ELECTRIC POWER

12 March 1958

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

Mr. Walker L. Cisler, President of the Detroit Edison Co., was born in Marietta, Ohio, in 1897. He graduated from Cornell University (M.E.) in 1922. From 1922 until 1941 he was with Public Service Electric and Gas Co., of Newark, New Jersey, rising to Assistant Chief Engineer, Electric Department. During the war he was Chief, Equipment Production Branch, Office of War Utilities, WPB, later serving as Chief, Public Utilities Section, SHAPE with the rank of colonel. He has been with Detroit Edison since 1945 in various executive capacities, becoming president in 1951. He is a fellow of the AIEE and AIME, President of the Atomic Industrial Forum, Chairman of the Atomic Power Development Arm, and a trustee of Cornell University. This is Mr. Cisler's second appearance at the College.

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COLONEL KLEIN: Admiral Clark, Gentlemen: In our Public Services Program we have already covered telecommunications and transportation, and this morning we are turning our attention to the subject of electric power, to learn how vital it is to our economy and to our national security, and to see what is being done to insure that our energy requirements in any kind of a national emergency will be met.

We have as our speaker this morning Mr. Walker L. Cisler who, since 1943, has been associated with the Detroit Edison Company, and who, since 1951, has been President of that company. He is no stranger to the College. He has been here many times before. He has spent virtually his whole life in the public services field, and I know of no one more qualified to give us an authoritative talk on the subject of electric power than he.

Before I introduce Mr. Cisler, I want to welcome the very distinguished guests we have with us this morning and who will be our seminar panelists this afternoon. You will have an opportunity to meet them personally in our discussion groups this afternoon. Gentlemen, it is indeed a pleasure to have you with us, both for the lecture this morning and for the discussion groups this afternoon.

The title of Mr. Cisler's lecture is "Electric Power". Both the lecture and the discussion period following the lecture will be unclassified.

Mr. Cisler, it is indeed a pleasure for me to welcome you back to the College and to introduce you to this year's class. Mr. Cisler.

MR. CISLER: Admiral Clark, Colonel Klein, Members of the Industrial College of the Armed Forces and many old friends here, with whom I have been associated for many years in electric power work: It is always a great pleasure for me personally to come to the Industrial College to talk with you about matters of mutual interest. I have always found it of great benefit to me to do so, and I welcome the opportunity to be here with you this morning.

Because of the presence of the other gentlemen in civilian attire, with whom I have been associated in many ways in the past, I cannot

pose as an expert here before you, because there are those among you who know just as much as and probably more about the subject than I do.

The subject that I have this morning is peace and wartime aspects of the electric power industry.

In view of the extremely important place of electric power in our expanding economy, and its even greater importance during national emergencies, it is entirely appropriate to consider as a single matter the adequacy of the electric power industry to meet its responsibilities under both situations.

I am sure you will find that managements of nearly all power systems follow this policy in their day-to-day operations and in their planning for the future.

In the late 1930's, prior to the outbreak of World War II, the entire country was recovering from the depression which began in 1929. There had been little need for several years to undertake extensive expansion of many power systems. In addition, many individual power systems were engaged in difficult legal problems associated with the Holding Company Act. As a result, there was little planning of a comprehensive nature, and there was little acceptable data concerning the actual power capacity available either for the peacetime economy or for the production of military materials.

The estimates concerning the demands which might arise in the event of a national emergency were equally inadequate. By various means, however, and with effective cooperation between governmental agencies and the electric power industry, adequate power was made available when hostilities came. In no case was military production delayed by the lack of power; and the civilian economy was well provided also.

The electric power industry has advanced tremendously since World War II, not only in its planning but also in providing up-to-date, factual information concerning existing system capabilities and programs for the future.

Capability, as used here, means the maximum load-carrying ability of the systems, with all power sources available and with no allowances for outages.

Edison Electric Institute Power Surveys

To facilitate the periodic establishment of factual data, the Edison Electric Institute in 1947 inaugurated a program of semiannual electric power surveys, which have been continued and substantially expanded in scope since that time. The report of the twenty-second survey of that series was issued last fall. The twenty-third such survey will be conducted early in April, and the report will be ready for distribution shortly thereafter. This is a copy (holding it up) of the twenty-second semiannual survey, and I have brought with me additional copies which will be distributed to you. Mr. Edwin Vennard, Vice President and Managing Director of the Edison Electric Institute is here this morning and I know that he will be very happy to make copies of the twenty-third survey available to the Industrial College as soon as they are off the press.

For those of you who are not familiar with the EEI survey procedure, the reports are presented on a national and also on a regional basis, conforming to the eight power-supply regions as defined by the Federal Power Commission and as shown in chart 1, page 4.

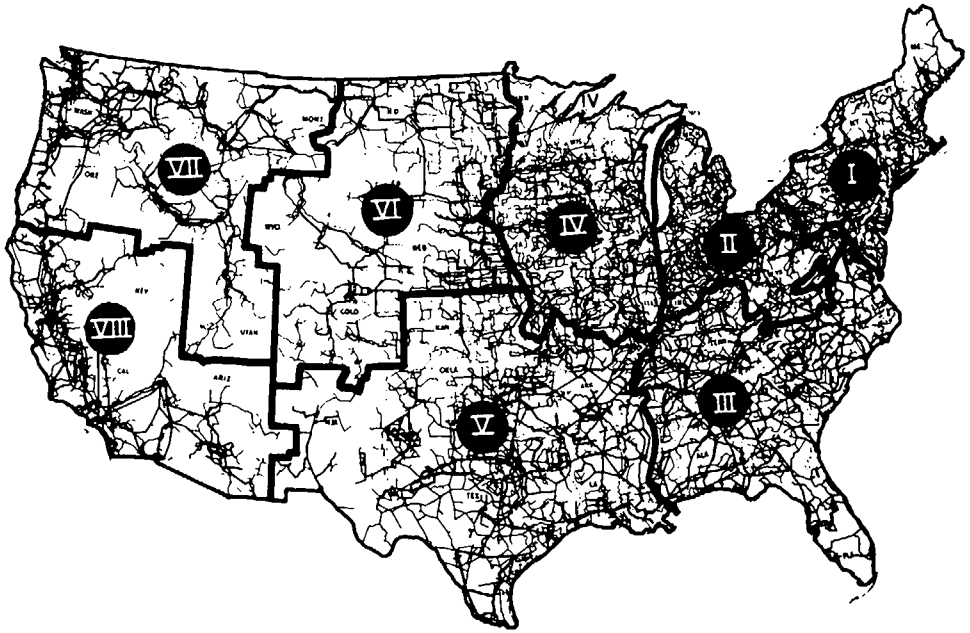
Power systems throughout the country, both investor-owned and those of governmental agencies, Federal and non-Federal, cooperate in the surveys and submit statistical information concerning actual system peak capabilities, peak loads, gross margins, and energy output.

In addition, forecasts of the conditions which are expected to exist for at least three years in the future, with respect to loads, generating capability, and energy requirements are submitted.

The survey covers approximately 98 percent of the capability of the power systems of the country. These values are summarized for each of the eight power-supply regions, account being taken of interconnection and interchange agreements.

The basic information is compiled primarily by those who are responsible for the actual operation of the individual power systems and those who are responsible for forecasting and planning for the future power requirements. They know far better than anyone else the true capability and dependability of the generating facilities which are involved, the capacity of interconnections, and other factors which may influence system operation. You may be sure, too, that they have the best and most realistic predictions concerning the probable future loads in their respective areas.

Chart 1



Capability, Peak Load and Gross Margin Forecasts

You are interested, no doubt, in the results of these surveys. Chart 2, page 6, shows the nationwide December capability, peak load, and gross margin as reported in the twenty-second semiannual survey, as of 1 October 1957. December is used as the principal reporting period because, with the exception of Region 5, and possibly Region 7, it is the month during which the most critical contions occur.

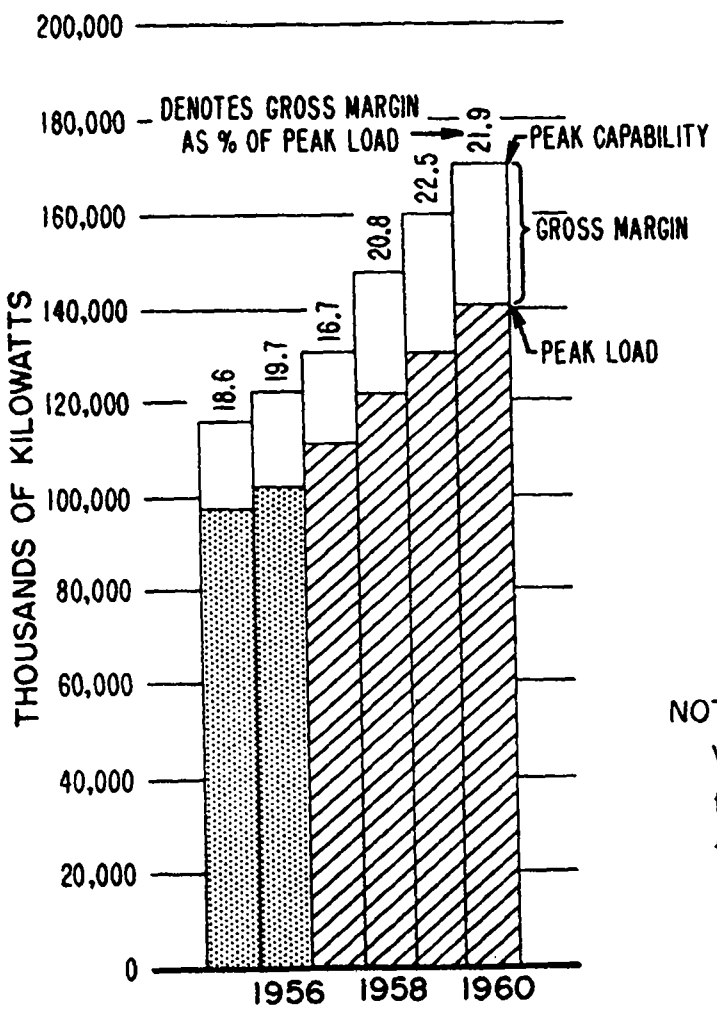
You will note that the peak load, shown by the shaded portion of the bars, increased from 97.8 million kilowatts in 1955 to an expected 140.8 million kilowatts in 1960. Similarly, the nationwide power system capability increased from 116 million kilowatts in 1955 to an expected 171.6 million kilowatts in 1960. The gross margin is the difference between the peak capability and the peak load. It includes the provision for scheduled maintenance, system operating requirements, and emergency outages. Any remainder, after these needs are met, is available for unpredicted loads.

The gross margin, as you see, varies between 16.7 to 22.5 percent of the peak load during the six years shown. I will comment later on the significance of these numbers.

Preliminary information now available for 1957 shows that the actual capability at the year end was very close to that expected. Because of slackening industrial operations, the December peak load reached only about 107 million kilowatts, instead of the 112 million kilowatts expected in October. As a result, the gross margin for December 1957 was about 22 percent of the peak load.

The values for each of the eight power-supply regions are shown by chart 3, page 7. You will observe that in all cases the bar charts are similar in trend to that for the Nation as a whole. It is interesting to note that the capability in each of Regions 1, 2, and 3, which together include most, but not all, of the country east of the Mississippi River, was close to 25 million kilowatts at the end of 1957. Taken together, the capabilities of these three regions total a little over 75 million kilowatts, or about 58 percent of all the 1957 electric power capability in the United States.

Chart 2



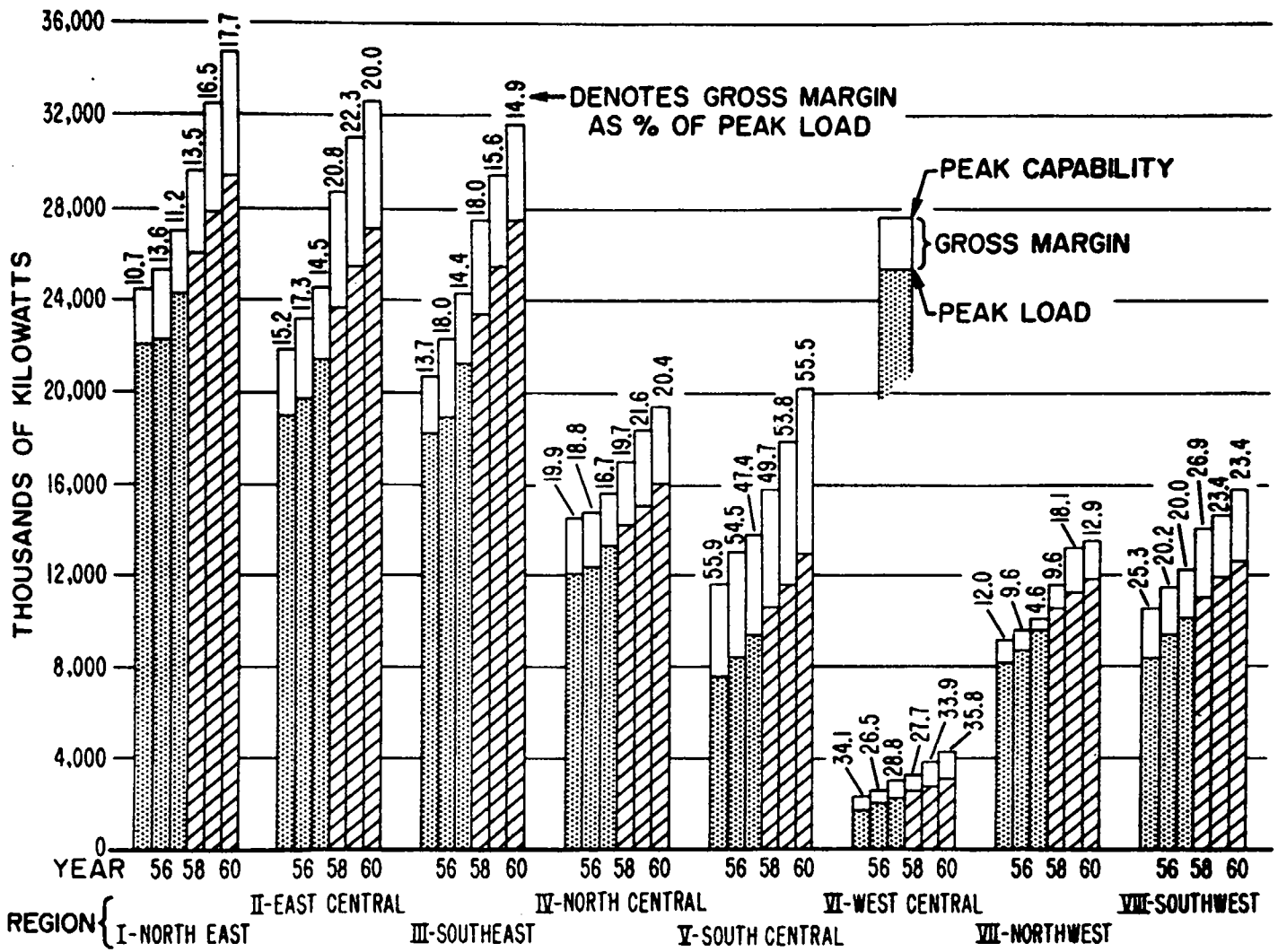
PEAK CAPABILITY represents the maxi
kilowatt output with all power sources av
It must, therefore, provide the necessar
allowance for maintenance, emergency
outages and system operating requireme

GROSS MARGIN includes the provision
maintenance, emergency outages and s
operating requirements. Any remainder
these needs are met, is available for
unforeseen loads.

NOTE:

Values indicated are the sum of regional totals for December and do not reflect the fact that the maximum loads in some regions occur in summer.

Chart 3


THOUSANDS OF KILOWATTS
36,000
32,000
28,000
24,000
20,000
16,000
12,000
8,000
4,000
0
YEAR
56 58 60
DENOTES GROSS MARGIN AS % OF PEAK LOAD
PEAK CAPABILITY
GROSS MARGIN
PEAK LOAD
10.7 13.6 11.2 13.5 16.5 17.7
15.2 17.3 14.5 20.8 22.3 20.0
13.7 18.0 14.4 18.0 15.6 14.9
19.9 18.8 16.7 19.7 21.6 20.4
55.9 54.5 47.4 49.7 53.8 55.5
34.1 26.5 28.8 27.7 33.9 35.8
12.0 9.6 4.6 9.6 18.1 12.9
25.3 20.2 20.0 26.9 23.4 23.4
REGION
I-NORTH EAST
II-EAST CENTRAL
III-SOUTHEAST
IV-NORTH CENTRAL
V-SOUTH CENTRAL
VI-WEST CENTRAL
VII-NORTHWEST
VIII-SOUTHWEST

Manufacture of Heavy Power Equipment

In addition to the information with respect to loads and capability which I have discussed, the Power Survey Committee, in cooperation with the power systems and equipment manufacturers, compiles comprehensive information concerning the specific plans for the expansion of generating facilities. This includes detailed data as to the manufacture of heavy power equipment, including steam turbine-generators, hydraulic turbines, generators for hydraulic turbines, steam generators (boilers), power transformers, and atomic power reactors.

In the course of obtaining these data, equipment production, material supplies, manpower, and other pertinent problems are discussed with the manufacturers of heavy power equipment. Thus, full information concerning the manufacturers' probable ability to meet their production schedules is established.

Scheduled Additions to Generating Capacity

One of the most significant and revealing features of this part of a survey is the compilation of scheduled additions to electric generating capacity. A tabulation of the invidivual generating units, giving the system, station, capabi lity, and scheduled date of operation, is included as an appendix to the survey reports.

The list, in the twenty-second survey report, published as of 1 October 1957, included 534 generating units, both thermal and hydraulic, with a total generating capacity of nearly 53 million kilowatts. Of these, 508 units, with a total capacity of more than 48 million kilowatts, were scheduled for service in the four years, 1957 through 1960. It is possible that some of these units may be delayed if the present slackening of industrial activity continues.

It should be stressed here that power systems generally are planning for as much as 25 years ahead. They review their situation frequently and adjust construction plans to meet load conditions.

Significance of Power Surveys

I would like to express my personal opinion as to the significance of the survey data I have been discussing. Experience over the past 11 years has shown quite clearly that, under most circumstances, the gross margin on a power-supply region basis is a good indicator of the power situation within that region.

Though there is no universal agreement, it will usually be found that, if the gross margin is 10 percent or more, all power loads can be satisfactorily carried. In some instances systems have operated successfully, and without curtailmaent, with gross margins as low as 5 percent.

On the other hand, most system operators feel that 10 percent gross margin is not fully adequate for long-term purposes, and plan their new capacity in a way which provides somewhere between 15 and 20 percent gross margin. This range seems to assure the unquestioned ability to carry all loads and to provide considerable latitude for growth and unforeseen loads.

On this basis, the present power-expansion programs, as shown in the EEI surveys, seem wholly adequate. We must recognize, however, that problems may arise in local areas from various causes, such as adverse water conditions, or extreme weather conditions, either unexpectedly warm, or extraordinarily cold, as have recently occurred in the southeastern part of our country.

Trends in Power System Development

In the endeavor to meet the rapidly increasing power requirements, a number of well-defined trends have appeared, some of which are as follows:

1. The size of thermal generating units has vastly increased. During World War II, the size of the largest units available was about 125,000 kilowatts. In 1957, nine units, with a capacity of 200,000 kilowatts or more, were placed in service. In 1958, machines with a capacity of more than 300,000 kilowatts will come on the line. One of these will be on the Edison System there at the River Rouge Plant. The largest unit now on order, 500,000 kilowatts, will be installed in the Widow's Creek Plant of the Tennessee Valley Authority. Present trends are that prices have moved so high that there is little or nothing to be gained by resorting to even larger units. And I am speaking of the capital investments as well as the operating economy.

2. Steam pressures and temperatures have advanced steadily. In some instances, severe metallurgical problems are being experienced with steam temperatures of 1100 degrees Fahrenheit. One supercritical pressure unit is now operating, and two more are under construction.

3. The reheat steam cycle has been adopted for nearly all large-size installations in the endeavor to gain fuel economy. Several systems are now considering less efficient, and thus less costly, equipment to be used primarily for peak-load purposes.

4. With the completion of the Saint Lawrence Seaway and Niagara Falls redevelopment projects, about all of the large hydrosites east of the Mississippi will have been developed. Additional power for this whole area must come from thermal plants.

5. Though many plants today are being equipped to burn coal, gas, and oil, depending upon cost considerations, coal is to become more and more the basic fuel.

6. The interconnection of power systems has continued, and many large systems are now continually synchronized. There is much exchange of power for reasons of economy and for capacity purposes.

7. Extra high-voltage transmission is now being installed in several sections of the country. This will permit the transmission of power over much longer distances and in greater quantities. Present systems in the United States are designed for about 345,000 volts, but others are considering even higher voltages which have worked well in Europe.

8. Summer power loads, resulting from air conditioning, now are nearly as large as winter loads in most urban areas. This is causing substantial revisions in the operation of power systems, particularly with respect to maintenance schedules and reserve requirements.

Electric Power and National Emergencies

You are concerned, of course, with how this power-expandsion program, planned primarily for the peacetime economy, meets the needs of a national emergency.

Based upon my experiences in World War II, both in the United States and in Europe, where active warfare was carried on, I believe the power industry is capable of meeting the power requirements of any national emergency.

Prior to World War II, the country, as stated earlier, had experienced a long depression. The manufacturing industries were operating at a low level and, until defense mobilization began, in 1939, there had been little reason or need for new power-generating equipment.

Power systems, however, recognized the expanding power requirements as soon as defense mobilization got under way, and placed orders for a great many new machines. Many problems concerning the relative priority of these units and their importance as compared with military equipment, particularly Navy propulsion units, arose almost immediately.

As the situation developed, the manufacture of many civilian products, particularly automobiles, was suspended, and the defense production which was substituted did not require as much power as the civilian production it replaced, except in certain electrochemical and metallurgical processes.

The present situation is far different. A large power-expansion program, designed to match the peacetime economy, is in progress. Most of the materials required to manufacture the equipment are flowing through the producers' shops and, in the event of a defense crisis, they would clear those shops before plans for the manufacture of military materials could be formalized.

Most importantly, the 15-to 20-percent gross margin, which I discussed earlier, provides very substantial blocks of power, available for immediate use in most every part of the country. Through existing interconnections and coordinated operation, which already is extensively practiced for reasons of economy, there is a great deal of flexibility as to where power can be made available.

I would offer a number of thoughts for your careful consideration. Today interconnections between power systems extend over very large areas of the country. The operators of those systems know their potential capabilities and their ability to supply new loads. You will find they are willing and anxious to cooperate in any power-supply situation, as they did in meeting the power requirements of the Oak Ridge, Paducah, and Portsmouth Gaseous Diffusion Plants of the Atomic Energy Commission.

It would be tremendously helpful to all power systems if information concerning probable defense requirements were available, particularly if substantial new loads are envisioned. For example, in

Detroit, during World War II, the industrial power load declined as factories were converted from peacetime to military production. As a result, we were able to supply power to a substantial magnesium reduction plant.

With the highly mechanized processes used in those same plants today, we would expect the same effect now, because it likely would take a very long time to arrange defense production procedures comparable to the automation used in some of our most modern factories. We could be wrong in this thought, particularly in the event of a prolonged emergency.

You may be sure that, in all our planning for The Detroit Edison Company, we give full consideration to the possible defense requirements of the many facilities in our service area. I am sure other operators include similar consideration in their planning for the future.

Atomic Power

Mr. Samuel Hill suggested that I discuss the future role of atomic electric power. I find it difficult to believe that atomic power, as such, will be of real significance within the next 10 to 15 years. There is a broad developmental program under way in the United States and elsewhere. Many different reactor types and concepts are being considered. Several have been built, some are under construction, and others are in the advanced planning stage. I believe that most of these developmental plants will function about as anticipated.

We must realize, however, that we do not have sufficient operating experience to know definitely the operating reliability of power reactors or the cost of power produced. We would be unwise indeed, at this time, or in the years immediately ahead, to rely upon unproved new equipment of this kind for any substantial or vital part of our power supply.

We need experience with many first-generation power reactors and with second- and third-generation designs to have the assurance that atomic power is feasible from the operational standpoint. Similarly, we need extensive advances in technology and fuel cycles to produce atomic power that can be justified on a competitive basis.

The Enrico Fermi Atomic Power Plant

As you may know, a substantial number of power systems, manufacturers, and engineering firms have joined in the Enrico Fermi Atomic Power Plant Project being built near Monroe, Michigan. Chart 4, page 14. The reactor is of the sodium cooled, fast neutron, breeder type, designed to produce 100,000 kilowatts of electric power initially, with the expectation that later its output may be increased to 150,000 kilowatts. Construction of the plant was started in 1956 and the site appeared as shown by chart 4, in early February of this year.

The reactor building is now ready to receive the reactor vessel when it arrives in April.

We fully expect this plant to perform in an acceptable manner when it comes into service late in 1960, yet we know that, under some circumstances, its continuity of service may be less favorable than that of conventional generating plants.

Taken as a single unit in a very large interconnected system, this would not create unmanageable problems. On the other hand, we would not think of such a plant as the firm source of power for a specific vital defense production facility.

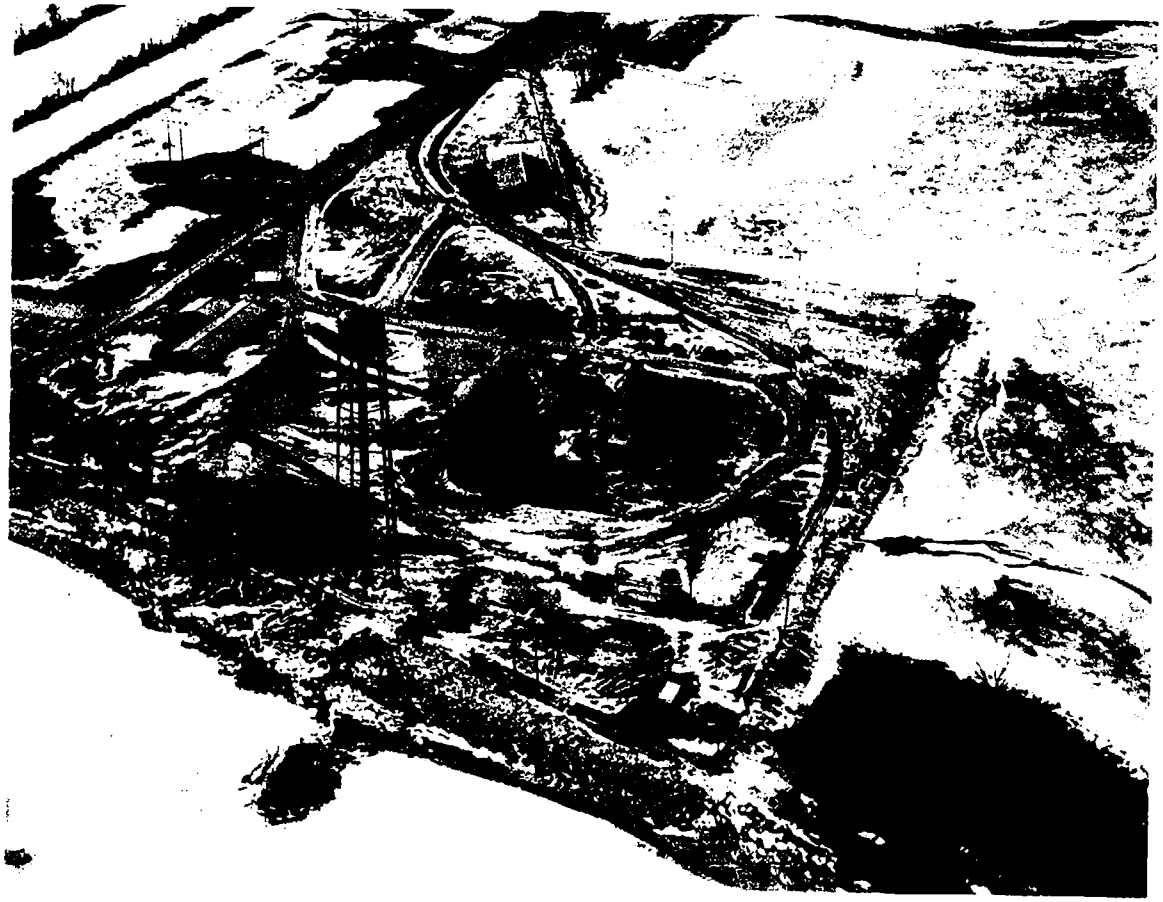
We are studying possible second- and even third -generation concepts, with the thought that improved reactors will be built at the earliest possible time. Others are pursuing similar courses. I am sure we will know much more about atomic power by the middle 1960's.

Recovery of Power Systems from an Enemy Attack

Mr. Hill also suggested that we examine the ability of our electric power production and distribution systems to recover from an enemy attack. This is an extremely difficult matter, because no one knows the extent of the destruction which might be involved, or the part of the population and the industry that might survive and require service.

It is our understanding that, during World War II, heavy bombing attacks seldom were directed against powerplants, because it was found that either the plants could be repaired quickly or the power supply could be restored through interconnections or other means. Much more effective results apparently were obtained by concentrating on facilities utilizing the power. Thus it was generally found, both in Britain and in Western Europe, that the power supply exceeded the requirements.

Chart 4



I have great difficulty in believing that a military attack by missiles, or even bombers, could completely knock out all of the sources of power for power systems where the several generating plants and interconnections are spread over a rather wide area.

The Detroit Edison Company, for example, serves about 7,600 square miles of southeastern Michigan. We have six large generating plants, as shown by chart 5, page 16, located along the Saint Clair River, the Detroit River and Lake Erie. At the present time, the capability of these six plants totals 3,101,000 kilowatts. The most northerly and southerly are nearly 70 miles apart. Two are quite close together.

In addition, we have three heavy interconnections with Consumers Power Company, two with the Ontario Hydroelectric Power System, two with the Ford Motor Company, and one with the Public Lighting System of the City of Detroit. Taken together, these interconnections have a capacity of 750,000 kilowatts, as compared with about 3 million kilowatts for our six powerplants.

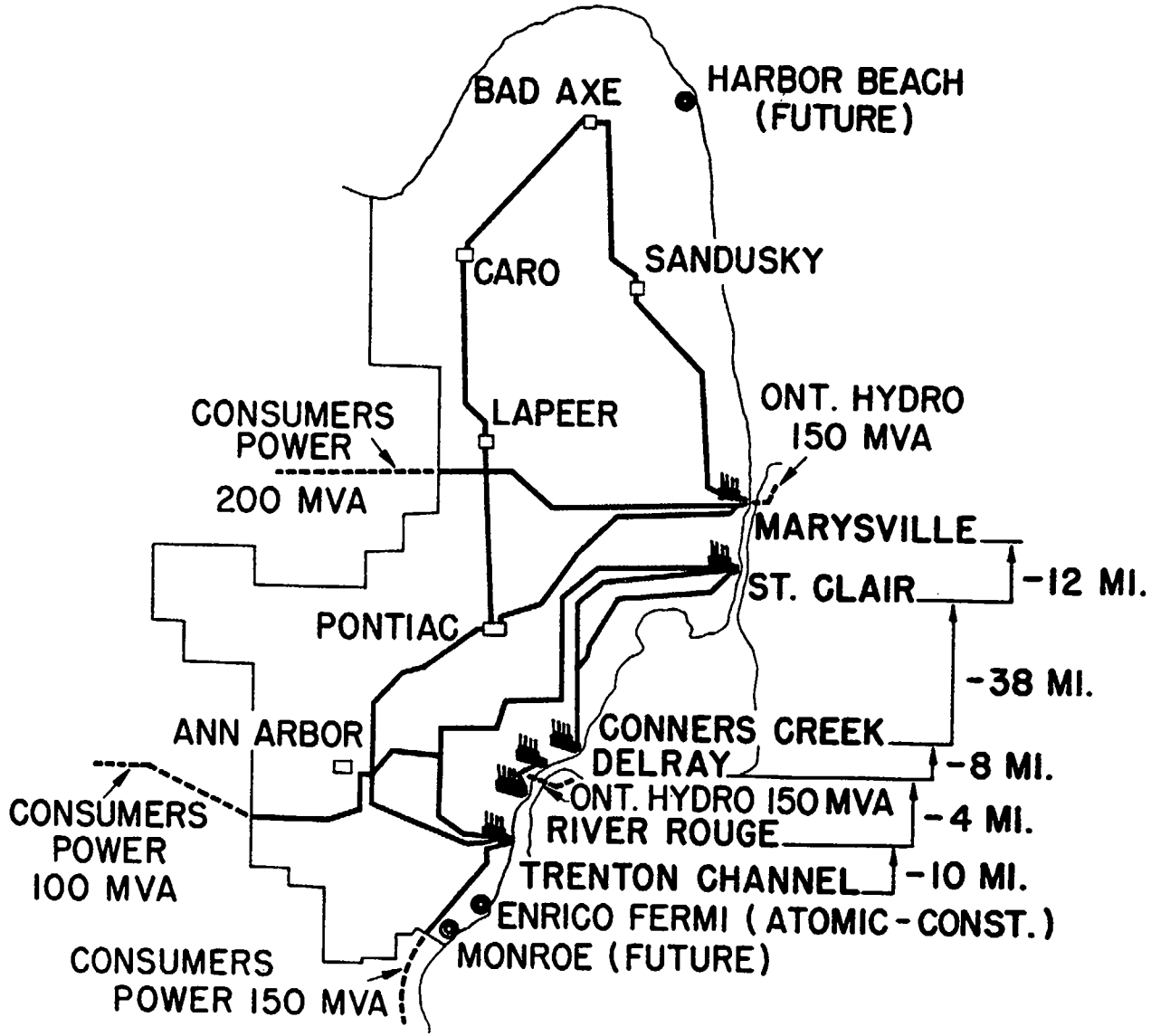
A strategic missile or bombing attack might damage, or even destroy, one or more of the plants, and part of the transmission system. In the same attack, important power-utilization facilities also would be destroyed. I do not believe, however, that all sources of power could be destroyed or even badly damaged, except perhaps by saboteurs or by direct occupation.

It is my feeling that power sources, with sufficient capacity to serve whatever load might remain, would survive almost any military action except possibly occupation by enemy forces. This is in keeping with our experience in Western Europe during World War II. Bombing did restricted damage, generally to generating stations, but demolition acts did great damage wherever the retreating forces were so minded, as, for instance, in Italy.

Powerplants ordinarily are highly individualistic. Usually only a limited exchange of repair parts is possible. Most power systems now have a highly skilled central maintenance group, capable of making all practical repairs in a short period of time.

In times of emergency, it would be possible to loan such skilled personnel to systems that are in distress, just as we now loan line crews where floods and hurricanes have struck. We cannot make any useful evaluation of the results which such practices might produce under the attack conditions which are envisioned, but I believe that surprisingly good results would be accomplished.

Chart 5


BAD AXE
HARBOR BEACH (FUTURE)
CARO
SANDUSKY
CONSUMERS POWER 200 MVA
LAPEER
ONT. HYDRO 150 MVA
MARYSVILLE
ST. CLAIR
-12 MI.
PONTIAC
-38 MI.
ANN ARBOR
CONNERS CREEK
DELRAY
-8 MI.
ONT. HYDRO 150 MVA
-4 MI.
RIVER ROUGE
CONSUMERS POWER 100 MVA
TRENTON CHANNEL
-10 MI.
ENRICO FERMI (ATOMIC-CONST.)
MONROE (FUTURE)
CONSUMERS POWER 150 MVA

The restoration of transmission and distribution systems should be a somewhat less complicated problem than the restoration of powerplants. As you know, we experience extremely severe storms in many places in the United States which cause extensive damage.

As we have come to depend more and more upon electric power for our work and living, power systems have found it necessary to develop comprehensive disaster plans for the quick restoration of service. These plans appear to be as appropriate for military destruction as for natural disaster. Some of these have actually been used, and probably all of them have been given several dry runs.

In the event of disastrous military destruction, these plans would immediately go into effect.

The Detroit Edison Major Disaster Plant

The disaster plan of The Detroit Edison Company became operative in December 1956, after two years of investigation and study of the complex task of converting chaos, such as resulted from the 1954 hurricanes Carol and Edna, to order.

The first step in the organization of our plan was the appointment of a Disaster Director, with appropriate deputies, so there would be no question of responsibility or authority during such situations. The Director and his deputies have the continuing responsibility of knowing that the plan is thoroughly understood and that all who will function under it know their assignments and responsibilities.

Maximum decentralization and teamwork are the cornerstones of the plan. Included in the 432-page Major Disaster Plan Manual are the specific steps that are to be taken to assure prompt assembly of personnel, fast and accurate appraisal of the magnitude and nature of damage, and a quick estimate of the time, materiel, and personnel required to make repairs.

Based upon appraisals, company officials would seek assistance in the form of line crews and materials from others.

Under the plan, the company's 7,600-square-mile service area has been divided into 51 emergency work-dispatching headquarters. Each of the emergency headquarters is provided with telephones and

a special disaster kit. It also houses the necessary materials, circuit maps, instructions, emergency lighting, identification passes, and so forth, to permit the headquarters to operate as an independent line-restoration group.

The prime responsibility for solving the damage repair problem rests on the company's Overhead Lines Department. Employees of many other departments, however, have been assigned strategic supporting tasks which will free the overhead personnel and allow them to concentrate on the particular aspects that they are concerned with in line restoration.

Fortunately, we have had no occasion to use this plan since it became effective. We did engage in a dry run in 1957 and determined that it is workable. We plan to have such a test about once a year so that all may be familiar with their assignments.

We have studied this plan in connection with civil defense, and we believe it is entirely workable. We cannot envision any organization being substituted for those who know the system best.

The unknowns are the possible destruction of equipment and loss of life in the event of military action, and the possible contamination by radioactive materials.

The only answer we know to such possibilities is that those remaining must step in and fill the voids.

The Rand Study

A few years ago The Detroit Edison Company was one of a small group of power systems which made a study under the Rand organization of what would happen in case there was a percentage destruction of the generating capabilities--25 percent, 50 percent, and higher. Admiral, it might be that those who are here would be interested in having a review made of that Rand Study, because the purpose was to picture a situation involving a reduction in power capability brought about by the destruction of the power-generating facilities, and to determine what such destruction would do to military and other production. I would commend it to you for your studies.

This brings to a close my prepared remarks, but I do wish to add just a few words in connection with the Edison Electric Institute power surveys.

A year end survey of the power situation summarizing activities for the year 1957 was recently released.

Just within the last few days I received a copy of the first power survey of Turkey made by the Turkish Power System people. It is similar in form and detail to the EEI reports. The Japanese have a comparable semiannual survey program, which had its origin from these EEI reports. The same is true for the OEEC countries of Western Europe. We find that Canada is making a similar survey, and I believe that other countries will follow, as well.

The importance of adequate electric power data is being recognized in many countries, and the EEI plan of providing such information is being followed.

As I told Admiral Clark earlier, I am going to leave a copy of Detroit Edison's Major Disaster Plan with him, for whatever use he may find it valuable.

Summary

In closing, I believe it most important that there be a full understanding of the electric-power situation by those responsible for the defense of our country. Comprehensive information concerning our power systems is available from the Edison Electric Institute, the Federal Power Commission, and from power system representatives; and there are other governmental agencies as well.

It should be recognized, however, that the management and operators of the various power systems know full well--and I believe this is understandable--the capabilities of those systems. I am sure that you will find that they are prepared to cooperate with the armed services in the resolving of all problems, whether of a peacetime nature or related to defense matters with which you are concerned.

I think electric power is a highly important aspect of your work. It is particularly important to us here in the United States, where we have more than 40 percent of the total electric power of the world.

I have in my experience become familiar with electric power in many of the countries of the world and I believe we are most fortunate, indeed, in having these great electric power systems--private, Federal and non-Federal--because, taken together, they give us very great strength for peace and for defense.

COLONEL KLEIN: Gentlemen, Mr. Cisler is ready for your questions.

QUESTION: How much of the power generated is produced by oil in this country?

MR. CISLER: I can't give you the exact figure on that. I believe that it is of the order of 15 to 20 percent. I think about 65 percent of the thermal power comes from solid fuels, and the balance from liquid and gaseous fuels. Last year the total solid-fuels requirements were about 130 million tons, and the equivalent of coal, gas, and oil, in terms of coal, totaled up to about 190 million tons, but I can't give you the exact division between oil and gas.

(Editor's Note: EEI statistics for 1956, the last year now available, show that 80 percent of the power generation in the United States was by thermal plants and 20 percent by hydro. Coal (158 million tons) was used to produce nearly 69 percent of the thermal power; oil (3.05 billion gallons), 9 percent; gas (1,237 billion cubic feet), 22 percent.)

QUESTION: Mr. Cisler, since you indicate that it is necessary to plan for as much as 20 to 25 years ahead, can you tell us a little bit about your problems and methods of going about financing plant expansion in today's market?

MR. CISLER: Yes, I am very happy to. As you know, to carry on such a large power-expansion program means very great capital requirements because the electric-power industry is a high-investment industry--$4 to $5 of investment per dollar of gross annual revenue. That is far in excess of a normal industrial manufacturing facility. For The Detroit Edison Company in 1957, about $81 million of new money, plus money coming out of the retirement reserve, was spent to expand the system and to replace inadequate facilities. Our construction budget for 1958, as now planned, will be of the order of $75 million, and probably between $50 and $60 million of that must come from new borrowings. In planning ahead, it is important that financing be anticipated, because some powerplants, as you well know, may require 3- to 4-year construction period and funds for their construction must be assured before work is started. On a countrywide basis, roughly $2 billion a year in new capital is required by the electric-power companies. That, of course, is a very important factor because those systems, borrowing from private sources, are in

competition for the money in the market and in competition with others who are seeking that same money.

This emphasizes the importance of getting the greatest amount of capability on a systemwide basis for each dollar of investment; and, because of increasing prices of materials and equipment and manpower and the like, less is obtained today than in earlier years. Consequently, less new capacity is obtained per dollar of investment to enable you to produce revenue. Strenuous endeavors are being made to increase the load factor in order to compensate for these other retarding factors.

A few years ago the EEI Electric Power Survey Committee made a survey looking 25 years ahead in an effort to determine the probable load and capability required to serve such loads. I think, again, Admiral, that survey report would be of interest to you. It is rather interesting that, of the total generating capacity additions over the next 25 years as estimated a few years ago, 90 percent of all additional power would need to come from thermal sources because development of the hydraulic resources is largely completed. Therefore, we must look to the conventional fuels and to atomic energy as our sources of thermal energy for this 90 percent in the future.

QUESTION: Sir, would you tell us something about the international interconnections of power, as, for example, between Detroit and Ontario? Do they exist to any degree?

MR. CISLER: Yes, international exchange exists in many places in this country. There is a very large exchange at Niagara Falls and this will be increased when the St. Lawrence Seaway and Niagara Falls redevelopment are completed. It exists in the Northwest States and there are smaller interconnections in some of the easternmost New England areas and in the Maritime Provinces of Canada. And, of course, there is interchange, too, between Mexico and the States on the border there, but not in substantial quantities.

The great international exchange of energy occurs in Europe. It is really a most interesting and encouraging interchange that goes on there. Since the close of the war, there has been a continued increase in the flow of electric power back and forth between the countries.

When I was in Europe last December, the Belgians were cascading power through France into Switzerland and on into Italy. Such operations are not uncommon. Electric power is flowing across international

boundaries there without restriction. The transactions are made over the telephone, in very much the same manner as interconnections used here between various systems in the United States and our international interconnections.

The exchange of electricity is really a common market in electricity similar to the Schumann Plan, and the Coal and Steel Community of Western Europe. No laws or governmental decrees have brought it about. Rather operators of power systems, realizing the economies and the gains that can be achieved, the same as here in this country, have initiated and extended the activity. The Union for Coordination of the Production and Transmission of Energy, which is an unofficial group, is working on an informal basis to exchange power in payment for equipment manufactured in one country and installed in another. In other instances, large projects have been undertaken on an international basis.

I feel that electric power in Europe has been one of the really great ambassadors of good will between the countries there.

QUESTION: You spoke of power sources. Has your Institute been making any study on using the sun's energy more directly? Are there any possibilities in this area?

MR. CISLER: No studies have been made by the Edison Electric Institute, which primarily is a statistical organization bringing together all of this material and data and the people concerned. As you know, however, conferences have been held in Arizona. William Reilly is here and he can tell you about the solar energy activities in Arizona and other States. I think that solar energy at this time has no real applications of note although the time may come.

I was in the Belgian Congo in July and August to see some of the undeveloped and developed hydro resources and mining operations. I visited one of the scientific research institutions there, close to the Equator, where they were carrying on some of the geophysical year operations. I found that one of the scientists had a boiler to heat water for use in his home up on the roof of his house. It was quite a big device in order to heat a realtively small amount of water; and that was right close to the Equator.

Solar energy can be utilized on a limited basis, but not in any commercial quantities.

QUESTION: Sir, can you tell us what percentage of the total power, electric energy, comes from federally owned and operated sources, and do you visualize that the Federal system is dropping back or expanding?

MR. CISLER: About 80 percent is in investor-owned power systems such as the Potomac Electric Power Company here in Washington, Baltimore Gas and Electric Company, and Philadelphia Electric Company. About 11 to 12 percent is in the Federal-owned power systems such as TVA, Bonneville, and the like. And then, about 8 or 9 percent is in the non-Federal systems, the municipal systems, like the City of Los Angeles, and other smaller ones.

As to the increase and relative change in those percentages, I am not one to judge. I can take only what would be shown by this report as to what is being undertaken in the various areas. As we have already said, certainly the future is going to be in thermal plants. There will undoubtedly be the development of a substantial part of the remaining hydro. How much will be done by the Federal systems, which, with the exception of TVA, have been primarily hydro systems, I am not in a position to know.

QUESTION: Sir, with the higher cost of labor and materials in this country, what would you say our prospects would be in the world market for providing nuclear powerplants, say, in the next five years, and what part do you think this would have in helping to develop economic nuclear power in this country?

MR. CISLER: That's a very big question, and one, of course, which is before the country. It certainly can best be answered by those who have a public responsibility, such as those in Government and in the Congress.

If we judge by experience in connection with conventional thermal power, other nations have gained much of our know-how since the end of the war. It has been my privilege to meet with many visitors from overseas and I know the European countries and other countries have benefited greatly by observing and utilizing our advancing technology and engineering in conventional ways. They have certainly caught up to us to a very great extent, and, in some areas, such as in electric-power transmission, I think they have been ahead of us, and we in turn have learned from them.

I spoke of a unit of a half-million kilowatts for the TVA system. The Central Electricity Generating Board of England has contracted for two units of a slightly larger size.

Those experiences are directly related to atomic energy. You know of the outstanding accomplishments of the British in their atomic energy developments. We have read about the accomplishments of the Soviet Union, but we know less about their accomplishments than we do about those of the British. The United States, the United Kingdom and the Union of Soviet Socialist Republics are the countries that undoubtedly have done most in atomic energy development.

It is important, in thinking of worldwide atomic power development, to consider how far the United States should go, and what are the economic aspects involved, and how much atomic power would be of value to the lesser developed areas--as I like to call them, rather than underdeveloped areas. While large investments are required in order to generate power, the investment required to utilize power may be more than ten times as large.

In the interest of conserving capital it may be that power requirements can be served best by conventional powerplants rather than resorting to high-cost atomic installations.

I know that other countries, such as France, Belgium, and Japan--and I see many of the people there and meet with them--are concerned about this matter.

I think that the atomic power development program under way in the United States is going to be very meaningful. It is very broad. In my judgement it has greater breadth and greater depth than any other program now under way in the world. On that basis, certainly others would have much to learn from what we are doing.

QUESTION: I am wondering about the impact of increasing wages on the price of your product. Can you tell us what percentage of the cost of your product, electricity, is eaten up by labor?

MR. CISLER: Well, wages and salaries are a very considerable item of expense, I can assure you. In fact, they amount to 22.4 percent of our gross revenue not including retirement, insurance, and other fringe benefits, and are the largest single item of expense in connection with our own company. They exceed that of fuel, fixed charges, interest, and the like. Wages have been on the increase, as

they have been in almost every other industry, but, by the use of larger generating units and careful management, we have kept the percentage cost reasonably constant over the past several years.

Some of our wage and salary rates are geared to the cost of living index and, when there is an increase in the cost of living of one cent, it means about a quarter of a million dollars in increase to payroll expense. All of the increases over the past few months added together mean a substantial amount. With us, at the present time the average hourly wage for the more than 10,000 people on the hourly and weekly payrolls is more than $2.85 an hour.

The only way to keep the cost of service down is to make the dollars invested work as hard as possible, and they will work hard, if unreasonable restrictions are avoided, to get increased kilowatt hours of production for each of these hours of manpower to be paid for, to get the maximum amount of capacity for the dollar that has to be invested.

Expressed in a different manner, with a gross income of $251 million in 1957, Detroit Edison spent nearly $61 million for direct payroll expense and pensions, and that does not include such other expense items as payroll taxes and employee insurance benefits. Payroll expense requires a very substantial part of a company's gross income. The amount will vary, of course, in different systems throughout the country, depnding upon the kind of service given. For example, with us, we have the exchange of burned-out lamp bulbs, which cost something of the order of $1.75 million a year. In addition, we provide appliance repair service and other unusual service. Much of this goes into payroll expense. Those are services that are given to the customers and form a part of the rate structure, and therefore reflect themselves, in that sense, in a higher total payroll expense.

COLONEL KLEIN: Mr. Cisler, I want to thank you very much for sparing time to come down here to be with us today, and for giving us such a comprehensive coverage of the subject. Thank you very much.

MR. CISLER: Thank you very much. May I wish you all well in all that you are doing.

(17 June 1958--4,100)O/mms:mjs:ekh