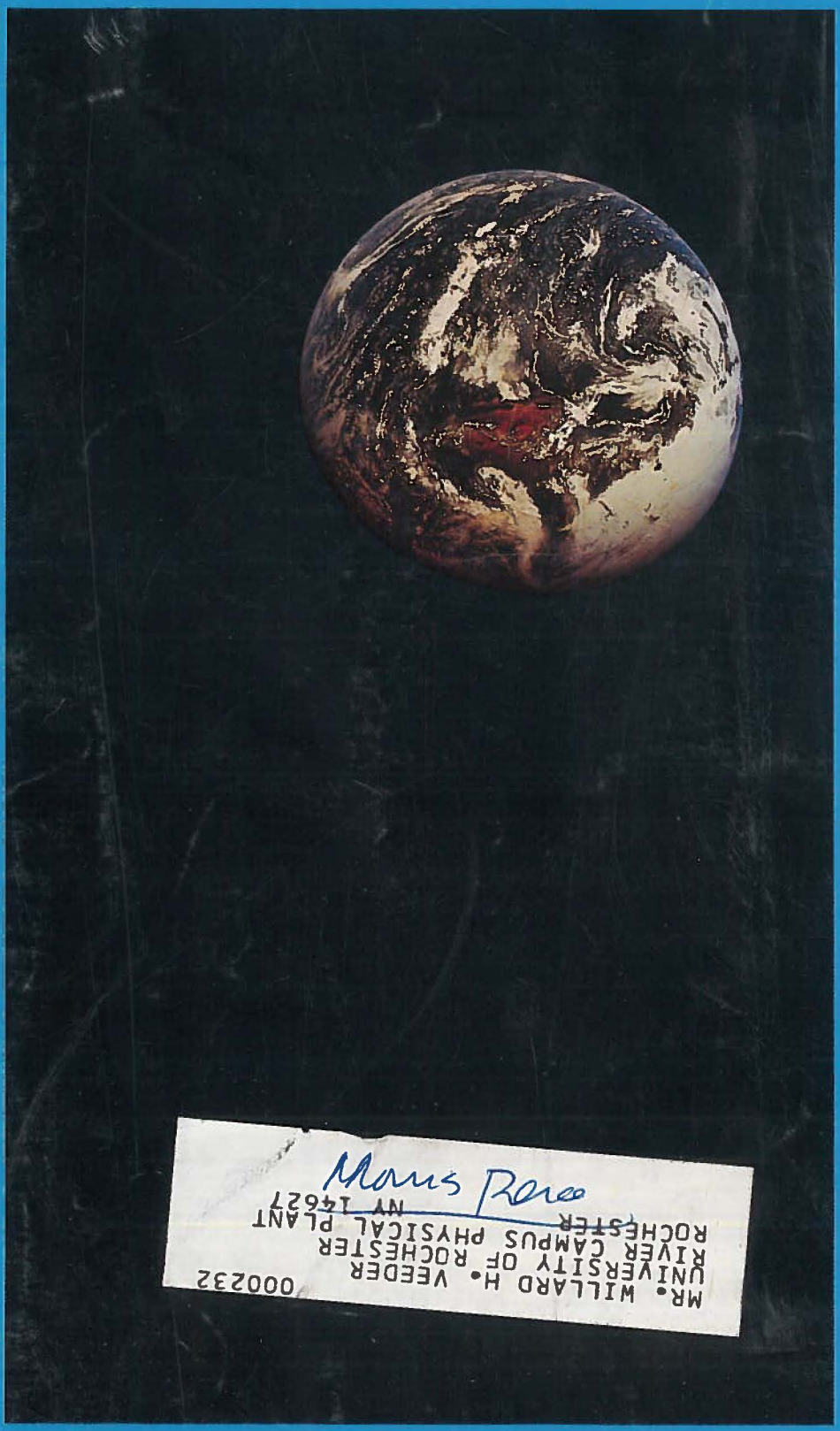
District Heating & Cooling

Volume 76 Number 2 Fourth Quarter 1990



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District Heating and Cooling: *A Clean Solution*

By H.C. Mortensen
Metropolitan Copenhagen Heating Transmission Company

Energy and the environment. It's the theme for IDHCA's annual conference in 1991—and appropriately so. To function in today's environment, we require the use of energy. It is one of the most essential factors that enable increased material welfare. Yet when we use energy, we impact our environment—our earth, air, water, and comfort—in some way, shape or form. Both energy and the environment have become crucial areas of concern in our man-made, everyday lives.

Given the integration of these areas, it seems that more intensive political efforts would have been made over the past 20 years to ensure the sensible and environmentally benign use of energy. Yet it is easy to criticize our policymakers and not ourselves. Who can say, in all honesty, that he or she is willing to pay more for oil to heat and cool the home or fuel the car? Not everyone can say they would voluntarily connect to a district heating and/or cooling system whose price per unit may not be competitive in some cases—even though it's clear that expanding such district systems may indirectly help reduce air pollution and indeed be a clean solution.

H.C. Mortensen, President of Metropolitan Copenhagen Heating Company, Copenhagen, Denmark Courtesy Metropolitan Copenhagen Heating Transmission Company

Energy Use a Given, So Approach Must Change

Although it makes sense to want a clean solution to our energy concerns, it is not realistic to suggest that society return to a Stone Age state of life. We need to understand exactly where our energy and environmental problems lie and begin to solve them—immediately.

Broadly speaking, a considerable amount of the pollution comes from using energy in many forms—at home, at work, in industry. In many cases when we link energy use and the environment, we start spouting chemical formulas for all of the solid, gaseous and liquid substances that are released when energy is used. But that's not really necessary to understand that something needs to be done about the so-called "greenhouse effect."

Scientists still disagree about whether the temperature in the atmosphere has risen and will continue to rise—and whether it is caused by natural and man-made processes that release carbon dioxide into the atmosphere. In my opinion, though, that argument about the future is not the real problem. The real problem is the carbon dioxide that has already been released and that will be released in the next few years. It is real, no matter what the formula. Quick solutions have to be found to deal with this risk.

But where can we attack this problem? We know that transportation, individual heating and cooling, industry, power plants, refuse incineration plants, and yes, even district heating and cooling plants, are the source of emissions. If we start by looking at transportation, fuel-driven cars are the main cause for concern, despite the fact that stronger demands for catalytic converters and the like have helped. Yet even though new technology is on its way which will help to restrict emissions even further, nobody expects that such new technology can be developed and put into commercial operation within the next 15 to 25 years. As a result, it does not appear that transportation belongs to the category where quick solutions can be found.

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In regard to individual heating and cooling systems, it appears that the only effective possibility of limiting emissions above and beyond current high-efficiency furnace options is for these systems to connect to a district heating/cooling system.

Industrial emissions have been supervised and controlled by environmental authorities in industrialized countries for a number of years. Reduced emissions have resulted from implementation of costly purification measures and development of new production technology. Yet many model solutions have not been implemented due to cost restrictions—and a quick resolution is not expected.

That leaves power plants, district heating and/or cooling plants, refuse in-

cineration plants, etc., with power plants being responsible for the most substantial emissions. These emissions may be reduced by (a) cuts in usage levels and (b) cogeneration of electricity and heat/cooling.

Energy usage levels are typically affected by price. When fuel prices fall, energy use increases—and vice versa. This definitely correlates with increasing demands for comfort in modern society and—generally speaking—the individual lack of willingness to respect the link between energy consumption and pollution.

Industrial consumption follows a corresponding pattern. Political willingness to accept the desire for increased material welfare in industrialized countries leads to increased industrial production. And the solution to the problem in the developing countries requires greater industrial production. So there appears to be no easy solution to cutting emissions given these current and projected behavior patterns—unless we can educate more people and more countries about the potential that combined heat and power and district heating and cooling hold.

Decreasing Consumption and Emissions is Possible

In Denmark, the need for space heating is decreasing while district heating's share of the market is increasing. This scenario is the result of our energy-related effort that began in the wake of the 1970s energy crises. These efforts were primarily aimed at stabilizing and/or reducing energy costs wherever possible, a greater reliability of supply and a re-allocation of energy consumption.

Today, Denmark's energy consumption for space heating is approximately 30 percent lower than consumption levels before the oil crisis. A considerable amount of this reduction has been achieved through efficient cogeneration of electricity and heat. Almost half of the present district heating demand in Denmark is supplied from combined heat and power (CHP) plants.

But CHP (also known as the cogeneration of electricity and heat) is more than energy efficient. It also has considerable environmental advantages because of its inherent energy efficiency. This means that the comprehensive expansion of district heating in Denmark during the 1980s fits with the increased attention being paid to the environmental consequences of energy consumption. Especially after the Brundtland Commission report's findings on the relationship between development and the environment, it is clear that these consequences can no longer be ignored.

Almost half of the present district heating demand in Danish cities such as Copenhagen is supplied from combined heat and power (CHP) plants. Courtesy Metropolitan Copenhagen Heating Transmission Company

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The Brundtland Commission's report notes that the rate of increase in energy consumption in relation to the Gross National Product has fallen in the industrialized countries during the last 13 years. This decrease accounts for one-third of the original rate of increase in energy consumption. Nevertheless, a predicted increase in global energy consumption due to industrialization, agricultural development and a rapid population increase in the developing countries will call for even more energy in our future.

If you imagine such a energy-intensive future, based primarily on the present mixture of fossil fuels (gas, oil and coal), then the environmental risks are so disturbing that they create a fertile breeding ground for a variety of concerns: acidification of the environment, air pollution from cities and industries, and the serious threat of a global rise in temperature or the "greenhouse effect."

Danish Experience: A Case Study of Action

Environmental pollution already has been the focus of increased attention, especially in the Scandinavian countries, for a number of years. In Denmark, for example, a number of steps have been taken to reduce the emission of sulfuric and nitric oxides resulting from burning coal. Present legislation requires the emission of sulphur dioxide (SO_2) to be reduced by 1995 to less than half of the level of the early 1980s—and a similar reduction of NO_x emission is targeted for the early years of the next century.

But if we look at the Brundtland Commission report's projections about the probability of a crucial rise in global temperature, we have to admit that there is presently no existing pollution control technique that can counteract the threat of carbon dioxide (CO_2) emissions. This is particularly serious since CO_2 is a gas that is produced by burning any type of fossil fuel. Only more efficient use of the energy contained in those fuels can help.

The report predicts that these rises in temperature will take place within the foreseeable future. It stresses that maybe as early as the 2030s, the rise of the average global temperature will be "greater than ever before in human history." Remember, of course, that this is based on a

continuation of the present growth of carbon dioxide emissions.

Based on the many serious threats to the environment that exist, the Brundtland Commission maintains that the model economic growth picture for the future will, in all probability, **exclude** even a doubling of energy consumption based on the present mixture of primary energy sources. Such a period of growth must necessarily be less energy-intensive than earlier growth. This means that future investment efforts must be shifted away from increasing further primary sources of energy supply to developing far more efficient, fuel-saving machines and equipment.

By using combined heat and power, we can address a number of the recommendations of the Brundtland Commission report. Combined heat and power systems can increase a single-source generation plant's efficiency from only 40 percent to more than 80 percent. In general, you could say that district heating and/or cooling can simply be considered a by-product of electric generation and, as a result, relatively benign in terms of its incremental effects on the environment.

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It is obvious that district heating and cooling, apart from guaranteeing consumers a stable, safe energy supply, is also able to satisfy numerous recommendations and visions contained in the Brundtland Commission's report on future energy development and the environment.

In April 1989, I participated in the International Energy Agency/OECD's "Expert Seminar on Energy Technologies for Reducing Emissions and Greenhouse Gases." Based on the presentation, "Role of Combined Heat and Power in Energy Conservation and Emissions Reduction," one of the seminar's conclusions was that:

There is an array of energy technologies and courses of action which are already available and demonstrated, although their large-scale and accelerated adoption might involve additional cost for the energy users and the governments; these costs, including all environmental components, need to be more carefully assessed along with other barriers which are constraining the introduction of the energy technologies into the market.

District heating and cooling, along with combined heat and power systems, have been identified as a clean solution to our energy and environmental dilemma. Now it's up to us to make it work—in countries around the world.

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