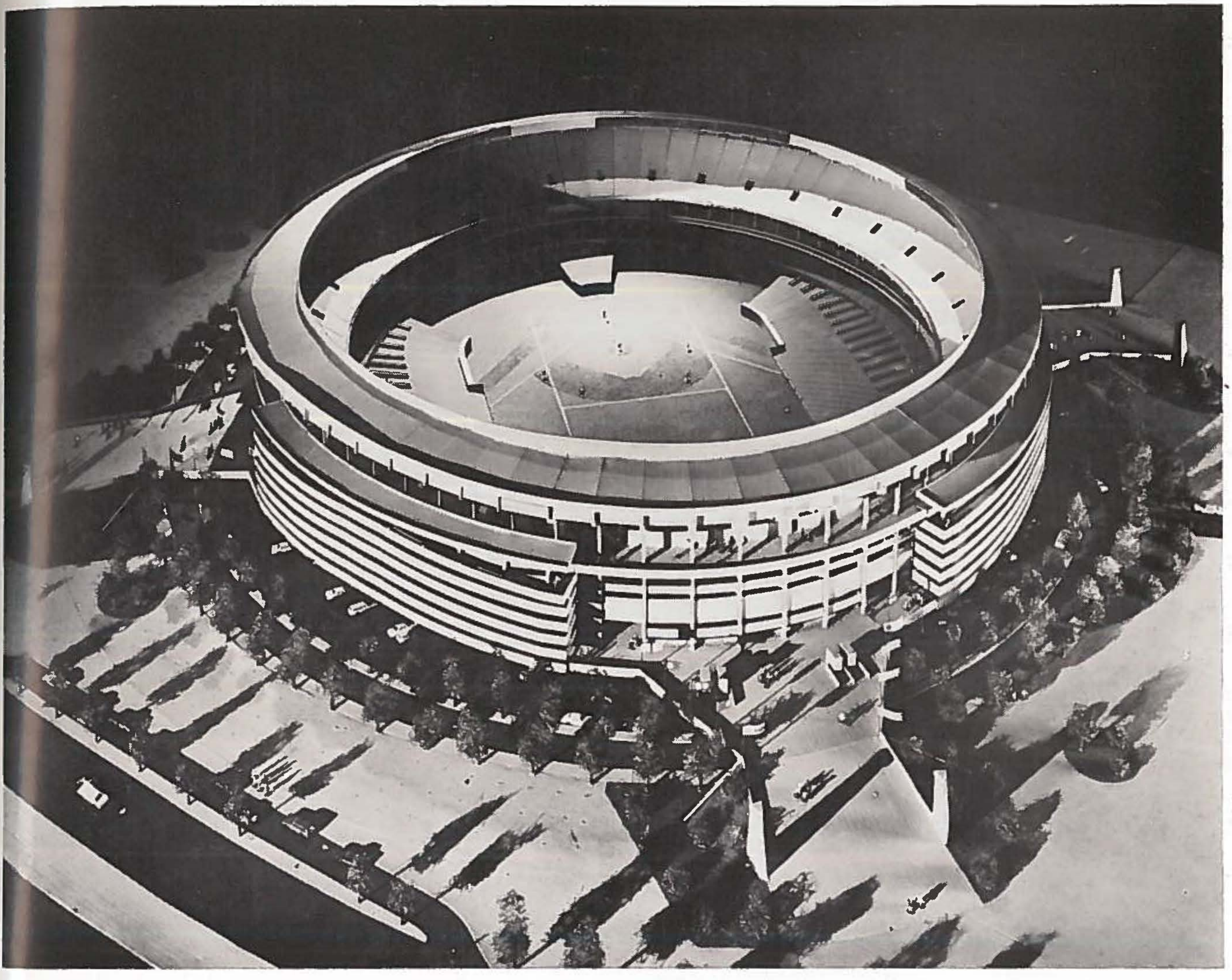
DISTRICT HEATING



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THE WORLDWIDE POSITION OF DISTRICT HEATING AND ITS CONCOMITANT RESPONSIBILITIES

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World Energy Conference

THE KEYNOTE ADDRESS
at the
IDHA 1970 Annual Meeting
Mont Gabriel, Quebec, Canada

Mr. Chairman, members of the International District Heating Association and guests, the setting here at Mont Gabriel Lodge is delightful and the recreation has been most pleasant. I trust that what I will have to say on behalf of the World Energy Conference will be as stimulating and provocative as our surroundings are pleasurable and revitalizing.

I am deeply honored to be your "keynote speaker" at this 61st Annual Meeting of the International District Heating Association. There are not many trade and technical associations around the world which enjoy the maturity and prestige of your organization. Normally, coming of age connotes senility, but I have observed that this is not true of industries situated in the energy sector of the world's economy. On the contrary, energy industries seem to have discovered the fabled "fountain of youth" when it comes to the matters of growth and flexibility in meeting consumer demand. Therefore, I have chosen as a theme for my remarks, "The Worldwide Position of District Heating and its Concomitant Responsibilities." I trust that at the completion of my remarks, we will have been impressed with the status District Heating holds in the World as an energy industry, and more importantly, we will have been challenged by our responsibilities to continued economic and reliable supply to the consumer while improving the human environment.

First, let us consider the World-wide Position of District Heating. The field of District Heating has held the interest of the World Energy Conference since its founding 46 years ago. In 1964, during a Sectional Meeting of the World Energy Conference held in Lausanne, Switzerland, it became apparent that an "appraisal of the state of development of District Heating in various countries around the world" would be of great interest to many member nations of the World Energy Conference.

A Committee to, "Determine the Position of District Heating in the World," was, therefore, formed in August, 1965 consisting of eight member nations: France, FRG, Netherlands, Romania, Sweden, Switzerland, USSR and the USA. Mr. Robert Ginna, former Chairman of the Board of Rochester Gas and Electric Corporation was the U. S. representative. He was assisted most ably by our Chairman today, Mr. Bill Megley of the Boston Edison Company.

Following the submission of a very extensive questionnaire and a detailed analysis of its answers, it became evident that District Heating represented a very large proportion of the supply of heat in as many as 15 countries around the world.

The Study showed that there are many features common to the District Heating industry among the various countries in spite of great differences in climatic and economic conditions. The recognized advantages of District Heating are much the same everywhere: fuel savings, reduction in the over-all cost of heat supply to the consumer, alleviation of atmospheric pollution, convenience, flexibility and security of supply to the consumer.

As might be expected, it was found that all conventional fuels compete in the production of heat, and the use of nuclear fuel was just commencing. In Sweden, the Agesta Station, near Stockholm, was the first to use nuclear fuel and the practice appears most likely to develop elsewhere.

Regarding the future prospects of District Heating, opinions of different countries varied substantially. Some of them, like the USSR, Yugoslavia and Romania, have decided to pursue the development of District Heating to the extent that it will constitute an important factor in national energy policy. They have extensive plans for the combined production of electricity and heat.

Other countries questioned the rate of expansion of District Heating in the face of growing competition from other methods of heating; i.e., individually heated dwellings, collective heating of blocks or groups of blocks using natural gas and the elimination of the increasing siting and environmental restrictions being placed on District Heating plants.

Nevertheless, the opinion, generally expressed, was that District Heating would continue to develop and supply a large portion of the continuously increasing requirements for heat resulting from extensive town planning and from the general tendency found everywhere towards an improvement in the standard of living.

Contributing directly to the development and future progress of District Heating is the recent establishment of two World Energy Conference technical committees. The one committee is entitled the "Ad Hoc Committee on the Quality Control of the Environment," and the other committee is entitled the "Ad Hoc Committee on the Large-Scale, Long Distance Transport of Heat Energy." This latter committee recently foreshortened its title to "Telethermics" as a result of the semantic genius of its committee members.

We now come to the second part of our theme, "the Concomitant Responsibilities of District Heating." Certainly, we in District Heating are committed to the maintenance of the quality of our environment. However, reflection on what we have achieved and contemplation of what the future holds is most important at this time.

Within a very short time mankind has been brought face to face with unprecedented opportunities for economic growth and social progress which can be shared by all nations. But with these advances have come unparalleled threats to man's relationship to the chain of life of which he is a part and to the global environment upon which he depends—both delicately dynamic systems that can be altered irreversibly before one is aware of the danger. Man is now in danger of overreaching himself on his finite planet.

Consider first the matter of population. When the survival of men was controlled by a seasonal and uncertain food supply and the prey of widespread epidemics, the number of men was regulated much like any species population, although the number did increase slowly as men gained ascendency by the techniques of an agricultural way of life. It is estimated that by 1650 there were about 500 million people on the earth. This doubled in 200 years to one billion; doubled again in 80 years, by the year 1930. Today, 40 years later, it has come close to doubling again, to about 3.6 billion. It is predicted that in 30 years, the Year 2000, world population may be between six and seven billion. Growth exceeds a million people each week. Sooner or later, population growth will be halted either by natural events or by the intelligent action of men themselves.

The fossil energy reserves of the earth, developed by geological processes over eras of time, are being utilized at an ever-increasing rate. Recent studies made in the United States under the auspices of both the National Academy of Sciences and the National Research Council show that although coal has been mined for about 800 years, about half of the total reserves have been consumed in the last 33 years; and that about half of the cumulative total of petroleum extracted from the ground has been consumed in the past 14 years. Although it is difficult to predict the ultimate scale of fossil fuel recovery, some experts believe that, with the present upward trend in energy utilization, petroleum, natural gas, oil shale and tar sands may be seriously depleted in a century, and coal in two or three centuries.

The timely development of nuclear power is, of course, essential because men in such large numbers as exist today—and in the larger numbers that can hardly be avoided in the near future—must have an abundant energy supply. Moreover, as time passes it appears that as much of our fossil fuel resources as possible should be conserved for essential combustion uses, for chemical industries and possibly as a source of food through the action of micro-organisms.

There seems to be even a serious limit to nuclear power, if we must depend upon the current types of reactors that utilize only one or two per cent of the natural uranium in the earth's crust. The prompt development of breeder reactors is essential, because they promise to utilize about 80 per cent of the energy in uranium, thereby extending the world's energy supply many times beyond the limits of fossil fuels. In addition, by the Year 2000, we can hope for practical results in the field of fusion power, which could extend our energy supply indefinitely.

The combustion of fossil fuels is altering the composition of atmosphere in ways that we do not yet fully understand. Furthermore, insecticides, industrial chemicals and natural wastes are affecting lakes, rivers and the ocean itself. The waste heat from industry and power plants is presenting the beginnings of an ecological involvement that may become very serious in future years unless appropriate steps are taken to disperse or utilize the heat in a more effective manner. Nuclear energy for space heating, process heat and electric power offers a considerable improvement over the burning of fossil fuels, but great care must be taken to protect the environment from radioactive wastes and the exhaust heat that is not directly utilized.

Several courses are open to concerned persons. One is to go on as we have during the past century. This is, of course, unthinkable. Another alternative, which we hear recommended, even by some scientists, is to turn back on our course, and establish patterns of life that require less energy consumption, and fewer products and services of the sort that affect the environment. Such a return to a simpler way of life is attractive from the philosophical point of view, but it does not seem to be practical. The world population is already too large to be supported at a much lower energy scale and it is the desire of millions, even billions of people, to consume more, rather than less. Most of the developing nations would certainly welcome, at this stage, more rather than less of the environmental effects of an industrial economy. So this approach is of very doubtful value.

The third possibility is to go forward, but to alter our course towards what has been called a "steady state society." This requires a consciously selected ceiling on population growth and a large-scale development of technology to bring harmful environmental effects under control. This would mean the fullest possible protection of air, land and water from the side effects of production and consumption; the recycling of organic and inorganic wastes in what are essen-

(Continued on next page)

tially closed systems; the recovery and reuse of materials; the recycling of water for multiple uses; the fullest possible utilization of the energy in heat. It also means the design and construction of new cities and more favorable ways of living because urban and rural environments today are frequently far from the quality that men desire and technology can provide. I believe qualitative improvements on this vast scale are well within the ability of mankind when the alternatives are clearly understood.

One requirement, may I say again, will be a large, dependable and economic supply of energy from nuclear sources. Our task will be to provide the energy and to do so in ways that are environmentally acceptable. Much thought and cooperation will be required, and it is here that the International District Heating Association and the World Energy Conference can provide joint leadership.

You will recall that I mentioned a second Ad Hoc Committee at the outset of my talk. Early discussions by the members of this "Ad Hoc Committee on Telethermics" centered about the expected large expansion of District Heating systems in the next two decades. Furthermore, it is expected that a great amount of heat energy will come from nuclear fueled plants, both steam and electric production. Such plants, for economic reasons, must be very large, and safety and siting restrictions will require that the plants be located some distance from urban centers.

The utilization of nuclear energy will also be desirable from the point of view of maintaining the quality of the human environment. Central coal and oil-fired plants and even single domestic units possibly will be eliminated in many urban centers by legislative action, requiring the utilization of nuclear energy.

Ultimately, a District Heating use may be found for the exhaust heat from electric power generating plants which will approach 10,000 MW in single plant capacity within 20 years. The waste heat which will be rejected from these power plants normally will be at a temperature not exceeding 95 F. At this temperature the heat is of little value to district heating requirements in urban centers. Temperatures more on the order of 160 F at the heating center are required in order to serve domestic heating requirements satisfactorily. Therefore, a possible constructive use of heat being rejected from electric power stations might be to operate the turbines at higher back-pressures during the heating season. Looking forward to the day of the breeder reactor, the fuel cycle cost may be reduced to almost a zero level making thermal efficiency of lesser importance. This being the case, the turbine-generator could be operated at a higher back-pressure with the waste heat being conducted by the 160 F condensing water over distances up to ten miles. This distance would possibly correspond to the remotest heating load requirement for an urban-sited nuclear plant. In the summertime there would be no need for the waste heat and, therefore, the electric generating plant could operate at a lower back-pressure to achieve higher output and the exhaust heat would be discharged to the atmosphere through cooling towers. An alternative use for the exhaust heat might be to use the same hot water system to supply energy to urban absorption air conditioning systems.

These creative concepts make it urgent that the techniques for transportation of heat over long distances be rapidly developed. Large-scale pipelines for transportation of hot water are already in limited operation. More recent applications of liquid metals have been made in the nuclear power field. Fast-breeder reactors use liquid metals to transfer heat from the reactor core to the power plant steam-generators. It is expected that newly initiated design work for a large-scale proto-type liquid metal cooled fast breeder reactor will be very helpful to District Heating companies wishing to consider the utilization of liquid metals for the long distance transportation of heat energy.

The "Ad Hoc Committee on Telethermics" has set an ambitious program for itself. One of the configurations to be studied will provide heat from a nuclear plant to a large District Heating system with a peak of about 7,500,000 lb per hr, as an alternative to oil-fired hot water units located within the system. In this case study, the nuclear power plant with two, 800 MW units, with provisions for extraction of about 4,000,000 lb per hr, will be located as close to an urban center as possible without special reactor containment design. A ten-mile hot water line from the plant to the periphery of the system will be used to transport the equivalent of 1300 MW of heat.

Technical solutions will be considered together with costs of the systems and their reliability requirements. Through the cooperative effort of the 68 member nations in the World Energy Conference, it is anticipated that a Committee report will be presented at the World Energy Conference in June 1971, to be held in Bucharest, Romania.

Certainly, the World Energy Conference would be most pleased to receive the assistance of the International District Heating Association in the pursuit of the objectives of this Study. As organizations dealing with energy and its utilization within the human environment, our responsibilities are great. I trust that together we may meet the challenges of the District Heating industry by providing optimum economic utilitarian and environmental solutions. ●

(Editor's Note: Mr. Hart is Executive Engineer at The Detroit Edison Company.)

DID YOU KNOW THAT IN . . .

England: A government survey of the technical and financial aspects of district heating is to be started in the Fall of 1970, and it will take about 18 months to complete.

Denmark: There are 480 thermal district heating systems in operation. In Odense, for example, 35,000 of the 50,000 homes are heated by district heating; 28,000 from the power station and four peak load stations, and the remaining suburban homes from cooperative stations.

Russia: The Moscow district heating system is the largest in the country and its installed capacity in early 1968 was 3,000 MW, and the thermal capacity was 10,650 Gcal/h. Of this, 9,900 Gcal/h is distributed as hot water and 750 Gcal/h as steam. The system supplies more than 24,000 blocks of apartments, public buildings, and 360 factories. The distribution system is 1,200 km long.

In Alma-Ata, the capital of Kazakhstan, the 700,000 residents will soon be provided heat by underground boiling water, and at a minimal charge. The water table, about two miles beneath the surface, is estimated to have water at boiling point; at the surface level it is over 70 C (158 F).

Munich, Germany: For the 1972 Olympics, the turf will be heated by a 13-mile warm water piping system nine inches below the ground, to protect it from snow and frost. Artificial turf for the Olympic stadium has been ruled out.