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Editors' Note

This book is the work of the staff of *The New York Time+-the* reporters, the copy editors, the news editors, the news assistants, all the people who worked through 'the blackout to put out a paper and who followed the story in the days to come.

The editors of this book, who work together on the Metro= politan Desk of *The Times,* take thii opportunity to express their thanks to the staff for the privilege of working with them that night. Every person on the staff performed, under great difficulties, at the peak of his ability. We want to say a special word about Peter Kihss, who pulled together all the threads of a vastly complicated story and turned out a lead-piece that all his colleagues regard as a high point in daily journalism under deadline pressure.

The material for this book came from a variety of *Timed* sources. There were the articles written for the newspaper, re-woven into running narrative, Added to those, and worked into the book, were special research, interviews and articles by *Times'* members.

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Donald Johnston
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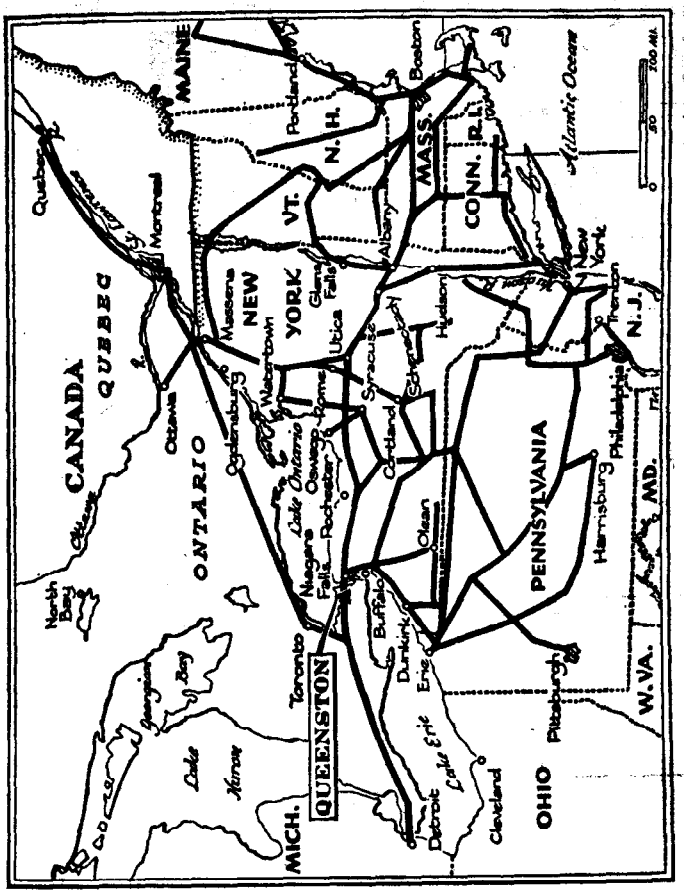

POINTER INDICATES SITE OF SIR ADAM BECK STATION NUMBER 2 IN QUEENSTON, ONTARIO, FOUR MILES NORTH OF NIAGARA FALLS, WHERE ALL THE TROUBLE STARTED. HEAVY BLACK LINES MARK MAIN INTERSYSTEM TRANSMISSION LINES.

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1. The Plugged-In Society

There *are 30* million Americans who have something new and vivid in common-people in New York City and Burlington, in Boston, Rochester and Providence, in dozens of other cities and hundreds of towns and villages in the Northeast. They were together during the great blackout of 1965. From now on they will be asking each other, "Where were you when the lights went out?" and some of us will actually wait to hear before breaking in to tell our own stories.

It was a curious experience, one that existed on many levels for many people and raised questions and left mysteries that the specialists will be examining for years to come—and not just the engineers looking for the switch not thrown, the generator burned out or the computer gone wild.

Psychologists will peer into the behavior of men under stress, sociologists will examine the suddenly torn fabric of modem life, economists will dissect the relationship of public utilities to public interests, generals will check worriedly over intricate military patterns in renewed guard against a mechanical failure which could blow out not just the lights but also mankind. And philosophers and theologians will search their minds for the meaning of man's position in a technological society which he found he neither really understood nor controlled, a most bewildering and frightening moment of awareness.

The hours of the darkness brought with them some sudden flashes of light-quick insights into fears that haunt Americans ("the Chinese," a housewife on New York's East Side thought when she saw New York fade from her window, and then was a little ashamed), swift glimpses, too, of resourcefulness under pressure, the uncovering of hidden talents and sensitivities, the latent instinct, even in our own nervous, compartmentalized society, for people to reach out toward each other.

Housewives in high-rise buildings all over town, who had never known their neighbors, found themselves knocking on apartment doors, offering candles and snacks. For a Pakistani woman, huddled in the dark with her frightened child, New York will never be quite as cold as it was before the woman next door brought in a bit of candle. People discovered the things they could do-hook- up a lamp to a battery, lead frightened strangers through a subway tunnel, climb hundreds of steps to lead office workers down to the street.

The blackout brought fears and mysteries; it also brought a certain exhilaration. In every man there is a corner of rebellion against the machine, and the blackout allowed us a brief period of freedom from its dominance. We were all delighted at the rediscovery of the importance of things that were not plugged into walls-things that were almost forgotten by us-most of all, the wonderful, wonderful candle.

What a moment of triumph to know that the huge computers we really did not like and that we suspected really did not like us were lying massively idle and useless, but the old pencil sharpener still worked. It was modem man's closest equivalent to being alone on a desert island, and the great joy of making do buoyed us all. We knew we would be recaptured and brought back submissively to the prison farm of modem technology but it was good being free, loose and on the run for a few hours.

It is easy, looking backward, to divide all the reactions and emotions into neat little piles with neat little labels-fear, courage, selfishness, resourcefulness-and make the quick assumption that what was important about the blackout was the common denominators revealed. Indeed, there were these unifying threads but, more important, the blackout was a reminder that because of our own needs and backgrounds we respond to a collective situation quite individually.

The blackout was a lark for youth, a terrible trial for age. It was an opportunity to help for the young man who stepped off the sidewalk and directed traffic which suddenlv had been wondrously freed from the discipline of traffic lights. It was an opportunity to gouge for the taxi driver who packed his cab full of passengers and made each pay double or triple the whole fare. As usual, New Yorkers helped gouge themselves. They stood in the roadway, flagged down taxis and shouted, 'Thirty dollars to Brooklyn!" "Ten dollars to the Viiage!"

Our society is such that there was not an area of life, physical life or mental life, that was not in some way touched by the fact that the power had failed.

There were all the things that in one way or another are plugged into the wall. When the plug was pulled out we found

it difficult to go about our ways, found it difficult even to communicate with each other.

The plug was pulled out of the wall for the subways 'and 800,000 people found themselves in the dark, underground, stock-still. In New York, people think of the subways as dangerous places-although there is considerably less crime under the sidewalks than on them-and these early moments of black immobility were chilling. Those pickpockets fortunate enough to be on the subways at that historical moment in the records of their trade probably had an interesting time, but there was no terror in the tunnels.

The commuter trains slid to a halt and the whole machinery of suburban life, built around the clock and the railroad timetable, slid to a halt with them. By the time commuter and housewife got together again, other travelers had flown from New York to Cairo.

We couldn't move toward each other unless we had cars and it was difficult talking to each other-the phones worked but were overloaded. The people who talk at other people were also, for the most part, silenced. The newspaper presses in the blackout area. were not rolling, radio was available only to those who had transistors or were in cars, and the television industry was shut down.

Most of the time, we find out what is collectively important to us by picking up the paper, switching on the radio, clicking through the television channels. We are then told what we have been doing or should be doing or what our leaders are doing for us or to us. When the presses stop, television goes out and radio's voice is narrowed, we lose touch with the President of the United States, with Dean Rusk, with the men dying in Vietnam; we can't hear Peking yelling at us and we don't even know just what it is we are supposed to rush out and buy. We are left alone, without editorial writers and commentators telling us what to think about.

The disruption of the communications industry during the blackout, therefore, had a rather poignant and disturbing effect. Here were 30 million people sharing a common experience and, except for those with transistors, they didn't know what the experience was. In the eerie candlelit newsroom of *The Times* that night-good God, somebody said, this story is all ours if we can just get it out on the streets; nobody knows it yet, they are in it but they don't know it.

It was not only that almost every material part 0f our society was involved and affected by the pulling of the plug in the wall —transport, communications, manufacturing, buying and selling and consuming.. For many of us the most fascinating part of the blackout was the effect and impact it had on things

that are enormously important in our society, or any society, but cannot be seen or touched or heard-our fears and our worries, our taboos and our insecurities.

In an apartment twenty stories over the East River in New York City, three 'mall boys were filled at first with the Halloween spirit of it all, but then they grew quiet and sat silently with their mother, looking out the window. One of the boys said solemnly after awhile, "An attack from outer space!" He wasn't joking either and neither was his mother at the unspoken thought in her own mind-an attack, somewhere, from inner space.

Through the minds of two knowledgeable newspapermen flashed the same thought at about the same time, as they were to discover later. Both thought, 'The anti-Vietnam demonstrators have pulled something off.."

Probably because all those rock 'n' roll stations and the radio networks did such a fine job, and because so many teen-agers had bought so many transistors, the word that all was safe carried rapidly enough to prevent any spread of fear. But it is a fact that we live in a world so in terror of itself that a simple power failure on a wide scale could instantly touch off the deepest and most terrible fears in many American minds. Even when the fear was passed off or shrugged off or laughed off and even when it quickly proved to be entirely false, other fears rose to take its place.

We had all been told time and again that it could never happen. We had been assured by impressive charts and diagrams and by even more impressive scientific jargon not to worry our heads, that the computers and the switch-offs and other things that the likes of us couldn't understand and needn't bother to understand would take care of things. We could go about our business without fear of the dark.

We had all accepted that and yet it did happen. The lights went out and for a terribly long time nobody could make them go on again. For five days, until the trouble was traced to a town in Ontario four miles from Niagara Falls. Nobody could even tell us why they went out. Then, all of a sudden, they weren't telling us any more that it could not happen again. Suddenly we were being told by our scientific and engineering betters, that it could indeed happen again maybe right tonight. So now we believe that it could happen again and we have very little faith in the infallibility of our engineers, a good *reaction* indeed for all of us.

But what is in our minds now, and what came immediately to many of our minds that night and could not be driven out, is the dreadful next-step thought. If all those highly educated engineers were so terribly wrong about assuring us that there

could not be a massive power failure, that they had successfully guarded against it, that the good old computers were right in there protecting us day and night, how can we be sure that there won't be another kind of short circuit some place, or some other little technical mishap that we couldn't possibly understand, and that as a result a missile will come out of its concrete dungeon in Nebraska or Siberia and put us all in darkness again, and forever?

This is not a new thought, of course, and titillating books and movies have been written about it-the "Fail-Safe" syndrome, it is sometimes called. It is a recurring fictional theme. Somewhere on an electronic war board New York or Moscow flashes red, the missiles rise, the cities disappear. Then a lone survivor creeping about the war room finds that that first red flash had just come from a simple short circuit. The irony of it all.

With the blackout, these fears came back, and stronger, because our experts had proved to be so wrong. If the electrical experts are wrong, why not the military experts? If you can't even trust Con Ed, can you trust the Pentagon? There is plenty of reassurance available. We hear that the President has to give the word, there are keys and double keys, there are coded passwords, there are two men with revolvers watching each other at critical posts in case one goes mad (suppose they both go mad?) and all sorts of safeguards.

And yet. Can it be said, really, that it is beyond all possibility that something could go wrong? There is nothing to be done about this; men learn to live with the fear. All that can be said is that the night of the blackout made the fears just a bit sharper, made doubts just a bit heavier, made people quite a bit more skeptical of the reassurances of the experts. It is a good thing,. all told, to see the engineering experts get one in the eye, because we all are too much in awe of them. But, of course, if the military experts turn out to be wrong, well then jt is our eye.

The night the lights went out, the very fact of their going but, and nobody knowing quite why for so long a time, touched On something even deeper in significance than the missiles 50 miles from the controlling button.

One way or another it made most of us in the dark realize acutely that the dilemma of modem man is that he lives in a society he does not really understand and cannot really control. All societies, from the family through the tribe to the United Nations, are, happily, beyond total control. They are made up of individual human beings, and no force has been found that controls the minds and souls of individual human beings totally.

But although society never has been totally controllable, its component elements-people--more or less understood each other. One human being reacted to another human being as a human being-loving him or killing him or working for him *or* -cheating him or teaching him or whatever. Now we find that in a real sense something else has *entered into* society and we human beings are not alone. The machine is in it with us.

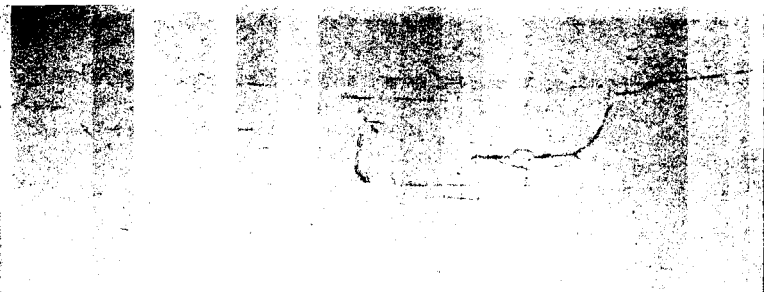
We can't talk to the machine, we can't get angry at it, or love it, but it certainly is affecting our lives, our individual lives and our lives as residents of a city or members of a nation. Of course, we are the masters of the machine. Are we? Without getting too metaphysical about it, without succumbing to the temptation to give machines personalities--although we all have known machines that have benefited enormously from a good kick in the slats-it is still a fact that machines control us at least as much as we control them.

Human societies have been through all sorts of crises—wars, rebellions, plagues. Now it seems to me that we are approaching a new kind of crisis-The Age of Mechanical Disobedience. The machines are quite all right as long as they do what they are supposed to do, but we are now so dependent on them that when something goes wrong in our machines our lives are disrupted.

The machines are plugged into each other and we are plugged *into* the machines and when somebody pulls a plug it means that we as well as the machines begin sputtering and throwing out gears, burning oil and screeching to a stop. The proof of our dependency, it seems to me, is that so many of us are more afraid of nuclear death by short circuit than by military decision.

Most of the city froze that night. But there were islands of activity. One of them was on the third floor of 229 West 43d Street, the news room of *The New York Times.*

The blackout came a couple of hours before first-edition time. The blackout made the switches on the wall useless but something else clicked immediately into life-the professional response of a team of newspapermen in crisis. We worked in candlelight, put out copy, rushed it across the river to the plant of *The Newark Evening News* and the next morning *The Times* was the only New York newspaper on the stands. Yes, we were *proud* of ourselves and our paper, but most of all we were proud of the tradition that impelled us-the tradition that it is a newspaper's job to publish. Too often newspapers and newspapermen have forgotten that. We published, and as far as we were concerned, the score the next morning was People 1, Machines 0.



2. "And Everything Was Gone"

The Energy Control Center of the Consolidated Edison Company of New York is a modern, high-ceilinged room where no one ever sleeps. It is bathed in bright fluorescent light night and day. In its antiseptic atmosphere, among the switches and meters and circuit diagrams, trained men work around the clock to keep the world's largest city 'supplied with its most precious commodity—electrical power.

At 5:15 on the night of November 9, 1965, the lights in the Energy Control Center Bickered. Edwin J. Nellis, a baldish, small-shouldered man of 62, was in the controller's chair. He was the human connection between Con Edison's electrical generators and its customers and between the company and the other utilities in the vast *Northeast* Power Grid.

Moments after that first flicker the needles of the meters in front of Mr. Nellis began to pitch and yaw wildly. The indicator of the key gauge, the one showing the balance of electricity between Con Edison and the grid, went off the scale.

By then Mr. Nellis *realized* that *New* York was on the losing end of a massive power drain, a drain that was already hurtling downstate along the singing cables of the grid. But it was too late. ("Electricity moves at the speed of light," Mr. Nellis was to say tersely days afterward. "If you can beat that, I can't.") At 5:27 P.M., Eastern standard time, New York City-Baghdad on the Hudson, the Great White Way, the hub of the nation's commerce and communications-was sucked into the maw of blackness, following scores of other cities upstate and in New England.

It was as if some gigantic creature of night and chaos had swept across the chill Northeast evening, snuffing illumination in Vermont farmhouses and Manhattan skyscrapers, stopping subways in their tunnels and phonograph records on their turntables, halting traffic and emergency surgery, postmen on their rounds and children at their play.

It was a night of courage and confusion, of laughter and fear, of riot and humanity, of tragedy and romance. For some the blackout was only a momentary annoyance; for others it was an eerie all-night fantasy when the whole machinery of life came to a halt. For all, it was a time they will not soon forget. This is the story of that night-The Night the Lights Went Out.

Tuesday, November 9, 1965, did not begin as an extraordinary day. The sun rose over the Northeast at 5:35 A.M. The weather was clear, and there was no sign of rain. Upstate and in New England, farmers got up to do their chores---milking, feeding the stock, breaking. the thin sheet of overnight ice on the water troughs. In the cities, there was the sleepy stir of deliverers and shopkeepers. Suburban commuters readied themselves for the trip to their jobs in the metropolitan centers. Children walked grimly down country roads to catch the school bus. An ordinary day.

In the news, former President Dwight D. Eisenhower was taken early in the morning to Fort Gordon Army Hospital in Georgia with what was first thought to be a mild heart disturbance. President Johnson was still recuperating at his Texas ranch from his gall bladder operation. Paratroops of the ,173d Airborne Brigade engaged in a 5erce firefight with Vietcong guerrillas in Zone D. A twenty-one-year-old pacifist named Roger Allen La Porte set himself on tire in front of the United Nations building to protest against war. The New York police began a new policy of towing away illegally parked cars from midtown streets.

It looked like an ordinary day, too, on the Northeast Power Grid. The mild fall weather lessened the drain of electricity for a major use—air conditioning or heating-and so it did not look like the full generating capacity of the system would have to be fed into the grid.

The grid is a vast interlocking network of plants and lines in which the power companies of the Northeast pool their facilities to make cheaper electricity available and to help each other in times of need. It began its formation around 1950 with the interconnection of previously independent local utilities.

The grid has two major parts-the Ontario-New York-New England pool and the New Jersey-Pennsylvania-Maryland pool. The pools are connected, but easily separable. Within each system, however, the members are greatly dependent on one another and can be separated only as a last resort

The main trunk of the Ontario-New York-New England pool is shaped roughly like an elongated T. The crossbar runs east and west from Niagara Falls to Boston; the stem runs

north and south from Schenectady to New York City. From this main artery of Dower run hundreds of feeder lines criss-crossing the Province of Ontario in Canada and seven states—New York, Massachusetts, Vermont, New Hampshire, Maine, Connecticut and Rhode Island. There is also a connection to two tiny towns—Milford and Matamoras-at the northeastern tip of Pennsylvania and to a number of populous suburban communities in Bergen and Passaic counties in northern New Jersey.

The virtue of the pool is that in times of normal demand for electricity the member companies can shut down some of their expensive steam-fed facilities and "ride" on the cheaper current provided by hydroelectric generators like the two million-kilowatt one at Niagara Falls.

The important fact about the pool is that within its network of cables the current runs in both directions. This means, for example, that even though a member company in Vermont is borrowing current from Niagara Falls, if the current from the falls suddenly stops, the Vermont concern will find itself lending its own electricity to other members. The principal drawback of the system is the dreaded "cascade effect," a phenomenon in which a sudden and excessive demand for power in one part of the network will milk dry all the other components. The result would be a complete shutdown of all the generating capacity in the system, total darkness.

To prevent this, the members of the grid have elaborate systems of circuit breakers and automatic shut-offs. Each component has the equivalent of Con Edison's Energy Control Center where engineers can watch the ebb and flow of power and, if absolutely necessary, cut the company loose from the grid.

For the members of the grid on Tuesday afternoon, however, the cascade effect was the furthest thing from anyone's mind. For one thing, it had never happened before. For another, power demand was as expected-normal. Consolidated Edison, the giant component of the grid with a generating capacity of 7.6 million kilowatts, was riding on 350,000 kilowatts from upstate in addition to the 4.5 million it was producing itself. The Orange and Rockland Power Company and many others in the pool were doing the same-letting their own plants idle while the upstate power flowed in.

Around 4 P.M. the companies began preparing for the peak demand of the day-the time around dusk when house lights and office lights and neon signs go on, when elevators emptying office buildings get their peak use, when extra subways and trains are put into operation for, commuters, when children come in from play and turn on the television set,

when millions of thermostats jolt millions 'of heating plants into operation.

The sun set at 4:44 P.M., revealing a night' of crystalline beauty. All over the East, lights winked on; husbands and travelers began the journey home, housewives started the preparations for supper. In the bars, the ice machines spewed out fresh cubes for that one quick one between office and home.

The temperature in New York Citv at 5 P.M. was 46 degrees. The metropolis was a fairyland of light-great runways of light on the avenues, glowing islands of light under the sidestreet lamps, riots of light on the Times Square billboards, warm, beckoning windows of light in innumerable apartments and homes, cold, shadowless panels of light in innumerable offices, secure patterns of light at the airports.

The moon, one day past the full, rose at 5: 13. Strangely, it was almost precisely at that moment that the trouble began. The moon rose, and the lights went out.

In Conway, New Hampshire, an 11-year-old boy named Jay Hounsell was walking along the road on the way home to supper, In the chill night, in the way of boys, he was swinging a stick to pass the time. Idly, he whacked it against a telephone pole at the side of the path. The light on the pole went-out. He could see the lights all over town go out. Jay, terrified, ran all the way home.

"His eyes were sticking right out," Mrs. Hounsell recalled later. "I wasn't sure he hadn't done something, but I told him it didn't seem possible that a whack on a telephone pole could put out the whole gizmo."

Atop a hill in Montclair, New Jersey, a housewife gazed out her picture window toward Manhattan. It was a magical spectacle at twilight-tiny diamonds glinting all along a horizon of lovely, deep blue. It had to be shared. She called her 16-year-old son. He came, and when he arrived at the window she turned and-it had vanished.

Mrs. Josephine O'Keefe, who lives in the Park Slope section of Brooklyn, recalled it this way: "I could see the New York skyline from my windows. All of a sudden, it's dark -dead, kind of. The last time was in the war, it was dark about the same way."

At the Michael C. Fina Company, a concern in midtown Manhattan that sells silver and crystal, the customers froze in the blackness when the lights flickered and failed. They did not want to jolt a display and precipitate a costly shower of shards.

At Mount Sinai Hospital in Manhattan, Mrs. Monserrata Marcana, 35 years old, was giving birth to twins. The first

'daughter was delivered just before the blackout. The- second was delivered by flashlight.

Over Kennedy International Airport in Queens, Captain Ron George was bringing his Air Canada turboprop with 80 passengers aboard in for a landing. "We turned right," he recalled, "and everything was gone." Captain Carl E. Loftstedt, piloting a Scandinavian Airways System DC-8 fan jet with 89 aboard, had a similar experience. "I saw the airport, I saw the runway," he said "I looked at the instruments, when I looked up I couldn't find it again."

That was how it was when the lights went out.

It started somewhere on New York State's Niagara frontier. Sometime around 5: 15 P.M., at some place in that section of the Northeast Power Grid, a large chunk of the input of the system was somehow cut off. This created a tremendous vacuum of power, something that the grid abhors. In the cooperative economics of the network, it meant that the generating plants of all the component companies were instantly called upon to make up -the loss. And it could not have come at a worse time—the time of peak demand in any business day.

Some of the generating plants were idling, riding on the upstate power that suddenly disappeared. Obviously, they were in 'no condition to make up the lack. It takes time to stoke a steam generator, or release the sluice gates at a hydroelectric generator. So that left it up to the generating plants that were operating at the time the vacuum appeared to take up the slack.

Generating plants are fickle mechanisms. When the power demanded of them is equal to their capacity to produce it they thrive. But when more electricity is asked of them than they can hope to produce they shut down—automatically—and produce nothing. This is 'what happened that Tuesday night.

The cascade effect has been likened to a file of falling dominoes. But the order in which the dominoes fall does not necessarily indicate the order of responsibility for the failure. It merely shows which components the power-hungry grid called on first, and which were found wanting Generally, the first dominoes to fall would be those closest to the source Of trouble.

The first sign of trouble in the grid came about 5:15, when lights all over the area serviced by the Ontario-New York-New England pool began to flicker. The Canadian component of the grid, the Ontario Hydra-Electric Commission, was apparently the first to succumb.

This state-operated utility, serving about six million people in southern Ontario, reported that "an electrical disturbance" somewhere in northern New York forced it to shut down at 5:15 or 5:16 P.M. The next victims were the New York State Electric and Gas Corporation and the Rochester Gas and Electric Company, both of which blew their fuses at 5:17. The New York State concern, serving the Binghamton, Finger Lakes, Elmiia, Ithaca, Auburn area, said its shutdown was "momentary." Once its generators were freed of the grid, they provided power for their own area again. There were fluctuations and low voltage in the system for a time, but by 7 P.M. it was stabilized.

Most of New Jersey was saved by throwing of switches—once by man and once by automation.

At 5:19 P.M. the Orange and Rockland Power Company, serving the area on the west bank of the Hudson River just above New York City, went out. The massive power drain had moved along the left or western arm of the T and, at the intersection, was calling for power from both the south and the east. About half the Orange and Rockland service area, including some of Rockland County and most of the concern's customers in northern New Jersey, were saved by the quick reaction of a supervisor in the Stony Point, New York, plant. He detected the sudden surge of power and, acting on his own initiative, threw the switch that cut his generators from the grid.

Company officials declined to identify the operator. But they emphasized that if the supervisor had taken such action on his own under more normal circumstances, it would be a very serious matter. As it was, he got nothing but praise.

About the same time, the New Jersey-Pennsylvania-Maryland pool was saved from disaster. That pool, connected with its -northern neighbors, was disconnected by seven switches that were thrown automatically when the demand became fierce.

The next components to go, at 5:21 P.M., were Massachusetts and Rhode Island at the far eastern end of the T. All of Massachusetts except Peabody and Holyoke-which has its own municipal power plant-was cast into darkness. What little there is of Rhode Island was also shut down, although three small companies-the Blackstone Valley Electric Company, the Newport Electric Company and the Block Island Light and Power Company-were back almost immediately.

At 5:22 the power drain, having exhausted the possibilities of the main artery (the T) for the moment, turned to the smaller feeder lines. The Niagara Mohawk Power. serving Buffalo and surrounding areas,-found part of its service cut

off at 5:22. The Central Hudson Gas and Electric Company, providing power for the area above Rockland and Orange, went out completely at 5:25.

Then it was the turn of the great metropolis that was to be affected most seriously of all. The Consolidated Edison Company, serving New York's five boroughs and' Westchester County, first began to notice the trouble when the lights flickered at its Energy Control Center at 128 West End Avenue at 5:15.

Mr. Nellis, who has been with Con Edison 41 years and a supervisor since 1937, was in charge. He gave this account of the preliminary events that evening:

"At approximately 5: 15 we had our peak load and were wngratulating ourselves on a very orderly peak period. Conditions were excellent. We had an excellent reserve in our system. Suddenly we had this severe short in the system [upstate]. The lights dipped very seriously. We immediately called for an instrumentation check. The check showed all our generating facilities [in the city] were indicating normal operation.

"But instruments showed an immense flow to the north. The Flushing station reported an operation of relays at one of our substations and we knew we had a fault some place in the interconnection [another term for the Northeast Power Grid]."

However, before giving the order to pull Con Edison free from the grid-which is done by pressing eight buttons in the Energy Control Center-Mr. Nellis had to deal with four telephone calls.

Three were incoming, from stations in Flushing, Rockland County and Orange County. All reported trouble. Mr. Nellis also placed a call to Syracuse to get more information on the trouble. When Syracuse reported "trouble to the north," Mr. Nellis said, he told the Syracuse station, "Under those conditions Pm going to cut clear of you."

Mr. Nellis gave the order to press the buttons, which activate circuit breakers at a Con Edison facility at Pleasant Valley in Dutchess County. But by then it was too late. At 5:27 P.M. all parts of the world's largest city except Staten Island and a small portion of Brooklyn were plunged into blackness and chaos.

Staten Island was spared because a circuit breaker unexpectedly cut it from the rest of the city system. "It operated automatically," said John P. Neubauer, manager of system operations. "I don't know why it opened." Mr. Neubauer also stressed that the decision to pull out of the grid "is- practically always a human decision."

At 5:28 P.M., the Long Island Lighting Company, serving most of Nassau and Suffolk Counties, followed Con Edison into the maw. At 5:30 P.M. almost ail of Connecticut went. The exceptions were downtown areas of New Haven, Stamford and Hartford. Vermont and the Keene and Peterborough areas of New Hampshire were the last to go—at 5:38 P.M. The state of Maine was saved by circuit breakers, and was able to lend some of its power to other areas later in the evening.

At 5:40 P.M., then, this was the situation. A major part of the 80,000 square miles and 30 million people served by the companies of the Ontario-New York-New England pool, including practically every urban area, was without power.

All subways and elevators and electrically powered trains stopped. All lights were out. Factories ground to a halt. Traffic moved with difficulty because there were neither stop lights nor street lamps. Facilities from prisons to zoos, colleges to greenhouses, were black and cold and still while their inhabitants groped in the darkness.

Mothers in stalled trains and darkened homes tried to comfort their squalling children. The suppers on millions of stoves grew cold. No gasoline could be pumped at service stations. Commuters were stopped in their tracks. Millions of television and radio sets crackled and died. To some, it seemed as though the world were ending at last.

New York City, the most dependent on electricity for its manifold and wondrous activities, was the hardest hit. Thousands were trapped in elevators like hamsters in their cages; 800,000 were in the inert subways, tens of thousands were in the train and bus stations and in the air overhead. The metropolis was a black, suffering pool of inactivity, bathed only in the glare of automobile headlights and the lambent light of the indifferent moon.

The first reaction of people in the blackout areas was that the failure was a local one. In rural and suburban places, loss of power is a common occurrence; lines are forever coming down in ice and snow and high wind Even midtown Manhattan had a massive power failure in 1961.

When the radio stations started coming through on transistor radios, however, it became obvious that the phenomenon of blackness was a far from local one. ". . . Reaches from Maine to Miami, Boston to Chicago" the radios were saying. "Cause unknown Canada is in darkness . . . Pittsburgh is still . . . President 'Johnson has summoned his emergency planning board . . . immediate investigation . . . sabotage feared . . . cause unknown."

The first reports were, of course, greatly exaggerated, al-

though it was difficult to exaggerate what the radios were calling "the worst power failure in the history of the World." The thoughts of the people turned to war-and nuclear destruction. Perhaps this was that moment of ultimate dread.

This fear was soon allayed when the Strategic Air Command war room in Colorado Springs reported 'Condition Green"-normal. The suspicions of sabotage were not quieted for several hours. until Bill D. Moyers, President Johnson's press secretary, reported from Austin, Texas, that that factor had been all but ruled out.

For many, the feeling that was left-at least for a while—was a kind of existential loneliness, the true woe of a man baffled and fearful in a world he never made. Before,, the lights always turned on when the switch was flicked. The elevator always descended smoothly and quickly to the appointed floor. If technology failed on such a massive scale, what was left? What would go next?

But these feelings passed. What was left was coping with the disaster, finding a way home or a way to be rescued or a way to get a drink or a hot dog. The bigger burden was left to the electric companies.

The first task of each of the affected areas was to isolate itself from the grid. In most cases, this was done automatically when the overloaded generators in each local system shut down. Then the fickle generators had to be started again This meant stoking them or providing water power to drive their turbines. And it also meant getting them in phase with all the other generators in the Northeast Power Grid.

All the generators in an interconnected system producing alternating current must turn at precisely the same frequency and cadence. If they don't, the eccentric generator will be at war with the others, canceling out power or producing a breakdown. There was some suspicion that an out-of-phase generator or bank of generators was the initial cause of the blackout.

The switches that were thrown open by the voracious power vacuum had to be closed, sometimes by hand in remote places.

Care also had to be taken not to overload the generators again. They had to be shut off from the demand for power and their capacity brought up. Then, as the power built up, block after careful block of the area serviced by the generator could be thrown into the system and lighted again. To reduce the initial demand on the generators, customers were warned by radio and telephone to turn off all their lights except one-so they could tell when the power was back.

Outside the almost paralyzed metropolis, the blackout had

gripped a great part of the Northeast. The Ontario Hydro-Electric Commission, apparently the first victim of the power drain, was among the first to restore service. The lights went out for an hour in downtown Toronto and there were two further blackouts of 15 and 20 minutes. By 8 :30, however, service was restored to most of the Commission's territory.

When darkness came to Toronto. about 200 children were ice skating on the rink in Nathan Phillips Square. A Department of Parks truck pulled up, turned on its lights, and the skating continued.

The police said there were no major traffic accidents or law enforcement problems. Hospitals switched to emergency power. A few subways were caught in tunnels until the power returned. There were some temporary problems when electrical heating systems were disrupted. Fireplaces came into use as the evening temperature dropped to 31 degrees. Water service was interrupted at some places by difficulties at pumping stations.

At Toronto International Airport, emergency lighting enabled operations to continue. Flights to New York, however, were canceled. Thousands of homeward-bound workers took the easy way out and headed for the nearest bar. "The power can go off at 5:30 every night," said Thelma Day, hostess at the Cork Room. "It keeps the cash registers ringing." Tavern customers grew chummy by candlelight, holding matches for each other to drink by and building little bonfires on the bar with paper coasters.

Fifty people scheduled to appear in Toronto night traffic court escaped possible fines when the presiding magistrate dismissed all charges.

Rochester, apparently the second victim in the line of falling dominoes, was without power for about four hours Emergency measures were taken in utilities and all available policemen were mobilized to maintain order and direct traffic. The city in general remained calm. Law enforcement agents said there was less crime than usual. A rumor of looting in the wards where race rioting occurred in July, 1964, proved to be false. The rumors, however, were given wide currency on the radio.

The Rochester Telephone Corporation, like all local telephone companies, switched to emergency diesel generators and was able to maintain service. The generators are standard equipment in all telephone company offices. While phones over the Northeast were sometimes snarled during the long night, it was mainly from. overuse.

Tbe Orange and Rockland Power Company area, which had blown at 5:19, was gradually restored to full service by

P.M. In the end, the utility was able to shunt 10,000 kilowatts to the Central Hudson Gas and Electric Company to start one of its generators and still later to transfer the jolt of power to a Con Edison plant on the Harlem River.

At one point, as the utility was switching blocks of its service area back on, the question arose as to whether to restore the United States Military Academy at West Point or the giant Ford assembly plant in Mahwah, New Jersey, first. "Those cadets have to study tonight," said Dean Seifried, a vice-president of the utility, and West Point won out. Ford was back a few moments afterward.

One of the most serious incidents of the entire evening occurred in Massachusetts, which had gone dead at 5:21. It began with a report that the inmates in the maximum security section of the state prison in Walpole, Massachusetts, had begun "yammering" in the darkness. Soon, it was a full-scale riot. About 300 inmates rampaged through the prison for two hours, tossing tables and chairs about and ripping plumbing from the cell walls. Windows were smashed and bunks were torn from their fixtures. State troopers fired tear gas into the section, but no lasting effects or injuries were reported. Prison officials said later that, although the prisoners had "stormed around like madmen and tore up everything they could lay their hands on." tbev believed the rioting had been spontaneous and without dir&ion. Troopers from 16 barracks in eastern Massachusetts were sent to the prison, along with a riot-control squad from a neighboring prison in Norfolk, to assist the 45 guards on duty and the 70 guards who were called from their homes. Damage to the maximum security section was estimated at $75,000. In the cold light of morning, the rioters were questioned by officials and then all 576 inmates of the institution were "turned to" to mop up the debris

Elsewhere in the state, several deaths from falls in the dark and from heart attacks were reported as a result of tbe blackout. But for most residents. the blackout meant only a period of inconvenience ranging 'from a few minutes to three hours. Some planes had to be diverted from Logan International Airport in Boston.

The Yankee Atomic Company's nuclear power plant at Rowe, Massachusetts, which had been shut down for a scheduled periodic refueling, was returned to the line five days ahead of schedule to help out. It has a capacity of about 125 000 kilowatts. Some power to Massachusetts was furnished by the Central Maine Power Company and the Bangor, Maine, Hydroelectric Company. For many years, Maine was prohibited by law from exporting power and so developed a

system independent of the grid. Repeal of the Fernald Power Law a few years ago allowed the companies to sell surplus power outside the state.

Three incidents of looting were reported in Springfield, Massachusetts, the scene of racial disturbances this summer, but in other areas local and state police had no trouble. Governor John A. Volpe called out the National Guard for stand-by duty soon after the power failed. But the troops were not used for active patrolling.

The New England Telephone Company reported experiencing slow dial tones for the first few momenta of the blackout but after appealing by radio for customers to avoid all but emergency calls there was a drop in volume. Between 5 and 6 P.M. there was a 10 per cent increase in long distance calls and an 800 per cent increase in local calls;

In Rhode Island, the blackout persisted in various sections of the state from a few minutes to three-and-a-half hours. All off-dutv police in Providence were called back to patrol the business district but there were no incidents. All hospitals switched quickly to auxiliary generators, as did the big naval bases in Newport and Quonset. Emergency runway lights at Quonset enabled a Trans World Boeing 707 jet with 13 passengers to lay over for four hours until the Boston airport was clear. The plane was bound from Detroit to Paris. For a time, Mayor Joseph A. Doorley, Jr. of Providence discussed with the police the idea of sealing off his city to incoming traffic. He abandoned the idea but added, "How the hell could something like this happen in this day and age?"

Rhode Island also had a power vacuum in its government. The first four state officers in line of succession were not available. Governor John Chafee was somewhere in the Pacific on the way home from Vietnam with other governors. Lieutenant Governor Giovanni Folcarelli was in Boston. State Senator Francis P. Smith, president pro tem of the Senate, was on his way to Puerto Rico. Secretary of State August P. LaFrance was in Hawaii at a meeting of the National Conference of Secretaries of State. This placed the mantle of succession on Primo Iacobucci, Deputy Secretary of State. But 15 minutes after he was found and arrived at the State House to sign a proclamation declaring a state of emergency, power had been restored.

Power in the Buffalo area, which had died at 5:22, was back within the hour. In Syracuse. which failed at the same time, most service was restored by 8:45. During that time the lighthouses on Lake Oneida went dark for the first time in memory. The big problem in Syracuse was getting home. Many people were caught in stores and storeowners were reluctant to let them leave in the daik., fearful of thefts. As the blackout continued, the stores finally let their customers out by flashlight, examining them closely and requiring that sales slips be displayed. Hundreds of Syracuse residents were at evening mass in Catholic churches when the blackout fell. The masses were finished by candlelight. At St. Daniel's Church, a class of youngsters was confirmed by the flicker of altar candles. As the ceremony ended, the lights came on.

At Crouse Irving Hospital, a woman arrived to have a baby. There was no elevator service so the emergency room on the ground floor was converted into a maternity ward and delivery was accomplished. An Eastern Ambulance Service vehicle, called for an emergency, was locked in its garage by the electrically operated door. An attendant climbed to the top of the door, dismantled the controlling gadget, and opened it by hand.

At Syracuse University, some male students frolicked for a time in the dark as if they planned a panty raid. It didn't develop. Elsewhere on the campus, Frank J. Sheed, Catholic theologian and publisher, spoke to students by candlelight in Hendricks Chapel. He said it reminded him of a speech he made in London during the Blitz. Gretchen Wyler, the entertainer, was to open her act at the Hotel Syracuse that evening. But she was getting her hair done when darkness fell and had to wait until the power was restored to get it finished. Then she went on.

The blackout hit farmers right around milking time, and many depend on electricity to run their milking machines. One dairyman wasn't disturbed. He simply hooked his 'tractor to a generator and went on milking.

In Liberty, New York, in the Sullivan County resort area, an emergency operation at Maimonides Hospital was interrupted for 90 seconds when the lights went out. Standby equipment restored light and the operation went on. Generally, the Sullivan County area was lightly affected. At the New York City reservoir at Neversink, pumps that force the flow in the chlorination system were halted for five minutes until auxiliary equipment started them again. There was no trouble at the state correctional institution at Woodboume, which has 687 inmates Emergency equipment supplied current there immediately. The Central Hudson Gas and Electric Corporation, which blew at 5:25, was back within a few hours without incident. Nassau and Suffolk Counties, out at 5:28, were largely back by 9 P.M. although there was one brief false alarm when the lights flickered on, dimmed, and went out again.

The Long Island Railroad's 5: 19 from Pennsylvania Station

to Babylon in Suffolk County was halted about two miles west of Woodside, Queens, by the great power break. As the lights went out, the jokes went on. There was virtually no griping and all the riders stayed in their seats until shortly after 11 o'clock that night when half the passengers began leaving the train and the other half decided it was time to sleep. The frustration of the hours created a sudden friendliness, and usually reserved women chatted with men they had never seen before. The hungry passengers talked alternately about steaks and coffee and martinis and exchanged what goodies they had in their pockets and pocketbooks-peanuts, sugarless wild cherry drops and even antacid tables. One smiling bachelor went so far as to stop the conductor and ask him if he could be compared to a captain of a ship. When the conductor announced that he thought the analogy a fair one, the bachelor asked the conductor to marry him to the girl seated beside him.

Rumors as to when the electricity would come on were spread continually by one middleaged man who paraded from car to car. As his reports proved false one after another he was labeled "Charley Truth" by a smiling trainman who spent three hours trying to take his transistor radio away from him. In one no-smoking car, several women protested to Lawrence Jogodnik of Seaford, Long Island, because they found his cigar smoke stifling. He paid no attention to them, but finally opened the train door and marched to the car's platform area. As he slammed the door behind him he shouted: "I can't stand the smell of this cigar." Mrs. Fred Bosch of Wantagh asked if anyone wanted to read the book she was carrying—Dale Carnegie's "How to Stop Worrying and Start Living."

When there was a report at 11 P.M. that it might be morning before the electricity was restored, men and women began climbing from the opened doors of the sixth car. Those deciding to stay got into sleeping positions with their arms draped about persons who had been complete strangers five hours before. Besides chatting and sleeping, passengers passed time trying to read newspapers and books in what light was available from the moon, while some sang songs in low choruses. Another rider jealously kept a transistor radio to his ear as others sought to find out what was happening. Three men tried playing pinochle but gave it up when they found themselves reneging because they could not read their cards properly.

A man drew laughter when he asked, after three hours of waiting, if he was on the right train. A short time later when an automobile drove past its headlamps glowing brightly, a young commuter identified it for his co-riders as a "new kind

of invention called a car with something that works on electricity."

"The only thing bothering me," said an older man next to him, "is that my wife won't believe me when I come home late."

'Why not?" the younger man asked.

"Because last month I told her I was late because of a power failure," he said.

Those who left climbed over thiid rails near a substation called Harold and headed toward Queens Boulevard after walking over hundreds of yards of dirt and stone and railroad ties and climbing up and down four sets of wooden stairways. They followed a leader who carried a flashlight.

'Where are we going?" a woman asked her husband.

"We're just following the guy with the light," he replied. "I hope he's not-some kind of nut headed for a cliff."

Connecticut, out around 5:30, was one of the slowest areas coming back. Much, of the trouble in the southwestern part of the state came not from the 'absence of 'power there but from the absence of husbands trapped in New York City. Every commuter separated from his home by the blackout had a story. On the 5:11 and 5:13 New Haven Railroad trains from Grand Central Station to Fairfield County, there was much cameraderie. Both trains were stalled at 125th Street in Manhattan until about 11 P.M. On the 5:13, Albert V. Vamer Jr., moderator of the Greenwich Town Meeting, took over the communications. Using a transistor radio, he got news of the blackout and then relayed it to his own train and the 5:11 as well.

Two commuters, Theodore F. Brophy and Rein Maremaa, both of Greenwich and both employees of the General Telephone Company in New York City, were stalled at 125th Street and decided to make a move. With three other commuters, they hired a taxi for $25 and were in Greenwich by 7:15. J. B. Fleming of Old Greenwich also got off the stalled train and caught a bus. Some of his comrades were short of money, so he lent them the $3 fare. On the Cross County Parkway on the way to Connecticut the bus stalled. Then it was rammed by a car, injuring the bus driver. A Catholic priest from Cardinal Spellman High School came along in his car and ferried the would-be commuters to his rectory in the Bronx. There another car provided by the priest got them to Stamford about midnight.

By 11:30, power in all but 12 small towns in Connecticut had been restored. Governor John N. Dempsey offered the

use of his National Guard to Massachusetts early in the evening but the troops were not needed.

In Vermont and the southern portions of New Hampshire, blacked out at 5:38, the power was back on in 30 minutes to two hours. The residents trundled out portable generators, long-stored candles and weak flashlights to cope with the dark. Many dairy men had their cows milked by the time the blackout hit. The farmers who were lazy and didn't have their herds milked weren't admitting it. Lieutenant Governor John J. Daley, acting governor of Vermont while Philip H. Hoff was in Europe, was eating dinner by candlelight in Wells River when a call came through from President Johnson. "I know there is a problem in Vermont," Mr. Johnson said, "if you need any help let me know."

Thus, by 10 P.M., service over most of the Northeast Power Grid was crawling back to normal. A few systems had been saved by automatic shutoffs that separated them from the grid in the crucial period from 5:15 to 5:38. Others, the majority, had chosen to override the automatic circuit breakers and try to save the grid. They paid the price in blown generators, but by 10 o'clock most of them had been restored. There was, of course, one vast exception. That was the teeming metropolis of New York City, still in total darkness after almost every other light in the Northeast was back on.

3. The Stricken City

New York City was stricken at a vulnerable moment-the height of the Tuesday evening rush hour when millions were bound for home. It was 5:27 P.M.; the last trace of daylight had vanished from the western sky. The canyons of the city, choked with motorists and pedestrians were ablaze with electric light. Then suddenly the urban scene went black. Street and building lights dimmed, flickered and went out. Hundreds of thousands of persons were trapped for hours in elevator shafts, subway trains and commuter trains. Millions, caught in the plunging darkness of their homes and offices, groped for candles and flashlights. Pedestrians abroad at that moment were more fortunate. The sidewalks were washed with the headlights of slow-moving tragic and presently a full moon, shining in a cloudless sky, gave them enough light to walk by without fear of hitting obstructions.

A chill, gusty wind intensified the mood of helplessness for the stranded millions. Many didn't have enough pocket money to spend long hours in bars and restaurants. With collars turned up against the cold, crowds of pedestrians started trudging the miles of ghostly streets toward home. For the young and romantic, the night was lovely. Walking the moonlit streets, they could see the sky-remarkably clear of smoke—and marvel at the stars. The towers of Manhattan, etched against the sky like a steel engraving, their walls unbroken by window lights, seemed as cold and uninhabitable as glaciers For the old, the night held uncertainty and even terror. Some had to be lifted through ceiling panels of stalled elevators. Many had to be carried down from subway trains to the ink-black roadbed where, tugging at the Coattails of the one in front, they stumbled and groped through tunnels to the nearest station and a stairway to the street. Out in the cold, they gulped eagerly at the fresh air. But,

then taking stock, they found themselves still stranded and far from home. Thousands took refuge in National Guard armories thrown open to them after 8 P.M. by Governor Rockefeller.

At 5:27 P.M. Major General Robert E. Condon. director of Civil Defense for New York City, was stepping into an elevator at the Biltmore Hotel when the lobby lights dimmed and died. He made his way to the street. Seeing that all lights were out in the area, he called his headquarters by car radio and alerted civil defense offices in the five boroughs.

Governor Rockefeller was on his way from Kennedy International Airport to his home at 812 Fifth Avenue when darkness struck the city. He had been in Atlanta to attend the National Pure Water Conference of the National Association of City Officers. As his car was leaving the East River Drive in Manhattan the Governor noticed the snarled traffic, and then the pitch dark. He went home and climbed the fifteen stories to his apartment. He had a candlelight dinner with his wife, then took her with him to his New York office at 22 West 55th Street. It was 7:30 when he arrived. By then the gravity of the situation was clear. Mr. Rockefeller ordered out the National Guard and took other emergency measures. He worked by the light of flashlights and candles lent by a nearby restaurant. Mr. Rockefeller then made statements for the leading radio stations. For his message to get on the National Broadcasting Company network he had to call the network affiliate in Chicago by telephone, which in turn relayed the message to the station in New York and on to the air. Mr. and Mrs. Rockefeller went home about midnight, climbing those fifteen flights again. They had several hours to wait before the lights went on.

President Johnson received word of the massive power failure at 6 P.M. Except for a quick meal, he was at his desk until he went to bed at 1 A.M. At the height of the crisis he was talking to Mr. Ellington in Washington every five or ten minutes.

Mayor Wagner, who was to leave after twelve years as Mayor on December 31, was in his car on the East River Drive when the power failed. Using his telephone connection to the Fire Department radio, he established the seriousness of the situation and turned the limousine back to City Hall. The snarled traffic caused him a half-hour delay. He conferred with his Emergency Control Board until long after midnight.

Mayor-elect John V. Lindsay was about to enter an elevator at radio station WEVD, 117 West 46th Street, when the power failed. He was scheduled to tape an interview with Victor

Riesel, the syndicated labor columnist, who is blind. Mr. Riesel, who had arrived a moment earlier, was trapped in an elevator near the second floor. Mr. Lindsay ran to the second floor and shouted encouragement, then left for a candlelight dinner engagement with his campaign staff while workers tried to extricate Mr. Riesel. Some observers said later it was odd that Mr. Lindsay had not been invited to the City Hall conference. An aide said Mayor Wagner had felt that it was his resporsibiity to deal with the problems of the city until December 31.

By 6 P.M. that night it was obvious that the city was in deep trouble, Most of those in the subways were able to make their way to the darkened streets immediately. But there were more than ten thousand for whom what promised to be a quick ride home turned into a seven-hour incarceration. The most difficult evacuation took place just after 10:30, when seventeen hundred passengers were escorted from four trains on the Williamsburg Bridge high above the East River. They had been stranded for five hours.

Throughout the system, with emergency lights glowing, subway attendants and policemen walked deep into the tunnels and far out on elevated structures to lead passengers to safety. An IRT train stalled underneath the East River between the Grand Central and Vernon-Jackson stations. After a two-hour wait in dimly lit cars, the passengers were led by Transit Authority policemen two thousand yards to the Queens station and, finally, the street and fresh air. The passengers coming from powerless trains gave similar reports. They said most trains sputtered into stations, moving in fits and starts as the lights grew dimmer. The lights finally went out, the trains stood still, the doors opened. Most passengers sat and waited, striking up conversations. Most of the irritation was taken out in sarcasm.

Mrs. Yael Klein of 360 Cabrini Boulevard said that her northbound IND Eighth Avenue train had stalled halfway out of the 168th Street station and that a conductor had entered the car with a flashlight and said there was a power shortage. The passengers were then led out of the cars by the conductor, Mrs. Klein recalled. The exit was orderly. Passengers joked as they trooped to the street above. At some places, subway workers were brisk and terse in the manner of New York conductors. At the northbound IRT platform at Broadway and 42nd Street, a Transit policeman walked along a stalled train and shouted: "O.K. Trains not running. Everybody out." Policemen were assigned to help in the evacuation and to keep anyone from walking into the stations. "You don't want to go in there," said a policeman at the IND station at 42nd Street and Eighth Avenue, as he pointed down a flight of stairs

that ended in darkness. "Go find a cab," he suggested. The crowd around the station entrance laughed.

The transportation situation on the streets above the subways was little better. There were not nearly enough cabs or buses to go around. Taxis were going at premium rates in some cases, and just finding one ranked as a major achievement, By the end of the evening thirty-five hundred of the Transit Authority's four thousand buses were in operation, but large crowds still waited at comer bus stops as the overtlowing vehicles lumbered by.

At midnight, the Transit Authority sent food and coffee to the ten thousand still trapped underground. At sunrise, as the first passengers were entering the reactivated trains, there were still some people sitting in subwavs thev had boarded the night before. At least sixty-people spent the strange night in an Astoria line train. stalled in the 60th Street tunnel beneath the East River. The train started up again at 7:15 A.M., about 14 hours after it had left Grand Central Station for what is normally a twenty-five-minute trip. A spokesman for the Transit Authority said that those and a few passengers in other trains refused to be escorted because they did not want to have to find their way home from strange neighborhoods. Others were said to prefer to wait rather than walk along catwalks in dimly lighted tunnels or high above streets and rivers. Throughout the night, no serious injuries were reported on the subways. When power was finally restored, transit workers had to walk every foot of the system's seven hundred and twenty miles to make sure no one had fallen unconscious on the tracks or was still wandering through tunnels looking for an exit.

The elevators were another grave problem. Most of the thousands trapped in skyscrapers and apartment buildings were quickly extricated, and their fear melted into joviality.

'Thank God we've got some whiskey," said a lawyer caught in his thirty-second-floor office during the long night. "First we just sat around having drinks. Then we had a seance, to communicate with the spirit that caused this bliss."

"We could have walked down, but it was about six hundred steps, so instead we all got to know each other," he said.

Most of those in elevators when the power went out were only temporarily inconvenienced. Many of the city's elevators are equipped with a safety device which automatically lowers the cab to the next floor, where the doors can be opened manuallv.

"But 'it's still alarming," one man recalled, shortly after getting out of an elevator stalled nine floors above the ground in midtown. "The light flickered out. All three of us pressed

the alarm button—we waited and we heard nothing. This older man started talking about a heart ailment, so we told him to take off his coat, and relax He did, and a few minutes later the doors opened. I can tell you we were glad to be out."

Many others remained suspended high above ground level for hours, their only contact with the outside world being elevator-car telephones run by batteries. In at least three of the city's tallest structures—the Empire State, R.C.A. and Pan Am buildings—firemen and building personnel broke through walls to reach those trapped in the elevator shafts. Seventy-five people in eleven elevators were rescued from their makeshift prisons in those three buildings. Some had waited as long as seven hours for their release. A 31-year-old slacks salesman, Martin Saltzman, spent six and a half hours squeezed in a car with twelve other people near the twenty-first floor of the Empire State Building. He said later that his tight little group had passed much. of the time telling jokes and playing word games. "One guy wanted to smoke a cigar," he said, "but we wouldn't let him." Rescuers eventually broke through the shaft wall in the elevator and the car's occupants-ten men and three women--climbed to safety on a ladder lowered through the roof panel. Another group released after five hours and fifteen minutes together decided to meet again under happier circumstances. The prisoners, strangers at first, organized a Blackout Club.

During the night, Vange Burnett, a 52 year old guest at the Hotel Windsor on West 58th Street was wandering about somewhere on one of the building's 16 stories. The Florida businessman, in New York to visit a trade show, was apparently looking for a staircase.

Six days later, after the missing persons bureau had been notified of the man's disappearance, a hotel employee found his body at the bottom of the service elevator shaft In his hand was a burned out candle.

Kennedy and LaGuardia airports were closed to incoming and departing aircraft the moment the lights winked out at 5:27 P.M. Emergency power sources were used to run the control tower radios, which advised circling planes that the runways were inoperative. American Airlines Flight 342 would have been on the ground except for a twenty-minute delay in Cincinnati. Instead, Captain Bill McCormick of South Salem, New York, circled over the darkened airport at eleven thousand feet. "It was a beautiful night," the 52-year-old pilot recalled. "You could see a million miles. You could see the Verrazano Bridge and parts of Brooklyn, but beyond Brooklyn

where we usually see the runways at Kennedy and Floyd Bennett Field it was dark."

"I thought, 'another Pearl Harbor!' " he mid, half-laughing.

At about 6 o'clock Captain Reinhard Noethel was piloting his Lufthansa German Airlines 707 jet with forty passengers. from Cologne, Germany, at thirty-nine thousand feet. "I told, the passengers that on the left-hand side was Boston," he recalled, "then I looked out and all I saw were some blue lights,'

Although they had never seen a blackout of this size or length, the pilots were familiar with power failures. They flew on to Newark or Philadelphia or, in the case of the Lufthansa flight, landed at Bradley Field, Windsor Locks, Connecticut. To a man they were grateful for the good visibility. Had it been the night before, when there were rainstorms, one said, "There would have been tragedy."

Captain Jeremiah Parris, piloting the Eastern Air Lines Constellation on the Boston-Washington shuttle due at La Guardia Field at 6:23 P.M., ran into the blackout at Stamford, Connecticut. He was "surprised and amazed" by the magnitude and had trouble finding the field. "But we knew where the airport was supposed to be," he said, "and it's hard to move, so we found it." By that time, La Guardia was using its battery-powered light system to operate one runway for a handful of incoming and departing flights.

In all, about one thousand overseas passengers were affected by the blackout. Many of them were put up in nearby hotels or motels. At Kennedy, American Airlines rolled out all its planes, which are equipped with independent power systems, and loaded eight hundred stranded passengers. They were fed a meal and shown motion pictures until the lights came back.

The Federal Aviation Agency estimated that about five hundred airliners were forced to divert from their intended destinations because of the power failure. About two hundred flights were shunted from Kennedy and La Guardia. Most of them landed at Newark, where there were one-hour landing delays because of the overcrowding. "It was one sweet mess," a Federal official said later.

The city's more than one hundred hospitals were equal to the situation. Emergency generators supplied power in all but a few cases. The emergency rooms were crowded with patients who had tripped over something in the gloom or been struck by a car. At Bellevue Hospital in Manhattan, the auxiliary generator proved inadequate and some administrators were worried about a panic among the psychiatric patients. However, nurses moved through the darkened wards with candles to give reassurance. A half-dozen rookie patrolmen called over from the Police Academy had nothing to do but sit by

themselves and talk quietly. Dr. -Robert Gallance had to complete a delicate, hour-and-a-half eye operation at Bellevue in the beam of a battery-powered light. He was nonplussed. "You know," he said later, "when things are 'ordinary around here the patients don't even get their bedpans. In a disaster, everythii works out beautifully."

In parts of the city where water has to be pumped electrically to faucets, there was a shortage when the lights went out. That, however, was hardly a shock. The entire city had been laboring under the threat of drought for much of the year. However, the lack of water did add to the misery of the night. Fortunately, there were no fires in the affected areas.

The blackout also struck the city in its breadbasket-commerce and industry. Millions of first-class letters, representing about fifteen per cent of the nation's total mail for the day, were held up at post offices and train stations. The daily clearance of 2.8 million checks by the Federal Reserve Bank of New York could not be completed. The Stock Exchange on Wall Street had completed its business by the time the power failed, but many staff workers and other employees were still around. About fifty of them sat out the blackout on the clean-swept floor of the Exchange, where seats usually sell for $250,000 a piece. One staff member of the Big Board recounted this tale of woe: "I sold thirty-seven boxes of Girl Scout cookies for my daughter around the Exchange. I brought them in this morning. They were chocolate-mint and butter-vanilla flavors. The price was fifty cents a box. I should have held on to those cookies. I could get two dollars a box tonight. It's the old story. I sold too soon."

There was a flood of jokes about stocks in candle companies. The trend, it was said, was up. And, on the other side of the ledger, one brokerage-house analyst made what must rank as the understatement of the whole wild evening: 'This may shake confidence in utility stocks when the market opens tomorrow."

Throughout the financial district, which employs some seventy-five thousand people in various phases of the securities industry, the story was much the same—foraging for food and matches and waiting for the electric power to return. In the shambles of Wednesday morning, it was estimated that the blackout in the city had caused up to $100 million in losses to business and industry.

And then there was the chaos in the mass media, another mainspring of New York life.

For television the night was a disaster. All nine channels in New York went dark, the blackness striking just before 5:30 during the kiddie hour. Within moments horrified chil-

dren facing nothing but homework were telephoning neighbors to ask if they too had lost "The Three Stooges" or Sandy Becker. By midnight the prolonged television blackout was officially classified as the industry's first non-telethon.

One show that didn't get on was an American Broadcasting Company special, "The Wild, Wild East." Despite its title, it had nothing to do with the prolonged power failure. Another program that didn't get on anywhere in the country was "The National Citizenship Test," which was to test viewers' knowledge of their rights and obligations as citizens. With the aid of countless organizations, the Columbia Broadcasting System had spent months preparing the show and alertiug the public. Bantam Books had published and distributed all over the country a paperback with a front cover that hailed the questions and answers "from the electrifying television broadcast that challenged millions of Americans." The book was to go on sale the following morning. But on the night of the blackout, when CBS postponed "The National Citizenship Test" for two weeks, it realized it would have a rigged quiz show on its hands if the paperback went on sale the next morning. Telegrams were sent to stores asking them to hold up the sale of the book containing all the answers. Dr. Frank Stanton, president of CBS visited the studio that had been set up for 'The National Citizenship Test." He said: "It's a shame. We get a live show and this happens."

When the blackout hit, newsrooms of all three networks were getting ready to send out their early evening news programs across the country. NBC's "Huntley-Brinkley Report," which normally originates in New York and in Washington, was put on from Washington, Chicago and Los Angeles but without appearances by Chet Huntley, who was on vacation, or David Brinkley, who was in New York and phoned news of the blackout to Washington. Walter Cronkite's CBS news program, normally originating in New York, went on from Washington, but without its chief. He telephoned a report on New York's blackout blues to Roger Mudd, emergency anchor-man in Washington. On the following morning there were no overnight television ratings for network v.p.'s to crow about in New York. But every performer and producer had the satisfaction of knowing that at least he had not been licked by the opposition.

By contrast, New York's radio stations broadcast the blackout. The sound medium, often overshadowed, proved resourceful in patching together emergency circuits. That it vividly demonstrated its indispensability in a moment of crisis was confirmed by the most tangible testimony that a broadcaster could seek: Untold numbers of listeners took the trouble to

supply what news they could to help the station. A New Jersey couple drove into New York and climbed 24 flights of stain to give WOR seven gallons of gasoline with which to operate au auxiliary generator. New York gasoline pumps were inoperative because of the blackout.

The transistor radio reached out to all corners of the darkened city. At one point, the Otis Elevator Company broadcast an appeal to people trapped in their own and other manufacturer's products. The company assumed that some in their unchosen prisons would have radios and heed the call. The message? Don't try to get out.

'For five of the city's six major newspapers of general circulation there was no circulation. With their great presses silent, the newspapers could not print. The sole exception was *The New York Times.* It shifted its publication base to Newark, where it was able to print 480,000 copies of a special 10-page edition in the plant of *The Newark Evening News* and distribute them in New York the following morning

The city's great train terminals-Pennsylvania Station and Grand Central-were tombs. The darkness was broken only by the flashlights of conductors and the hand-held matches of weary passengers going nowhere. When it became apparent that the power would not be back for hours, many of the stranded travelers made their way to the already crowded hotels to seek lodging for the night. Some stayed in the stations and tried to sleep on the hard marble floors.

At Grand Central, morale was boosted for a time by a young lady who perched herself on the counter of the information booth and appealed for help in doing a crossword puzzle. "I need a five-letter word starting with 'l' meaning 'vertical column,'" she called out. Forty adults clustered nearby frowned in deep concentration. "Lally," cried DeWolf Thompson, who runs the Menemsha IM at Martha's Vineyard. Mr. Thompson, like thousands of others that night, was going nowhere. He and the other stranded commuters had been drawn like moths to the emergency searchlight set up within the station.

At the Port Authority Bus Terminal on Eighth Avenue at 41st Street, emergency generators kept a semblance of light for an hour after 5:27. The homebound New Jersey commuters were packed into the terminal's large arcade, but buses were moving swiftly in and out of the terminal and through the Lincoln Tunnel to Jersey-that island of light in a troubled world.

In some of the leading Manhattan department stores, executives served as temporary maitres d'hotel for shoppers who elected to remain during the blackout. The largest crowd, num-

bering four thousand or five thousand was given an impromptu dinner by Macy's on Herald Square in the store employee's cafeteria. Later, they were invited to rest overnight in the store's huge home-furnishings departments, At Altman's on Fifth Avenue, more than five hundred customers and employees were invited to remain in the store after closing and sample delicacies in the Altman fancy foods department. On the eighth floor, John Burke Jr., president of the store, poured coffee in 'the Charleston Gardens restaurant. Smaller shopkeepers, fearful of looting, locked their doors and stood guard by candlelight. A number of places did a land-office business in candles and flashlights, often at outrageous prices.

The city's hotels looked like bivouac areas at the height of the blackout. Travelers slept on cots in banquet rooms and on carpets in hallways, lobbies, mezzanines and stairways. The atmosphere was that of 4:30 A.M. on New Year's morning. There was also an air of incipient romance. At 11:45 P.M. at the Hotel Biltmore, sleeping forms huddled close together on the lobby furniture. Beyond, in the restaurant, waiters with candles guttering on their trays moved among the tables with glasses of water. While their elders slept, junior executives, their attaché cases at their feet, eyed the pretty young secretaries. At 11:50, the bartenders removed all the bottles from the Men's Bar and announced that no more liquor would be sold. One man, walking out of the bar with a male companion, turned to him and said disgustedly: "What a night to go steady. And all I've got is you."

The city's restaurants were festive. Even pizza parlors, illuminated by candles stuck in beer bottles, looked cozy. Customers around the city compared the mood with the end of Prohibition. The Four Seasons, one of the city's most expensive restaurants, opened a free soup kitchen for hungry travelers.

The United Nations building, usually a magic lantern over the East River, was dark and cold. But even there, where diplomatic wrangling is common, the goodwill that pervaded the city showed itself in interesting ways: two stranded diplomats shared a limousine, both aware that in other circumstances they probably would not have greeted each other. In the maze of lightless United Nations corridors, diplomats obligingly shared the few candles that were available from the United Nations Gift Shop or patiently waited for uniformed guards with flashlights to lead them out of basement conference rooms.

By dinner time, food had become a hard-to-find commodity. Across First Avenue, at the United States Mission, Arthur J. Goldberg, this country's representative, found himself with a lavish repast of food and drink prepared for the Military Staff Committee of the United Nations, but few of the invited guests turned up for the feast. So Mr. Goldberg sent out a call to all the members of his own staff to come and be fed. "We had a great time," sighed one girl friday on the staff. "There was a cheese board with every conceivable kind of cheese, each studded with the flag of the producer country. There was a Navy chef carving the roast, caviar and chicken, petit fours and dips."

The food situation was more austere in the United Nations building, where staff employees of the world organization queued up for sandwiches in the cafeteria. But spirits were high at the candlelit tables. At times, the Australian contingent broke out into a lusty "Waltzing Matilda." There was a swaying circle dancing the Israeli "Hora."

The Secretary General, U Thant, was in his thirty-eighth floor office suite when the power failed and plunged the entire United Nations enclave into blackness. He and his Under Secretaries waited for almost five hours, conversing and listening to news broadcasts. Then, anxious to join his family at home in Riverdale, the Secretary General marched down the thirty-eight flights of stairs to the street. He emerged carrying two candles and said cheerfully that he had "no complaints." Under Secretary Ralph J. Bunche, Nobel Prii winner and once a collegiate basketball star, was not so stoical; he complained of a charley horse.

Mr. Thant's suite was given over to a staff member, a young expectant mother. More than three hundred Secretariat employees-translators, calligraphers, simultaneous interpreters, statisticians, chauffeurs-spent the night sleeping on couches, chairs and benches in the great marble-and-glass skyscraper.

The General Assembly meetings were in progress when the power failed. In one, the Soviet delegate, Georgi P. Arkadiev, had just made a prediction: "I fear that tensions are about to be revived . . ." Then the lights went out.

In another meeting hall, the diplomats heeded the instructions of a security guard and stayed in their seats in total darkness, waiting for the lights to go on. After a long wait one impatient member called out in French, proposing an adjournment vote. A show of hands was impossible—but the meeting broke up.

The evacuation of most of the staff and the diplomats was a smooth, quick and efficient procedure, since the United Nations is prepared for such emergencies. The plan of operations calls for selected staff employees iu each department to serve

as captains and floor wardens, who take assigned posts and lead the three thousand occupants to exits. Instructions and signs are given in two languages, French and English.

The Bronx and the Central Park zoos had their problems like everyone else. At the Bronx showplace, keepers and de partment chiefs worked through the night to keep the animals warm. The men, working without sleep, stuffed blankets between the bars in the small-mammals house, where diminutive, heat-sensitive lemurs, flying squirrels and small monkeys began their nocturnal peregrinations. The reptile house presented a difficult problem, since no one was willing to try to wrap a cobra in a blanket. Small portable propane gas heaters were taken in to warm the cold-blooded vipers, anacondas, iguanas, caymans, crocodiles and their ilk.

For the world of the theater the night was a sad one: the show-in most cases-did not go on. Through most of New York City's entertainment area there were no house lights, no flashing marquees, no baby beams for the orchestra's music stands, no power to pull back the great curtains. Concerts, operas, recitals were canceled, and movie houses emptied quietly when the projection machines rolled to a stop and the screens became blank.

At the sixty-two-hundred-seat Radio City Music Hall, three thousand persons were watching the film "Never Too Late" when the power failed. Most of them filed out of the theater, whose lobbies and lounges were lighted by special generators. Eight-hundred persons stayed in their seats, however, and were entertained by Richard Leibert, the theater's organist, Dick Venice, a trumpeter, and other performers. Three-hundred patrons decided it was safer to stay during the blackout and spent the night in the auditorium.

At the Mark Hellinger Theater, where the musical "On A Clear Day You Can See Forever" was playing, a treasurer reported: "On a clear night you can hardly see a thing here." One of the few shows that dared to go- on was Arkady Leokum's two one-acters, "Friends" and "Enemies," at the Theater East, 211 East 60th Street. The three performers, Eli Mintz, Jay Berney and Danny Fortus, played before an audience of seven theater-goers and two dogs. The dogs were the pets of one member of the audience. The lighting: by flickering candle,

The lights went out in Carnegie Hall, too, right in the middle of a performance by Vladimir Horowitz. The pianist had just started Chopin's Polonaise-Fantasy, rehearsing his program before an invited audience of about two hundred, mostly students from Rutgers University. Although the hall went

pitch black, Mr. Horowitz continued playing the difficult work, not missing a note. His sonorities. crashed through the dark hall. About two minutes after the blackout, a stage hand rushed out with a flashlight and focused it on the keys. Mr. -Horowitz stopped listened while the stage hand explained that the whole block was out, then started the Chopin work again and played it through. He finished the remainder of his program.

Perhaps saddest of all was the cancellation of the Broadway opening of 'The Zulu and the Zayda," a new play starring Menasha Skulnik. Several of the actors wanted to open with flashlights instead of footlights, but when this notion proved more valorous than wise everyone gave up and straggled off into the gloom.

In the art galleries, art lovers were not to be deterred. In many galleries visitors hauled out flashlights, cigarette lighters and matches, and crowded close to the paintings.

It was a night of no sports. The harness-racing program at Roosevelt Raceway in Westbury, Long Island, was canceled at the last minute, with a crowd of about two thousand on hand. Some of the fans had arrived aboard the "Get-Even Special," a bus line that carries bettors from the Aqueduct race track.

When the blackout descended, about seven thousand policemen were on duty. They were augmented by five thousand off-duty patrolmen called by radio or telephone to report to their nearest precinct. Their principal job was to keep the dangerously snarled traffic moving and to act as stoplights at key crossings They also helped to free those in the subways and to augment regular forces in areas where looting or rioting was feared. There actually was very little crime during the evening, far less than on an average lighted one. But the policemen, working doggedly at a task that seemed impossible, came in for well-deserved praise for their efforts.

The city's prisons, to the relief of everyone, were tranquil during the emergency. "We had no trouble at all, not one instance," reported Mrs. Anna M. Kross, Commissioner of the Department of Corrections.

The Fire Department, which also called in its off-duty men, had a busy evening. Its radio was out of service from 5:30 to 8 : 3 0, and the dispatchers had to keep in touch with vehicles and firehouses by telephone. The department answered numerous calls for assistance. At 7 P.M. firemen were summoned to the thirty-sixth floor of the Pan Am Building. They ran up all those stairs, dragging hoses behind them, only to find that the blaze, confined to a wastebasket, was already out.

More than five thousand National Guardsmen, summoned by radio and telephone, reported for emergency duty that

Tuesday night. The men, most of the 42d (Rainbow) Division and the XVII Corps Artillery, helped the police lead stranded subway riders from dark tunnels, directed traffic and rushed emergency generators to hospitals. They opened their armories to shelter hundreds of New Yorkers who had no way of getting home. About twelve hundred of the stranded spent the night trying to sleep on floors or wooden chairs in the 42d Division's 7 1st Regiment Armory at Park Avenue and 34th Street. The Red Cross sent coffee and the city's Welfare Department provided blankets. The National Guard set up a dispensary in the armory, but there was no serious demand for medical help.

The police and guardsmen were helped in directing tragic by a hardy band of amateurs. They could be seen at many comers, waving to cars with flashliits or rolled up newspapers and wearing the brightest possible clothing-in one case a bedsheet. A banker and a bootblack joined forces to prevent traffic accidents at 46th Street, where tragic flows blind out of the Grand Central Terminal bypass. The bootblack, Steven Smith, who works at 230 Park Avenue, flourished a newspaper. "I never directed traffic before," Mr. Smith observed as the limousines and taxis slid by in the gloom. "But I'm sure doing it now." The banker was John Cogswell, an executive of Lease Finance International. whose home is in Panama City. He wielded a handkerchief in concert with Mr. Smith. Elsewhere, a Franciscan monk was seen directing traffic near Pennsylvania Station.

Everywhere, the blackout brought out the best. Suddenly enveloped in blackness, that curious species called a New Yorker still scurried through the streets with the confidence of a bat. They helped one another, gave one another rides home, lent each other matches and cigarettes and candles. In many apartment lobbies, children with candles stood ready to lead tenants up the pitch-black stairs.

Early in the evening, a dozen people gathered at the main gate of the First Presbyterian Church on Fifth Avenue between 11th and 12th Streets, and greeted a sexton who walked out and distributed votive candles from a cardboard box. At St. Patrick's Cathedral, visitors warmed their hands over the vigil candles. Husbands came to Manhattan to pick up wives sheltered in the church, which stayed open long past its 9 P.M. closing. Stranded shoppers chatted quietly and some dozed or reclined in the pews. One husband. who came with a flashlight, did not want to go around flashing'it in drowsy faces, so he put it under his chin and walked among the pews looking like a Halloween pumpkin until his startled spouse recognized him.

There was a bright spot in the harbor, too. The torch on the

Statue of Liberty stayed lighted throughout the emergency. It was supplied by current from the New Jersey side.

Almost as soon as the' blackout' struck, Con Edison began work to bring its system back to normal. It was heavily handicapped by the breakdown of three generating plants out of its total of ten. At 7 P.M., however, smoke began to curl from the plant in Ravenswood, Queens. The Hudson Avenue station followed at 7: 15. One by one the great furnaces glowed and the ponderous armatures began to turn. One by one the sections of the city became lighted. It was like a giant rousing after having slept too long.

By 11 o'clock, seventy-five per cent of Brooklyn was back in. By midnight, much of the Bronx and Queens were lit. Sections of Manhattan began to switch from black to light around 2 A.M., and by 3:30 most service was restored.

At the Waldorf-Astoria Hotel, one of the last places to be without power, the lights began to wink on at 5:25. As the lights gradually illuminated one public room after another, groups gathered at the elevators. Sleepy bellboys set to work chipping the candles off the marble staircase and the ornate gold clock in the center of the lobby. The clock was almost precisely on time. Twelve hours had passed.

The sun rose at 6:36 A.M., burning away the mist of the early morning. The Northeast shuddered, stretched, awoke, Except for the litter and the candlewax and the husbands who never got home-it was another ordinary day.

Perhaps a young lady in a luncheonette on Lexington Avenue and 63rd Street said it all. It was at the height of the Night the Lights Went Out. "This is the type of day where you remember everything," she said. "Everything you did, everything you ate. I'll remember it all."

She was eating lukewarm frankfurters and cold baked beans, by the light of a flickering candle.

4. The Morning After

Wednesday morning, November 10th. New York and the Northeast arose to a bright cold day. The spectacular regional power failure that had blacked out most of the city-in some areas for thirteen and a half hours-was, in the main, over. But many of the effects-and certainly the memories—lingered on.

How many men, rumpled and unshaven, and women, hair askew. and in need of a facial, roused themselves from strange surroundings may never be known. The lucky ones rose from their own beds with only some candle wax on the bedside table to remind them of the night before;

But tens of thousands of others awoke, on hotel couches, on department store sofas, on escalator steps, terminal benches, cardboard pallets, ban&et room tables, coach seats in stalled trains, desks, mezzanine floors, stairways, parked cars, vestibules, clammy red seats in subways marooned in a subterranean labyrinth, gloomy armories, and, occasionally, on innerspring mattresses in hotel rooms.

And, as they queued up for telephones, for coffee, for a washup, for a ticket home—a good-deal of the euphoria and bonhomie of the previous evening rapidly disappearing in the steely glint of another workday—the incredibly complex apparatus of the city upon which they all depended and which in turn depended on power, was lurching into motion.

By dayiight the city's electricity had been restored. According to Consolidated Edison records, all of Brooklyn was restored to service by 2 A.M., Queens by 4:20 A.M., Manhattan and Westchester by 6:58 A.M. and the Bronx by 7 A.M. Throughout the city, as the power came on, thousands of sleepers were startled into wakefulness as their bedrooms were flooded with lights. They had gone to sleep forgetting to turn off the switch.

But a bare recitation of the facts does not begin to tell of the enormous, frustrating and often, halting, task of revivifying a city that was a flabby Goliath felled by "a single blow. Elevators had to be restored; subways and 'trains had' to be extricated from sidings, tracks and tunnels and put back on schedule; schools, houses, office buildings, institutions, stores, had to have heat; the chaos in the thousands of businesses, offices and banks had to be surmounted; perishable food supplies had to he checked in thousands of war+ house freezers; airport traffic had to be unsnarled. Only the hospitals, citadels of organized routine, could be said to be functioning in any way resembling normalcy.

Harried commuters, weary of their Stygian odyssey and comfortless rest in the city, waited patiently for the restoration of rail service to carry them to their fretting wives in thousands of mortgaged split-level homes in Westchester, Fairfield, Suffolk, Nassau and Rockland counties. Many of those stranded overnight took the day off and, early in the afternoon, the first train home.

Although emergencies existed in many cities and communities of upstate New York, New England and Canada during the blackout, none were as hard hit as New York and none took so long to recuperate.

Despite extraordinary efforts, the city's regular stride that Wednesday was uneven-limping, spurting, frenetic, meandering-anything but regular.

The city's weary subway riders were still plagued by the effects of the blackout that stranded some 800,000 of them for as long as fourteen hours. The stations filled early but the trains were late in getting started. It was 8:30 AA&-well into the morning rush hour-before all the lines were operating. The first train to draw power from the third rail and raffle on its rounds was on the IND line between Brooklyn and Queens. The "GG" train started up with a cheer from motormen at 6 A.M., only to be discontinued at 7:15 because of crowding at stations. It was later resumed at 7:40 A.M. As the first passengers were entering trains that morning, there were still some "veterans" sitting on seats they had commandeered the evening before.. At least sixty persons spent the night in an Astoria-line BMT train stalled in the 60th Street tunnel beneath the East River. The train finally started up at 7:15 A.M.—about fourteen hours after it had pulled out of Manhattan for what is normally a twenty-five minute ride to Queens. The passengers had declined an offer from transit policemen to lead them out along a catwalk to the nearest station. A patrolman brought them coffee and sandwiches and stood watch over them during the night. A spokes-

man for the Transit Authority said that they and a few passengers had refused to be escorted out because they feared trying to find their way home from strange neighborhoods.

The crush of passengers that morning was smaller than the usual weekday average of 4.7 million. Still haunted by the gloom and stagnancy of hours spent in cheerless grimy tunnels, many drove their cars to work, took taxis or stayed home.

Despite the smaller number Of passengers, Service Was poor. Trains were far behind schedules, if indeed they were on any perceptible schedule at all. The. Transit Authority had to reduce the number of trains in service because crews needed a rest after the, long night, during which some men worked sixteen straight hours. And equipment had to be checked for damage due to the power failure. A major reason for the delay in restoring full subway service was that A.C. current, which the Transit Authority obtains from Consolidated Edison, had to be converted into D.C. current to operate the trains. Also voltage had to be doled cautiously into the rejuvenated system in order to avoid risking blowouts in circuit breakers. The Astoria-bound train was one of the last to be "found" by the Transit Authority and the Police Department, which had sent hundreds of its men deep into tunnels in search of marooned trains.

In a statement the Authority complimented "the many thousands of subway passengers who endured in an orderly and good-humored way the plight in which we all found ourselves because of last night's power failure."

But there were bitter complaints from passengers. On a southbound BMT train stalled only thirty feet from the Thirty-fourth Street and Broadway station, Frank Ching of 505 East 79th Street said all the conductor would tell the passengers for two hours was to stop smoking.

Thousands of stranded airline passengers awoke in parked planes and terminal lounges at Kennedy International Airport, where electric power was restored at 4:37 A.M. A National Airlines jet-prop Electra bound for Washington made the first take off at 5:27 A.M., about twelve hours after the lights went out. International airlines announced extra flights to Cairo, Tel Aviv, Lisbon, Paris and London and added stranded passengers to regularly scheduled flights. LaGuardia Airport, closed only about a half hour by the blackout, quickly became operational as a Diesel-powered emergency generator lighted the runways and powered the control tower. Visual flight rules were in effect, and pilots were aided by the clear skies and bright moonlight.

The commuter railroads-the Long Island, the New Haven

and the New York Central—tried valiantly to restore normal service but were hampered because they had to spend a good deal of time moving stalled trains all along their routes

Bus service continued to be the most dependable route to outlying areas. Those operating out of the Port Authority terminal remained in service during the blackout because the ramps, tunnels and bridges received their power from New Jersey, a state that was on the whole immune to the inundating darkness that paralyzed New York

When the lights came bn, the city's hotels shook themselves awake from the nightmare, but for some-the few that still had no water or elevator service-the nightmare continued. In the early morning hours the hotels looked like bivouac areas, with people strewn about lobbies on cots. Hotel staffs weaved on weary legs, retaining their good spirits, infected by the cheerful way their guests had borne the "disaster." At the Waldorf-Astoria, the lights took fifteen minutes to go on, beginning about 5:25. Hundreds were camped out all over the elegant lobby. As the lights gradually illuminated one public room after another, groups gathered at the elevators, and bellboys set to work chipping the candle stubs off the marble staircases and the ornate gold clock in the center of the lobby.

"It made me proud," said Frank G. Wangeman, executive vice-president at the Waldorf Astoria. 'The cooperation of the staff and the guests was-thrilling."

"New Yorkers are terrific," said John C. Egan, general manager of the Commodore, where the lobby featured wall-to-wall people.

By mid-afternoon service was normal in most hotels, although the Sherry Netherlands and the Park-Sheraton were still without water and elevator service.

Corporate confusion was rampant in the city's thousands of businesses on Wednesday because of depleted staffs. Offices were littered with empty bottles from executives' private stock and scattered tidbits from raided, larders. Businesses were late in getting started. Even the New York Stock Exchange and the American Stock Exchange were late in opening.

But nowhere was the morning after more harrowing than at the offices of Consolidated Edison. where hectored executives strove to maintain their aplomb in the face of their most chaotic hour. Bleary-eyed officials, gulping coffee to stay awake, tried to handle a deluge of calls from the public, the press and government officials. Investigators and repairmen swarmed over the mechanical heart of the company's

power system—the Energy. Control Center at 128 West End Avenue near Sixty-fifth Street. It was here that the company had its first indication of serious trouble just minutes before the blackout when "the house lights dipped severely."

"No, we didn't see this first on the instruments," the official supervising electric circuits at the time said. "We saw it on our house lighting."

Extra crews were working overtime trying to repair the damage to the three turbine generators knocked out by the failure. The company said the repairs on the units, whose loss cut Con Edison's power-producing capacity nearly twenty per cent, would take "several days." This did not mean any emergency, a Con Ed spokesman said, but it did mean that the situation was difficult:

'We are still capable of producing all the electricity that's needed," one official said, "but the power situation is tight. We don't have the great reserve we usually have." He was exasperated. "All day long," he said, "we've been getting calls from people about radio reports that the power may go off again tonight. I don't know how these rumors start, but we're not expecting any trouble."

I-Iii exasperation certainly stemmed in part from the fact that he had been at his desk since Tuesday morning without a break. A lot of other employees and executives at company headquarters at 4 Irving Place were in the same shape. When the power went off on Tuesday evening, many had just finished work and started home. Knowing they would be needed, they went back to the building and climbed the sixteen flights of stairs to the public relations office, to which all calls were being directed. Engineers and repair men also returned to work. Although the several vice-presidents in the room got frequent progress reports by telephone from engineers at the energy control center, one of their best sources of information was the view from the sixteenth floor. An executive would go to a window, see a smokestack' at one of the power plants suddenly start belching clouds of black in the moonlight, and then would report that the plant could be expected to be turning out electricity in a short time. The company's woes increased when engineers reported that the million kilowatt steam-turbine generator at the Ravenswood plant in Long Island City might not turn for another week. The unit, the nation's largest, went into operation only last June. It had broken down due to burned-out bearings in the turbine. When the lights went off so did the electric pumps that bathe the bearings in lubricating oil. The two other units idled in the system of twelve power-generating plants were at the Astoria plant in Queens, a 335,000-kilowatt generator, and a 137,000-

kilowatt unit at the company's East River plant on 14th Street which was put out of commission by an electrical fire. Emergency crews, wearing orange hard hats, worked around the clock to remove the damaged parts with crowbars-and cranes. No estimate was available of the total cost of the damage.

But, however grim the situation and the dispositions around the Con Ed executive offices might have been, their advertising copy, prepared by Batten, Barton, Durstine & Osborn, chose to philosophize on the situation. When the airline industry is hit with a disaster, the immediate reaction of the individual airlines is to pull their advertising out of all media. But Tex Antoine, came on television as usual, clad in a smock, bright-eyed and mustached, to give the Con Ed-sponsored weather report Wednesday night over NBC-TV, with this opening:

"Well, last night was quite a night, wasn't it?" and added something about the city being romantic by candlelight.

Mr. Antoine and Uncle Wethbee went on to give a news report, rather than a product commercial, that "an electrical disturbance somewhere on the interconnected system north of our territory created an instantaneous and enormous drain on our facilities."

"North of our territory," and "out of our area" were phrases used during the commercial report to indicate where the trouble had been-or had not been. Mr. Antoine's message went on to say that this disturbance "had the effect of stalling our generators . . . just as any machine would stall with an overload. Our plants shut down automatically, as they were designed to do . . . to prevent serious damage which could take weeks . . . or even months to repair."

Some viewers, still riled over Tuesday's discomfort, found the approach a bit flippant for the seriousness of the situation. However both NBC and Con Ed reported that they got nothing but a positive reaction to the commercial. "Everyone thought it was wonderful," said Ray Martin, advertising manager for Con Edison. Mr. Antoine reported that his television crew liked the approach and that he got several calls of congratulation. In its newspaper advertisements, the company offered the same explanation of the "disturbance somewhere on the interconnected system north of our territory" and went on to list some of the "'bright spots" that resulted from the blackout:

"On hundreds of streets, citizens using flashlights calmly helped direct the flow of traffic."

"Elevators in countless buildings stalled between floors, and perfect strangers became friends."

Throughout the day, experts in electronics and in utilities

waged learned arguments, and academicians voiced hypotheses, about "grids" and "quarrels'-situations in which a generator of alternating currents gets out of phase with other generators on the same circuit-as they sought clues to the cause of the blackout. After a meeting with his Emergency Control Board, Mayor Wagner, warned "against the assumption that all is well and that we can now return to 'business as usual' and the use of electric power as usual."

It was not a common assumption. Throughout the day ouildings switched off unneeded lights in lobbies and offices. And thousands of New Yorkers found themselves without water-particularly those on higher floors of apartment buildings and hotels-because electric pumps were stopped by the power failure. Ironically, the street lights came on during the day on Broadway and other parts of the city. Armand D'Angelo, the city's Commissioner of Water Supply Gas and Electricity, said the shutdown had disrupted 30,000 electric switches hat turn 70,000 street lights on and off. They had to be reset oy crews from the Broadway Maintenance and the Welsbach Corporations.

A woman resident of Stuyvesant Town, was indignant that the uppermost thirty stories of the Empire State Buildmg were bathed in the glow of floodlights Wednesday evening, in view of the Mayor's admonition to curtail electricity. She called officials of the world's tallest building, which rises 1,472 feet on Fifth Avenue between 33rd and 34th Streets, to complain Shortly after 8 P.M. the illuminated pinnacle was died. At Flushing Meadow, however, the World's Fair Umsphere was lit. The fair, which closed October seventeenth, is being dismantled. A spokesman said the Unisphere was connected to a circuit of lights needed for security. If the Unisphere was darkened he said, the other lights would go out, too.

And while Con Ed officials in New York puzzled over the cause of the blackout and experts in Washington, Albany, Trenton, Boston, Hartford, Toronto and New York huddled together around conference tables, pouring over grid maps and reports, and issuing nondefinitive pronouncements, the pulse of ordinary life quickened over the 80,000-square mile area of the Northeast that had been pitched into an ebony maw. From Toronto to New York economiums were lavishly traded. Hostesses, able to save the beef stroganoff by heating it over the outdoor barbecue grill, basked in the 'bravos' of grateful guests. In the Park Avenue apartment of the Countess de la Bruyère, the dinner party she gave was described as "a tumultuous evening" although the baked Alaska "was a bit squishy."

"I use only candles in my dining room," the Countess said. "Electric light is so garish."

In Manhattan, in a building on West 11 1th Street, a young wife dutifully thanked an elderly, r&dent who had combed through the darkened six-story" building from apartment to apartment his arms filled with candles.

"My wife and I always keep a lot of candles," the gentleman said.

In White Plains, grateful motorists praised a group of teenagers, who took over the direction of traffic when the signal lights failed, On radios in Connecticut, where much of the news of New York City concerns its seamier side, astonished announcers were telling their listeners of the incredible grace nder pressure displayed by normally "ill-mannered," 'hard-boiled," and "helpless" New Yorkers. The word went out, that all it took to dispel theii pugnacity and make them polite, soft-boiled and self-assured was a catastrophe.

In downtown Manhattan, one good turn led to another. Girls working for the Internal Revenue Service were sustained during the blackout by a local restaurant whose delivery boys, repeatedly climbed many flights of stairs to fortify them with free coffee, buns and sandwiches. The next morning a number of the girls, who bunked on office couches, heard that several of the establishment's waitresses had been delayed for work. The girl friday's straightened their clothes, marched down the stairs, and within minutes were slinging hash with the best of them.

Agencies had hosannas for other agencies, as well as for themselves. And they were merited.

"Superb," said Police Commissioner Vincent L. Broderick of his 26,000-man force. New York's policemen and firemen chased vandals, fought fires and helped accident victims throughout the blackout and managed to keep such incidents to a minimum. The crime rate had actually been lower than usual, Mr. Broderick said, in a situation fraught with the potential of widespread disorder and lawbreaking.

"This department rises to every challenge and it rose to last night's magnificently," the proud chief declared in a communication to the city's precincts. About 125 store windows were smashed in the city, including a wig shop in Harlem, and a dozen stores were looted. Sixty-five persons were arrested for various crimes, including burglary, robbery, grand larceny and felonious assault. Mr. Broderick said such offenses would have been considerably more frequent but for the efforts of the 12,000 policemen and police auxiliaries who patrolled in the five boroughs. The large number of policemen

in the streets also was credited with preventing vandalism and looting in the suburbs. Authorities in Nassau, Suffolk, Westchester and Rockland counties said there were virtually no such incidents in their areas.

The firemen were more often heard than seen, their sirens blowing eerily as the engines threaded their way through darkened streets and across hazardous intersections. Statistics compiled the morning after showed 4,773 firemen on duty, plus 400 volunteers. They helped 100,000 persons from stalled subway trains in Manhattan alone, giving many coffee, soup and shelter in firehouses. They had to break through elevator shafts to evacuate persons in the Empire State Building. From 6:00 P.M. to 5:00 A.M. they fought 282 fires, four times normal, and faced 227 false alarms, compared to a usual 50.

The Department of Water Supply, Gas and Electricity, with 700 men on duty, stepped in to supply 600,000 consumers of the private Jamaica Water Supply Company with city water after their own supply was cut because of dependence on electrical pumps. Sanitation Department water flushers were "sanitized and filled with city drinking water" to be sent to neighborhoods-where water supplies had been cut off so that residents could line up and get water in pans and tubs. The Health Department checked food wholesalers and retailers against spoilage of food and warned consumers, whose freezers and refrigerators had been defrosted, to discard any piece of meat, poultry, 5sh or dairy product that smelled a little "strange." If the appearance of these foods, and prepared foods such as potato salads and meat dishes, looked "peculiar," the department said it would be best to throw them out. Frozens foods only partly defrosted could be refrozen, the department said, but those completely thawed should be prepared immediately. Nothing could be done for Schrafft's. It reported that $200,000 worth of ice cream melted.

And for housewives vexed with candle wax stains, the United States Department of Agriculture, the extension service of New York State College of Home Economics at Cornell University, and the Carpet Institute, all pitched in with remedies for removing the drippings, from fabrics, upholstery, carpets, painted surfaces and wood surfaces.

The most desirable thing the 'night of the blackout, next to being home with the lights on, was a telephone that worked. The New York Telephone Company, which operated at full capacity on emergency diesel generators during the hours of lightlessness, said that it had apparently set a record for the number of telephone calls handled. Many persons credited the continuation of the telephone service, for forestalling panic and possibly catastrophic consequences. A spokesman for the utility announced that, although no formal count had been taken, it was evident that the company put through an unprecedented number of calls. In a normal day, the number of calls made in the state is about forty-five million. The company has diesel generators as standard equipment at all of its 505 offices. They switch on automatically when the regular power fails. The usual complement of workers was on hand during the blackout and about 6,000 employees stayed at their places through the night. Collection of coins at pay stations was also stepped up to prevent clogging of the mechanism.

Frederick R. Kappel, board chairman of the American Telephone and Telegraph Company, said exultantly, "Every Bell System employee can take pride in this performance. Their response demonstrated once again the dedication of telephone people to their jobs and re-emphasizes that dependability of service has become a telephone tradition."

There were gripes, of course. Many New Yorkers and many commuters still bristled at the gouging they took from taxi drivers, and hawkers of candles and flashlights. On Wednesday morning, as tired executives stood at the New Rochelle train station, waiting for laggard commuter runs, vehicles from a private bus company pulled up and offered to take them to New York for three dollars a piece, far in excess of the train cost. The commuters banded together and, fed up with profiteering, refused to budge. The buses finally took them for a dollar fifty a piece, more in keeping with the train fare.

For bankers, trudging late to their offices in the city, the day was cause for weeping. They moved quickly to unsnarl the mountain of unsorted checks that piled up during the blackout. In a typical twenty-four-hour period, the city's eight major money-market banks-plus the Federal Reserve Bank of New York-clear or sort, some five million-checks, representing a total dollar value of seven billion to ten billion. Practically all of this is done by computers that read magnetic characters imprinted on the checks. But these mazes of wires and circuits were cold and still Tuesday night. Auxiliary power systems, which kept lights burning at most of the banks and time locks operating on head-office vaults, did not have the muscle—and, in some cases the proper current-to keep the check-clearing process going.

The banks faced a two-fold problem in their cleanup. First,

was the purely mechanical business of catching up with the sorting. This phase they handled with little difficulty. Second was the more complicated problem of offsetting a vast-though undoubtedly temporary—increase of credit in the banking system that was certain to result from the check-clearing snarl. Normally, the Federal Reserve System gives credit to its member banks for checks that are in the process of clearing within two days after they have been deposited initially, whether or not they have been actually presented to the bank on which they have been drawn. Thus, a slowdown of the normal clearing process, such as occurred during the blackout, leads to a big increase in the so-called "float," the credit granted on such uncleared or floating checks. The Federal Reserve left its two-day rule standing. But several other things were done to ease the clearance problem. The New York Clearing House Association, which handles the bulk of clearing within the city, scheduled three special times for its members to exchange checks. In addition, the Clearing House extended for a day, the deadline within which the Monday, Tuesday and Wednesday items could be presented. Usually these items have to be in by the next business day after they are deposited. For its part, the Federal Reserve Bank of New York said that in view of the difficulties the banks had encountered, it would not impose penalties on banks that failed to maintain their legally required reserves during the statement week that ended Wednesday.

Broadway had its bookkeeping problems, too. The stars were undoubtedly pleased to see their names in lights again on Wednesday, although somewhat dimmed to conserve electricity, but the moguls who own the theaters and produce the plays were bowed down by a box office dilemma.

"What do you do with a guy who had a pair for 'Fiddler on the Roof' for Tuesday night and we can't give him anything until March?" one treasurer asked.

Exchanges or refunds had to be made to 30,000 who had tickets for twenty-two shows whose curtains did not go up on Tuesday. Theater treasurers spent a good part of the day explaining in hundreds of phone calls that tickets could be exchanged for other performances or that refunds would be given. All Broadway shows, with the exception of "Fiddler on the Roof," at the Imperial Theater, played their regular Wednesday matinees. The Imperial operates on both alternating and direct current. When the direct current had not been restored by 1:35 P.M., Harold Prince, the show's producer, decided to cancel the performance. The current went on about fifteen minutes later. Most Broadway houses have a combination of alternating and direct current. In many playhouses, the

direct current was not restored until a few minutes before 2 P.M., the normal Wednesday matinee curtain time. Some performances were delayed up to a half hour. The opening at the Cort of 'The Zulu and the Zayda," scheduled for Tuesday night, was postponed to Wednesday evening and was given a mixed reception by the critics. A matinee preview of the play was held using a generator that normally is employed to light motion picture set exteriors on location. It was rented at a cost of $1,000.

Off-Broadway was almost normal, although a couple from New Jersey were the sole audience at two one-acters, "Good Day" and 'The Exhaustion of Our Son's Love" at the Cherry Lane in Greenwich Village. Manny Peluso, author of 'Good Day" took the couple to a restaurant next door to the theater and read the script to them. It took forty minutes.

The music world rescheduled some concerts and culture was being served up all around town as usual. The Metropolitan Opera National Company's performance of "Madame Butterfly," canceled Tuesday, was presented Sunday. In art, despite the fact that the blackout came at the prime time of the week for show openings (Tuesdays from 5 to 7 P.M.), a number of undaunted art lovers looked at pictures with flashlights and matches. Most movie theater marques were partly dimmed and business was generally a little below average. At the Radio City Music Hall, where 300 stalwarts had remained in the auditorium all night, doors opened as usual at 10 A.M.

Many nightclubs, including the Copacabana, the Persian Room and the Latin Quarter, were closed during the dim-out, but a number of discotheques using candles kept open for those fanatically devoted to the undulations of the monkey, the frug and the watusi.

As the city limped back to a semi-daze, executives of producing, distributing and sales organizations poured gloomily over their ledgers counting the losses of the blackout which were estimated at $100 million. And during the day, since most companies were either short-handed or closed early because of the fear of another power failure, there was another severe disruption of business activity. Some businesses profited from the blackout, among them hotels, car rental agencies who leased everything that wasn't stranded on upper floors of garages requiring elevators to move them, and restaurants and bars, all of which had an excess of customers. Souvenir stores gouged a public willing to overpay for flashlights, batteries and candles. And, there were the illegally high fares obtained by taxi drivers, running as high as fifty dollars for a trip to Port Washington, Long Island.

But far exceeding the gains were the losses in retail and

wholesale sales, food spoilage, and advertising that was not printed or broadcast. John Liner, an international insurance counselor, estimated that the losses could reach the $100 million mark. But insurance industry experts agreed that only a fraction of that amount would be covered by insurance. Charles Clark, assistant general manager of the Insurance Information Institute, the trade association of the fire and casualty insurance companies, said that "the effect on the insurance business from a loss standpoint will be absolutely minimal." Mr. Clark noted that premiums for property and liability insurance in the United States totaled $10 billion last year. Of this amount, he said, business-interruption insurance—designed to do for the insured what his business would have done if there were no interruption-accounted for only $50 million. Some insurance men indicated that $50 million in premiums would buy more than $1 billion in insurance protection.

Companies in the Northeast with business-interruption insurance would probably not get reimbursed for their losses, however, because claims are paid only when the cause of the loss is an insured peril, normally fire and windstorm. Mr. Clark pointed out that even those concerns that also had protection against a power or refrigeration loss as a result of failure of a transmission line or power source would be covered only if the original cause of loss was something like fire or windstorm. Only a "miniscule amount" of the loss seems to be covered by insurance, he said.

Insurance brokers were unable to assess whether the number of automobile and liability claims for accidents during the blackout would be substantially higher than average. The city's police said there were thirty-three vehicle accidents involving injuries and forty-four vehicle accidents involving Property damage.

Radio and television networks said "losses will be in the hundreds of thousands of dollars." However one executive said "We'll be making up a portion of the losses for make-goods-" "Make-good" is the term used in the broadcasting industry when a network or station makes on its commitment to an advertiser by broadcasting a previously scheduled Program at another time.

Thousands of office workers, who were able to inch their way home Tuesday, returned to work to find themselves unable to use the elevators in their buildings. The impassable steps of the garment center, where the sidewalks teem at noon with men in white-on-white shirts, standing around and "schmoozing," were clogged as early as 9:30 A.M. Lobbies, too, were filled with employees awaiting the word, which many of them later received, to return home.

The Commerce and Industry Association of New York, said that more than half the personnel of many big companies were absent Wednesday. At 2 P.M., business and city offices started to close down, with some leaving a skeleton force, usually personnel who lived in Manhattan, to maintain essential operations. Little mail was delivered to the towering skyscrapers, where those stranded for the night had whiled away the hours with impromptu parties, song fests and other revels. Sorting operations at the post office had been halted by the power failure and workers had a mammoth task of digging through thousands of mail bags, already swollen by Christmas advertising.

Intrepid public relations men, however, were not stayed by this problem and managed to transmit all matter of trivia on how the loss had affected their clients. For instance the New York Hilton reported that 30,000 candles were used to light the way of guests. And the Simmons Company, makers of bedding, announced that it had accommodated fifty lucky strandees on mattresses and sofas in its New York showroom.

Perhaps the news-release-of-the-day was the one issued by Tyco Laboratories, Inc., a manufacturer of batteries for emergency lighting systems. "New attention is being paid to the emergency lighting equipment industry," it said.

And at the New York Stock Exchange, which opened an hour after its normal 10 A.M. day begins, investors were playing the hunches—as usual. Three electric utilities that figured in the blackout sold off fractionally on the Exchange, while three electrical equipment concerns that stand to benefit from power company modernization efforts closed at higher prices. Consolidated Edison was off ⅜, Niagara Mohawk Power was off ¾ and Pennsylvania Power & Light was down an ⅛. General Electric, on the other hand, gained 1⅝ and Westinghouse Electric ⅝. Significantly, perhaps, the best performer was I-T-E Circuit Breaker. It gained three points.

In the city's department stores, where some of New York's leading merchants had served as temporary maîtres d'hotel during the lightless hours, there was a tidying up in the home furnishings departments of Macy's and Bloomingdale's where stranded shoppers found surcease from the blackness. One delighted lady, a guest of Bloomingdale's, stated that she slept in a bed with an $800 price tag on it. At Altman's, more than 700 persons, customers as well as employees, dined in the store's gourmet department, while coffee was served in the store's Charleston Gardens restaurant. Altman's and Alexander's, the new department store on 59th Street, were the only two major stores able to maintain lights during the blackout. Both have auxiliary power systems. A number of customers

who spent the night in Bloomingdale's were treated to breakfast by the store's staff, headed by Lawrence Lachman, its president.

Reflecting the prevailing anxiety about a repetition of the blackout, several of the leading stores closed an hour to an hour and a half early in an effort to prevent an overload of electric power. B. Altman closed at 4:30; as did Lord & Taylor. Saks Fifth Avenue and Abercrombie & Fitch closed at 4:O0. Stores on 34th Street, such as Macy's, Gimbals, Ohrbach's and Franklin Simon remained open until their normal closing hours. While Bernard B. Zients, executive head of Gimbels, reported that the day's business was "substantially less" than normal, executives at other stores said that sales and traffic appeared average. A spot check of the leading stores found business light during the morning and early afternoon, while in a number of hardware departments a near feverish activity was under way as shoppers purchased flashlights, candles and large battery powered illuminating lamps. Transistor radios sold briskly. During the noon hour the basement hardware department in the F. W. Woolworth store on 42nd Street received a large turnout of shoppers seeking flashlights and batteries.

"I never saw anything like it," declared a saleswoman. "It looks like everybody expects the lights to go out again."

The aftermath of the blackout provided a boon for at least 345,000 pupils, some of whom did their homework bv candlelight. About 15,000 youngsters were sent home when eleven city schools were forced to shut down because of a lack of electricity and heat. To ease the strain on the transportation lines, 330,000 other public and parochial school pupils, who normally use buses and subways to go to class, were excused from attending school. But some determined students refused to take advantage of the day off and walked or rode bicycles for distances as great as three miles.

'The kids were wonderful," a Brooklyn principal said, "some traveled two hours to get here and came an hour late, *but they got here."*

The Board of Education closed all schools at 3 P.M., dropping late session day classes and all afternoon and evening programs. There were effects too, on many colleges and universities. City College first suspended all day undergraduate classes-affecting about 60,000 students-and then curtailed all late afternoon and evening classes at its units in the Bronx and Manhattan and at the New York City Community College in Brooklyn and the Staten Island Community College. New York University, canceled all classes at 1:30 P.M. at its

Washington Square. campus, with the exception of those at the Law School.

School corridors were a buzz with tales of what happened when the lights went out. At Central Commercial High School, Third Avenue and 42nd Street, classes were in session for 1,000 students, most of them girls, when the blackout started. The school operates two sessions, with the second running from 12:50 to 5:50 P.M. Concerned that the studepts would not be able to get home if they were dismissed-the youngsters come from all parts of the city—officials kept 600 in their classrooms all night. The 400 others were allowed to leave when their parents came to take them home.

Murray Schwab, who teaches bookkeeping, recalled, "When the lights went out, the kids made jokes like, 'Somebody should have paid the electric bill.' As the evening wore on we sang songs, even me with my voice. After a few hours they began to get sleepy. They put their heads down on tables and went to sleep. They were tremendous, they behaved beautifully and took it all in stride."

But no one bore the brunt of the blackout with more dignity, humor and stoicism than the commuter. It was he, who, as his martini warmed, his salad wilted, his steak curled and his wife worried, forged his way home on darkened roads or managed to survive in the bars, hotels, lobbies, clubs, terminals, offices and stalled trains. In the morning, members of their grizzled ranks formed a big queue at a coin-operated electric shaver in the men's room at Grand Central station. Others hooted when a disembodied voice over a station's loudspeaker system barked appreciation for "your cooperation" in waiting. Some bearded commuters h-ad ensconced themselves for the night in a shiny new automobile on a revolving exhibit. Now they turned out of the car as the pedestal once aaain began to turn.

Somber and-tired, -they jammed Grand Central Terminal and Pennsylvania Terminal in mid-afternoon, elbowing their way past the thronged track gates, hoping to take earlier trains an usual. The New Haven Railroad reported that their esuscitated carriers were crowded early in the day with persons who reversed their normal routes, took the day off, and ed the city as soon as they could. A 3 P.M. rush hour was reated in the terminals, heightening the problem of the New aven, which operated with some difficulty at fifty per cent of onnal, and the Long Island, which rose from forty to eighty er cent of normal. Despite the vicissitudes of the railroad etable, especially on Wednesday, a group of weary Madison

Avenue executives waited patiently at the Greenwich, Connecticut, station for two and a half hours until a jammed train finally picked up some of them.

A reporter making a spot check of the area on his way to New York offered some of them a ride in his automobile.

"Not today, François," one wrinkled, ruddy-cheeked man retorted. "Not today in that traffic."

When the reporter said that traffic on the New England Thruway was light, the ruddy-cheeked one glared and again expressed his perverse fealty to the railroad, "Not today, François."

Things were back to normal in the suburbs, and-in many of the cities of upstate New York, New England and Canada, long before they were in New York City. In Mount Vernon, off-duty policemen. who had postponed their picketing of City Hall due to the blackout, protested the rejection of their demand for a twenty per cent increase in pay. In Bridgeport, Connecticut, where the ladies auxiliary of the Ancient Order of Hibemians canceled their meeting Tuesday night, plans were made to m-schedule it.

In New York City, as the hour of 5:27 P.M. neared, and millions of eyes gazed quizzically at the lit buildings, hands groped for the battery-tilled talismans in their pockets. By 5:30 P.M. the spell was broken. The buildings were still lit, the darkening streets were awash in neon blaring the contorted spelling of brand names (EZ Off, Redi-Wip), the names of theaters, movie houses, hotels, stores and bars.

Mom than one person smiled at the lettered sign in a Horn and Hardart cafeteria on the Avenue of the Americas: "Pardon Our Appearance, We Were Up All Night."

On Thursday the sixteen million residents of the metropolitan area could do almost everything they were able to do before 5: 27 P.M., Tuesday. They again had their choice of air, rail, bus and subway service, which was about as punctual as ever.

'We were right on the dot," a woman stepping off the 7:58 A.M. from Tarrytown, "'which was unusual 'even before the blackout,"

Relaxed and rested after a good night's sleep, residents showered and shaved, went to restaurants and theaters, thronged stores and supermarkets, and visited libraries and museums as usual. But some said their lives would never be quite the same. Railroad commuters reaped a residue of good fellowship after sharing dark hours in incapacitated trains and black tunnels. A Connecticut woman found her

fellow commuters less impersonal after spending the night on the 5:30 to Norwalk.

"Everybody recognizes everybody else now," she said '@'Although they've seen me' for ten years, and they've done nothing but help me up the stairs now it's a tip of the hat and a 'good morning, 'Phyllis, h&v are you today?' "

Refreshed railroad crews retrieved rolling stock, which had been abandoned, in time to serve Veterans Day traffic, although that was unusually light. The Transit Authority reported that its 8,480 trains were on schedule, although many subway passengers repeated short delays on the IND "E" trains. Health Department inspectors peered into the refrigerators of 1,000 restaurants and grocery stores and found only three restaurants in which food had spoiled because of the power failure. Mayor Wagner told New Yorkers they no longer needed to maintain voluntary restrictions on electrical power.

The Consolidated Edison Company reported that it had restored an ample reserve for its system serving the metropolitan area, with 5.1 million kilowatts of capacity on hand against the Wednesday peak demand of 4,333,000 kilowatts between 5 P.M. and 6 P.M. Federal, state, local and utility investigators still mulled over the outrage, trying to unravel the mystery of why 80,000 square miles in the Northeast power- grid territory went black.

"I want to know--and New Yorkers are entitled to know -just what happened here," Mayor Wagner declared

A resolution was filed in the City Council urging the city to "recapture" the three transit power plants it sold to Con Edison for $125,840,000 in 1959. Councilman-at-Large Paul O'Dwyer said the utility had "conducted its activities in such a manner as to fail to isolate its facilities from defects arising in areas outside of the city and upon occasion has even failed to isolate defects in its own system from impact upon the operation" of the city's subways.

By Friday, the blackout was dimming as a topic of conversation. Hospitals reported that spoilage in blood banks was kept to a minimum by the cool weather and the cooperation of hospitals and local communities. Only about 100 pints were lost out of between 3,000 and 4,000 on hand in the city, which consumes about 1,000 pints daily. The outside temperature Tuesday night was ideal for the storage of blood-between thirty-eight and forty-one degrees. A number of hospitals without auxiliary generators removed their blood banks from refrigerators and placed them out-

doors. Some spoilage occurred at hospitals that used dry ice during the blackout and did not remove it soon enough after power was restored. Consequently the blood became too cold: it crystallized and had to be discarded.

Mayor Wagner told Con Ed officials, whose only. bright moment that week appeared to be the postponement of a court action against the utility for air pollution, that the city could not tolerate another long paralysis of subways such as followed the power failure.

"Changes will have to be made," he said, during a meeting with Con Ed's three top executives. And Con Edison explained why the company needed more time than other power companies to restore service. The danger of damage to immensely expensive equipment was a major item in the explanation. T. C. Duncan vice president for engineering pointed out that some of the company's local networks required "as much electricity as a good-sized city," and that power could not be restored in such generating stations until they were brought to a high level of production. It takes power from some source, he said, even to start auxiliary equipment in service. By the time such power got to the major generating stations, Mr. Duncan said, "the boilers had cooled down and the turbines had come to rest."

The turbine generators had to be turned slowly by mechanical means to make sure they had not been bowed out of shape in the blackout. "Bowing could have completely ruined them if they had been revolved by steam without their preliminary check," he explained, The company's huge boilers, some of which are fifteen stories high, must build up temperatures of 3,000 degrees and produce pressure of more than 2,000 pounds a square inch.

Mr. Duncan said, 'The machines were brought up to speed as quickly as possible, and it was then possible to synchronize them with other turbine generators operating at other stations in the system. As soon as this was done and load was available, the load was picked up as rapidly as possible." He said he considered the restoration "most expeditious."

"Expeditious" was perhaps not the word that tumbled most readily from the lips of one quarter of the residents of Pelham Manor, New York, a wealthy Westchester suburb. It was early Thursday before the lights went on for some of the village's residents—perhaps the longest wait of all in the metropolitan area. Miss Florence Theberge of 649 Ely Avenue said, "We burned a lot of candles and we kept the fireplace going. It all seemed kid of strange and I kept thinking about how the people must have lived in Pelham Manor in the primitive days when there was no electricity."

In her carpeted split level home Mrs. James Vasta, a youthful brunette with tousled hair, recited a catalogue of woes,

"The house got cold and clammy. Two of my three children are sick because of the power failure. The electric motors that open the garage doors wouldn't work We heat with gas, but electricity is needed to ignite the gas. The television sets wouldn't work The children were afraid of the dark. We kept thinking of sabotage being responsible for the blackout, Fortunately my fireplace in the basement room provided some heat. Fortunately, too, my Cadillac was in the driveway and I was able to go to a little shop on the Boston Post Road where a sign advertised firewood. I piled logs in the Cadillac and brought them home. Unfortunately my father and mother and my brother who live down the street have no fireplace, so they came and slept on the floor and on a lounge-in front of our fireplace."

Then, emphatically, she said, "No, the blackout wasn't a lot Of fun for us."

5. The Grid

Switching on a light is such a common thing nowadays that Americans never stop to think what lies behind the wall switch. Few realize that by flicking the switch a person "plugs in" to a massive continental electrical system, by far the biggest in the world

The electric utility industry as it is known today is less than one hundred years old (Thomas A. Edison invented the first practical incandescent lamp in 1879). Yet it is no exaggeration to say that the United States has, in a broad sense, an electrical economy. Artificial light is only the most obvious manifestation. Electricity operates machines in our factories and milks cows on the farm. It is a vital part of our defense and security establishment. It is the basis of our telephone and radio communications and drives the presses that print our newspapers. And in our homes we are surrounded by electrical appliances-refrigerators, stoves, dishwashers, toasters, air Conditioners, clothes dryers, television sets.

The use of electric power in the United States has increased tremendously since! the turn of the century. Power output today is more than ten times what the nation produced in 1930 and triple the amount of fifteen years ago. Virtually every household in America now has access to electricity, even in the remote hill country. Production has reached such gargantuan proportions that the concept is difficult to grasp: for example, total output adds up annually to more than a trillion kilowatt hours, or enough to keep ten trillion 100-watt lightbulbs burning for an hour.

Put another way, the United States has more electric power capacity than the next five countries of the world combined—and almost three times the power capacity of the second-ranking Soviet Union. And though the United States has only about one third the area of the Soviet Union, it has more than four times the miles of transmission lines.

The rapid progress made in electrical technology in the United States over the last half century has turned the electric utilitiea industry into the country's biggest. It is a gigantic complex of huge power stations and a network of wires that reach out like an octopus across the land and feed power into millions of little wall plugs. It is this network that makes it possible for the masses to have electricity at a cost most Americans can afford. Privately owned companies serve about eighty per cent of the customers and Government agencies or cooperatives twenty per cent.

'The network-or "grid" as it is called in the electric industry-connects not only the producer to the consumer but also producer to producer. For reasons of efficiency, economy and reliability of service, local and regional electrical systems have found it advantageous to cooperate in "'pools" and interconnected grids for the exchange of power. The over-all system has reached a stage of development where a Florida housewife, plugging in her toaster, may use power whose production or distribution was shared by a company in Wisconsin, Or a Kansas utility may help a system in Oklahoma that temporarily loses its service because of mechanical trouble.

But though electricity has become such a part of our lives that we take it for granted, it remains a mystery to most people. They know electricity more for what it does than' what it is. What exactlv is electricity? How is it produced and how does it reach our'homes? What is the meaning of such words as electron, current, volt, kilowatt, generator, steam turbine, high-tension line, circuit-breaker, interconnection, pooling? Exactly what is a grid and how does it operate?

Electricity itself is not power but a form of energy. It must be transformed into power. The term "electricity" comes from the Greek word for amber, elektron. Electricity is made up of electrons, which are little particles revolving about the center of every atom. Electrons are so small that they are invisible, even with a microscope. Yet it is the passage of these particles along a wire or other conductor that constitutes an electric current. Electrical energy travels through a wire nearly as fast as the speed of light, or about 186,000 miles a second. That is why a voice on a telephone is heard almost instantaneously at the other end of the line.

The best conductors of electricity are metals, because they have electrons that are free to move from atom to atom-a condition necessary for effective conduction of electrical energy. Conversely, materials such as rubber and glass do not permit free movement of electrons and thus serve as good insulators.

The flow of electricitv involves three factors: (1) the pressure that causes the current to flow-this is measured in volts; (2) the rate of flow, measured in amperes; and (3) the resistance of the conductor to the flow, measured in ohms. Proba bly the most familiar measurement term is watt, which is used to denote the amount of power conducted. A kilowatt is equal to one thousand watts. It is diicult to grasp the meaning of these terms because electricity is not something that can be seen or held or weighed. Electricity must be understood by its effects-that is, by the heat or light it induces or the power of its magnetism.

In an electrical current electrons travel through the conductor from a negative source to a positive source of electricity. The agent that pumps the current is either a generator or a battery. Generators transform mechanical energy into electrical energy; batteries, such as those found in automobiles, transform chemical energy into electricity. Most of the world's electricity is produced by generators.

The production of electricity begins in a power plant or generating station. There generators produce electricity through electromagnetic induction, a process based on a principle discovered in the 19th Century by Michael Faraday, a British physicist. Faraday found that by moving a magnet past a coil of wire he could induce, or produce, an electric current in the wire. Generators in power stations usually are at least as bii as a family garage.

There are two principal ways of operating generators: one is to burn coal or other fuel to make steam for a turbine which drives the generator; the other is to utilize power from flowing or falling water, as at Niagara Falls or the Hoover Dam. For this reason generating plants are usually found near coal fields or rivers. In some isolated plants of small capacity the primary mechanical energy may come from oil or gas engines.

The generator is the start of an electric circuit that also includes the wires and any device the energy operates, such as a light bulb or a TV set. A simple circuit consists of only two wires: one carries the electricity from its place of origin to its place of use; the other leads back to the point of generation.

In order to produce some effect, the circuit must be unbroken thereby allowing the current to flow freely to the device it is intended to operate. An example is the way an electric light switch works. When the switch is "off," contacts in the wall connection are separated-that is, the circuit is broken—and the light doesn't work. When the switch is "on," the contacts are joined—closing the circuit-and the bulb is illuminated.

The currents flowing from generators are of two kinds:

direct and alternating. A direct current flows in the same direction continuously until the circuit is broken, Direct current requires more complicated generators and electric motors than alternating current. One of its principal-uses- is in industrial operations where the motors change speeds quite often. Another common use is to charge batteries.

Alternating current, on the other hand, changes direction periodically in what is called a cycle. This is the kind of electricity found in nearly all American households. It requires relatively simple generators and motors and can be transformed easily into high voltages. This latter characteristic is important to the electrical industry because power loss over transmission wires is lower with high voltage-a vital economic factor in the expansion of electrical power systems across the country.

The production and transmission of electricity possess an unusual property which influences the whole foundation of the Industry. Unlike almost all other industries, electric utilities must manufacture their product at the very instant the customer wants to use it-and the electrical industry can store energy in the form of coal and impounded water to meet future requirements. This does not, however, lessen the need for generator capacity to match the customers* demands.

In the first years of the electric utility industry there was no long-distance transmission of electricity from the generating plant to the consumer. For one thing, the application of electricity at that time was very limited and people at first were wary of what uses were made of it. For another thing, the early generators and transmission lines were crude and incapable of projecting power very far.

The pioneer generating plant in the industry as it is known today was the Pearl Street station in New York City, which began operating in 1882. It was followed gradually by scattered plants built to serve only local areas, such as the one at Niagara Falls. The first power transmission of any real size from the Niagara Falls station came in 1896, when electricity was sent twenty-two miles over an 11 ,000-volt line to Buffalo, New York.

As new applications for electricity were found and public demand for its use increased, the companies were encouraged to undertake wider technological research and the development of better equipment. More powerful and efficient generators were developed and improved transmission systems carried the power farther and farther from the generating plants. The first 60,000-volt line went up over San Francisco Bay in 1901, a 100,000-volt line was constructed in Colorado in 1909, a 230,-000-volt line went up in Southern California in 1923 and the first 345,000-volt line (of the type in wide use today) was estab-

lished in an area covering parts of West Virginia and Ohio in 1953.

A notable period of growth in the industry came in the nineteen-thirties when rural electrification-with much of the impetus stemming from the Government—surged ahead. Another spurt of progress came after World War II when the use of electricity expanded rapidly in homes and factories.

As the electric industry grew, and the costs of research, development and plant construction grew proportionately, individual utilities soon noted a duplication of effort and expense. At the same time it was imperative that the cost of electricity to the customer be kept reasonable if the industry was to continue expanding. Out of these factors came the idea of pooling resources and linking systems.

The pooling idea progressed in three stages. First, large units within a local system were tied together with a transmission network which reduced the amount of electric capacity companies had to keep in reserve for maintenance and repairs. Second, small systems were linked and the companies themselves were consolidated into larger, more efficient organizations which have evolved into today's electric utilities. And third, service areas of utilities in adjacent regions were interconnected.

This progressive intertwining led to our modern power network, which covers virtually the whole country with 350,000 miles of high-voltage transmission lines. Nearly all major electric power systems in the United States, providing ninety-seven per cent of the nation's electric energy requirements, are members of one of six principal interconnected groups. The largest of these, the Interconnected Systems Group, combines the resources of about one hundred and twenty utility systems extending from the Rocky Mountains to the Atlantic Coast and from Canada to the Gulf of Mexico.

There are two main advantages to the grid system.

First, the pooling of resources and the purchase and exchange of power within a region avoids costly and unnecessary duplication and thus leads to better efficiency and economy. The savings then can be passed along to the consumer in the form of lower prices.

The second advantage is greater reliability of service. In an emergency cut-off of power in one part of the system because of equipment breakdown or human error, electricity can be transferred to the stricken area from another section over the "party line."

The working of a grid can be illustrated by the system used in New York State. Six companies are tied into the. system Via a 345,000-volt line that runs across the state from Buffalo to

New York City. Feeder lines branch off the main trunk into all sections of the state, and local power systems draw electricity from the trunk when needed and send electricity into it when another area is in need. The biggest company in the system is Consolidated Edison, which serves more than ten-million customers in the New York City metropolitan area. Over the interconnected network of wires there is a constant flow of power throughout the state, the amount and direction of the flow depending on the respective needs of the various regions.

The constantly changing needs and flow of *power are* determined by a computer, or electronic "brain," in a control center. The computer calculates instantly how the electricity may be delivered most economically by plants in various parts of the state. Then the system operator can call for the starting up or shutting 'off of the generators as the demand for electricity increases or diminishes.

The state network, in turn, is tied into a loose confederation of forty-two power companies covering the northeastern United States and parts of Canada. Thus, there can be interchanges of power over an area stretching west to Michigan, north into Ontario and east to Massachusetts. By the same token the regional grid is interconnected with other regional grids in chain-link fashion across the country.

The primary concept behind the grld system as set up in New York is that various sections of a state consume power at various rates. Moreover, consumption within each section varies according to time of day, the season of the year and the weather.

For example, a section catering to tourists will have its greatest use of electricity during the summer months, whereas a university town will have low consumption during the summer vacation. In this period the company serving the tourist area can draw power from the university town; during the winter months the process can be reversed. In this way the respective companies need less electric generating capacity to meet their peak demands than they would require if they were operating alone.

In New York City there is an upsurge of power demand around 5 P.M. when workers are going home on the electrically operated subways and lights are being turned on in millions of apartments. In rural areas upstate the pattern of power consumption is determined by the schedules for milking cows, the brooding of chicks and the harvesting of crops.

Thus the pooling idea is not only beneficial in terms of initial investment-the construction of one large generating plant to serve five companies is relatively cheaper than building five

smaller plants-but it also provides the most effective use of equipment within the system.

Pooling and interconnections have one primary goal—keeping down the cost of electricity to the consumer. That the industry has succeeded is best seen in its own statement that during the last twenty-five years, when the cost of living has more than doubled, the average price of residential electric service has been reduced by nearly half.

The grids represent the latest phase of the industry's search for efficiency. The technological approach has been to develop better equipment by making improvements 'm existing equipment.

For example, in 1938 it took 1.41 pounds of coal to produce one kilowatt hour of electricity. Today the most efficient plants use about 0.8 pounds. Yet in this same period of time industry consumption of coal has soared from approximately 12.9 million tons to more than 211.2 million. While turbine generator units with a capacity of 100,000 kilowatts were considered large just before World War II, units of 500,000 to a million kilowatts are becoming relatively common. Pressures and temperatures have soared from 750 degrees Fahrenheit and 1,250 pounds per square inch in 1930 to over 1,200 degrees and 5,000 pounds or more today. All of these factors add up to one thing: more efficient production of electricii at lower cost

The history of the electric industry has been that when peak performance in one technological phase becomes more difficult to achieve, research is shifted in another direction. It was this practice that led the industry around 1950 to devote more attention to more efficient transmission of electricity.

In 1956 the maximum transmission voltage--the "amount" of electricity carried on a cable-was 345,000 volts. By 1962 this had risen to 460,000 volts, and the industry is on the threshold of transmitting power at 765,000 volts. This improvement in the means of transporting electricity over greater distances, along with development of extremely efficient generating stations, has been the basis for the trend toward pooling.

Now when one local system contemplates building a new generator on the order of 200,000 kilowatts and a nearby system foresees a future need for a unit of about 50,006 kilowatts, the two utilities team up and share the cost of building a larger, more efficient generating station at a point readily accessible to both. They might decide that future demands would make possible a 400,000-kilowatt station.

Thus the old concept of building power plants adjacent to where they will be supplying electricity has been changed. It

is far cheaper now to place generating stations nearer fuel supplies, whether inside or outside the service area, and then transmit the electricity in greater quantities to the points of use. In other words, it costs less to transport the electricity than the fuel.

Aside from the economy factor of an interconnected pool, there is the safeguard factor for emergencies. Grids are devised partly to overcome blackouts-minor ones at least-brought about by malfunctions In generating or transmission equipment. If one region suddenly loses power, the system is so arranged that power can be shifted immediately from another region.

But with this advantage goes a risk: namely, that a massive breakdown in one part of the system might create excessive strain and automatically set off a chain reaction throughout the network. There are safeguards against such a cascading effect, but blackouts in the past, including the monumental one on the night of November 9, 1965, have shown that the safeguards are not foolproof. Some systems have circuit-breakers that automatically disrupt the electric current when the power load becomes too great in the line; or too low, or when the current is reversed. Regional systems also have control centers where the circuit can be broken manually by means of buttons.

One factor that determines whether a system has automatic circuit-breakers is the range of voltage carried. In the New York State system, for example, the 345,000-volt lines are in a high range, These lines, which stretch over the world's most concentrated electric market, are so designed so that a region hit by a local power failure can immediately have a surge of energy sent into it from the Niagara, St. Lawrence or another power source.

To he capable of this instantaneous action, the system must be able to accept a wide range of power loads. Hence the main trunk, the electric superhighway bisecting the state, is not equipped with circuit-breakers sensitive to slight changes in load. The decision to cut a local system out of the grid is a human one and the actual cut-off must be done manually at a local control center. The Consolidated Edison control center in New York City, for instance, has eight buttons that must he pushed to isolate the city from the rest of the northeastern network.

On the other hand, the Pennsylvania-New Jersey-Maryland system has lines of lesser voltage and is protected by circuit-breakers. In case of trouble in the grid-say in neighboring New York-this tri-state system can be isolated automatically whenever the circuit-breakers sense a problem.

If it has no automatic device to isolate it from the network in a crisis, a local system faces one obvious danger: it must rely on human judgment and action to break the circuit before the system is hit by a malfunction cascading through a grid. This introduces the possibility of human error and overlong delays in pushing the button.

Ordinarily a regional system has sufficient capacity to compensate for any strain on one part by shifting surplus power from another. The ultimate danger, however, is that a serious fault in one section, or a combination of several malfunctions along the line, might impose a load bigger than the whole system can handle.

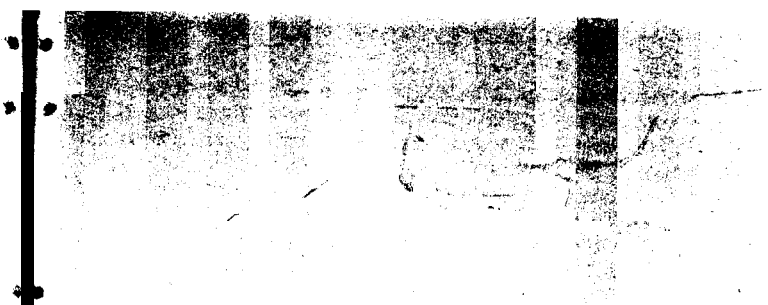
In that case the entire system may collapse, forcing the generators out of synchronization. If individual control centers along the line fail to cut their local systems off in time, they will be thrown into darkness. The local power plants shut down automatically through the operation of protective facilities designed to prevent damage to the electrical equipment in such circumstances.

Industry experts say it is preferable to have a relatively brief blackout caused by an automatic shut-off at the local power plants than to have an overload damage the generating station equipment, which might bring about a longer blackout. Present-day equipment is massive and very costly. Some boilers are fifteen stories high and hang upside down from the roof to prevent their tearing the building apart when they expand under fantastic pressures. If crucial equipment is knocked out, the resulting problems may be worse than those caused by the relatively brief blackout.

The length of a blackout caused by a protective shut-down of a power plant depends on the time required for a local system to fire up auxiliary power or restart its main generators. This is not a simple matter of pressing a button.

The restoration starts with isolating the power system of each area to make sure that no electricity can come into the local area and cause power surges that could result in new power failures. Then all power plants on the system must be refired and worked up to their generating capacities. Often this means getting old equipment out of mothballs to speed up the proceedings or replace damaged equipment. The process requires at least several hours.

Then, as power is produced by the individual stations, these plants are linked into a local system. The local systems are then interconnected until the entire grid is working again.



6. Detective Story

The North American electric power industry puts out a booklet boasting of the "challenging assignments" its engineers undertake in the normal course of events. These can range "from the design of high-voltage transmission networks to the operation of giant thermal-electric generating stations. Or they can involve the development of electronic means of operating electric systems, advanced work on an atomic power project, or the engineering of power uses for many different types of industry."

What happened on Tuesday, November 9, was far from normal. Suddenly, many utilities engineers found themselves with the most challenging assignment of their careers. They became international detectives. They had a tough mystery to crack: what caused the great blackout?

As soon as the lights went out, the investigations began. Before the lights went on again in the 80,000-square mile area, thousands of engineers, generator operators, line patrol pilots, dispatchers, system operations controllers and top executives of the forty-two northeast power companies had spent a sleepless night. They were to spend many more. For as their investigations widened, turning up precious few solid clues, the deeper became the mystery, the more elusive its solution. If anyone knew the answer, he was not talking.

It may have been a human error or oversight. It may have been a broken relay at a power plant that had gone undetected. It may have been a mechanical flaw, though the utility companies soon decided that such trouble would have been more readily detected. It may have been a "nervous breakdown" of an electronic computer somewhere in the vast power grid that supplied the blacked-out region. Or it may have been a strange set of coincidences, minor and momentary lapses by either man or machine, or both, that pyramided into a major breakdown. Only sabotage seemed to have been ruled out as a cause.

Some believed that the task might turn out to be impossible, that they might never pinpoint the initial breakdown that triggered the "cascade" of power failures in six states and Ontario.

In New York City, the Consolidated Edison Company said that the failure might have occurred "somewhere to the North." Indeed, one of the first reports, within the first hour, implicated the Sir Adam Beck Plant Number 2 in Queenston just across the border in Ontario, four miles west of Niagara Falls. There might have been an equipment failure, either at the plant or somewhere between it and the New York systems. But the Canadians immediately said that they could find no evidence that such a failure had occurred. If it did, it had gone unnoticed at the moment. Investigators began chasing down dozens of other clues.

The Canadians fixed the blame to the South. In between, where much of the sleuthing was concentrated, the utilities of upstate New York insisted that they could not find a failure in their systems. Joseph C. Swidler, Chairman of the Federal Power Commission, was pessimistic. "'We may never trace where it started," he said, "but we're going to try." This was echoed by many other officials.

Federal, state, city and utility investigators fanned out with the speed of epidemiologists in search of a rampant germ and the thoroughness of a Sherlock Holmes on the trail of a killer. By finding the culprit, they hoped to prevent a possible recurrence of such a crippling power failure. Working day and night, in the field and in their offices, they checked every possibility of malfunction. They inspected remote substations, patrolled transmission lines by plane, by helicopter and by foot. They carefully examined each of the 400-odd generating units in the region. They questioned system operators who manned the control panels when the lights flickered and went out. They pored over miles of graph paper, looking for a clue from the squiggly ink tracings that register current flow and frequency. Their task was made even more monumental by the nature of electricity. It is generated, delivered and consumed in the same split second. Unless the disturbance had left a permanent scar on the equipment or was somehow monitored by the many dials, meters and recording instruments, its source might never be tracked down. Thus the investigators sought, by every means possible, to reconstruct the conditions throughout the grid shortly before, during and immediately after the failure.

The command post for the inquiry was the Federal Power Commission offices in Washington. When President Johnson, at his Texas ranch, first heard of the power failure, he immediately dispatched a memorandum to Mr. Swidler. The "full resources of the Federal Government," the President said, are

"at your disposal." As the independent Government regulatory agency for the electric power industry, the commission already had considerable resources and knowledge at its command.

One of Mr. Swidler's first acts was to send F.P.C. engineers to the central control rooms of Con Edison in Manhattan. Niagara Mohawk's system lay in the heart of the affected region and extended to the Canadian border. The first concern of the F.P.C. engineers: coordinate efforts for restoring service. They also began to sift fact from rumor.

Niagara Mohawk officials were getting all sorts of conflicting reports. "Last night on the radio," one of the utility men said later, "there were the damnedest rumors you ever heard. At one point it was supposed to be an earthquake. Then they said the trouble had been traced to Niagara Falls, then Messena and then to Clay. There was a new spot every five minutes."

Reports of a line break near Niagara Falls were quickly checked. They were false. Then the fear of sabotage crept in. Alerted to the possible murder of linesmen, the state police and Federal Bureau of Investigation agents sped to the gloomy, desolate Montezuma Marshes outside Syracuse. All was calm. Other F.B.I. men took up positions at the central control room of the New York State Power Authority at Niagara Falls. It was just a precaution.

Then came word, at about 10 P.M., that all the trouble started at a remote-controlled substation on the Power Authority's lines west of Clay, a hamlet ten miles north of Syracuse. The report came from a Niagara Mohawk district engineer. The high-tension 345,000-volt transmission lines stretching over Clay are part of the authority?? "superhighway" of power dis tribution, running from Niagara Falls east to Utica and south to New York City. At scores of points along the line, including Clay, power can be taken off or added as the need arises. If these lines were in trouble, the entire problem could perhaps be solved.

Niagara Mohawk repairmen who drove out to Clay found the substation in apparently perfect order. There were no signs, they reported, of mechanical "trauma." A few days later, however, an airplane pilot recalled that he was flying into Syracuse's Hancock Field at the moment of the blackout. As he passed over the high-tension wire not far from Clay, he saw a flash of tire. "It looked like a barn tie, a barn full of hay," said Weldon Ross, a part-time instructor-pilot from Syracuse. "It lasted for perhaps ten seconds."

All the rumors seemed to turn out to be just that—rumors. With no explanation of the failure readily apparent, Mr. Swidler had his aides telephone some of the nation's most experienced authorities on electric power production and transmission.

They were told to catch airplanes and be in Washington the next morning-Wednesday. Two of them were vice presidents of Niagara-Mohawk, the power system in the heart of the trouble zone. The others were drawn from organizations outside the affected area-from the Pennsylvania-Jersey-Maryland Utilities pool, Vii Electric & Power Company, Commonwealth Edison of Chicago, American Electric Power Corporation, the Department of Interior and the Tennessee Valley Authority. They were ten in number, and were designated the task group. They were to be Mr. Swidler's board of experts, the men who were to advise him on ways to go about the investigation and help analyze the findings. F. Stewart Brown, chief of the F.P.C. Bureau'of Power, was assigned to head the group.

The next morning, after power was restored to all parts of the area, the task group arrived and went into a long strategy conference with Mr. Swidler, the other commissioners and key staff members. Then acting on orders from the President and the guidance of his task group, Mr. Swidler sent telegrams to twenty-one utility companies in the black-out region. They were ordered to send "'responsible representatives" to Washington, armed with documents and data to answer a list of nineteeen questions. F.P.C. investigators wanted to know the load and direction of power flow on each significant line that connected individual utilities systems into the regional power grid-both just prior to the "outrage" and at the moment of the breakdown. They wanted to know the load each generating unit was bearing. They wanted to know the normal capacities of these lines and generating units. They also asked the utilities to try to reconstruct the sequence in which the circuit breakers, the power system's safety devices, switched on throughout the grid, and the effect each of these operations had on the line loads and generating outputs. Like detectives, the F.P.C. investigators were seeking to reconstruct the "scene of the crime." The telegrams went out Wednesday' morning. The Utilities representatives were told to be in Washington at 9 A.M. the next day. By the time the companies got their summonses, they were already well underway with their own investigations.

Every generating unit was checked for some telltale mechanical slipup. None was found. Three generating units of Con Edison, including its million-kilowatt Ravenswood 3 steam-turbine generator, were damaged. But that was a result of the power failure—not a possible cause. In two of the units, the turbine bearings had burned out from lack of lubrication during the power lapse. Planes and helicopters flew the length of the New York State Power Authority's trunklines, looking for clues. The patrols returned with nothing to report

One of the nation's thousands of line patrol observers, William W. Kobelt, of Walkill, New York, took off in his Utility Super Cub at dawn the day after the blackout. He usually starts his patrol of the lines of Central Hudson Gas and Electric Corporation at 8 A.M. "But anytime there's trouble like a lightning *storm or a* hailstorm," he explained, "Pm out at daybreak." He was out early Wednesday morning, looking for trouble. He flew close to tree-top level. He's been doing his job since he was discharged from the Army Air Corps in 1945.

He said, "You follow the lines looking for a break. Or smoke. Or a fire. I only radio in when the trouble is serious. If the line trouble is real serious I hover in the vicinity until the trucks get to it."

Mr. Kobelt checked wires, crossarms, and structures of the transmission towers. He looked for fallen trees. But he couldn't find any trouble.

The fact that the companies were able to restore service with the same equipment that had been in use before the black-out, according to power experts, indicated that the problem lay elsewhere. It also served to reassure many investigators that it was not the work of saboteurs. Nowhere could they find any apparent equipment problem that could have short-circuited the grid. Gradually, the investigators began to realize that their search could take days, or weeks or even months. The usual causes of power failm-es-fallen lines, storms, short circuits, generator breakdowns-had been considered and looked for. The cause seemed to k more complex.

A host of other investigations were also being initiated. In Albany, the New York Public Service Commission asked for preliminary reports in five days from the state utility companies and municipalities. The New England Conference of Public Utilities Commissioners called in power company officials for a meeting in Boston. Governor John N. Dempsey of Connecticut ordered an investigation. Mayor Robert F. Wagner of New York City conferred with Con Edison officials. He said that after reports of federal and state agencies were received, the city would act to prevent a recurrence of the failure.

"Can It Happen Here, and If So, How Do We Stop It?" That was the subject of a post-blackout meeting of the New Jersey Public Utility Commission. Only a few scattered communities in New Jersey were affected by the failure. In Chicago Mayor Richard J. Daley said that his inquiry of the possibility of a blackout didn't turn up anyone who would say it couldn't happen there. The Defense Communications Agency set out to review what effect, if any, the failure had on the nation's military readiness. In all cases, a spokesman said, auxiliary power

units cut on automatically so that there was no apparent lapse in the strategic alerting systems.

On Thursday morning, two days after the blackout, when the utilities executives and engineers filed into Room 45 12 of the F.P.C. headquarters, they still were unable to pinpoint the cause. They were even reluctant to speculate. With Mr. Swidler presiding and the task group sitting in as the panel of experts, the formal hearings opened behind closed doors- The companies' engineers unfolded their maps and charts, drew diagrams on the blackboard. But, after two days of testimony, it became clear that the mystery remained just as much a mystery as when they started.

On Friday, Mr. Swidler adjourned the hearings for a week-end recess to give the companies more time to draw together even more technical data. Mr. Swidler said that the cause may have stemmed from "many problems, a whole complex of them instead of one particular incident-"

As a result, he wanted to see the Companies' oscillograms, which would show the minute-by-minute flow and frequency of electrical currents. They are the "fingerprints" in the mystery. Utilities kept recording devices, known as oscilloscope& at key points in their systems. Con Edison, for example, has 138 oscilloscopes positioned at substations from upper Westchester to Staten Island. Oscilloscopes print out their zigs and zags on 100-foot rolls of thin, sensitive paper that is 14-inches wide. So engineers cleared their desk tops, spread out the rolls of oscillograms and began scanning for and marking any unusual variations in the line patterns.

The tedious part of the investigation was in progress at utilities offices throughout the area. Nearly all of Con Edison's 700 engineering and technical employees had crisis assignments. Into the quiet, somewhat austere offices of Con Edison Chairman Harland Clement Forbes were arriving all the data bearing on the failure. The entire matter, his asssociates said, presented a spectacle of technical untidiness that he abhorred

A slim, taciturn New Hampshire man, Mr. Forbes is a veteran of forty-one years in the power business-and of three major electrical failures in the last twenty-nine years. In January 1936, when he was system engineer of Con Edison! a four-hour failure struck New York late one afternoon. Five days later, Mr. Forbes delivered a critique of the "disturbance" to the annual convention of the American Institute of Electrical Engineers. Since the cause was unknown, he said, "a similar breakdown, presumably, could occur in a big city at almost any time."

His reluctant prophecy came true in June 1961, when five

square miles of the city were crippled by another failure. This time the failure struck the city and Con Edison so fast and so mysteriously that the first indication that the system operator at the company's Energy Control Center had of trouble came when "the house lights dipped severely."

"No," explained Edwin J. Nellis, the 62-year-old system operator. "We didn't see this first on the instruments."

He said that he gave the order to cut New York City and Westchester away from the grid after other parts of the grid upstate had begun to draw an immense amount of electricity from the Con Edison system. For this reason, Con Edison officials insisted that the failure originated out of their system. Because no dials registered the drain until it had already occurred, the investigative task was that much harder. That was why the oscillograms could prove to be the key "witnesses" at the F.P.C. hearings.

Elsewhere, the utilities engineers and executives moved their detective work indoors to their charts and graphs. At Binghamton, the New York State Electric & Gas Corporation checked all its instrument data, concluded that the fact it was one of the first systems to black out-at 5: 16 P.M., about the same moment that Rochester also went out-did not necessarily implicate its equipment and operation. The company's engineers hoped that the records of power surges and flows would hold the key to the failure. Such records were gathered from its plants and substations in the forty-three upstate counties served by the utility.

The chairman of the Rochester Gas and Electric Corporation went away from the initial Washington hearings unable to explain the puzzle. "We are certain that it did not originate on our Rochester system," Robert E. Ginna declared "And no testimony at the hearing has indicated anything to the contrary." But, in fact, perhaps the first indication of trouble anywhere in the northeast showed up on the dials of the utility's Andrews Street distribution center in Rochester. The utility, Mr. Ginna said, had been receiving 200,000 kilowatts under an agreement with the New York State Power Authority. Suddenly it stopped. "We don't know what happened to the 200,000 kilowatts," he said. "It just wasn't there." The authority had said that Rochester abruptly "'stopped taking" the 200,000 kilowatts of power late Tuesday. 'We wouldn't deliberately commit suicide," Mr. Ginna retorted.

The Rochester utility's normal requirements amount to about 500,000 kilowatts, and the system bad been generating about 300,000 with another 50,000 "spinning" in reserve. The rest is supplied from its power link with the State Power Authority. Whether the power stopped flowing or Rochester

stopped taking it, no one seemed to know. Once answered, it could be an important clue. Meanwhile, Rochester Gas & Electric hired special consultants from the New York City engineering firm of Ebasco Service, Inc. They were supposed to check two stations in the power link that might be "suspect."

Another focus of activity was Niagara Mohawk's System Operations Center outside Syracuse. From all the data it had gathered and inspections it had run, however, Niagara Mohawk reported that it still could not find any malfunction of its own equipment or any sign that neighboring systems might have been to blame.

So what did go wrong? F.P.C. staff experts said that the first two days of hearings gave them little to go on. The industry was still baffled. But there were some leads. One of the more interesting ones some engineers said, was the way that the lights went out. They didn't just go out suddenly. They dimmed, Bickered, then died. And the timing might provide a tipoff-5: 17 in Rochester and Binghamton, 5: 19 in Orange and Rockland counties, 5:22 in the Niagara Mohawk area, 5:25 in the area served by Central Hudson, 5:27 in New York City and 5:28 on Long Island. This, some experts believed, indicated that the system was fighting to correct itself, until the disturbance became more than it could cope with. This might explain the unusual surges of power in transmission lines just before the failure. Shortly after 5 P.M. on Tuesday, power was coursing eastward across the New York state trunklines. This was normal. It was the peak load hour, and New York City was drawing heavily from the grid. Suddenly the surge reversed itself, throwing a shock into the entire grid.

With this in mind, Niagara Mohawk engineers at first suspected that the troublespot might have been a generator that got out of step. This maverick "quarrelled" with the other generators and threw the grid out of kilter. Normally all public utility generators east of the Rocky Mountains are phased in unison so that alternating current can be switched from point to point at will throughout the interlocking networks. The cycles of their output are synchronized. A slight variation can be tolerated if it is soon brought into line. A major variation forces other generators to "hunt" for a new phase more aligned to the maverick's. This produces what engineers call "instability." They sometimes use the analogy of a team of men pulling a rope in the same direction. If enough of them start changing direction and force, it could throw them all off stride. The out-of-phase current finally causes other generators on the circuit to shut down. The more generators that cut off, the more that will follow suit. For any generator feeding current into the system at that point would be so overloaded that its safety devices, the circuit-breakers, would bring it to a halt.

In the case of the New York transmission lines, engineers speculated, their circuit-breakers may not have been sensitive enough to catch the "quarrel" in time. Because the lines must be able to accept a wide range of loads, up to 345,000 volts, its circuit breakers are not always able to detect slight variations in phase. Other lines, such as in neighboring Pennsylvania and New Jersey, . were protected by more sensitive circuit-breakers that isolated their regions before they, too, were affected. Edward L. Hoffman, assistant to the chief system electrical engineer of Niagara Mohawk, said that it was true that some generators dropped out of phase. But that, he said, "was secondary to the main cause of the failure."

Thus the investigators returned to the original question: what was the source of the power failure7 All Mr. Hoffman could say was that there was "some kind of disturbance somewhere that caused the generators to get out of step." One theory held that an electronic impulse from a control center might have gone haywire or, through human error, was misdirected toward throwing a switch that poured power west and north. The exact region where such trouble could have started remained unknown. It could have been in New York State, Canada or even as far west as Michigan. Other investigators were questioning the role of the grid in the failure. Does its existence make blackouts more or less likely? What exactly prevented the series of automatic controls from switching on to localize the failure?

If the grid was somehow to blame, the Canadians said they wanted out. But by Monday, November 15, six days after the power failure, F.P.C. investigators had dug to the root of the mystery. It lay in Canada.

Before the F.P.C. hearings were to resume in Washington that morning, Chairman Swidler announced that the beginning of the power failure "seems to have occurred in the Ontario hydro-generating plants on the Niagara River."

On the same morning, before Mr. Swidler made his announcement, the chairman of the government-owned Hydro-electric Power Commission of Ontario called a hurried press conference in Toronto. W. Ross Strike, the chairman, is a reserved, staid lawyer cast in the mold of a British gentleman. A public servant for thirty-three years, he was appointed to the commission in 1944, became chairman in 1961 and has served longer in the post than anyone else-two years longer than Sir Adam Beck, the Commission's first chairman, after whom one of the Niagara Falls power plants is named.

Engineers, Mr. Strike told reporters, had zeroed in on the exact cause and location of the failure that plunged the north-

east U.S. and parts of Canada into darkness. It was a faulty relay at the Sir Adam Beck Station No. 2.

The plant, just across the border at Queenston, was the same one that on the night of the blackout was an early suspect, a possibility that the Canadians seemed to dismiss. After nearly a week probing the circuits and lines and data in that vicinity, it turned out to be true. The relay is a telephone-sized automatic control device that regulates and directs the flow of current. The type of relay involved at the Beck plant was one that measures the electric power load on a transmission line and sets a load limit beyond which circuit breakers will operate and break connections. When the relay failed to give off the proper signal and a circuit breaker did not open, the result was first a surge of excess electric current and then a draining away of power from the still functioning systems.

At the time of the relay breakdown, some 350 to 380 kilowatts of power were being fed over the affected Ontario Hydro line west toward Hamilton, Ontario. Because the relay did not work, there was an overload on the line. This caused relays onotherlhbmfeedingthroughtheplanttooperatecircuit breakers and the total of 1.6 million kilowatts going through the Beck station suddenly reversed course-as electricity will do when it is unable to flow in the direction it is supposed to.

Much of all this vast quantity of electric current raced back across upper New York State, tripping safety equipment from Rochester to Boston and points beyond. At this point, the second phase in the breakdown occurred. Consolidated Edison, in New York City, and other power companies to the south thathadbeen receiving power from the area knocked out of service by the power surge, were hit by a reverse flow in their own lines. Their power rushed, somewhat as air will rush to fill a vacuum, into the upstate New York-New England-Ontario region. The generators in New York City and elsewhere, inadequate to fill the huge power vacuum, automatically shut themselves off.

Mr. Strike described the situation at the moment of the breakdown. Hydro was importing 500,000 kilowatts of power and the Beck plant was feeding some 1.1 million kilowatts of locally produced power into the North American network Suddenly, and inexplicably, a relay failed. In an instant, power from Beck backed up into the U.S. distribution system causing a rapid increase in the frequency. This tripped safety equipment along the way-but, all of it apparently did not work.

Mr. Strike said, "A preliminary investigation indicates that protective equipment on the Ontario Hydro system failed to function in a normal manner and resulted in a power interruption. Early studies indicate that relay trouble isolated Hydro's Sir Adam Beck Station No. 2 from the Ontario system and this in turn fed some 1.1 million kilowatts into. the U.S. network. Protective equipment on the systems in the U.S. also apparently failed to operate and resulted in a major blackout."

"Everyone wishes it would be on the other man's system," Mr. Strike remarked later.

"We're not going to hide a damn thing," he said. "It's to everyone's advantage to find out what happened"

Mr. Strike said the location of the trouble in a relay station had been sensed last Friday and had been pinpointed on Sunday. As late as last Thursday, Mr. Strike was blaming United States utilities for not divulging information to help Ontario's investigation of the blackout.

Although only a few Niagara Falls plants and the power project itself suffered any interruption in flow of power, the situation rapidly became more acute elsewhere. At 5: 17 in the Robert Moses Niagara Power Plant at Niagara Falls, dials on automatic control devices began fluctuating wildly. The Moses Plant is the heart of the State Power Authority installation. The dials show the amount of power that the Moses Plant is producing, the electricity that is flowing into its switchyard, the power moving through the area for the Northeast Power Grid and other factors that affect the plant. At the same time, the generators had been producing power at a synchronized 120 revolutions a minute. Twelve of the thirteen hydraulic turbine-generators, each with a rating of 150,000 Kilowatts, were on the line. State Power Authority officials said that this was normal for that time of day.

The evenlv bitched hard whine of the generators became discordant, each began spinning at different speeds, each producing a different sort of whine. This resulted from the sudden fluctuation of power frequency and a sudden sharp drop in power demand.

Automatic governors, which set the speed of each generator, went into action, but soon the generators were "fighting each other," engineers said. As one began to slow down to compensate for the loss in demand, another would speed up as its automated equipment sensed an increasing demand for its own power production. Power within the plant went off—one of the few locations in the Niagara Falls area where a blackout occurred. Protective devices in the plant operating automatically, had disconnected the plants own electric service from its home-produced power.

Herbert Hibbard, assistant chief project operator, took three men with him and ran downstairs to take over manual operation of the units. They gradually synchronized each generator,

bringing each back to its proper operating speed. 'Ibis enabled resumption of electric service to the plant. By 5:45 P.M., operations were proceeding about normally. However, about 6:30 P.M. the frequencies of the generators shifted once more as the system-wide demand for power again became chaotic: Again the operators calmed the generators.

There were no other interruptions at the New York State installation, but engineers began checking the transmission lines that feed the output of the project south and east-to Rochester and Syracuse and to the St. Lawrence project. Lines from the project to Ontario Hydro were kept out of service on the request of private utilities.

In Washington, Mr. Swidler immediately submitted a detailed report to the White House., the Office of Emergency Planning and the Department of Defense.

When the Beck relay broke, Mr. Swidler reported, 'There followed a series of trip-outs of transmission lines and generating plants" throughout the upstate New York system. The trip-outs "resulted in the transfer of a large block of load to the New England and southern New York systems including the New York City system. The load thus shifted to the New England and southern New York systems was beyond the capability of their generating plants, and the result was the complete collapse of their service."

Why had it taken the investigators so 'long to find that faulty relay? Mr. Swidler had carefully avoided any speculation. It was not even clear when the F.P.C. finally homed in on the Ontario plant. Officials in Washington suggested that Mr. Swidler may have been inclined to be particularly cautious about naming the Ontario Hydro plant as the source of the original trouble because a foreign nation was involved. In any event, it became clear on Monday that the Power Commission's investigation had focused on the Beck plant as the source of the trouble at least as early as late last week. Mr. Swidler's official statement made a point of the fact that officials of Ontario Hydro had been involved in the investigation throughout.

One problem with identifying the source was the fact that the malfunctioning relay operated normally once power was restored Tuesday night in the Ontario Hydro system. So did all other equipment in all of the affected companies, except for generators and other equipment that had been damaged clearly as an effect of the breakdown, rather than as a cause.

These revelations helped explain the great reversal of power in the New York transmission lines. The disturbance tripped off generators all along the line. When they went off, a tremendous amount of power flowed toward the north from

the Con Edison generators. "Our generators," Con Edison's Chairman Forbes said Monday evening, "were unable to respond quickly enough to the enormously increased load thrown upon them-over a million kilowatts--and this resulted- in the shutdown in New York City."

Many questions remained unanswered. What caused the relay to go on the blink? How long was it out? Mr. Swidler gave no indication of what initially caused the disturbance. And out of Queenston came one report that a failure of an oil-immersed circuit breaker-one of the eighteen in the Hydro switchyard there triggered the whole breakdown Resembling huge boilers, they are key components in the transmission of power. One of these failed about 5:15 P.M. on the day of the blackout, according to evidence traced down by Ontario Hydro computer studies.

The Federal Power Commission, Mr. Swidler said, would continue its investigation. They wanted to know what kicked out the relay and why the failure spread as widely as it did. A mystery had been solved, but another one remained to be solved. Ontario Hydro engineers offered to help the F.P.C. experts from the affected utility companies, F.P.C. stag engineers and teams of consultants began intensively studying the power flows and other data. Out of this they reconstructed in general the various power movements and the operating failures of The Night The Lights Went Out. Hopefully this investigation, Mr. Swidler said, "will suggest measures to minimiie the possibility of a recurrence."

Until a crisis occurs-such as the one on November 9th the American public knows little and cares less about the Federal regulatory agencies that have been set up to protect its interests. But now that almost all the lights did go out one night in the most densely populated area of the nation, and now that more and more electricity is being traded back and forth over bigger and bigger areas, tbe name of the Federal Power Commission is creeping further and further up in the news.

There is now a general belief that the commission is empowered to regulate the electrical industry from top to bottom. That., of course, is what private-power protagonists fear may happen and public-power adherents fear will not.

The commission has limited and specific authority. Its decisions affect many people and there are few decisions it makes that do not cause controversy, whether from nature lovers and conservationists who opposed its permission to Con Edison to build a plant at Cornwall on the scenic Hudson, or from the industry people who support or oppose letting private electrical companies build plants on the waterways of

the Northwest There has been a good deal of misconception about the powers of the commission and about the role of its members. Its authority is limited, although its role grows. The blackout raises questions about its future in developing the electrical resources of the country, but the answer must come from Congress.

What can the commission do? Fii of all, it has the authority to grant licenses for hydroelectric plants built along the country's waterways. It has no control over the construction of plants built elsewhere and much of the country's energy come from steam-powered plants not situated on rivers. Second, it is charged with regulating the rates of companies in interstate operations. This applies only to wholesale rates; retail rates come under the authority of the states. Third, it has much greater authority over natural gas than over electricity. Fourth, it is required by law to check the country's power resources and to encourage the voluntary development of the intergrid electrical systems. But it cannot force the creation of grids.

Although the commission was established forty-five years ago, it has become an agency of action and decision, many observers feel, only since President Kennedy took office and appointed Joseph C. Swidler as chairman. This is not to say that it has become a wild-eyed promoter of statecontrolled electricity. Mr. Swidler has often said he favors coexistence of public and private power. He is generally considered to be a moderate concerned with but not over-zealous about the jurisdiction of his agency.

The commission was established in 1920 with powers only to oversee the development of the tben-new hydroelectric systems. It was founded on the premise that the waterways belong to the public, in many ways parallel with the air, which is regulated by the Federal Communications Commission. At first, the F.P.C. consisted of members of the Cabinet. In 1930, the present organization was arrived at-five members appointed to four year terms by the President. The chairman receives $28,500 a year, the other commissioners, $27,000.

In 1935, on the wave of the New Deal, the commission got its first broad responsibility. The Public Utilities Holding Act gave it a jurisdiction over interstate, wholesale electric rates. It was required to establish a uniform system of bookkeeping for electrical companies, "to get the water out of the books," as one observer noted. Even with those powers, the commission did not have much to do with electricity thirty years ago. Most electrical companies operated entirely within state liner and were not affected.

Three years later, the Natural Gas Act of 1938 gave it wide

powers over the pipelines that were feeding gas to consumers. Here again, it regulates wholesale rates to "the city's gate." At that point the rate becomes a local affair. Overall, the commission has had more impact on the gas industry than on the electrical producers.

With the advent of President Kennedy and Mr. Swidler, the commission turned its eyes more to electric power. While it cannot order companies to form intergrid systems it can in some instances compel them to supply existing power to small communities and cities that have difficulty in buying directly. One of its first cases under the Kennedy Administration resulted in a New England electrical producers supplying power to the town of Shrewsbury, Massachusetts. The community had formerly been forced to buy through a middleman supplier at greater expense.

In December, 1964, the commission issued a long awaited report on national power. The report concluded that by accelerating electrical interconnections, consumers might realize an $11 billion saving by 1980. Since the blackout, the report itself has become an item of dispute as part of the debate over whether intergrids will help or hinder in the future.

In the gas industry, the commission has also been active. It decided last September that two rates should be applied to gas emanating 'from the Permian Basin in the Southwest. This decision allowed higher rates to be charged for gas from gas wells than could be charged for gas that came as a by-product from oil wells. It was designed to stimulate further use of resources. The action established a permanent system for regulating production of natural gas. Although the transmission companies and consumers welcomed it, the producers did not. The whole matter is ndw in court.

In 1964, the commission voted three to two to allow the private Pacific Northwest Power Company of Portland, Oregon, to build a $200 million dam on the Snake River. Mr. Swidler and David S. Black, another commissioner, dissented, holding that the publicpower system of Kennewick, Washington, a group of sixteen public-utility systems had the preference under the Federal Power Act of 1935. Secretary of the Interior Stewart L. Udall said he favored a Federal dam as the best wav to coordinate Federal proiects in the area and to get maximum regulation and power for the entire Columbia River Basin.

Because of the tendency to categorize people, the commission members are often said to represent either the public or the industry. In practice it is difficult to find any one member who can be painted entirely one complexion or the other.

Mr. Swidler, the 58-year-old chairman, was feared by the

industry agents when he took office. He was a Kennedy appointee, a veteran of President Franklin D. Roosevelt's "100 days," a man who for many years has called himself a liberal Democrat.

"I am in favor of the present dual system of part public and part private ownership," he once said. "This dual system is good for the private utilities, good for the public -systems and, above all, good for the public."

Mr. Swidler's term on the commission expired last June 22, but he was asked to remain at least until November 15. He had planned, immediately after leaving the commission, to go into private law practice in partnership with David Freeman, who is assistant to the chairman. There had been speculation that President Johnson would not be sorry to see Mr. Swidler go. But there did not seem to be any basis for this. After the blackout, Mr. Freeman said the President had telephoned Mr. Swidler, coincidentally, only two hours before the blackout November 9 and asked him to stay on. Mr. Swidler agreed to stay as chairman until the end of the year.

Lawrence J. O'Connor was also appointed to the commission in the first year of the Kennedy Administration He is said to be the most industry-minded man in the group, yet the 50-year-old Texas oilman, a Democrat, has not cast his vote with entire consistency, although he does believe in less regulation than do some of his colleagues. Mr. Black, a 37-year-old lawyer from Seattle, has no party tag, although he has been described as a moderate liberal in politics. He has had a career in state and Federal agencies and is considered to be au advocate of public power. He was appointed in 1963.

Charles R. Ross. a Vermont Republican. was named commissioner in 1961. He was reappointed by 'President Johnson in 1965. The 45-year-old lawyer is generally assigned to the consumer side of the ledger by those who assess the commission's opinion.

The law requires that the commission be bi-partisan and thii led to the appointment of Carl E. Bagge earlier this year. Mr. Bagge, thirty-eight years old, was general counsel to the Atchison. Topeka & Santa Fe and has been active in the Republican party. Although his appointment was said to be one of an industry-minded man, his voting trend is not yet apparent.

Some powers of the commission are now being studied by Congress. For example a bill under consideration holds that all electrical production is of a local nature and would threaten the F.P.C. jurisdiction over wholesale rates.

The Federal Power Commission has been expanding over the years. Today it has eleven hundred employees. Most of them work on gas problems but recently more attention is being focused on electricity. Its headquarters are a few floors in the General Accounting Office building but there is a feeling that more room will be needed. Its field activities grow out of offices in New York, Chicago, Atlanta, Fort Worth and San Francisco.

As of now, no one can say what the future of the Federal Power Commission will be. But there is little doubt that it will have increasing responsibilities in the years to come as the country's power supply knits more tightly together. Its relation to the consumer, particularly in the huge towns and cities, may seem remote, but its effect is felt in one way or the other by almost anyone who pays an electric bill.

7. A Call from the President

As the President and Mrs. Johnson rode a few miles north of their Texas ranch, the radio in their white Lincoln Continental tuned in to the 6 o'clock news broadcast. President Johnson heard the report that sudden blackness had blanketed New York City and great areas of the northeast.

His quick concern as President was for the people--their health, their wellbeing, their safety. His quick concern as Commander-in-Chief was for the defense of the country.

Hi first act was to reach for the receiver of his radio-telephone and call Buford Ellington, director of the Office of Emergency Planning, and Secretary of Defense Robert S. McNamara. While he talked, the purring car closed the distance to the LBJ ranch.

The blackout crisis was proof again that for the President there is never escape from office. He had gone to his ranch near Johnson City 'seventeen days earlier to recuperate from surgery, performed on Oct. 8, to remove his gall bladder and a kidney stone.

The ranch is home for the President, his retreat, his return to himself, and he tries there to keep the chores of the Presidency to their minimum. The day started quietly. He had arisen early, by custom, and had received word from his Armed Forces aide, Colonel James Cross, and his personal physician, Vice Admiral George G. Burkley, on the hospitalization of General Eisenhower at Fort Gordon, Georgia. The President telephoned Mrs. Eisenhower, then sent a wire to the general.

Following his doctor's standing orders, President Johnson took a walk around his ranch, then went to his desk to check some documents. He approved a reorganization of some of the operations of the Department of Health, Education and Welfare and gave directions to have Secretary of State Dean Rusk,

Mr. McNamara and other top foreign policy advisors to come to the ranch two days later for a conference.

He ate lunch with Mrs. Johnson and took his customary nap. It was later in the afternoon that he began his drive around the Texas hill country. He loves this country and finds a sense of well-being and peace there. As the sun begins to go down behind the rough hard-scrabble hills, Mr. Johnson often takes his car out on the public roads to see the deer and watch the sunset.

The sun was soon to disappear, leaving Texas in darkness, when the President's radio told him of the startling loss of light in the eastern cities and towns and hamlets.

Completing his calls to Mr. Ellington and Mr. McNamara, the President next talked to Joseph A. Califano, Jr., one of his special assistants, who was also in Washington. His fourth call was to his press secrtary, Bill D. Moyers, who had established the temporary White House press headquarters at the Driskill Hotel in Austin, sixty-five miles east of the President's ranch,

It was not very long before the President was sitting at his desk in the white ranch house, where, except for a quick meal in the dining room only several steps away, he remained in office and conference by telephone throughout the evening, until he went to bed at 1 o'clock in the morning.

The President gave directions for full Federal assistance to the governors of all the darkened states and received assurances from the Pentagon that all defense systems were 'go"-safely intact and smoothly operating. Every military installation, the Pentagon announced, had auxiliary power systems, and these had "kicked on," usually automatically, where the lights in the stricken zones flickered, then died.

Confident that he had cleared his desk of first-priority measures for the emergencies at hand the President turned quickly to his concern for the future security of the people and the country. He dispatched this urgent memorandum to Joseph C. Swidler, chairman of the Federal Power Commission:

'Today's failure is a dramatic reminder of the importance of the uninterrupted flow of power to the health, safety and well-being of our citizens and to the defense of our country.

'This failure should be immediately and carefully investigated in order to prevent a recurrence. You are therefore directed to launch immediately a thorough study of the causes of this.

"I am putting at your disposal the full resources of the Federal Government and directing the Federal Bureau of

Investigation, the Department of Defense and other Government agencies to support you in any way possible.

"You are to call upon the top experts in your action in conducting this investigation. A report is expected at the earliest possible moment as to the causes of the failure and the steps you recommend to be taken to prevent a recurrence."

People in trouble-and rarely have there been such sudden full-scale trouble and potential peril as there were that Tuesday night of darkness-means also and instantaneously that a nation's defenses may be down; it was the military security of the United States that created that night so much concern in so many places.

Mr. Moyers, who from the Colonial Room of the hotel was funneling the news and developments from the temporary White House in Texas to an anxious nation. was asked about the President's reference to the Federal Bureau of Investigation in the directive to the Federal Power Commission. Did this mean that the Government believed sabotage was involved?

Mr. Moyers, cool as always, replied:

"This indicates nothing other than that all the resources of the Government are to be at the disposal of the Federal Power Commission in making the investigation."

He added that the President had not talked with J. Edgar Hoover, director of the bureau, but had indicated to the Justice Department and other Federal agencies that he wanted complete cooperation in the inquiry.

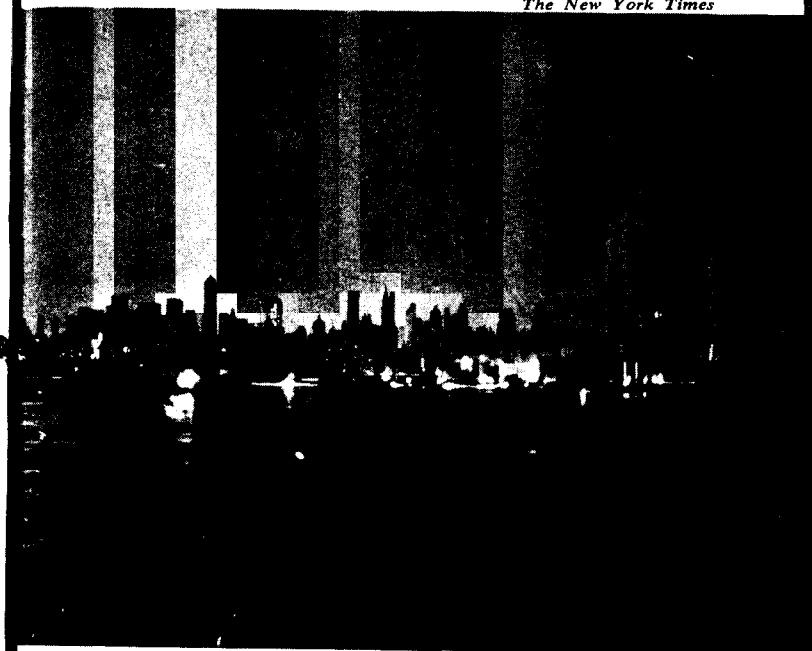
In the usually uncommunicative headquarters of the FBI in Washington nobody talked, on the record or off the record. The assumption was, however, that agents of the investigative agency had moved at once, fanning through the blacked-out regions and checking with the local police departments.

As the hours passed, however, and then as the days went by, sabotage did not emerge as the villain. But uneasy in many minds was the thought that it *could* have been sabotage, that if indeed the darkness that suddenly engulfed 30 million Americans was finally traceable to a single "unimportant" power plant going out of whack, might it not then be equally plausible for half a dozen saboteurs to paralyze the country's vast interconnected power systems simply by cutting a few wires?

The question-and the grim possibilities--raised another question-and even more grim possibilities-on the vital issue of survival: defense. Were the country's defenses also vulnerable when so much of the power that feeds the armed forces could short circuit into nothingness?

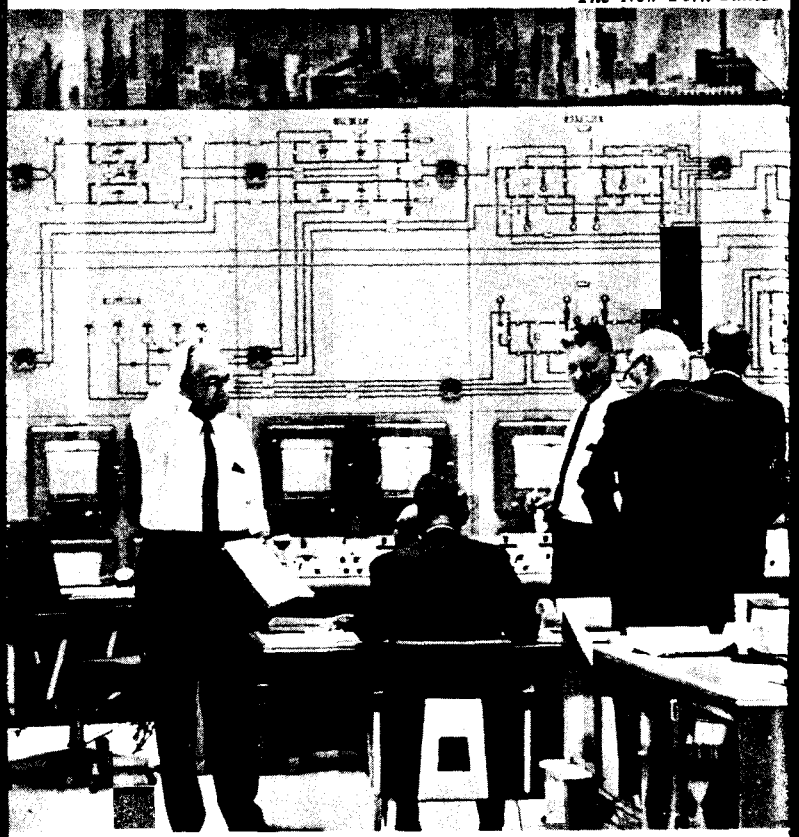
All the information that has been given out by officials of the Department of Defense and all the information that has

The New York Times



The blackened city seen from New Jersey.

The New York Times



Consolidated Edison Energy Control Center's night crew.

been pyramided by probing reporters add up to evidence that the defense network functioned smoothly.

From General Thomas **Powers,** the blunt-spoken 'man who once **commanded** the Strategic Air **Command and** is now in retirement, came the most terse and assuring comment on the continuing operations of one of the **country's** most vital defenses--SAC.

'The Strategic Air **Command** has its own methods of generating power," he said. "It doesn't depend on anybody."

Confident in their system that provides **auxiliary—completely** independent-power at all Air Force, Army and Navy installations, officials at the Pentagon nevertheless checked major military stations throughout the country in a swift **precautionary** measure when the blackout descended. They declared that military operations and communications had not been seriously affected. The word "seriously" was apparently a bit of military conservatism. The Pentagon meant that its bases had not been totally uninvolved, but, caught for the moment in the blackout, they had been able to switch to their own power sources.

The statements out of the Pentagon did not quiet all fears. Representative L. **Mendel** Rivers, Democrat of South Carolina **and** chairman of the House Armed Services Committee, called on Mr. **McNamara** to make a "full report" on the effect of the power failure on national defense.

"Such a failure must come as a great shock to the American people, for it indicates a heretofore unrealized vulnerability that could have most serious consequences," Representative Rivers said to the Secretary of Defense.

There was one report that the Nike Hercules base near Hartford, one in a series of air defense installations housing batteries of anti-aircraft missiles, had been **immobilized** by the blackout. But inquiry at the Pentagon produced only the comment that investigators were "looking into everything" and would make their report through the Federal Power Commission to the President. Unofficially, spokesmen at the Pentagon were acknowledging that the defense communication **system** probably had not been "perfect." A reporter making a call to the White House telecommunications center three days after the blackout was told that everyone in the center **was** very busy "re-examining how we came out."

Nobody would openly discuss the 'hot line'*-the special telephone that connects the White House with the **Kremlin—** when inquiries were made to determine if the vast blackout had shown weaknesses that could someday critically delay communications between the heads of the two great nations. But it was indicated **unofficially** that the "hot line" had not been

affected, and those who know the operational procedures at the White House noted that there were "several" alternatives always available to keep the power working on the key link.

It is these "alternatives," or "back-up systems" or what in military jargon is called "redundant systems," that kept defense installations free of the crippling power failures.

While there was same initial and very brief trouble during the blackout, quick switching of power sources made it possible for the Pentagon to communicate with every base and depot.

First to be checked during the early-and suspenseful-minutes of darkness were the three regional bases of the Strategic Air Command: the Westover Air Force Base at Springfield, Mass., the Griffiss Air Force Base at Rome, N. Y., and the Plattsburg, N. Y. Air Force Base. Simultaneous checks were made with other major installations, including SAC headquarters at Omaha and the North American Air Defense headquarters in Colorado Springs.

"There are reports of difficulty on some land lines, but there are adequate alternate routes to take care of such emergencies," the Pentagon reported shortly after the civilian power network collapsed.

Independent generators on the tiny island post of Fort Jay in the middle of New York harbor, headquarters of the First Army, kept military activities there in full swing; soldiers and their families stared from the windows of their old red-brick barracks at the eerie scene of a lightless metropolis looming up from dark waters.

Throughout New York and New England the lights at the military landing fields blazed brightly from their own generating sources, and in many instances commercial aircraft, their pilots dismayed as cities below them suddenly vanished, Winged in for safe landings on military strips.

The Navy, with a number of warships in darkened harbors along the coast, dispatched them to power stations and hooked them up together to provide temporary electricity, while the Army rolled out many of its portable generators and lent them to critical land spots to give power.

Typical of the emergency service offered stricken land areas by naval ships was the case of the U.S.S. Bristol, a reserve training ship berthed at the naval shipyard in Brooklyn. The destroyer, which has two steam and two diesel turbines capable of generating 500 kilowatts, was ordered to proceed to two plants of the Consolidated Edison Company.

With Commander William S. Butler on the bridge, and a skeleton crew of 60 officers and men aboard, the Bristol left the naval base five hours after the city's lights began flickering, arriving at the Consolidated Edison plant on the East River at

Astoria, Queens, about midnight. The remainder of the ship's crew, another 60 officers and men, had gone on shore leave earlier.

Before leaving the naval base, Commander Butler took aboard a supply of electrical feeder cables to use in transmitting power from the ship's engine room to the plants on shore.

When the Bristol arrived at the Astoria plant emergency crews there already had the generators going again. Two hours later and four miles down the river the Bristol found that the second plant-at 14th Street &Manhattan-had also been able to get going again. But the Bristol anchored in the middle of the East River and stood by through the night, symbol of the defense elements essentially untouched by the crisis but ready to serve as needed.

Responding to orders from the President to help wherever they could, the military services offered all kinds of assistance. The naval air station at Floyd Bennett Field in Brooklyn supplied mobile power units to keep the lights and vital equipment in operation at Brooklyn General Hospital. One hospital received a shipment of ice from the naval shipyard in Brooklyn.

But for the military services the military needs, of course, came first, and it is these critical needs that were fully met, according to the Pentagon spokesmen. Washington was virtually unaffected by the blackout, except for a momentary "dip" in the local power system, but had the nation's capital suffered a power 'collapse the Pentagon could have kept in full operation through the use of its own auxiliary sources.

But if the Pentagon were someday to be eliminated-a direct missile hit, perhaps, crippling all communications-there are still a number of communication alternatives to link the crews flying on SAC patrols and the men underground in the missile silos across the country, according to Defense Department officials. They say that the blackout, insofar as it affected the military network at all, demonstrated dramatically how independent their own communications and power plant systems were. How many communication alternatives are available to military posts if the regular commercial links are broken are often a military secret, but in some highly sensitive installations there are reported to be "four or more" separate systems.

In many defense posts an auxiliary generating plant "kicks in" automatically within sixty seconds of the moment that the civilian power source fades, while in the major defense installations-the SAC airdromes, for example, and other key bases -the "back-up generator" is keyed for instantaneous switch-in.

Pentagon officials say that they did not need to wait for the blackout crisis to test the readiness of their standby generat-

ing units. At the key defense bases the auxiliary Rower units are tested every week, each test lasting far four hours.

The cry went up quickly after the blackout ended: why can't the rest of us have "back-up" and "alternative" systems, if the Army and the Navy and the Air Force can have them? The Army and the Navy and the Air Force say there is no great secret to their success; they simply are forced to install their several systems, for reasons of national security, and bother the cost, which is enormous. The stockholder and the taxpayer, they note, are not likely to approve spending that kind of money for less than urgent provisions.

In his column in The *Nation,* written the day after the power blackout for *the editorial* page of *The New York Times, Ar*thur Krock touched on another aspect of this question. He stated that it had been "amply proved to about thirty millions of Americans last night that vast reciprocal integration of the industrial sources of power and light, a corollary of the federalization concept, can create a calamity of the same size instead of compensating for a local failure." Mr. Krock, arguing that bureaucratic doctrine and procedures did not deserve all the blame, paid special tribute to the armed forces:

"The armed forces contain bureaucracies, too, and more of its members are in uniform than not. However, it is notable that there was no breakdown of communications or electronic installations in the defense centers last night. And this fact, taken in conjunction with the Navy's solution of the problem which overwhelmed the light and power companies through the United States-Canadian complex, called Canus, suggests that the investigation the President has ordered may reveal a superior competence in the military administration of these facilities, where the political issue of public versus private power does not reach.

'The Navy was confronted by the problem when the electrical system on the battleship North Dakota failed and the vessel was exposed for fourteen minutes to a Japanese bombardment it was-unable to return. Immediately orders went out for the installation of auxiliary power and for a schedule of constant drills in turning it on. Also, the experience of the North Dakota was made the basis of meticulous and successful planning for anything electric or electronic which might conceivably go wrong."

The "back-up" principle, as a matter of fact, was also in use by the telephone companies, which helped to keep the defense establishments working without any real interruption. For example, there are 505 buildings operated by the New York Telephone Company in New York and in each one of these 505 structures a standby diesel generator switched on

automatically when the blackout came. It marked the first time that all the standby generators operated simultaneously, to provide continued service for 9.7 million telephones in the state.

Nat so certain was the efficiency of the civil defense system during the crisis. Some military officials in Washington conceded privately that the blackout showed, as one officer put it, "a type of vulnerability," but they tended to regard it as more of a police and civil defense problem than a military one. Less pessimistic judgments were made, however, by the Civil Defense authorities themselves, who said they regarded the experience as a successful demonstration of their operations. A spokesman declared: "Our job is to keep people informed, and we did. There was no panic."

While military officials were checking their vital installations in the darkened areas, the Civil Defense chiefs communicated with each of seven hundred warning points throughout the country.

The first Civil Defense calls went to the ninety-seven warning points in Region I, covering eight states in the Northeast. Within two to five minutes, a spokesman reported all communication points were in contact with headquarters in Washington. Civil Defense warning stations were apparently able to relay complete reports of what was going on. These relays went in two directions-providing information about a local area to Civil Defense headquarters and providing to local areas reports received from Washington.

But liaison may not always have been as smooth as Civil Defense spokesmen contended. Governor Rockefeller, for example, quickly complained that he was unable to communicate with the public over a single hookup during the blackout because the Federal Government had failed to implement a new civil defense communications system in the state. The governor reached the public by individual radio stations. In some cases he went on "live," in others, hi message on what authorities were doing about the emergency was taped.

Mr. Rockefeller characterized the lack of such a system as a "major weakness" in emergency procedures. He said that the old Conelrad civil defense system, in which two points on the radio dial provided reception in an emergency, was abandoned two years earlier. In its stead, a straight Federal subsidy to twenty-five radio stations in the state, to pay for diesel- or gasoline-powered auxiliary generators then was proposed to enable the stations to remain on the air in emergencies.

Mr. Rockefeller said that the $1 million or less needed for the subsidy has not been made available.

But civil defense officials in New York City said information during the emergency had been received and relayed

through the entire Northeast region by a radio-telephone network of the North American Air Warning System. This is a 24-hour-a-day hookup under the North American Air Defense Command.

Less technical, and much more pictorial and dramatic, was the convergence in armories of National Guardsmen summoned by radio and telephone to emergency duty. More than Eve thousand of them, mostly men of the 42d (Rainbow) Division and the XVII Corps Artillery, turned up in armories in New York City to help the police lead stranded subway riders from dark tunnels, direct traffic and rush emergency generators to hospitals. The Guardsmen opened their armories to shelter hundreds of New Yorkers and visitors to New York, who had no way of getting home. Hundreds of them spent the night trying to sleep on floors or in wooden chairs.

Civil Defense headquarters at 135 East 55th Street resembled a wartime command post, dimly lit by battery-powered battle lamps. The city's Civil Defense director, Major General Robert E. Condon, sent generator-communications units to City Hall, police stations and firehouses.

General Condon would not estimate the number of Civil Defense workers who turned out in New York City to meet the crisis, but other officials gave a guess that the total may have been as high as 200,000.

All of this was soon history, soon the stuff of personal recollections to be told and retold, but it was also something that made for uneasy memory. There was every sign that the nation's defenses had met the crisis, had demonstrated clearly that they could keep functioning within a wide area of paralysis.

At the same time, every crisis teaches, and the Eastern blackout had its own lessons to give, its own implications for the terrible day that could come when vast paralysis might be prelude or part of war. For a long time after the lights went out in the country's Northeast regions the lights burned specially brightly in the Pentagon as strategists analyzed the crisis, studied its import-and planned.

8. The Fail-Safe Syndrome

Few events since the last war have awakened such deep uneasiness as did those of Nov. 9, 1965. When reports began coming in that communities as widely separated as New York and Boston had been hit, ill-defined fear took hold of many citizens. It seemed impossible that so many cities could be struck by a single accident. The only alternative explanation was that the blackouts were occurring by design. What did that mean? Was it sabotage, prelude to an attack? Was it a demonstration against the Vietnam war by a group of technically trained students? Or was it merely a surprise test of Civil Defense capabilities?

When later reports indicated that none of these was the probable explanation-that a single, inadvertent malfunction of some sort had knocked out the entire system-then fear for the present shiited to fear for the future.

In the first place, it was evident that a single ingenius saboteur could paralyze a large number of our cities. Secondly, it had been demonstrated with terrible effectiveness that our most sophisticated technology is far from foolproof. The electronics and automation of electric power generation, control and distribution over the most populous section of the country are not far removed from another family of highly automated systems -those relating to our national defense. Across the country Minutemen Missiles stand ready in their underground silos, each with its designated target in the Soviet Union. Across the Arctic Ocean there are other missiles, aimed at American targets. Supposedly no one man-and no one accident-can launch one of these weapons inadvertently. The chances, we have been told, that a nuclear holocaust could be started by accident are virtually zero.

Yet there is the "fail-safe syndrome"-the fear that this could occur despite all the safeguards. Fail-safe procedures are

those designed to provide back-up protection in case some component of a system malfunctions. Breakdowns of such procedures have been dramatized in books and moving pictures such as "Fail Safe" and "Dr. Strangelove." The events of November 9 apparently constituted a chain reaction that raced through the vast power grid of the northeast, paralyzing its generators one by one. It resembles, too closely for comfort, the chain reaction that could be initiated in the defense system of a great power by an accidental launching or some "highly improbable" event, such as the explosive impact of a giant meteorite.

November 9 also brought to mind some of the visions that men have had of a civilization become SO automated that it collapsed from the sheer weight of its complexity. The British author, E. M. Forster, has drawn a frightening picture of such a society in his story, "The Machine Stops." In his tale the world has evolved to the point where each person lives in his own underground cubicle, linked to others only by what would today be called television (the story was written before World War I). All human needs-light, food, even medical care—are provided by pushbutton control.

Civilization is thus one vast, global machine, driven by a "central power station" in France. If anything goes wrong-or if anyone gets out of line—the "Mending Apparatus" takes care of it. Then, suddenly, the Mending Apparatus itself begins to fail. The power plant weakens. Lights dim. The artificial air becomes foul. Automatic beds the world over fail to function. Finally there is darkness and frightful silence. Those born and raised under the Machine realize for the first time that it hummed. Then all perish.

Are we moving toward such a catastrophe? There are brilliant men who believe so. One of them is Fred Hoyle, a leading cosmologist, science fiction author and Plumian Professor of Astronomy and Experimental Philosophy at Cambridge University in England. He has sounded his warning on a number of occasions, particularly in a lecture entitled "A Contradiction in the Argument of Malthus," given at the University of Hull. It was the English clergyman and economist Thomas R. Malthus who argued at the end of the 18th Century that the population always increases faster than the food supply. He viewed starvation and war as the characteristic brakes on population growth.

Mr. Hoyle believes this is no longer the case. Technology is making it possible to provide for more and more people. As it does so, it becomes increasingly complex. Centralization and bigness make for greater production efficiency, be it the generation of electric power or the processing of food. But such societies become increasingly vulnerable to catastrophic disruption. When mankind was primarily rural, each family was largely independent and self-sufficient. Now. we have already reached the stage where a disruption of the arteries of power, of food, or of fuel can be disastrous, as those planning Civil Defense are vividly aware.

Mr. Hoyle argues that our civilization will become so vulnerable that it will ultimately succumb to some such threat as a new disease, a nuclear war, or simply a general collapse like the one depicted by Forster. Then, in his hypothesis, a new society will slowly evolve, populated by beings somewhat better equipped to deal with the problems of overpopulation and technology. They, too, will ultimately fall, he says, to be replaced by an even more public-spirited and intelligent race of beings. This sawtooth pattern will continue, he theorizes, until a society finally emerges fully capable of a long-term survival.

Harrison S. Brown, professor of geology at the California Institute of Technology, is less optimistic about the ability of successor societies to become technological. The easily accessible resources of this planet have been exhausted-the iron, coal, copper, oil, etc. Hence he fears that those surviving a holocaust would be unable to build a new civilization such as our own.

The optimists, however, point out that the events of Tuesday night not only illustrated the weakness of our society but the marvelous ingenuity and adaptability of the human being. This, in fact, may prove to be the flaw in the argument of Mr. Hoyle. New Yorkers witnessed countless remarkable performances by their fellow citizens.

This spirit of public service and cooperation in the-face of common danger, so typical of wartime and other crises, may have roots in primeval herd instincts. Will mankind recognize the ultimate crisis in uncontrolled technological development? Or will profit-seeking, love of comfort and ultra-hationalism lead man down the road envisioned by Mr. Hoyle and Mr. Forster?

9. Mr. Moyers

In time of crisis, when a nation is confronted by the unknown and a whole people are puzzled and afraid, information-the facts, the honest appraisals-becomes one of the most acute concerns of efficient government.

President Johnson, after hearing on his radio about the massive power failure, made his first of four emergency calls on his radio-telephone to Bill D. Moyers, the White House press secretary.

Mr. Moyers had established the temporary White House press headquarters in the second-floor Colonial Room of the Driskill Hotel in Austin, an hour's fast drive from the President's ranch. The call from the President reached the 31-year-old press secretary in his own third-floor hotel suite. Half an hour earlier he had completed hi routine afternoon briefing for the corps of reporters covering the temporary White House, so most of the newsmen were still in the Colonial Room preparing or writing their stories. Those who were not were quickly rounded up, and Mr. Moyers began a marathon briefing that continued on and off for about seven hours.

As the hours wore on, the air became foul with tobacco smoke and the odors of stale food. Mr. Moyers stood at a lectern at the front of the room, alternately taking telephone calls from the President and his aides and then relaying information to the reporters. For emphasis he occasionally jabbed the air with a long, thin, black Brazilian cigar.

The briefings began so quickly and went on so late that no stenotypist was on hand to take down all of the briefing sessions by Mr. Moyers. Here, for the record, are reconstructions of some of Mr. Moyers' briefings that night on the blackout crisis, taken from the notes of John D. Pomfret, correspondent there for *The New York Times. The* parts that were recorded. in an official White House transcript are so marked.

Mr. Moyers first reported on the President's initial telephone calls from his car. He said that **the President had told them to stay on top of the situation as long as necessary, to report to him frequently and to offer the governors of the affected states all possible Federal Assistance.**

Mr. Moyers said that initial reports indicated that the source of the trouble might be a break in the power line running from Niagara Falls south at a point between Rochester and Buffalo.

He said that Mr. Califano had telephoned an aide in Gov. Rockefeller's office who had reported that the Governor was in a plane at the time of the failure and had been unable to land at Albany because the runway lights were out.

Mr. Ellington, he said, had asked that the people in the affected area use as little electricity as possible as their power was restored to avoid putting additional strain on emergency sources of electricity.

On the President's orders, Mr. Moyers said, Secretary McNamara had opened all military airfields in the area to commercial airplane traffic and had instructed military commanders in the area to offer all assistance at their disposal to officials of communities in their vicinities.

Mr. Moyers tentatively identified the extent of the area affected as parts of New York, Connecticut, Maine, New Hampshire, Vermont, Pennsylvania, Massachusetts and Toronto. He said that A. 0. O'Connor, the Regional Director of the Office of Emergency Planning in Massachusetts, at that moment had a conference call underway with governors in the affected region in an effort to determine the exact extent of the area.

Meanwhile, in Washington, Dr. Donald Hornig, the President's science advisor, was at work in Washington trying to discover the cause of the failure.

Dr. Hornig reported frequently during the evening to the President, then to Mr. Moyers. After talking with Dr. Hornig shortly before 7 P.M.—8 o'clock in the east-Mr. Moyers gave this report:

Dr. Hornig has just told the President that the best information we have at the moment is that the failure started in the area of the Niagara-Mohawk Power Company near Syracuse. According to Dr. Hornig, it was

not the Niagara Falls generator. The situation spread essentially by the domino effect-the cascading effect—from one switching point to another. As one failed in one area, this overloaded the next, it went out, overloading the one down the line, and so on. Our latest information is that they have not yet isolated the source of the original trouble. We are trying by all possibie means to track that down.

Mr. Moyers continued: the Niagara Falls-Massena, N. Y., facilities are back in operation. Power is back on iu the Rochester area. Consolidated Edison has informed Dr. Homig that they expect to have some power on within the hour and a fairly substantial amount in about three hours.

President Johnson said that he ordered Gov. Ellington to send the regional O.E.P. people out tonight to make an on-the-spot survey to see what would be needed in the way of items such as medical supplies and water.

Joe Califano has told the President that Gen. William McGee, head of the Federal Aviation Agency, has informed him that plane8 are landing at both Kennedy and LaGuardia Airports in New York now, the fields are using emergency lighting, but they are diverting a tremendous number of flights from Philadelphia, Boston and Albany and some flights from Kennedy to the south and west.

Mayor Wagner has reported to Joe Califano from New York that mainly the situation, as far as possible, is under control. All the emergency services of hospitals are operating. Fire and police stations are taking care of thousands of people stranded in the city. There has been a slight easing of the traffic jam clogging the streets.

At this point Mr. Moyers took a brief rest and then returned to the platform at 8: 30 P.M.

Following is the official White House transcript of this part of the briefing:

Mr. Moyers: The following is a memorandum already dispatched to the Chairman of the Federal Power Commission by the President:

Q. What is his name?

Mr. Moyers: Joseph C. Swidler.

"Today's failure is a dramatic reminder of the importance of the uninterrupted flow of power to, the

health, safety and well being of our citizens and to the defense of our country. This failure should be immediately and carefully investigated in order to 'prevent a recurrence. You are therefore directed to launch immediately a thorough study of the causes of this failure. I am putting at your disposal the full resources of the Federal Government and directing the Federal Bureau of Investigation, the Department of Defense, and other government agencies to support you in any way possible. You are to call upon the top experts in our nation in conducting this investigation. A report is expected at the earliest possible moment as to the causes of the failure and the steps you recommend to be taken to prevent a recurrence."

Q. Bii, does this in any way indicate there may be sabotage?

Mr. Moyers: This indicates nothing other than the fact that all of the resources of the government should be made available to the Federal Power Commission as they conduct an investigation.

Q. Bill, would you rule out nationalization as one of the steps to be taken?

Mr. Moyers: Would I what?

Q. Rule out nationalization of the power companies as one of the steps to be taken?

Mr. Moyers: That's not in anybody's mind.

Q. Bill, Swidler is retiring-resigning from his job on the 15th. Does that mean he will stay on until this investigation is over?

Q. What was the question?

Mr. Moyers: The question is that Mr. Swidler has already announced that he will be leaving the chairmanship of the Federal Power Commission-I don't know the exact date. What d&s this mean? It means that this memorandum will go to Mr. Swidler and whoever is chairman of the Federal Power Commission, of course, will be conducting the investigation.

(The next day, the White House announced that a few hours before the blackout, the President, through Mr. Califano, had asked Mr. Swidler to remain as F.P.C. chairman until Dec. 3 1, and that the next morning he had agreed.)

Q. Bill, has the President talked directly to J. Edgar Hoover (director of the F.B.I.) in connection with this situation.

Mr. Moyers: No. The President has communicated to the Justice Department-to the Attorney General—

his desire that the Department of Justice, and other agencies of the government, cooperate in this study.

Q. Did he talk to Attorney General (Nicholas de B.) Katzenbach?

Mr. Moyers: I am not sure that he talked personally to Attorney General Katzenbach, but the instructions of the President have gone to the Attorney General as, in fact, they have gone to other department heads and agency directors.

Q. This means that most of us will have to file separately. I am still centered around the President. Can you give us a little personal insight as to where he is sitting doing this?

Mr. Moyers: The President is at his desk in his office at the ranch, where he has full communications facilities available to maintain constant touch with the appropriate officials. He receives calls at least every five minutes, giving him information on an up-to-date basis of what is happening.

Q. When and how did he learn of the blackout?

Mr. Moyers: The President first heard of the power failure when he was just a little north of his ranch, riding out in his car, listening to a radio newscast. He immediately, through the very excellent, modern, and highly efficient communications system that accompanies the President wherever he goes, was in touch with special assistant Joseph Califano back in Washington, who, by the way, had not heard about it by the time the President called, Secretary McNamara, Governor Buford Ellington, who is the Director of the Office of Emergency Planning, and his press secretary. The President returned in a matter of minutes to his office at the ranch, where he has been this evening receiving reports and issuing instructions to appropriate officials of the government.

Q. Some of the reporters were in the room when you made the announcement and have left. My question is whether they are filing?

Mr. Moyers: I have no idea.

Q. Bill, would you repeat your announcement for film?

Mr. Moyers: Yes.

Q. Were these telephone calls made. from the President's car to Buford Ellington and Secretary McNamara?

Mr. Moyers: He talked to each of them.

Q. In the car?

Q. When you say he received a report from his radio, you don't mean it was over NBC or CBS, it was over his 2-way radio?

Mr. Moyers: It was over a regularly announced newscast.

Q. You mention here a reference to the Defense Department. Does this in any way mean there is something happening with the defense system tonight?

Mr. Moyers: No. It means that a power failure could have au effect on the defense system. The power is essential to the defense of our country.

Q. So far as you know, there was no interruption to any of the warning system?

Mr. Moyers: That is correct.

Q. Bill, do they yet know the cause of what caused the chain reaction?

Mr. Moyers: No.

Q. Bill, do you happen to anticipate making any further announcements tonight?

Mr. Moyers: I will put out anything I have concerning future developments from here as I get them. I really don't anticipate much, but I will put out anything we get.

Q. What is the atmosphere in the President's office?

Mr. Moyers: The atmosphere in the President's office is one of quiet efficiency.

Q. Who did he call first, Secretary McNamara or Mr. Califano?

Moyers: I don't have the exact order. I think it was Buford Ellington, Secretary McNamara, Mr. Califano, and then the press secretary, in that order.

Q. Bill, the last we had from you was that they had not yet isolated the original source of the trouble. Is that still the case?

Mr. Moyers: That is still the case.

Q. Who is out there with the President helping him?

Mr. Moyers: Marvin Watson (presidential appointments secretary), Col. James Cross (the President's armed forces aide).

Q. How many secretaries are there, two or three?

Mr. Moyers: Three. Vickie McCammon, Marie Fehmer, and Miss Ginny Thrift, who is Col. Cross' secretary and who also helps the President from time-to-time,

Dr. (Donald) Hornig, who is the President's science adviser, said he talked again to the President of the Niagara Mohawk Power Company, Mr. Minot Pratt, who is not able to confirm or deny the already mention-

ed report that the power failure occurred in his jurisdiction. He simply said it has not been located yet.

Dr. Homig also talked to Mr. William S. Chapin, who is the general manager of the New York State Power Authority to confirm that the Niagara Falls and the Messena plants are operating.

Q. Bill, Who was in the President's car when this was made known to him?

Mr. Moyers: I don't know.

Mr. Califano has just informed the President that Governor (William W.) Scranton has reported to the White House that power is back in the State of Pennsylvania, that the area affected in Pennsylvania was less than earlier believed, and that the power companies have told Governor Scranton that they expect no more problems during the night in that state.

Q. Bill, how long ago was that conversation with Governor Scranton?

Mr. Moyers: The President did not talk to Governor Scranton. Mr. Califano talked to Governor Scranton, and he related the information to the President. Governor Scranton talked to Mr. Califano about 10 minutes ago.

Q. Has Mr. Califano had any dinner yet?

Mr. Moyers: No.

Q. Has the President eaten?

Mr. Moyer-s: Yes.

Q. Bill, can you tell us what time it was when the President was told of General Eisenhower's illness this morning?

Mr. Moyers: It was about 6:15.

Q. Has anyone in the Federal Government raised the possibility of sabotage7

Mr. Moyers: I don't know anyone who has raised that possibility. The President believes that the Federal Bureau of Investigation should be involved in this study because it does have resources that should be of help during the study to find out specifically what happened when the power failed

Q. But the government is not ruling out the possibility?

Mr. Moyers: That is correct. I know of no one who has talked about the problem of sabotage and, therefore, it is not ruled in or ruled out

Q. Did the President eat at his desk?

Mr. Moyers: No.

(Mr. Moyers took a brief break and resumed his briefing at 9:40 P.M., 10:40 in the East)

Mr. Moyers: The President has just talked to Governor Rockefeller and Mayor Wagner, both of whom assured him that they would cooperate fully in the investigation ordered tonight by the President through the Federal Power Commission.

Mayor Wagner informed the President that it appeared that about one-third of the power in New York City was operating again

I talked to Dr. Donald Homig, the President's science adviser, who has been on the phone constantly this evening with people in the local power companies, and Dr. Homig says that those people believe that while the original source has not been pinpointed, they, that is, the officials of the power companies and others concerned with the problem in New England, are, and this is Dr. Homig's quote, pretty well agreed upon the belief that there is substantially no chance of sabotage. End quote.

In fact, while I repeat the original source has not been pinpointed, there are some people who are most concerned with the problem in the power companies and in the New York State Power Authority, who believe that this could have happened as a result of a failure in the automatic frequency control equipment. I Want to emphasize that this is purely conjectural, but it is one of the routes down which your mind could lead you as you study the problem from the standpoint of engineering and technology.

There has not been, Dr. Homig informs me, much time for diagnosis, and, he repeated to me with inflection that seemed to underscore his statement, no one knows exactly what did happen.

Officials in New York, and again I repeat that this is unproved and conjectural, but officials in New York are saying that the difficulty may lie on two lines carrying the main power supply between Rochester and Clay, New York, at a point approximately one hundred miles between these two cities. According to these officials, the only way to determine if that in fact is the point of disruption is to trace these two lines manually, that is, to walk them, and they have already started the tracing process.

If by in the morning at daylight they have been un-

able manually to locate the problem, they will use helicopters.

Let me again emphasize however that this is not authoritative and this is not firm. This is, again, one of the routes down which you could go in pursuing the possibilities of the source of the problem.

Q. You say the New York City Power Authority people have been speculating on this?

Mr. Moyers: Yes, officials of the New York State Power Authority have been speculating in this.

Q. Whose lines are these-Niagara's or Mohawk's?

Mr. Moyers: I don't know.

Q. This point a hundred miles between the two locations doesn't mean anything to me.

Mr. Moyers: We can check that on the map. Governor Volpe (John) has informed the White House that 60 per cent of the power is back on in Boston.

(Mr. Moyers went out and came back at 10:35 P.M.-11:35 in the east.)

Mr. Moyers: Mr. Swidler has communicated to the President the following steps taken to implement the President's directive to investigate the causes of the power breakdown.

1. A telegram has been sent to all of the major companies involved, requesting that they assemble the relevant facts as to the impact of the interruption on their systems and the steps taken to restore service.

2. A group of electric power system operation experts from various private and public power systems throughout the country will meet tomorrow in Washington to help plan the details of the investigation.

3. As I have already informed you, Mr. Swidler has been in wmmunication directly with the Attorney General and the Secretary of Defense to assure wntinuing *liaison.*

4. A Federal Power Commission staff team has been dispatched to the operating offices of the Niagara-Mohawk system so that the commission can be fully informed on the steps taken to locate faults which precipitated the breakdown of service.

5. Another Federal Power Commission staff team has been dispatched to the operating offices of Con Edison in New York to cooperate and coordinate with the efforts of that company to restore service.

Mr. Swidler informed the President that the commission staff would work through the night on these, as well as other steps now being planned, to carry out the President's directive. The chief of the Bureau of Power of the FPC, Mr. F. S. Brown, has been named staff director of the investigation.

The President continues to receive up-t-the-minute reports from his assistants and advisers in Washington. He is of course keeping in touch also through newscasts.

Q. Where are the operating offices of Niagara-Mohawk Power Company, Bill?

Mr. Moyers: Syracuse is the headquarters of Niagara-Mohawk.

Q. Did Mr. Swidler talk to the President on the telephone'?

Mr. Moyers: This was a cable sent through our communications system in the form of a memorandum to the President.

Q. Is the President staying awake?

Mr. Moyers: He is awake.

Q. Bill, could you say whether these teams are already on the way?

Mr. Moyers: Yes, they are.

Q. Bill, I notice Mr. Swidler has been asked several questions in Washington according to our wire and he keeps bucking them down here, saying, "You'll have to ask the White House about that." So you might end up for quite some time being the primary source of information as to what the Government is doing.

Mr. Moyers: I haven't talked to Mr. Swidler but the information I have I will be glad to make available. He is perfectly free to talk to you and I will so instruct him I think the President has done all he can do tonight.

Q. Bill, to help round out the stories, could you let us know when the President finally goes to bed?

Mr. Moyers: If I can I will, Jack

Q. For the time being, at least for the wires, we will continue to keep somebody in here.

Mr. Moyers: I think that is a good idea. If something comes up I'll be down and give it to you.

Q. Anything new on Eisenhower, Bill?

Mr. Moyers: No. That's all I have. If anything major breaks we will have you called in your rooms.

The Press: Thank you, Bill.

(At about 12:30 A.M.—1:30 in the east-Mr. Moyers reappeared. No stenotypist was present. What follows is a reconstruction from *The Times'* reporter's notes of what he said.)

Mr. Moyen: President Johnson was notified shortly after midnight that several of the persons working on locating the problem believe with tentative confidence that the probable source of the trouble was a mechanical breakdown at the substation near Clay, N. Y., about 20 miles north of Syracuse. They ran tests by conducting power on a detour around the substation and it worked well. When they poured power through the substation, there was trouble. Since then, a number of persons equally authoritative have said that they believe this is pure conjecture and that they are not sure that the trouble was at the substation.

Dr. Homig says that almost all of the power in Brooklyn is back in operation. Charles Eble, president of Consolidated Edison, told him that they are diverting some power from Brooklyn into Manhattan. Mr. Eble expects the situation in Manhattan to be under control by sunrise. Two power stations are working in the Bronx.

(In response to reporters' questions, Mr. Moyers elaborated on his information concerning the possible source of the power failure.)

Mr. Moyers: The people who came up with the original feeling that it was the (Clay) substation say they still feel it was the probable cause. The Clay substation is a remote control-station. It is run by remote control from Syracuse. I called the manager of Niagara-Mohawk at Syracuse. He is Jack Mowers. He tells me that for the last several hours the substation has been working well and that there is no reason to believe that this was the cause.

Q. Who came up with feeling that the source of the trouble was the substation at Clay?

Mr. Moyers: Federal officials in conjunction with New York State Power Authority officials. At last count, they were still searching for the difficulty and personnel were en route to the substation for a check.

(With that, Mr. Moyers reported that the President was about to go to bed for the night and that he did not expect to have any more information until morning. It was almost 1 A.M.—2 A.M. in the east.)

10. From Abroad: Smiles, Sneers and Disbelief

From the Via Veneto to the Ginza the reaction to the blackout was dismay, disbelief and simple amazement. And on Red Square, there was, not unexpectedly, a trace of a sneer.

"Are you sure it isn't sabotage?" a Japanese businessman demanded.

"It can't happen here. , . . We think. . . . We hope," said a West German power expert in Frankfurt.

"It is quiet in the streets of New York," the correspondent for Tass, the Soviet press agency wrote. "And if there are signs of panic it is not among the population. The Pentagon announced that the blackout has not paralyzed the United States defenses."

In both East and West, many newspapers carried banner headlines and some carried assertions of chaos, panic, paralysis, and looting.

Tass gave a mildly sardonic-somewhat acid--account of the power failure, declaring that "radio stations constantly call upon the population not to panic. There are cases of looting under the cover of darkness," Tass went on, "but according to the latest reports this has been cut short." (Like other international news agencies, Tass received reports from its New York correspondents by telephone during the blackout.)

In Moscow, meanwhile, Izvestia, the Government's evening newspaper, told its readers that Americans caught in the blackout reacted with "panic and unreasonable hysteria. The state of shock and even panic spread to ordinary people and to politicians," the New York correspondent for *Izvestia* reported.

Muswvites expressed both incredulity and amusement that a major part of the most modern nation on earth could be knocked out so easily. In other parts of the world, some

people smiled at reports that Americans feared they were being invaded.

A man in Bogota, Colombia, said simply: "It was a Communist Chinese plot to sabotage the United Nations." The suggestion of sabotage was apparent elsewhere too.

The London *Evening Standard's* correspondent in New York wrote:

"Americans, calm but fearful that an enemy attack might follow, are asking in the thousands today, 'Have the Communists decided on some form of attack on this country . . or are we merely victims of an unprecedented breakdown in modern civilized communications?' "

Afternoon papers in London treated the blackout as a catastrophe, with many pictures and eye-witness accounts. A British electricity official said such a blackout could not have happened in Britain, adding: "As we are a nationalized industry, everything is geared to seeing that breakdowns don't occur."

To which a *London Standard* columnist snapped: "I expect the Americans felt equally complacent before the disaster."

These were well-chosen words, for a few days later parts of London and the industrial cities of Birmingham and Derby were hit by power blackouts due to the first storm of winter.

The power blackout received headlines in Paris. *France-Soir,* France's biggestcirculation daily, told its readers, "Life stopped in New York and for 30 million Americans for ten hours . . . unbelievable spectacle in the greatest city in the world."

French newspapers played up reports of stalled elevators in skyscrapers, mass prayer in St. Patrick's Cathedral and White House orders for an investigation of possible sabotage.

Some press reports blamed the blackout on private ownership of power in the United States, and the alleged reluctance of private power companies to make necessary investments in cables.

Asked whether such a blackout was possible in Paris, officials of the state-run utility, Electricité de France, "hesitated to give a frank answer," according to *France-Soir.* But officials pointed out that the Paris electric power grid was fed by several major lines, not one. Paris, it was noted has suffered from partial power failures on three occasions-twice in 1962 and once in 1963. In addition, disgruntled utility workers have periodically darkened the city of light with strikes for higher wages.

In West Germany, *Die Welt* of Hamburg, one of the country's leading newspapers, said that the blackout provided

sociologists, politicians and soldiers with "ample material for thought." After praising the. "discipline" of New Yorkers in preventing a panic, the newspaper stressed that the sense of humor of many residents never failed even in a darkened subway when one prankster shouted, "The Russians are coming." "They picked the right time," was one weary reply. "Now they can't find us."

The director of a West German power company, when asked what he thought of the blackout, said it hardly surprised him. "I keep telling the wise guys," he said, "that no matter what you do, things like this can happen, and we'd better be prepared rather than put blind trust in what people call 100 per cent safe."

Most Romans, accustomed to frequent though limited electric power failures, were simply incredulous at the extent of the blackout on the East Coast. *Il Tempo* of Rome, headlining its front page story, "New York Plunged into chaos," said "the perfect, wmplex mechanization of New York was totally crippled and showed its incapacity to face an emergency that almost assumed the characteristics of a catastrophe." The power failure was of "incredible proportions," the newspaper said.

Paese Sera, a Rome afternoon newspaper headlined its story, "New York Cancelled by Darkness." "In the world in which we live," the newspaper commented, "even the most perfect mechanism can be a traitor to man. , . . Science and technology, therefore, are not enough to think for us and we are forced to be on guard. It is still man that must prevent machines from turning against hi." In its report from New York, *Paese Sera* said that for the most part, it seemed people were "diverted" by the blackout although "dramatic episodes were lacking."

London's residents, in reading about the massive power failure, were carried back twenty-five years to the days of wartime blackouts. One picture in an afternoon newspaper particularly stirred old memories. It showed Americans making a temporary-or at least makeshift-home in Grand Central Station. During the blitz Londoners slept in their subway stations.

News of the power failure came too late for morning newspapers to have more than a brief front page account. But afternoon newspapers treated the blackout as a catastrophe, with many pictures and eye-witness accounts. Sprawled across the front pages were photos of the blacked out New York City skyline.

"Slowly, rather comically," began one account, "the lights

began to dim." Another writer found "women sobbing in panic."

There had never been a power failure of such dimensions in Britain, though lights in many London apartments dim all too frequently in the winter months when power use is greatest. At that time, the Central Electricity Generating Board, which operates the nationalized power industry, said it was "inconceivable" that a blackout of the New York scale could happen in London.

A spokesman for the Board said there were so many alternative sources of supply that no single failure could produce such a breakdown. He noted, too, that the worst that could happen in London probably had already happened. This was when a fire at the Battersea power station blacked out parts of West and South London on April 20, 1964. It was four hours before the lights came back. That failure occurred, said the spokesman, not because of the effect of the station, but because the fire was in a tunnel through which important cables passed.

The Argentine press varied widely in its coverage of the power failure. The morning paper, *La Prensa,* made it the lead story with a half-page headline: "Dozens of United States Cities Without Light." The other big morning paper, *La Nacion, gave* the story relatively little importance, running only seven paragraphs with a two-column headline on the second page. Except for *La Prensa,* which hinted at the possibility of sabotage, the- tendency in the Argentine press was to treat the episode as a curious hazard in an over-industrialized societv.

Bogota's *El Espectatot* said simply: "An incredible event which paralyzed such cities as New York and Boston seems impossible. Yet it happened." Newspapers in Bogota--and in Santiago, Chile, were swamped with phone calls from people wanting to know what happened in the United States. Some reported the Voice of America had gone off the air.

From power companies around the world came one basic reaction: a denial that it could happen in their home country.

In Japan, officials of the Tokyo Electric Power said firmly that such a blackout would be "inconceivable" in Japan.

"Considering the advanced technical level of power distribution here, it is all but impossible for a power failure to black out Tokyo for hours on end," a spokesman for the company declared.

"It reveals the Achilles' heel of the American giant," remarked a spokesman for the Hague Municipal Power Company. "This definitely could not have happened on any such

scale anywhere in Europe short of earthquake disasters or large floods affecting tremendous areas."

The spokesman recalled a 1953 Dutch flood when eighteen hundred people died: 'We kept the power going right into the heart of the stricken area by circular loops and as fast as these were shorted by water we replaced them. Major public utilities anywhere in Europe are just not out of power for more than half an hour."

Probably the most nonchalant reaction to the blackout came from normally vociferous Albania. There, electricity was shut off by Government decree for six hours to reduce consumption in the face of a severe drought, according to radio reports from the Albanian capital of Tirana monitored in Munich.

11. Bewitched and Bewildered

Across the country the reactions came swiftly: Officials were aroused, newspapers were indignant and citizens were utterly perplexed.

In New York, Mayor-elect John V. Lindsay, who was swept into office one week earlier, promptly called for better city-wide communications to help cope with emergencies such as the power failure. He said that if he had been in office, he would have been on the radio constantly during the blackout, communicating with the people. He added quickly, however, that he was not being critical of Mayor Wagner, who he said had been "stuck in traffic."

Actually, Mayor Wagner was driving home when the black-out began but was able to reach a friend's apartment, have a bite, and return to City Hall within two hours. The Mayor, himself, said in the aftermath of the blackout that the city's power supply must be set up "so that, if there is a break . . . it would be of short duration."

Speaking to reporters, Mr. Wagner became visibly annoyed when a newsman persisted in an attempt to get bis view on how much responsibility the power companies had to bear for the blackout. "You're not an expert," the Mayor shot back, "and Pm not an expert."

One day after the blackout, Governor Rockefeller had his turn, too, calling it "unbelievable," "fantastic," and a "source of deep concern for everyone." He observed that he had had no idea a power failure could have "happened to this extent."

From outside the city came many other worried reactions to the blackout. Senator Warren G. Magnuson, chairman of the Senate Commerce Committee, asked the Federal Power Commission and the Office of Economic Planning for the earliest possible reports on "what happened, why it happened, and what should be done to insure that there will not be a recurrence."

The Washington Democrat said that his committee would make a thorough analysis of the blackout. "The security, welfare and safety of the people have been placed in jeopardy," he said. "We must be certain it does not occur again anywhere."

Representative Walter Rogers, chairman of the House Power subcommittee, said that lawmakers would have to re-examine the premises on which the country's power policies had been built. The Texas Democrat declared that power authorities had long led Congress to believe that such a failure was impossible because of built-in safeguards. "Well, somebody was mistaken," he added, "because it has happened."

Mr. Rogers argued that the country's power systems should have two independent back-up systems to take over in case the primary system failed.

There were other reactions, too, from state and Federal officials.

Newspaper comments were sharp. ***The New York Times,*** in an editorial entitled "Aladdin's Lamp Blacks Out," said:

"Short of a nuclear bomb, the most crippling affliction that can befall a modem metropolis is a total power failure. The blackout that crippled New York and most of the Northeast last evening was a-dismaying reminder of the vulnerability of any community to a severing of its electric lifeline.

"It is hard to comprehend why a single break at one point in an interconnected, system compels a virtually complete suspension of service affecting nine states and two Canadian provinces. Apparently, no means exist for allocating power on any partial basis, even in communities like New York that have very substantial generating plants in their own localities. The result, as last night's critical failure proved, is community paralysis beyond the dream of any saboteur.

"Suddenly, man's capacity to send rockets to the moon, to fly weightless around the globe, to produce limitless quantities of goods without human effort, faded into irrelevance. People rediscovered their feet: the candle came back into its own; the infinite resiliency of the human spirit was demonstrated anew.

"The Consolidated Edison system had hoped, after the partial collapse of the city's electric supply in June, 1961, that it had erected a power grid comprehensive enough to sustain any conceivable load. But the domino effect of a break in a main feed line near Buffalo has made evident the delusiveness of this hope.

'The need now is for a new assessment of how the omnivorous appetite of our industrial society for electric current' can be satisfied with anything approaching full security even against the briefest of interruptions. The nation's power companies already have demonstrated great resourcefulness in interconnecting their facilities; there is no reason to believe the limit of that has been reached. Above all, a way must be found to prevent a simple break from blotting out all the power plants serving tens of millions of persons."

The Wall Street Journal said, in 'part:

"Ironically, the power grid system, which was devised partly to overcome blackouts in the area, appears to have operated in this case to spread them. The system, the product of cooperation among private utilities and public agencies, with over-all supervision by the Federal Government, obviously must get a searching review. Somebody certainly did some faulty planning."

Other newspapers were caustic. "It is a shocker," cried *The New York Journal-American.* "It is an outrage. It is a disgrace-city, state and national."

The New *York Post* said Consolidated Edison "has long been a sacred cow of state and city politics. The people have a right to insist that there will be no cover-up this time. No perfunctory post-mortem will be tolerable."

The New York World-Telegram and Sun wrote, "If it wasn't sabotage, then it was human failure of the most incomprehensible sort."

"No matter what the explanation for last night's power failure may *be,"* said *The Boston Traveler,* "It's not going to be satisfactory."

'The fantastic power failure . . . was a disgrace," said *The Albany (N.Y.) Knickerbocker News.*

Several newspapers expressed shock that the most populous area of the country could be so vulnerable to what appeared to be a single breakdown or a single operational error.

The Buffalo (N.Y.) Evening News said "the most serious element of the whole weird episode is its proof of how grotesquely vulnerable this great over-organized society of ours really is to sudden disruption.

"If a simple break in a circuit can spread this massive blackout over the entire northeastern United States, what wuld a tiny band of superskilled saboteurs or a wuple of well-placed nuclear bombs accomplish?"

Russell Baker, writing for the editorial page of *The* Times, gazed into the future and came up with this vision:

'The end came on Sept. 17, 1973. It had been forecast by

an M.I.T. undergraduate who had been running the law of probability through his computer.

"The frequency of malfunction in New York, his computer noted, had increased at such a rate that an ultimate day of total breakdown was a statistical certainty by the early 1970's. Naturally, no one took the forecast as anything more than an undergraduate hoax.

"The chain of events on that last day began at Shea Stadium at 4:43 P.M. when the Mets finished a scoreless ninth inning against the Mexico City Braves, thus becoming the first team in history to lose 155 games in a single baseball season.

'Two minutes later, Irma Amstadt, a Bronx housewife, turned on the kitchen faucet and noticed that there was no water. Going to the telephone, she dialed her plumber, not knowing that at that very moment, in defiance of the law of probability, 6,732,548 other persons in New York were simultaneously dialing telephone numbers.

"Mrs. Amstadt's call was the one that broke the system's back. Somewhere in a sealed, windowless building a transistor gasped and failed. Under the incredible overload, other transistors all over the city groaned and gave up. And so, with the telephones out, it was hours before the authorities could learn that there was not a drop of water left anywhere in the pipes of the five boroughs.

'The press might have detected it almost immediately, but, as chance would have it, the biennial newspaper strike began that day at 5 P.M. and not a single newspaperman was on duty.

"At 5.03 P.M., outside the Waldorf-Astoria Hotel, a taxi driver was shot by a man who had been trying unsuccessfully for fifty-five minutes to get a cab. It was later established that the man had been trying futilely to find an empty cab during the rush hour in Manhattan for sixteen years. 'I just snapped,' he said later. That was a day when everything seemed to just snap.

"News of the shooting spread rapidly through the city's cab fleet. Panic seized the drivers who feared a general uprising by the rush-hour hordes signaling in vain for taxicabs. As a result the drivers abandoned their hacks in the streets.

By 5: 30 P.M. the resulting traffic jam extended from Trenton to New Haven. Two minutes later, a radio sports reporter announced that the Yankees had dropped their fourth in a row to the Milwaukee Athletics and were, thus, once again mathematically eliminated from any possibility of finishing in the first division.

'This news was interrupted by a bulletin reporting that more than fifty knifings had occurred simultaneously on fifty dif-

ferent subway trains scattered throughout the city and that the subway trainmen had walked out on a wildcat strike to press demands for more police protection.

"At City Hall, there was no hint that anything untoward was happening until 5:12 P.M. when it began to snow. The Mayor watched the snow for perhaps twenty minutes and then summoned his press adviser. What is that?' he asked, pointing out the window. 'Snow, your Honor,' said the press adviser, who was one of the brighter products of the Democratic machine that had been returned to power after John Lindsay had gone on to more manageable tasks than governing New York.

"The Mayor was aggrieved. 'In the old days, when the machine was running this city right,' said the Mayor, 'it never snowed in September.' 'True,' said the press adviser, 'but the machine is like everything else in New York these days. It doesn't work.'

"All over the city, with no water left in the pipes, no subways running, no telephone service, no newspapers, the snow pouring down and both the Mets and the Yankees dead, people felt in a gay festive mood. And so, as people will under hardship, millions decided to spend a night on the town.

"In the theater district alone, 500,000 people appeared at box offices demanding theater tickets, which then retailed at $79.90 per seat. With vast lines at every box office, the manager Of a theater in 43d Street announced at 8:22 P.M. that there were no tickets available for anybody without enough influence to rate a good table at Twenty-One.

"New Yorkers, being New Yorkers, might not have broken even then, except for a Brooklyn man named Omar. At that moment in Brooklyn, Omar plugged in his electric carving knife and the entire Atlantic seaboard from Labrador to Chattanooga was plugged into blackness.

"By next morning, of course-we all know the story,—volunteers began bringing out the first New York survivors, and six days later the President viewed the area in a flying inspection tour and ordered his historic m-evaluation of American civilization.

"Which, as everybody knows, is why nobody lives in cities any more."

12. Did We Learn Anything?

Even as the last bulb flickered into blackness. the experts were trying to learn what they **could** about man and **machine** suddenly **plunged** into a great laboratory of darkness. There were experts who wanted to learn how things could be kept running somehow, even if the big generators laid down on the job again. Other experts wanted to leam how people **reacted** when electricity was suddenly displaced from their way of life.

Aviation experts immediately undertook the job of **making sure that never again would the giant airports be knocked out for lack of current. Experts on people prowled the dark and by flashlight checked the public pulse. Were people frightened? Were they exhilarated? Were they angry? Citizens who were not experts took quick cram courses in how to get along by themselves and with others when the power failed.**

New Yorkers, perhaps more so **than** others in the Northeast, learned about themselves. For years they had been told and many had become convinced that they lived in a city that hung by a thread above a swamp of hysteria and panic. They learned that, while the blackout was something their town **could not take in stride, the city could stand up surprisingly well. People did not assault each other—as much as they did** when the-lights were on. The slums of Bedford-Stuyvesant did not break out in insurrection.

And they learned that they could use their feet. They walked the streets, they walked the stairways, they walked the long bridges that hold the city of islands together. They also stood, in elevators., crowded subways and jammed buses with **surprising patience. Some of them learned on the job how to direct traffic.**

George and Patricia Nash, who do research for Columbia University's Bureau of Applied Social Research, moved quickly

to find out what the blackout meant in personal terms. Flashlights in hand, they confronted one hundred and seven New Yorkers on the streets in four Manhattan neighborhoods. They sortied out early in the blackout and learned a lot about expectations and fears.

For one thing, sixty per cent of the people they spoke with said they had received most of their information from radio. Twenty-two per cent learned what they knew from friends, authorities or passers-by; the rest were in total darkness, having learned nothing from anybody.

Two people felt that getting home was more urgent than helping science and interrupted their interviews to catch buses. An interview with another man, who might have spoken at length, was scratched because he was drunk,

One of the most important things they found was that a little radio can go a long way. Although more than half of the people had kept in touch with the blackout by radio, none of those interviewed had a radio himself.

They learned that women enjoyed the whole business more than men did. About twenty-five per cent of the women expected people to have a pleasant time. Only seven per cent of. the men went along with this. "Perhaps this is an indication of the fact that manv women in our society lead lives of boredom and enjoy the chance to partake in an unusual event," observed Allen H. Barton, the bureau's director. "The men, on the other hand, may feel that it is something to be taken seriously and certainly not 'enjoyed."'

The bureau took note of the fact that the city was calm and sought to learn from individuals what they did and why everything was so orderly.

"In a period when there was no sure and definite information, except that the lights were out, questions which gave free rein to people's imagination could serve to allow us to see how the average citizen perceives his environment," the bureau explained.

Basically, they found that people were well informed, not too alarmed and expecting a rather quick return to normal. About one-third of those questioned were substantially correct in their knowledge of what had been said to have happened. One quarter of them knew that there had been some sort of mechanical problem. Although the researchers never raised the subject, eight per cent of those questioned believed sabotage had laid the lights low.

The scientists did ask, "What do you think people will do while the lights are out?" and, then, "Do you think there will be trouble?" Just over half of the answers discounted the likelihood of trouble. One out of four of those who didn't expect

trouble even said that they thought things would go along pleasantly, that people would enjoy themselves or that there would be a generally good feeling. But forty-five per cent believed there was a chance of trouble, such as looting, rioting or thievery.

There was not much argument over the question, "How long do you think it will be before the lights wme back on?" Altogether, seventy-one per cent did not believe the lights would glow again shortly or within two hours, suggesting that there was pretty good information on the scope of the blackout.

But the bureau's analysis, which started by candlelight shortly after the interviews had been completed at 11 P.M., came up with some striking class differences on opinions of the blackout. The divisions-upper middle, lower middle and working class (apparently not many of the wealthy were groping about at the test points)—broke ranks on several issues.

One third of the working class thought sabotage was involved; only twelve per cent of the others did. Only fifty-five per cent of the working class believed there was no question of sabotage, compared with seventy per cent of the others. No one mentioned any factual basis for his views. The bureau believed most people of all classes rejected sabotage as a cause because most of them had actually heard first-hand radio reports.

The bureau reported that one "intelligent" East Sider had said it couldn't have been sabotage because "the thing was too effective." A Yorkville man, on the same side of town, held that there was every reason to suspect sabotage just because the blackout was so big.

More than half of the working class thought there was a chance of trouble in the darkness; only forty per cent of the others did. Almost all of those who felt that things would be atmospherically rosy while physically dark-thirty per cent—were from the upper middle class.

'If the working class was more suspicious about the reason for the lights going out and more pessimistic about possible trouble which might occur while they were out, they were at the same time less ready to believe that the lights would come back on quickly," the bureau decided. Almost all the people who believed the lights would be out for a short time were from the bureau's category of upper middle class.

The bureau, which apparently had the monopoly on such research during the actual blackout, said: 'The difference in a person's social position was found to result in a lower level of knowledge of events, which led to greater concern and a different estimate of when thiugs would return to normal. Again, there was no increase in level of knowledge as the

evening passed. The working-class people were. the least well informed, even though they happened to be the last interviewed because they were concentrated in the last areas visited."

In its conclusions, the bureau came up with some observations that might be a key to reactions in future breakdowns.

"We must note that the different pictures people carry in their minds are not necessarily based on fantasy," the report says. "It may well be that working-class people have been exposed to more trouble and violence and, hence, are behaving rationally in being more likely to expect it. The overwhelming picture that emerges, however; is that this study, just as many studies of disasters have shown, demonstrates that given a crisis, people behave sensibly, provided that there is some form of reliable communication. The effectiveness of communication would seem to be a key explanatory factor in accounting for the relatively normal behavior of the large portion of the city's population."

While people went on ticking, if at a different tempo, there were other things that did not tick at all. There were lessons to be learned by those who had not done so in the past. What could be done to keep going next time?

For one thing, the need for auxiliary or back-up generators was overwhelmingly obvious. Those institutions-like hospitals, the telephone company and local radio stations-that were able to switch to their own emergency equipment were able to function; everythiig else stopped.

Fortunately for everyone, most of the radio stations were ready. New York's stations were acclaimed for a major community service. The sound medium, so often overshadowed by the more glamorous and dramatic instrument of television, proved resourceful in patching together emergency circuits. The tireless commentators of the major stations injected a note of humor and congenial cameraderie that undoubtedly contributed to the city's calm. Untold numbers of listeners took the trouble to supply what news they could to help the stations.

The flexibility and simplicity of radio were evidenced only moments after the power shutdown. While the city's nine television stations were plunged into darkness that was to last for hours, the older medium quickly improvised substitute hookups. Commercials were forgotten.

Unlike the TV stations, all of which cluster atop the Empire State Building to get the widest coverage from the city's highest point, the radio stations are scattered over the metropolitan area. Some transmitters were not blacked out; others had stand-by generators that were immediately switched on in a standard operation for a medium that was in business during

World War II. The main problem for radio was rigging up temporary connections between studios and transmitters. Within varying periods of time-ten to twenty minutes or so-all the major outlets were back on the air for a marathon public service that did not end until the early morning hours.

In the candlelit studios the same format evolved out of necessity at every station. Two, three or more staff members huddled around the microphone to pass along the news as it dribbled in. The informality of the setting took away the foreboding sense of crisis normally associated with the delivery of bulletins on the air.

Everywhere on the dial the hard news was mixed with light banter, some excellent phrasemaking and a touch of acid for the electrical engineers who had maintained that a massive power-distribution grid spanning a big part of the hemisphere was more efficient than the homegrown generator.

With the blackout coming at the high point of the evening rush hour, the radio medium enjoyed one of the peak audiences that has proved immune to television's economic inroads-the throngs of drivers and passengers listening in automobiles. In other places, on the streets, in homes or in buses, it was the night of triumph for the much scorned transistor radio. The miniaturized squawk boxes, which need only nine volts or less of battery power, were a focal point of cosmopolitan interest.

Many teen-agers could chortle over the adult generation's dependence on the handy "toy" that so frequently pours out rock 'n' roll. Theirs was the joy of maintaining that the Beatles had contributed to the national security by helping popularize the most mobile form of electronic communication.

But while things were running so smoothly in radioland, there was massive evidence of much to learn regarding facilities that actually move people, not just speak to them. But there were reasons to hope that the lessons learned the night of November 9th were being used as a stepping-stone to tomorrow's stability.

Ideas were not long in coming-from politicians, from engineers, from the public. Some were immediately translated into action.

Many of the first proposals centered on the need for better communications. The New York City Police Department pondered a suggestion to give each of its twenty-seven-thousand members a transistor radio so that those off duty could be called in by broadcasts.

The subway system was a primary source of concern. Mayor Wagner told three Consolidated Ediion executives: "Changes will have to be made." He warned them that another long subway stoppage could not be tolerated.

'Why did it take so long for the subways to get rolling? They were out for fourteen hours, a stoppage longer than the blackout itself. The electric company men agreed that there should be some way to restore the service faster, although they insisted that even if the subways had had their own plant, the results would have been the same. The Mayor told them to confer with the Transit Authority anyway and seek ways to get alternate power on the rails. From elsewhere in the city government came a proposal to reroute buses atop the subway lines in such a crisis so as to serve the displaced riders along their customary routes.

Paul O'Dwyer, a Councilman at Large, filed a resolution urging the city to get back three transit power plants it sold to Con Edison for $125,840,000 in 1959. The company, he said, "had conducted its activities in such a manner as to fail to isolate its facilities from defects arising in areas outside of the city. and upon occasion has even failed to isolate defects in its own system from impact upon the operation" of the subways. Boston's subways, he commented pointedly, ran throughout the blackout. with lights on in the stations. too. The Boston system, run by the Massachusetts Bay Transportation Authority, controls its own power source, the Councilman noted.

The three New York plants were sold by the city to avoid a heavy investment in rehabilitation. The Transit Authority agreed with MT. O'Dwyer. If it had been running the power plants, a spokesman said, trains, would have kept going on at least two divisions. Con Edison said it was willing to work with everybody to avoid trouble but observed that 'if the subways had their own independent power system the electric company might not be able to lend a hand if the transit plant ran into problems.

Busy with the Mayor, the Councilman and the subway agency, the utility had no time *to* deal with forty-year-old David Franklin, a Brooklyn resident who bought space in Thursday morning's *Times* to add to the hue and cry. "Give separate generators back to the subway," his advertisement ordered in agate type.

The same issue nagged the airlines. While the blackout made the subway underground fearsome and excruciatingly uncomfortable for many thousands, the power failure turned the airways into a frightening arena of possible disaster. Airline officials were shocked that Kennedy International and La Guardia Airports were so easily wiped off the map for want of emergency power. Several said only the good weather averted mid-air tragedy.

When the power went out, all light, radio, radar and instrument-landing systems went out because they were plugged

into the commercial electrical system. Battery-operated equipment and some auxiliary generators were pressed into service at once but the vital detection devices and approach and runway lights remained dark most of the night.

On Friday, November 12, five heavy-duty generators were on their way to New York from a Federal Aviation Agency depot in Oklahoma City. Others were to follow. The two 125-kilovolt-ampere generators are for control-tower supply at each of the airports. The Port of New York Authority, which runs the airports, will have the two smaller 37½-kilovolt-ampere generators at its disposal; each can light one runway. The fifth generator will power an emergency communications center at the F.A.A.'s regional headquarters at Kennedy. The center will check on how much equipment is working if the power fails in the future.

The Federal agency also let it be known that generators designed to help air navigation would be shipped to a score or more locations elsewhere so that planes would not be endangered when the current gave out.

For its part. the Port Authority did some stock-taking. While Newark Airport was unaffected in brightly lit New Jersey, and while La Guardia could handle traffic twenty minutes after the breakdown, the sprawling Kennedy field was out for twelve hours, except for emergency landings. The Port Authority caucused, by night letter, with the airlines that use its fields. It wanted to know how its clients felt about all this, whether they believed a self-contained generating system was needed at each airport, including Newark, to guard against outside power failures.

The three airports, it noted, "meet or exceed" F.A.A. requirements for an independent back-up power source. The last eighteen years have shown that the present systems are "'more than adequate," according to the Authority, but in view of criticism by "unidentified airline officials" it wants the airlines' official views. Each field has more than one independent power source, but Kennedy and La Guardia were extinguished because the breakdown was so widespread that it also knocked out the back-up substations.

The F.A.A. said that since the agency had in recent years arrived at a policy of relying fully on commercial power for its equipment, it could not very well fault airport operators who did the same. But; the spokesman said, if commercial power is shown to be unreliable, policy might be changed.

Businessmen, too, sought means of staying in business should Con Edison go out of business again. The day after the blackout a manufacturer of bearings called the Caterpillar

Tractor Company to ask about the cost of equipment that would power his plant during an emergency. A salesman told him that he would need a five-thousand-kilowatt unit, larger than Caterpillar supplied, and that, when he found it, it would cost him about $500,000. "It doesn't matter," the manufacturer said. "I lost more than that during this one blackout."

He was among dozens of businessmen and property owners trying to avoid the helplessness that had gripped them that night. According to Syska & Hennessy, consulting engineers, there are almost as many answers to the problem as there are troubled building owners.

The answers range from storage batteries for emergency lighting in systems costing as little as $100 to the $10.5 million "total energy" system that provides light, heating and cooling for the twenty-thousand residents of Rochdale Village, a giant apartment project in Queens.

According to the Caterpillar Tractor Company, which makes smaller units, powered by natural gas, total-energy plants can be found to suit buildings of almost any size, at costs that run roughly $100 a kilowatt. But such units are best installed when the building is under construction because parts of the system are built in. The skyscraper headquarters of the Chase Manhattan Bank in downtown Manhattan was one of the foresighted buildings. When the lights went out, the building went over to the two-generator emergency system designed by Meyer, Strong & Jones, consulting engineers. It powered three elevators, some lights and vital pumps, heating and ventilation units.

Besides storage batteries, in complex units that can cost over $20,000, systems that can be installed to run vital equipment in a building constructed without any emergency back-up, include diesel generators, steam generators and units that can be tired both by gasoline and natural gas, a spokesman for Syska & Hennessy explained. In general, batteries can be expected to cost about $60 a cell, installed. Diesel generators will run about $200 a kilowatt; gas and gasoline-engine generators may be put in for about $150 a kilowatt, and steam generators will go as high as $350 a kilowatt.

How about the elevators? The working populations' of the large cities move vertically almost as much as horizontally. During the blackout, many elevators just stopped where they were, trapping the riders. In some buildings, mostly the new ones, devices lowered the powerless cars to the nearest floor. In one building at least, the new Columbia Broadcasting System headquarters, the elevators are equipped to take all passengers to the ground floor before going out of action;

the building even has an elevator that ran through the blackout on emergency power. But elevators are not required to do this in New York. Will changes be forthcoming?

Many hospitals have auxiliary power. But what about those that do not? This applies to other public institutions—the armories, the railroad stations and so on. The policemen and firemen ran through their stockpile of auxiliary generators quickly. There was as much talk about putting a generator in every basement as there once was about a chicken in every pot. Yet it remained to be seen what would be accomplished once the pressure was seemingly off.

A special New York State Legislative Committee will explore the possibility of a state law requiring that elevators be equipped with emergency devices to keep them from being stranded between floors if electricity fails. The Committee will also study the advisability of laws that would mandate: standby power generators in all hospitals, emergency lighting systems for the hallways of office buildings and apartments, and a radio system on the New York City subways to keep passengers informed as to conditions during a blackout and thereby help avoid panic.

The ordinary householder and commuter also vowed to be ready for the next blackout. They bought candles and flashtight and transistor batteries and even extra gasoline tanks against another electrical shutdown of gas station pumps. But batteries fade away, gas tanks run empty, candles are diverted to more frivolous purposes, even matches in the desk have a way of disappearing. Emergencies, hopefully, do not come in such rapid succession that anyone can maintain eternal vigilance. There are lessons that must be learned, and then learned again.

13. Past Imperfect

On a steamy day in June, 1961, the lights in midtown Manhattan flickered and went out for four and a half hours. Then -as during the blackout of 1965—New Yorkers were dismayed, officials were outraged and Con Edison was assailed.

"How many more blackouts and how many more tragedies must we have before the Public Service Commission will recognize that the fundamental transmission and distribution system of the Con Edison Company is not sound?" asked Armand D'Angelo, Commissioner of Water Supply, Gas and Electricity, in an official report to Mayor Wagner.

Con Edison said promptly after the report that it had engaged an engineering corporation to "review" and "analyze" the blackout on June 13, 1961—the last major power failure before the big one in 1965. At the time, five square miles of midtown Manhattan were without electric power on the hottest day in two years.

Like the 1965 blackout, the 1961 emergency hit at the worst possible time: in the late afternoon and early evening. The midtown section of the IND subway was knocked out at the start of the Tush hour. Hundreds of passengers were stranded in sweltering trains up to an hour. Some trains were stalled under the East River.

Offices and homes went dark, too, affecting hundreds of thousands of persons from 43rd Street to 77th Street, between the Hudson and East rivers in an irregular and spotty pattern.

Unlike the 1965 blackout, however, the fear and confusion in 1961 were compounded by 96-degree heat. Air conditioners stopped. Elevators, offices, subways and buses were brutally hot.

At the time of the blackout, Con Edison reported that it had had the largest load on its facilities in history from 3 to 4 P.M. on that June day, but denied that overloading had caused a

power failure. Then, about a month after the 1961 power failure, the Public Service Commission directed Con Edison to change its substation design to prevent a similar major power breakdown. The next day Mayor Wagner charged that the Commission, a state agency, was two years too late with the directive. The Mayor held that the Commission should have taken such action after a similar power failure in upper Manhattan two years earlier in 1959. He said the Commission had given Con Edison a "whitewash." A spokesman for the Commission denied this.

Later, the utility completed a $25 million construction program. It was not announced officially, but company men disclosed it in answer to questions. It was reported at the time that three new power substations had been built, raising the total to ten. The supply systems of all ten were said to have been reinforced so service would continue if any two transformers or supply circuits failed.

In the 1961 blackout, two circuit breakers at the West 65th Street substation failed an hour apart. The cause was given as faulty insulation. With the two supply circuits out, the load was too much for the rest of the system to carry, and power was cut off. It was reported, however, that neither of the faulty circuit breakers had been carrying a load beyond its capacity.

In the blackout on August 17, 1959-a scorching day-the lives of 500,000 people were disrupted in a five-square-mile area of upper Manhattan. On the West Side power was knocked out more than thirteen hours. On the East Side, there was an eight-hour stoppage. "It was easier to restore East Side power," a Con Edison spokesman said hastily. "No discrimination was involved."

The city was jolted by that power failure, but some enterprises fared quite well. Service of the New York telephone company went unaffected. And that evening in darkened Central Park, a production of the musical "Carmen Jones" was given as scheduled. Both the park theater and the telephone company were equipped with their own stand-by diesel generators and were able to supply their own power.

At the time, Con Edison indicated that such a power failure would probably not recur. A headline in *The New York Times* said: "A Second Big Failure Called Unlikely." And the utility's officials said the odds against a recurrence were "infinitesimal." A city report, however, charged that the 1959 blackout "rests squarely with the Consolidated Edison Company." MT. D'Angelo, reporting to the Mayor, argued that the breakdown had been caused by overloading. And he said that Con Edison had not lived up to its design standards and "overestimates its capacity." Con Edison denied that overloading had been the

cause of the failure and said that Commissioner D'Angelo's report was "clearly premature." The report was made one week after the blackout.

Four months after the blackout, the Public Service Commission, after an inquiry, announced that the cause of the electrical failure was still a mystery. Its report Cleared Con Edison of charges that an inadequate network design had been responsible.

In general, power failures have never been strangers to New York City. They have, in fact, plagued the city for many years. In October, 1957, Grand Central Terminal and more than a dozen surrounding hotels were blacked out by a power failure of more than two hours. At the time the Consolidated Edison Company and the New York Central Railroad pointed accusing fingers at each other. Both agreed there had been almost simultaneous mishaps in the power systems of each company, but each said the other had caused the failure.

A series of blackouts plagued the city during the hot weather in June, 1957. During another hot spell in June, 1955, a rash of failures hit Brooklyn and Con Edison had to pack manholes with dry ice and string perforated garden hose through conduits to cool them with running water.

In 1936 and 1938, the failure of the central network at the Hell Gate plant of Con Edison brought severe disruption to large sections of the city.

A short circuit in the power plant on January 15, 1936, almost paralyzed Manhattan north of 59th Street and in the Bronx and in Westchester County. Lights of offices, hospitals, department stores, homes and industrial outfits flickered, then went out. Trolley cars throughout the Bronx were stalled. Subway systems were blocked. Patrons in movie houses got their money back and returned to their darkened homes through darkened streets.

Sixty thousand persons were caught on subway trains that stalled, and hospital attendants in some operating rooms used flashlights so surgery could continue. In one hospital a boy was saved while attendants kept striking matches for more than an hour to provide light.

On September 21, 1938, floods from a hurricane poured into the Hell Gate plant, cutting off power in large areas of Manhattan, mainly Washington Heights and Harlem, and in all of the Bronx. In that failure-like the one in 1965—other power plants were affected along the Eastern Seaboard. Almost all of Long Island was plunged into darkness; Westchester County was without electrical service, and many radio stations in the Northeast were forced to suspend broadcasts.

Certainly blackouts have not been uncommon across the

country, either. On June 25, 1962, for example, a power failure knocked out electricity in an eight-state, 300,000-square-mile area in the Middle West. It was attributed to overloaded circuits that resulted from a string of effects starting when a mechanical difficulty halted a generator in Omaha. It was called the most extensive accidental blackout in the nation's history -until The Big One.

14. The Power of the Future

"Politics and economics may play a role in deciding how to prevent a repetition of the great Northeast power failure,'! *Eileen Shanahan wrote in The Times* on Friday, November 12th. 'This was the one conclusion that stands out clearly a5 Government and industry technicians continued to grapple with the most immediate problem presented by the blackout: finding an explanation of its cause. Outside the large, windowless Federal Power Commission conference room in which the experts were working, advocates of Government-owned electric power and private power were renewing their old battle, a battle that is at the heart of the struggle over how to prevent power failures. But that is not all that is involved.

"The Government and private-industry investigators have before them what is specifically and solely a technical question: HOW did it happen? Their answer, however, will point the way toward remedies that are certain to displease one side or the other-and conceivably both-in the fight over who is to own major electric power facilities and what kin& of facilities should be built in the future.

"Both public and private power advocates may well have some mixed feelings. For whatever preventive measures are proposed, they are bound to cost someone money and probably lots of it. If it is discovered that larger power-generation facilities are needed to meet peak demands or emergencies, who is to pay for those facilities? Wii the managers and stockholders of private utility companies be willing to bear the expense of standby facilities that may never be needed or needed only once every few years? Should they, in fact, be required to bear such expense?

"Should the Government bear the expense? While there are, within the Government, many advocates of increased ownership by the Government of power generation and transmission facilities, it would be a mistake to assume that the Government, as such, takes a position in favor of government ownership. Particularly right now.

"President Johnson himself, already grappling with a Federal budget for-next year inflated by the still-unmeasured costs of the war in Vietnam and the big new welfare programs, could quite conceivably take a dim view of proposals for buge new Government outlays for power facilities.

"The prospective expense for taxpayers will not, however, silence the demands for more Federal electric power from those who distrust utility companies but who do not have direct responsibility for Government budget policies. Those demands have been heard increasingly in the last several days from the traditional advocates of government Ownership Of power facilities—supporters of the cooperative power movement and others.

"In addition to the classic public vs. private ownership fight, other policy issues are brought into new focus by the Northeast power failure. The breakdown is seen in some quarters as further demonstration of the need for the controversial Storm King Mountain power plant that Consolidated Edison wants to build to serve New York City-a plant that conservationists have fought for years.

'Those who believe the Government has been following a wrong policy in limiting the imports of heavy fuel oil-a relatively cheap fuel-are also on record since Tuesday citing the massive blackout in support of their traditional economic and political arguments.

"The whole issue of the planned national interconnection of electric power systems-which in the view of some could have averted the Northeast blackout and in the view of others would have made the darkness nationwide-is raised again by the failure. The lines here, however, are not clear-cut politically. The national inter-tie, as proposed by the Federal Power Commission, has very substantial although not unanimous, industry support.

"Joseph C. Swidler, Chairman of the F.P.C., not only has to walk a tightrope between conflicting political and economic forces, but while conducting the blackout investigation his tightrope. extended across our northern frontier because the trouble originated in another country and because Mr. Swidler apparently felt impelled to inform the President of his preliminary findings before making them public.

"Mr. Swidler, whose appointment to the commission by President Kennedy in 1961 thoroughly frightened the electric power industry, has since made a record of avoiding partisan controversy and is spoken of well in most industry quarters despite the fact that the commission's now famous National Power Survey that was published eleven months ago recommended ever-increasing interconnections between electric

systems. The contents of the study raise some questions both for the technicians and the politicians.

"In 1962," Miss Shanahan concludes, "there was a massive blackout in the Midwest covering an area four times as large as the New York-New England blackout., and a less extensive one last January. Although the 1962 wide-area failure in the Midwest was well known to power experts before the commission's survey was completed last year, the study made no significant mention of it, while recommending an enlargement of the kind of interdependence that made Tuesday's blackout so extensive. The commission has offered no explanation of the omission."

The future of the electric power system of the United States is currently obscured by the cloud of controversy that Eileen Shanahan outlines above. Although the power controversy has been intensified by the great blackout of November 9th it has been fermenting in the background for many years: It involves, on the political level, the thirty-year-old battle between proponents of public power against those in favor-of private power. On a more technical plane—but this is where it' hits home most directly to the average citizen--there is the question of a nationwide power grid as against regional grids or tie-in systems. In fact, the blackout in the Northeastern part of the nation has even brought into sharp challenge the prao ticability of regional power grids.

In addition, the controversy over the power industry's future -at least as it involves expansion plans by private companies -has dramatically spilled over onto the community and personal level.

After a long and heated fight, the Consolidated Edison Company received approval this spring from the Federal Power Commission to build a $162 million plant for generatmg power at Storm King Mountain along the Hudson River in New York. The company wants to construct a huge reservoir on top of Storm King into which water would be pumped from the Hudson. During periods of peak power use the water would be returned to the river, generating electric& as it fell

Governor Nelson A. Rockefeller of New York endorsed the project, thereby calling down upon his already unhappy political head the wrath of conservation groups. They have taken their battle to Federal courts.

Leo Rothschild, president of the Scenic Hudson Preservation Conference, described as "incomprehensible" Governor Rockefeller's failure to use his influence "to help enable the citizens of the state to make their own decision regarding the future use of the Hudson River and its great valley."

Mr. Rothschild warned that he and his group would continue to fight to prevent the building of the power plant.

Mrs. Pauline Siegler, secretary of the Cornwall Taxpayers* Water Protection Association," also said the Governor's decision was wrong. "Hundreds of people here are opposed to Consolidated Edison's plans, but we are too afraid of intimidation, reprisal and loss of jobs to speak out." She said that litigation would be too costly for her organization but that the group would support any action by the Scenic Hudson Preservation Conference, of which it is a member.

Clearly the first requirement of the future is to assure that over-all power needs can be filled, excluding possible malfunctions or breakdowns. The amount of electric energy it takes to run the world's greatest industrial machine and to supply the day-by-day needs of a population that will soon exceed 200 million, is enormous. But here, at least, there is little cause for alarm.

The Federal Power Commission has estimated that by 1980 the United States will require 2.8 trillion kilowatt-hours of power a year. That is more than two-and-a-half times the estimated total of 1.1 trillion kilowatt-hours consumed in 1965. To produce this vast amount of energy, according to the Government agency, an interconnected and coordinated utility industry will need an installed capacity of about 525 million kilowatts. The F.P.C. also this that by 1980 the average retail cost for residential, commercial and industrial electricity should be brought down to 1.2 cents a kilowatt-hour, compared with an average price in 1962 of 1.7 cents and back in 1940 of 2.2 cents.

Can this large order be tilled? Absolutely, says the utility industry, which has been consistently ahead of target in its schedule for increasing capacity. The capability of the total electric utility industry has already reached about 235 million kilowatts, an increase of more than twelve million kilowatts during 1965 alone. The industry's power capability has more than doubled in the last ten years and is more than five-and-a-half times that of twenty-five years ago. (Kilowatts measure the production- capacity or capability of electric generators and also the power requirements of electrical appliances and equipment.) Electric generators now in operation-and they are getting bigger all the time--range in size from less than one hundred kilowatts to a maximum of dne million. In power stations the average size of units currently being installed is approximately 150,000 kilowatts. As new generating installations are established, the number of the larger size generators is increasing.

So much for the sheer size of the electric power industry within the next few years. There appears to be little doubt that there will be plenty of power—plus a healthy reserve-to meet all conceivable needs;

The real uncertainties revolve around the nature of the power system of the future. Because the present controversy has so many facets, a clear outline will not emerge for some time to come.

The long, bitter fight over public versus private power, goes back more than thirty years, and is still far from resolved. It dates at least to the early days of the New Deal, when the administration of Franklin D. Roosevelt, an aggressive proponent of public power, launched the multi-billion-dollar Tennessee Valley Authority project. Under the administration of Dwight D. Eisenhower the private-power spokesmen moved to the fore and Government-sponsored public projects were held down in scope and number. Although the Johnson Administration, with its liberal Democratic bent, could be expected to take a strong pro-public power stand, it has for the most part played a largely neutral role.

In fact, the public versus private power issue simmered for several years until the Federal Power Commission suddenly brought it back to white-heat in 1964.

In a sweeping report the F.P.C. recommended the creation of a national power grid, that would inevitably involve a considerable amount of Federal funds-and Federal control. The public-power interests have been urging its formation for years, but the private utility companies have taken a dim view of binding themselves into a single giant system.

The Federal Power Commission issued a 'guideline pattern" for development of the entire electric power industry. This all encompassing pattern, it was said, "is designed to encourage full regional and countrywide coordination of all systems by 1980 and sets a target for a twenty-seven per cent reduction in the average unit price of electricity to consumers."

The agency did not stipulate that its recommendations were mandatory, as indeed they could not be unless new laws are enacted. But the F.P.C. said it hoped its survey would "excite interest in the many opportunities for savings which should be explored." Considering the position of the Commission in regard to the industry it regulates on a national level, this would appear to be the understatement of many a year.

The F.P.C. envisioned by 1980 three major east-west interties of transmission facilities and another long-distance interconnection between the Northwest and the middle South. The lengths would range up to nearly two thousand miles and

there would be power flows of as much as four million kilowatts.

The Government report noted that the vital link in these power networks would be extra-high-voltage transmission lines, which enable large amounts of power to be transmitted economically over great distances.

The F.P.C. reported flatly that its national plan could result in a saving of $11.7 billion in plant investment and annual savings to consumers of $11 billion by 1980. There would be a reduction of about twenty-seven per cent in the average unit price of electricity for residential, commercial and industrial users.

The F.P.C. paid special attention to small power systems. Of the approximately 3,600 electric power systems serving the country, 3,190 are small, with peak loads of 25,000 kilowatts or less. And among the 3,190 about 2,000 are publicly owned while 904 are rural cooperatives and 289 are private companies. The utility industry calls all private companies "investor-owned," although the proportion of stock held outside the management may vary widely.

The details of the F.P.C. grand plan are as follows:

Before 1970 along the Eastern seaboard there would be extra-high-voltage transmission lines at 500 kilowatts carrying power from generating centers in the coal fields of the Appalachian region to major cities from New York to Norfolk and southward.

On the West Coast, north-south ties, at 500 kilowatts alternating current and 750 kilowatts direct current, would connect the Columbia River system and the Pacific Northwest with southern California and the Colorado River power system of Utah, Arizona and adjacent states.

In the mid-continent area, 345-kilowatt lines would be expanded and 500 and 700 kilowatt lines built to send power from coal-producing areas in Illinois, Kentucky, Indiana, Ohio and western Pennsylvania to the industrial centers of the region. Coal and lignite resources of the high plains and the Rocky Mountain states would furnish low-cost energy over extra-high-voltage networks.

Under the F.P.C. program, full coordination within these big regional systems would be achieved by 1970. Then, by 1980, there would be heavy-duty interconnections between the nation's east and west zones, resulting in one great national network-with all regions linked and able to come to the rescue of any other in a power emergency.

The private power companies, understandably, have been reluctant to criticize the F.P.C.'s recommendations and, openly, thoy are cooperating. Still the Edison Electric Institute is un-

derstood to be making a computer study of the F.P.C.'s cost findings. Private power people think that the huge investment required to establish a national network would not be economical until far in the future.

In addition, the utility companies, in the aftermath of the collapse of *a regional power* set-up, are having some serious thoughts about the advisability of a national system.

Philip Spom is the former chairman of the giant privately owned American Electric Power System. He is also considered within the utility industry to know *more* about advanced techniques than almost anyone else in the field. In the immediate aftermath of the November 9th blackout, he stressed that both sides-public and private--ought to "give pause before they push blindly forward with a nationwide grid."

Mr. Sporn came to this tentative conclusion:

"The events of that Tuesday boil down to one of two approaches to a solution. Either there was need for more grids and interconnections with every possible rerouting and interchange provided for, or there should be serious questions as to the limitations of power interconnections." And then the tantalizing, and still unanswered, questions, 'Where is the practical limit? The profitable limit?"

0. B. Falls, president of Commonwealth Associates, Inc., engineering arm of Commonwealth Services, is more positive: He believes strongly that now is the time for "a serious reevaluation of the need for a national grid."

Mr. Falls makes a point that is not often stressed by the private companies in the present period of emphasis on bigger and more far-flung power systems. Utilities, he declares, are spending far more than they should on interconnections "just to avoid Federal intervention." The shadow of the Federal Power Commission bulks ever large.

"The industry must look at load interconnections," according to Mr. Falls. "I feel that for any total load in this country there is probably an optimum limit that can be established for interconnections. In order to reach that optimum a) any one time in history, I do not see any necessity for having a United States grid. There is no question but that we should have regional grids, but even their size should be determined by careful analysis."

Robert T. Person, president of the Edison Electric Institute, takes an understandable position since his organization represents all elements within the industry, those who favor a nationwide power grid and those who are dubious about such a set-up. He merely says, "I would say we have a lot to learn from this experience. We should try to set up what happened, study *it* and avoid any possible duplication of the conditions in the future."

However, George A. Orrok, vice-president in charge of engineering for, the Boston Edison Company, is sure the entire nation would have been plunged into darkness "in less than a second" if the F.P.C. national-grid plan had been in effect. He believes the only thing that prevented a worse blackout was that the existing eastern grid is "weak in spots."

Secretary of the Interior Stewart L. Udall called on November *15th* for more *international pooling* of hydroelectric power between the United States and Canada and said that the northeastern *power* blackout might have been averted if stronger mter-ties had existed. In remarks addressed to a Toronto audience, Mr. Udall, an advocate of a national power grid, indicated that both countries have little choice about power pooling because of future demands. "Our two countries will have to spend in the next ten years more for generation, transmission *and* distribution of electricity than we have over the previous eighty years," Mr. Udall said.

The night the lights went out has raised doubts about regional power grids, since it was such a set-up that triggered the blackout. An official of one major New England utility, for instance, thinks that at the very least there should be a thorough investigation of power-transmission lines in the high voltages before any thought is *given* about proceeding toward a nationwide grid. But even as the whole grid concept comes under question, more regional tie-ups are in the *works.*

In the closing weeks of the 1965 Congressional session, public power advocates pushed through-a bii authorizing construction of a large power project for New England. It is known as the Dickey-Lincoln School. New England is the only region in the nation with no major federal power projects. The Dickey-Lincoln School federal project would use the hydroelectric resources of Canada to power the steam-generating system of New England and would, in effect, be the foundation of another Northeastern grid, tying in with the Niagara-Mohawk complex.

The investigations into the northeastern power failure are of particular concern to such emerging regional groups as WEST. That stands for Western Energy Supply and Transmission Associates, a utility group that covers part of California, Arizona, New Mexico, Texas, Nevada, Utah, Colorado, Wyoming and Idaho—about one-fifth of the land area of the United States.

WEST has plans for a twenty-year $10.5 billion-plus joint expansion program. This would utilize interconnections, power plants, hydroelectric sites and huge generating units in a regional complex that few, if any, of the individual companies could afford on their own.

Another giant interchange on the regional level is under construction between the South Central Electric Companies

and the Tennessee Valley Authority. Eventually this seasonal power arrangement-keyed to peak loads-envisions the private utilities supplying the T.V.A. with 1.5 million kilowatts of energy during the summer, while the Government will supply a similar amount to the investor-owned utilities in the winter months. An initial connection has been made at West Memphis, Arkansas, while the over-all project is scheduled for completion in 1967.

As far as this group is concerned, things have not been changed at all by the northeastern failure. An official of the Arkansas Power and Light Company puts it this way:

"The Northeast is a densely populated area with extremely large power loads concentrated in the metropolitan centers. The Southwest area is less densely populated and the power loads are widely dispersed in this section of the country." He adds:

"Much care is given to providing two or more sources of power to every load center and the interconnected systems are controlled and operated in such a way that a damaged portion would be automatically isolated from the rest of the system."

One of the immediate results of the blackout is that the entire utility industry is now taking a closer look at its operations than at its profit position. One answer, some think, is more use of the ubiquitous computer. The utility industry is already one of the most computerized of all' industries, but even these "miracle-machines" failed in the crisis.

Some computer experts say the systems involved on the evening of November 9th were not computerized enough. After all, decisions are and must be made by the man at the control center, and there is some evidence that he didn't believe-at least until it was too late-what the computers were telling him.

A computer programmer long active in the utility business has this to say: "If the computer systems involved had been designed to act on their own information without waiting for human reaction, most sections would have been able to disassociate themselves from the grid in time to save themselves."

William Joyce, official of the Diebold group, a management-consulting concern specializing in automation, cites the human element in it all, "Any man hesitates before wmmitting himself to a very serious act. What the computer could have done was to display graphically the enormity of the situation and the time in which a decision must be made."

The air-defense system of the North American continent uses a computer-human relationship. The computer alerts the controller to any danger and tells him what he should do to avert it within a given time limit. In an emergency, the computer takes over completely in "self-protection." All tests and trial runs show that this system works completely.

Nuclear power plants are also becoming ,a factor in supplying the nation's need for electricity. Last year, in a commencement speech at Holy Cross, President Johnson said a breakthrough had been achieved, 'and the "long-promised day of economical nuclear power is close at hand."

Evidently, the President was alluding to the $68 million atomic-power plant planned by the Jersey Central Power and Light Company at Oyster Creek, New Jersey. At the time of the announcement of the plant; the president of the New Jersey utility, William H. McElwain, said that after a reasonable break-in period the total cost of power from the nuclear-power station would be less than for any other type of plant the company could install at the site.

A significant aspect in atomic power is the investment required for a nuclear reactor-usually considerably higher than the investment needed for a comparable fossil-fuel type plant. Nevertheless, it has been found that the larger the plant, the smaller, the gap, and further advances in this direction are expected.

According to the National Power Survey, a 300,000-kilowatt atomic plant placed in service in 1967 probably would cost $130 for each kilowatt of capacity, or $40 to $60 more than the cost for a conventional plant. But by 1980, the cost of a 1.2 million-kilowatt nuclear plant should cost $107 a kilowatt, equal to or no more than $12 a kilowatt higher than the cost in a conventional power plant.

Another inhibiting factor at present, the survey found, was that atomic plants require more specialized operating staffs and have higher maintenance costs than those in most conventional operations. Such costs, however, are expected to decline with increased capacity and greater operating experience.

In its latest Electric Power Survey Report, the Edison Electric Institute says there are now in operation fourteen nuclear power projects, ranging in size from those producing 4,300 kilowatts to others turning out 255,000 kilowatts. An additional two projects are ready to go into operation. These sixteen projects have a total capacity of about 1.1 million kilowatts.

An additional thirteen such projects are under construction or design and another is still in contract negotiations. Of these fourteen projects, eleven would turn out 330,000 kilowatts or more. The fourteen projects would have a total capacity of about 6.1 million kilowatts. Two of the plants under construction were scheduled to be in operation before the end of 1965.

Projects under construction or design, their sponsors, and

their expected hourly kilowatt output in addition to the Oyster Creek project, include the following:

Hanford, Washington, Washington Public Power Supply System, 800,000; Haddam, Connecticut, Connecticut Yankee Atomic Power Company, 490,000; Millstone Point, Connecticut Light & Power Company, Hartford Electric Light Company and Western Massachusetts Electric Company, 600,000.

Also, Nine Mile Point, New York, Niagara Mohawk Power Corporation, 500,000; Corral Canyon, California, City of Lo8 Angeles, 462,000; Brookwood, Rochester Gas and Electric Corporation, 450,000, and a plant to be built at a site not yet determined by the Boston Edison Company, capable of turning out 600,000 kilowatts an hour.

Coal still occupies the top spot as a fuel for the power industry although it has lost practically all of its railroad and retail markets. Last year it further improved its competitive position in the power industry when transportation costs were lowered by both the railroads and the barge lines. That was accomplished by the introduction of trainload rates and the use Of unit or long car-linked trains. At-the same time, through mechanization of mines, the industry has been able to keep prices at the minehead nearly unchanged for the last twenty years. In some areas, prices actually have been held slightly below their level at the end of World War II despite sharply increased wage rates.

NOw that the freight rates have been reduced, and railroads, in cooperation with utility companies, have greatly improved handling facilities, the coal industry feels that it can hold most of the utility business. In 1964, it is estimated, coal supplied nearly two thirds of the energy requirements of utility companies in the United States,

The coal industry is now planning to attempt to break the hold of gas and oil on the huge West Coast utility market. Nuclear power, the coal industry's greatest long-term threat, is not expected to exert a substantial competitive effect for the next decade or two. The coal industry asserts that nuclear power plants take three or four years to build and are more expensive than plants burning coal.

For the moment, anyway, the fuel sources for power seem adequate. Also because of the ever-increasing demand for power, and for economical ways to produce it in huge amounts, it seems reasonable to conclude that the technological developments of fuel sources will be as numerous as the past developments in the means of producing electricity. Finally, the many views on the ownership of electric power are destined to continue as a major source of discussion and controversy for years to come.

15. The Times by Candlelight

The New York Times, organized to function in any emergency, defied The Great Blackout of Tuesday, November 9. Though its giant plant lay spookily dark and silent, it put out a ten-page adless paper-from another state. It was the only New York morning newspaper published on Wednesday, November 10.

The blackout began with a sudden absorbing of the light, as if ninety per cent of the fluorescent illumination had suddenly been sucked up a funnel. There was a wild flickering for about a minute, like a silent alarm. At 5:27 P.M. the electric clocks stopped, the machinery fell silent, air-conditioning blowers hummed to a halt. An eerie silence fell over all the fourteen floors.

Men and women gathered in knots. Nobody knew what was happening. Dayside crews were getting ready to leave. There was some laughter, a few half-shouted jokes. Somebody said, "It's just us." Somebody else looked out the big black windows onto the street and saw that it wasn't just us. "Is it citywide?' someone asked.

It was the hour the city room ordinarily warms to its night's routine. First-edition deadline was three-and-a-half hours away. Wednesday's paper had been laid out for ninety-six pages.

The city room lay in nearly total darkness. Typewriters ceased to clatter. There seemed to be virtually no ringing telephones. A few men lit matches or cigarette lighters and several got on the phone to find out if other points were affected. Within moments the true dimension of the failure began to be confirmed.

Electricity is the newspaper's lifeblood. It powers the teletypes, the typesetting machines, the stereo casting pots, the presses. There was no indication when power would be restored.

The microphones through which the Metropolitan Desk summons its reporters was dead. Staffers could not be found except by personal excursions out from the desk. Assistant Metropolitan Editor Arthur Gelb, armed with a batch of wooden matches thrust into his hand by Gil Haggerty, a desk assistant, groped his way through the vast midnight. "Peter, Peter," he called. He found Peter Kihss, assigned him to write the over-all lead. Within ten minutes he had fifteen of his men scurrying to key spots in the city-to Con Edison, to Police Headquarters, to the Emergency Control Board, into subways. "Fowler, Fowler," he called, and crashed head-on into the partition that separates real-estate news from the city room. He sent Glenn Fowler and his real-estate staff to office buildings throughout the city to check elevators. By the time Metropolitan Editor A. M. Rosenthal, who had been caught in the dark on the eleventh floor, made his way back to his desk by stairway, the basic assignments had been made. Immediately, he began to coordinate coverage; before the night was out he had thirty-five staff men at work on various angles of the story.

By 5:45 P.M., the first candles began to flicker. Pat Burns, a staff photographer, had run over to Woolworth's on Broadway and 44th Street, found it closed, finally got in by showing his police card. He panted back with $10 worth of candles. Gil Haggerty had gone in the other direction, to the Times Square Hardware Store on Eighth Avenue. He had only $10; they had fifty flashlights. Gil hurried back with the store's clerk, got Managing Editor Clifton Daniel to sign an I.O.U. for all fifty, went back to the store and picked them up.

The supply department turned over to the city room the limited supply of candles and flashlights it had on hand. Eugene Buckingham of the stock room called for emergency delivery of several cartons of candles from a supplier in Lynbrook, Long Island. It was mid-evening before they reached 43d Street; meanwhile the first candles had dwindled. Everyone tapped their own private sources for light. Someone called the New Yorker Hotel and one of the hotel's staff hurried up with a few dozen handsome dinner candles. The Astor Hotel yielded tall tapers. Pat Boyle of circulation combed the neighborhood churches, rounded up votive candles from Holy Cross Church and from St. Malachy's.

All communications lines except the telephone were out. This meant that not only was there no light to work by but the staff had no normal service from the press associations. An emergency system was set up. David Broder of the Washington Bureau, on assignment in Cincinnati, telephoned in blackout copy that was chattering in on The Associated Press machines out there. Homer Bigart, on assignment in New Jersey, called

in with material plucked from the wire service machines in New Brunswick. The Washington bureau telephoned copy taken off its machines. Reporters and secretaries were pressed into service at the receiving end. They batted out the stuff in the dark. They also took copy from national and foreign correspondents that ordinarily cornea by automatic telephone recorder.

News and production executives huddled in candlelit conferences. At 6 o'clock they decided to go ahead with alternate plans. If power came on by midnight it would be possible to get out a paper in *The Times's* own plant. If it did not, means must be found to print elsewhere.

New Jersey, which was largely unaffected by the blackout, seemed the logical place. Mr. Daniel put in a call to two afternoon papers-The *Newark Evening News* and *The Jersey Journal. The* telephone, though working, had begun to sag under the avalanche of calls. Getting through to New Jersey was slow and time-consuming. Eventually, though, both papers agreed to turn over their facilities to *The Times.* It was decided to accept the offer of *The Newark News;* it had better mechanical facilities and Newark was a more convenient get-away point than Jersey City for delivery trucks. Nobody knew, or worried about, the cost.

Edward Sugrue, general manager of *The News,* told Mr. Daniel that *The Times* should bring over its own editorial staff, that *The* News would make available its mechanical equipment and crews.

"If power is not back by 9 o'clock," Mr. Daniel told him, "we'll start moving over, We're planning an eight-page paper." It was then 7:30.

Plans went full steam ahead for printing in New York and printing in Newark. Rosenthal, Gelb and Assistant Metropolitan Editor Sheldon Binn worked out a new schedule for the Newark edition.

The city copy desk, with Bob Slosser in charge, braced itself for the copy avalanche. Half the desk was assigned to nonblackout copy; the other half, supplemented by four copy editors borrowed from the foreign and national desks, awaited blackout copy. Orders went out from the bullpen to all desks to cut nonblackout copy to the bone.

Assistant Managing Editor Ted Bernstein' was editor in charge in Newark, with Bob Crandall, an assistant news editor, as his aide. Dave Lidman, make-up editor, handled make-up. Nine copy editors, with Jack Badiner in charge, formed the copy desk. Mr. Rosenthal plucked four men from his staff as a rewrite battery. A picture deskman and two

copyboys rounded out what quickly came to be known as *The Times* staff-in-exile.

The twenty-man crew left 43d Street at 9 o'clock. Twelve of them were herded like troops in the back of a *Times* panel truck for the forty-minute drive across the Hudson River.

Also carted across the river were the front page and editorial page mastheads, some unedited copy, and type that had been set in the composing room before the blackout-including the TV and radio listings, book column, crossword puzzle, an editorial and some society news to use as filler, if necessary.

Circulation Manager Pat Reynolds called in his city and suburban roadmen, in their cars, and set up a motorized shuttle service to carry copy from 43d Street to *The Newark News.*

Copy, written and edited by candlelight, was assembled in "takes" at a copy control desk set up in the bullpen. Hank Lieberman, an assistant news editor, logged it, stuck it in large manila envelopes and turned it over to a courier control desk manned by Bill Holwmbe, assistant to the managing editor and Armida Gaeta of the foreign news desk They keyed each envelope to its courier, then turned it over to waiting circulation men whose cars were at the ready in *The Times'* loading areas. The copy lift worked smoothly. Between 9: 15 and 11:45 P.M., 21,000 words were moved from 43d Street to Newark. Duplicates of all stories were held in New York because no one yet knew for sure where the paper would actually be printed.

Strange faces kept popping out of the gloom. At one point somebody came up to Mr. Rosenthal and asked: "How about some coffee?" Mr. Rosenthal thought the stranger wanted a cup, said "Get some" and turned away. The stranger promptly went out into the street and came back with a trayful of coffee in cups. He turned out to be a lawyer, a cousin of Dick Shepard of the news staff. He'd just dropped by to see what was going on.

Two wives of newsmen-Barbara Gelb and Katie Witkin—who were to go out with their husbands that night for dinner, spent the night instead in the city room. Mrs. Gelb provided some turkey sandwiches and late in the night Mrs. Witkin provided a good idea-an interview with a pilot who found himself coming in for a landing at 5: 27 as New York disappeared below him. The idea was accepted but Mrs. Witkin was scolded by the editors for not having come up with it sooner.

In the middle of it all, Mr. Daniel's secretary whispered to him that his mother-in-law was on the telephone, calling from Missouri.

"Hello, Clifton," Mrs. Harry Truman said. "Are you all right? I just spoke to Margaret. I could get through to her but she said she couldn't reach you. She asked me to call you to find out whether she should meet you at Sardi's for dinner."

There was no dinner for the Daniels that night at Sardi's.

At *The Newark News* plant *The Times* crew was greeted by William R. Clark, the editor, and City Editor Harry Anderson.

"What have you got in the way of 48- or 60-point type?" Mr. Bernstein asked. He wanted a large bold type face for the banner headline on Page One.

"Coming from *The New York Times,* that sounds funny," Mr. Clark said. "But I suppose even *The Times* isn't going to be conservative tonight." A 48-point type face was selected.

Mr. Bernstein learned that *The Newark* News market tables, with final Wall Street closings, were already made up for early editions of Wednesday's News. Mr. Clark agreed to let *The Times* use them. The tables ran a little over a page. Bernstein called Daniel. They agreed, with this extra material, to jump the size of the paper to 10 pages.

Al Blayer, assistant to the production manager, had gone-to Newark earlier in the evening to cope with any mechanical problems that might arise in the composing room, stereotype shop or pressroom. He reported to Bernstein that the pressroom could deliver a million copies of *The Times* provided it got a 2 A.M. press start. It had been learned early in the negotiations with *The News* that *The Times* would have to be clear of the pressroom by 7 A.M., the hour at which *The News* began its press run.

The *Newark News* city room is about on&quarter the size of *The Times'* and, *as* one of *The Times'* rewrite-men put it, "Neatness doesn't count." It was beautifully cluttered and filled with old wooden desks, coat racks, green lockers and filing cabinets.

The Newark News staff was at work on a 96-page paper of its own and a good many of its reporters and editors were working the night shift. Mr. Clark swept the papers from his desk and turned over his small office to Ted Bernstein. A large wooden desk, ordinarily occupied by feature and editorial writers, was converted into *The Times* copy desk. A smaller desk adjacent to it, served as a little picture desk. The rewrite men shared desks and headsets with *Newark News* reporters and waited for telephone stories. Bernstein sent out for sandwiches and coffee for all hands.

Mr. Bernstein selected *Newark News* headline types to be used over single-column, dauble-column and three-column

stories. The copy editors had to figure the character count in each line, found it entirely different from the count to which they were accustomed. This added an extra burden to men who think instinctively-in terms of *Times* headline count.

As The Times copy arrived from 43rd Street in fifteen-minute relays, it was spilled out on the wpy desk and slugged "*Times*" to differentiate it from News copy. which was going to the composing room at the same time. The editors gave it a swift go-through, added inserts taken over the phone by the rewrite battery and handed it to the copy boys, who ran it one floor up to the composing room. The National Broadcasting Company moved in with a television camera crew and filmed the entire operation.

Ten news photographers worked on the blackout story, but their printing equipment lay powerless in the ninth floor laboratory. Picture Editor John Radosta asked John Belson of personnel, who lives in New Jersey and had a car, to scout Hudson Countv for available lab space. Belson and John Forbes of the Picture desk reported back before 7 P.M.; they had found a small, badlyequipped lab in Union City. The four-man lab crew, headed by Frank Molloy, piled their equipment-paper, film reels, developer, etc.-into Belson's car and were off. Belson continued to shuttle film and prints between New York and Union City until the news operation moved to Newark. Then the photo crew packed up its gear and shifted its base to *The Newark News* photo lab. That brought the entire across-the-river operation under one roof.

The number of pictures processed by *The Times* crew-in-exile ran over a thousand with no possibility of keeping track of who took what. Paul Duffy, a one-man picture desk, selected and cropped the pictures for the edition. Molloy, doubling as picture make-up man in the composing room, directed them to their position in the paper.

* * *

Meanwhile, in the candlelit news room in New York there was no let-up in plans to print on 43d Street should power be restored in time to make this possible. News Editor Lewis Jordan, in continuous consultation with production executives Tom Campion, Andrew Ragona and Bill Mattson, laid out alternate size papers that dwindled in size as the hours dragged on.

All through the plant employees who could not get home offered their services to the harassed news room crew. Bob November and Manny Garcia of promotion and John La Rosa of production hauled eleven loaves of bread up eleven

flights to the cafeteria, where it was converted into sandwiches. Then they carried the sandwiches down to the hungry staff chained to telephones and typing mills.

About sixty staffers slept the night through in the building. The lucky ones found beds in the few bedrooms in the plant cu slept in medical department cots or cots that were put up on various floors. Others bedded down in offices that had couches or upholstered chairs.

Arthur Hays Sulzberger, chairman of the board, was kept informed of developments by phone. Harding Bancroft, executive vice-president (and acting head of the paper in the absence of the publisher, Arthur Ochs Sulzberger, who was in Europe) kept in constant touch with Vice-President Ivan Veit and Mr. Daniel.

"We've got to commit ourselves one way or another by midnight,"-Mr. Daniel told them. Shortly before midnight they committed themselves to Newark.

Mr. Daniel called Ted Bernstein. "It's all yours," he said.

Stereotype and pressroom crews, held all evening on the chance that *The Times* might publish in its own plant, were released. Printers and photo engravers stayed through the night and got going, when power returned at 4:10 A.M., on copy and engravings for advance sections of the following Sunday's paper.

Shortly after midnight Mr. Daniel climbed on top of the metropolitan desk where he could be seen and heard throughout the cavernous city room, and relayed to the staff the decision to print in Newark. He thanked them all for a great iob.

Rosenthal and Gelb buttonholed men who had finished their assignments, dispatched them in cars (driven by circulation men who had earlier carried out the copy lift) and on foot all over the city to watch what was happening. They were instructed to type up their notes and turn them over next morning to Homer Bigart, who was to write a narrative of the blackout for Thursday's paper.

"Good night" was given in the 43rd Street city room at 12:50 A.M. Candles were blown out and the nerve center of *The Times* moved across the river to Newark. Men at kev spots-Con Edison, Police Headquarters, etc.-were told to report late news directly to the Newark city room.

When Syd Schanberg called in with a late bulletin from Con Edison he got a Newark News reporter on the phone. "Any *Times* men around?" Syd asked.

"Hell, yes," the News man said. 'They're all over the place. So is N.B.C. It's like Hollywood around here."

The ten black metal page forms that would eventually hold