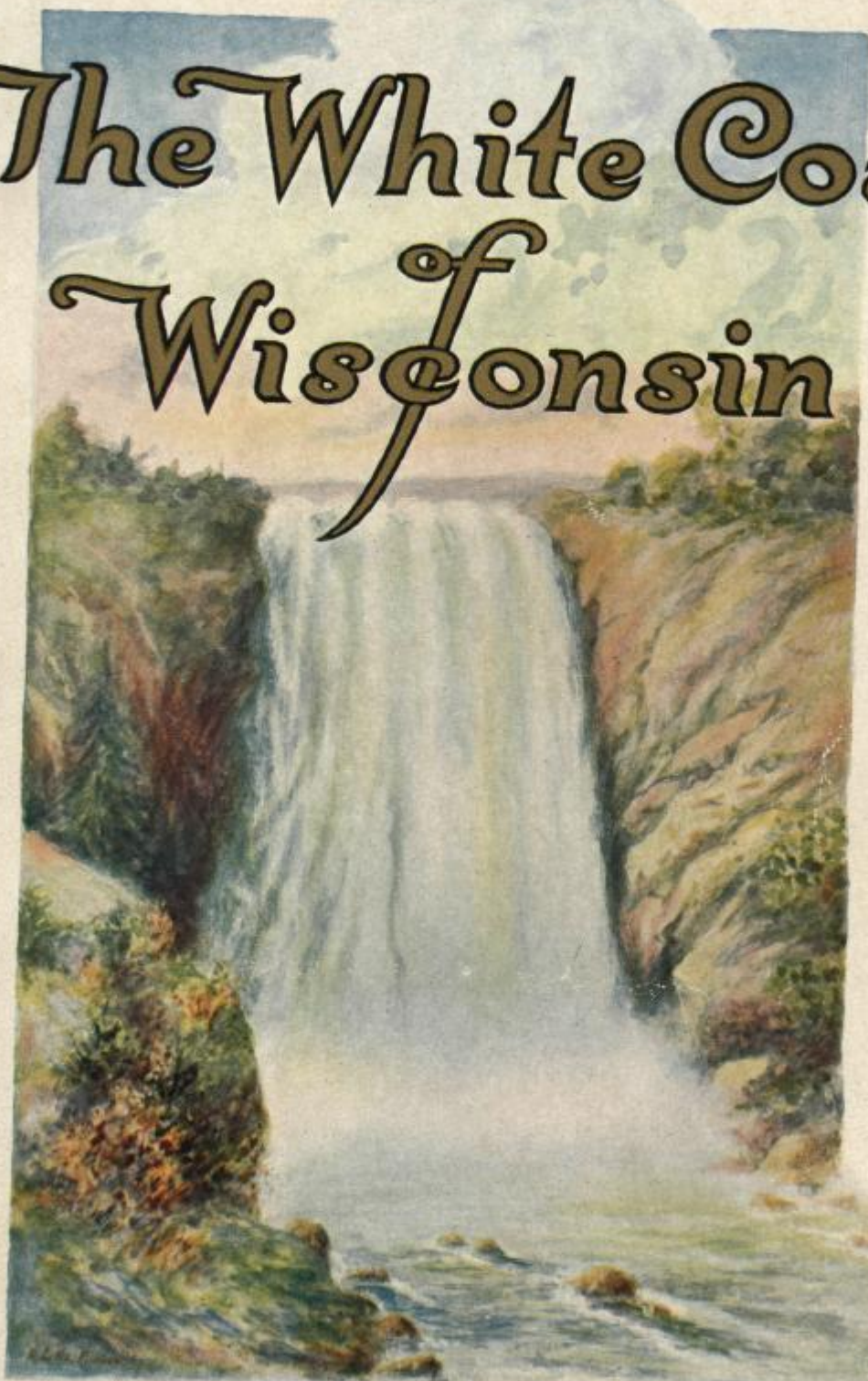


PAM
93-
571

16189

The White Coal of Wisconsin



The White Coal of Wisconsin



1918

Wisconsin-Minnesota Light and Power Company

*Kelsey-Brewer & Co.
Grand Rapids, Mich.
Engineers and Operators*



JOHN

*This book designed and published for Kelsey,
Brewer and Company at the press of the
Etheridge Company at Grand Rapids, in
Michigan. The text by John A. Russell.*

The White Coal of Wisconsin



Foreword

FROM that day when the world was young and the glacier had ploughed its way across prehistoric continent and uncharted sea, leaving in its wake the forms of the mountains and the hills and the receding levels of the valleys, the waters of the earth have run down to the lakes and the oceans. And from that other day when the winds were loosened and set free, the watery vapors have torn themselves from the seas and climbed to the clouds on ladders of sunlight, to be carried back as snows to their mountains or to fall again as rains upon their valleys.

Day in and day out, year in and year out, come season or season go, the endless round of the movement of the waters of the earth has gone on and on again, from snow drift to shower; from rainfall to seepage of field and fen into brook and rivulet; from river flow to lake and ocean, and from these again to rain cloud, to be burst by the lightning or made crystalline by the cold.

They are never lost, never consumed, never diminished in volume, never perma-

nently transformed. All the waters of the earth that ever were are still some place in nature, in the moisture of the surface, in the rain cloud, in the damp of the air, in the snow and the rain, in the water course and in the sea that is open and that which is closed.

They have their moods, too, these waters of the earth. They purr and whisper through meadow, foam merrily over boulder, rush madly through river, and in their seas give the poet his license to declare that "man marks the earth with ruin; his control ends with thy shore. Upon the watery plain the wrecks are all thy deeds."

They are jealous of their liberties, and as they tumble waywardly from level high to level low, they put beside them, or capture and carry as their prisoners, the sands, the rocks, the forests that stand in their way, and bid them restrain their hurry or change their courses. For the waters are not gentle when their liberties are restrained, and the limit of their power is the only limit of their resistance. He who



The White Coal of Wisconsin



Up-Stream View of Power Station

seeks to drive them must make his harness safe and strong; else they will run away with both him and it.

This power of the waters was not made to be idly wasted. Man, whose great ancestor had tamed the Fire and set it to do his work, was not to be balked by the wayward strength of the Flood. He learned to hold it with leash and thong, builded for it a treadmill fashioned after its kind, and whispered to it to do his useful work, to grind his food, to turn his looms, to cut the trees of the forest into useful shapes, and to make the page upon which he recorded his transactions and his deeds. As he learned more of the other forces of Nature, he whispered to the Flood again that he had new work for it to do, that he would harness it in a new way and make it turn the wheels from which he might draw the

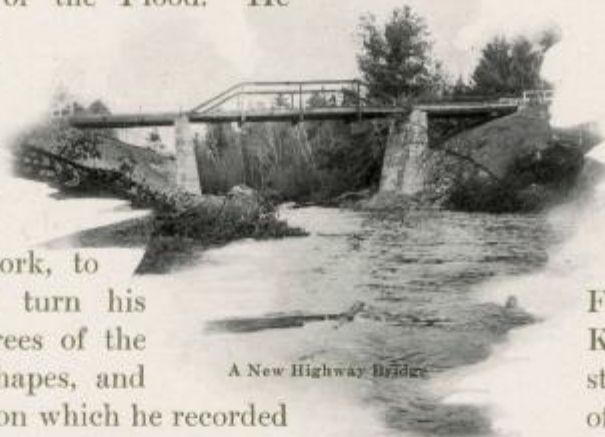
Lightning, that he had already tamed to do his work.

Man has made the Flood his galley slave, to serve him as it rushes from hilltop to sea; and when its work is done he releases it on a brief furlough of idleness, content to let the Sunlight

and the Winds be its warders, to bring it back and set it to work again.

This booklet is the story of the Taming of the Flood in one part of the Kingdom of Man—the story of the application of the hard wrought

Wisdom of the Engineer and the resources of Capital and Labor to the poetry of the Sunshine and the Winds and the Rainfall, and the reduction of all of them to the practical purposes which commerce and industry serve in the processes of civilization.



A New Highway Bridge



The White Coal of Wisconsin



Original Condition of Wisconsin Dam Site

What Water Power Means in Terms of Coal-

THE Northwest—and the whole country, for that matter—has had an experience with a shortage of its fuel supply. This experience has been most drastic with particular relation to the coal required to furnish power for factories. Because fuel to make steam, to be used in turning over engines, has not been available, the national government has lately found it necessary to shut down industry for stated periods.

If, in this emergency, there were undeveloped coal beds in Wisconsin, containing coal of good quality and capable of being mined economically, it can be readily imagined that endless capital would flow to their development, and that the earth's surface within their limits would be speedily dotted with head-houses and breakers and all the other external evidences of the coal mining industry; while through the deepening shafts and from the ever extending galleries and ever opening "rooms" in the bowels of the earth would come forth thousands and thousands of tons of the Black Coal of Commerce.

Wisconsin has no Black Coal deposits of useful value. But she owns a reserve of White Coal, that, compared with the Black Coal supply, has advantages which become obvious the moment they are discussed.

"White Coal" is the poetic name which the Italians have given to water-power. Once developed, White Coal calls for no great labor supply to extract it from the earth or prepare it for market. In its production there are no occasions for dispute between operator and employe about the conditions of labor and the returns therefor. There are no blockades in transportation from the sources of power to the points of its consumption. There can be no confiscation of the energy on the road to its use, and no diversion of it to some customer other than him for whom it is intended. It cannot be shipped beyond the confines of the territory which has equipped itself to employ it. No Fuel Administrator may prohibit or lessen its use, because, to the extent of the capacity of each development, its supply is limited only by the



The White Coal of Wisconsin



Bringing in Construction Material

quantity of the rainfall and the volume of the snow drift. Wisconsin's rivers have in them, as they run to the Lakes and the Mississippi, a force that is the equivalent of a million horsepower. The engineers have a way of figuring this equivalent into exact values in tons of coal. What those values are may be appreciated

from consideration of the coal equivalents of the power now being generated by Wisconsin-Minnesota Light and Power Company, at its power stations now in service and what may be generated from the reserve powers as yet undeveloped.

Taking high water with lessened supply, and the variations of its work day in and day out, the great dam at Wissota produces an annual output of 140,000,000 kilowatt hours of electric energy. It takes four pounds of coal, and sometimes more to produce a kilowatt of electric energy for an hour. The product of Wissota is,

therefore, the equivalent of 560,000,000 pounds of coal per year, or 280,000 tons. The miners work an average of 250 days in the year, and the quantity of coal required to produce the amount of power generated at Wissota would involve the total annual output of a mine producing 1,120 tons of coal a day.

A coal mine producing that much coal every operating day in the year is a pretty sizable colliery.

Taking one thing with another a coal mine produces about four tons of coal per man and boy employed at the collieries; so that the quantity of power produced at Wissota represents, again, the productive labor of 280 miners, trammers, breaker-boys, pit bosses, hoisters, loaders, checkers, shipping clerks and superintendents ordinarily employed at a coal mine.

Loaded on cars this output means 28 daily car loads of 40 tons each. The coal with which the power demands of the Northwest are supplied comes, largely,



Bringing in the First Supplies



The White Coal of Wisconsin



Getting Up Steam for Work

from Southern Illinois and Indiana. These mines are located at an average distance of 600 miles from the points of consumption in the territory served with electric power by the Wisconsin-Minnesota Light and Power Company.

Including the time spent in loading and unloading and delays at sidings, junction points and terminals the average daily progress of a coal car toward its destination is 20 miles. Each day a mine producing enough coal to be the equivalent of the power generated by the waterfall at Wissota must be supplied with 28 cars to take its output and to move 20 miles a day toward their destinations.

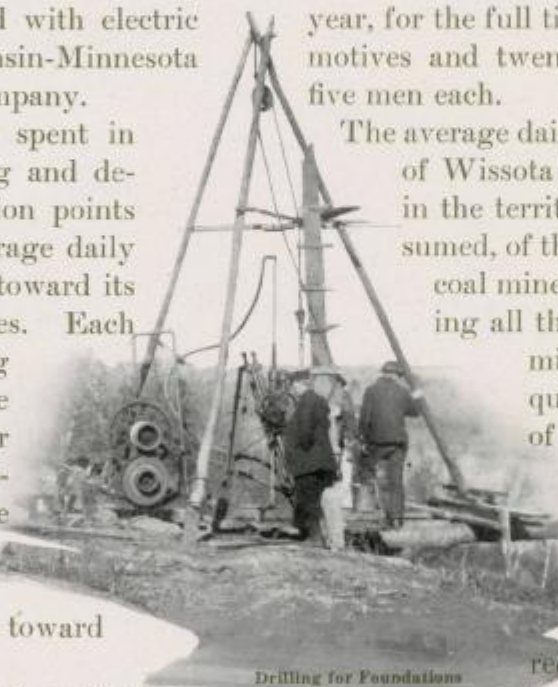
To keep up this supply until the first group of cars become available after a return trip calls for a thirty-day supply of cars, or 840 cars in all, to be continuously in service carrying the coal equivalent of Wissota's power supply to its market of use. Of the 840 cars, about 740 are constantly en route, the remaining 100

being in process of loading and unloading. To handle this traffic on the railroads calls, for the equivalent of 250 days in the year, for the full time of twelve road locomotives and twenty-four train crews of five men each.

The average daily electric power output of Wissota Dam is the equivalent, in the territory in which it is consumed, of the power produced from coal mined by 280 miners, working all the days in the year that miners usually work; requiring the exclusive use of 840 coal cars, twelve

road engines and 120 train men. The number of these, with the men required to switch the cars, maintain the railroad

tracks and equipment, direct the handling of the trains and keep their records, shows the amount of human endeavor expended and physical property devoted to the mining and forwarding of coal that is replaced by a single great water-power, consuming in its operation and the distribution of its



Drilling for Foundations



The White Coal of Wisconsin



Making a Highway to Wissota Camp

energy less than a hundred men, employed not hundreds of miles distant, but in the field where the energy is used for industrial purposes.

Follow this coal a little further. If it be unloaded by hand—at an average rate of twenty tons per day to the man—the mere unloading of this quantity of coal and placing of it ready for use is the work of 120 men, while the actual firing of the furnaces in which it is used calls for the services of as many more.

The amount of coal which would be required to produce the power which comes from

Wissota every day would require from its original place in the mine to its disposition on the grate bars the services of two-thirds of a thousand men.

When to Wissota's output are added those of the Cedar Falls Dam, the Menomonic River Dam, the Chippewa Falls, Eau Claire and Rice Lake Dams, all operated by Wisconsin - Minnesota Light and

Power Company—16,300 horse power in all,—there is represented in this Company's output of electric power the total daily productive capacity of nearly a thousand men, engaged in the mining, transportation and use of coal. If there be added to this computation the equivalent value in coal of the powers not yet developed, amounting to approximately 75,000

horse power, and reserved for the future by Wisconsin-Minnesota Light and Power Com-

pany, the figures are more than doubled. Mean-

time the power produced at Wissota, at

Cedar Falls, Menomonie Dam and Rice Lake, and the Power that may be later on produced

at other dam sites on the Chippewa, and on the lower reaches of the Red Cedar River, costs no stroke of the miner's pick in the recesses of the earth; involves no tedious tramping to shafts; takes up no energy in hoisting to pit-mouth; calls for no skill in preparing and breaking; takes up no space on railroad cars and tracks; keeps no alert engineer watching the blinking signals as



Teaming in the First Timber



The White Coal of Wisconsin



Leading Rock Out of Chippewa River Bed

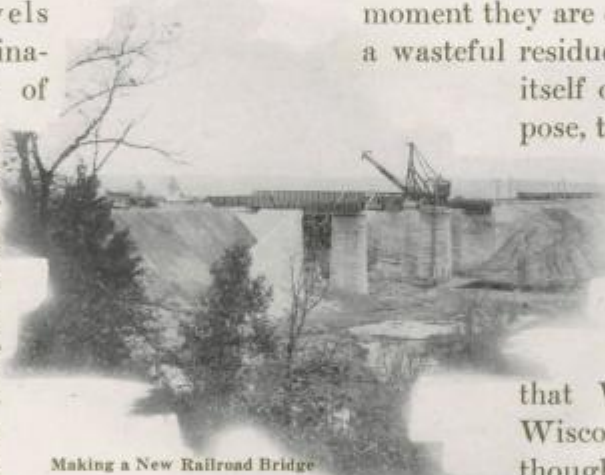
he drags the weary length of the coal train behind him in the night; is delayed by no inclement weather; is shunted from no main track to siding and back to main track again when the "limited" must have the right of way; becomes the subject matter neither of disaster nor of wreck.

Coal fuel travels from mine to destination at the rate of twenty miles a day. Coal for power is not effective for long after the torch that kindles it is applied, and a great residue of each coal fire must be allowed to wastefully burn after the work at which it has been put is over with and done.

Mark the contrast with electric power. Where coal travels twenty miles a day the electric current travels at the inconceivable rate of 288,000 miles a second. The sta-

tion operator has not heard the echo of the click of the switch on his control board at Wissota before the current to which he has given escape is ready to actuate machines in St. Paul and LaCrosse. Where coal requires time "to get up steam", the motors are rotated by electricity the moment they are enlivened by it. Where a wasteful residue of coal is left to burn itself out to no economic purpose, the cost of electric power ends the moment the work of the machine is done and its supply cut off.

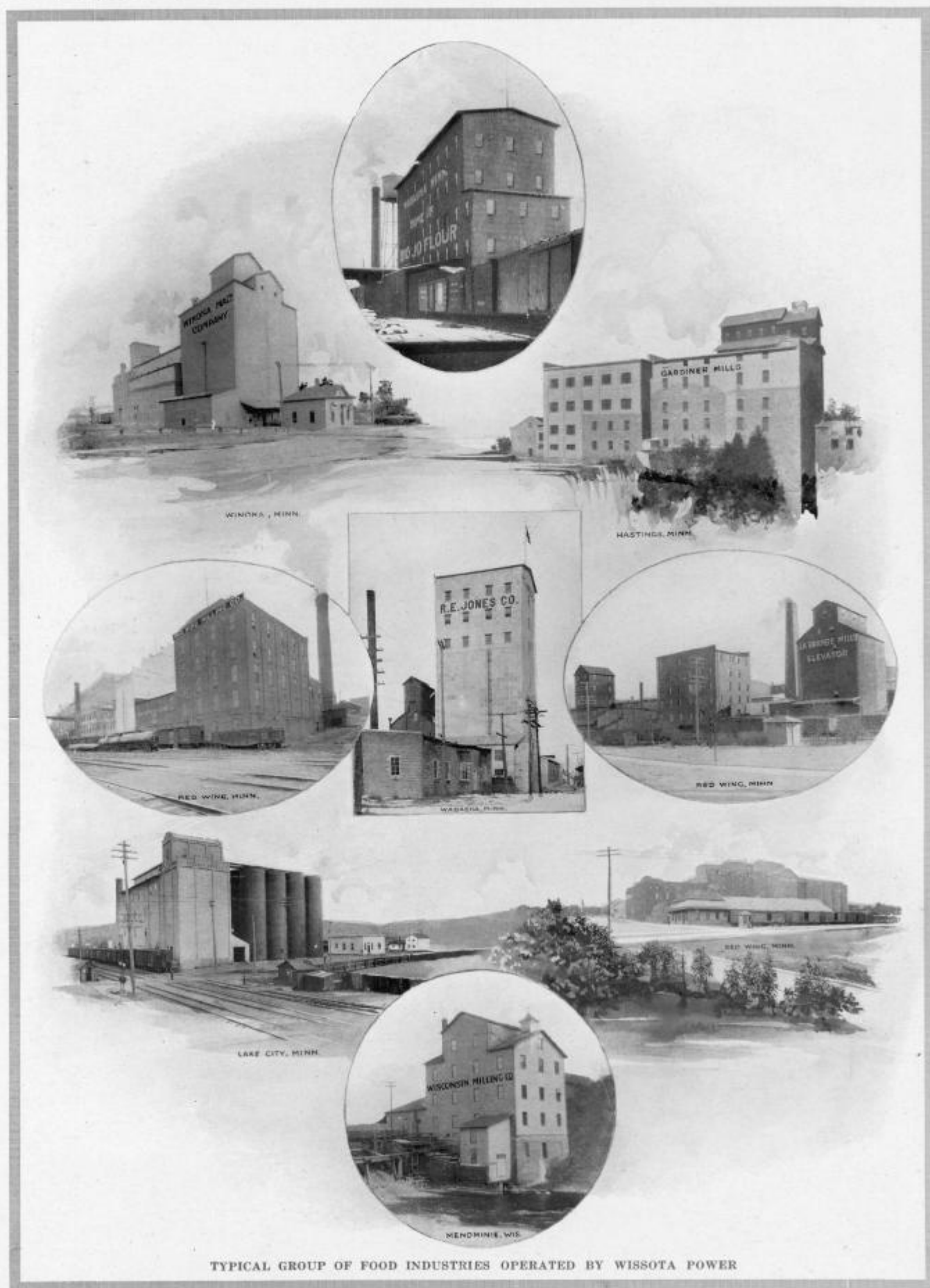
These are the things that White Coal means to Wisconsin. They give the thoughtful reader the reason why investments in its development may realize such tremendous economies as to give the investor a generous return even while his investment is realizing a splendid economy for the public, both in money and convenience.



Making a New Railroad Bridge



The White Coal of Wisconsin



The White Coal of Wisconsin



Chippewa Falls, Wisconsin, and an Undeveloped Power

The Chippewa as a Power Stream -

THE water power resources of Wisconsin are unique. They grow out of its peculiar topography. Wisconsin has a favorable "lay-out" as a source of water power. In practically every other area of equal size in the United States the slopes from the high-lands are pretty evenly divided in all directions. Except in the mountainous regions the slopes are not abrupt, but regular and gradual through the lengths of the creeks and the rivers.

This is only partly true in Wisconsin. There is a high ridge across the northern part of the state, thirty miles from Lake Superior, that limits the area which drains into Lake Superior to the narrow belt between the height of land and the lake. This ridge is from 500 to 1,000 feet above the level of Lake Superior, and as a result the waters that fall north of it run off rapidly and fiercely to the lake.

All the creeks and rivers in that section have rapid currents. Few of them originate in swamps or lakes which hold the rainfall and regulate its flow. As a rule

the rain waters go tumbling off, lickety-spit, down the steep decline to the great lake. None of the rivers, the Black, Bad, Namadji, Bois Brule, Montreal and Gogoshungun Rivers, are of much length, their average being thirty miles, while the largest, the Montreal, is only fifty miles long.

Of the portion of Wisconsin's territory left after cutting off the Lake Superior water-shed, the greater portion is drained into creeks and rivers which find their way into the Mississippi. Of these rivers the St. Croix, Chippewa, Black and Wisconsin flow in a general southwesterly direction from sources in the second tier of counties in the northerly part of the state, as far east as Florence and Forest. East of Forest the water-shed is toward Lake Michigan, the Menominee, Peshtigo, and Oconto Rivers running directly into the Green Bay of Lake Michigan, while the interior rivers as far west as Langlade and Portage, Waushara, Marquette and Shaw Counties have a general southward trend through their basins and combine to form the system which feeds Lake Winnebago



The White Coal of Wisconsin



Tearing Out the Rock of the River Bed

and the Fox River. Outside the Fox River Valley, by far the greater portion of the water-fall of Wisconsin runs off to the Mississippi River through the westerly portion of the state. This means that the opportunities for water power development are to be found most largely in that section. Indeed, outside the great development that has been made on the Fox River, the western portion of the state is the only part in which great powers have so far been created.

The greatest of the power streams of Northwestern Wisconsin is the Chippewa River. The uppermost reaches of its tributaries extend from the middle of Vilas and across Ashland, Sawyer and Washburn Counties. Its great confluent, the Flambeau, drains the entire of Price county and the eastern half of Rusk. Its own east and west branches drain all of Sawyer county and the southeasterly triangular half of Wash-

burn. The run-off from Rusk County contributes equally to the main branch of the Chippewa and to the Flambeau. The Yellow River drains the entire of Taylor County and gives up its burden to the Chippewa, above Wissota Dam site. The Red River drains the whole of Barron and

Dunn Counties and delivers their water to the Chippewa at Dunnville. The waters of the south half of Taylor County and of the westerly part of Clark are carried to it by the Eau Claire River. Three score creeks and little rivers, great enough in dimensions to have



Making the First Coffee-Dam

formed, in their time, water-courses for the pine logs brought to their banks for rafting, swell the quantity of water that passes between its banks from its sources to the Mississippi.

The northerly reaches of the river traverse swamps and low-lands from which the rainfall and the drainage leach out slowly, ensuring constancy of water



The White Coal of Wisconsin



The Trestle for the Industrial railway

supply; and broaden out into ponds, basins and lakes in which tremendous quantities of flood water are naturally stored, and which, with control, become immense areas for the impounding of the water that falls during the time that nature is most generous with her flood supply and rain fall, against the period when she is in thriffter mood.

By the time the Chippewa River has reached Chippewa Falls it is carrying the drainage of 5,600 square miles. By the time the Red River empties into the Chippewa it has in its watery burden the drainage of 1,997 square miles. These two areas are taken into account here because they represent the water resources of the Chippewa Valley which are controlled by Wisconsin-Minnesota Light and Power Company.

To the average layman the drainage area of a river means very little. To the engineer it is the key to the power value of

the stream. There is not so much of mystery about it, either. The water power of a river grows out of its supply of water and the amount of fall which can be made available at given points. The supply of water in Northwestern Wisconsin is considerably greater than that in Minnesota

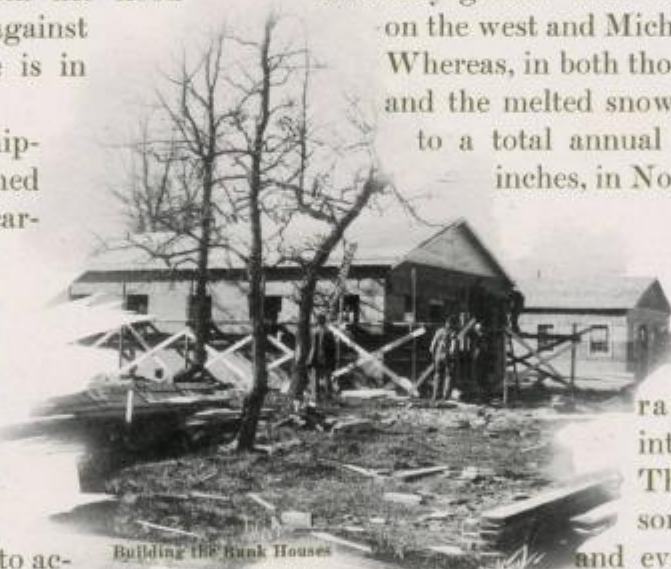
on the west and Michigan on the east. Whereas, in both those states the rain and the melted snows are equivalent to a total annual rainfall of 29.5 inches, in Northwestern Wisconsin the total

rainfall is 32.25 inches per year.

From a fourth to a third of this rainfall runs off into the streams. The balance is absorbed by the earth

and evaporated by the

sun. The quarter portion of the annual rainfall which runs off into the streams means an immensity of water. It means for every square mile of area—nearly 27,000,000 square feet—a quantity of water which would cover it to a depth of eight inches. It means for the 5,600 square



Building the Bunk Houses



The White Coal of Wisconsin



The River Grows Unruly

miles of the area of the territory which the Chippewa River drains above Chippewa Falls, 5,600 times as great a quantity as that last stated. It means for the territory above the mouth of the Red Cedar River nearly 2,000 times that quantity, as an addition. It means, to take the formula of the engineers, a contribution to the river flow of about a cubic foot of water for every square mile enumerated for every second of the year.

It does not all come at once, nor does it come evenly through the year. Normally it comes in flood with the spring thaws and freshets; in lessened quantity as the flow becomes normal and the flood has passed; in increased quantity and at accelerated speed as the spring rains and the fall storms furnish supply. The volume of the water passing through the Chippewa River has been as little as 3,000 cubic feet a second in February and as high as 51,000 cubic feet a second in September. There is water a plenty, at any rate. The

engineer's problem is to equalize its flow as best he may at its point of use.

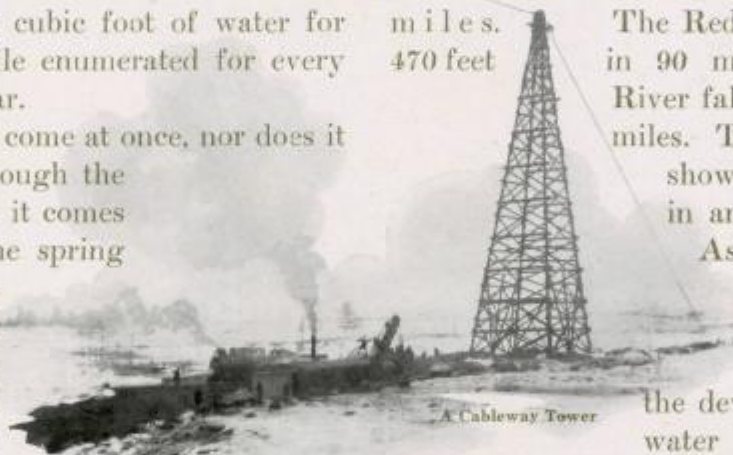
There is fall in the Chippewa Valley as well. The sources of the river are, at their highest point, 1,600 feet above the level of the sea. From this point to Chippewa Falls, there is over 800 feet of fall. The Flambeau River descends 570 feet in 150 miles.

470 feet

The Red Cedar descends in 90 miles; the Jump River falls 500 feet in 65 miles. The Yellow River shows nearly as much in an equal distance.

As a consequence of the conditions stated, the problem of the development of the water powers of the

Chippewa and Red Cedar Rivers has included these factors: Utilization at practical points of the largest possible amounts of fall, and the control of the flood-water and storm-waters of the upper reaches of the rivers and streams, so that they may be impounded as they accumulate and gradually released to swell the stream flow when this becomes reduced from natural causes.



A Cableway Tower



The White Coal of Wisconsin



When the Flood Took Hold

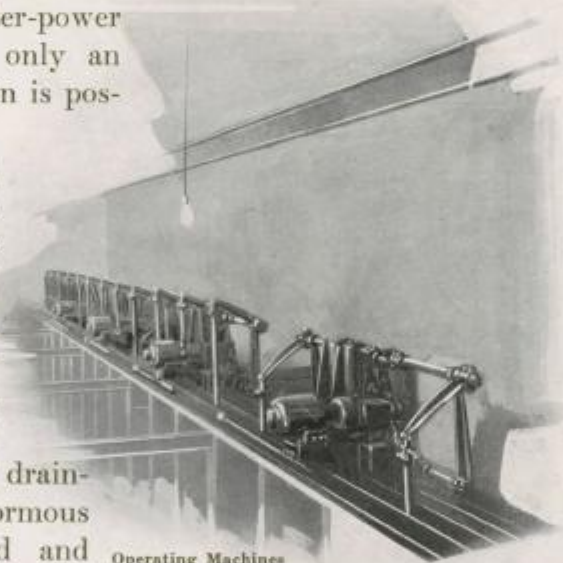
The ideal water-power system would conserve all the available water supply and feed it over the water-wheels of power stations at such speed that none of it would be wasted. On the Chippewa, as on most other water-power streams of volume, only an approach to perfection is possible.

In the Chippewa River, however, the approach may be made nearer to perfection than on any other similar operations. Lakes of considerable size and number exist in the drainage area, in which enormous quantities of flood and storm water may be confined. Some of these have been already utilized by Wisconsin-Minnesota Light and Power Company, and some others will be utilized in the future, as will be shown in the more detailed description of the de-

velopment of the river's power at Wissota. Suffice it to say here that in this treatment of the storage facilities of the river lies the control of the discharge of its waters; so that the power stations established at its falls and rapids may have their supply of water measured out to them by their own needs rather than by the caprice of nature.

Under this treatment the water developments become

permanent producers of quantities of power that are definitely constant, and which may be relied upon to meet the requirements of demand of the market in which they are sold.



Operating Machines for Type H Switches



The White Coal of Wisconsin



Water Running Over Spillway

The Making of Wissota Dam -

THE Wisconsin - Minnesota Light and Power Company was organized in July, 1914, under conditions more clearly set out in the subsequent chapter about "A Territory as Large as a Kingdom." It is a Wisconsin corporation. It has an authorized capital of Ten Million Dollars, of which Five Million Dollars is Seven Per Cent. Preferred Stock, and Five Million Dollars is Common Stock. It has authority to issue Bonds to the amount of Twenty Million Dollars. Amounts of these various issues have been so put out from time to time for the purpose of carrying out its corporate plans.

It owns and operates the gas supply of Eau Claire, Chippewa Falls, and La Crosse, in Wisconsin, and of Winona and Red Wing, in Minnesota. It operates twenty-four miles of local and interurban railway in and between Eau Claire and Chippewa Falls. It owns and operates the city water supply of Chippewa Falls. It furnishes hot water service at La Crosse. Its income in the calendar year 1917 was

\$1,712,220.40. Of this income twenty-seven per cent. was credited to its gas properties, and the rest to its electric utilities, for, after all, the street railway lines are customers of the electric supply and the water works duty is performed by electric pumps.

Its gas business has been highly developed in the communities served, but the growth of this activity must naturally follow other lines of development than the electric supply. Gas cannot be piped to long distances and its uses are less varied than those of electricity. The electrical development knows no such limitations. Already the company supplies light and power to more than forty communities in Northwestern Wisconsin and Eastern Minnesota. The number of these is constantly being increased by extension into places which have previously had no such service, or by the acquisition of local properties from owners who recognized that electric energy made from fuel cannot serve the public as continuously or as well as that supplied from water-powers. In



The White Coal of Wisconsin



Placing Regulating Gates

addition, the Company has owned—partly since its organization and partly as subsequent acquisitions—many thousand acres of land contiguous to the water-power streams of the Chippewa Valley, available for flowage when the development of the various power-sites become timely.

These were the general features, financial and otherwise, of the organization which undertook the construction of the great dam and the water-driven electric power station at Wisconsin, on the Chippewa River, two and a half miles north of Chippewa Falls. It had already in operation, on the Red Cedar River, a modern type dam and power house of 10,000 horse power capacity, operating under a head—or water-fall—of fifty feet. It had another smaller dam on the Red Cedar of 2,200 horsepower; was deriving 400 horsepower from an installation at the old Weyerhaeuser mill property at Chippewa Falls, and had an 800-horsepower interest

in the Dells dam near Eau Claire. Its managers were strangers neither to the development and operation of such properties nor to the market possibilities of their product.

Exploration and tests having determined a suitable location, work was commenced, in November, 1915, upon the creation of a barrier to the waters of the Chippewa River which would consolidate sixty feet of its fall at a single point and make it available for the production of electric energy.

It was foreseen that the task would employ a large force of workers and that it would take many months of time. So, as a first step, a regular town was laid out, for the housing of the employees, adjacent to the site of the proposed improvement. The groundwork of the town planning was the water and sewerage system. Pure water was taken from springs above the dam site and distributed into every build-



Testing the River Bottom for Foundations



The White Coal of Wisconsin



Another Stage of Flood-Gate Setting

ing; and a complete sewerage system was laid down to empty its wastes into the river at a safe distance down-stream from the camp site.

The structures included a modern home for the superintendent of construction; bungalows for engineers and foremen living on the job with their families; bunk-houses and a central dining room for the working men; and separate houses made available for workers with families. The bunk-houses were heated by steam, conveyed under-ground from the source of supply; lighted by electricity, and their lavatories were supplied with hot water. The commissary facilities included a kitchen of large size, backed up by a cold storage house for meats, an ample grocery supply and root-houses for the storage of vegetables. The dining room was of capacity sufficient to seat 350 persons at a time, this being about half the

force employed. The meals were served on china, with a waiter to each twelve persons.

In the bunk-houses standard double-decker iron beds with mattresses for each person were provided. Each employe was required to bathe and have his linen washed weekly. The sheets on the bunk-

house beds were renewed with the same frequency, with an additional renewal each time a new tenant

called for their use. Gambling and liquor supply were taboo. Reading and recreation rooms

were attached to each bunk-house. For the camp, as a whole, a tobacco shop, a billiard and pool room and an assembly room in which recreational features were provided, were established and maintained. These features varied from exhibitions of "Movies" and amateur exhibitions to really pretentious concerts provided by considerate residents of the adjacent city of Chippewa Falls.



Shoveling Rock by Power



The White Coal of Wisconsin



Building Power-House in Midwinter

A hospital with six beds, a pharmacy and a resident physician provided for emergency cases, and the general run of minor ailments with which the usual proportion of so large a force might be afflicted. For the inevitable casualties, first aid was provided by the resident physician; while the services of a leading surgeon of the neighboring city and the facilities of a modern general hospital in the same place were at the disposal of employees whose cases called for surgical treatment or continued hospital attention.

There were not a few children of school age in the construction camp at Wissota. For these a standard Wisconsin school-

house was built and a teacher provided by the Wisconsin - Minnesota Light and Power Company, this being the first recorded case of a district school maintained in Wisconsin without a tax levy.

Aside from these creature comforts, a complete equipment for the construction of so great a work as the power-station at Wissota was intended to be, was assem-

bled at the spot. A spur track was built in from the main line of the railroad, and out of the supplies brought in upon it grew great towers, carrying cable ways of two and a half inch steel rope across the river; boiler houses and drill sheds; machine and repair shops, immense piles of lumber; stores of steel bars for reinforcement, fabricated and otherwise; hoisting engines and gear; lorry cars and diminutive locomotives; dredges and steam shovels; logs for piling and false work; stone for cribbing; cement bin houses and mixers

and the thousand and one things that go with intensive construction.

As the beginning of the work was followed by the advent of winter—and one of the winters of Northwestern Wisconsin at that—the scene presented at Wissota in short order after the beginning of work on the water-power development was one of industry framed in exhausting steam.

The point on the Chippewa River at which the engineers deemed it best to



Gravel Washing Plant



The White Coal of Wisconsin



Transmission Line Builders' Camp

locate this development is 100 miles east of St. Paul, ninety miles south of the iron region, and 213 miles northwest of Milwaukee. Up-stream from it the Chipewewa's drainage basin has a length of 180 miles and a greatest width of ninety miles. The total amount of fall in the river for a considerable distance was consolidated at this point into a single available fall of fifty-seven feet. To accomplish this necessitated the building of a barrier sixty feet high, extending from hillside to hillside and across the valley and bed of the stream 4290 feet in length, 910 feet of this being a concrete spillway and the remainder earth embankments 3380 feet in length in their various sections.

To make the foundation for this concrete structure a channel was cut in the bed of the river, which is of granite rock. This rock was explored by drill holes, each of which was tested under a water pressure of fifty pounds to the square inch to develop possible seams and faults. These

drill holes in the rock foundations aggregated 2,154 feet in length.

The location of the power house and spillway were determined to some extent by the geographical conditions. On the right of the site is a high bluff below which is the river bed, composed of an old and a new channel surrounding an island. On either side of the island there were rapids with a drop in the river of about three and

one-half feet. Placing the power-house at the foot

of the rapids was more economical than a location further upstream. Going further downstream

would have necessitated excavating

through loose material below the rapids to get a favorable foundation on ledge rock. While each channel has rapids, the south channel was deeper and a trunk-line railroad ran along the south bank at this point. The bank is 85 feet above the river bed. This feature made the depositing of concrete in the power-house comparatively easy.



Complete Concrete Mixing Plant at Work



The White Coal of Wisconsin



Down Stream from Wisconsin Dam

The site presented other natural advantages when it came to locating the spillway. Placing it next to the power-house, which is in the old channel, would have caused the north end to come in the north or new channel, necessitating a high, costly concrete spillway with the disadvantages accompanying a long fall of the spilling water. Accordingly the earth embankment was built adjoining the power-house and the spillway located on the plateau further north.

The embankment material between the power-house and the south bank was obtained from the south bank. That between the power-house and spillway section was handled by steam shovels and trains. It was transported over a timber trestle and dumped, after which it was sluiced into place.

The water in the south channel of the river was coffered off above and below the proposed site. Ordinary timber crib coffered filled with rock and "A" frames

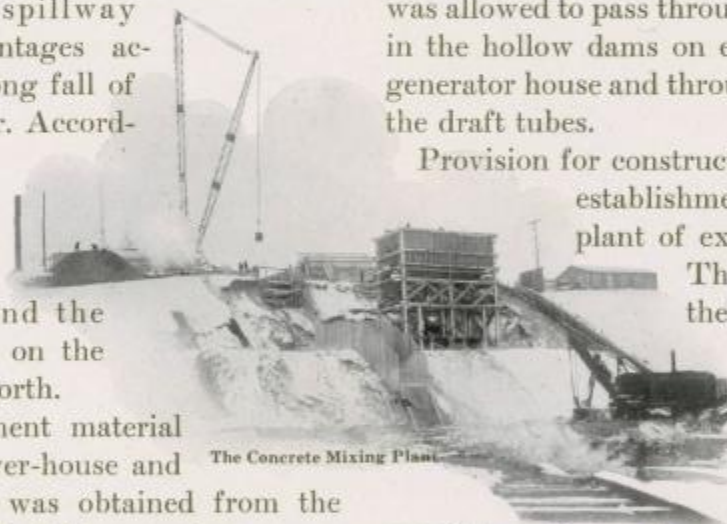
sheeted up-stream and backed up with rock were used. The first coffered crossed the south channel above and below the site and extended across to the island. This left open the channel north of the island. Upon closing the north channel the water was allowed to pass through twelve sluices in the hollow dams on either side of the generator house and through the sluices in the draft tubes.

Provision for construction involved the establishment of a concrete plant of extensive capacity.

This was located at the top of the south bank, which was the south end of the dam. The capacity of this plant

was 600 yards per day of ten hours. The plant was divided into four bins, one for cement, of 100 barrels capacity; two for gravel, each with 120 yards capacity, and one for sand with 180 yards capacity. Mixing machines of adequate capacity were installed.

The gravel was obtained on the north bank and carried across the river bottom



The Concrete Mixing Plant



The White Coal of Wisconsin



Company's Gas Plant at Eau Claire, Wisconsin

and south channel below the up-stream cofferdam on a timber trestle. A belt conveyor elevated this gravel from the gravel storage pit to the bin.

Bulk cement delivered in box cars was unloaded at the siding and with a Weller cement elevator was emptied into the cement storage, which was 16 x 120 feet, and capable of holding about 5,000 barrels at one time. A screw conveyor located longitudinally in the center of the cement storage floor delivered the cement to a belt conveyor which in turn placed it in the cement bin of the mixing plant.

The correct weight of gravel, sand and cement was obtained by daily tests of the materials after which the proper weights were set on four balance scales. The aggregate was then put into the mixers and thence into two-yard buckets which were on the electric cars. The cars delivered these at the job on the trestle or else to the cableway.

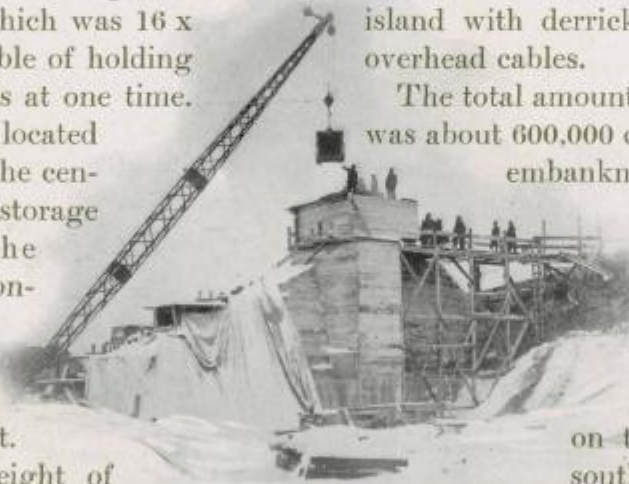
Construction was begun in December,

1915, by excavating for the north embankment core wall. This was done by steam shovel and was carried to rock. The main coffer in the river channel was unwatered December 26, 1915, and on December 28, 1915, the dam was closed. In January, 1916, work was well under way on the island with derricks, steam shovels and overhead cables.

The total amount of earth embankment was about 600,000 cubic yards. All earth embankment was core-walled with a concrete wall reinforced vertically and longitudinally with steel rods.

Rock excavation on the island and in the south channel amounted to 70,000 cubic yards.

On August 28, 1916, construction on the power-house and hollow dam was high enough to allow of turning the river through the hollow dam sluices and spillway tubes under the power-house. The north channel had been coffered off and the coffer in the south channel torn out. Upon closing off the north channel, the



Placing Concrete Under Winter Conditions



The White Coal of Wisconsin



New Railway and Highway Bridges

earth fill across the river was begun. All earth dumped from the trestles was sluiced in place to make immediate settlement as complete as possible.

The pond, or Wissota Lake, was raised by dropping the temporary gates of the sluices in the hollow dam section on either side of the power house and closing the valves in the spillway tubes under the power-house.

The earth fill, concrete core-wall and rock excavation for the core-wall, together with the stripping of the dam site, removing the overburden and placing loam in the embankment were all let under one contract.

About 37,000 yards of rock were excavated for the core-wall trench and about 580,000 yards of earth were placed in the embankment with dump cars and with sluicing. Six steam shovels operated in the pit on the north bank and these loaded three dump car trains. These trains trav-

elled over trestles located in the embankment. On account of the frozen condition of the ground when most of this was placed, the fill was placed higher at the outer edges of the embankment than at the core-wall, live steam was forced into the puddle near the core-wall, and the material

was dumped into this first. In this way the frost was taken out of the earth and a compact job resulted.

In order to secure the 60 foot head at Wissota it was necessary to move portions of both the Omaha and Soo Line Railroads and change highways at different places, all of which necessitated the rebuilding

of six bridges. These bridges varied from a small highway bridge over Stillson Creek to a railroad bridge and highway over the Chippewa River, about half way up the pond. The piers of the Chippewa River work were very massive—about 30 feet wide at the bottom, 12 feet thick and



Letting Water Through the Ports



The White Coal of Wisconsin



Public Buildings in Eau Claire, Wisconsin

50 feet high. The railroad bridge was constructed with four 100-foot girders. The highway bridge over the Chippewa River has four spans with 750 feet total. About 15,000 yards of concrete, 30,000 yards of rock excavation, 350,000 yards of earth fill, 600 tons of structural steel and a considerable amount of piling were required for the construction of these bridges.

For the six power units decided upon, each with 92-inch diameter wheels, it was necessary to make the generator house 193 feet long. Adjoining the generator house on the south is the switch room. On either side of the generator house the impounded waters are taken care of by hollow dams resting on rock.

All piers were saw-toothed into the rock to make sliding impossible.

The pond is held at a normal elevation by 13 automatic Stauwerke gates, whose combined lengths are 832 feet. The concrete structure supporting these gates is located on the rock plateau north of the

north river channel. As soon as the pond level rises, the gates start to open. The mechanism of the gates is so sensitive that a rise of one inch in the pond level is sufficient to start the gates downward. The gate is wide open—in other words in a horizontal position—as soon as the pond level has risen four inches above its normal stage. If the pond level rises only two inches, the gate will be only half open. This movement is entirely independent of any operator. It is, further, independent of any wiring, electric motors, supply of current or transmission gears. It is wholly subject to the increase in water pressure due to the flood itself through the

rise in the pond level, a force which never fails at the right instant, independent of weather or any other conditions.

The striking features of Wissota Dam are the following:

It was built by Wisconsin-Minnesota Light and Power Company to provide electric energy for the territory in North-



Bridge on Reconstructed Railroad Line



The White Coal of Wisconsin



Making Earth Fill at North End of Dam

western Wisconsin in which the Company operates, covering nearly 14,000 square miles.

The quantity of its electrical product being years in advance of the needs of the territory in which it is produced, the construction of the work was hastened and its financing made much easier by contracting to furnish its excess of power to the Northern States Power Company for use in the Twin Cities.

The dam at Wissota is fifty-seven feet higher than mean water level, has 910 feet of concrete spillway, and 3,380 feet of earth embankment, with a concrete core-wall inside it.

The drainage area above the dam is 5,600 square miles.

The mechanical plant is designed for the use of a maximum of 9,000 cubic feet of water per second.

The prime motors are six turbines, each of 7,500 horse-power capacity, which run at 120 revolutions per minute, and are installed in open reinforced concrete flumes with spiral scroll cases.

These turbines drive six 6,000-kilowatt, three-phase, 60-cycle Allis-Chalmers electric generators, direct-connected to the turbines, set vertically, each of them of a capacity of 6,000 kilowatts, produced at 13,200 volts.

The construction of the plant consumed eighteen months of time, from November, 1915, to May, 1917.

The average output of the station is 140,000,000 kilowatt hours of electric energy per year.

This current is distributed over 380 miles of transmission lines, 100 miles of which extend from Wissota to St. Paul, seventy-five miles of this line being in a mathematically straight line, which is probably the largest stretch of perfectly straight transmission line in the

United States. The water storage capacity which it is next proposed to develop up-stream from this station, to provide for the conservation of flood flow and storm-water, will take care of seventeen billion cubic feet of water.

The normal discharge of water through

Typical
Transmission Line Tower



The White Coal of Wisconsin



Completing Rock and Earth Embankment to raise lower Cofferdam

the Chippewa River at Wissota is 5,842 cubic feet per second.

The minimum flow is 1,300 cubic feet per second.

The water storage facilities are calculated to bring the low water stage of discharge of 2,000 cubic feet per second up to 3,000 cubic feet per second during the low water months.

These are, strangely, not the months of the summer, during which streams in other parts of the country are lessened in volume, but the months of December, January and February, during which the waters of Northwestern Wisconsin are held back by freezing weather conditions.

The standing head of Wissota water-power development is fifty-seven feet.

The dam holds back water which, at its normal stage, creates a pond or lake of 6,377 acres, or just a trifle less than ten square miles. The greatest daily draft

which can be made on the water of the pond will reduce its level but a foot and a half.

The longest transmissions of the energy produced are over a 100-mile line to St. Paul, which will be duplicated, and over 120 miles of line to LaCrosse. The St.

Paul transmission line is built of three copper wires, hung on four-legged steel towers, fifty-seven feet high and anchored into the earth with iron anchors.

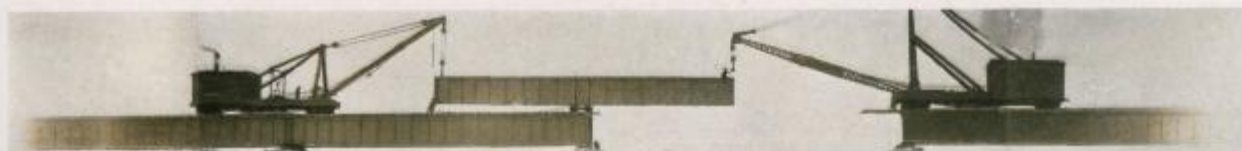
The line is planned to carry 20,000 kilowatts of energy at 110,000 volts, with a line loss not exceeding 9 per cent, or 30,000 kilowatts with a line loss not exceeding 13 per cent.

The amount of concrete used for the dam, powerhouse, core-wall and other construction was 90,000 cubic yards.

The total rock excavation exceeded 120,000 yards.



Scroll Case and Wheel



The White Coal of Wisconsin



Excavating for Power House

The total earth fill amounted to more than One Million Cubic Yards.

The structural steel used weighed over 1,400 tons.

The reinforcing steel used weighed 1,300 tons more.

The cement used was equal in bulk to 110,000 barrels.

The core-wall in the earth embankment is eighteen inches in thickness at the rock and tapers to twelve inches at the top.

The core-wall is seventy feet high in some places.

The dam was constructed by Kelsey, Brewer & Company, engineers, Grand Rapids, Michigan.

The Fargo Engineering Company, of Jackson, Michigan, were the designers of the dam and accompanying works, and acted as consulting engineers for the entire enterprise.

The hydraulic machinery was constructed by the Allis-Chalmers Company,

Milwaukee, Wisconsin. The electrical transforming and switch-apparatus was made by the General Electric Company.

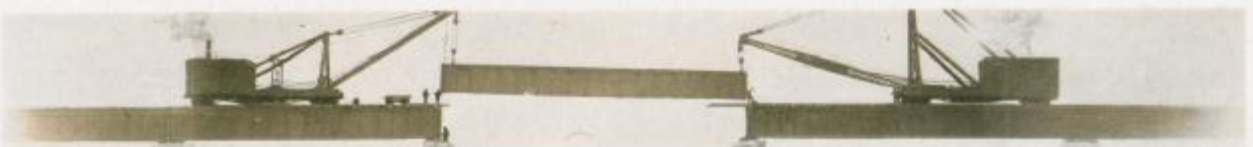
The total cost of Wissota Dam, power station, its transmission lines and accessories was approximated \$5,000,000.



Machine Shop
Operated by Wissota Power

When the supplementary works for the conservation of storm water and flood-flow in the reservoirs up-stream from Wissota Dam are erected one of the greatest water-power developments of the Middle West will be completed. The effect of the creation of these res-

ervoir projects will be the impounding of nearly twenty billion cubic feet of water, to be held and fed into the normal low water resources of the river and its confluents as it is needed to keep up a continuous output of power, making Wissota Dam one of the steadiest and most reliable sources of electric power on the continent.



The White Coal of Wisconsin



Guntzie Side

A Territory as Large as a Kingdom~

BELGIUM is in every one's mouth nowadays. It is one of the "Little Kingdoms" whose integrity is to be restored when the war is won by the United States and the Allies. Its area supports five millions of people. Its capital city had at its zenith, a population of less than three-quarters of a million.

Because it is a Kingdom, even a "Little Kingdom"—Americans are inclined to associate with it the idea of size. Belgium is 165 miles long in its greatest dimension and 120 miles across. Yet Kingdom as it is, its area is really less than that of the territory which the facilities of the Wisconsin-Minnesota Light and Power Company serve with electric energy for the various uses to which electric current is put.

An area as great as that of one of Europe's "Little Kingdoms" forms the field of the peaceful and industrial occupations of Wisconsin - Minnesota Light and Power Company. Its population is well nigh three-quarters of a million people. Added to these the populations of the

Twin Cities of St. Paul and Minneapolis, the power markets of which are available and physically connected with Wisconsin Dam, aggregate nearly three-quarters of a million more.

This territory was originally the seat of the pine timber trade of Wisconsin. As the raw material supplies of that territory became exhausted the cities turned to industry and the cut-over lands were reduced to the purposes of agriculture. Every portion of the area of Wisconsin and Minnesota shown by the map of the Company's field of operations is traversed by railroads. Every county has its quota of thriving villages. The area, as a whole, has its due proportion of well-grown cities.

The power resources of the industries of these places were first of all, the remnants of the wood supply. Then came coal, some shipped by lake and rail from Lake Erie ports, with the greater supply from the Indiana and Illinois mines, all of it burned in the furnaces of the individual users. As the use of electricity came to



The White Coal of Wisconsin



Pouring Concrete in Cofferdam

be developed there began the era of the making of power in bulk and its distribution over wires to retail users in small areas.

Meantime the possibilities of the water-powers of Northwestern Wisconsin were not fully appreciated. The units of water power which were susceptible of combination into great sources of power supply had been gathered into private ownership in the days of the lumber operations. Small dams here and there furnished waterfall sufficient to run the saw-mills or hold back water enough to drive the rafts down the rivers when it was released for that purpose. Still other dams restrained the waters of the lakes and marshes to provide flood-water for the log-drives after the river waters had run off.

But that was all. There were no consolidations of lesser water-powers into single ones of great head and great possibilities. That remained for a later day.

The presence of great amounts of spruce

and other paper-making timber contiguous to some of Wisconsin's rivers brought about the next stage of progress in the consolidation and utilization of water powers. Seemingly immense quantities of power were required for grinding

wood and turning the rolls upon which the ground-wood and the sulphite fibre were made into paper. To provide this, long stretches of falls were consolidated and the waters impounded by greater dams and into greater ponds than had theretofore been erected. This was the case particularly on the Fox,

the Wisconsin and the Wolf Rivers. But the power thus derived was used directly on water-wheels, was not turned into electric energy and was not distributed to whomsoever chose to buy and use it.

Then came the era of development for popular use. Its advent was delayed



Railroad Signals Operated by Wisconsin Power



The White Coal of Wisconsin



Pouring Concrete in Abutment

somewhat by well-meant but impractical plans for state control of the water-powers, some aiming at state ownership of the powers, some even at development at state expense.

These failed for various reasons. Exclusive private titles to stream-beds and necessary flowage lands adjacent to them could not be upset, and courts so decided.

Then the attention of legislatures was directed toward such regulation of private and corporate ownership as, while not hampering development, would still preserve to the public the right to regulate the corporations engaging in development.

Wisconsin, equally with every other Western State, had experienced many evils incident to the development of its railroads. Excessive capitalization had been established, and remained to become the foundation of excessive rates. Great

promotion profits had been taken without "by your leave", and remained as a burden to be supported for a long time. Discriminatory systems of rates had been in vogue, whereby one community or one set of customers had undue advantages over other consumers and customers.

Wisconsin's contest to cure these remaining evils of pioneer development cul-

minated in the establishment of a Railroad Commission, with large powers of control, and the water-power control problem was finally solved by passing it over to the Commission, under a schedule of regulations not unlike

those applied to railroads and other public utilities.

This made possible several conditions. Among them were the following:

THAT companies developing the water-powers of the State might be organized, but that their capital should honestly



500 feet Complete Corewall



The White Coal of Wisconsin



Down Stream View of Wisconsin Dam

represent the investment made in them. This was in the interest of the investor, to begin with, and of the users thereafter.

THAT the capital obtained for development should be honestly and intelligently spent in the enterprise. This was in the interest of the investor.

THAT the values accruing from putting together the elements of the water-power enterprises should be estimated on the basis of the finished project, rather than from the separate values of the disconnected units which formed part of it. This was in the interest of the pioneer and developer, in that it put an honest but not an excessive premium upon the applica-

tion of brains and foresight to the combination of natural conditions with industrial possibilities.

THAT the reviewing power of the State should ever influence the relations of the power companies with their patrons, to the end that the one might not exact an overcharge for service rendered, nor the other demand such service for less than its proper cost, with a proper additional return for the capital invested. This was not only in the interest of both the investor and the public, but of public order as well, by preventing discord between public servants and their patrons.

THAT the corporations rendering such



Down Stream View of Wisconsin Dam

The White Coal of Wisconsin



Showing Lake Wisconsin in Back Ground

services should be kept free from competition so long as they served the public adequately and justly. This, again, was in the interest of the investor, by preventing the duplication of facilities, the building of two plants to do the work for which one would best suffice. Under these regulations entrance into the business of power development, in a large way, became possible to capital under ideal conditions. It became possible for large investments to be made safely, in large developments, producing large quantities of power, spreading the costs of the highest grade of management and technical control over the largest possible gross amount of busi-

ness, thereby reducing the proportion of cost of management—technically called “overhead”—to the lowest reasonable percentage.

At this stage of the perfection of Wisconsin's system of legal control and regulation of such industries in the interest of continued harmonious relations between public utility companies and their patrons, there were a number of such companies operating in Northwestern Wisconsin and Eastern Minnesota under diverse ownerships. The La Crosse Gas and Electric Company operated a gas and electric lighting system at La Crosse, in conjunction with a central heating system. The



Taken from River Bed at Tail Race Level

The White Coal of Wisconsin



Excavating in Spillway Channel

Chippewa Valley Railroad, Light and Power Company owned and operated the electric light and power, and street railway properties of Eau Claire and Chippewa Falls, an interurban railway connecting the two cities, and an undeveloped water power at Chippewa Falls. It had also already absorbed the light and power companies at Elmwood, Ellsworth, Spring Valley and Menomonie, and the water works at Chippewa Falls.

The Red Wing Gas Light and Power Company and the Winona Gas Light and Coke Company were operating in their respective cities on the west bank of the Mississippi River. The Eau Claire Gas Light Company was doing business in Eau Claire, Wisconsin. A considerable number of smaller places either had no electric supply, or were furnished such service only in connection with other lines of business, the hours of service and the quality thereof being

dependent upon the necessities of "the other business" rather than upon the needs of the users of electric current.

From these properties, as a nucleus, and with the purpose of operating all of them and such others as might be later acquired, there was organized the **WISCONSIN-MINNESOTA LIGHT AND POWER**

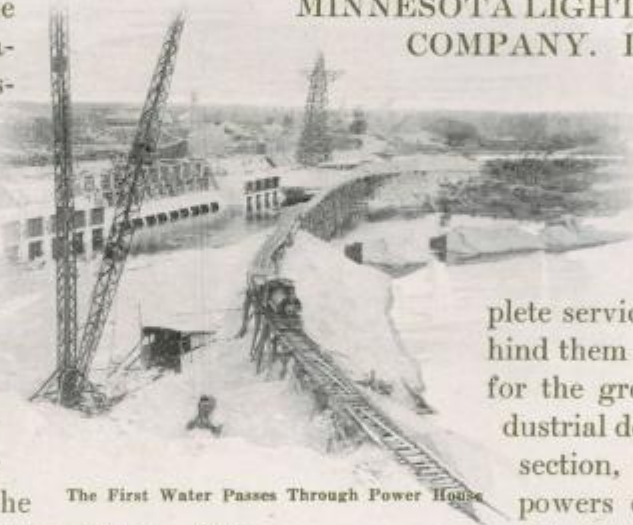
COMPANY. Its purpose was to

consolidate and organize the public utility facilities of the whole territory into one complete

service, and to put behind them all as a provision for the growth and the industrial development of the section, the undeveloped powers of the Chippewa River and its tributaries.

The extent and possible usefulness of these powers is fully set forth in another place in this publication, and need not be repeated here.

It is sufficient to indicate that the **WISCONSIN-MINNESOTA LIGHT AND POWER COMPANY** was built



The First Water Passes Through Power House



The White Coal of Wisconsin



Interior of Blacksmith and Machine Shop

upon foundations broad enough, and was planned with sufficient study of the future needs of Northwestern Wisconsin and Eastern Minnesota, to provide, under the laws of Wisconsin, exactly what the people had started out to get for themselves—the development of their great natural power resources, the most reasonable cost of the resulting service, an honest but not exorbitant return upon the investment required, and an assurance to the investor that no ill-advised competitive effort to do the same service would bring about excessive and duplicate investment.

The territory which this organization serves, and which, with development, it will continue to serve more intensely, has been likened in area to one of the "Little Kingdoms." It includes the counties of Monroe, LaCrosse, Trempeleau, Jackson,

Pepin, Pierce, St. Croix, Barron, Dunn, Eau Claire, Chippewa, Clark, Vernon, Washburn and Buffalo, in Wisconsin, with a combined area of 11,436 square miles; and the counties of Winona, Wabasha and Goodhue in Minnesota, with a

combined area of 1,945 square miles, making an area of 13,381 square miles in which Wisconsin-Minnesota Light and Power Company's resources are to the largest extent the supply of electric power.

If to these be added the areas of Hennepin, Ramsey and Dakota counties, in Minnesota, to which large amounts

of power are furnished by wholesale contract with local distributors, a further area of 1,325 square miles is added, making 14,706 square miles of territory up to date which constitute the marketing field for the produce of the power of the falling waters of the Chippewa Valley, when



Placing Transformer Weighs 21 Tons



The White Coal of Wisconsin



Locating Center Line of Buttresses

applied to water-wheels actuating machines which produce electric energy.

This is a very great field for opportunity in the business of producing and distributing electric power. It has a present population of a million and a half, which is constantly growing by natural increase and accessions from immigration and settlement. In area it is larger by half than the whole of Massachusetts or of New Jersey; nearly three times as great as Connecticut; six times the size of Delaware, and ten times the size of Rhode Island. While not so long nor so closely settled as these states, it has very much of industrial development and its people are progressive. It is the seat of the flour milling industry of the Northwest. It lies nearer to the primary sources of iron and steel supply than any industrial section in the Union. It has enough timber left to constitute the basis of a long-lived

industry in the fabrication of wood products from their forest state to their finished condition. It is far from a coal supply for its power purposes, and while coal has in the past supplied and perhaps ever will supply a large share of its power needs, the

water resources of the territory, and particularly those which have been developed

by Wisconsin - Minnesota Light and Power Company, are operating its mills and factories, lighting its city streets and homes, and are even being applied to the mechanics of agriculture.

Already there are mills and factories in great number in this Kingdom of Industry

which are carrying on their work wholly with electric

power. Their extent and importance can best be gathered by the reader of these pages from the illustrations which are shown on the various pages of this book.



Runway through Hollow Dam



The White Coal of Wisconsin



Assembling Concrete Mixers

The Wisconsin-Minnesota Light and Power Company-

IT IS NOT the purpose of this booklet to lay as much stress on Wisconsin-Minnesota Light and Power Company, the corporate owner and operator of the properties described in these pages, as upon the extensive work of development which it has undertaken in Northwestern Wisconsin. It may not, however, be out of place to give a few of the salient facts connected with this extensive public service corporation.

It was organized under the laws of Wisconsin, in June, 1914.

Its authorized capital stock is \$10,000,000, divided into \$5,000,000 of Seven Per Cent Cumulative Preferred Stock and \$5,000,000 of Common Stock.

Of its Common Stock Two Million Five Hundred Thousand Dollars, in par value, is owned by American Public Utilities Company, and represents an actual investment in excess of that sum.

Of its Preferred Stock upwards of Four Million Dollars is outstanding.

The ownership of its Preferred Stock is divided between more than Twelve Hun-

dred Individual Stockholders. It has an authorized issue of Twenty Million Dollars of Five Per Cent Bonds, of which upwards of Seven Million Dollars are in the hands of the public.

Since its organization the Company has paid out to its security holders, for interest on its Bonds and Dividends on its Preferred Stock, nearly a Million and a Quarter Dollars.

Its properties include gas, electric lighting, street railway, water works and central heating properties as follows:

At Eau Claire, Wisconsin—The entire facilities for supplying gas and electric light and power to the city; the street railway system of the city, and an interurban railway connecting it with the contiguous city of Chippewa Falls.

At Chippewa Falls, Wisconsin—The entire facilities for furnishing gas, electric light and domestic water supply to the city, and the street railway system of the city.

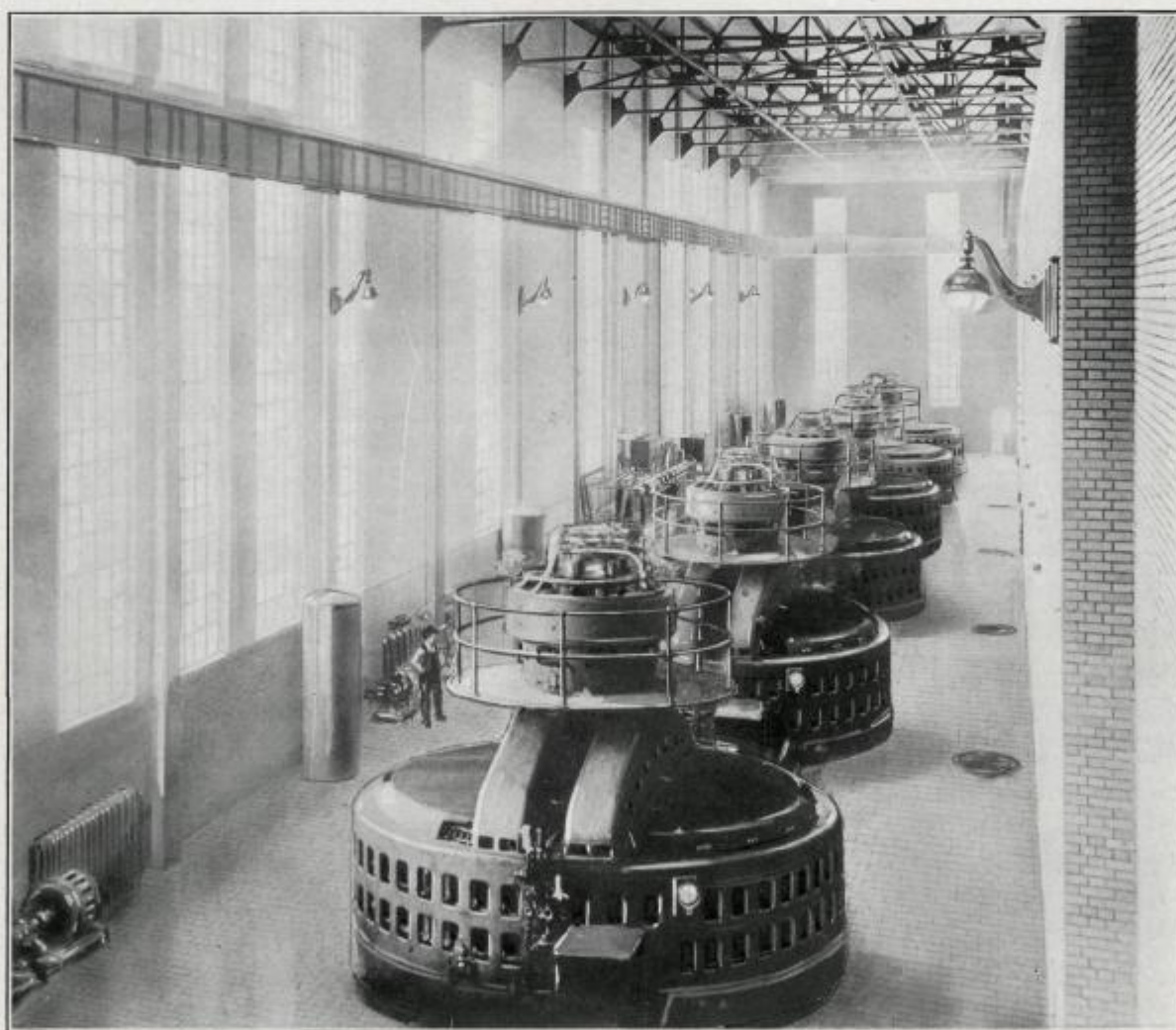
At La Crosse, Wisconsin—The entire facilities for supplying gas and electric



The White Coal of Wisconsin



Pouring Concrete in Corewell



Interior View of Wisconsin Hydro-Electric Station, showing six, seven thousand four hundred H. P. Generators



The White Coal of Wisconsin



Setting up Forms for Pen-Stocks and Scroll Cases

light and power to the city, and a central heating system.

At this point the water power facilities of the Company are reinforced by a modern steam power station of large capacity.

At Menomonie, Wisconsin—The entire facilities for furnishing electric light and power to the city.

At Winona, Minnesota—The entire facilities for furnishing gas to the city.

At Red Wing, Minnesota—The entire facilities for furnishing gas and electric light and power to the city, as well as to Wabasha and Lake City, Minnesota.

At the following places in Wisconsin, the enumerated electric light and power facilities: At Wissota, a hydro-electric generating station of 45,000 horse-power. At Eau Claire, an interest in a hydro-electric generating station equal to 800 horse-power. At Cedar Falls, a hydro-electric generating station of 10,400 horse-power. At

Menomonie, a hydro-electric generating station of 2,200 horse-power. At Chippewa Falls, a hydro-electric generating station of 350 horse-power. At Rice Lake, a hydro-electric generating station of 400 horse-power. In addition, when developed, power equal to 75,000 horse-power.

The Company's transmission lines have a combined length of 328 miles, and are being constantly increased as the demand for the Company's service is extended to additional communities. The operations of the Company are conducted in Wisconsin under the Public Utility Laws of the State and are supervised by the Wisconsin Railroad Commission, and in Minnesota under equitable public franchises.

No Preferred Stock in addition to that at any time outstanding, may be issued unless the earnings of the Company, applicable to the payment of dividends upon the Preferred Stock outstanding and that to be issued, shall be one and one-half times the requirements for this purpose.



Low tension, 13,200 volt switches



The White Coal of Wisconsin



CHIPPEWA FALLS, WIS.



CHIPPEWA FALLS, WIS.



RED WING, MINN.



CHIPPEWA FALLS, WIS.



RED WING, MINN.



RED WING, MINN.

SHOE INDUSTRIES SUPPLIED BY WISCONSIN POWER

The White Coal of Wisconsin



Excavating Rock in Spillway Channel

Growing Domestic and Industrial Uses of Electricity~



The First Light

lighting and street car operating, at that, and they do the lighting in a way very different from the ways in which it used to be done.

The first lighting of the pioneers was done with the pine-knot "flambeau", or torch, shown herewith, which lighted the way on many a dreary passage through woods and river. Then came the tallow wick-lamp, a basin of tallow with a float-

ing wick and which gave modest illumination to camp and cabin. It in turn was followed by the candle-stick and the candle lantern in which the molded tallow-candle found their use. The ancient lantern was a thing of wonder as an illuminating device. Made of tin, perforated with a chisel, so that the flaring edges of each perforation acted as a wind-brake for the opening, it served only as an indication of light rather than as a light giver. Incidentally, the illustration shown herein is a reproduction of an actual lantern of this type used for more than forty years on a Chippewa Valley farm which is now lighted electrically. The smoking whale-oil lamp, without a chimney, and the ordinary house-lamp came next, types



The Tallow Lamp



The White Coal of Wisconsin



The Earth Dam Growing



The Candlestick

which have almost ceased to be familiar even in the smaller communities of Western Wisconsin and Eastern Minnesota, and which are reproduced here rather as recollections of the things that have been than as examples of things that are.

When came the electric light, it was the ponderous, clumsy, badly regulated open-carbon lamp which is illustrated herein, as a contrast to the boulevard or "White-way" type of street illumination of the present day and age, the modern form of street illumination which is exclusively used in the six leading communities served by Wisconsin-Minnesota Light and Power Company, and partially used in many others of lesser size but equal ambition.

But lighting and street car service are not the only purposes to which electric power is devoted in the territory which

draws its energy from Wissota Dam and the other sources of power controlled by Wisconsin-Minnesota Light and Power Company, and which stake out for it the lines of duty along which it must proceed to provide for increasing demands in the future. No more interesting showing of the general replacement of steam power by electricity in the larger industries and its substitution for manual and other power in domestic life and agriculture can be given than that taken from the actual experiences of the Company in the territory in which it operates.

Among the things which are being done electrically in Western Wisconsin and Eastern Minnesota at this time are the following varied operations:

The streets and public places of cities and villages are lighted.

Stores, houses, churches and public auditoriums are furn-



The Candle Lantern



The White Coal of Wisconsin



Work of the Steam Shovel



The Whale Oil Lamp

ished with illumination.

Advertising signs are operated.

Public water systems have their pumps driven by electricity.

Telephone and telegraph plants, and police and fire alarm systems are actuated.

The "movie" type of amusement in small places, as well as large, is wholly dependent on

electric power. In fact this form of amusement cannot exist, with modern appliances, in a community not supplied with electric service.

The signal systems of three steam railroads are furnished the power to actuate them.

Many thousands of barrels of flour are ground each day in mills having "electric drive."

Shoe manufacturing machines producing 3,000 pairs of shoes per day depend on it as their motive power.

Freight and passenger elevators run by it.

Street railways, both local and inter-urban, are supplied with power.

Domestic and commercial refrigerating machinery is kept in motion.

Laundry machinery, both in public laundries and private homes, is operated from the electric supply.

Cabinet-makers use electrically heated glue-pots.

Under one roof in a single Wisconsin factory wool is carded, dyed, spun, woven and manufactured into ready-to-wear clothing, every machine used in the various operations being electrically driven.

In domestic economy thousands of tiny electric motors are used to run sewing machines, washing machines, vacuum cleaners, coffee grinders, and other thousands of heating units operate percolators, toasters, chafing dishes, flat irons, curling iron heaters and serve a score of other domestic uses.



The Kerosene Lamp



The White Coal of Wisconsin



Panorama View of Construction Works at the Dam



The First Electric Arc

In agricultural industry the use of electric power extends from the use of operating motors in the implement factories, to the farms, where electrically driven machines are used for milking, churning and cutting ensilage.

In the preparation of food-stuffs electric motors operate machines used in candy factories, cracker factories, sauer kraut works, cider mills, custom feed mills, flour bleachers, popcorn and peanut roasters, soda mixers, condensed milk plants and meat chopping and grinding establishments.

From the making of paper to its completed use in the press, electrically driven machines are sawing wood, grinding pulp, turning paper making machines, furnishing light for making illustrations, operating type-setting machines, heating matrix tables for printing offices, and running the presses.

For the making of wearing apparel, electric motors are operating in the same territory, woolen mills, bleaching machinery, manifold cutting-knives for tailors, button making and sewing machines, and are furnishing the motive power for the spinning of wool.

In medical and surgical work, electrically driven drills are used by dentists, electrically heated sterilizers by physicians, and electric heating pads and nursing bottle warmers in the infirmary and the nursery.

In the fabrication of wood, electric motors are used in Western Wisconsin and Eastern Minnesota to drive machines which make church furniture, base-ball bats, axe and hammer handles, chisel handles, shoe lasts, electric pianos, fishing tackle and bee keepers' supplies.

Current from Wisconsin and the other



The Modern Street Lamp



The White Coal of Wisconsin



Shoveling Broken Rock From Foundations



The Electric Stove

sources of power of Wisconsin-Minnesota Light and Power Company is being used to operate church organs for Divine service.

It is employed to operate barbers' massage machines and air purifying devices, to vulcanize automobile tires, to supply the power for automatic air pumps, to charge storage batteries, and to operate floor polishing and scrubbing machines.

In several places the whole series of processes for making automobile tires is conducted on machinery actuated by electric power.

In practically every community in which the Company operates, frozen water pipes are thawed out by the use of electric apparatus.

In business offices electric motors are being used to operate cash registers, adding machines, sampling and sealing devices.

In metallurgical work, electric spot welding, soldering, metal refining, riveting and plate cutting are being done with electric power derived from the Chippewa River and its confluent.

There are cannon in use on the Western Front in the European war which were finished on lathes made by electric power in Eau Claire.



Electric Heating Device



The Electric Heater



The Electric Radiator



The Electric Tailors' Goose



Electric Heating Pad



The White Coal of Wisconsin



Eau Claire Box and Crating Company, Eau Claire, Wis.



The Electric Sad-Iron



The Electric Soldering Iron



The Chafing Dish



The Electric Percolator

American soldiers in the various national cantonments are being fed, in part, with canned food-stuffs which were hermetically sealed by electric soldering irons, whose heat was derived from Chippewa River power.

Some of the bacon that is fed to them was branded with electrically heated branding irons, indicating the origin of food product.

American soldiers, both at home and abroad, are wearing great-coats, the raw materials and the manufacture of which, from start to finish, were handled on machines driven by Wisconsin power.

American gunners are firing shells made in Detroit on lathes manufactured in one Wisconsin community which uses no other power in quantity than that furnished by this company.

American automobile users are driving on roller-bearing axles, the tools to make which were fabricated by Chippewa River's energy.

These are practical facts within the Company's knowledge of the domestic and industrial uses to which the power of Wisconsin and the energy derived from its sources are being put at the present time.



The Curling Iron Heater



The Electric Hot-Plate



The Electric Grill



The Electric Glue Pot



The White Coal of Wisconsin



A Railroad Shop Operated by Wisconsin Power

The Communities Served by this Organization-

THE communities in Western Wisconsin and Eastern Minnesota which are served by Wisconsin-Minnesota Light and Power Company include some of the most prosperous cities of the Northwest, as well as some of the most thriving. The Twin Cities of Minneapolis and St. Paul use a great deal of the power produced by Wisconsin-Minnesota Light and Power Company, under a contract between that company and the Northern States Power Company, which distributes electric energy in these cities. The importance of these two cities is too well known to require extended mention. Suffice it to say that their ever-growing demands for power give promise of furnishing a ready market for the surplus produced at Wisconsin and the other water-power developments already made or to be made by the Company for all the years that the supply will be available.

The cities in which Wisconsin-Minnesota Light and Power Company operate electric and gas utilities and render their services to its patrons make up a group

of communities with a most remarkable diversification of manufacturing industry. The largest of these are LaCrosse, Eau Claire, Chippewa Falls, Menomonie and Rice Lake, in Wisconsin; and Red Wing, Wabasha and Hastings, in Minnesota, besides an imposing group of smaller places whose aggregate present and growing demands for electric energy constitute the solid foundation of Wisconsin-Minnesota Light and Power Company's business in Western Wisconsin and Eastern Minnesota. A brief indication of the size, development and industries of each of these places follows:

La Crosse, Wisconsin

The seat of LaCrosse County, situated 198 miles west of Milwaukee and 140 miles south of Minneapolis; population, 33,000. The LaCrosse division of the C. M. & St. P. Ry. places it in communication with Chicago; the Southern Minneapolis, Dubuque and River divisions of the same road with Iowa, Minnesota, the Da-



The White Coal of Wisconsin



Down Stream View From Wissota

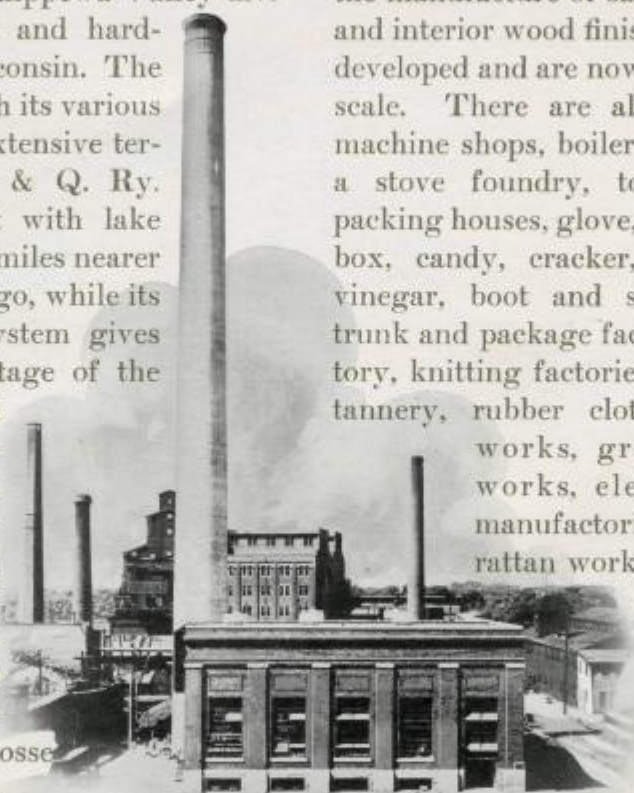
kotas and the Pacific coast, and the Wisconsin Valley and Chippewa Valley divisions with the pine and hardwood regions of Wisconsin. The C. & N. W. Ry., with its various divisions, develops extensive territory. The C. B. & Q. Ry. brings it in contact with lake navigation, over 200 miles nearer tidewater than Chicago, while its place in the Hill system gives LaCrosse the advantage of the Northern Pacific and Great Northern connections to the Pacific Coast. The Father of Waters itself, during the season of navigation, is an important factor in the city's distribution problem. The LaCrosse & Southeastern Ry. bring LaCrosse into

more direct communication with Vernon, Crawford and Richland counties. The city was incorporated in 1856. For years the staple industry was the manufacture of lumber. The mills have now disap-

peared; but kindred industries, such as the manufacture of sash, doors and blinds and interior wood finishings, have steadily developed and are now operated on a large scale. There are also large foundries, machine shops, boiler works, boat works, a stove foundry, tobacco warehouses, packing houses, glove, mattress, box, cigar box, candy, cracker, furniture, broom, vinegar, boot and shoe, confectionery, trunk and package factories, a button factory, knitting factories, carriage works, a tannery, rubber clothing factory, tool works, granite and marble works, electrical instrument manufactories, woolen mills, rattan works, iron works, brick mills, breweries and

cooperages. Its flour mills have a daily capacity of 6,000 barrels. There are works for the manufac-

ture of plows and agricultural implements. LaCrosse carries on an extensive jobbing business with Western Wisconsin, Northern Iowa, Southern Minnesota, and the states of North and South Dakota.



The Company's Steam Plant at La Crosse, Wis.



The White Coal of Wisconsin



Northwestern Iron and Steel Company, Eau Claire, Wis.

Taxes and insurance rates are moderate. The total banking resources of the city are \$14,000,000.

During 1917 the electric send-out of Wisconsin-Minnesota Light and Power Company in this city was 7,273,000 Kilowatt hours, and the gas send-out 149,111,000 cu. ft. The Company also maintains a central heating plant in the city.

Eau Claire, Wisconsin

The county seat of Eau Claire county, population 20,000, located on both sides of the Chippewa and Eau Claire rivers. The C. M. & St. P. Ry., C. St. P. M. & O. Ry., and M., St. P. & S. Ste. M. Ry. run through the city. Eau Claire is 84 miles east of St. Paul and 321 miles northwest of Chicago. The city's industries include foundries and machine shops, lumber and shingle mills, a paper

and pulp mill, a refrigerator and ice box factory, furniture factories, shoe factories, a sawmill, machine works, automobile works, breweries, pork packing establishment, boat works, creameries, sweat pad factory, trunk factory, overall and shirt factory, trunk factory, canning plants, box and veneer factory, sauerkraut and pickle

plants, candy factory, steel and iron works, gasoline engine factory, a rubber tire factory, harness and saddlery factory, and numerous other minor industries.

The city is the seat of a Normal training school, a hospital, public auditorium, armory, Car-

negie Library, Y. M. C.

A. structure, and a tuberculosis sanitarium.

The total banking resources of the city are in the neighborhood of \$6,000,000.

The Company's electric send-out in this city for 1917 was 16,398,497 Kilowatt hours, and its gas send-out for the same period 64,896,800 cubic feet.



LA CROIXE, WIS.



The White Coal of Wisconsin



Chippewa Falls, Wisconsin

The judicial seat of Chippewa county, population 10,000, located on the Chippewa river and on the C. M. & St. P. and C. St. P. M. & O. and M., St. P. & S. Ste. M. Rys., 12 miles north of Eau Claire, 104 miles east of St. Paul and 350 miles northwest of Chicago. It is connected with Eau Claire by an interurban electric railway. There is a fine court house and jail, many fine business structures and costly residences, 3 banks, churches of several denominations, beautiful Irvine Park, the Wisconsin Fair Association grounds, a Carnegie Library, a Federal building for postoffice and United States revenue offices. The County Asylum, located just outside the city limits, was completed at a cost of over \$75,000. The Home for the Feeble-Minded, three miles southeast of the city, represents an investment of \$1,000,000. Among the more prominent industries are flouring

mills, shoe factories, auto works, sash, door and blind factories, a canning factory, a foundry and machine shop, brick works, cigar factories, shirt factory, glove factory, hosiery factory, woolen mills, creameries, beet sugar factory, and a brewery. The city is the market center for a large farming community, and is located nearest of

the cities served by the Company to Wisconsin hydro-electric power - producing station.

The banking resources of the city aggregate \$3,500,000.

The Company's electric send-out in 1917 in Chippewa Falls was 2,652,818

Kilowatt hours. The gas send-out in the same year was 19,855,000 cubic feet.

Winona, Minnesota

The county seat of Winona County, population 21,000, and fourth city in



The White Coal of Wisconsin



A portion of Menominee, Wisconsin

population in the state. The C. & N. W. C. B. & W., C. G. W., C. M. & St. P. and the C. B. & Q. Railways give excellent transportation facilities. Has Baptist, Catholic, Christian, Congregational, Episcopal, Evangelical, Lutheran, Methodist and Presbyterian churches,

water and gas works, electric lights, electric street cars, a Commercial Club, flour, feed and planing mills, three breweries, a malting plant, bottling works, C. & N. W. and C. G. W. Railway shops, meat packing plants, wagon, carriage, box, shoe, traction engine, fire apparatus, overall, candy,

harness, soap, broom, glove and medicine factories, brick manufactories, foundries and machine shops, wholesale and jobbing houses, department stores, a number of good hotels, a public library with 32,000 volumes, opera house, a State Normal school, the College of Saint Teresa for

Women, conducted by the Sisters of St. Francis, a commercial college, four banks, several grain elevators and warehouses, and a city hospital.

The total banking resources of the city are \$12,000,000.

The Company's gas send-out for 1917 in this city was 100,000,000 cubic feet.



The Company's Office at Winona, Minnesota

Red Wing, Minnesota

The County seat of Goodhue County, population 12,500; located on the C. M. & St. P. Ry. and the C. G. W. R. R. and the Mississippi River, 41 miles southeast of St.

Paul. Has Baptist, Catholic, Christian Science, Episcopal, Lutheran, Methodist and Presbyterian churches, a good public school system, the Lutheran Ladies' Seminary and Red Wing Seminary, a public library, a municipal theatre, four banks, six hotels, two breweries, a tannery, two



The White Coal of Wisconsin



Omaha Railroad Shops at Eau Claire, Wis.

hospitals, and flour and feed mills. The principal manufacturing industries are furniture, sewer pipe, stoneware, malt, launches, engines, barrels, shoes, linseed oil, brick and gloves. The Minnesota State Training School is located here.

The total banking resources of the city are \$125,000. The Company's electric send-out in this city for 1917 was 2,777,919 Kilowatt hours. The gas send-out for the same period was 32,779,000 cubic feet.

Wabasha, Minnesota

County seat of Wabasha County, population 3,000, on the C. M. & St. P. Ry. and the Mississippi River, 70 miles southeast of St. Paul. Has Catholic, Congregational, Episcopal, German Lutheran and Methodist churches, two banks, three hotels, three grain elevators, flour and planing mill, boat works, a brewery, an opera house, public library, creamery, hospital and Orphans' Home. Ships flour, barley, produce, wool, sash, doors and

boats. The total banking resources of the city are \$1,000,000.

The Company's electric send-out in this city for 1917 was 2,777,919 Kilowatt hours.

The gas send-out for the same period was 33,000,000 cubic feet.

Menomonie, Wisconsin

Judicial seat of Dunn County, population 6,000, located on the Red Cedar River and on the C. M. & St. P. and C. St. P. M. & O. Rys., 70 miles east of St. Paul and 240 miles northwest of Milwaukee. Has Baptist, Catholic, Congregational, German Evangelical, German Lutheran, Methodist Episcopal, Unitarian, and three Norwegian churches, a public school system, the Dunn County Normal School, the Dunn County Agricultural School, a magnificent memorial building costing \$107,000, and containing a library, and the Stout Institute, recently



The Company's Salesroom, Winona, Minnesota



The White Coal of Wisconsin



The Company's Power Dam at Rice Lake, Wisconsin

taken over by the state with property valued at \$675,000, and an enrollment of 500 students; four substantial banks. Immense quantities of brick are manufactured and shipped.

Menomonie has the greatest pearled barley mill in the world, a piano factory, automatic pump works, flour, feed, saw and planing mills, an electric light and power plant, gas engine factory, gas plant and cigar factories. Menomonie is the location of the Wisconsin Milling Company, operating the third largest flour mill in the state. The total banking resources of the city are \$3,000,000.

The Company's electric send-out for 1917 in this city was 1,610,220 Kilowatt hours.

The Menomonie and Cedar Falls hydro-electric stations of the Company are located near this city.

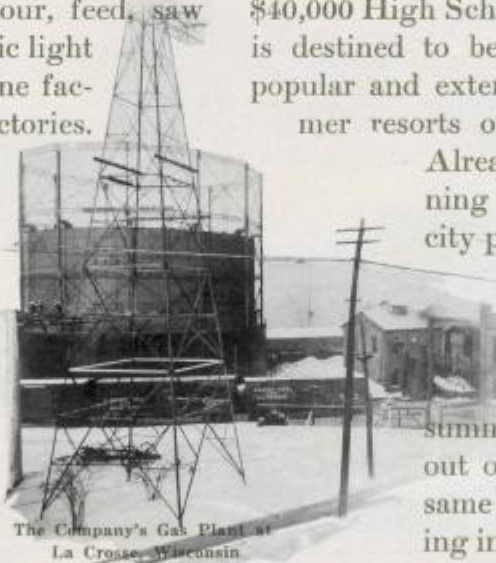
Rice Lake, Wisconsin

Located on the shore of Rice Lake at

the mouth of Red Cedar River and on the C., St. P. M. & O. and M. St. Paul & S. Ste. M. Railways, in Barron County, 255 miles from Milwaukee. Has a public library, three banks, churches of the various denominations, and an up-to-date public school system, which includes a \$40,000 High School building. Rice Lake is destined to become one of the most popular and extensively patronized summer resorts of Northern Wisconsin.

Already a splendid beginning has been made in the city park and broad driveway skirting the west shore of Rice Lake and an extensively planned park and summer resort has been laid out on the east shore of the same lake. The manufacturing industries are mostly concerned with the production of lumber and wood products. The Company's Rice Lake power station is located at this point.

The total banking resources are \$1,500,000. The Company's electric send-out for 1917 in this city was 876,172 Kilowatt hours.



The Company's Gas Plant at La Crosse, Wisconsin



The White Coal of Wisconsin



Gillette Tire Works at Eau Claire, Wisconsin

Hastings, Minnesota

County seat of Dakota County, population 4,500; on the C. M. & St. P. and the C. B. & Q. Rys.; 20 miles southeast of St. Paul. Its exceptional transportation facilities make it a shipping and receiving point of great importance to the surrounding country. Has Baptist, Catholic, Episcopal, Lutheran, Methodist and Presbyterian churches, a hospital, two banks, six hotels, a brewery, a malt house, two grain elevators, flour and feed mills, a time-recorder factory, an opera house, a commercial club, and a creamery.

A State Asylum for the Insane is located here. The city is the market for an extensive farming community.

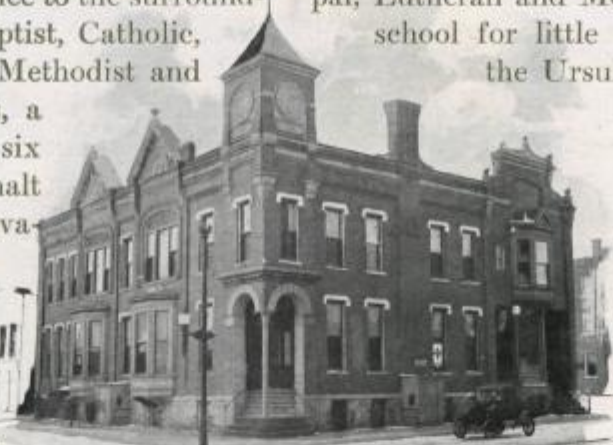
The total bank resources of the city are \$400,000.

The Company's electric send-out in this city for 1917 was 560,000 Kilowatt hours.

Lake City, Minnesota

In Wabasha County, population 3,500; is a steamboat shipping point on Lake Pepin and the C. M. & St. Paul Ry. Fifty-seven miles from St. Paul. Has Baptist, Catholic, Congregational, Episcopal, Lutheran and Methodist churches, a school for little boys conducted by

the Ursuline Nuns, a public library, three banks, three hotels, five grain elevators, flour and feed mills, a creamery, storage plant, boat, button, shirt and wagon factories, a Commercial



The Company's Office at Chippewa Falls, Wisconsin

Club, an opera house, electric light plant and a fine water works system. The State campgrounds are located at the southerly limits of the city, upon which the National Guard hold annual encampments. The total banking resources of Lake City are \$300,000.

The Company's electric send-out in this city for 1917 was 350,000 Kilowatt hours.



The White Coal of Wisconsin



Chippewa Sugar Company, Chippewa Falls, Wisconsin

Alma, Wisconsin

The County seat of Buffalo County, population 1,200, located on the C., B. & Q. Ry., and on the Mississippi River, 30 miles northwest of Winona, Minn., 221 miles northwest of Milwaukee, and 306 miles northwest of Chicago. Has water works, churches of the Catholic, Lutheran, Methodist and Reformed denominations, public schools, a county training school for teachers, two banks. Steamboats run to St. Paul, St. Louis, and all intermediate points.

The total banking resources are \$750,000.

The Company's electric send-out at this point for 1917 was 120,000 Kilowatt hours.

Alma Center, Wisconsin

An incorporated village, population 500, on the main line of the C. B. & W.

Ry., in Alma Township, Jackson County, 12 miles northwest of Black River Falls, the County Seat, and 152 miles from Green Bay. It has Catholic, Lutheran, Methodist and Presbyterian churches, a graded school and a bank.

The total banking resources of the village are \$100,000.

The Company's electric send-out in this village for 1917 was 84,000 Kilowatt hours.



Lumbermen's National Bank, Chippewa Falls, Wisconsin

Altoona, Wisconsin

An incorporated city, population 900, located on the C., St. P. M. & Q. Ry., the Eau Claire River and Otter Creek, in Washington Township, Eau Claire County, three and one-half miles east of Eau Claire, the seat of justice and nearest banking point. It was first settled in 1882. Has Catholic, Episcopal, Lutheran and Methodist churches. Its principal industry is the railroad shop of the C., St. P. M. & O. Ry. It is con-



The White Coal of Wisconsin



The Dells Pulp and Paper Company at Eau Claire, Wis.

nected by the Company's electric railway with Eau Claire.

The Company's electric send-out at this point is included with the totals for Eau Claire.

This point is the center of an extensive tobacco growing region.

Augusta, Wisconsin

An incorporated city, population 1,500, located on the C. St. P. M. & O. Ry., in Eau Claire County, 23 miles southeast of Eau Claire, the county seat, 100 miles southeast of St. Paul, and 250 miles northwest of Milwaukee. It has Baptist, Catholic, Lutheran, Methodist and Universalist churches, a High school building, two banks, opera house, etc. The shipments comprise grain, beef, pork, butter, honey, farm products and livestock.

The total banking resources of Augusta are \$500,000.

The total electric send-out for 1917 at this point was 212,000 Kilowatt hours.

Barron, Wisconsin

The judicial seat of Barron County, population 2,000, located on the M., St. P. & S. S. M. Ry., 91 miles northeast of St. Paul and 252 miles northwest of Milwaukee.

It is the receiving and distributing point for a rich agricultural section and has six churches, good schools, a Carnegie library, two opera houses, two public halls, three banks, two hospitals, saw, flour, planing mills,

canning factory, brick works, and the largest cooperative creamery in the world, and woolen mills.

The total banking resources of Barron are \$400,000.

The total electric send-out for 1917 at this point was 214,000 Kilowatt hours.



RED WINE, MINN.



The White Coal of Wisconsin



Railroad Shops Operated by Wisconsin Power

Birchwood, Wisconsin

Located on the M., St. P. & S. Ste. M. and C. St. P. M. & O. Rys., in Birchwood Township, Washburn County, 30 miles southeast of Shell Lake, the County seat. Population, 600. Has Catholic, German Lutheran, and Methodist churches, a graded public school and a bank. This place is the seat of a lumber industry and a shipping point for farm products.

The total banking resources of Birchwood are \$75,000.

The total electric send-out at this point for 1917 was 89,000 Kilowatt hours.

Bloomer, Wisconsin

An incorporated village, population 1,500, located on the C., St. P. & O. Ry., and on Duncan Creek, in Bloomer Township, Chippewa County, 14 miles from Chippewa Falls, the County seat. Has Catholic, Congregational, Lutheran and United Brethren churches, an opera hall, two banks, and grain, livestock and prod-

uce are shipped. The total banking resources of Bloomer are \$320,000.

The Company's electric send-out for 1917 at this place was 272,000 Kilowatt hours.

Boyceville, Wisconsin

On the M., St. P. & S. Ste. M. Ry. in Tiffany Township, Dunn County; population 600, 16 miles northwest of Menomonie, the judicial seat. Has German Lutheran, Methodist Episcopal and Norwegian Lutheran churches and a bank. Is an agricultural products shipping point.

The total banking resources of Boyceville are \$72,000.

The Company's electric send-out for 1917 at this place was 82,715 Kilowatt hrs.

Boyd, Wisconsin

On the M., St. P. & S. Ste. M. Ry., in Delmar Township, Chippewa County,



The White Coal of Wisconsin



Northern Wisconsin Fair at Chippewa Falls, Wisconsin

population 700; 18 miles east of Chippewa Falls, the judicial seat, and 339 miles from Chicago. It contains Methodist, German Lutheran and Catholic churches, two banks. It is a timber and farm products shipping point.

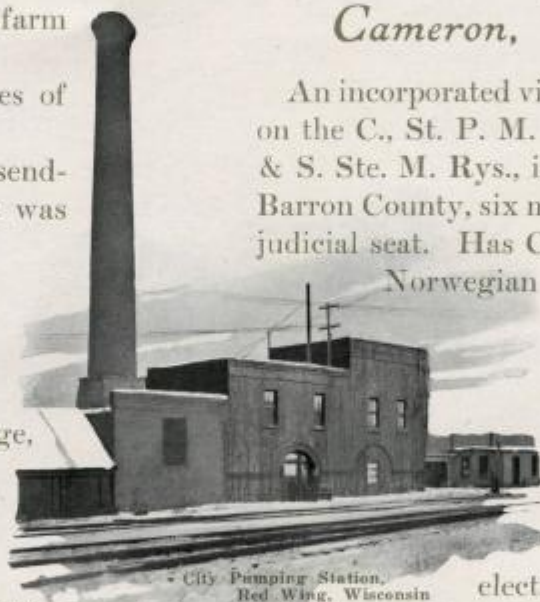
The total bank resources of Boyd are \$450,000.

The Company's electric send-out for 1917 at this place was 224,000 Kilowatt hours.

Cadott, Wisconsin

An incorporated village, population 1,000, located on the Yellow River and on the M., St. P. & S. Ste. Marie Ry., in Chippewa County, 113 miles east of Chippewa Falls, the judicial seat. It has Catholic, Methodist, Presbyterian and German Lutheran churches, a school, opera house, two banks. It is the shipping outlet for a large quantity of agricultural and forest products.

The total banking resources of Cadott are \$200,000.



City Pumping Station, Red Wing, Wisconsin

The Company's electric send-out for 1917 at this point was 84,000 Kilowatt hours.

Cameron, Wisconsin

An incorporated village, population 700, on the C., St. P. M. & O. and M., St. P. & S. Ste. M. Rys., in Stanley Township, Barron County, six miles from Barron, the judicial seat. Has Catholic, German and Norwegian Lutheran and Methodist churches and a bank.

The total banking resources of Cameron are \$190,000.

The Company's electric send-out at this point for 1917 was 123,411 Kilowatt hours.

Cedar Falls, Wisconsin

On the Red Cedar River, in Red Cedar Township, Dunn County, five miles northwest of Menominee; is a small settlement, whose principal importance is that it is the location of the Company's Cedar Falls hydro-electric station.



The White Coal of Wisconsin



Street View at Eau Claire, Wisconsin

Downing, Wisconsin

An incorporated village, population 500, in Tiffany Township, Dunn County, on the M., St. P. & S. Ste. M. Ry., 22 miles northwest of Menomonie, the county seat. An inexhaustible supply of timber and good railroad facilities make it a desirable location for manufacturing enterprises. It has a Union church, public school, and a bank.

The total banking resources of Downing are \$100,000.

The Company's electric send-out at this point for 1917 was 37,898 Kilowatt hours.

Elk Mound, Wisconsin

On the C. St. P. M. & O. Ry., population 350, in Elk Mound Township, Dunn County, 12 miles east of Menomonie, the County seat. Has German Lutheran and Norwegian Lutheran churches and a bank.

The total banking resources of Elk

Mound are \$50,000. The Company's electric send-out at this point for 1917 was 16,481 Kilowatt hours.

Ellsworth, Wisconsin

The judicial seat of Pierce County, population 1,200, is located on the C. St. P. M. & O. Ry., 14 miles southeast of St. Paul, and 275 miles northwest of Milwaukee. It has water works, Catholic, Episcopal, Methodist and Presbyterian churches, schools, an \$80,000 court house, an opera house and two banks.

The total banking resources of

Ellsworth are \$350,000.

The Company's electric send-out at this point for 1917 was 62,411 Kilowatt hours.

Elmwood, Wisconsin

An incorporated village, population 650, on the C. St. P. M. & O. Ry. (on the Eau Galle River and Cady Creek, in Spring Lake Township, Pierce County, 22 miles



Lumber Mill at Rice Lake, Wisconsin



The White Coal of Wisconsin



Concrete Bridge Over Chippewa River at Eau Claire, Wisconsin

northeast of Ellsworth, the judicial seat. Has Catholic, German Lutheran and Methodist churches and a bank.

The total banking resources of Elmwood are \$250,000.

The Company's electric send-out at this point for 1917 was 77,382 Kilowatt hours.

680, on the C. St. P. M. & O. Ry., in Lincoln Township, Eau Claire County, 14 miles southeast of Eau Claire, the County seat. Has three churches, a graded school and an opera house.

The banking business of Fall Creek is done at Eau Claire.

Fairchild, Wisconsin

Located on the C. St. P. M. & O. and F. & N. E. Rys., in Fairchild Township, Eau Claire County; population 700; 32 miles southeast of Eau Claire, the judicial seat; is the center of trade for the rich farming sections which surround it, and has Catholic, German Lutheran and Methodist churches, and a bank.

The total banking resources of Fairchild are \$250,000.

Frontenac, Wisconsin

A village, population 300, on the C. M. & St. P. Ry., 10 miles from Red Wing, Minn. Has Catholic, Episcopal, German and Norwegian Lutheran churches, a hotel, a feed mill and a grain elevator. The Maria

Academy for girls and young ladies, conducted by the Ursuline Nuns, is located near the banks of Lake Pepin. Ships wood, grain, stone, cattle and poultry.



St. Joseph's Hospital, Chippewa Falls, Wisconsin

Fall Creek, Wisconsin

An incorporated village, population

Glenwood City, Wisconsin

A village, population 1,000, located on



The White Coal of Wisconsin



River Front View of Winona, Minnesota

the M. St. P. & S. Ste. M. Ry., and on Tiffany Creek, in Glenwood Township, St. Croix County, 40 miles northeast of Hudson, the County seat, 20 miles east of New Richmond, and 55 miles east of St. Paul. It has water works, a fire department, a driving park, a bank, churches of the leading religious denominations and a high school building costing \$28,000.

It is the shipping point for an extensive agricultural territory.

The total banking resources of Glenwood City are \$200,000.

Haugen, Wisconsin

A village, population 250, on the C. St. P. M. & O. Ry., in Oak Grove Township, Barron County, 17 miles north of Barron, the judicial seat. Has a Catholic church and a bank.

The total banking resources of Haugen are \$50,000.

The Company's send-out at this point for 1917 was 40,672 Kilowatt hours for the last six months of the year.

Humbird, Wisconsin

A city, population 2,500, located on Hall's Creek and on the C. St. P. M. & O. Ry., in Mentor Township, Clark County, 18 miles southwest of Neillsville, the County seat. Has Catholic, Free Methodist, German Lutheran and Methodist churches, a high school and a bank.

The total banking resources of Humbird are \$150,000.



Rutledge Home for Aged People,
Chippewa Falls, Wisconsin

Mondovi, Wisconsin

An incorporated city, population 1,400, on Buffalo River, and on the C., St. P.

M. & O. Ry., in Mondovi Township, Buffalo County, 30 miles northeast of Alma, the judicial seat. It has Catholic, Congregational, Evangelical, German and Norwegian Lutheran and Methodist Episcopal churches, and two banks.

The total banking resources of Mondovi are nearly \$1,000,000.

The Company's electric send-out for this point for 1917 was 107,340 Kilowatt hours.



The White Coal of Wisconsin



Race Track at Chippewa Falls, Wisconsin

Neillsville, Wisconsin

An incorporated city, population 2,100, located on the C. St. P. M. & O. Ry., at the confluence of Black River and O'Neill Creek, in Clark County, of which it is the County seat, 15 miles northeast of Merrillan and 66 miles northeast of La Crosse. The city has an excellent system of water works and a fire department. There are churches of the Catholic, Congregational, Episcopal, German Lutheran, Methodist, Presbyterian and Scandinavian Lutheran denominations, a Carnegie public library, and an opera house and three banks. Neillsville is the center of a prosperous agricultural community.

The total banking resources of Neillsville are \$1,250,000.

The Company's electric send-out at this point in 1917 was 231,750 Kilowatt hours.

Rusk, Wisconsin

A village, population 75, on the C. St.

P. M. & O. Ry., in Red Cedar Township, Dunn County, six miles northeast of Menomonie, the County seat and nearest banking point.

Sparta, Wisconsin

Located in Monroe County, on the C. M. & St. P. and Omaha Railways; population 4,500. This place is the commercial center of a very large agricultural area devoted to the growing of tobacco, as a leading product, and the general run of other agricultural products. The city has two

flouring mills, a sash and door factory, a well driller factory, a pickle salting station, and furnishes a very heavy tonnage of live stock, grain and dairy products. It is also the location of a State school for Dependent and Neglected Children.

The Company's electric send-out at this point for 1917 was 676,179 Kilowatt hours.



County Asylum,
Chippewa Falls, Wisconsin



The White Coal of Wisconsin



Chippewa Foundry and Machine Company, Chippewa Falls, Wisconsin.

The combined banking resources of Sparta amount to \$1,500,000.

Spring Valley, Wisconsin

An incorporated village, population 1,000, located on the Eau Galle River and a branch of the C., St. P. M. & O. Ry., in Spring Lake Township, Pierce County, 21 miles north-east of Ellsworth, the County seat. Has Catholic, Congregational and Lutheran churches, water works, electric light plant, and two banks. Is the shipping and market point for a large agricultural and dairy area.

The total bank resources of Spring Valley are \$600,000.

The Company's electric send-out at this point for 1917 was 118,600 Kilowatt hours.

Stanley, Wisconsin

An incorporated city, population 3,000,

located on the M., St. P. & S. Ste M. and S. M. & P. Rys. and on Wolf River, in Delmar Township, Chippewa County, 23 miles from Chippewa Falls, the County seat. Has Adventist, Catholic, Lutheran, Methodist, Episcopal and Presbyterian churches, two banks, a shoe factory, saw mill and a brick and tile works. Ships live stock, grain, potatoes, farm products and shoes.

The total bank resources of Stanley are \$350,000.

The Company's electric send-out at this point in 1917 was 118,600 Kilowatt hours.

Tomah, Wisconsin

A city, population 4,000, located on the C. M. & St. P. Ry., in Monroe County, 17 miles northeast of Sparta, the County seat, and 42 miles from La Crosse. The city has water works, a fire department, Baptist, Catholic, Congregational, Episcopal, German Methodist, Lutheran and Meth-



Erie Lake Summer Resorts



The White Coal of Wisconsin



Main Street, Rice Lake, Wisconsin

odist churches, good schools, a government school for Indians, a library a public hall, an opera house and three banks. The bridge building and frog shop department of the C., M. & St. P. Ry. is located here, and gives employment to about 300 people.

The total banking resources of Tomah are \$1,000,000.

The Company's electric send-out at this point for 1917 was 235,850 Kilowatt hours.

Viroqua, Wisconsin

The County seat of Vernon County, an incorporated city, population 2,300, lo-

cated on the C., M. & St. P. and L. C. & S. E. Rys., 34 miles south of Sparta, and

202 miles west of Milwaukee. It has a water works, a fire department, three banks, churches of the Catholic, Christian, Congregational, Lutheran and Methodist denomina-

tions, a high school for teachers, free public library, and a graded school.

Viroqua is situated in the midst

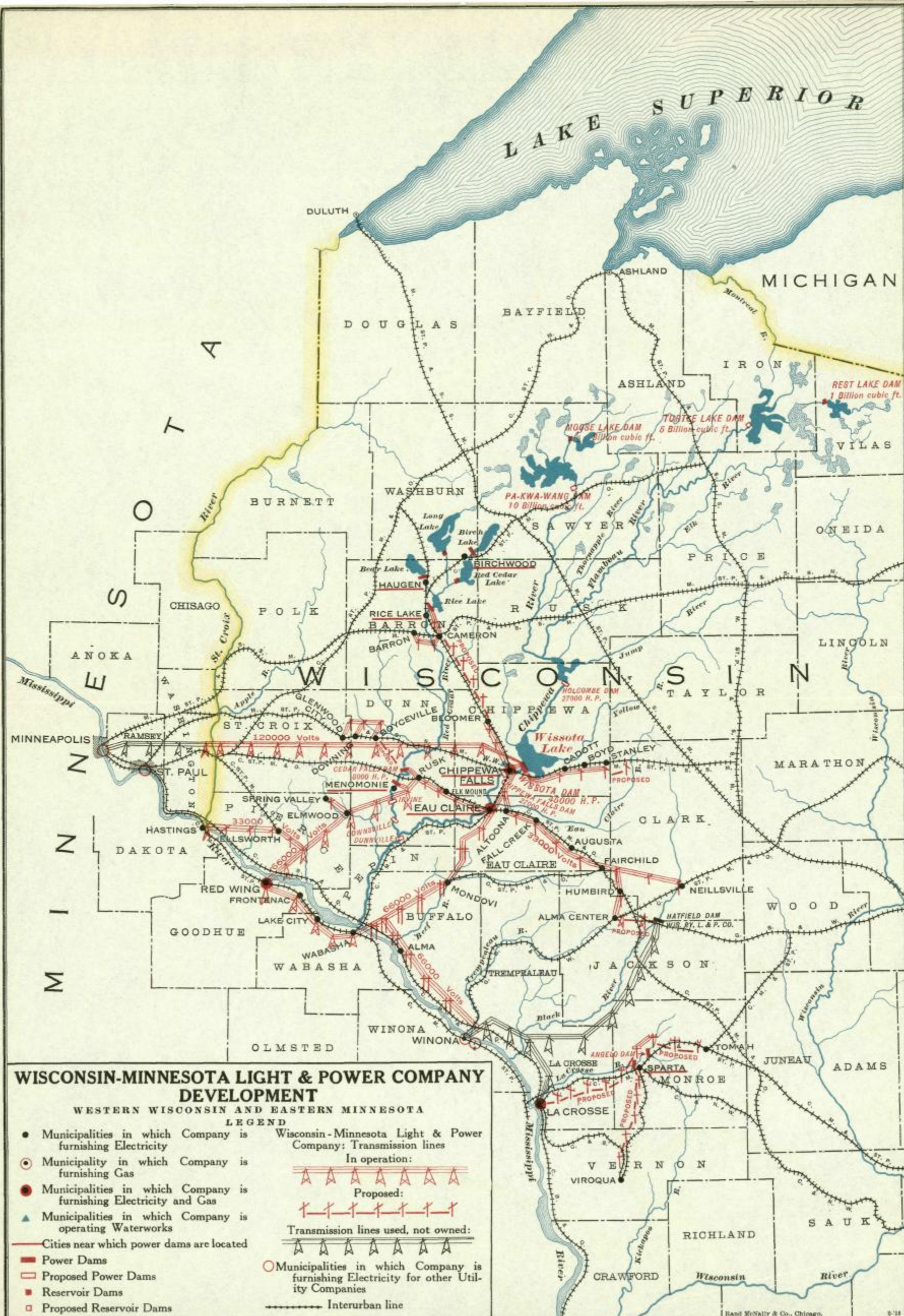
of a very fertile section of country and is the distributing point for grain, livestock, wool, ties and tobacco.

The total banking resources of Viroqua are \$2,000,000. The Company's send-out for 1917 was 210,270 Kilowatt hours.



Interior of Rice Lake Power House





WISCONSIN - MINNESOTA LIGHT & POWER COMPANY

TO THE STOCKHOLDERS:

There is submitted herewith a comparative statement showing the earnings of the company for the calendar years ended December 31, 1916 and 1917, respectively; also balance sheet as of the latter date.

Because of the very rapid growth of the physical properties of the company and the very substantial capital expenditures which have been made in the past two years, the officers of the company desiring to have the stockholders fully advised as to what has been accomplished submit herewith a very complete description and map of the company's property under the title, "The White Coal of Wisconsin."

JOSEPH H. BREWER,
President.

March 15, 1918.

WISCONSIN - MINNESOTA LIGHT & POWER CO.

COMPARATIVE EARNINGS STATEMENT FOR THE YEARS ENDED DECEMBER 31, 1916 AND 1917

	Year Ended December 31st		
	1917	1916	Increase
Gross Earnings.....	\$1,712,220.40	\$1,277,089.70	\$435,130.70
Operating Expenses	\$ 695,909.21	\$ 505,937.53	\$189,971.68
Taxes	119,891.44	89,620.88	30,210.56
Operating Exp. and Taxes..	\$ 815,740.65	\$ 595,558.41	\$220,182.24
Net Earnings	\$ 896,479.75	\$ 681,531.29	\$214,948.46
Interest Charges	* 298,861.36	\$ 242,801.12	56,060.24
Net Income.....	\$ 597,618.39	\$ 438,730.17	\$158,888.22
Preferred Stock Dividends..	176,574.88	162,353.73	14,221.15
Balance	\$ 421,043.51	\$ 276,376.44	\$144,667.07

*Excluding interest amounting to \$108,036.80 in 1916 and \$247,052.06 in 1917 charged to construction accounts, which construction was uncompleted and therefore unremunerative in those years.

WISCONSIN - MINNESOTA LIGHT & POWER CO.

BALANCE SHEET—DECEMBER 31, 1917

Assets

Plant Property	\$17,090,152.49
Investments	6,412.50
Treasury Bonds	151,500.00
Discount on Bonds	503,057.50
Deferred Accounts	41,680.54
Materials and Supplies	242,562.45
Prepaid Insurance	4,294.22
Accounts Receivable	629,149.17
Cash	20,948.62
Total Assets	<u>\$18,689,707.49</u>

Liabilities

Preferred Capital Stock	\$ 4,622,000.00
Common Capital Stock	2,500,000.00
Bonded Debt	9,733,000.00
Notes and Accounts Payable	784,632.18
Consumers' Deposits	7,054.44
Accounts Paid in Advance	5,921.99
Accrued Accounts	110,627.72
Reserve Accounts	69,636.98
Miscellaneous Liabilities	1,476.53
Surplus	905,357.65
Total Liabilities	<u>\$18,689,707.49</u>

DIRECTORS

Joseph H. Brewer, President.

Charles A. Boalt, Treasurer,
Director Capital National Bank, St. Paul, Minn.

Adolph H. Brandt,
Vice-President Grand Rapids Savings Bank, Treasurer Grand
Rapids Trust Co., Grand Rapids, Michigan.

John H. Blodgett,
Paine, Webber & Co., Bankers, Boston, Mass.

Blaine Gavett, Secretary.

Charles B. Kelsey, Capitalist.

P. D. Kline, Vice-President and General Manager.

William B. Parsons, Vice-President,
Director Merchants National Bank of St. Paul, Minn., Director
Deposit Bank of Winona, Minn.

Charles McPherson, Counsel.

W. J. Ripley, Assistant Secretary; Assistant Treasurer.

George G. Whitworth,
Treasurer Berkey & Gay Furniture Co., Director Grand Rapids
Savings Bank, Grand Rapids, Michigan.