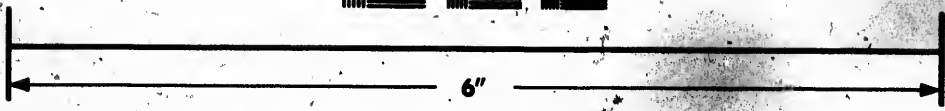
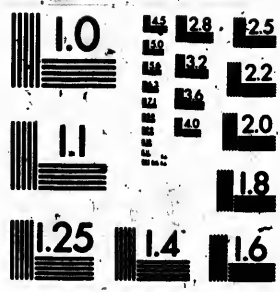


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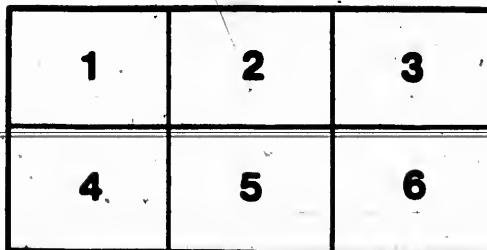
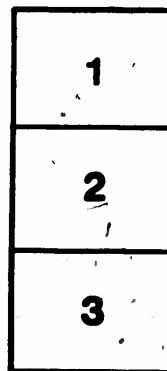
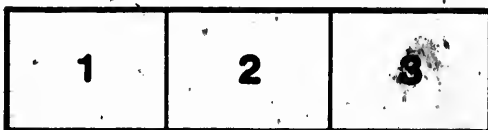
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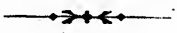
Toronto B.T.

1900

REPORT

OF

Special Committee Re Electric Power.



To the President and Council of the Board.

GENTLEMEN,

In considering the question of electric power, your Committee have found it desirable and necessary to take under consideration the question of power generally, and our report will cover the following:—

1. Kinds of power most largely in use.
2. Power conditions as they now exist in Toronto.
3. Power facility as a factor in attracting new industries.
4. Desirability and probability of cheaper electric power for Toronto.

Under the first head we find there are five motive powers, which are now in practical common use in large cities and manufacturing centres. They are as follows:—

(a) WATER POWER.—Cities and villages located close to a waterfall, or conditions admitting of forming a water head of sufficient fall, can make direct application of such power. As a primary power, however, it may be used at a considerable distance from the community deriving benefit from it in generating and transmitting electric current, as is well known.

In cities and towns where the water supply is abundant, and cheap, and where there is good pressure, small water-motors are quite commonly used.

In many lines of manufacture hydraulic machinery can be used to great advantage. For manufacturing purposes generally cheap water is a most essential feature, if not water-power.

(b) STEAM POWER.—The introduction of rival powers has by no means driven the steam engine—man's greatest helper—from the field. On the contrary, steam engineers have so constantly brought out improved devices for the economical production of steam power, that even in centres where electric power is produced to good advantage, steam pretty well holds its own, more especially in plants requiring from, say, 75 h.p. upwards. In comparatively large plants, requiring from 50 h.p. and upwards, where steam is required for heating or other purposes, it can pretty well hold its own against electric power under average conditions.

Where steam is also used for industrial purposes in the same business, there seems to be no question but that, generally speaking, steam power is still the most economical for the manufacturer. It may also be said that steam engines and boilers have been so perfected and brought to such a standard of excellence that the depreciation in value, due to the use of such apparatus, amounts now to much less than it did a comparatively few years ago.

The use of steam apparatus is so generally understood that intelligent labor for its attendance is readily obtainable. Steam is undoubtedly the most important power factor, notwithstanding the great advances made by electricity; indeed, in most instances the electric current itself is dependent on the steam engine.

(c) GAS AND GASOLINE.—Gas as a power producer is again being revived in many busy centres, and such developments have recently been made in both gas and gasoline engines, that we have felt it desirable to mention this power in our report.

We have become accustomed to think of the gas engine as a small machine, suitable for light service, but these engines are now commonly sold for 50, 75 and 100 h.p., and single engines developing 650 h.p. are now in actual operation. A 30,000 h.p. gas engine electric station, where the gas engines are directly connected to the dynamos as primary powers, is now in course of construction in Pittsburg, Pa. It is claimed that the consumption of gas in these engines has been reduced to 13 ft. per h.p. per hour.

The power value of gas is determined by the number of heat units it contains. Natural gas has about 940 heat units; illuminating gas has only 650 heat units, consequently it takes a somewhat greater number of feet per h.p. per hour to produce the same amount of power.

As for gasoline engines, splendid results are being obtained by the latest machines, the makers guaranteeing that a wine gallon of gasoline will produce a h.p. for 10 hours.

(d) ELECTRIC POWER.—Electricity may be said to be a secondary force, a handmaid or servant of steam or some other primary power. It has its special sphere of usefulness, in which it undoubtedly excels.

Electricity, however, has its limitations, which are seldom realized or understood, resulting in many false suppositions as to its universal utility by its too ardent advocates.

In the field of power, for facility of distribution, even when distance is taken into account, electricity has no rival. Hence for the supply of small scattered powers in a community there is nothing to be compared with it. The ease of distribution of electric current has also led some large manufacturers to install most elaborate, direct-connected, steam-driven electric plants, with a

view to distributing electric power to the various departments of their works, connecting the motors directly to the main-line shafts of the several rooms, and in some instances connecting individual motors to the several machines in a single department, thus making a splendid equipment, and dispensing with long lines of shafting and much belting. Such perfect distribution of power requires a very elaborate and expensive installation, but it gives the advantage of operating certain departments, or, for that matter, individual machines, irrespective of any other department, and, when intermittent service is required, effects some saving.

It is only reasonable to suppose, however, that electrical apparatus will have to be very considerably cheapened and simplified before this ideal method of application can come into general use, which will take time.

Electricity, in addition to its advantages for power and lighting, is also capable of adaptation in certain industrial and metallurgical uses, which could not otherwise be economically and practically carried on.

(e) COMPRESSED AIR.—This has been styled "the century's new power." Like electricity, it is a secondary force to be developed and distributed by steam or some other primary power. Compressed air has been in use for many years, but the extent of its possibilities and its wide usefulness are only recently beginning to be understood. To say nothing of the many kinds of pneumatic machinery and air-driven tools now largely used, compressed air motors are in successful operation in several large cities. Paris (France) is said to be one of the largest users of compressed air. There, it is said, there are now many miles of mains serving customers with air through pipes with meters, as gas is distributed, and operating machinery, large and small, in all lines of industry.

2. POWER CONDITIONS AS THEY NOW EXIST IN TORONTO.

(a) WATER POWER.—Toronto, of course, can boast of no water power for direct application. The nearest large power of importance is that of Niagara Falls, which, we believe, is close enough to us to lead us to hope that at some time in the not too distant future it will supply us with electric energy.

Beyond its use for hydraulic elevators, water can scarcely be said to be used as a power in Toronto, because of the limited supply and cost. It is claimed by one engineer who made a report on the subject, that in the matter of hydraulic power for elevators, if the bill for such use is \$18 per month, it will pay to change to electric power, even under the present rates charged by the Toronto Electric Light Company.

(b) STEAM POWER.—The total quantity of power of all kinds in use in the City of Toronto will be found to be surprisingly

small to any one who has not carefully looked into the subject. Your Committee have had reports from several engineers and persons competent to make an estimate and form an opinion on such matters. It is probable, omitting the Toronto Railway Company and the Toronto Electric Light Company, that in the neighborhood of from ten to twelve thousand h.p. will be the maximum present consumption in the city of Toronto. From the best information obtainable it is likely that from five to six thousand h.p. of this amount is used by people requiring under 50 h.p.

About two years ago an effort was made to gain statistics as to the quantity of steam power alone used in the city, and it was estimated to be in the neighborhood of 17,000 h.p., which includes the plants of the Toronto Railway Company and the Toronto Electric Light Company, these alone aggregating some 10,000 h.p., which makes about 7,000 h.p. in use in other industries. This amount has doubtless somewhat increased since then.

The basis of the cost of steam power is, of course, the price of coal. We have received several estimates from competent engineers as to the cost of producing power from the average steam plant. These estimates were found to vary considerably. The conditions under which steam is generated vary greatly in different industries. It is probable, however, that a well-equipped plant, developing, say, 100 h.p., can produce power at from \$20 to \$25 per h.p. per annum for ten hours per day, 300 working days. Plants developing a greater amount of power, with most modern appliances, can probably reduce this cost somewhat. The duty now charged on steam coal is 53 cents per ton, and is an important item in the power problem.

(c) ELECTRIC POWER.—Where electric power can be most profitably used is for scattered motors, where the use of a steam plant or gas engine would not be large enough to pay for a man's time to look after it; and it is especially desirable when the power is intermittent and is only paid for when it is used. There are at present probably from three to five thousand h.p. in motor capacity installed for such use in our city, generating in the neighborhood of 1,500 to 2,000 h.p. actually consumed on an average. There are but few electric isolated plants in the city where electric current is generated by the producer for his own power purposes. The Toronto Electric Light Company are practically the only source whence electric current can be purchased in Toronto at the present time. Their charges average from 2½ to 3 cents per h.p. per hour, and they do not care to furnish a greater amount to any one customer than 25 h.p. Their price to large customers, where conditions are favorable, has been as low as 2 cents per h.p. per hour, whereas for other very small powers at a great distance from their mains they charge even higher than three cents. Two cents per h.p. for ten hours per day, 300 days in the year, amounts to \$60 per annum per h.p.

IN COMPARING STEAM AND ELECTRIC POWER a number of conditions have to be taken into consideration. Undoubtedly consumers of less than 25 h.p., where steam is not largely used for other purposes, could use electric power to great advantage, even at the price charged by the Toronto Electric Light Company. Consumers of from 25 to 50 h.p., where steam is not used for other purposes, could profitably use electric power if the price were in the neighborhood of \$25 per h.p. per annum. The Hamilton Electric Light & Cataract Power Company are supplying electric current at \$20 per h.p. per annum to consumers of 50 h.p. and upwards. This is the lowest bona fide price we have known to be made for electric current. The Hamilton Company, however, hamper this with varying conditions. We have been informed of an alleged offer made by them of \$15 per h.p. to a very large prospective consumer, but do not learn that this can be confirmed. Notwithstanding the apparently very low price of \$20, we know of one manufacturing plant close to the Hamilton Power Company's transforming station, who considered it to their advantage to put in a steam plant, because of the saving in using the exhaust steam for heating.

It may also be said that the Hamilton power has thus far been largely taken by corporations and industries in which the people exploiting the power are more or less interested.

At Niagara Falls, (N.Y.) where electric energy should be, and doubtless is, produced as economically as any place in the world, both the Cataract Power Company and the power company operating the old canal, charge at the rate of \$25 per h.p. per annum for power in limited quantities. There are, however, no restrictions, and the power can be used twenty-four hours a day if desired. Where larger quantities of power are taken, concessions are made, but these concessions are conditional upon matters of location, purposes for which the power is supplied, term of lease, and so forth, and special inducements are generally made to parties locating on the lands of the Power Companies, both of whom are seeking to develop the properties acquired by them.

In comparing steam and electric powers for manufacturers using greater quantities than 50 h.p. per annum, several conditions must be taken into consideration. Manufacturers having steam plants installed, are, as a rule, well satisfied with them, and probably would not care to change, as, at best, the saving would be so trifling, if any. Furthermore, the installation of electric apparatus, if done in the most approved manner, and so as to secure the greatest amount of efficiency, would involve a very considerable outlay, quite the equivalent of the cost of the steam plant, and perhaps more. On the other hand, the depreciation of a modern steam plant, because of the excellence to which steam engineering has attained, is comparatively light, probably not exceeding ten per cent., whereas even in the best known types of electric generators and motors they are con-

stantly being improved, and the present rate of depreciation cannot be considered as much less than 20%. Then the question of utilization of steam power for other purposes in most manufacturing plants is an important consideration, the steam boiler being in most instances a necessity, even if electric power were utilized, for such purposes as heating, drying and other industrial uses.

Quite a large number of manufacturers, also, use refuse as a part of their fuel, which reduces the cost of steam production. As an illustration, one of our largest manufacturing concerns, which uses about 1,000 h.p. from steam boilers, produces it at a cost of about \$4 per h.p. per annum, most of the fuel being waste material, shavings, sawdust and blocks.

Then again in business enterprises, where the possibility of a cessation of power would be a serious loss, they cannot afford to take the chance of an occasional stoppage by a breakdown on a long transmission line, which, under present conditions, is not an altogether remote possibility.

Add to all this the fact that in manufacturing plants of any considerable size the percentage of the cost of power is such a small percentage of the cost of the output and the annual expense, and we believe the majority of our leading factories would not readily change to the electric power, even under quite favorable circumstances as to price.

(d) **GAS AND GASOLINE POWER**—Gas engines were used to a considerable extent for small powers in Toronto prior to the introduction of the electric motor. It is estimated by one engineer that the gas engine does not now figure as prominently in the city as it might do, especially since the engines of this type for both gas and gasoline have been so largely improved. Neither the gas nor gasoline engine can, of course, displace any of the present electric motor power, but they might be used to advantage, with economical results, in the place of many of the small steam plants now installed generating from, say, 25 to 75 h.p. The heat units of the gas supplied by the Consumers' Gas Company are said to be 650, and from this it is computed that from 17 to 20 feet of gas would supply a h.p. for one hour, with the latest improved engine. Putting it at 20 ft. per hour—the present price of gas being 90 cents—would mean \$54 per h.p. per annum of 300 10-hr. days. With the latest type of gasoline engine, if, as guaranteed, a wine gallon will give a h.p. for ten hours, at the present price of gasoline (14 cents per wine gallon, or 17½ cents per imperial gallon) the price would be about 1 2-5 cents per h.p. per hour. The gas or gasoline engine could not, of course, compete against electric current at Hamilton or Niagara prices.

(e) **COMPRESSED AIR**—So far this new power has not come into any considerable use in Toronto. There are, however, sev-

eral large isolated plants utilizing this wonderful force to a considerable extent. In one of our chief factories an air-compressor plant was recently installed, involving an outlay of nearly \$10,000 for the purpose of delivering through the works both low and high-pressure air for atomizing fuel oil in oil furnaces, and also for air lifts, pneumatic machines and air tools of various kinds. It would seem that the air motor, if proved a success elsewhere, would, in course of time, get into use here also, which would, no doubt, result in a public service of compressed air being provided in our city.

3. POWER FACILITY AS A FACTOR IN ATTRACTING NEW INDUSTRIES.—The name of "cheap electric power," accompanied, as it generally is, with so many false suppositions regarding its cheap, inevitable, and universal application to industrial purposes, has made cities having large quantities of electric power to offer, appear formidable competitors of cities less favored. The idea that power transmitted by electricity is all that is needed to start up immense manufacturing industries is very largely a matter of imagination. We are sure that the promoters of the great Cataract Power Company of Niagara Falls (N.Y.) were sorely disappointed when their lands were so slowly taken up, and their anticipated rapid developments for the consumption of their power failed to materialize. Cheap power is by no means the all-important feature in attracting new industries. As evidence, there are outlying towns in this province, such as Trenton, which are in a position to offer free site and free electric power to manufacturers, and yet, for the most part, they have achieved very indifferent results. There are other matters, which it is not in the province of this Committee to report upon, which are important to the manufacturer seeking a site, such as facility for transportation, facilities for publicity, close association with other industrial enterprises, ease of obtaining contented employees, with suitable residences for their accommodation, reasonable arrangement as to site, taxation, water privileges, etc.; indeed, if Toronto ratepayers generally were as much interested in promoting industrial enterprises and getting them to locate in Toronto, as are the citizens of our rival municipalities, we would see Toronto's manufacturing interests develop more rapidly. Something should undoubtedly be done to promote and awaken an interest along this line in Toronto.

4. PROBABILITY AND DESIRABILITY OF CHEAP ELECTRIC POWER FOR TORONTO.—While electric power is not the all-important inducement in procuring new industries that is generally supposed, your Committee believe that cheap electric power would be a great boon to our city, especially to the smaller manufacturers, and that reasonable measures should be taken to procure power connection with one of the companies operating at Niagara Falls. It might be well for the Board of Trade to

appoint a committee who would assist in bringing about and encouraging such an enterprise.

We can scarcely anticipate that electric power being furnished under present conditions in our city (it being developed from coal) can be produced at a much cheaper rate. Our hope for cheaper power is to bring the current from one of the great Niagara generating plants. We take it that there is no probability of obtaining power from the same source as the Hamilton Electric Light and Cataract Power Company, since they are not likely to generate more power than Hamilton can conveniently consume, even though, otherwise, arrangements could be effected. Neither is it probable that we can obtain connection with either of the great power companies on the United States side of Niagara Falls. There are two companies organized for developing and operating plants at Niagara on the Canadian side. One of these, the Canadian Niagara Falls Power Company, is in reality an off-shoot of the Cataract Power Company of Niagara Falls, (N.Y.) It is only now getting under way with its plant. A new organization recently completed is the Ontario Power Company of Niagara Falls, Limited. This company is about to begin operations, and alleges its intention of delivering power to Toronto. The question of long-distance transmission of electric current has by no means been satisfactorily solved. The loss is very considerable, to say nothing of the heavy cost of the installation of the lines and the expense of their maintenance. The nearest route by land, around by Burlington Beach, would be some 71 miles from the power station of the Ontario Power Company to Toronto. If a cable is found practicable, the total distance from the power station, coming across the lake, would be some 41 miles, 36 of which would be under water. It is said that this is not an impracticable route. Meantime we take it that it will be at least one to two years before Toronto can be supplied with current from Niagara. The Toronto Electric Light Company have signified their intention of bringing power from Niagara, and the question arises whether or not Toronto, as a city, should control this proposed Niagara power connection. This is a matter for consideration, and one on which your Committee are not prepared to report at the present time, not having sufficient data at hand.

We are pleased to be able to add that, because rival municipalities have sought to make a strong point of cheap electric power when endeavoring to secure new industries, the Toronto Electric Light Company have, through their manager, signified their willingness to assist the city authorities in meeting this competition until the power connection with the Falls is established, which would doubtless involve a loss to them.

All of which is respectfully submitted.

W. E. H. MASSEY,

TORONTO, 25th April, 1900.

Chairman.

