of meter service makes it no longer necessary for the companies to preserve a record of the number of lamps wired for use, therefore the number reported by each company is largely an estimate.

One of the most noticeable features in connection with the data concerning lamps is the decrease in the number of "all other varieties" and the general acceptance in the industry of two types—the incandescent and arc—as the standards for light service. Although the estimated number of arc lamps has increased during the decade, it is the incandescent lamp that has made the greatest gains. The total number of arc lamps increased from 419,561 in 1902 to 635,815 in 1907, but at the census of 1912 the number was only 560,981, a decrease during the latter five-year period of 74,834 arc lamps, or 11.8 per cent.

In 1902 arc lamps wired for commercial purposes formed 45.3 per cent of the total number in service; in 1907 this percentage had risen to 49.9, but in 1912 it had dropped to 30.7. Although the arc light lost ground in commercial or private lighting, it made considerable gains in the public field, showing increases of 21.9 per cent for the census period of 1907 to 1912 and 69.4 per cent for the 10-year period 1902 to 1912. In striking contrast to the small gains and losses for the arc form of lighting were the great strides made by the incandescent system. The total estimated number of incandescent lamps wired for service was 45,991,836 in 1907 and 19,636,729 in 1902, a gain of 26,355,107, or 134.2 per cent, for the five-year period. From 1907 to 1912 there was a gain of 39,565,983, or 86 per cent, while that for the decade was 65,921,090, or 335.7 per cent. The percentage of increase was practically the

same for both public and commercial lighting, 353.5 and 335.3, respectively. The invasion by the incandescent lamp of the public field, formerly so largely occupied by the arc, is particularly noteworthy, and is due principally to the improvements in the tungsten lamp. Notwithstanding the great advances made, this system of lighting is still in a transitory state, as evidenced by the many methods now being used to light the streets in various cities, in the effort to meet the continued demand for a high candlepower, diffusible, economical lamp suitable for open-air service.

Perhaps the best illustration of the revolution in incandescent lighting caused by the tungsten lamp is found in the following tabular statement showing the proportionate annual sales of different types of incandescent lamps from 1907 to 1912, inclusive, as reported at the Chicago session of the National Electric Light Association in June, 1913, by the lamp committee of the association.

TYPE.	1912	1911	1910	1909	1908	1907
Total.....	100.0	100.0	100.0	100.0	100.0	100.0
Carbon.....	25.47	52.90	63.08	68.98	84.12	93.27
Gem.....	33.59	19.00	14.88	15.07	8.58	5.88
Tantalum.....	1.00	2.74	3.57	2.12	1.78	0.75
Mazda.....	30.94	25.30	18.47	13.83	5.52	0.10

What has been said of the total for lamps in the United States is equally applicable to the two industries shown in the table. The central stations reported 92.6 per cent of the total number of lamps in 1902, 88.6 per cent in 1907, and 89.4 per cent in 1912. A general

decrease in commercial arc lighting, a moderate increase in public arc lighting, and large gains in incandescent lighting for both public and commercial service represent the trend of events in the electric-lighting field for the five years from 1907 to 1912.

Of the different items of line equipment presented in the table, capacity of stationary motors shows the greatest percentage of gain during the decade 1902-1912, and meters were second in that respect for the same period.

Table 34 gives for commercial and municipal stations the numbers of lamps, stationary motors, meters, and customers for 1912, 1907, and 1902.

Of the total number of lamps of all types, the number of arc lamps formed but seven-tenths of 1 per cent in 1912 and 1.3 per cent in 1907, while in 1902 it formed 2.1 per cent. The enormous increase during the decade in the number of incandescent lamps and the small increase in the number of arc lamps account for this decreased proportion. In the commercial field for the decade there was a decrease in the number of arc lamps. While there have been improvements made in the form of arc lighting, much greater advances have been made in the incandescent lamp, which now lends itself to all forms of illumination without the care and attention which necessarily accompany the arc light. Notwithstanding the decrease in the number of arc lights reported by commercial companies from 1907 to 1912, during this period the number of arc lights furnished by municipal stations showed an increase of 10.7 per cent, as compared with 63.3 per cent for the five-year period 1902 to 1907.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—LINE EQUIPMENT: 1912, 1907, AND 1902.

Table 34 CLASS OF STATIONS.	ARC LAMPS.			INCANDESCENT LAMPS.			OTHER VARIETIES— NERNST, VAPOR, ETC.			STATIONARY MOTORS SERVED.		Number of meters on consump- tion circuits.	Number of cus- tomers.
	Total.	Public.	Com- mercial.	Total.	Public.	Com- mercial.	Total.	Public.	Com- mercial.	Num- ber.	Horse- power.		
Total:													
1912.....	505,395	351,858	153,537	76,454,096	2,033,831	74,450,265	23,046	912	22,134	435,473	4,130,619	3,617,189	3,837,518
1907.....	555,713	289,391	266,322	41,445,097	802,693	40,637,304	162,338	5,716	156,622	187,184	1,649,026	1,683,917	1,946,979
1902.....	385,698	211,725	173,973	18,194,044	455,660	17,738,384	(¹)	(¹)	(¹)	101,064	438,005	582,689	(²)
Commercial:													
1912.....	413,544	267,113	146,431	69,428,356	1,602,855	67,825,501	20,937	491	20,446	413,578	3,966,328	3,146,998	3,311,870
1907.....	472,773	216,309	256,464	37,393,549	638,456	36,755,093	153,468	4,584	148,884	162,677	1,617,337	1,468,763	1,663,354
1902.....	334,903	166,723	168,180	16,616,593	372,740	16,243,853	(¹)	(¹)	(¹)	99,102	434,681	526,011	(²)
Municipal:													
1912.....	91,851	84,745	7,106	7,055,740	430,976	6,624,764	2,109	421	1,688	21,895	164,291	470,191	525,648
1907.....	82,940	73,082	9,858	4,052,448	170,237	3,882,211	8,870	1,132	7,738	4,507	31,689	215,154	283,625
1902.....	50,795	45,002	5,793	1,577,451	82,920	1,494,531	(¹)	(¹)	(¹)	1,962	3,324	56,678	(²)
PER CENT OF INCREASE. ³													
Total:													
1902-1912.....	31.0	66.2	-11.7	320.4	346.3	319.7	.....	.....	.....	330.9	843.1	520.8	.....
1907-1912.....	-9.1	21.6	-42.3	84.5	151.5	83.2	-85.8	-84.0	-85.9	180.5	150.5	114.8	97.1
1902-1907.....	44.1	36.7	53.1	127.8	77.5	129.1	.....	.....	.....	65.4	276.5	189.0	.....
Commercial:													
1902-1912.....	23.5	60.2	-12.9	317.8	330.0	317.5	.....	.....	.....	317.3	812.5	498.3	.....
1907-1912.....	-12.5	23.5	-42.9	85.7	151.1	84.5	-36.4	-89.3	-87.3	154.2	145.2	114.3	99.1
1902-1907.....	41.2	29.7	52.5	125.0	71.3	126.3	.....	.....	.....	64.2	272.1	179.2	.....
Municipal:													
1902-1912.....	80.8	88.3	22.7	347.3	419.7	343.3	.....	.....	.....	1,016.0	4,842.6	729.6	.....
1907-1912.....	10.7	16.0	-27.9	74.1	153.2	70.6	-76.2	-62.8	-78.2	385.8	418.4	118.5	85.3
1902-1907.....	63.3	62.4	70.2	156.9	103.3	159.8	.....	.....	.....	129.7	853.3	279.6	.....

¹ Not reported separately.

² Not reported.

³ A minus sign (-) denotes decrease.

The proportion of the total number of arc lamps reported by the commercial stations decreased from 86.8 per cent in 1902 to 85.1 per cent in 1907, and to 81.8 per cent in 1912, and the proportions of arc lights in public service reported by such stations were 75.9, 74.7, and 78.7 for the censuses of 1912, 1907, and 1902, respectively. Municipal plants reported less than 5 per cent of the number of arc lights in the commercial field in any of these census years.

The proportion of the total number of incandescent lamps reported by commercial and municipal companies was about the same for each census, the commercial stations furnishing slightly more than 90 per cent in each year.

There was an increase of over 4,800 per cent in the horsepower of stationary motors served by the municipal plants from 1902 to 1912. Notwithstanding this great percentage of increase, of the total amount of such power for all central stations in the latter year, that reported by the municipal stations was equal to only about 4 per cent. This was an increase, however, as compared with the proportions shown for prior censuses, which were 1.9 per cent in 1907 and eight-tenths of 1 per cent in 1902.

In Table 55 (p. 82) the line equipment of the central electric stations is shown for 1912 by geographic divisions and states. It appears from this table that two of the nine divisions, combined, the Middle Atlantic and East North Central, contributed a large proportion of this equipment, as follows: Of arc lamps, 63.2 per cent; incandescent lamps, 53.2 per cent; horsepower of stationary motors, 48.7 per cent; and meters on consumption circuits, 49.3 per cent. These two divisions reported 46.8 per cent of the total number of customers. New York was the leading state in all these items, as it is in population and manufactures.

The increases in the line equipment of commercial and municipal central electric stations are presented in another form in Table 35. This table gives the average per station for number of arc and incandescent lamps, the average number of meters on consumption circuits, and the average number of stationary motors, together with the average horsepower per station and per machine for stationary motors for 1912, 1907, and 1902.

For both the commercial and municipal stations there was an increase in the average number of arc lamps per station in 1907, as compared with that in 1902, but a decided decrease when the averages for 1912 are compared with those for 1907; in fact, the average for 1912 was less than that for 1902. In direct contrast to this condition, there was an increased average number of incandescent lamps per station shown for each succeeding census, the larger gain in the average for this type of lamp having taken place during the period of loss for arc lamps—that is, the period 1907 to 1912.

The average number of meters per station has practically doubled, as shown by both commercial and municipal stations, at each succeeding census, and the average number of stationary motors per station shows even greater rates of increase.

The increasing popularity of electric power is shown by the great increase in the motor load connected to each station. In 1902 the average horsepower per station was 121; in 1907 it was 350; while in 1912 it had jumped to 791 horsepower, equivalent to a gain of 126 per cent in the average for 1912 over that for 1907.

Table 35

	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—LINE EQUIPMENT, AVERAGE PER STATION: 1912, 1907, AND 1902.			
	Census.	Total.	Commercial.	Municipal.
Arc lamps:				
Average number per station.....	1912	97	113	59
	1907	113	137	66
	1902	107	119	62
Incandescent lamps:				
Average number per station.....	1912	14,649	18,975	4,517
	1907	8,792	10,801	3,237
	1902	5,026	5,924	1,936
Meters on consumption circuits:				
Average number per station.....	1912	693	860	301
	1907	357	424	172
	1902	161	188	70
Stationary motors:				
Average number per station.....	1912	83	113	14
	1907	35	47	4
	1902	28	35	2
Average horsepower per station.....	1912	791	1,084	105
	1907	350	467	25
	1902	121	155	4
Average horsepower per machine.....	1912	9.5	9.6	7.5
	1907	9.9	9.9	7.0
	1902	4.3	4.4	1.7

Street lamps.—In 1912, for the first time, the census schedule contained inquiries as to the number of arc and incandescent lamps used for street lighting. Notwithstanding the advances made in lighting streets by electricity, the problem is still receiving careful consideration from both commercial and municipal stations, on account of the interdependence of the economics and the physics of illuminating engineering. The complexity of the subject may be understood when consideration is given to the number of factors involved, such as the character of buildings facing the street, the materials and conditions of sidewalks and streets, the presence of trees or other obstructions and even psychological conditions.

Because of their characteristics, arc lamps were at first used to the exclusion of all others for outdoor service, and the improvement in this form of light from the original open arc to the inclosed luminous arc and to the flaming arc has been remarkable and has caused this light to continue the predominant one in street service. The wonderful advances in tungsten incandescent lamps, however, have made them a new and important feature in outdoor illumination. The great flexibility of this style of lighting renders it specially valuable and economical where lighting by arc lamps would be impossible or impracticable.

LINE EQUIPMENT.

Many of the municipalities operating their own plants, and some of the smaller commercial stations, have a greater proportion of arc than of incandescent lamps in street service.

In addition to the two types of lamps shown, 23,046 lamps of other varieties were reported as used for all purposes. These have been disregarded in preparing Table 36.

In order to make a comprehensive presentation of the lamps used for street lighting in 1912, there are shown in Table 36 the numbers of arc and incandescent lamps used for this purpose by the commercial and municipal stations, by geographic divisions and states, and also the proportions which commercial and municipal form, respectively, of all arc and all incandescent lamps used for street service.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER OF LAMPS USED FOR STREET LIGHTING, BY GEOGRAPHIC DIVISIONS AND STATES: 1912.

Table 36 DIVISION AND STATE.	ARC LAMPS.				INCANDESCENT LAMPS. ¹				PER CENT DISTRIBUTION OF EACH CLASS OF STREET LAMPS.			
	Total for all purposes.	Street lamps.			Total for all purposes.	Street lamps.			Arc.		Incandescent.	
		Total.	Reported by—			Total.	Reported by—		Commer- cial.	Municipal.	Commer- cial.	Municipal.
			Commer- cial stations.	Municipal stations.			Commer- cial stations.	Municipal stations.				
UNITED STATES.....	505,395	348,643	264,152	84,491	70,484,096	681,379	474,048	207,331	75.8	24.2	69.6	30.4
GEOGRAPHIC DIVISIONS:												
New England.....	44,682	29,633	26,798	2,835	7,955,766	124,142	96,665	27,477	90.4	9.6	77.0	22.1
Middle Atlantic.....	131,552	109,039	100,889	8,150	22,096,036	125,044	116,765	8,279	92.5	7.5	93.4	6.6
East North Central.....	138,042	106,688	57,954	48,734	18,590,902	114,419	55,216	59,203	54.3	45.7	48.3	51.7
West North Central.....	40,860	24,751	18,073	6,678	8,327,120	102,152	59,734	42,418	73.0	27.0	58.5	41.5
South Atlantic.....	21,389	17,679	9,812	7,867	3,886,979	44,142	27,570	16,563	55.5	44.5	62.5	37.5
East South Central.....	18,365	15,247	10,766	4,481	2,147,154	18,816	9,755	9,061	70.6	29.4	51.8	48.2
West South Central.....	19,045	14,326	11,078	3,248	3,285,680	27,083	18,445	8,638	77.3	22.7	68.1	31.9
Mountain.....	9,920	8,150	7,879	3,271	2,239,231	23,817	17,532	6,285	96.7	3.3	75.2	24.8
Pacific.....	30,904	28,130	20,903	2,227	7,955,178	102,264	72,357	29,907	90.4	9.6	70.8	29.2
NEW ENGLAND:												
Maine.....	1,863	1,411	1,094	317	481,656	9,839	7,700	2,049	77.5	22.5	79.2	20.8
New Hampshire.....	1,900	1,482	1,482	0	397,487	9,100	8,584	516	100.0	0	94.3	5.7
Vermont.....	1,050	1,013	709	304	404,049	5,563	3,787	1,776	70.0	30.0	68.1	31.9
Massachusetts.....	28,238	17,601	15,834	1,767	4,686,834	67,372	53,124	14,248	90.0	10.0	78.9	21.1
Rhode Island.....	4,419	3,058	2,993	65	640,769	10,640	10,681	9	97.9	2.1	99.9	0.1
Connecticut.....	7,182	5,068	4,686	382	1,344,971	21,628	12,749	8,879	92.5	7.5	58.9	41.1
MIDDLE ATLANTIC:												
New York.....	94,324	47,391	44,403	2,988	12,834,436	62,706	58,793	3,913	93.7	6.3	93.8	6.2
New Jersey.....	22,555	16,052	15,561	491	2,061,254	33,708	32,208	1,410	96.9	3.1	95.8	4.2
Pennsylvania.....	64,673	45,506	40,925	4,671	6,250,346	28,630	25,674	2,956	89.8	10.2	80.7	19.3
EAST NORTH CENTRAL:												
Ohio.....	36,318	30,893	21,234	9,659	3,454,142	20,168	6,888	13,280	68.7	31.3	34.2	65.8
Indiana.....	17,328	14,989	10,077	4,912	2,375,533	19,873	9,550	10,323	67.2	32.8	48.1	51.9
Illinois.....	53,486	35,399	13,556	21,813	7,375,038	41,065	20,835	20,230	38.4	61.6	50.7	49.3
Michigan.....	20,516	16,220	5,310	10,910	3,601,427	22,425	11,688	10,737	32.7	67.3	52.1	47.9
Wisconsin.....	10,394	9,187	7,747	1,440	1,784,762	10,888	6,255	4,633	84.3	15.7	57.4	42.6
WEST NORTH CENTRAL:												
Minnesota.....	9,201	6,495	5,239	1,256	1,857,876	21,776	13,584	8,192	80.7	19.3	62.4	37.6
Iowa.....	4,679	3,637	3,066	571	1,512,552	27,479	17,784	9,695	84.3	15.7	64.7	35.3
Missouri.....	13,394	6,687	4,785	1,902	2,526,515	16,719	8,603	8,116	71.6	28.4	51.5	48.5
North Dakota.....	866	644	385	259	219,451	5,074	3,320	1,754	59.8	40.2	65.4	34.6
South Dakota.....	1,134	904	627	277	278,042	4,382	3,246	1,136	69.4	30.6	74.1	25.9
Nebraska.....	3,682	2,451	1,910	541	1,034,661	12,149	5,883	6,266	77.9	22.1	48.4	51.6
Kansas.....	7,904	3,933	2,061	1,872	898,023	14,573	7,314	7,259	52.4	47.6	50.2	49.8
SOUTH ATLANTIC:												
Delaware.....	131	91	86	5	41,959	1,507	850	657	94.5	5.5	56.4	43.6
Maryland.....	6,047	4,147	3,474	673	1,025,961	9,276	7,508	1,768	83.8	16.2	80.9	19.1
District of Columbia.....	1,966	1,166	1,166	0	658,899	5,626	5,626	0	100.0	0	100.0	0
Virginia.....	2,589	2,513	652	1,861	237,079	4,369	2,098	2,271	25.9	74.1	48.0	52.0
West Virginia.....	2,468	2,096	1,313	783	305,312	2,922	2,826	96	62.6	37.4	98.7	1.3
North Carolina.....	1,928	1,887	835	1,052	571,380	5,532	2,045	3,487	44.3	55.7	37.0	63.0
South Carolina.....	2,345	2,196	1,399	797	268,720	2,875	1,380	1,495	63.7	36.3	48.0	52.0
Georgia.....	2,651	2,370	660	1,710	410,068	7,283	1,848	5,435	27.8	72.2	25.4	74.6
Florida.....	1,264	1,213	227	986	367,601	4,752	3,398	1,354	18.7	81.3	71.5	28.5
EAST SOUTH CENTRAL:												
Kentucky.....	7,814	7,332	6,263	1,069	849,194	5,278	3,896	1,382	85.4	14.6	73.8	26.2
Tennessee.....	4,808	3,938	1,888	2,050	670,870	6,732	3,172	3,560	47.9	52.1	47.1	52.9
Alabama.....	3,920	2,314	1,652	662	347,871	2,805	1,135	1,670	71.4	28.6	40.5	59.5
Mississippi.....	1,823	1,663	963	700	279,219	4,001	1,552	2,449	57.9	42.1	38.8	61.2
WEST SOUTH CENTRAL:												
Arkansas.....	1,102	1,045	373	672	243,725	4,731	2,837	1,894	35.7	64.3	60.0	40.0
Louisiana.....	7,267	4,474	4,156	318	584,015	4,451	2,592	1,859	92.9	7.1	58.2	41.8
Oklahoma.....	3,659	3,303	2,642	661	593,311	8,334	4,699	3,635	80.0	20.0	56.4	43.6
Texas.....	7,617	5,504	3,907	1,597	1,865,620	9,567	8,317	1,250	71.0	29.0	86.9	13.1
MOUNTAIN:												
Montana.....	2,193	1,560	1,547	13	388,718	2,791	2,040	751	99.2	0.8	73.1	26.9
Idaho.....	1,349	1,109	1,024	85	261,092	3,886	2,535	1,351	92.3	7.7	65.2	34.8
Wyoming.....	492	396	376	20	112,226	1,168	1,059	109	94.9	5.1	90.7	9.3
Colorado.....	4,175	3,859	3,783	76	1,032,845	7,872	7,073	799	98.0	2.0	89.9	10.1
New Mexico.....	377	247	229	18	112,187	627	533	94	92.7	7.3	85.0	15.0
Arizona.....	686	454	454	0	136,390	1,335	1,335	0	100.0	0	100.0	0
Utah.....	333	321	262	59	150,380	5,237	2,706	2,531	81.6	18.4	51.7	48.3
Nevada.....	321	204	204	0	45,443	401	251	150	100.0	0	62.6	37.4
PACIFIC:												
Washington.....	4,729	2,661	1,016	1,645	779,787	20,223	4,986	15,237	38.2	61.8	24.7	75.3
Oregon.....	1,285	1,128	1,068	60	332,196	6,239	4,721	1,518	94.7	5.3	75.7	24.3
California.....	24,890	19,341	18,819	522	6,793,195	75,802	62,650	13,152	97.3	2.7	82.6	17.4

¹ Exclusive of 23,046 lamps of other varieties, 578 of which were used for street lighting.

Of the total number of arc lamps used for street lighting, 75.8 per cent were reported by commercial stations and 24.2 per cent by municipalities. In incandescent street lighting 69.6 per cent of the lamps were reported by commercial stations and 30.4 per cent by municipal stations.

In the Mountain division the commercial stations furnished practically all (96.7 per cent) of the arc lights used for street lighting, a larger proportion than is shown for any other group of states. In the Middle Atlantic states 92.5 per cent of the arc lights used for street lighting were reported by the commercial companies, and this class of stations in the New England and Pacific states reported the next largest proportion, 90.4 per cent in each case.

In four widely separated states—Arizona, Nevada, New Hampshire, and the District of Columbia—all of the street lighting by arc lamps was done by commercial companies. In the District of Columbia, Arizona, New Hampshire, Rhode Island, New York, New Jersey, West Virginia, and Wyoming over 90 per cent of the incandescent lamps for street lighting were furnished by commercial companies; and in the District of Columbia and Arizona all of the public street lighting, both arc and incandescent, was done by such companies.

Street lighting by municipal stations was of exceptional importance in Georgia, for which state these stations reported 72.2 per cent of the arc lamps used for such purposes and 74.6 per cent of the incandescents. Virginia and North Carolina, of the same geographic division, Washington, and several states in the East North Central division show large percentages

of lamps for street lighting by municipal stations, but none that equal that for Georgia.

Stationary motor service.—As a source of income and as a consumer of current the stationary motor is second only to the lamp. The adaptability of the electric motor to all sizes of power units, the ease and small cost of installation, the economy of space required, its cleanliness, its instantaneous availability, the absence of noise, and the ease of operation make it superior to all other forms of motors or engines, except where conditions preclude its installation.

The growth in the use of stationary motors driven by current received from central electric stations is shown in Table 37, which gives the number and horsepower of stationary motors, by geographic divisions, for 1912, 1907, and 1902.

The increasing popularity of electricity as a motive power is shown by the comparative figures reported for the number and horsepower of stationary motors. The total number of stationary motors reported for central stations increased from 101,064 in 1902 to 167,184 in 1907 and to 435,473 in 1912, a gain for the two five-year periods equivalent to 65.4 per cent and 160.5 per cent, respectively. The increase in the horsepower was even greater, being 276.5 per cent from 1902 to 1907 and 150.5 per cent from 1907 to 1912. During the decade the total horsepower of these motors increased by 3,692,614, or 843.1 per cent, and their number by 334,409, or 330.9 per cent. The average horsepower per motor, which in 1902 was 4.3, had increased to 9.5 in 1912. The average capacity of motors was largest for the Pacific and Mountain divisions, 19.71 and 19.44 horsepower, respectively.

CENTRAL ELECTRIC STATIONS—NUMBER AND HORSEPOWER CAPACITY OF STATIONARY MOTORS: 1912, 1907, AND 1902.

DIVISION. ¹	1912		1907		1902		AVERAGE CAPACITY.			PER CENT OF INCREASE IN HORSEPOWER.			PER CENT OF TOTAL HORSEPOWER.		
	Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.	1912	1907	1902	1902-1912	1907-1912	1902-1907	1912	1907	1902
							9.49	9.86	4.33	843.1	150.5	276.5	100.0	100.0	100.0
United States.....	435,473	4,130,619	167,184	1,649,026	101,064	438,005	9.49	9.86	4.33	843.1	150.5	276.5	100.0	100.0	100.0
New England.....	55,042	391,308	23,841	154,720	12,736	62,163	7.11	6.49	4.88	529.5	152.9	148.9	9.5	9.4	14.2
Middle Atlantic.....	124,416	1,213,681	34,108	544,020	29,938	149,083	9.76	15.95	4.98	714.1	123.1	264.9	29.4	33.0	34.0
East North Central.....	114,404	799,421	49,345	307,558	23,257	80,304	6.99	6.23	3.45	895.5	159.9	283.0	19.4	18.6	18.3
West North Central.....	47,540	316,113	19,027	138,027	9,767	33,331	6.65	7.25	3.41	848.4	129.0	314.4	7.7	8.4	7.6
South Atlantic.....	26,163	361,011	8,948	95,373	2,516	16,541	13.80	10.66	6.57	2,082.5	278.5	476.6	8.7	5.8	3.8
East South Central.....	7,592	62,081	3,039	21,656	3,935	7,510	8.18	7.13	1.91	726.6	186.7	188.4	1.5	1.3	1.7
West South Central.....	15,337	103,765	7,220	42,507	10,633	11,024	6.77	5.89	1.04	841.3	144.1	285.6	2.5	2.6	2.5
Mountain.....	12,114	235,506	6,091	94,960	2,394	20,953	19.44	15.59	8.75	1,024.0	148.0	353.2	5.7	5.8	4.8
Pacific.....	32,865	647,733	15,565	250,205	5,888	57,096	19.71	16.07	9.70	1,034.5	158.9	338.2	15.7	15.2	13.0

¹ See page 25 for states composing the several geographic divisions.

In 1902 the so-called flat rate was the principal form of contract between the producer and consumer of electric current. Each year since then has seen a large decrease in the number of stations operating under this form of agreement and a proportionate increase in the metered service, so that at the present time practically all consumers are on a measured current basis. The number of meters reported is not, however, identical with the number of customers, be-

cause of the conflicting methods of accounting in use by the different companies; with some each meter is a customer, while with others the customers are counted regardless of the number of meters in service.

The electric railways did not report stationary motors in 1912, but in 1907 they reported 20,468 stationary motors with a capacity of 158,923 horsepower, and in 1902, 10,049 motors with a capacity of 35,688 horsepower.

The largest amount of power capacity of stationary motors at each census was reported by the states of the Middle Atlantic division. In 1912 this division reported 1,213,681 horsepower, or 29.4 per cent of the total for the United States; in 1907, 544,020 horsepower, or 33 per cent of the total; and in 1902, 149,083 horsepower, or 34 per cent of all of this kind of power shown. Although the amount of power reported by this group of states formed a decreasing proportion of the United States total for each succeeding census, still it increased 264.9 per cent from 1902 to 1907, 123.1 per cent from 1907 to 1912, and 714.1 per cent for the decade 1902 to 1912. In 1912 the East North Central group, with 19.4 per cent of the total, and the Pacific states, with 15.7 per cent, were the next largest users of this kind of power. These three groups of states reported nearly two-thirds (64.4 per cent) of the total horsepower for stationary motor service in the United States.

The South Atlantic division, which in 1902 showed but 16,541 horsepower in stationary motors, reported 361,011 horsepower in 1912, an increase of over 2,000 per cent, the largest percentage of gain for any of the geographic divisions. The Pacific and Mountain divisions, in the order named, show the next largest percentages of increase for the 10-year period 1902 to 1912. In 1902 the Middle Atlantic division reported more than one-third (34 per cent) of the total of this kind of power, and the East North Central, the New England, and the Pacific divisions followed, in the order named, with 18.3 per cent, 14.2 per cent, and 13 per cent, respectively. Combined, these four groups of states reported for that year 79.6 per cent of the total for the United States. In 1907 these same groups again led all other divisions in the proportion of the total power reported, but the Pacific division had passed the New England group. In 1912 their relative positions were the same as in 1907. In 1907 the proportion of the total shown by these four divisions combined was 76.2 per cent, and in 1912 a slightly smaller percentage, 73.9, was reported.

Considering the horsepower of stationary motors in the individual states, as shown by Table 55 (p. 82), New York reported 795,256 horsepower in 1912, and led all the others for the three censuses. This horsepower was more than double the amount reported by any other state, with the exception of California, which state was second with 603,742 horsepower. California made the greatest absolute gain from 1907 to 1912, but New York takes precedence in this respect for the decade 1902 to 1912. In addition to the two states named, each of the following states reported more than 100,000 horsepower for stationary motors in 1912: Illinois, Massachusetts, Michigan, Missouri, Ohio, Pennsylvania, and South Carolina.

The largest average horsepower capacity of the motors in 1912 was 38.3, reported for Montana. The states of Utah, South Carolina, Georgia, Nevada, and

California followed, in the order named, with average motor horsepowers of 35.9, 28.5, 25.8, 22.4, and 20.8, respectively.

The extensive use of stationary motors of varying capacity in connection with manufactures no doubt accounts for the smaller average capacity per motor in the more eastern states, where the manufacturing industries are largely centralized.

Subsidiary equipment.—At the censuses of 1907 and 1902 data relative to the subsidiary equipment located in the power houses and that in the substations of central electric stations were reported separately. These data have been combined in Table 38 in order to render the totals for 1902 and 1907 comparable with the information as reported at the census of 1912. The table also gives the subsidiary equipment of the electric railways.

Table 38 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS, AND ELECTRIC RAILWAYS—SUBSIDIARY EQUIPMENT: 1912, 1907, AND 1902.

	Census.	Rotary converters and motor generator sets. ¹		Boosters.		Transformers.	
		Number.	Kilowatt capacity.	Number.	Kilowatt capacity.	Number.	Kilowatt capacity.
Total.....	1912	4,667	2,646,396	511	47,628	22,304	6,461,336
	1907	2,532	1,305,651	261	21,856	11,062	2,826,693
	1902	742	333,426	297	31,577	3,457	631,936
Central stations....	1912	1,827	1,009,136	328	22,821	13,868	4,103,939
	1907	670	363,419	127	4,810	5,788	1,693,532
	1902	301	173,373	193	17,911	1,800	419,367
Commercial.....	1912	1,781	996,531	295	20,151	12,972	4,039,236
	1907	665	362,706	106	4,474	5,479	1,677,682
	1902	299	173,229	184	17,735	1,765	418,068
Municipal.....	1912	46	12,605	33	2,670	896	64,703
	1907	5	713	21	336	309	15,850
	1902	2	144	9	176	35	1,299
Electric railways....	1912	2,840	1,637,260	183	24,807	8,436	2,357,397
	1907	1,862	942,232	134	17,046	5,274	1,133,161
	1902	441	160,053	104	13,666	1,657	212,589

¹ Prior to 1912 motor generator sets were not included.

Electric railways reported 61.9 per cent of the total kilowatt capacity of rotary converters and motor generator sets in 1912, compared with 72.2 per cent in 1907 and 48 per cent in 1902. Of the total kilowatt capacity of these machines located in central electric stations, the commercial stations reported 98.8 per cent in 1912, 99.8 per cent in 1907, and 99.9 per cent in 1902.

The capacity of the transformers increased 5,829,400 kilowatts, or 922.5 per cent, from 1902 to 1912. The electric railways reported 36.5 per cent of the total kilowatt capacity of transformers in 1912, 40.1 per cent in 1907, and 33.6 per cent in 1902. For the central stations, the commercial stations reported 98.4 per cent of the kilowatt capacity in 1912, 99.1 in 1907, and 99.7 in 1902. The average capacity of the transformers for all stations increased from 183 kilowatts in 1902 to 290 kilowatts in 1912. As in the case of most machines used in central station work, the average capacity of the transformers increased consider-

ably during the decade 1902-1912. During this period the average capacity of these machines in central stations increased from 233 kilowatts to 296 kilowatts; of those in the commercial stations, from 237 to 311 kilowatts; and of those in municipal stations, from 37 to 72 kilowatts. The average capacity of transformers reported by the electric railways shows a very large increase—from 128 kilowatts in 1902 to 279 in 1912.

The total kilowatt capacity of the boosters shows an increase for the decade 1902-1912 and for the five-year period 1907-1912, but from 1902 to 1907 the fig-

ures indicate a decrease. The statistics for boosters for central stations in 1902 and 1907, however, are no doubt incomplete because, unlike the schedule used in 1912, the schedules used in 1902 and 1907 did not specifically call for boosters under the substation equipment, and when these machines were reported they were placed under the general heading of "Miscellaneous." The extent to which boosters were reported in 1902 and 1907, therefore, is uncertain. For the electric railway industry there has been a steady increase in the capacity of these machines.

CHAPTER VI.

FINANCIAL STATISTICS.

Capitalization.—The statistics of capitalization of central electric light and power stations for prior censuses were confined to the par value of authorized and outstanding preferred and common stock and bonds of commercial corporations; the par value of the bonds issued by municipalities to secure funds for the construction, purchase, or operation of the municipal stations; and the returns made on such capitalization in the form of dividends and interest. For the year 1912, however, a more extended report was requested, and a balance sheet as of December 31, 1912, was secured from all central stations, commercial and municipal. The capitalization for 1912, therefore, includes for commercial companies, in addition to capital stock and funded debt, the cash investments, value of real estate mortgages, and floating debt.

The balance sheet for municipal central stations shows funded debt amounting to \$31,189,357 and cash investments amounting to \$27,064,963, which together aggregate \$58,254,320. It is doubtful, however, that this sum fairly represents the capitalization of this class of stations, since no cognizance is taken of the indebtedness which has been liquidated. In Table 39, therefore, the capitalization of municipal stations for 1912 is given as the amount reported for the cost of construction and equipment.

	Central electric stations— Capitalization: 1912.
Total.....	\$2,289,622,199
Commercial stations.....	2,212,557,055
Capital stock.....	1,154,587,016
Common.....	977,639,057
Preferred.....	176,947,959
Funded debt.....	897,907,681
Cash investments.....	12,165,075
Real estate mortgages.....	10,170,898
Floating debt.....	137,726,385
Municipal stations:	
Cost of construction and equipment.....	77,065,144

Of the total capitalization in 1912, as shown in Table 39, the commercial stations reported 96.6 per cent and the municipal stations 3.4 per cent. The capital stock, of which 84.7 per cent was common stock and 15.3 per cent preferred, represented 50.4 per cent of the total capitalization. The funded debt was equal to 39.2 per cent of the total capitalization, the floating debt to 6 per cent, the cash investments to five-tenths of 1 per cent, and real estate mortgages to four-tenths of 1 per cent.

Gross and net capital, commercial stations.—In the preceding table the total capitalization of the industry as a whole is shown. The table which follows gives for commercial companies the gross and net capital

and the net capital pertaining strictly to the electric light and power industry.

	Commercial central electric stations—Gross and net capital: 1912.
Common stock.....	\$977,639,057
Preferred stock.....	176,947,959
Funded debt.....	897,907,681
Cash investments.....	12,165,075
Real estate mortgages.....	10,170,898
Floating debt.....	137,726,385
Total.....	2,212,557,055
Deduct intercompany holdings and treasury securities.....	126,305,618
Net capital.....	2,086,251,437
Deduct investments outside of electric light and power industry..	76,721,716
Net capital based on electric light and power industry.....	2,009,529,721

To arrive at the net capital it is necessary to deduct intercompany holdings, \$77,787,160, and treasury securities, \$48,518,458, leaving \$2,086,251,437 as the net capital. The intercompany holdings or the stocks and bonds of certain electric companies held by other electric companies are deducted, since they have been reported as capitalization by the companies which originally issued them, and their inclusion by a purchasing company is a duplication. In like manner, treasury securities constitute a duplication, since they represent stock or bonds legally ready for disposal, which have already been reported as outstanding capitalization but held in the treasury subject to issue.

To arrive at the net capital pertaining strictly to the electric light and power industry it is necessary to deduct outside investments. These include investments in the stock and bonds of companies other than electric, \$65,895,784, and other permanent investments, \$10,825,932, a total amounting to \$76,721,716, leaving \$2,009,529,721 as the net capital based on the electric light and power industry. It will be seen from these figures that after the elimination of the duplications referred to the net capital shows a shrinkage of 5.7 per cent, as compared with the gross capital, while the net capital based on the electric light and power industry shows a falling off of 9.2 per cent, as compared with the gross capital.

Capital stock and funded debt of commercial stations.—In order to present comparative statistics of capitalization it is necessary to use the totals as secured at the censuses of 1907 and 1902. The data are confined, therefore, to those for the commercial stations, since the statistics of capitalization for municipal stations are unsatisfactory.

COMMERCIAL COMPANIES—CAPITAL STOCK, FUNDED DEBT, AND DIVIDENDS: 1912, 1907, AND 1902.

Table 41	1912	1907	1902	PER CENT OF INCREASE.		
				1902-1912	1907-1912	1902-1907
Number of commercial companies having outstanding capitalization.....	12,663	22,516	2,049	30.0	5.8	22.8
Total capitalization outstanding.....	\$2,052,494,697	\$1,841,995,182	\$627,515,875	227.1	52.9	113.9
Capital stock.....	1,154,587,016	741,317,497	372,951,952	209.6	55.7	98.8
Common.....	977,639,057	686,003,772	349,080,231	180.1	46.8	90.8
Preferred.....	176,947,959	76,313,725	23,871,671	641.2	134.9	215.5
Dividends, amount.....	34,580,872	19,300,572	6,189,837	458.7	79.2	211.8
On common stock.....	28,602,399	16,883,812	5,560,341	414.4	69.4	203.6
On preferred stock.....	5,978,473	2,416,760	629,496	849.7	147.4	283.9
Funded debt.....	897,907,681	600,677,685	254,563,923	252.7	49.5	136.0

¹ Exclusive of the capitalization of 169 electric railways which operated electric light and power departments, and 116 central electric stations not reporting stock and bonds for sundry reasons, but including 18 stations whose capitalization was reported by other stations, and 23 stations reporting bonds only.

² Exclusive of 37 companies (21 operating electric railways with capitalization included in report for street and electric railways; 9 corporations reporting capitalization in one state and owning establishments in another state, which are reported separately in certain of the tables; and 7 not reporting capitalization for sundry reasons), but including 2 companies reporting bonds only, their capital stock not being separable from that representing other interests.

The capitalization of commercial companies increased \$714,479,307, or 113.9 per cent, from 1902 to 1907, and \$710,499,515, or 52.9 per cent, from 1907 to 1912. The kilowatt-hour output shown in Table 29 increased 141.1 per cent and 97.3 per cent, respectively, for the same periods. It will be seen, therefore, that there was a harmonious relation between the percentages of increase in capitalization and in output.

The number of stations reporting capitalization increased 147, or 5.8 per cent, from 1907 to 1912, as compared with an increase of 467, or 22.8 per cent, from 1902 to 1907. Of the entire capitalization, the total capital stock formed 56.3 per cent in 1912, 55.2 per cent in 1907, and 59.4 per cent in 1902, while bonds (funded debt) represented 43.7 per cent, 44.8 per cent, and 40.6 per cent, respectively. The relative importance of stocks and bonds, therefore, showed considerable variation between 1902 and 1907, but changed only slightly between 1907 and 1912.

The funded debt increased \$346,113,762, or 136 per cent, from 1902 to 1907, and \$297,229,996, or 49.5 per cent, from 1907 to 1912. There has been a gradual lessening in the proportion of common stock, from 93.6 per cent of the total capital stock in 1902 to 89.8 per cent in 1907 and 84.7 per cent in 1912, and necessarily a corresponding increase in the percentage for preferred stock.

The statistics of capitalization collected by the Census Bureau should not be used as a basis for computing the return on investments in central electric stations. Many companies operate other industries in connection with central stations, and their systems of accounting are such that it is impossible to obtain data pertaining to the investment, income, and expenses for each branch, although the information for the entire enterprise may be very complete.

However, in 1912 the 2,663 commercial companies reported dividends on common stock to the amount of \$28,602,399, being equivalent to 2.9 per cent on \$977,639,057 of common stock, as compared with 2.5 per cent in 1907 and 1.6 per cent in 1902. The amount

of dividends on the preferred stock in 1912 was \$5,978,473, equal to 3.4 per cent; in 1907 the rate was 3.2 per cent, and in 1902, 2.6 per cent. Some of the 2,663 companies reported for 1912 did not pay dividends for the census year, while others declared them upon one class of stock only.

Cost of construction and equipment.—The schedule used at the census of 1902 called for a separate statement as to the cost, during the year and to date, of land; buildings; machinery, tools, and implements within stations; overhead electric service construction; underground electric service construction; lamps, motors, meters, and transformers, wired for use; supplies of every description on hand; and miscellaneous equipment. The object of these inquiries was to ascertain the total cost of the plant and equipment, and the expenditures during the year for extensions, additions, and repairs. It was presumed that the electric companies kept an account of this kind, but a majority contended that it was impossible to report the cost in such detail, and many asserted that they had no data from which even the total cost of the plant and equipment to date could be estimated with a fair degree of accuracy. Moreover, a considerable number of the electric stations have changed ownership during recent years, and the purchase price often has little relation to the actual cost of the plant, and in fact seldom, if ever, represents this cost. The transfer is frequently made through the exchange of stock or by some other arrangement whereby it is impossible to ascertain the money equivalent. In view of these conditions the attempt to ascertain the cost of construction in such detail was abandoned in 1907, but in an effort to preserve the comparative value of the statistics the total cost of the plant and equipment to date and the cost of construction during the census year were requested. Even this modification of the inquiry was unsatisfactory, and in 1912 it was still further simplified, and only the total cost of construction, equipment, and real estate was called for.

Many and varying factors enter into the cost of plants and equipment. Sites and rights, which in one

instance may cost but little, in another may be very expensive. The equipment of a station designed and prepared to supply current to a large city or thickly settled community is quite unlike that of a station transmitting electricity considerable distances and selling in bulk to but few customers.

Notwithstanding these limitations the data presented in the following table may be accepted as presenting a fair approximation of the growth of the industry in respect to cost of construction and equipment for the United States, for the several geographic divisions, and for the individual states.

CENTRAL ELECTRIC STATIONS—COST OF CONSTRUCTION AND EQUIPMENT: 1912, 1907, AND 1902.

Table 42 DIVISION AND STATE.	TOTAL COST OF CONSTRUCTION AND EQUIPMENT.			Actual increase: 1902-1912	Per cent of increase: 1902-1912
	1912	1907	1902		
UNITED STATES.....	\$2,175,678,266	\$1,096,913,622	\$504,740,352	\$1,670,937,914	331.0
GEOGRAPHIC DIVISIONS:					
New England.....	153,468,258	92,582,350	55,538,120	97,930,138	176.3
Middle Atlantic.....	584,107,361	391,858,983	211,010,618	373,096,743	176.8
East North Central.....	388,575,873	203,859,358	87,654,667	300,921,206	342.3
West North Central.....	170,306,935	86,378,753	39,840,684	130,466,251	327.5
South Atlantic.....	134,310,186	58,513,594	19,462,480	114,847,706	590.1
East South Central.....	74,964,574	27,384,959	9,081,612	65,882,962	725.5
West South Central.....	76,052,774	31,981,172	13,247,115	62,805,659	474.1
Mountain.....	203,195,798	57,380,775	23,662,909	179,532,889	758.7
Pacific.....	390,696,507	146,973,678	45,242,147	345,454,360	763.6
NEW ENGLAND:					
Maine.....	19,926,292	12,629,101	4,824,850	15,101,442	313.0
New Hampshire.....	18,061,576	8,695,652	6,447,560	11,614,016	180.1
Vermont.....	10,027,600	7,234,498	2,691,170	7,336,430	272.6
Massachusetts.....	71,707,238	43,273,226	29,562,267	42,144,971	142.6
Rhode Island.....	11,839,294	7,327,862	5,428,796	5,910,498	108.9
Connecticut.....	22,406,258	13,416,011	6,583,477	15,822,781	240.3
MIDDLE ATLANTIC:					
New York.....	350,526,904	252,731,789	112,998,778	237,528,126	210.2
New Jersey.....	69,058,381	65,219,445	56,432,502	12,626,879	22.4
Pennsylvania.....	164,522,076	73,007,749	41,570,338	122,942,738	295.7
EAST NORTH CENTRAL:					
Ohio.....	69,243,894	42,557,000	26,381,897	42,862,497	162.5
Indiana.....	47,930,252	25,680,710	6,706,510	41,223,742	614.7
Illinois.....	162,104,226	88,142,233	38,329,275	123,774,951	322.9
Michigan.....	72,764,830	37,001,060	11,559,169	61,205,661	529.5
Wisconsin.....	36,532,671	10,478,355	4,678,316	31,854,355	680.9
WEST NORTH CENTRAL:					
Minnesota.....	44,360,910	24,138,081	9,236,505	35,124,405	380.3
Iowa.....	22,126,518	9,986,666	8,554,234	13,572,284	158.7
Missouri.....	48,624,710	33,865,760	15,679,872	32,944,838	210.1
North Dakota.....	4,881,632	1,619,997	416,843	4,464,789	1,071.1
South Dakota.....	11,318,041	2,806,363	623,504	10,694,537	1,715.2
Nebraska.....	12,971,316	7,372,081	3,305,840	9,665,476	292.4
Kansas.....	26,023,808	6,589,805	2,023,886	23,999,922	1,185.8
SOUTH ATLANTIC:					
Delaware, Maryland, and District of Columbia.....	39,970,422	34,010,868	11,825,766	28,144,666	238.0
Virginia.....	10,927,379	1,790,271	1,039,347	9,888,032	951.4
West Virginia.....	13,390,173	2,682,935	1,123,440	12,266,724	1,091.9
North Carolina.....	12,090,231	2,241,701	803,936	11,286,295	1,403.9
South Carolina.....	34,012,368	8,803,382	2,442,989	31,569,379	1,292.2
Georgia.....	19,890,925	7,354,286	1,252,578	18,638,347	1,488.0
Florida.....	4,028,688	1,630,061	974,425	3,054,263	313.4
EAST SOUTH CENTRAL:					
Kentucky.....	19,709,023	10,356,088	3,670,152	16,038,871	437.0
Tennessee.....	41,517,416	7,514,333	3,603,088	37,914,328	1,052.3
Alabama.....	8,726,776	7,293,876	908,895	7,817,881	860.2
Mississippi.....	5,011,359	2,220,662	899,477	4,111,882	457.1
WEST SOUTH CENTRAL:					
Arkansas.....	4,811,879	1,922,658	1,082,505	3,729,374	344.5
Louisiana.....	14,275,269	11,614,121	6,056,603	8,218,666	135.7
Oklahoma.....	13,352,640	7,130,864	597,516	12,755,124	2,134.7
Texas.....	43,612,986	11,313,529	5,510,491	38,102,495	691.5
MOUNTAIN:					
Montana.....	64,583,391	17,950,677	4,740,807	50,842,584	1,262.3
Idaho.....	32,482,566	3,251,460	785,030	31,697,536	4,037.7
Wyoming.....	2,200,032	942,326	467,463	1,732,569	370.6
Colorado.....	66,989,142	23,126,179	8,665,826	58,323,316	673.0
New Mexico.....	3,133,760	989,317	369,877	2,763,883	747.2
Arizona.....	9,258,049	1,672,589	810,341	8,447,708	1,042.5
Utah.....	11,555,496	5,148,596	7,521,780	4,033,716	53.6
Nevada.....	12,993,362	4,289,631	301,785	12,691,577	4,205.5
PACIFIC:					
Washington.....	22,510,528	20,789,849	3,537,022	18,973,506	536.4
Oregon.....	23,796,747	14,403,278	5,157,651	18,639,096	361.4
California.....	344,389,232	111,780,551	36,547,474	307,841,758	842.3

The cost of construction of central electric plants, which includes that of the equipment devoted to the generation and distribution of electric current, for the United States as a whole, increased \$1,670,937,914, or 331 per cent, from 1902 to 1912. In all of the geographic divisions, with the exception of the New

England, the Middle Atlantic, and the West North Central, the per cent of increase was greater than the rate of gain for the United States. The largest percentage of increase, 763.6 per cent, is shown for the Pacific group; the Mountain division is second, with 758.7 per cent; and the East South Central group

third, with 725.5 per cent. The largest actual gain, \$373,096,743, was in the Middle Atlantic states, and the relative value of the equipment in this group may be better understood when it is considered that the amount representing this *increase* was greater than the total amount of the entire investment reported in 1912 by the central electric stations in any other group except the East North Central and Pacific divisions. This latter division was second in the amount of actual increase, and the East North Central third.

Several of the geographic divisions show considerable change in their respective proportions of the cost of construction and equipment in 1912, as compared with their proportions in 1902. The most noticeable decreases are as follows: The Middle Atlantic division, from 41.8 per cent in 1902 to 26.8 per cent in 1912, and the New England division, from 11 per cent to 7.1 per cent. Of the increases during the 10-year period, those for the Pacific division from 9 per cent in 1902 to 18 per cent in 1912, and for the Mountain division from 4.7 per cent to 9.3 per cent, were the most pronounced.

Considering the states individually, New York had the largest amount invested at all three censuses, although California reported the greatest increase,

\$307,841,758, during the decade. The greatest percentages of increase are shown for Nevada and Idaho. Oklahoma shows a gain of more than 2,000 per cent, and 10 other states—Arizona, Georgia, Kansas, Montana, North and South Carolina, North and South Dakota, Tennessee, and West Virginia—made increases of over 1,000 per cent from 1902 to 1912. These large percentages of increase, however, represent the states wherein the electrical industries were practically undeveloped 10 years ago. Important water powers are located in many of these states, and by their utilization electricity is generated at a minimum cost. The water powers in the Pacific, Mountain, and East South Central states have been developed very extensively during the past decade, and the states in these divisions show the largest increases in the cost of construction and equipment of central electric systems.

Table 43 gives for commercial and municipal stations the total number of stations, the cost of construction and equipment, the kilowatt capacity of dynamos, the horsepower of primary machines, and the average cost of construction per kilowatt capacity of dynamos and per horsepower of prime movers, for 1912, 1907, and 1902.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COST OF CONSTRUCTION AND EQUIPMENT; AVERAGE COST OF CONSTRUCTION PER KILOWATT CAPACITY OF DYNAMOS AND PER HORSEPOWER OF PRIMARY POWER MACHINES: 1912, 1907, AND 1902.

Table 43	TOTAL.			COMMERCIAL.			MUNICIPAL.		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of stations.....	5,221	4,714	3,620	3,659	3,462	2,805	1,562	1,252	815
Cost of construction and equipment..	\$2,175,678,266	\$1,096,913,622	\$504,740,352	\$2,098,613,122	\$1,054,034,175	\$482,719,879	\$77,065,144	\$42,879,447	\$22,020,473
Kilowatt capacity of dynamos.....	5,134,689	2,709,225	1,212,235	4,766,012	2,500,209	1,098,855	368,677	209,016	113,380
Average cost of construction per kilowatt capacity of dynamos.....	\$424	\$405	\$416	\$440	\$422	\$439	\$209	\$205	\$194
Horsepower of primary power machines.....	7,628,648	4,098,188	1,845,048	6,969,320	3,776,837	1,685,020	559,328	321,351	160,028
Average cost of construction per horsepower of primary power machines.....	\$289	\$268	\$274	\$301	\$279	\$286	\$138	\$133	\$138

The total cost of construction and equipment for all stations reported for 1912 was an increase of \$1,078,764,644 over the cost reported in 1907, or 98.3 per cent. For the same period the commercial stations increased \$1,044,578,947, or 99.1 per cent, and the municipal stations \$34,185,697, or 79.7 per cent. The commercial stations reported 96.5 per cent of the total cost of construction for the 5,221 central electric stations in 1912 and 95.6 per cent of the total for the 3,620 stations in 1902. The average cost per station in 1912 was \$416,717, as compared with \$232,693 in 1907 and \$139,431 in 1902. The averages per station for the commercial stations for the same years were \$573,548, \$304,458, and \$172,093, and for municipal stations \$49,337, \$34,249, and \$27,019, respectively. The average cost of construction per kilowatt capacity of dynamos for all stations decreased from \$416 in 1902 to \$405 in 1907, but increased to \$424 for 1912. Similar changes took place in the average cost per

horsepower of prime movers, which decreased from \$274 in 1902 to \$268 in 1907, but increased to \$289 in 1912. The averages for commercial stations are in harmony with those for all stations, but for municipal stations the average cost of construction per kilowatt capacity has increased during each five-year period, while the average for the primary power units was the same in 1912 as in 1902, although showing a decrease from 1902 to 1907.

Income.—The schedule used at the census of 1912 called for returns of income in less detail than in 1907 and 1902, because the detailed information secured in the earlier years was unsatisfactory. In the census of 1907, for instance, the attempt was made to secure separate income data for arc and for incandescent lighting, for stationary motor service, for charging automobiles, and for electric heating, cooking, welding, etc., but these were all abandoned as separate inquiries in 1912.

The inquiries as to income, and also as to operating expenses, used in the schedule for 1912, with slight modifications, conform to the system of accounting adopted by the United States Interstate Commerce Commission. The different items of income for which separate totals were reported are shown in Table 44. This table also shows the per cent each item forms of the total income.

ACCOUNT.	CENTRAL ELECTRIC STATIONS—INCOME: 1912.	
	Amount.	Per cent of total.
Total income.....	\$302,115,599	100.0
Electric service.....	286,980,858	95.0
Commercial light, power, and heat.....	221,200,466	73.2
Municipal street lighting.....	27,273,226	9.0
Municipal building lighting.....	2,504,511	0.8
Current sold to other public service corporations.....	31,019,660	10.3
Estimated value of free service:		
Commercial stations.....	513,644	0.2
Municipal stations.....	4,469,351	1.5
Interest and dividends from investments.....	4,891,449	1.6
All other sources.....	10,243,292	3.4

The great bulk of the income was for electric service, but 5 per cent of the total income being derived from other sources. As might be expected, most of the income (nearly three-fourths) was reported for commercial light, power, and heat. Current sold to other public service corporations was second in importance, and municipal street lighting, shown separately for the first time at the census of 1912, was third. The income from interest and dividends from investments and all other income were comparatively unimportant. The estimated value of free service formed but 1.7 per cent of the total income. In 1912 the estimated amount reported for free service was \$4,982,995, while in 1907 this item was reported as \$6,010,595, indicating a decrease during the five-year period of \$1,027,600, or 17.1 per cent. Although in 1912 a small amount (\$513,644) was shown for such service for commercial stations, for franchise privileges, etc., free service was chiefly reported by the municipal stations, such stations reporting 89.7 per cent of the total in 1912 and 94.4 per cent in 1907.

The differences in reporting the items of income at the several censuses render it impracticable to give comparative figures, except for gross income, for electric service, and for receipts from all other sources. Data relating to these three items of income and to the number of stations are shown for commercial and municipal stations for 1912, 1907, and 1902.

The municipal stations formed 22.5 per cent of the total number reported at the census of 1902. This proportion increased to 26.6 per cent in 1907 and 29.9 per cent in 1912. This increase in number, however, loses much of its significance when it is considered that the gross income of the municipal stations formed only 8.1 per cent of the total income

of both classes of stations in 1902, 8 per cent in 1907, and 7.7 per cent in 1912.

CLASSIFICATION OF INCOME.	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—GROSS INCOME: 1912, 1907, AND 1902.			
	Census.	Total.	Commercial.	Municipal.
Number of stations.....	1912 5,221 1907 4,714 1902 3,620		3,659 3,482 2,805	1,562 1,232 816
Gross income.....	1912 \$302,115,599 1907 175,642,338 1902 85,700,605		\$278,896,610 161,630,339 78,735,500	\$23,218,989 14,011,999 6,965,105
Electric service.....	1912 286,980,858 1907 189,614,691 1902 84,186,605		264,317,150 156,000,257 77,349,749	22,663,708 13,614,434 6,836,856
All other sources.....	1912 15,134,741 1907 6,027,647 1902 1,514,000		14,579,460 5,630,082 1,385,751	555,281 397,565 128,249
Per cent of increase:				
Number of stations—				
1902-1912.....		44.2	30.4	91.7
1907-1912.....		10.8	5.7	24.8
1902-1907.....		30.2	23.4	53.6
Gross income—				
1902-1912.....		252.5	254.2	233.4
1907-1912.....		72.0	72.6	65.7
1902-1907.....		104.9	105.3	101.2
Electric service—				
1902-1912.....		240.9	241.7	231.5
1907-1912.....		69.2	69.4	66.5
1902-1907.....		101.5	101.7	99.1
All other sources—				
1902-1912.....		899.7	952.1	333.0
1907-1912.....		151.1	159.0	39.7
1902-1907.....		298.1	306.3	210.0

Table 56 (p. 88) shows that in income, as in most other features of the industry, the Middle Atlantic and East North Central divisions lead all others, these two divisions combined reporting in 1912 \$160,005,679, or 53 per cent of the total income. The Pacific division was third in gross income, with \$32,195,997, or 10.7 per cent of the total. With few exceptions these three divisions lead in the several items of income shown in Table 56. For municipal building lighting the Middle Atlantic division reported \$1,287,893, or 51.4 per cent of the total for such service; and for interest and dividends from investments, \$2,529,416, or 51.7 per cent of the total. In estimated value of free service for municipal stations, the East North Central division led, with \$1,846,837, or 41.3 per cent, while of the total shown for "all other income" this division reported \$3,484,991, or 34 per cent. Four of the states showed a gross income in 1912 of upward of \$20,000,000, as follows: New York, \$57,218,973; Illinois, \$30,045,297; California, \$27,685,573; and Pennsylvania, \$24,387,863; their proportions of the total income being 18.9 per cent, 9.9 per cent, 9.2 per cent, and 8.1 per cent, respectively. In the amounts reported for commercial light, power, and heat these four states also led, but with California instead of Illinois in second position. The amounts reported for this service were: New York, \$42,388,607, or 19.2 per cent; California, \$19,941,719, or 9 per cent; Illinois, \$19,693,842, or 8.9 per cent; and Pennsylvania, \$16,811,493, or 7.6 per cent. In income for municipal street lighting, New York reported \$4,556,339, or 16.7 per cent of the total for such service; Pennsylvania, \$3,363,079, or 12.3 per cent; and Massachusetts,

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

\$2,322,146, or 8.5 per cent. In income for current sold to other public-service corporations, Illinois led, with \$5,231,534, or 16.9 per cent, followed by New York, with \$5,090,032, or 16.4 per cent; California, with \$4,763,032, or 15.4 per cent; and Pennsylvania, with \$2,801,257, or 9 per cent. No other state reported as much as \$2,000,000 for such service.

DIAGRAM 15.—CENTRAL ELECTRIC STATIONS—GROSS INCOME, BY STATES: 1912, 1907, AND 1902.

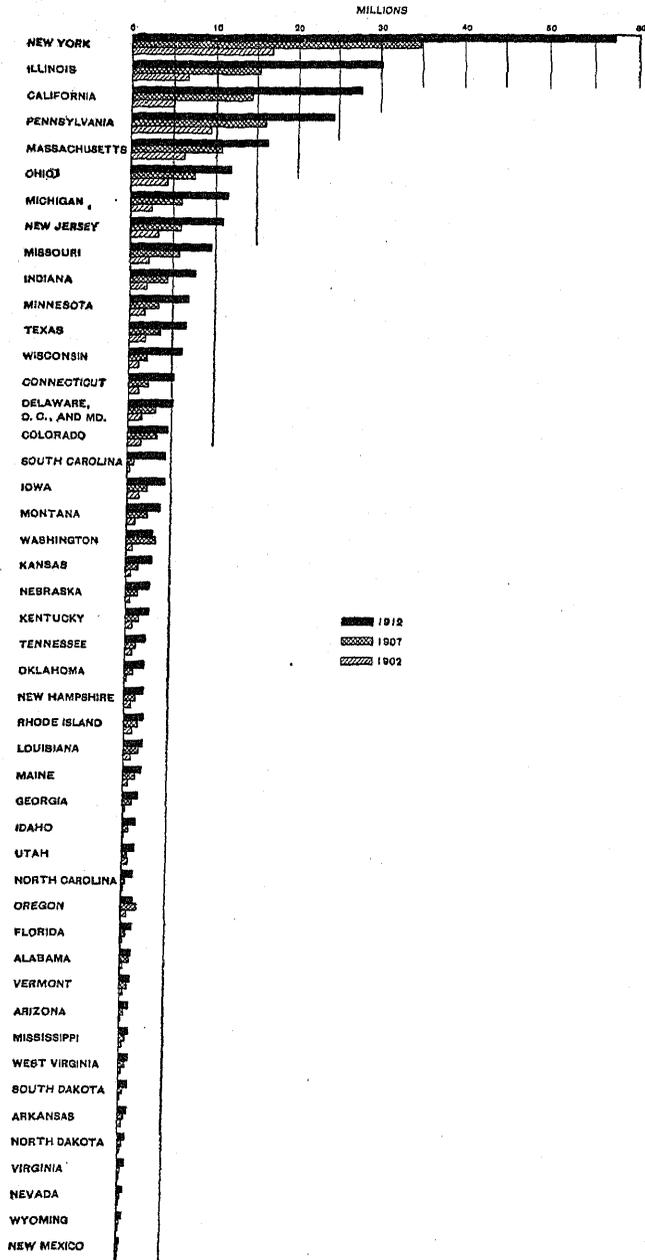
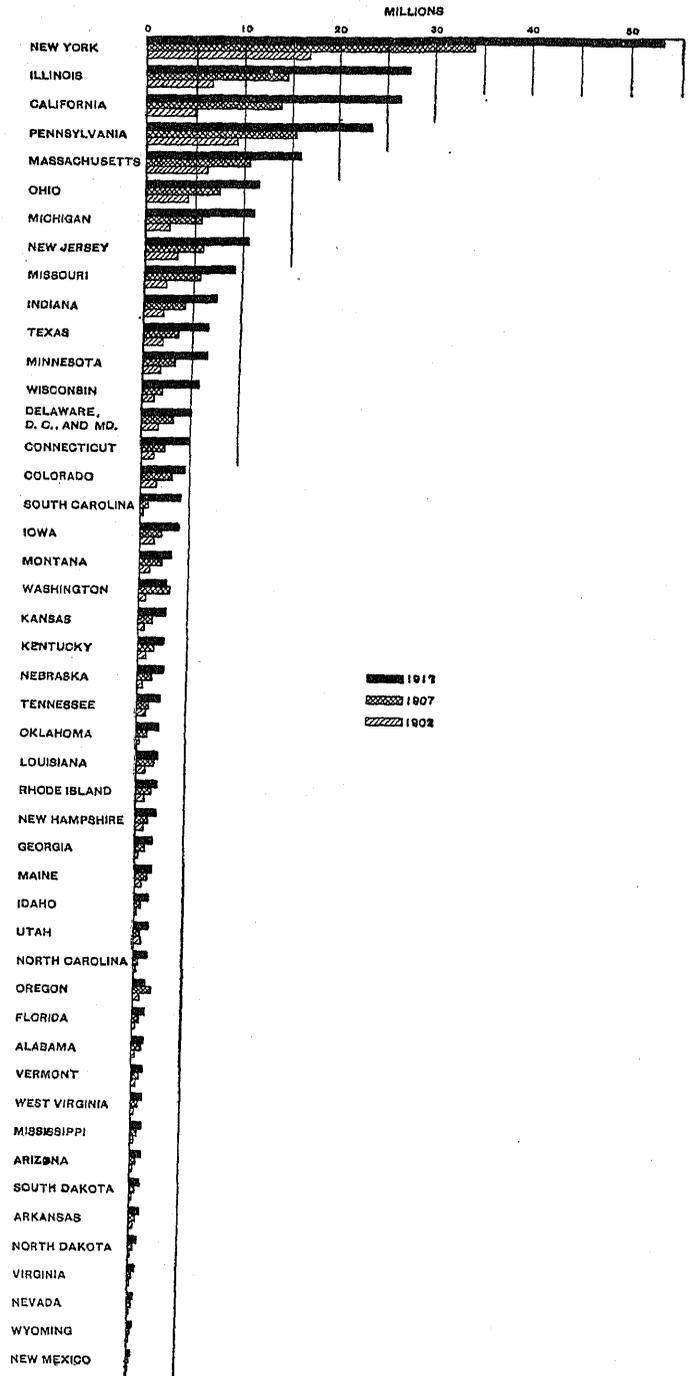


DIAGRAM 16.—CENTRAL ELECTRIC STATIONS—INCOME FROM ELECTRIC SERVICE, BY STATES: 1912, 1907, AND 1902.



Changes in the size of the dynamos used in central stations and data as to earning capacity in respect to size are presented in the following comparative table, which gives for 1912, 1907, and 1902 the gross income for stations grouped according to dynamo capacity.

CENTRAL ELECTRIC STATIONS—GROSS INCOME FOR STATIONS GROUPED ACCORDING TO DYNAMO CAPACITY: 1912, 1907, AND 1902.

CLASS OF INCOME.	Census.	Total.	STATIONS GROUPED ACCORDING TO DYNAMO CAPACITY.						Stations having no generating equipment.
			Under 200 kilowatts.	200 and under 500 kilowatts.	500 and under 1,000 kilowatts.	1,000 and under 2,000 kilowatts.	2,000 and under 5,000 kilowatts.	5,000 kilowatts and over.	
Number of stations.....	1912	5,221	2,002	948	327	214	152	161	507
	1907	4,714	3,038	821	269	169	115	75	227
	1902	3,620	2,587	586	172	98	67	32	78
Per cent of increase: 1902-1912.....		44.2	12.2	61.8	95.9	118.4	126.9	403.1	550.0
Gross income.....	1912	\$302,115,590	\$16,625,878	\$18,111,238	\$14,079,923	\$16,518,054	\$25,448,529	\$188,434,343	\$22,897,634
	1907	175,642,333	17,140,070	14,786,719	10,465,110	13,149,808	21,915,199	89,930,073	8,255,359
	1902	85,700,605	14,440,351	10,409,319	7,001,486	8,414,307	13,839,846	30,027,061	1,568,235
Per cent of increase: 1902-1912.....		252.5	15.1	74.0	101.1	96.3	83.9	527.5	1,360.1
Electric service.....	1912	286,980,858	15,934,092	17,166,227	13,322,200	15,832,795	24,398,710	179,107,243	21,219,591
	1907	169,614,691	16,344,745	13,954,088	10,075,476	12,617,855	21,277,402	87,277,832	8,067,293
	1902	84,186,605	14,090,189	10,122,092	6,896,143	8,175,941	13,635,206	29,756,206	1,510,828
Per cent of increase: 1902-1912.....		240.9	13.1	69.6	93.2	93.7	76.9	501.9	1,304.5
All other sources.....	1912	15,134,741	691,786	945,011	757,723	685,259	1,049,819	9,327,100	1,678,043
	1907	6,027,647	795,325	832,631	389,634	531,953	637,797	2,652,241	188,066
	1902	1,514,000	350,162	287,227	106,343	238,366	204,640	270,855	57,407
Per cent of increase: 1902-1912.....		899.7	97.6	229.0	619.3	187.5	413.0	3,343.6	2,823.1

The distinctive changes brought out by this table are the exceptionally large growth of income for stations with dynamos of the largest capacity and the remarkable increase in that for stations without generating equipment.

Between 1902 and 1912 the total income increased by \$216,414,994, of which amount the increase for the stations reporting a dynamo capacity of 5,000 kilowatts and over was \$158,407,282, or 73.2 per cent, and for the stations without generating equipment, \$21,329,399, or 13.5 per cent; the increases for these two classes alone thus representing 86.7 per cent of the total growth. In 1902, of the total income for electric service that for stations reporting dynamos of 5,000 kilowatts and over represented 35.3 per cent and that for stations without generating equipment 1.8 per cent. In 1912 the proportions for these classes of stations had increased to 62.4 per cent and 7.4 per cent, respectively.

The smallest increase in gross income during the decade is shown for the stations having less than 200-kilowatt capacity, while, on the other hand, the largest increase for stations reporting dynamos is shown for those of 5,000 kilowatts and over.

The largest percentage of increase in gross income for any class of stations in the table is reported for the stations having no generating equipment, which emphasizes the growth in the operations of stations using purchased current. This condition has largely been brought about by the economy connected with the generation of electricity in stations of large dynamo capacity, which is made available over large areas by means of long-distance transmission lines.

Expenses.—Details for expenses, like details for income, were reported differently at the several cen-

suses. In the following table the expenses are shown in detail as reported in 1912, with the percentage which each item of expense forms of the total.

ACCOUNT.	CENTRAL ELECTRIC STATIONS—EXPENSES: 1912.	
	Amount.	Per cent of total.
Total expenses.....	\$234,419,478.	100.0
Fuel.....	34,743,754	14.8
Electric current and electric power purchased.....	18,074,344	7.7
Rent of offices, conduits, underground and water privileges.....	4,279,596	1.8
Supplies, materials, salaries and wages, and other miscellaneous expenses, not elsewhere specified.....	91,847,508	39.2
Taxes:		
Real and personal property.....	8,048,291	3.5
Capital stock.....	997,012	0.4
Federal corporation.....	558,706	0.2
Earnings.....	2,598,338	1.1
Miscellaneous.....	944,991	0.4
Interest on funded and floating debt.....	48,302,900	20.6
Injuries and damages.....	1,200,989	0.5
Insurance.....	2,320,151	1.0
Charges for depreciation.....	18,843,863	8.0
Charges for sinking fund.....	1,654,035	0.7

Of the expenses reported in 1912, supplies, etc., constituted the chief item, and formed 39.2 per cent of the total; interest on funded and floating debt, 20.6 per cent, was second; and cost of fuel, 14.8 per cent, was third. Charges for depreciation and charges for sinking fund, not reported at prior censuses, combined formed 8.7 per cent of the expenses; and taxes, which are reported in considerable detail, formed 5.6 per cent.

For comparison with prior censuses it is necessary to arrange the expenses into the four groups for which separate figures are given in the following table. The total for supplies, materials, and salaries and wages includes sundry expenses incident to operation and maintenance, such as advertising, law expenses, tele-

graph and telephone service, power other than electric, and expenses of a similar character not elsewhere reported. In the reports for 1902 and 1907 interest on funded debt was treated as a fixed charge and not as an item of expense; but to make the data for these two years comparable with the figures for 1912, interest amounting to \$27,991,762 in 1907 and \$12,623,545 in 1902 has been included with the expenses for those two years. The total for rent of offices, etc., in 1912 includes charges for depreciation, \$18,843,863, and charges for sinking fund, \$1,654,035, or \$20,497,898 in all for items that were not reported at the censuses of 1907 and 1902.

Table 48

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—EXPENSES: 1912, 1907, AND 1902.

CLASS.	Total.	Commer- cial.	Municipal.	Per cent of total.	
				Com- mer- cial.	Muni- cipal.
Number of stations:					
1912.....	5,221	3,650	1,562	70.1	29.9
1907.....	4,714	3,462	1,252	73.4	26.6
1902.....	3,620	2,805	815	77.5	22.5
Total expenses:					
1912.....	\$234,419,478	\$217,502,313	\$16,917,165	92.8	7.2
1907.....	134,196,911	123,880,201	10,316,620	92.3	7.7
1902.....	68,081,375	62,835,388	5,245,987	92.3	7.7
Rent of offices, conduits, and water privileges; taxes, interest on fund- ed and floating debt, injuries and damages, insurance, and charges for depreciation and sinking fund—					
1912.....	89,748,872	87,022,175	2,726,697	97.0	3.0
1907.....	51,061,122	49,434,241	1,626,881	96.8	3.2
1902.....	21,817,004	21,094,560	722,444	96.7	3.3
Cost of fuel—					
1912.....	34,748,754	30,373,445	4,375,309	87.4	12.6
1907.....	23,057,745	19,824,902	3,232,783	86.0	14.0
1902.....	11,635,509	10,189,685	1,445,824	87.6	12.4
Electric power pur- chased—					
1912.....	18,074,344	16,912,612	1,161,732	93.6	6.4
1907.....	6,417,237	6,080,905	336,332	94.8	5.2
1902.....	2,130,759	2,007,193	123,566	94.2	5.8
Supplies and materials, including salaries and wages, and other ex- penses not elsewhere included—					
1912.....	91,847,508	83,194,081	8,653,427	90.6	9.4
1907.....	53,660,807	48,540,183	5,120,624	90.5	9.5
1902.....	32,498,103	29,543,950	2,954,153	90.9	9.1
Per cent of increase:					
Number of stations—					
1902-1912.....	44.2	30.4	91.7		
1907-1912.....	10.8	5.7	24.8		
1902-1907.....	30.2	23.4	53.6		
Total expenses—					
1902-1912.....	244.3	246.1	222.5		
1907-1912.....	74.7	75.6	64.0		
1902-1907.....	97.1	97.2	96.7		
Rent of offices, conduits, and water privileges; taxes, interest on fund- ed and floating debt, injuries and damages, insurance, and charges for depreciation and sinking fund—					
1902-1912.....	311.4	312.5	277.4		
1907-1912.....	75.8	70.0	67.6		
1902-1907.....	134.0	134.3	125.2		
Cost of fuel—					
1902-1912.....	198.6	198.1	202.6		
1907-1912.....	50.7	53.2	35.3		
1902-1907.....	98.2	94.6	123.6		
Electric power pur- chased—					
1902-1912.....	748.3	742.6	840.2		
1907-1912.....	131.7	178.1	245.4		
1902-1907.....	201.2	203.0	172.2		
Supplies and materials, including salaries and wages, and other ex- penses not elsewhere included—					
1902-1912.....	182.6	181.6	192.9		
1907-1912.....	71.2	71.4	69.0		
1902-1907.....	65.1	64.3	73.3		

¹ Includes a small amount paid for power other than electric.

In 1912 the largest single item of expense, \$91,847,508, was for supplies and materials, etc., which formed 39.2 per cent of the total expenses for that year, as compared with 47.7 per cent in 1902. The largest percentages of increase are shown for electric power purchased, and although the amount shown for this item forms but a small proportion of the total, the increased percentage in 1912 is in harmony with the general trend toward the concentration of generating stations into larger units of capacity and the purchase of current by the smaller ones wherever practicable. In fact, the economy of large units is generally recognized in the electrical world.

Of the total expenses, the proportions contributed by the two classes of stations, commercial and municipal, vary but little from census to census. For the municipal stations the largest proportion for any one item, 12.6 per cent in 1912 and 12.4 per cent in 1902, is shown for cost of fuel. These stations are generally small and built to meet the demands of the municipalities, and water-power is seldom available. The municipal stations, for instance, in 1912 reported 20.2 per cent of the total horsepower for gas and oil engines, 8.2 per cent of the total for steam power, and for water power but 5.3 per cent.

Balance sheet, commercial companies.—The special data covered by this inquiry embrace details relative to assets and liabilities, together with the deficit or surplus. The difference between the deficit and surplus shows a net surplus for each geographic division and state.

Table 49 (p. 72) gives the assets and liabilities for commercial central stations, by geographic divisions and states.

Assets.—The \$2,098,613,122 reported as the cost of construction, equipment, and real estate should not be considered as representing the value of properties which are engaged exclusively in the generation and distribution of electric current. In the case of the large hydroelectric station—the type which has had the greatest growth in the last five-year period, 1907 to 1912—many and varying conditions under which the stations are built and equipped must be given consideration. Often large tracts of land must be purchased, miles of riparian rights secured, large reservoirs built to secure a plentiful supply of water, and private rights of way acquired for the high-voltage lines; these and many other factors enter into the values shown by the figures in the table. Again, the franchise values, good will, intangible assets, etc., are often included, so that the actual cost of construction, equipment, and real estate is affected more or less according to the methods of bookkeeping employed by the reporting company. There were many different methods of bookkeeping shown in the balance sheets of the various companies reporting, but it is probable that a company would not underestimate the value of its properties or magnify the sum of its liabilities. The average cost per kilowatt capacity of dynamos of

commercial stations in 1902 was \$439 in 1907 it had decreased to \$422, while in 1912 it had increased to \$440—practically the same as 10 years before. The average cost per horsepower capacity of prime movers, which had decreased from \$286 in 1902 to \$279 in 1907, increased to \$301 in 1912, a gain of \$22 per initial horsepower in the latter five years.

The 3,659 companies whose financial condition is reflected in the balance sheet held as assets in 1912, stocks and bonds of companies other than electric to the value of \$65,895,784, and of other electric companies to the value of \$77,787,160, in addition to other permanent investments listed at \$10,825,932. These combined holdings amounted to over 6 per cent of the total assets.

A number of companies hold as assets varying amounts of their own stock and bonds which may be carried as current assets or used as collateral for floating loans or for immediate delivery in case of sale. These are more or less a bookkeeping liability and represent a certain amount of duplication which should be deducted from the total invested to secure the net capitalization. The item of cash, current assets, and supplies was \$140,138,589, and includes bills, notes, and accounts receivable, and represents the working capital of the companies. The total amount reported for the sinking and other special funds was \$9,939,237.

Liabilities.—In addition to the \$977,639,057 of common stock, \$176,947,959 of preferred stock, and \$897,907,681 of bonds issued, there was \$12,165,075 reported as “cash” invested in central electric stations. This amount represents the cash capital of the 587 individuals, 293 firms, and seven other forms of ownership engaged in the generation of electric current. There were also a few cases of large corporations engaged in other branches of industry which, either from local pride or from sociological motives, furnished electric current for lighting small towns in the immediate neighborhood. The investment in electrical equipment in such cases was so small as compared with the whole establishment, that, for accounting purposes, it was carried as “cash investment” upon the books of the company. The item of \$137,726,385, which is shown as floating debt, includes loans and notes, in addition to short-time securities floated for the purpose

of construction, purchase of new equipment, etc. It forms 6.3 per cent of the aggregate amount of stock, funded debt, cash investment, and floating debt.

Notwithstanding the fact that the difference between the deficit and surplus results in a net surplus amounting to \$115,671,116, for the commercial stations as a whole, that not all of these companies were successful financially is evidenced by the deficit shown of \$7,409,621. In but few states, however, does the deficit form an appreciable part of the total.

Balance sheet, municipal stations.—Table 50 (p. 74) presents a balance sheet of municipal stations for the year ended December 31, 1912.

Many of the municipalities operating electric stations do not have systems of bookkeeping which are adapted to the uniform system of accounts generally employed by the commercial stations. The lighting plant is often operated not upon a separate basis but as one of the branches of the utilities of the municipality; and some other branch of the utilities may not only absorb the surplus and supply the deficit, but use the income, which often is not commensurate with the services rendered for various purposes, and may impose upon the electric plant, without adequate reimbursement, many expenses in the way of service.

Under these conditions the comparison of the cost of construction, equipment, and real estate with the funded debt, cash investments, and real estate mortgages has but little significance. The additions and betterments are often made by a special tax levy or a sum voted for the purpose out of the general receipts from taxation without any additional encumbrance being placed on the plant. With many of the stations the balance sheet is really a yearly statement rather than an accumulative summary of the financial condition.

DETAILED COMPARATIVE SUMMARY.

In the several tables of this report comparative statistics have been presented for the various features peculiar to the electric light and power industry, such as primary power, dynamo capacity, and line equipment, each subject being treated in a separate table. Table 55 (p. 82) brings together the principal facts in a detailed comparative summary, by geographic divisions and states, for 1912, 1907, and 1902.

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

COMMERCIAL CENTRAL ELECTRIC STATIONS—BALANCE

Table 49 DIVISION AND STATE.		ASSETS										
		Cost of construction, equipment, and real estate.	Stock and bonds of other electric companies.	Stock and bonds of companies other than electric.	Treasury securities.		Other permanent investments.	Cash and current assets, including supplies.	Stock and bond discount.	Sinking and other special funds.	Sundries.	Profit and loss deficit for companies showing a deficit.
					Stock.	Bonds.						
1	UNITED STATES.....	\$2,098,613,122	\$77,787,160	\$65,895,784	\$16,418,819	\$32,099,639	\$10,825,932	\$140,138,589	\$20,229,893	\$9,939,237	\$10,665,361	\$7,409,621
GEOGRAPHIC DIVISIONS:												
2	New England.....	147,947,181	2,769,854	5,076,669	479,202	413,507	688,661	11,582,675	173,714	593,362	1,006,191	143,463
3	Middle Atlantic.....	589,011,561	25,851,737	23,167,238	3,345,030	7,430,486	3,782,301	47,902,799	2,077,714	2,840,929	2,559,305	1,716,163
4	East North Central.....	357,102,214	3,924,608	7,574,629	4,330,426	8,006,267	1,518,117	25,590,642	2,380,046	1,130,978	1,349,152	2,705,922
5	West North Central.....	159,568,592	15,548,030	861,540	1,570,441	7,896,900	77,118	13,150,220	1,084,543	819,601	856,469	401,553
6	South Atlantic.....	127,176,089	6,137,901	4,312,349	501,550	740,119	577,760	7,475,162	659,112	600,087	173,117	778,670
7	East South Central.....	70,760,454	59,023	8,990	187,529	1,134,555	149,537	3,057,994	888,016	101,953	296,662	116,437
8	West South Central.....	71,901,145	451,013	18,000	166,907	144,004	72,548	3,637,253	559,794	156,297	635,264	370,587
9	Mountain.....	201,965,260	11,214,352	1,743,797	3,111,275	2,083,000	2,033,959	12,585,623	2,571,574	345,603	1,708,670	382,442
10	Pacific.....	382,081,617	11,829,784	23,132,572	2,717,369	3,350,801	1,295,931	15,156,213	9,235,380	3,350,427	2,080,531	704,384
NEW ENGLAND:												
11	Maine.....	19,687,953	136,700	2,540,131	463,600	108,643	10,128	1,024,179	50,153	55,975	45,856	23,243
12	New Hampshire.....	17,905,032	2,222,026	3,425	3,500	32,981	138,005	836,059	64,768	84,244	176,707	18,953
13	Vermont.....	9,277,420	.....	.....	7,000	175,283	8,391	483,664	36,110	118,736	75,333	16,931
14	Massachusetts.....	68,395,610	.....	301,388	.....	.....	201,334	5,963,643	.....	246,374	594,407	70,250
15	Rhode Island.....	11,330,919	361,128	534,195	.....	69,600	.....	1,131,589	.....	74,104	14,292	1,337
16	Connecticut.....	21,350,244	50,000	1,697,930	5,102	33,000	330,803	2,143,544	22,683	13,929	99,596	12,744
MIDDLE ATLANTIC:												
17	New York.....	348,096,341	18,542,881	16,130,282	2,699,070	882,418	2,715,977	36,014,118	1,446,210	2,508,855	626,688	1,290,269
18	New Jersey.....	68,069,100	280,772	68,488	23,750	2,259,370	376,996	3,311,007	50,723	154,881	1,577,871	92,070
19	Pennsylvania.....	162,046,060	7,028,084	6,950,468	622,210	4,288,698	680,328	8,577,674	574,781	177,193	354,746	333,824
EAST NORTH CENTRAL:												
20	Ohio.....	64,625,010	193,350	1,758,289	479,414	1,719,890	70,341	3,170,248	314,828	213,209	156,386	113,812
21	Indiana.....	43,747,700	17,088	184,456	1,680,502	3,268,850	51,131	2,836,320	774,621	42,262	169,090	195,003
22	Illinois.....	147,782,820	1,504,780	5,605,686	960,000	1,928,672	533,534	12,100,007	154,006	399,452	245,203	8,884
23	Michigan.....	66,285,610	144,100	55,030	68,425	147,800	214,603	4,932,454	938,907	157,439	571,267	2,076,983
24	Wisconsin.....	34,661,074	2,060,290	71,168	1,142,075	941,055	648,508	2,455,613	197,684	318,616	207,206	311,285
WEST NORTH CENTRAL:												
25	Minnesota.....	41,767,683	10,461,780	15,416	18,750	3,442,500	.....	3,935,332	378,541	403,331	46,462	66,869
26	Iowa.....	20,555,159	10,000	10,611	491,514	1,658,345	54,118	1,690,230	118,833	34,244	258,756	131,033
27	Missouri.....	46,350,586	781,196	303,136	2,500	409,583	15,000	4,572,167	819,000	30,902	176,136	123,410
28	North Dakota.....	4,598,964	3,025,700	14,700	.....	1,314,700	.....	340,285	119,875	82,630	1,212	.....
29	South Dakota.....	10,985,163	.....	114,693	218,818	163,000	1,000	442,441	49,440	19,812	220,730	28,617
30	Nebraska.....	11,595,718	166,726	27,912	146,859	538,772	.....	589,092	47,911	266,658	28,591	70,733
31	Kansas.....	23,745,324	1,103,534	270,072	701,000	370,000	7,000	1,580,673	150,943	3,000	124,582	70,841
SOUTH ATLANTIC:												
32	Delaware, District of Columbia, and Maryland.....	39,527,113	1,703,952	1,375,575	8,300	428,649	156,718	2,442,026	400,031	455,967	73,080	93,350
33	Virginia.....	9,517,318	68,990	.....	18,500	31,000	25,456	223,670	331	4,614	2,625	11,395
34	West Virginia.....	13,280,643	42,000	2,875	130,000	70,750	44,044	426,772	69,288	8,554	8,643	25,037
35	North Carolina.....	10,722,951	.....	11,274	.....	30,000	.....	440,529	.....	10,543	38,527	23,833
36	South Carolina.....	33,436,891	4,322,959	2,735,425	.....	51,970	345,242	3,047,810	109,637	115,133	49,156	429,979
37	Georgia.....	18,344,251	.....	185,000	.....	52,750	6,300	728,243	62,400	5,276	1,014	129,265
38	Florida.....	2,346,922	.....	2,200	344,750	75,000	.....	166,112	17,423	.....	72	65,811
EAST SOUTH CENTRAL:												
39	Kentucky.....	19,025,541	.....	.....	4,929	1,020,825	500	710,745	565,000	85,964	39,613	52,156
40	Tennessee.....	39,953,142	.....	1,110	32,600	14,230	.....	1,568,238	65	3,773	119,339	25,758
41	Alabama.....	7,975,241	25,000	7,150	150,000	.....	149,037	548,011	143,905	29	137,096	34,565
42	Mississippi.....	3,815,530	34,025	700	.....	59,500	.....	231,000	179,043	12,187	614	3,958
WEST SOUTH CENTRAL:												
43	Arkansas.....	4,242,013	.....	2,500	101,000	.....	17,723	252,932	38,000	9,820	28,084	50,493
44	Louisiana.....	13,093,106	7,500	363	6,910	.....	12,880	498,286	.....	114,070	34,793	11,997
45	Oklahoma.....	11,697,726	423,513	7,350	3,831	143,654	5,321	637,444	251,035	27,921	195,981	132,433
46	Texas.....	42,358,300	20,000	7,787	55,255	350	36,624	2,338,591	270,759	4,436	370,466	175,664
MOUNTAIN:												
47	Montana.....	64,441,739	2,000	1,379,846	35,425	73,000	2,334	7,546,623	980,420	56,327	67,608	16,985
48	Idaho.....	32,245,940	10,134,400	70,175	1,206,685	983,000	1,831,793	1,184,677	238,646	15,504	577,261	208,015
49	Wyoming.....	2,167,032	.....	.....	.....	.....	.....	154,438	28,400	38,707	4,098	11,552
50	Colorado.....	66,709,390	854,322	263,382	1,711,632	1,507,000	352,846	2,234,277	569,438	121,539	309,218	110,716
51	New Mexico.....	3,070,844	149,502	1,155	15,077	125,000	858,564	170,960	50,000	.....	21,281	22,036
52	Arizona.....	9,255,049	.....	2,989	.....	70,000	91,922	352,729	621,545	5,838	672,516	6,407
53	Utah.....	11,095,475	6,000	10,500	130,956	225,000	26,500	446,187	83,125	20,080	56,248	6,075
54	Nevada.....	12,977,000	68,128	15,750	11,500	.....	.....	495,732	.....	87,458	440	6,056
PACIFIC:												
55	Washington.....	16,316,527	394,700	10,225	368,920	166,426	151,539	1,015,679	351,609	6,094	33,546	126,135
56	Oregon.....	23,230,309	227,764	6,871	445,608	209,918	39,454	591,314	225,733	23,909	192,742	21,435
57	California.....	342,534,781	11,207,270	23,115,476	1,902,841	2,974,457	1,104,938	13,549,225	8,658,038	3,320,424	1,864,243	556,814

FINANCIAL STATISTICS.

SHEET, BY GEOGRAPHIC DIVISIONS AND STATES: 1912.

Total— Assets or liabilities.	LIABILITIES.											Net surplus.	
	Capital stock.		Funded debt.	Cash in- vestments.	Real estate mortgages.	Floating debt.	Reserves.	Accounts payable.	Interest and taxes due and accrued.	Divi- dends due.	Sundries.		Profit and loss surplus for com- panies showing a surplus.
	Common.	Preferred.											
\$2,490,023,157	\$977,639,057	\$176,947,959	\$897,907,651	\$12,165,075	\$10,170,898	\$137,726,385	\$64,422,773	\$40,936,406	\$19,007,229	\$3,214,790	\$26,804,167	\$123,080,737	\$115,671,116
170,874,452	75,834,720	4,439,400	34,085,052	338,573	3,590,632	17,180,314	3,294,642	2,350,737	473,467	715,705	18,885,334	9,635,906	9,402,443
700,685,263	253,732,087	26,025,176	266,347,898	1,114,784	3,126,937	49,067,682	25,230,361	11,608,732	7,037,488	211,549	3,146,683	54,035,936	52,319,773
415,613,001	153,343,283	26,166,726	160,241,006	3,529,160	1,261,846	19,093,604	19,218,890	6,088,855	5,085,988	339,878	1,045,172	20,149,093	17,443,171
202,534,913	65,534,602	18,814,511	83,185,109	2,592,464	1,144,148	11,095,205	4,400,763	4,492,791	1,408,765	330,467	1,204,854	9,233,234	8,791,681
149,131,916	54,165,186	20,043,810	56,663,669	714,564	279,217	7,458,913	1,537,995	1,320,554	573,296	554,616	1,151,197	4,663,899	3,890,229
76,770,152	39,038,397	2,310,783	27,589,301	447,055	245,053	2,725,615	381,783	1,003,826	428,223	121,966	115,958	2,365,162	2,248,725
78,202,902	32,128,311	10,328,085	22,391,853	1,408,455	256,925	4,258,274	1,101,204	1,022,211	452,389	50,389	1,092,901	3,711,905	3,341,318
241,275,564	109,037,743	23,045,147	74,017,501	704,199	184,624	17,233,618	1,640,982	3,141,800	1,370,948	169,930	664,777	10,064,295	9,681,853
454,934,964	194,824,728	45,774,321	173,386,292	1,265,871	81,516	9,613,160	7,616,653	9,906,900	2,181,665	620,290	497,261	9,166,307	8,461,923
24,146,569	8,510,358	1,423,600	9,885,583	134,030	1,418,400	1,173,910	67,085	175,516	55,696	25,891	12,070	1,264,430	1,241,182
21,485,700	9,283,000	1,256,400	7,427,102	87,358	295,582	1,063,279	318,482	342,154	88,934	5,959	124,361	1,242,089	1,223,136
10,198,868	4,692,705	99,750	3,732,384	113,885	15,650	608,571	225,238	140,947	17,618	10,906	592,214	592,214	545,283
75,773,006	33,972,627	368,850	3,854,100	98,059	1,831,500	10,414,874	1,648,557	1,058,504	133,806	520,147	17,888,821	3,983,161	3,912,911
13,511,164	6,769,700	1,046,800	3,912,300	5,241	28,500	216,755	780,281	112,237	36,892	94,300	117,015	415,934	414,597
25,759,175	12,636,330	245,000	5,278,583	5,241	28,500	3,702,925	245,909	521,329	140,521	69,408	722,261	2,168,078	2,155,334
431,562,109	140,362,305	18,193,887	150,915,443	598,690	1,297,525	41,676,041	24,144,403	6,860,969	4,611,474	159,437	2,308,809	40,433,123	39,142,854
76,871,088	39,512,305	419,560	30,778,222	392,415	1,390,850	6,555,087	360,374	1,018,801	1,481,299	16,670	1,481,299	1,766,576	1,674,506
192,252,066	73,857,477	7,411,729	84,654,233	392,415	1,390,850	6,555,087	725,584	3,728,962	944,715	35,442	619,335	11,836,237	11,502,413
72,825,777	28,992,200	6,300,859	17,578,400	1,028,272	445,550	3,378,738	9,883,289	1,527,425	377,863	265,589	246,624	2,300,988	2,137,156
52,967,023	17,040,804	1,741,200	24,261,900	354,572	37,640	3,295,910	642,238	621,514	296,353	3,933	64,249	4,606,710	4,411,707
171,213,044	70,796,041	11,735,652	65,798,061	791,830	192,284	4,584,295	5,307,928	1,072,372	2,076,612	2,375	614,364	8,240,523	8,231,639
75,592,583	22,335,387	3,054,650	34,702,061	1,100,848	258,200	6,116,810	1,483,419	1,673,870	1,862,352	19,366	91,641	2,893,579	816,641
43,014,574	14,177,674	3,334,335	17,900,584	253,638	328,172	1,217,851	1,901,516	1,193,674	472,808	98,615	28,394	2,107,313	1,796,028
60,536,664	14,806,119	7,507,000	28,771,483	392,619	325,500	4,420,924	954,456	666,532	530,664	159,700	27,520	1,974,147	1,907,278
25,000,917	9,402,131	1,451,853	9,799,321	592,774	121,629	1,941,568	157,723	414,936	141,222	55,799	58,480	1,403,481	1,272,398
53,073,016	17,481,761	1,415,070	23,246,160	345,527	149,500	1,422,558	2,750,603	2,567,462	388,842	100,368	51,682	3,754,083	3,630,673
9,498,066	2,040,000	2,019,900	3,371,700	205,450	77,800	1,312,853	50,618	42,128	44,333	33,057	82	300,145	300,145
12,243,709	5,340,310	1,198,600	4,108,144	141,318	273,500	490,146	88,335	161,673	99,124	2,524	12,526	327,509	298,892
13,448,972	6,325,977	669,838	4,171,151	374,470	44,785	689,138	89,630	181,365	81,401	610	29,611	791,098	260,696
28,132,969	10,078,304	4,552,250	9,717,150	540,306	151,434	1,418,020	309,398	458,695	121,179	28,509	24,953	732,771	661,930
46,664,761	14,037,170	4,192,024	23,755,200	129,705	88,550	1,601,396	960,630	406,894	171,409	43,878	6,182	1,277,823	1,184,473
9,903,899	4,100,306	1,129,663	3,405,625	118,331	19,000	807,882	3,962	145,596	32,212	1,406	964	138,952	127,557
14,108,600	6,078,571	1,089,337	5,173,957	81,575	10,000	995,169	93,274	215,009	34,075	3,500	996	333,143	308,106
11,277,657	5,260,350	125,500	4,616,632	147,600	3,500	502,753	87,194	118,778	7,915	72,740	4,454	300,241	306,408
44,644,202	15,601,572	13,104,300	10,978,957	77,620	45,000	1,723,640	353,035	190,079	137,173	432,158	51,804	1,942,358	1,512,879
19,514,499	7,752,100	372,986	8,120,805	107,279	20,000	1,298,767	40,000	139,513	187,416	794	1,084,878	339,961	260,696
3,018,292	1,335,117	30,000	615,493	52,454	98,167	529,300	-----	96,685	3,096	140	1,919	255,921	190,110
21,505,273	8,557,069	860,333	8,944,500	112,885	101,933	1,429,686	226,548	332,496	170,235	67,409	60,001	642,178	590,022
41,718,258	25,828,823	190,000	13,322,894	161,321	24,800	407,752	92,371	438,389	166,924	40,578	1,843	1,042,583	1,016,825
9,170,064	2,916,433	852,500	3,769,917	137,481	13,600	669,111	52,161	171,454	54,530	9,946			

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

MUNICIPAL CENTRAL ELECTRIC STATIONS—BALANCE

Table 50 DIVISION AND STATE.		ASSETS.						Profit and loss deficit for stations showing a deficit.	Total—Assets or liabilities.
		Cost of construction, equipment, and real estate.	Other permanent investments.	Cash and current assets, including supplies.	Stock and bond discount.	Sinking and other special funds.	Sundries.		
1	UNITED STATES.....	\$77,065,144	\$41,336	\$5,381,152	\$18,432	\$1,659,098	\$1,907,100	\$448,863	\$86,521,125
GEOGRAPHIC DIVISIONS:									
2	New England.....	5,521,077	9,506	537,841	.....	360,042	68,768	248,118	6,745,952
3	Middle Atlantic.....	4,095,800	.....	254,779	130	47,422	7,624	3,074	4,408,829
4	East North Central.....	31,473,659	7,830	1,584,067	42	418,957	1,759,389	44,343	35,288,287
5	West North Central.....	10,738,343	24,000	826,373	10,550	61,876	48,870	60,754	11,770,766
6	South Atlantic.....	7,134,097	.....	570,190	6,005	589,619	5,189	7,810	8,312,910
7	East South Central.....	4,195,120	.....	112,886	1,705	17,318	3,978	34,942	4,365,949
8	West South Central.....	4,061,629	.....	87,239	.....	36,334	6,627	9,777	4,201,506
9	Mountain.....	1,230,529	.....	103,816	.....	13,706	2,637	6,000	1,356,688
10	Pacific.....	8,614,890	.....	1,303,961	.....	113,224	3,718	34,045	10,069,838
NEW ENGLAND:									
11	Maine.....	238,336	.....	6,241	.....	1,544	.....	.....	246,121
12	New Hampshire.....	156,544	.....	3,339	.....	19,500	.....	.....	179,383
13	Vermont.....	750,150	9,506	69,817	.....	10,542	8,000	5,100	853,145
14	Massachusetts.....	3,311,628	.....	416,752	.....	296,056	60,768	243,018	4,328,222
15	Rhode Island.....	8,375	.....	2,300	.....	.....	.....	.....	10,675
16	Connecticut.....	1,056,014	.....	39,392	.....	33,000	.....	.....	1,128,406
MIDDLE ATLANTIC:									
17	New York.....	1,830,563	.....	211,940	.....	3,769	2,624	3,074	2,051,970
18	New Jersey.....	389,221	.....	4,985	.....	25,436	.....	.....	419,642
19	Pennsylvania.....	1,870,016	.....	37,854	130	18,217	5,000	.....	1,937,217
EAST NORTH CENTRAL:									
20	Ohio.....	4,618,884	.....	216,534	.....	286,311	4,636	5,138	5,131,403
21	Indiana.....	4,182,552	7,680	286,547	.....	28,856	75	2,897	4,608,607
22	Illinois.....	14,321,406	.....	408,131	.....	60,023	1,733,780	857	16,524,197
23	Michigan.....	6,479,220	150	593,287	.....	24,731	13,780	15,701	7,036,869
24	Wisconsin.....	1,871,597	.....	169,568	42	19,030	7,218	19,750	2,087,211
WEST NORTH CENTRAL:									
25	Minnesota.....	2,593,227	.....	299,483	.....	2,885	1,380	32,941	2,929,916
26	Iowa.....	1,571,359	.....	184,934	.....	4,147	2,650	11,324	1,774,414
27	Missouri.....	2,374,124	4,000	87,615	10,000	41,403	43,650	2,745	2,403,497
28	North Dakota.....	282,068	.....	28,269	.....	2,000	.....	.....	312,937
29	South Dakota.....	332,883	.....	24,453	.....	.....	.....	.....	357,336
30	Nebraska.....	1,405,593	20,000	107,665	.....	6,071	1,190	4,512	1,545,036
31	Kansas.....	2,278,484	.....	94,054	550	5,310	.....	6,232	2,387,630
SOUTH ATLANTIC:									
32	Delaware, District of Columbia, and Maryland.....	443,309	.....	13,201	.....	4,320	.....	.....	460,830
33	Virginia.....	1,410,061	.....	11,550	.....	1,070	.....	.....	1,422,681
34	West Virginia.....	100,530	.....	2,222	.....	810	190	.....	112,852
35	North Carolina.....	1,367,280	.....	91,269	2,500	3,900	3,049	.....	1,458,028
36	South Carolina.....	575,477	.....	51,662	3,505	.....	1,800	2,579	634,963
37	Georgia.....	1,546,674	.....	188,828	.....	6,394	.....	4,764	1,745,310
38	Florida.....	1,681,766	.....	211,888	.....	573,125	150	467	2,467,246
EAST SOUTH CENTRAL:									
39	Kentucky.....	683,482	.....	13,241	.....	1,318	.....	9,790	707,831
40	Tennessee.....	1,564,274	.....	46,380	102	15,500	35	2,500	1,628,791
41	Alabama.....	751,635	.....	12,893	1,603	.....	3,943	19,199	789,178
42	Mississippi.....	1,195,829	.....	40,367	.....	500	.....	3,453	1,240,149
WEST SOUTH CENTRAL:									
43	Arkansas.....	569,866	.....	12,342	.....	4,000	6,927	25	593,160
44	Louisiana.....	582,163	.....	17,466	.....	1,057	.....	.....	600,686
45	Oklahoma.....	1,654,914	.....	38,154	.....	10,302	.....	9,707	1,713,077
46	Texas.....	1,254,686	.....	19,277	.....	20,975	.....	45	1,294,983
MOUNTAIN:									
47	Montana.....	141,652	.....	22,121	.....	.....	.....	.....	163,773
48	Idaho.....	236,626	.....	11,050	.....	.....	.....	.....	247,676
49	Wyoming.....	33,000	.....	.....	.....	.....	.....	.....	33,000
50	Colorado.....	279,752	.....	27,900	.....	.....	.....	1,500	309,152
51	New Mexico.....	63,116	.....	5,874	.....	.....	45	4,500	73,535
52	Utah.....	460,021	.....	36,852	.....	13,706	2,592	.....	513,171
53	Nevada.....	16,362	.....	19	.....	.....	.....	.....	16,381
PACIFIC:									
54	Washington.....	6,194,001	.....	1,142,055	.....	56,720	1,527	34,045	7,428,348
55	Oregon.....	566,438	.....	14,787	.....	6,307	.....	.....	587,512
56	California.....	1,854,451	.....	147,139	.....	50,197	2,191	.....	2,063,978

FINANCIAL STATISTICS.

SHEET, BY GEOGRAPHIC DIVISIONS AND STATES: 1912.

LIABILITIES.										
Funded debt.	Cash investments.	Real estate mortgages.	Floating debt.	Reserves.	Accounts payable.	Interest and taxes due and accrued.	Sundries.	Profit and loss surplus for stations showing a surplus.	Net surplus.	
\$31,189,357	\$27,064,963	\$344,608	\$4,959,382	\$2,509,652	\$1,347,263	\$723,087	\$235,728	\$18,147,085	\$17,698,222	1
2,844,716	1,480,678	266,666	678,350	186,876	73,946	18,602	161,906	1,034,212	786,094	2
2,048,491	728,714	.....	85,463	167,879	30,113	5,214	16,568	1,331,382	1,328,308	3
7,141,321	18,000,729	1,150	2,803,312	1,048,969	235,431	650,720	23,715	5,382,940	5,338,597	4
5,312,801	2,236,522	41,000	322,303	128,870	204,632	13,824	15,322	3,495,187	3,434,433	5
3,966,415	1,025,604	24,150	200,751	4,603	332,245	4,623	6,925	2,747,594	2,739,784	6
2,188,741	1,543,408	6,667	204,099	14,000	57,353	4,218	600	346,883	311,941	7
2,246,529	913,648	4,975	218,071	800	35,093	8,228	5,032	769,730	759,953	8
675,811	196,752	.....	63,300	13,313	17,005	753	4,922	384,832	378,832	9
4,764,532	943,908	.....	383,723	944,542	361,160	16,905	738	2,654,325	2,620,280	10
48,500	161,500	.....	.....	.....	169	.....	.....	35,952	35,952	11
115,000	38,968	.....	7,113	.....	11,836	1,032	.....	5,434	5,434	12
541,900	40,000	.....	96,933	22,419	5,384	.....	16,000	130,509	125,409	13
1,782,742	1,235,210	.....	520,304	116,841	50,581	17,410	145,906	459,228	216,210	14
.....	.....	.....	7,000	.....	400	.....	.....	3,275	3,275	15
356,574	5,000	266,666	47,000	47,616	5,576	160	.....	399,814	399,814	16
765,980	229,776	.....	55,661	157,443	20,919	4,014	16,568	801,609	798,535	17
104,663	185,275	.....	.....	10,436	1,291	.....	.....	57,977	57,977	18
1,117,848	308,663	.....	29,802	.....	7,908	1,200	.....	471,796	471,796	19
2,533,520	2,220,809	.....	8,880	24,644	85,375	4,043	15,419	238,713	233,575	20
641,230	2,836,920	400	58,854	32,259	27,293	960	1,191	909,491	906,594	21
585,905	10,483,525	.....	2,584,485	796,902	36,375	629,169	.....	1,407,836	1,406,979	22
2,496,601	1,837,098	750	52,035	90,645	62,074	7,291	2,120	2,498,255	2,482,554	23
884,056	622,377	.....	99,058	104,519	34,314	9,257	4,985	328,645	308,895	24
1,091,336	887,845	.....	126,455	24,662	58,107	5,619	.....	735,892	702,951	25
509,789	317,412	.....	43,520	69,982	26,087	300	3,900	803,424	792,100	26
1,268,000	171,565	32,500	25,700	10,097	61,322	719	.....	893,594	890,849	27
120,300	55,000	.....	15,013	6,905	13,980	281	.....	101,458	101,458	28
104,315	88,637	.....	2,940	15,184	6,652	2,500	.....	137,108	137,108	29
634,333	459,123	8,500	48,238	.....	12,077	404	1,422	380,939	376,427	30
1,584,723	256,940	.....	60,442	2,040	26,707	4,001	10,000	442,772	433,540	31
231,500	63,829	18,000	16,800	.....	13,769	.....	.....	116,932	116,932	32
1,030,324	23,000	.....	77,158	.....	1,600	.....	.....	290,599	290,599	33
23,700	72,670	.....	.....	.....	.....	.....	.....	11,482	11,482	34
845,888	447,649	.....	64,000	.....	18,656	10	.....	91,925	91,925	35
398,900	70,012	6,150	7,155	1,174	7,894	1,200	484	141,994	139,415	36
1,078,280	124,006	.....	29,870	2,629	46,433	1,139	.....	463,953	459,189	37
352,823	224,538	.....	5,768	800	243,893	2,274	6,441	1,630,709	1,630,242	38
72,400	541,259	.....	15,842	.....	18,450	1,000	.....	58,880	49,090	39
828,600	640,841	.....	12,857	14,000	19,760	118	.....	112,615	110,115	40
467,500	92,217	6,667	162,000	.....	9,092	3,100	600	48,002	28,803	41
820,241	269,091	.....	13,400	.....	10,081	.....	.....	127,386	123,933	42
191,929	83,100	.....	63,270	.....	9,589	900	260	244,112	244,087	43
91,800	166,419	.....	79,546	600	8,312	300	.....	253,709	253,709	44
1,448,800	80,278	.....	24,105	.....	10,922	6,600	4,772	137,600	127,893	45
514,000	683,851	4,975	51,150	.....	6,270	428	.....	134,309	134,264	46
41,000	.....	.....	.....	13,313	4,137	.....	.....	105,323	105,323	47
170,000	19,430	.....	.....	.....	.....	.....	.....	58,246	58,246	48
.....	30,000	.....	.....	.....	.....	.....	.....	3,000	3,000	49
126,925	108,002	.....	37,200	.....	6,744	463	3,760	26,078	24,578	50
51,700	.....	.....	5,500	.....	820	.....	.....	15,615	11,015	51
271,186	39,320	.....	20,600	.....	5,304	300	1,172	175,289	175,289	52
15,000	.....	.....	.....	.....	.....	.....	.....	1,381	1,381	53
3,683,200	838,003	.....	236,234	725,805	303,741	14,150	738	1,626,477	1,592,432	54
443,500	6,700	.....	57,971	.....	.....	.....	.....	79,341	79,341	55
637,832	99,205	.....	89,523	218,737	57,419	2,755	.....	948,507	948,507	56

CHAPTER VII.

EMPLOYEES, SALARIES, AND WAGES.

Character of the statistics.—Each census has obtained statistics of the number of salaried employees and wage earners and the amounts paid in salaries and wages during the year. The schedules used at the censuses of 1902 and 1907 called for the average number employed during the year. Three classes of salaried employees were reported separately in 1907: Salaried officers of corporations; other officers (general managers, superintendents, electricians, and experts); clerks and bookkeepers. Separate data were also required for four classes of wage earners: Foremen; inspectors; engineers; and all other employees (including firemen, dynamo and switchboard men, linemen, mechanics, and lamp trimmers).

To compute the correct average number employed during the year, it would be necessary to consider the number employed each day. In 1907 many of the larger stations contended that it was impracticable to compute such an average, and therefore reported the number employed under normal conditions. It also developed that in many stations the same employees performed the duties covered by two or more of the separate classes of employees. In fact, in each of the smaller stations two or three persons did all of the work, and it was impossible to assign them to distinctive classes. In view of these conditions it was thought best to simplify the inquiries, and the schedule for 1912 called for the number employed on September 16 of that year, or if data were not available for that day, for the number employed on the nearest representative or normal day. Separate figures were required for three classes of salaried employees: Salaried officers of corporations; superintendents and managers; clerks, stenographers, and other salaried

employees. The wage earners were not reported by classes.

The change in the form of the inquiry had some effect on the numbers reported for the different classes at the census of 1912, as compared with prior censuses. It probably resulted in a larger number being assigned to the class of clerks and other salaried employees. For example, it may be that for some stations foremen, inspectors, and engineers who were specified as wage earners in the schedules of 1902 and 1907 were considered salaried employees in 1912 and reported as such. The comparability of the statistics is also affected to some extent by the method of reporting employees in the small composite and municipal stations where the employees devote only a part of their time to central station work. In some instances the entire number of such employees was reported, and in others only a portion of the number, depending upon the time employed in the central station or the system of bookkeeping used.

The effect of these various conditions on the comparability of the statistics, while noticeable, varies considerably in the several states. It is believed, however, that the average number reported for preceding censuses is fairly comparable with the number for a given date or normal day in 1912, but in view of the conditions named it is thought best to limit the detail comparisons with 1902 and 1907 to the totals for the United States, which are given in Table 51.

A comparison of the total number of employees and the total salaries and wages paid, for 1912, 1907, and 1902, by geographic divisions and states, is given in Table 52.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—EMPLOYEES, SALARIES, AND WAGES: 1912, 1907, AND 1902.

CLASS.	TOTAL.			COMMERCIAL.			MUNICIPAL.			PER CENT OF INCREASE: 1902-1912.		
	1912	1907	1902	1912	1907	1902	1912	1907	1902	Total.	Com- mercial.	Munici- pal.
Total:												
Number.....	79,335	47,632	30,326	71,395	42,066	26,909	7,940	5,566	3,417	161.6	165.3	132.4
Salaries and wages....	\$61,161,941	\$35,420,324	\$20,046,692	\$55,658,515	\$31,935,309	\$18,766,970	\$5,503,426	\$3,485,015	\$1,879,722	196.2	196.6	192.8
Salaried employees:												
Officers of corporations—												
Number.....	2,181	1,761	1,416	2,181	1,761	1,416	.....	.....	.....	54.0	54.0	.....
Salaries.....	\$3,839,136	\$2,202,028	\$1,465,471	\$3,839,136	\$2,202,028	\$1,465,471	.....	.....	.....	162.0	162.0	.....
Superintendents and man- agers—												
Number.....	4,702	4,357	2,564	3,629	3,268	1,875	1,163	1,089	689	86.9	93.5	68.8
Salaries.....	\$6,482,749	\$5,058,236	\$2,481,278	\$5,397,004	\$4,243,307	\$2,088,298	\$1,085,745	\$814,929	\$392,980	161.3	158.4	176.3
Clerks, stenographers, and other salaried employ- ees—												
Number.....	19,120	6,872	3,016	18,067	6,346	2,755	1,053	526	261	534.0	555.8	319.5
Salaries.....	\$13,985,419	\$4,473,523	\$1,716,831	\$13,400,937	\$4,293,620	\$1,652,430	\$584,482	\$179,903	\$64,401	714.6	711.0	807.6
Wage earners:												
Average number.....	153,242	34,642	23,330	147,518	30,691	20,863	15,724	3,951	2,467	128.2	127.8	132.0
Wages.....	\$36,854,637	\$23,686,537	\$14,983,112	\$33,021,438	\$21,196,354	\$13,560,771	\$3,833,199	\$2,490,183	\$1,422,341	146.0	143.5	169.5

¹ Number Sept. 16, or nearest representative day.

CENTRAL ELECTRIC STATIONS—TOTAL NUMBER OF EMPLOYEES AND SALARIES AND WAGES, BY GEOGRAPHIC DIVISIONS AND STATES: 1912, 1907, AND 1902.

Table 52 DIVISION AND STATE.	1912		1907		1902		PER CENT OF INCREASE. ¹					
	Num-ber.	Salaries and wages.	Num-ber.	Salaries and wages.	Num-ber.	Salaries and wages.	1902-1912		1907-1912		1902-1907	
							Num-ber.	Salaries and wages.	Num-ber.	Salaries and wages.	Num-ber.	Salaries and wages.
UNITED STATES.....	79,335	\$61,161,941	47,632	\$35,420,324	30,326	\$20,646,692	161.6	196.2	66.6	72.7	57.1	71.6
GEOGRAPHIC DIVISIONS:												
New England.....	7,352	5,004,983	5,088	3,899,439	3,673	2,680,627	100.2	109.1	44.5	43.7	38.5	45.5
Middle Atlantic.....	24,022	18,012,382	13,977	10,431,544	9,675	6,821,800	148.3	172.8	71.9	78.4	44.5	52.9
East North Central.....	19,233	14,085,033	10,324	7,213,771	6,866	4,260,583	180.1	230.6	56.3	95.3	50.4	69.3
West North Central.....	7,892	5,875,467	5,007	3,538,044	3,067	1,946,600	157.3	201.8	57.6	61.1	63.3	81.8
South Atlantic.....	4,317	2,780,706	2,622	1,692,982	1,537	799,317	180.9	247.9	64.6	64.2	70.8	111.8
East South Central.....	2,426	1,641,770	1,632	919,524	1,017	563,828	138.5	191.2	48.7	78.5	60.5	63.1
West South Central.....	3,655	2,543,847	2,474	1,694,619	1,350	887,919	170.7	186.5	47.7	59.5	83.3	79.6
Mountain.....	3,090	2,027,122	2,028	1,819,343	1,320	1,123,285	134.1	160.6	52.4	60.9	53.6	62.0
Pacific.....	7,348	7,090,631	4,480	4,311,058	1,821	1,562,673	303.5	353.8	64.0	64.5	146.0	175.9
NEW ENGLAND:												
Maine.....	629	402,394	502	308,006	340	202,726	85.0	98.5	25.3	30.6	47.6	51.9
New Hampshire.....	578	434,617	422	280,749	294	187,933	96.6	131.3	37.0	51.6	43.5	52.6
Vermont.....	340	219,897	297	188,780	242	132,645	40.5	65.8	14.5	16.5	22.7	42.3
Massachusetts.....	3,954	2,981,043	2,672	2,235,647	2,024	1,588,830	95.4	87.6	48.0	33.3	32.0	40.7
Rhode Island.....	511	512,771	450	350,605	274	238,724	86.5	114.8	13.6	46.3	64.2	46.9
Connecticut.....	1,340	1,054,261	745	529,652	499	329,763	168.5	219.7	79.9	99.0	49.3	60.6
MIDDLE ATLANTIC:												
New York.....	13,733	11,034,898	7,716	5,819,617	5,421	3,904,706	153.3	182.6	78.0	89.6	42.3	49.0
New Jersey.....	2,989	2,479,219	1,759	1,370,506	1,074	821,739	178.3	201.7	69.9	80.9	63.8	66.8
Pennsylvania.....	7,300	5,098,265	4,502	3,241,421	3,180	2,095,415	129.6	143.3	62.2	57.3	41.6	54.7
EAST NORTH CENTRAL:												
Ohio.....	3,131	2,264,892	2,157	1,543,925	1,766	1,053,901	77.3	114.9	45.2	46.7	22.1	46.5
Indiana.....	2,269	1,525,875	1,618	969,263	941	549,428	141.1	177.7	40.2	57.4	71.9	76.4
Illinois.....	8,036	6,223,882	3,902	3,032,721	2,339	1,603,904	243.6	288.0	105.9	105.2	66.8	89.1
Michigan.....	3,876	2,843,371	1,780	1,126,813	1,265	728,952	208.8	290.1	117.8	152.3	41.8	54.6
Wisconsin.....	1,921	1,227,013	867	541,049	565	324,308	240.0	278.3	121.6	126.8	53.5	66.8
WEST NORTH CENTRAL:												
Minnesota.....	1,568	1,222,493	1,062	755,778	649	433,256	141.6	182.2	47.6	61.8	63.6	74.4
Iowa.....	1,329	921,096	855	547,177	732	406,819	81.6	126.4	55.4	65.3	16.8	34.5
Missouri.....	2,434	1,883,644	1,800	1,306,640	997	684,197	144.1	175.3	35.2	44.2	80.5	91.0
North Dakota.....	232	197,983	150	113,383	75	47,260	209.3	318.9	54.7	74.6	100.0	139.9
South Dakota.....	338	264,169	169	127,143	85	58,116	297.6	354.5	100.0	107.8	98.8	118.8
Nebraska.....	882	598,703	404	313,427	237	149,180	272.2	301.3	118.3	91.0	70.5	110.1
Kansas.....	1,109	787,189	567	374,496	292	167,762	279.8	369.2	95.6	110.2	94.2	123.2
SOUTH ATLANTIC:												
Delaware, Maryland, and District of Columbia.....	1,240	936,805	1,024	759,508	549	326,599	127.5	186.8	22.0	23.3	86.5	132.6
Virginia.....	341	170,884	178	99,000	170	85,249	100.6	150.4	91.6	72.5	4.7	45.1
West Virginia.....	439	255,471	262	168,633	178	95,343	146.6	167.9	67.6	51.5	47.2	76.9
North Carolina.....	453	261,078	248	131,013	141	67,996	221.3	284.0	52.7	99.3	75.9	92.7
South Carolina.....	683	452,456	261	145,357	160	75,642	326.9	498.2	161.7	211.3	63.1	92.2
Georgia.....	607	417,959	384	232,711	203	92,173	243.3	353.4	81.5	79.6	89.2	152.5
Florida.....	455	280,053	265	156,700	136	73,315	234.6	290.2	71.7	82.5	94.9	113.7
EAST SOUTH CENTRAL:												
Kentucky.....	907	635,829	585	301,794	367	216,438	147.1	193.8	55.0	110.7	59.4	89.4
Tennessee.....	650	455,212	410	247,764	306	165,041	114.4	175.8	57.7	83.7	35.9	50.1
Alabama.....	456	286,936	343	208,533	162	87,049	181.5	229.6	32.9	37.6	111.7	139.6
Mississippi.....	407	263,793	288	161,433	182	95,300	123.6	176.8	41.3	63.4	58.2	69.4
WEST SOUTH CENTRAL:												
Arkansas.....	360	242,267	244	157,814	149	90,759	141.6	166.9	47.5	53.5	63.8	73.9
Louisiana.....	480	371,034	541	382,982	336	226,050	45.5	64.1	-9.6	-3.1	61.0	69.4
Oklahoma.....	785	581,580	414	264,604	92	61,929	753.3	899.1	89.6	119.8	350.0	327.3
Texas.....	2,021	1,348,966	1,275	789,219	773	509,181	161.4	164.9	58.5	70.9	64.9	55.0
MOUNTAIN:												
Montana.....	514	625,918	319	360,768	202	218,302	154.5	186.7	61.1	73.5	57.9	65.3
Idaho.....	324	334,063	188	171,125	88	66,719	268.2	400.7	72.3	95.2	113.6	150.5
Wyoming.....	163	149,356	96	77,811	53	46,125	207.5	223.8	69.3	91.9	81.1	68.7
Colorado.....	1,166	999,864	918	775,045	588	482,588	98.3	107.2	37.0	29.0	56.1	60.6
New Mexico.....	158	119,088	83	66,981	45	34,740	251.1	242.8	90.4	77.8	84.4	92.8
Arizona.....	217	219,798	148	130,663	86	82,644	152.3	168.0	46.6	69.2	72.1	58.1
Utah.....	401	365,399	198	159,686	240	177,391	67.1	106.0	102.5	128.8	-17.5	-10.0
Nevada.....	147	113,636	78	77,264	18	14,776	716.7	669.1	88.5	47.1	333.3	422.9
PACIFIC:												
Washington.....	1,078	880,309	885	800,441	274	218,177	293.4	303.5	21.8	10.0	223.0	266.9
Oregon.....	532	387,119	467	416,424	187	167,755	184.5	130.8	13.9	-7.0	149.7	148.2
California.....	5,738	5,823,203	3,128	3,094,193	1,360	1,176,741	321.9	394.9	83.4	88.2	130.0	162.9

¹ A minus sign (-) denotes decrease.

The employees represent those engaged in the operation and maintenance of the plants, including those employed in making ordinary repairs and replacements. It is probable that the regular employees in some stations were engaged in making additions to the plants and in new construction. In such cases it was impossible to segregate the data, and therefore the total numbers were included in the

census report. As a rule, however, the numbers of persons employed on addition and extension work were not so included.

As shown in Table 51 on the preceding page, the central electric light and power stations of the country gave employment to 79,335 persons in 1912, as compared with 30,326 in 1902, there having been an increase of 161.6 per cent during the decade. During

the same time the amount paid annually in salaries and wages increased by 196.2 per cent.

Of the total number reported for 1912, 26,093, or 32.9 per cent, were included in the class of salaried employees, and their salaries amounted to \$24,307,304, forming 39.7 per cent of the total annual salaries and wages. The number of wage earners formed 67.1 per cent of the total number of employees, and their wages 60.3 per cent of the annual salary and wage account. In 1912 the commercial stations of the country gave employment to 90 per cent of the total number of salaried persons and wage earners engaged in the industry.

There were, of course, no officers of corporations to be reported for municipal stations. There were, in 1912, however, 2,216 salaried employees reported, this number forming 27.9 per cent of the total for such stations. Their salaries amounted to \$1,670,227, or 30.3 per cent of the total amount paid in salaries and wages by this class of stations.

Considering the total number of stations of all classes reported for 1912, the average number of persons employed in each was 15.2, as compared with 10.1 for 1907 and 8.4 for 1902. The constant increase in the average number of employees per station is another indication of the increase in the average size of the station.

Table 52 shows that for the decade 1902-1912 the percentages of increase both in number of employees and in salaries and wages were conspicuously the largest for the Pacific division, while the smallest percentages of increase in these items are shown for the New England division. The actual increases, however, were greatest for the Middle Atlantic division.

For each of the nine divisions the percentage of increase during the decade was greater for salaries and wages than for number of employees. This condition prevailed also in all but four states.

Exceptionally large percentages of increase are shown for Oklahoma and Nevada, but the totals for these states are small, and the industry in 1902 was comparatively insignificant. The smallest percentage of increase in number of employees during the decade is shown for Vermont, while the smallest proportionate gain in salaries and wages was made by Louisiana. As already explained in another chapter, the totals for central stations in Louisiana have been diminished by the transfer of ownership since 1902 of large central stations to electric railways.

The total output of central electric stations and the average per employee, in kilowatt hours, as reported at the censuses of 1912, 1907, and 1902, are given in Table 53.

There was a much more rapid increase in the total kilowatt-hour output of the stations than in the total number of employees. While the data for the output of the stations reported for 1907 and 1902 are probably more defective than those for 1912, nevertheless they are sufficiently correct to use for general comparative

purposes. The average output per employee for 1912 was 145,370 kilowatt hours, as compared with 123,074 for 1907 and 82,670 for 1902. The average output per employee for the hydroelectric stations, for which separate statistics are given in Table 20, was 341,457 kilowatt hours for 1912, as compared with 91,252 for all other stations reported at that census. A similar comparison can not be made for preceding censuses, but it is fair to presume that the output per employee for the hydroelectric stations was much greater than that for any other class.

Table 53

DIVISION. ¹	OUTPUT OF CENTRAL ELECTRIC STATIONS AND AVERAGE OUTPUT PER EMPLOYEE, BY GEOGRAPHIC DIVISIONS: 1912, 1907, AND 1902.			
	Census.	Total number of persons employed.	Output of stations.	
			Total kilowatt hours.	Average per employee.
United States.....	1912	79,385	11,532,963,006	145,370
	1907	47,632	5,862,276,737	123,074
	1902	30,326	2,507,051,115	82,670
New England.....	1912	7,352	879,272,535	119,596
	1907	5,088	473,802,067	93,121
	1902	3,673	247,727,501	67,446
Middle Atlantic.....	1912	24,022	3,548,605,305	147,723
	1907	13,977	2,009,304,160	143,758
	1902	9,675	1,021,603,500	105,592
East North Central.....	1912	19,233	2,527,964,097	131,439
	1907	10,324	1,075,933,354	104,217
	1902	6,866	475,097,910	69,196
West North Central.....	1912	7,892	712,595,442	90,293
	1907	5,007	386,180,647	77,128
	1902	3,067	169,964,203	55,417
South Atlantic.....	1912	4,317	679,856,425	157,434
	1907	2,622	266,437,175	101,616
	1902	1,537	102,990,575	67,008
East South Central.....	1912	2,426	227,664,808	93,844
	1907	1,632	118,631,967	72,691
	1902	1,017	73,760,879	72,518
West South Central.....	1912	3,655	233,947,656	64,008
	1907	2,474	138,755,643	56,086
	1902	1,350	80,154,471	59,374
Mountain.....	1912	3,090	845,393,882	273,590
	1907	2,028	381,032,187	187,886
	1902	1,320	145,780,112	110,439
Pacific.....	1912	7,348	1,877,662,856	255,594
	1907	4,480	1,012,199,537	225,937
	1902	1,821	189,981,964	104,328

¹ See page 25 for states composing the several geographic divisions.

Among the several geographic divisions the largest averages per employee are found for the Mountain and the Pacific states. These two divisions also show very large percentages of increase per employee. The largest actual increase during the decade for any division in the average per employee, 163,151 kilowatt hours, and the largest percentage of increase, 147.7, are shown for the Mountain division. The Pacific and South Atlantic states follow in both respects, in the order named. It is significant that in each of these three divisions water is the predominating primary power.

Table 54 gives, for each of the several classes of employees as called for in the schedule used in 1912, their number and their salaries or wages, by geographic divisions and states.

EMPLOYEES, SALARIES, AND WAGES.

CENTRAL ELECTRIC STATIONS--EMPLOYEES AND SALARIES AND WAGES, BY GEOGRAPHIC DIVISIONS AND STATES: 1912.

Table 54

DIVISION AND STATE.	SALARIED EMPLOYEES.											
	AGGREGATE.		Total.		Officers of corporations.		Superintendents and managers.		Clerks, stenographers, and other salaried employees.		WAGE EARNERS.	
	Number.	Salaries and wages.	Number.	Salaries.	Number.	Salaries.	Number.	Salaries.	Number.	Salaries.	Number.	Wages.
UNITED STATES.....	79,335	\$61,161,941	26,093	\$24,307,304	2,181	\$3,839,136	4,792	\$6,482,749	19,120	\$13,985,419	53,242	\$36,854,637
GEOGRAPHIC DIVISIONS:												
New England.....	7,352	5,604,983	1,952	1,873,727	335	471,626	359	631,733	1,225	770,368	5,400	3,731,256
Middle Atlantic.....	24,022	18,612,382	7,467	7,004,263	527	999,610	890	1,476,179	6,050	4,528,474	16,555	11,608,119
East North Central.....	19,233	14,085,033	6,921	5,819,483	465	811,479	1,043	1,229,528	5,413	3,778,476	12,312	8,265,550
West North Central.....	7,892	5,875,467	2,602	2,307,605	218	325,627	758	879,969	1,625	1,102,009	5,290	3,587,862
South Atlantic.....	4,317	2,780,706	1,356	1,154,759	196	248,425	430	448,923	730	457,411	2,961	1,625,947
East South Central.....	2,426	1,641,770	730	658,536	78	127,097	259	289,014	393	242,425	1,696	983,234
West South Central.....	3,655	2,543,847	1,188	1,037,868	114	175,118	374	405,230	700	457,520	2,467	1,505,979
Mountain.....	3,090	2,927,122	1,228	1,368,792	105	217,105	273	410,261	850	741,426	1,862	1,553,330
Pacific.....	7,348	7,090,631	2,649	3,082,271	143	463,049	376	711,912	2,130	1,907,310	4,699	4,008,360
NEW ENGLAND:												
Maine.....	620	402,394	179	172,777	39	47,794	60	78,975	80	46,008	450	229,617
New Hampshire.....	578	434,617	170	141,361	52	46,123	41	48,093	77	47,140	408	293,256
Vermont.....	340	219,897	128	92,242	34	29,458	38	37,372	56	25,412	212	127,655
Massachusetts.....	3,954	2,981,043	992	945,461	148	224,034	168	313,061	676	408,366	2,992	2,035,582
Rhode Island.....	511	512,771	146	191,582	14	38,840	26	58,773	109	93,969	365	321,189
Connecticut.....	1,340	1,054,261	337	330,304	48	85,372	59	95,459	230	149,473	1,003	723,957
MIDDLE ATLANTIC:												
New York.....	13,733	11,034,898	4,726	4,469,644	248	563,178	443	812,508	4,035	3,093,958	9,007	6,565,254
New Jersey.....	2,989	2,479,219	640	656,493	53	140,597	97	148,271	485	367,625	2,349	1,822,726
Pennsylvania.....	7,300	5,098,265	2,101	1,878,126	221	295,835	350	515,400	1,530	1,066,891	5,199	3,220,139
EAST NORTH CENTRAL:												
Ohio.....	3,131	2,264,892	967	740,974	107	147,517	170	198,477	690	394,980	2,164	1,523,918
Indiana.....	2,269	1,525,875	700	542,408	54	70,492	191	209,982	455	261,984	1,599	983,467
Illinois.....	8,036	6,223,882	3,539	3,101,656	117	292,240	263	354,387	3,159	2,456,029	4,497	3,122,226
Michigan.....	3,876	2,343,371	1,225	1,040,732	106	200,010	270	298,201	849	542,521	2,651	1,802,639
Wisconsin.....	1,921	1,227,013	490	393,713	81	101,220	149	168,531	260	123,962	1,431	833,300
WEST NORTH CENTRAL:												
Minnesota.....	1,588	1,222,493	638	592,723	40	74,529	168	185,669	430	332,525	930	629,770
Iowa.....	1,329	921,096	481	377,129	54	49,050	155	176,731	272	151,348	848	543,967
Missouri.....	2,434	1,883,844	662	609,860	54	109,829	140	182,234	468	317,797	1,772	1,273,984
North Dakota.....	232	197,983	81	85,667	3	3,800	29	42,757	49	39,110	161	112,316
South Dakota.....	338	264,159	125	130,532	8	19,275	44	54,676	73	56,581	213	133,627
Nebraska.....	882	598,703	264	230,423	28	29,661	83	91,689	153	109,073	618	368,280
Kansas.....	1,109	787,189	351	281,271	31	39,483	139	146,213	181	95,575	758	505,918
SOUTH ATLANTIC:												
Delaware, Maryland, and District of Columbia.....	1,249	936,805	431	417,391	45	94,421	68	98,567	318	224,403	818	519,414
Virginia.....	341	170,884	102	62,383	21	11,750	39	33,001	42	17,632	239	108,501
West Virginia.....	439	255,471	110	82,720	23	17,554	34	38,896	53	26,270	329	172,751
North Carolina.....	453	261,078	167	108,049	29	20,911	71	64,177	67	22,961	286	153,029
South Carolina.....	683	452,456	174	179,250	44	66,453	59	65,748	71	47,049	509	273,206
Georgia.....	697	417,959	231	181,345	23	22,304	116	108,844	92	50,197	466	236,614
Florida.....	455	286,053	141	123,621	11	15,032	43	39,690	87	68,899	314	162,432
EAST SOUTH CENTRAL:												
Kentucky.....	907	635,829	246	254,065	35	66,246	74	95,227	137	92,592	661	381,764
Tennessee.....	656	455,212	191	169,011	23	39,140	76	82,091	92	47,780	465	286,201
Alabama.....	456	286,936	181	147,488	10	12,450	56	57,236	115	77,802	275	139,448
Mississippi.....	407	263,793	112	87,972	10	9,261	53	54,460	49	24,251	295	175,821
WEST SOUTH CENTRAL:												
Arkansas.....	360	242,267	110	89,043	9	7,539	54	59,160	47	22,349	250	153,219
Louisiana.....	489	371,034	175	153,233	8	20,708	30	40,013	137	97,512	314	212,801
Oklahoma.....	785	581,580	265	232,790	27	36,272	97	114,179	141	82,339	520	348,790
Texas.....	2,021	1,348,966	638	557,797	70	110,599	193	191,878	375	255,320	1,383	791,169
MOUNTAIN:												
Montana.....	514	625,918	165	235,172	10	33,420	39	64,102	116	137,650	349	390,746
Idaho.....	324	334,063	141	167,893	12	32,143	42	71,445	87	64,295	183	166,180
Wyoming.....	163	149,366	40	46,660	4	10,000	18	25,480	22	21,180	123	102,096
Colorado.....	1,166	999,864	415	446,686	42	90,090	53	121,123	290	235,473	751	553,178
New Mexico.....	158	119,088	54	50,916	5	3,412	21	26,209	28	21,295	104	68,172
Arizona.....	217	219,798	74	99,517	16	23,390	19	35,943	39	40,184	143	120,281
Utah.....	401	365,399	271	263,636	17	30,610	42	55,189	212	182,837	130	96,763
Nevada.....	147	113,636	68	53,322	3	4,040	9	10,770	56	38,512	79	60,314
PACIFIC:												
Washington.....	1,078	880,809	311	297,491	23	28,481	79	106,561	209	162,449	767	582,818
Oregon.....	532	387,119	181	145,231	16	24,340	51	64,064	114	56,818	351	241,888
California.....	5,738	5,823,203	2,157	2,639,549	104	410,219	246	541,287	1,807	1,638,043	3,581	3,183,654

Although not given in this table, the figures for geographic divisions in 1902, when compared with corresponding data for salaries and wages in 1912, show that the largest actual increase, \$11,790,522, or 172.8 per cent, was for the Middle Atlantic division. During the decade 1902-1912 the largest percentage of increase (353.8) occurred in the Pacific division. The South Atlantic division was second in rate of growth in salaries and wages from 1902 to 1912, with

247.9 per cent, chiefly by reason of large gains in North Carolina, South Carolina, Florida, and Georgia.

Reference to the statistics for central stations in 1902 shows that the six ranking states in number of employees were New York, Pennsylvania, Illinois, Massachusetts, Ohio, and California, in the order named. In 1912 Ohio was seventh, and the six ranking states were New York, Illinois, Pennsylvania, California, Michigan, and Massachusetts.