SEVERE SNOW STORM OF MARCH 19-20-21, 1958

AND ITS EFFECT ON THE PHILADELPHIA ELECTRIC COMPANY'S SYSTEM

By

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Before talking about the snow storm it is appropriate to tell you about the Philadelphia Electric Company. We serve electricity in Philadelphia and four surrounding counties in Southeastern Pennsylvania and two counties in Northern Maryland. The total service area is 2340 square miles with a population of 3,750,000. We have 1,172,000 electric customers.

The total installed electric generating capacity is 2,716,000 Kw. This capacity is installed in 8 steam-electric generating stations and one hydro station. The generating stations are connected by 69 Kv, 138 Kv, and 220 Kv Bulk Power transmission lines, some of which are installed in underground cable but most of which are installed on steel towers.

We operate interconnected with surrounding utility companies over lines of similar voltage to form the Five-Party Pennsylvania-New Jersey-Maryland Interconnection. The installed capacity of the Interconnection is 12,000,000 Kw. The interconnection Peak Load in December, 1959 was 10,372,000 Kw. The Philadelphia Electric Company's Peak Load in December, 1959 was 2,448,800 Kw., which was 95,000 Kw, less than the Summer Peak of 2,543,000 Kw.

STORM FORECAST

The official U.S.W.B. forecast for Philadelphia and vicinity on Wednesday, March 19, was "Mostly cloudy and cool today with some light rain in the morning. Tomorrow mostly fair and continued cool. High today - 45 degrees, low tonight - 32 degrees. Northeast winds 10 - 20 miles per hour today." With this mild report began a rampage of nature which was the greatest disaster ever experienced by the Philadelphia Electric Company.

Predicted light rain did fall in Philadelphia, but reports of snow flurries were received from the suburbs. Late in the afternoon it was snowing throughout our service area. The forecast was changed to "Light snow, with as much as two inches in the suburbs." At dusk, heavy, wet flakes began to accumulate.

In the darkness, Wednesday night, the storm once centered off the Carolina coast, veered towards Eastern Pennsylvania. The winds increased to thirty-five miles per hour, with gusts recorded on our own anenometer up to forty miles per hour.

By 10.00 p.m., the storm effects began to be felt. Wires were down in

some divisions, such as in Philadelphia, where there were reports of 100 wires down. By 11.00 p.m., it was apparent that the storm was far more than a seasonal disturbance. Preparations for emergency operations began in all divisions.

There have been deeper snows that were much easier to cope with. This snow was different. It was extremely wet and heavy and clung to everything it touched. The surface temperature never dropped below 32 degrees during the storm, giving the snow an unusually high water content. Eleven and four-tenths inches fell at the Philadelphia Airport.

It was a beautiful sight to behold, but I an sure you can appreciate the difficulties our crews met during their initial efforts to restore services.

The total depth increased rapidly towards the Western and Northern parts of the city, with seventeen inches reported in the Northeast and twenty-four to thirty-two inches in Delaware County and fifty inches as far west as Morgantown. The density of the snow was approximately 43 per cent, or twelve (12) inches of water equivalent to twenty-seven inches of snow.

From 11.30 a.m., to 6.30 p.m., on March 20, the wind blew steadily, slightly east of north, at an average speed of 35 to 40 miles per hour, with gusts up to 60 miles per hour. A recording of the direction and velocity was taken from our own anemometer located atop our 22-story office building.

In many areas we hired bulldozers to clear roads not yet reached by highway crews. Our own trucks inched along behind the bulldozers.

When it became apparent that we were facing a major storm, far worse than "Hurricane Hazel" that visited us in October 1954, our Emergency Procedures Department was alerted. We were almost completely immobilized by the depth of the snow. The State Highway Department was requested to send all available road clearing machinery to the areas to clear roads, so that we could make service restoration.

TRANSMISSION

Throughout the night, despite the fury of the raging storm, major transmission lines held. About 5.30 a.m., the transmission troubles started. A failure on a temporary wooden structure at Bradford Substation caused the loss of a 220 Kv line to Conowingo Station.

Later in the morning the second Conowingo line failed at the Susquehanna River Crossing at Conowingo. This was the first time in thirty years that these two lines were faulted simultaneously. Accumulation of ice and wet snow broke cable clamps tested for a load of 25,000 pounds. The river crossing spans are 2200 feet long. Sleet melting facilities have been installed on the ground wires at river crossings.

Tower failures occurred on the 138 Kv line between Byberry and Emilie Substations. Cross-arms were buckled by the weight of the ice on the conductors.

In order to get this line back in service as quickly as possible, wood structures were erected nearby to carry the still intact conductors of the line. The line was returned to service in eleven days.

A summary of the Bulk Power Transmission line outages was prepared during the course of the storm. Line No. 220-04, a new line, was not returned to service until April 19th; No. 130-25 line on March 30th; No. 130-26 line and No. 6649, 6650 and 6676 lines on March 23rd.

For seven hours on March 20, the only transmission line connecting the Philadelphia Electric Company with our Interconnected companies was one 220 Kv line to the Pennsylvania Power and Light Company.

The storm that "couldn't happen but did" broke wood poles that had withstood the full fury of Hurricanes. Poles carrying 33,000 volt lines broke like match-sticks. Seventy-seven out of 110 - 33 Kv transmission lines tripped and 57 of them had permanent faults. Hundreds of thousands of reports came through by telephone, telegraph and messenger. In Philadelphia thirty complaints per minute were handled.

Non-operating forces from the Engineering and Clerical Departments of the Company were pressed into service to patrol lines and report to the Division Operating Headquarters. Accurate reporting of damage by these employees saved countless hours of precious time.

One of the highlights of the storm was the use made of Helicopters. Helicopters from the Vertol Aircraft Corporation (20 of them, including 3 awaiting delivery to the French Air Force and 1 to Sweden, and additional Helicopters from the U.S. Army) were pressed into service to carry men and materials throughout the system. The Helicopters also performed many missions of mercy, delivering vital drugs and food to places that were inaccessible by highway. "Choppers" were also used for lifting poles and setting them in location.

LOAD REDUCTION

A load comparison curve for the period from Thursday, March 20 to Monday, March 24 shows a 571,000 Kw, reduction at 5.00 p.m., on March 20. During a heavy snow storm in February, when there were no service interruptions, the system load was 150,000 Kw, below normal due to the inability of people to get to work. On the assumption that a 170,000 Kw, reduction would have resulted from the same reason, we estimated that approximately 400,000 Kw, of load was interrupted due to loss of power.

By Saturday morning the number of customers without service was 144,000 and by Sunday evening reports from all divisions indicated that there were only 35,000 customers without service; most of them in remote outlying areas. All service was restored by Friday, March 28. The system kilowatt-hours were 19,500,000 below normal for the five-day period, amounting to a loss in revenue of over $300,000. A comparison curve of the actual loads of Thursday, March 13 and Thursday, March 20, showed a reduction in peak load of 312,000 Kw, and 7,500,000 Kwh. The load at 11.00 a.m., on Friday, March 21 was 352,000 Kw lower than the previous Friday. The kilowatt-hours were 6,900,000 lower.

EMERGENCY PROCEDURE

There were 850 non-operating employees used in patrolling the lines and crews from neighboring utilities added 1500 men to the regular Philadelphia Electric Company forces. Men were brought in from as far West as Jackson, Michigan, as far South as Atlanta, Georgia, and also from New England.

The ice accumulation on one of the 220,000 volt transmission lines was measured at 12 inches diameter. Most of the transmission line failures were caused by ice forming on the protective ground wires. These failures occurred in most locations where the lines were running East and West. The wind blew from a northerly direction which was responsible for the ice forming on conductors running East and West.

The cost of the snow storm to the Philadelphia Electric Company was approximately $6,600,000. Of this amount $3,000,000 was covered by All-risk Insurance, originally purchased in 1955.

CONCLUSION

After wind, snow or sleet storms, which cause damage to overhead power transmission and distribution facilities, the question is often asked "why power lines are not placed underground."

The answer, of course, is in the cost which would amount to hundreds of millions of dollars to place our 53,000 conductor miles of overhead transmission and distribution underground. To meet this investment, rates would obviously have to be increased to at least double their present rate. Another interesting fact regarding underground distribution is that during the period from March 20 to March 30, 1958, we had forty failures on the underground distribution system in Philadelphia. During the same period in 1957, when there were no bad storms, we had only six failures. Indirect after-effects of a severe storm can, and do,result in a marked increase in underground failures.

What then are we doing to avoid such a catastrophe in the future? Our management has set up a program over the next five years, to cost approximately $4,000,000 per year. This will include replacing of small conductors, changing the length of wire spans and replacing many poles. We are also installing a lot of self-

supporting insulated cable, particularly in the suburban areas where falling tree limbs are the greatest hazard to open wire construction. Every storm is different, but it is our present goal in the event of major disasters such as this one, to be able to restore all of our customers within three days.