ELECTRIC LOAD GROWTH IN SOUTHWESTERN OREGON

by

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ELECTRIC LOAD GROWTH IN SOUTHWESTERN OREGON

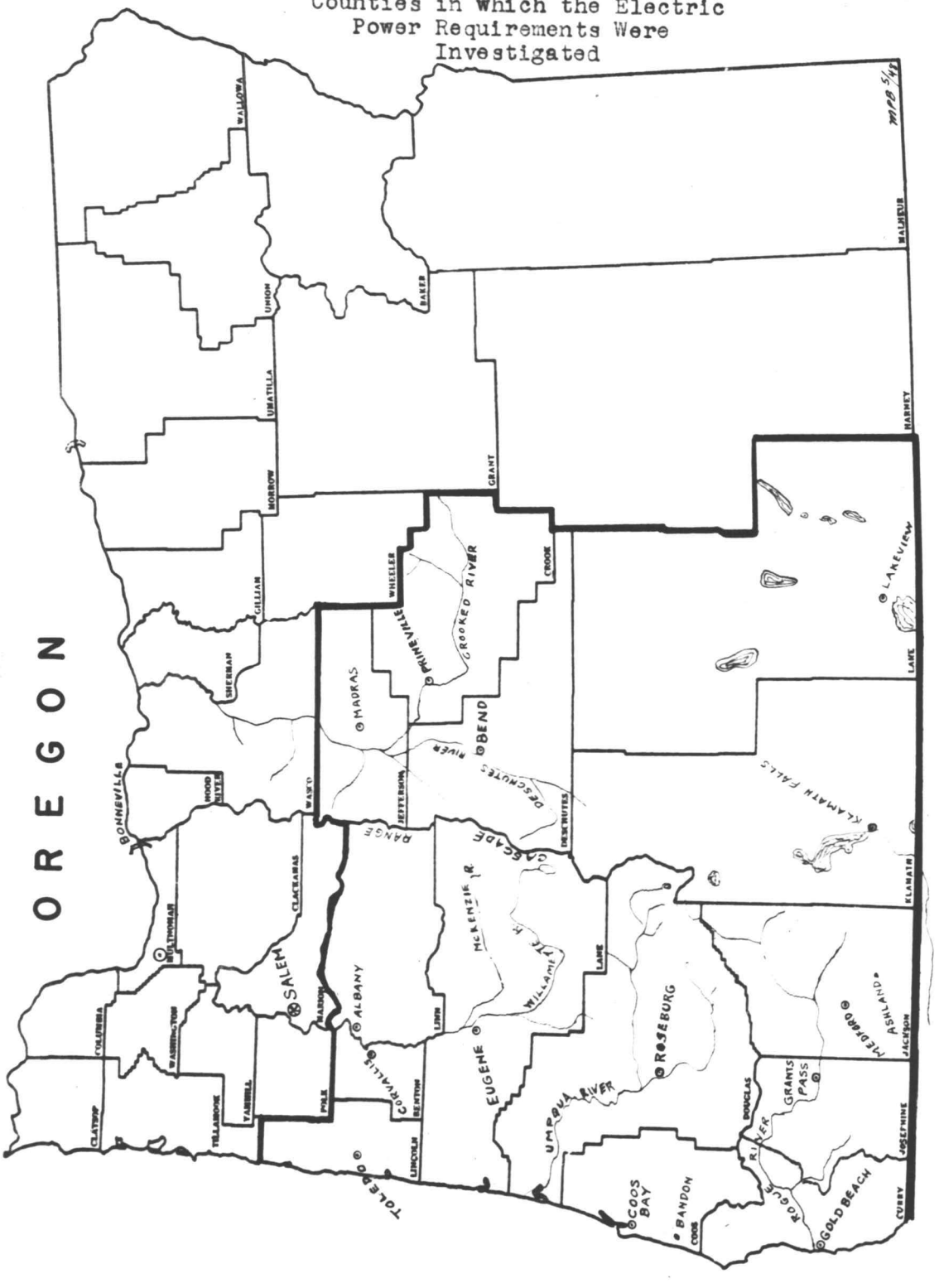
INTRODUCTION

The area investigated in this thesis is southwestern Oregon and consists of Coos, Crook, Curry, Deschutes, Douglas, Jackson, Jefferson, Josephine, Klamath, Lake, Lane, Lincoln, and Linn counties, which are outlined in Figure 1. These fourteen counties have an area of 43,336 square miles, with an estimated population of 450,000 in 1947.

In 1937 southwestern Oregon was served by 15 private utilities, 6 municipal utilities, and 1 R.E.A. financed rural cooperative utility. At the end of 1947 there were 6 private, 4 municipal, 8 R.E.A. financed rural cooperatives, and 1 public utility district serving the area. A half-dozen or more small communities near saw mills are served by generators installed at the mill to improve living conditions and attract employees to the community. Many farms and isolated commercial enterprises use lighting plants driven by gasoline or diesel engines. An interesting and effective hydro plant at an isolated tourist camp was made from a fire nozzle, rear axle of a truck, with paddles on one wheel, and a four kilowatt d.c. motor run as a generator.

Figure 1

The Outline Includes the Fourteen Counties in which the Electric Power Requirements Were Investigated



The influx of over 150,000 people since 1937 has created a positive demand for the extension of the distribution systems serving the region. Most of the population growth has been in or near the cities and small towns where it was possible to serve them with short line extensions, hence the load growth has been very rapid. The rural areas not served by the existing private distribution systems formed associations and applied for loans from the funds set up by the government through the Rural Electrification Administration. Most of these new REA projects were built into areas without distribution systems and purchased power from the private utilities. One project installed a small hydro plant and three other projects purchased power from the Bonneville Power Administration and were served from the line built from St. Johns to Eugene. Isolated sections of the projects used diesel generator plants until the systems could be connected to a private distribution system or to the Bonneville transmission line. Surplus power was purchased from saw mills by two projects that bought out private companies served by the mills. The rapid growth of these new REA projects overloaded the substations where power was purchased from the private distribution systems and mills serving the REA requirements. World War II stopped the expansion except where essential service was required and prevented the extension of Bonneville

facilities or the increase of capacity by the private utilities. The new people who have located in southwestern Oregon are for the most part engaged in agriculture and forestry, the two foremost industries of the region. A few are engaged in fishing, and in mining and processing the minerals taken from the earth. Employment has also increased due to the expansion of the many service facilities necessary for the growing communities as is clearly shown by Table 1.

The economy of the region has depended on the demand for the products taken from the land and shipped out of the area. When this demand slackened, the area income was reduced. The World War II demand for farm and forest products has caused the recent industrial expansion. Many small shops obtained contracts to make and ship parts for war machines and industrial equipment built on the west coast. These shops are now making peace-time products or are planning to make new products. A high percentage of the war workers who came to the northwest have stayed because they liked the region. Many skilled workers who came to the region are now available for industrial expansion. The present shortage of power, materials, and equipment has retarded this expansion in southwestern Oregon except in the few forest products mills that could obtain and install steam generation for their operations. This region is

rapidly becoming the forest product center of the northwest because of the large stand of timber in these counties. An integrated re-manufacturing of agricultural and forest products will help to prevent the unemployment which would result when the demand for lumber and agricultural products slackens.

It is the purpose of this thesis to show the recent and the potential possibilities of the growth of the electric power load in southwestern Oregon.

The basic statistical data were obtained from the reports of the Oregon Public Utilities Commission, the public power distributors, and the Eugene Office of the Bonneville Power Administration.

The statistical tables are arranged to indicate the load growth for the major classes of service. This total energy was supplied by electric plants located in southwestern Oregon and excess energy was exported until about 1945. After the REA utilities started building more lines, the excess power generated was absorbed in supplying the new distribution systems and by the load growth on the private and municipal utility systems. For the past two years the region has been short of generating capacity and the energy imported into southwestern Oregon has been limited to the transmission line capacity from the north and the excess power available in northern California.

Table 1

Population of Counties
of Southwestern Oregon

	1920	1930	1940	1947
Benton	13,744	16,555	18,629	25,835
Coos	22,257	28,373	32,466	36,703
Crook	3,424	3,336	5,533	7,616
Curry	3,025	3,257	4,301	4,054
Deschutes	9,622	14,749	18,631	20,333
Douglas	21,332	21,965	25,728	48,018
Jackson	20,405	32,818	36,213	52,905
Jefferson	3,211	2,291	2,042	5,646
Josephine	7,655	11,498	16,301	30,484
Klamath	11,413	32,407	40,497	40,887
Lake	3,991	4,833	6,293	8,220
Lane	36,168	54,593	69,096	103,916
Lincoln	6,084	9,903	14,549	19,293
Linn	24,550	24,700	30,485	46,192
Totals	186,881	261,278	320,764	450,102

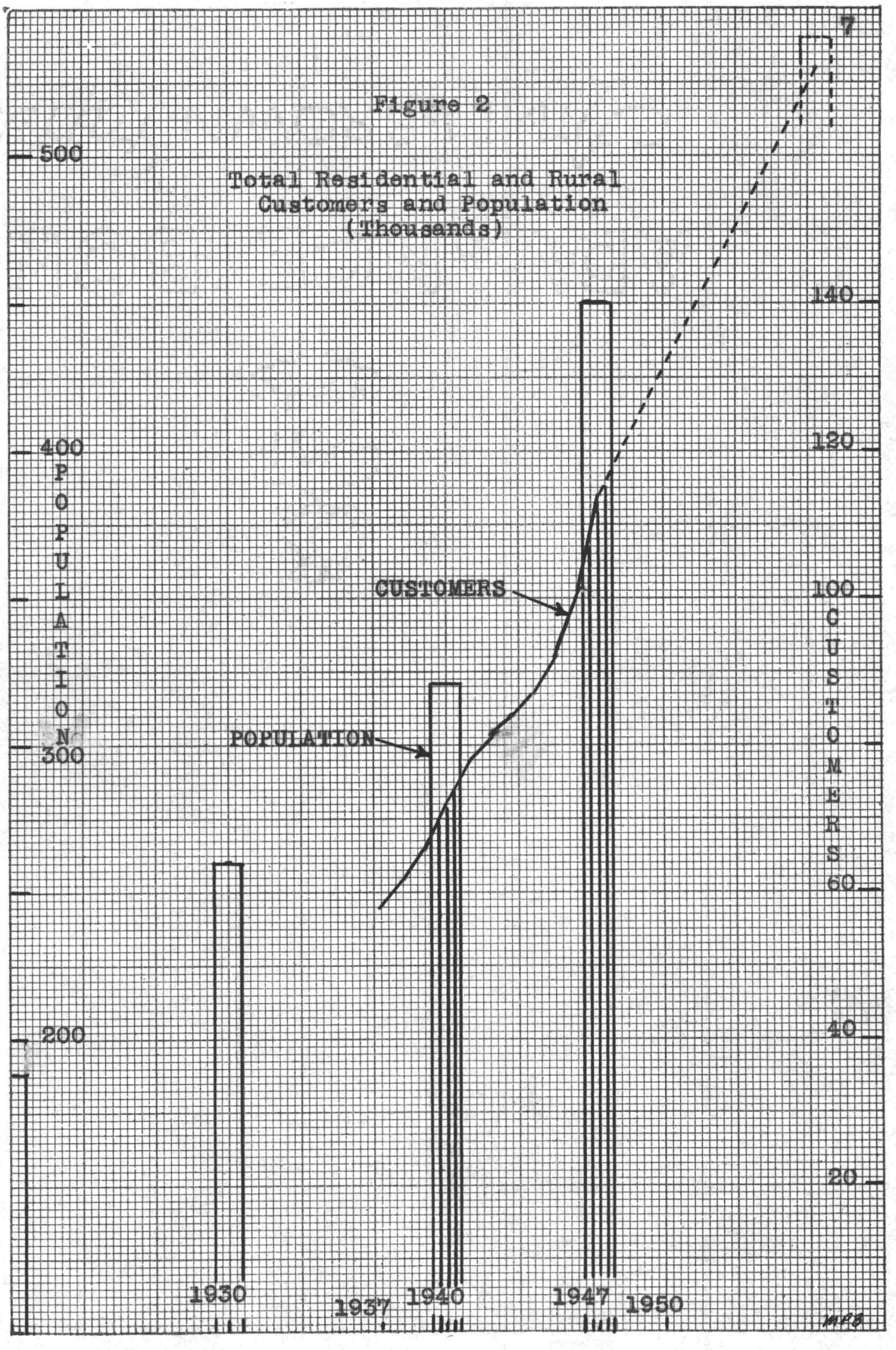
Source: 1920-1940 population from Oregon Blue Book.

1947 population from "Oregon's Population" by Elon H. Moore, University of Oregon, 1948.

See Figure 2 showing increase of residential and rural customers in relation to population growth.

Figure 2

Total Residential and Rural
Customers and Population
(Thousands)



INDUSTRIAL AND COMMERCIAL ACTIVITIES

The economy of southwestern Oregon is largely based on agriculture and forestry. Mine and quarry, and fishery products add to this economy as sources of raw material. The processing of agriculture products and manufacturing of timber products furnishes the greater amount of the cash income to the area. The service industries are dependent on the basic agriculture and forestry industries. Since the end of World War II the services catering to the rapidly increasing recreational and tourist business has added to the income of the area.

The agricultural enterprises of southwestern Oregon may be summarized by counties as follows:

The Pacific coast area of Lincoln, part of Lane and Douglas, Coos and Curry counties are good dairy regions and grazing is furnished on logged-off land for sheep and beef stock. Berries, truck gardening, grass seeds and bulbs are grown.

The area of Benton, Linn and Lane counties are considered to be one of the most diversified agriculture farm regions in Oregon. Over 65 products for commercial use are processed in the area. Dairying and general farming are followed and such cash crops as vegetables, berries, fruits, nuts, hops, flax, and seeds are grown.

The Umpqua Valley in Douglas county is a dairy, sheep, and poultry raising area. This valley is also a large producer of prunes, melons, tomatoes, seeds, fruit, and bulbs.

The Rogue Valley in Jackson, Josephine and Curry counties produce pears, peaches, tomatoes, and other vegetables, seeds, dairy products, hops, beef, broccoli, hay, and grain.

The area east of the Cascade Mountains, consisting of Crook, Deschutes, Jefferson, Klamath, and Lake counties, produces dairy products, turkeys, beef, sheep, hay, wheat, potatoes, and seeds.

The farm land distribution in the fourteen counties of southwestern Oregon is shown in Table 2. Irrigation of farm land is not limited to the semi-arid counties. Irrigation is needed during the summer growing season west of the Cascades, and is required in the semi-arid counties east of the Cascades. Additional irrigation is planned for the Basins of the Rogue, Crooked, Deschutes, and Klamath rivers. This new irrigation will add new farms to the region. The increase in the farm land will be reflected in the electrical load growth in the rural areas. The average annual use per farm customer in 1947 varied from 1500 to 2300 kilowatt-hours in the region. The rural use of electricity could not be separated from some of the reports and is combined with the residential load energy shown on Table 6. Irrigation pumping is shown in Table 8.

Table 2

Farms and Persons Living on Farms

County	Farms 1940	Farms 1945	Persons on Farms 1945
Benton	1,507	1,279	4,491
Coos	1,953	1,752	5,967
Crook	495	472	1,859
Curry	375	615	1,586
Deschutes	1,047	1,002	3,543
Douglas	2,734	3,205	10,719
Jackson	2,702	2,936	10,184
Jefferson	227	282	790
Josephine	1,944	2,157	7,152
Klamath	1,552	1,421	5,563
Lake	484	433	1,448
Lane	4,454	5,232	18,583
Lincoln	972	963	3,267
Linn	3,325	3,248	11,710
Totals	23,771	24,997	86,862
State Total	61,829	63,125	221,399

Compiled from Census Reports - U. S. Department of Commerce. 1940 farm population not available.

Table 2A

Farm Land Under Irrigation

County	Farms Reporting	Acres Irrigated
Benton	46	785
Coos	49	644
Crook	373	44,939
Curry*		
Deschutes	910	45,300
Douglas	171	1,735
Jackson	1,938	48,590
Jefferson	61	3,800
Josephine	1,548	21,049
Klamath	1,031	203,660
Lake	293	104,562
Lane	617	8,934
Lincoln	16	241
Linn	182	4,201

*Not reported separately

Source: Bureau of the Census, Department of Commerce for the year of 1944.

The large stand of commercial timber in southwestern Oregon and the demand for forest products has been the major factor in the industrial development since 1937. Over 50 percent of the industrial employment is engaged in converting trees into wood products. A complete shut down of the forest products industry in the region would seriously curtail the electric energy that is now sold by the utilities in the area. The resulting loss of wages would curtail residential and commercial energy sales and affect the utility business of most of the utilities serving the area. The lumber interests, as well as the civic minded business men of the area, are cognizant of this possibility and are studying ways of promoting further re-manufacturing of lumber products and waste wood in preparation for the time when the lumber demand returns to normal. The timber on private lands in the area east of the Cascade mountains, at the present rate of cutting, will soon be exhausted. The rate of timber cutting on the west side of the Cascades is above the estimated sustained-yield growth, except in Curry county and western Josephine county. However, the available commercial timber now standing would require several years to cut out even if the industry does not accept the sustained-yield formula. The large operators are arranging their mill operations and purchases of standing timber to be in position to maintain steady cutting over a long period of years. Many are considering new products for the area, such as

pulp, plywood, box and carton stock, plastics, charcoal, land-filler fibers, etc. These operations will more than absorb the labor released from the small tie-mill operations that sprang up during the war. In looking into the future of the utility load in southwestern Oregon it seems a good plan to expect that the further re-manufacturing of the lumber and wood-waste will require more employment and thus increase the utility load in the area. The energy generated in 1947 by steam sawmills and sold to the utilities in southwestern Oregon amounted to 83,236,000 kilowatt-hours. If these plants enlarge their plant operations and do not add new generating capacity, the utilities will have to secure energy elsewhere. As wood-waste becomes more valuable, the plants will either have to shut down their steam electric generation and buy utility power or generate power with a higher cost fuel. The private utility steam plants may have to convert completely to another fuel if wood-waste reaches five or six dollars per unit. The electric energy generated by utility-owned steam plants is shown in Table 4. Even if it is several years before the wood-waste becomes an expensive fuel, some of the mills may be loaded to generating plant capacity or want to get out of the power selling business. Most of the mills have had the experience and trouble of supplying power to utilities when suitable wood-waste fuel is short in an area. Also, as the utility loads grow and the customers are used to dependable and adequate power,

there will be more and stronger complaints when their equipment is shut down because another industry is having difficulty in furnishing part of the power supply. The steam plant operating costs will go up if the mills install additional equipment just to sell dependable power as a by-product of the forest. Some of the new mills that have started operations in the last two years have installed generating plants to take care of the ultimate mill operation, and will probably sell power only as long as the mill operations do not require the full capacity of installed generation.

The shortage of utility power and the need for disposing of the waste wood are the two main reasons for these new generating plants.

As long as the region does not have an adequate and dependable power supply, the large industrial plants will be forced to operate their own generating plants. The increased use of waste wood as a fuel will retard the establishment of new forest product industries in southwestern Oregon. Therefore, the region should have additional hydro power available and less use of waste wood for fuel purposes. The forest products industry is a valuable asset to the economy of the region. New industries could be started to further refine the lumber before it leaves the area, and to use more of the tree now going to waste.

The tourist and recreational business is another activity that has expanded and become an economic asset. The mountains and ocean provide the basic raw material that can add new wealth by expansion of the facilities used by tourists, vacationists, and sportsmen.

The mining operations are not as fully developed as in other parts of the Northwest. Gold, mercury, coal, granite, agates, limestone, and other minerals have been located and mined. Further exploration may discover deposits that will attract new industry in this field.

The fish products industry has not expanded as much as elsewhere in the Northwest. Harbor improvement is needed to provide suitable ports where the fishing fleet can unload and service the boats. The added fish cargo will attract other plants to the region and increase the production at existing plants.

LOAD GROWTH STATISTICS

The growth in population and industry during the past decade is indicated by Table 3, which shows the kilowatt-hours of energy input to the distribution systems serving southwestern Oregon. This energy load has grown from 33,939 megawatt-hours in 1937 to 1,007,361 in 1947. The energy generated by utility owned power plants is shown in Table 4. This table indicates that the hydro generation has remained about the same, and that the steam generation has doubled during the past decade. During 1947 all utility plants were run at maximum capacity during peak hours. This shortage of utility generating capacity in southwestern Oregon required 379,667 megawatt-hours of additional energy. As a result of this shortage, the utilities purchased about 83,236 megawatt-hours of energy from non-utility plants in the area and imported 296,431 megawatt-hours into the area. Table 5 indicates the area generation by utility plants and the amount purchased to meet the area load requirements.

The energy sold to residential and rural customers is shown in Table 6 and indicates the total customers and average kilowatt-hour use per customer doubled in the past ten years. Table 6A shows that the residential and rural customers of southwestern Oregon are using over twice as much electricity per customer as the national average.

Figure 2 on Page 7 shows the increase in the residential and rural customers in relation to the population growth. The extension of rural lines to serve areas without power, and the concentration of people around the small towns and cities has raised the population ratio from about 4.32 in 1940 to 3.87 in 1947. The national average is about 3.5. Table 7 shows the energy sales to commercial and industrial customers. This table also shows an increase of 7,000 kilowatt-hours in the average energy use. Table 8 has been included to indicate the growth that has occurred in the sale of energy to industrial and irrigation customers. Table 9 indicates the growth in the sales to governmental customers. The energy shown as street lighting and general power is not the total for the area as some reports include this energy in other accounts. The energy shown as High-voltage substations includes transformer losses and load energy to several large agencies. This energy is not included in the total energy shown in Table 3. Table 10 shows the average annual use per residential customer for the six municipal systems in the region. The high average use of 4290 kilowatt-hours is influenced by the 4896 kwh used by the Eugene Water Board customers. Table 11 shows the total population of the cities served by the six municipal systems. The low ratio of customers and population indicates the concentration of dwellings per block and

Table 12 shows the average annual use per residential customer in six typical cities. The low Eugene municipal rate and the 65% saturation of ranges is mostly responsible for the high average use per customer.

Table 3

Total Electrical Energy Input
to the Distribution Systems

	Total Customers	Total M-kwh	Ave.kwh/ Customer
1937	71,892	333,939	4,640
1938	76,042	335,664	4,410
1939	81,178	370,329	4,560
1940	88,306	417,710	4,490
1941	95,282	477,488	5,010
1942	98,785	509,239	5,150
1943	100,485	544,324	5,410
1944	104,097	582,212	5,575
1945	110,409	635,301	5,750
1946	121,913	798,651	6,550
1947	136,625	1,007,361	7,380

Energy input to the systems in thousands of kilowatt-hours.

This energy includes energy used and unaccounted for, and the transmission and distribution losses.

Table 4

Electrical Energy Generated by
Utility Owned Plants
(Thousands of Kilowatt-Hours)

	Hydro	Steam	Diesel	Total
1937	402,043	50,662	1,973	454,678
1938	376,798	17,262	1,803	395,863
1939	412,687	44,509	589	457,785
1940	414,177	61,906	664	476,747
1941	464,598	76,297	610	541,505
1942	450,825	66,936	485	518,246
1943	494,249	61,971	792	557,012
1944	482,951	82,621	1,008	566,580
1945	501,771	67,052	1,184	570,007
1946	495,479	84,959	1,374	581,812
1947	515,751	110,302	1,641	627,694

All plants were operated at maximum capacity during the peak load hours of 1947.

Table 5

Area Generation and System Load
(Thousands of Kilowatt-Hours)

	Utility Generation	System Load	(+)Surplus (-)Shortage
1937	454,678	33,939	(+)120,739
1938	395,863	335,664	(+) 60,199
1939	457,785	370,329	(+) 87,456
1940	476,747	417,710	(+) 59,037
1941	541,505	477,488	(+) 64,017
1942	518,246	509,239	(+) 9,007
1943	557,012	544,324	(+) 12,688
1944	566,580	582,212	(-) 15,632
1945	570,007	635,301	(-) 65,294
1946	581,812	798,651	(-)216,839
1947	627,694	1,007,361	(-)379,667

Some of the utilities purchase power from non-utility generating plants. The surplus and shortage figures include these purchases and the power transferred across the boundary lines.

Table 6

Total Electric Energy Sales to Residential and Rural Customers

	Total Customers	Total M-kwh	Ave.kwh/ Customer
1937	58,138	90,127	1,546
1938	61,599	100,027	1,623
1939	65,974	109,924	1,665
1940	72,358	126,303	1,748
1941	78,403	144,705	1,851
1942	82,453	161,352	1,955
1943	84,178	178,689	2,180
1944	87,040	195,976	2,244
1945	92,402	223,714	2,420
1946	101,653	285,863	2,810
1947	114,524	372,686	3,250

The total M-kwh of energy has been combined because of the present method of combining residential and rural sales in the reports of several of the larger utilities.

Total energy sales in thousands of kilowatt-hours.

Table 6A

Average Annual Use Per
Residential and Rural
Customer

	National Average	Southwestern Oregon
1937	805	1,546
1938	853	1,623
1939	897	1,665
1940	952	1,748
1941	986	1,851
1942	1,012	1,955
1943	1,070	2,180
1944	1,151	2,244
1945	1,229	2,420
1946	1,329	2,810
1947	1,435*	3,250

*Estimated

Source: Edison Electric Institute.

Table 7

Total Electric Energy Sales to Commercial and Industrial Customers

	Total Customers	Total M-kwh	Ave.kwh/ Customer
1937	13,585	144,236	10,630
1938	14,284	137,116	9,620
1939	15,046	161,503	10,730
1940	15,785	181,516	11,500
1941	16,507	208,505	12,580
1942	16,265	221,116	13,580
1943	15,821	233,050	14,750
1944	16,363	249,007	15,160
1945	17,680	258,816	14,640
1946	19,673	314,229	15,910
1947	21,842	384,638	17,520

The total M-kwh of energy sales has been combined because of the present method of reporting sales by most of the utilities. The above totals also include irrigation sales. See Table 8 for some of the industrial sales of the larger utilities and the irrigation energy that could be separated from the various reports.

Total energy sales in thousands of kilowatt-hours.

Table 7

Total Electric Energy Sales to Commercial and Industrial Customers

	Total Customers	Total M-kwh	Ave.kwh/ Customer
1937	13,585	144,236	10,630
1938	14,284	137,116	9,620
1939	15,046	161,503	10,730
1940	15,785	181,516	11,500
1941	16,507	208,505	12,580
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Total energy sales in thousands of kilowatt-hours.

Table 8

Electric Energy Growth of
Industrial and Irrigation
Customers
(Thousands of Kilowatt-Hours)

	Industrial	Irrigation
1937	102,162	5,254
1938	85,105	5,795
1939	102,057	6,776
1940	114,282	5,710
1941	133,003	5,563
1942	144,673	6,123
1943	156,540	6,644
1944	164,219	7,345
1945	168,934	6,889
1946	198,210	9,322
1947	244,771	9,341

The energy shown above is included in the commercial and industrial sales of most of the utilities. The data are given here to indicate the growth in these classifications.

Table 9

Electric Energy Sales to
Public Authorities
(Thousands of Kilowatt-hours)

	Street Lighting	General Power	High Voltage Substations
1937	4,007	4,698	-
1938	4,105	4,936	-
1939	4,120	2,183	-
1940	4,142	2,512	-
1941	4,222	5,200	-
1942	4,111	6,338	2,000
1943	4,320	6,181	4,000
1944	4,486	6,477	5,048
1945	4,628	7,576	3,824
1946	4,705	8,936	3,439
1947	4,977	11,471	1,357

Source: Estimated from Bonneville Power Administration data.

The street lighting and general power energy is totaled for the utilities reporting the sales. Some of the utilities do not segregate this energy. The high voltage substations' energy is mostly imported energy which is sold direct to large users.

Table 10

Average Annual Use Per Residential Customer for Municipal Utilities

	Total Customers	Total M-Kwh	Ave.Kwh/ Customer
1937	8,996	15,985	1,778
1947	15,992	68,696	4,290

Table 11

Total Population of Cities Served by Municipal Utilities

	Total Population	Persons per Customer
1937	26,350	2.94
1947	46,050	2.88

Source: State census to determine State tax refunds to cities.

These municipal utilities are located in Ashland, Canyonville, Drain, Eugene, Myrtle Creek, and Bandon. The municipal systems at Canyonville and Myrtle Creek were purchased by The California Oregon Power Company in 1947.

Table 12

1947 Average Annual Use Per Residential Customer for Six Typical Cities

	Total Customers	Total M-Kwh	Ave.Kwh/ Customer
Eugene	12,554	61,464	4,896
Grants Pass	6,127	15,562	2,540
Klamath Falls	11,854	31,200	2,630
Lakeview	1,242	2,419	1,940
Medford	9,383	26,914	2,868
Roseburg	4,698	13,027	2,770

The high average use of energy shown for Eugene is due mostly to the electric range load. 65% of the Eugene customers have electric ranges.

CONCLUSIONS

Southwestern Oregon's electric energy demand has doubled in the past five years. This rapid increase was largely due to the expansion in lumber manufacturing mills. The new R.E.A. lines picked up farms and some mill operations in the rural area. Established utilities also made rural extensions, but most of their load was picked up near the small towns and cities. The demand for lumber and farm products, together with the high prices, created new spending money for the region. The effect of this new prosperity can be noted in almost all classes of service except the street lighting and public authority classifications. This may be explained by the fact that the towns and cities were growing so fast that they could not take care of all of the municipal duties at once. The sale of power to municipal and other public authorities will increase when some of the necessary rebuilding jobs have been completed. Additional street and highway lighting is needed all over Southwestern Oregon. One or two of the cities have started but the increased lighting load is small and only along the business streets. New pumping plants, sewage disposal plants, shops, and government buildings will add new load when the rebuilding is completed. The farm income, for diversified cash crops, will probably not drop to any great

extent because of the demand for farm products. The farms will then be in the market for labor saving machinery in order to keep the operating costs down. With good farm income and the extension of rural lines to new farms, and the increased use of power by farm customers, the present average use of 1500 to 2300 kilowatt-hours might easily be increased to 5000 kilowatt-hours per year. Commercial lighting and flood lighting of buildings, parking areas, and play grounds will add energy load. The number of saw mills will be reduced because of changes in amount and type of timber cut, when the building demand slackens. However, many of these mills are using diesel or donkey engines and this change will not affect the utility load to any great extent. New re-manufacturing mills and the pulp and plywood mills coming to the area should increase the energy sales to the lumber mill operations. The number of new homes now waiting for power and wiring equipment will add new residential customers. These new homes will buy and use appliances and increase the energy use per customer. The potential increase of energy sales is difficult to estimate. However, the utilities of southwestern Oregon realize the necessity of obtaining new load energy for the region, and are planning now for increased energy sales. Additional hydro energy can be obtained in the region where multiple purpose dams are built. This potential hydro capacity has been

estimated to be around 500,000 kilowatts. Some of the power will be needed to pump irrigation water and open up new land now depending on meager rain fall during the growing season. The surplus power could be used in the Northwest power pool and release energy for other areas outside of southwestern Oregon.

Figure 3 is a forecast into the future energy demand of southwestern Oregon. The curve presents an energy load that could be met if additional power is made available to the region. The curve is based on the load increases of the past ten years. It therefore reaches into the future to indicate the potential industrial wealth that is available in southwestern Oregon.

Figure 3

Electric Energy Input to
Distribution Systems
(Millions of Kilowatt-Hours)