

## ELECTRICITY IN THE ILLINOIS RIVER VALLEY

BY

EUGENE S. HIGHT

*Assistant Vice President*

*North American Light and Power Company, Chicago*

Since the earliest recorded history, the water courses of a nation have been the center of its greatest industrial and social development. In early times, this was due to the fact that these water courses afforded facilities for transportation permitting the interchange of goods as well as the intercourse of people. This condition lasted for many centuries and it was not until the railroads were generally extended over great sections of any country that the use of the water courses became less important. Even with the railroad development, the rivers have not entirely lost their first great usefulness to mankind.

In the last few years, however, a new condition has arisen as a result of which the water courses have again become important as centers of great industrial development with attendant increases in population. The primary reason for this change is the great quantity of water required for industrial operations.

The increase of population in growing industrial centers requires increasingly large supplies of food and for that reason industrial development is most rapid even under our present highly efficient rail transportation system, in the agricultural portions of the country where inexpensive fuel is available for the industries.

These conditions are present in the Illinois River Valley and have been generally recognized ever since Cavalier de LaSalle made his report to Louis XIII to the effect that this area had the potential possibilities of becoming an empire as great or greater than the Kingdom of France, with all and more of the advantages which his own country had, made available to the growth of civilization.

LaSalle, however, did not even dream of the powerful agent which was to be discovered in later years, and which was to have probably the greatest effect upon industrial and social development of all of the great discoveries which have been known to man—the discovery of electricity and the development of its possible uses.

I have been asked to discuss briefly this development in connection with the Illinois River Valley. In doing this, I have included the area

lying between Joliet and Alton and extending for perhaps 50 or 60 miles on either side of the main channel of Illinois River. This area contains approximately 10,000 square miles of which practically all the rural territory is rich farm land. Within this area are some 900,000 people, about half of whom live in prosperous and thriving communities and about half on the 42,000 farms throughout the agricultural portion. The many and varied industries require a total of approximately 375,000 horsepower for their operation. Horsepower used averages .42 per capita, which is indicative of the great industrial development that has taken place in this valley.

Power in some form has always been necessary for the development of any territory, and this is unusually true of the territory with which we are concerned. The need for this power was felt early in the history of the valley, and its development first took the form of water power. In 1830, a man by the name of John Green built a dam on the Fox River at Dayton, Illinois, and used the water power to operate a grist mill. In 1839, the State of Illinois built a new dam at this place for the primary purpose of delivering water to the Illinois and Michigan Canal at Ottawa.

To the owners of the mill at Dayton, however, was reserved one-quarter of the water supply, amounting to about 475 horsepower, and with this supply, which was much greater than that available from the old dam, the Green family operated the first woolen mill in Illinois. It continued in operation until 1882 when it was converted into a pressed brick plant, which in turn continued to operate until 1901. This was the first general industrial development of power in the Illinois River Valley, although a number of smaller grist mill operations had been conducted on the subsidiary streams during this time.

In February of 1881, the Joliet Electric Light & Power Company was incorporated for the purpose of building a steam plant for the production of electricity. This date is earlier than that of the incorporation of the company that built the Pearl Street Station in New York City, which was the first one put into operation in United States for the commercial production of electricity. However, the Pearl Street Station went into operation in 1882 and the Joliet Station did not begin to deliver electricity until 1883. In the year 1899 a power station was operated at Ottawa, Illinois, for the purpose of supplying energy to an electric street railway company. This was the first electrically operated railway in the State.

Initially in the electricity industry, energy was generated as direct current and could be distributed only short distances from the center of generation. With the development of alternating current and the im-

provement of insulation material, which permitted higher voltage generation, the area that could be supplied from the central station was greatly increased. Greater numbers of people learned of the advantages that could be obtained by the use of electricity and demanded service so that the engineers of the industry were required to develop rapidly methods of distributing this energy greater distances. This led to the transmission line. In 1893 a single phase line with a voltage of 1,100 was built from Elmwood to Yates City, and in 1901, a 33,000 volt line, with a type of construction very similar to that now in use, was built from Joliet north to Blue Island. These were apparently the first transmission lines in operation in this great river valley.

The development of the steam turbine probably had the greatest single effect upon the development of the electricity industry for the reason that it permitted the production of electrical energy with constantly decreasing quantities of fuel. The first turbines which were installed early in this century required from 4 to 5 pounds of Illinois coal to produce one kilowatt hour. At the present time turbines are producing as much energy with slightly more than one pound of such coal. The first turbines had capacities ranging from 1,000 to 5,000 kilowatts; at present turbines on single shafts as large as 160,000 kilowatts are in operation.

This development, resulting from the increased necessity of reducing the costs of generating energy and the ability to control high voltage have resulted in the concentration of energy production in large central power stations from which the energy is distributed over large areas. However, the production of this energy from large central stations requires enormous quantities of water, with the result that such large centers of production must be located where large quantities of water are available and if possible, near sources of reasonably inexpensive fuel supplies. For example, the city of Peoria requires approximately 8,750,000 gallons of water per day for its normal operations. The plant across the river from Peoria which supplies this area with electrical energy uses approximately 55,000,000 gallons per day or more than six times as much as the whole city of Peoria.

A typical example of a modern central production plant is that at Powerton near Pekin on Illinois River. This station has a present capacity of approximately 225,000 kilowatts and another unit of 110,000 kilowatts will shortly be installed. It has a proposed ultimate capacity of more than 500,000 kilowatts and requires at the present time the enormous quantity of 240,000,000 gallons of water per day for its operation. It is the most efficient power station in the world, so far as records can

be obtained, and it is without question the most efficient power station in the United States.

The Powerton plant is one of the sources of electrical energy supply for the Illinois River Valley area. The plant across the river from Peoria with its capacity of approximately 60,000 kilowatts is another major source of such supply. A number of smaller plants are located in the Illinois River Valley area, and the total available capacity of such stations for this territory is approximately 535,000 kilowatts.

By means of the transmission line network which extends through the valley, these stations are interconnected with the enormous pool of power in the Chicago area which has a capacity of almost 1,500,000 kilowatts. They are also connected with the great St. Louis pool, which is interconnected with the hydro-electric plant at Keokuk and will shortly be connected with the new great hydro-electric development at Bagnell, Missouri, when it will have a total available capacity of 550,000 kilowatts.

Energy is distributed in this area largely by 66,000 and 33,000 volt transmission lines. The main trunk line which follows generally the Illinois River Valley from Pekin to Chicago operates at 132,000 volts. There are more than 6,600 miles of transmission and distribution lines in this area which deliver energy to 200,000 consumers.

The construction of these large central stations, high voltage lines and distribution networks is enormously expensive, as evidenced by the tremendous increases in capital investment which are necessary from year to year to provide equipment to meet the growing demands of the people for electric service. More than ten billion dollars worth of this equipment is now in use in this country and nearly one billion dollars are expended annually in order to keep pace with the growing demands.

Of necessity the new developments which require these enormous sums of money must be made with a capacity far in excess of the present requirements. It would be extremely improvident to build for today without giving careful consideration to the demands of tomorrow. This fact presents a very serious problem to the management of the electricity supply companies, that of making rates for the sale of electric service so low that the greatest possible number of people and industries may have the advantages which electric service brings, yet of maintaining the rates sufficiently high that a reasonable return may be earned on the initial investments which have been made to provide for future demands. The gentlemen among you who are connected with the operation of manufacturing plants know the effect of mass production on the cost of making and distributing a product. It is upon the effect of mass production and distribution that the electricity supply industry is de-

pending to make these expenditures for the future successful from a financial standpoint. The manufacturing industry which is producing electricity for its own use does not usually consider the fixed charges on the investment in its power station as a part of its total cost of power. A great many times this investment has already been written off out of the profits of the industry. This is not true of the electricity supply business and at times it becomes very difficult to supply electrical energy from a super-power network, at a rate which must include the fixed charges on the investment, to an industry which considers as the total cost of its own electricity only the operating charges necessary to manufacture it. However, the fact is patent that as these industries grow they will require additional power facilities when the fixed charges will become an obvious element of the power cost. As the electricity supply from a super-power system grows, the amount of investment which must be charged per unit of electric service becomes continually smaller, and therefore, the power supply company will continually improve its position in respect to being able to deliver quantities of energy to manufacturing plants at costs attractive to manufacturers. Of this gradual change in the economic relation of power supply to the industries, I invite the serious consideration of those gentlemen who are responsible for the lowest possible costs of their manufactured product.

Of the total power requirements of the industries in this Illinois Valley area, amounting to 375,000 horsepower, 300,000 horsepower is operated electrically and of this latter figure, approximately 250,000 horsepower is supplied from this distribution network. This indicates the extent to which the business men in charge of these industries realize the advantages of the uses of electrical energy.

However, these uses are not confined to the urban population and to these industries. There are approximately 42,000 farms in this area. Ten years ago, only a very few of these farms were supplied with electricity, but at present time more than 5,350 of them or 12.7 per cent of the total number, are supplied. This percentage compares very favorably with that of the entire State of Illinois, which is 9.8 per cent of the total number of farms in the State. Farm homes are demanding electrical service and rapid progress is being made in connecting them.

It is an aspiration of the men who have given their lives to the development of an adequate and economical supply of electricity, that within a reasonable time there shall not be one single home, business establishment, or industry which shall not have at an economical cost the advantages that electric service from a super-power system can bring. This conception is almost unbelievable in its far reaching possibilities. We do not realize that although there are more than two

hundred thousand users of electricity in the Illinois Valley, yet even at the present cost of electric service which is generally lower than it has ever been in this history of the industry, in 65 per cent of the homes in this area the old dust raising broom is still used for sweeping floors; in 75 per cent of the homes the old-fashioned washboard and wringer are still in use; in 96 per cent of the homes in towns that have no gas supply the old fashioned range is still operated when the same wire that brings the light to the home could also furnish a fuel available at the turn of a switch which would cook more efficiently than either coal or wood.

That is generally the case, but suppose we look at the rural communities. Only 13 per cent of the homes have electric service and in only 9 per cent of these homes is electricity used to sweep the floors or help in the other household work. Less than 7 per cent use electricity for pumping water into the house. In only 4 per cent of the farm homes is there an electric cooking range. The power separator is used in less than 3 per cent of all the farms and in only 2 per cent are there electrically driven sewing machines.

In the industries, however, the use of electricity is further advanced. Based on the report of The Power Survey Committee for the Great Lakes Division of the National Electric Light Association it has been determined that in 1920 there were approximately 180,000 horsepower of electric motors in the Illinois River Valley connected to super-power service. Based upon the rates of growth over the past twenty years, by 1940 or nine years from now, there should be a total horsepower installed in the industries of the Illinois River Valley of nearly one million. If by that time only one-half of this large amount of motive power were supplied by the super-power networks, this would still be approximately twice the present amount of motive power supplied and would represent an increase of more than 250,000 kilowatts for these industries alone.

In addition to these uses there will be special developments in the use of electricity, for the electrification of railroads, the development of the wireless communication systems and for the operation of devices which are even now only in the process of being discovered.

There is a new civilization being developed here in this great country of ours. A civilization, not built as those old civilizations were, on the slavery of human muscles but founded upon the development of natural resources and upon the power and energy of ions and molecules controlled through the knowledge obtained from the advancement of the physical sciences; a far more stable and enduring foundation

than that above which the civilization of Greece and Rome towered and finally fell when their foundations of human slavery crumbled.

President Hoover is quoted as saying "As we furnish power at less and less cost and as we increase the volume of its supply, we decrease the sweat of men and the drudgery of women." So we may look forward to a time not so distant in the future when by means of these great super-power networks, if they are permitted to develop unhampered by the narrow prejudices of short-sighted political leaders and may have the continued intelligent supervision of State regulating bodies, the whole Illinois Valley will be so completely, adequately, and economically supplied with electric service that the physical toil in the home and in the industries will be practically removed and this great social and industrial development of ours, so far ahead of that of any other country in the world, will reach a point almost unimaginable in the growth of industry, and in the comforts of living.