

ELECTRIC POWER DEPARTMENT
ANNUAL REPORT
YEAR 1957

Electric energy produced in the generating facilities of The Cleveland-Cliffs Iron Company during the year 1957 amounted to 192,962,430 kwh. This was an increase of 25.7% above the amount of energy generated in 1956. Of this amount generated 165,063,644 kwh (85.6%) were billed directly by our Company and used as follows: The Cleveland-Cliffs Iron Company used 43,269,865 (22.4%), Humboldt Mining Company used 16,196,014 kwh (8.4%), The Negaunee Mine Company used 38,926,483 kwh (20.2%), Marquette Iron Mining Company used 32,758,329 kwh (17.0%) and Upper Peninsula Power Company used 33,912,953 kwh (17.6%). The hydroelectric plants of our Company produced 41.8% of the energy, the Presque Isle Plant of Upper Peninsula Generating Company produced 40.6%, the Ishpeming Steam Plant Produced 15.7% and the Ishpeming Diesel Plant produced 1.9%.

In addition to the 33,912,953 kwh (17.6%) billed from our Company to Upper Peninsula Power Company, 27,898,786 kwh (14.4%) were delivered to that Company by Upper Peninsula Generating Company and billed for our account by the Generating Company to the user in accordance with mutual agreements. Of the amount which was supplied to Upper Peninsula Power Company by our Company's wholly owned generating facilities, 89.0% was supplied by the Ishpeming Steam Plant and 11.0% was supplied by the Ishpeming Diesel Plant.

Our Company and the Companies operated by it used 131,150,691 kwh which was an increase of 29.1% over the amount used for these operations during 1956. Energy supplied to The Cleveland-Cliffs Iron Company (including the Humboldt Mine) was obtained entirely from hydroelectric plants. The Negaunee Mine Company and Marquette Iron Mining Company obtained 29.6% of their energy requirements from hydroelectric plants, 70.2% from Upper Peninsula Generating Company's Presque Isle Plant, and 0.2% from the Ishpeming Steam Plant.

In spite of poor hydroelectric conditions, the increased utilization of fuel produced energy and the unfavorable change in the manner of distributing Administrative and General Expense between our Company and the Upper Peninsula Power Company (explained more in detail later herein), the average cost of energy to our Company's operations, including wheeling costs (but exclusive of capital costs) was reduced from \$.00872 per kwh in 1956 to \$.00748 per kwh in 1957. Economics in operation in effect throughout the year coupled with increased production of energy by Upper Peninsula Generating Company's Presque Isle Plant made this reduction possible. Because of rising costs of production materials and future reduction in the use of our high cost generating facilities by Upper Peninsula Power Company, the year 1957 will probably be the year of minimum production cost which will be obtained by our Company.

The income in excess of the operating expenses of the Electric Power Department increased from \$89,091 in 1956 to \$455,804 in 1957. The revenue from the sale of power to Humboldt Mining Company was nearly doubled and the compensation paid by Upper Peninsula Power Company for use of our Company's facilities was increased by 32%. The large portion of the improvement in earnings, however, was due to \$210,830 in additional revenues paid by The Negaunee Mine Company and Marquette Iron Mining Company for the use of our Company's generating facilities under new power agreements reached during the year.

Precipitation during the year 1957 was again below normal as had been anticipated. As indicated at the beginning of 1957, we are in another of the

dry cycles which occur at approximately eleven year intervals and which are of two or three years duration. The output from the hydroelectric facilities has decreased every year since 1951 during which year the output amounted to over 114 million kwh. The annual output has been below 85 million kwh for the years 1955, 1956, and 1957 with the minimum of 80,657,336 kwh being reached during the last year. Precipitation was low throughout the area being 24.53" at the Carp Power Plant and 28.78" at the McClure Power Plant compared with a high precipitation of 43.50" at the Carp Plant and 50.90" at the McClure Plant during the year 1951. The Marquette Weather Bureau has labeled the year 1957 as the third driest since 1872.

In view of the poor water conditions which were experienced, we consider the output of over 80 million kwh from the hydroelectric plants very satisfactory. This high output under such adverse conditions was made possible by the fact that we were able to operate the hydroelectric facilities at the point of maximum efficiency and thus take the best advantage of the water which was available. Addition of fuel burning equipment on our system has made available sufficient capacity to permit the use of fuel burning equipment for variable load operation thus enabling the operation of the hydroelectric plants as base load equipment in the most efficient manner. It has been noted that droughts in other areas, namely in the southwest and on the east coast, seemingly accompany droughts in our region. The drought which they have been experiencing for the past few years broke recently, and we hope that this is an indication of better conditions here for the coming season.

At the beginning of 1957 plans were under way for the installation of a second unit at the Presque Isle Plant of Upper Peninsula Generating Company. Stone & Webster Engineering Corporation was obtaining bids for equipment and some orders for equipment had been placed. Prior to the directors' meeting of that company on April 4, Upper Peninsula Power Company had entered into negotiations with The Celotex Corporation to construct a power plant to supply steam and electricity for a new processing plant which the corporation was installing in L'Anse. Our Company, in the meantime, had reviewed its plans for further development of low-grade ore and pelletizing plants on the Marquette Iron Range. This review indicated that the installation of these additional plants would be later than was originally anticipated. Thus soon after the first of the year it was realized that if the Power Company was successful in its negotiations with The Celotex Corporation and our Company's development plans were delayed, it would not be necessary to have a second unit at the Presque Isle Plant as soon as had been planned. Accordingly, at Upper Peninsula Generating Company's meeting of April 4 this matter was discussed and on April 9 orders were given to the Stone & Webster Engineering Corporation to stop all work on the project and to hold all orders and plans in abeyance for further development. In the Generating Company's directors' meeting of July 9 all work on the second unit for the Presque Isle Plant was postponed until such a time as was necessary to again begin engineering work and purchasing of material in order to have that unit in operation sometime early in 1962. As a further development in this matter the contract between Upper Peninsula Power Company and The Celotex Corporation was completed and ready for signature at the end of the year. This means that a new plant will be constructed at L'Anse by the Power Company which will make available for them approximately 13,000 kw of capacity for that company's use in serving their other properties on the interconnected system.

At the time of the annual adjustment between Upper Peninsula Power Company and our Company for the intercompany billings in accordance with the power exchange agreement between us, several questions arose concerning the interpretations of certain parts of the agreement. The major item questioned by the

1957.
Power Company was the manner in which the Administrative and General Expenses of the Electric Power Department were distributed between our Company and their Company. After several meetings and discussions of the situation there was a meeting held in New York on April 29 between representatives of our Company and their organization and an agreement was reached. This agreement provided for the charges which had been made prior to the end of 1955 remaining as they had been made, but that beginning on January 1, 1956 and thereafter the distribution of the Administrative and General Expense would be made upon the interpretation of the contract which was placed upon it by the Power Company. In addition to this there were also several ambiguities in the contract all of which were discussed and agreed upon at this same meeting.

Under the terms of the basic agreement between our Company and the Upper Peninsula Power Company it was agreed that at the end of five years or the beginning of operation of the second unit at Presque Isle, whichever was the earlier, a review of the agreement of July 15, 1953 would be conducted with the idea of making such changes in that agreement as might be deemed desirable by both parties. While plans for the second unit at the Presque Isle Plant were in progress and it was felt that this unit would be in operation early in 1959, several meetings were held to arrive at an agreement on the changes which should be made to correct difficulties experienced during the life of the agreement and also to correct any inequities which had resulted from its terms. These meetings had resulted in a general agreement as to the broad principles which would be involved in such an agreement. A meeting was held in Cleveland on January 9 and 10 which was attended by members of our Company and of the Stone & Webster Engineering Corporation which was retained by us together with the representatives of the Upper Peninsula Power Company and of the Stone & Webster Service Corporation which is retained for advisory service by them. This meeting resulted in the drafting of a summary of the points upon which agreement tentatively had been reached, together with points which should be reviewed and covered in the agreement.

At that time it was anticipated that the new agreement would be brought into final shape so that it could be adopted by January 1, 1959. Postponement of the plans for the installation of the second unit at Presque Isle, however, removed the immediate necessity for the adoption of a new contract. The Upper Peninsula Power Company suggested in the meeting on April 29, that an attempt be made to get a new contract into effect by January 1, 1958. This advanced the effective date of the new contract by one year from the effective date which had been originally anticipated. Our Company did not commit itself to such a change but agreed to consider a revised contract if it were drafted and forwarded to them. The redraft was sent by Stone & Webster Service Corporation on October 31. Prior to the end of the year the revised draft had been reviewed by our Company and by Stone & Webster Engineering Corporation. Indications were that the contract was not acceptable to us in its present form and that it would not be accepted by us without extensive revisions. It is not anticipated that the revised agreement will be adopted before active work is again resumed on the second unit for the Upper Peninsula Generating Company Power Plant.

The two hydraulic generators at the McClure Plant had not been overhauled since 1941. Accordingly, plans were made to overhaul these two units early during the year 1957. The number 1 unit was taken out of service on January 14, and a complete overhaul was given to the hydraulic turbine. At this time a stainless steel runner which had been purchased several years ago was installed and other major improvements were made. The top plate of the hydraulic turbine was found to be badly cracked when the unit was dismantled and was repaired. The difficulty experienced in fitting replacement parts into the turbine prolonged the period of overhaul and it was not until February 21 that the unit was again placed in

service. Immediately after it was found that the number 1 unit performed satisfactorily, the number 2 unit was taken out of service on February 25 and dismantled. The same condition in regard to the top plate was found on this unit as had existed on the number 1 unit, and it was also reinforced. The stainless steel runner was installed on this unit, but less difficulty of fitting the new parts into the old turbine was encountered than in the repair of the former unit. It was possible to get this unit back into service by March 12.

During 1955 Upper Peninsula Power Company had been negotiating with the city of Escanaba for the lease of a power plant which the city of Escanaba proposed to construct. These negotiations were concluded in January 1956 and construction of the power plant was begun. It was the intention of the Power Company to connect the power generating facilities thus acquired to their interconnected system by construction of a line from Escanaba to Gwinn and thence to the Cedar Substation in Ishpeming. The portion of the line between Gwinn and the Cedar Substation would comprise facilities jointly used by our Company and their Company and constitute a part of the jointly used system as defined in the agreement between those Companies. Construction was started on that portion of the line which was in the jointly used system early in 1957. During February a study was made on the calculating board of the University of Wisconsin at Madison of the conditions which would exist after the Escanaba Power Plant and the tie line between Cedar Substation and Escanaba had been completed. This board study was necessary to provide information for the purchase and adjusting of the relaying and protective equipment on the transmission system. The major portion of the work on the transmission line had been completed by the end of the year 1957 and approximately 90% of the charges to the construction work had been made. The line between Cedar Substation and Gwinn was placed in operation in the fall of the year, and it is expected that the entire line will be complete and tied into Escanaba early in 1958.

The Presque Isle Plant of the Upper Peninsula Generating Company delivered 156,461,600 kwh to the jointly used transmission system this year. This was an increase of 28% above the amount delivered last year. This increased production assisted in reducing the average cost of energy delivered (including fixed charges) from \$.0083 to \$.0078 per kwh. Since the full capacity of the plant as defined by our agreement with Upper Peninsula Power Company was utilized, the fixed costs were equally spread on the energy used by each. This resulted in a reduction in energy cost to our Company from \$.0118 to \$.0077 per kwh. No major difficulties were experienced and the economy of the station was good. On February 24 there was a field failure on this unit caused by a fault in the brushes of the pilot exciter and the machine ran for a short period of time without excitation. For a machine of this size to operate without its excitation sometimes causes serious damage to the field winding insulation. Accordingly, it was felt advisable to give the machine a thorough examination after this difficulty was experienced. The generator was shut down on February 26, and a specialist from the General Electric Company inspected the machine thoroughly and reported that no damage had been done. During this shutdown the boiler and all associated equipment were also given a thorough inspection. The plant was placed back into operation on March 6.

The Ishpeming Steam Plant was operated during every month of the year. Energy delivered to the jointly used system by the Ishpeming Steam Plant during 1957 amounted to 30,360,114 kwh which was an increase of 31% above the amount delivered in 1956. The production expense of this station was reduced from \$.0104 per kwh to \$.0096 per kwh in 1957. Of the energy produced by this plant, 99.5% was used by the Upper Peninsula Power Company. The cost of this energy to that Company was \$.01215 including that portion of the Fixed Charges assigned to them under the power purchase agreement. Operations were satisfactory and no major difficulties were experienced. The Steam Plant was shut down for its

annual inspection April 1 to April 8. No serious conditions were found.

A small amount of flyash erosion within the boiler is still being experienced, however, and on September 14 this erosion caused a leak in a boiler tube in the rear pass of the boiler. The erosion occurred at a point where the tube passed through a baffle and it was found that other tubes in the same locality were showing signs of extreme wear. Accordingly, this entire baffle was removed and all of the tubes were built up by electric welding. This boiler was returned to service on September 19. On September 26 a leak caused by erosion in the lowest rear tube in the economizer was discovered. The plant was shut down and this tube was built up by electric welding. The boiler was placed back in service on September 30. This problem of erosion has again been called to the attention of the manufacturer, and it is hoped that some suggestions for its reduction will be had in the future.

On September 23 a new conveyor belt was installed to replace the one used for transporting the coal from the bucket elevator to the coal hopper. This belt goes over a mechanical tripper which caused excessive wear where the ends were joined together by a mechanical splice. The ends of the new belt were vulcanized and it is felt that the life of the new belt will be much greater than the one joined by the mechanical connector. The sprocket in the upper end of the bucket elevator which takes the coal from the ground level to the bunker broke on November 2. Because the sprocket was cast iron and could not be repaired locally, it was necessary to procure a replacement sprocket from the manufacturer. The elevator was repaired and the plant was returned to service on November 5.

Both units of the Carp Power Plant were taken down, inspected, and cleaned beginning early in September. They were found to be in excellent condition except the rotor of the number 1 unit. The field windings of this machine were loose on the field poles. The same condition had been experienced in the number 2 unit several years ago but had been corrected. Since our shops were not equipped to do the work required, bids were taken on the repair work and the rotor was sent to the Westinghouse Repair Shops at Milwaukee for repairs during October. The repair work was completed and the unit was placed in service on November 9. No operating restrictions were placed on the plant by this generator being out of service, as water conditions were such that only one of the two units could be operated economically. Thus whichever machine was not under inspection or repair could be operated with no actual reduction in plant capability.

Several interruptions were experienced on the transmission lines during the year, but none were of great duration and no extensive loss of equipment was encountered. In several instances the duration of the interruption was extended because of faulty relay operations and because of faulty system dispatching. The transmission system served out of Ishpeming has expanded very rapidly in the last few years, and the operating personnel has not become thoroughly familiar with all of the various system conditions which may be experienced. The result is that new conditions sometimes cause confusion and delay in restoration of service. This condition is greatly aggravated by improper relay action. A new system of relaying has been installed at the Cedar Substation in connection with the Escanaba line. These relays have operated falsely several times and as a result the Presque Isle Plant has been kicked off of the line. Studies are being made both by the personnel of the Upper Peninsula Power Company and by representatives of the relay manufacturers to try to correct these conditions and it is hoped that a satisfactory decision will be reached in the immediate future.

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STATISTICAL DATA - 1957

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Precipitation -	0.25	0.91	0.57	2.35	2.60	2.55	1.13	2.17	5.88	1.50	3.74	0.88
Total precipitation at Ishpeming during 1957 -	24.53" (2.044 ft.)											
Average "	"	"	"	- 30.71" (45 year record)								

CARP RIVER PLANT:

Drainage area above intake dam													66.66 sq. miles
Cubic feet precipitation in 1957													3,798,516,750
Kilowatt hours generated in 1957													15,112,000
Cubic feet water utilized in 1957 (90 cu. ft. - 1 kwh)													1,360,980,000
" " " wasted over intake dam in 1957													42,372,000
" " " in Carp storage Dec. 20, 1956													332,412,360
" " " " " " " Dec. 20, 1957													372,625,940
" " " increase in Carp storage in 1957													40,213,580
Total run-off in 1957 (cubic feet)													1,443,565,580
Run-off per square mile of drainage area (cubic feet)													21,655,649
Second-feet run-off													0.687
	<u>1913</u>	<u>1914</u>	<u>1915</u>	<u>1916</u>	<u>1917</u>	<u>1918</u>	<u>1919</u>	<u>1920</u>	<u>1921</u>	<u>1922</u>	<u>1923</u>	<u>1924</u>	<u>1925</u>
Total Precip.	30.11	26.53	38.40	36.83	25.46	31.05	29.50	27.40	30.38	33.67	21.90	22.95	20.71
Sec.-ft. Run-off	1.03	0.67	0.93	1.29	0.70	0.79	0.83	0.73	0.68	1.06	0.59	0.50	0.25
	<u>1926</u>	<u>1927</u>	<u>1928</u>	<u>1929</u>	<u>1930</u>	<u>1931</u>	<u>1932</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>	<u>1937</u>	<u>1938</u>
Total Precip.	35.69	29.86	36.06	32.28	23.14	36.70	31.20	32.72	32.87	27.10	30.23	30.10	35.32
Sec.-ft. Run-off	0.85	0.98	1.11	0.67	1.10	0.83	1.13	1.14	1.00	0.79	0.89	0.86	1.33
	<u>1939</u>	<u>1940</u>	<u>1941</u>	<u>1942</u>	<u>1943</u>	<u>1944</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>
Total Precip.	33.58	30.34	32.20	34.26	32.04	32.77	30.81	26.12	32.88	22.87	37.23	30.64	43.50
Sec.-ft. Run-off	1.47	1.05	0.83	0.84	1.17	0.70	0.81	0.56	0.88	0.44	0.77	1.09	1.54
	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1957</u>							
Total Precip.	24.35	35.42	33.77	30.82	25.52	24.53							
Sec.-ft. Run-off	0.69	0.85	0.84	0.93	0.77	0.687							

McCLURE PLANT:

Drainage area above intake dam													140.52 sq. miles
Cubic feet precipitation in 1957 (Hoist Plant - 28.78"-2.398')													9,394,099,698
Kilowatt hours generated in 1957													41,603,000
Cubic feet water utilized in 1957 (125 cu. ft. - 1 kwh)													5,200,375,000
" " " wasted over intake dam in 1957													0
" " " in Hoist storage basin Dec. 20, 1956													1,554,892,584
" " " " " " " Dec. 20, 1957													1,320,423,500
" " " decrease in 1957													234,469,084
" " " in Silver Lake Dec. 20, 1956													91,408,800
" " " " " " " Dec. 20, 1957													0
" " " decrease in 1957													91,408,800
Total run-off in 1957 (cubic feet)													4,874,497,116
Run-off per square mile of drainage area (cubic feet)													38,995,977
Second-feet run-off													1.237
	<u>1921</u>	<u>1922</u>	<u>1923</u>	<u>1924</u>	<u>1925</u>	<u>1926</u>	<u>1927</u>	<u>1928</u>	<u>1929</u>	<u>1930</u>	<u>1931</u>	<u>1932</u>	<u>1933</u>
Total Precip.	35.10	42.03	26.60	30.49	24.06	43.95	35.51	43.80	38.75	30.81	37.02	32.54	35.07
Sec.-ft. Run-off	1.02	1.54	0.85	0.92	0.52	1.52	1.80	2.22	1.36	1.45	1.10	1.23	1.30
	<u>1934</u>	<u>1935</u>	<u>1936</u>	<u>1937</u>	<u>1938</u>	<u>1939</u>	<u>1940</u>	<u>1941</u>	<u>1942</u>	<u>1943</u>	<u>1944</u>	<u>1945</u>	<u>1946</u>
Total Precip.	35.02	29.96	32.16	38.18	40.93	41.22	36.59	38.15	40.20	35.64	37.62	37.94	31.91
Sec.-ft. Run-off	1.16	0.90	1.05	1.19	1.75	1.69	1.47	1.28	1.15	1.43	1.17	1.36	0.86
	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1957</u>		
Total Precip.	37.27	28.81	43.28	40.65	50.90	29.27	41.56	38.13	35.70	31.71	28.78		
Sec.-ft. Run-off	1.22	0.78	1.24	1.37	2.09	0.97	1.33	1.29	1.03	1.18	1.237		

Average precipitation at Hoist Plant - 36.14" (37 year record)

ELECTRIC POWER DEPARTMENTSTATISTICAL DATA - 1957Energy Delivered to Transmission System
by CCICo. Generating Facilities

	<u>Kwh Delivered to Lines</u>				<u>Total</u>
	<u>CCICo. Steam</u>	<u>CCICo. Hydro</u>	<u>CCICo. Diesel</u>	<u>UPGCo. Steam</u>	
Jan.	1,898,980	8,586,175	83,395	721,950	11,290,500
Feb.	3,102,825	6,003,295	119,365	4,201,495	13,426,980
Mar.	2,465,840	7,464,425	445,140	2,476,623	12,852,028
Apr.	1,190,830	8,236,860	13,900	1,563,015	11,004,605
May	1,299,350	7,919,955	327,155	3,271,606	12,818,066
June	2,957,735	6,472,815	449,315	4,708,263	14,588,128
July	3,494,750	4,757,510	293,825	5,223,885	13,769,970
Aug.	3,910,010	4,691,195	689,765	7,170,719	16,461,689
Sept.	3,140,410	5,356,746	960,860	7,207,900	16,665,916
Oct.	2,921,690	5,789,030	98,835	7,343,658	16,153,213
Nov.	2,374,380	7,426,310	33,655	3,773,725	13,608,070
Dec.	1,603,314	7,953,020	198,970	2,669,175	12,424,479
Total annual use by UPPCo. of CCICo. energy from UPGCo.				<u>27,898,786</u>	<u>27,898,786</u>
Total energy produced by CCICo. generating facilities	30,360,114	80,657,336	3,714,180	78,230,800	192,962,430

ELECTRIC POWER DEPARTMENT
STATISTICAL DATA - 1957

Utilization of Energy Delivered to
Transmission System by CCICO. Generating Facilities

	<u>Ishpeming</u> <u>Kwh</u>	<u>Hydro</u> <u>Kwh</u>	<u>Diesel</u> <u>Kwh</u>	<u>UPGCo.</u> <u>Kwh</u>	<u>Total</u> <u>Kwh</u>	<u>% of</u> <u>Total</u>
	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>		
The Cleveland-Cliffs Iron Co.	161,341	64,461,322	33.4	50,332,014	114,954,677	59.6
Humboldt Mining Co.		16,196,014	8.4		16,196,014	8.4
Upper Peninsula Power Co.	30,198,772			27,898,786*	61,811,739	32.0
Total	30,360,114	80,657,336	41.8	78,230,800	192,962,430	100.0

*Sold directly to UPPCo. by UPGCo.

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ENERGY & POWER REQUIREMENTS C.C.I. CO. OPERATIONS

