District Heating & Cooling

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UNICHAL'S District Heating Congress Highlights Challenge and Opportunity

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UNICHAL's District Heating Challenge and Opportunity in

J. J. Hof, Vestin, Arhem, The Netherlands

and

D. Dijk, Sep, Arhem, The Netherlands

Under the motto "For the Environment: District Heating in Europe," the 25th UNICHAL conference took place in Budapest from June 4 to 6, 1991. To a certain degree, the choice of this friendly appearing East-European town reflects the importance of district heating in the countries of the former Eastern block. Whereas district heating's share of the space heating market in Western countries averages about 7 percent, its share for space heating in the East-European countries is more than double that percentage. It was, therefore, gratifying that more than 60 of the 430 participants originated from countries like Poland, Hungary, Yugoslavia, Bulgaria and Czechoslovakia.

At the moment in Europe, excluding the USSR, there are approximately 1500 active district heating companies with a aggregate capacity of 282,000 MW. These systems produce about 2000 TJ (555,556 MWh) of heat annually, of which about 60 percent is generated in combined heat and power plants. In those heat/power stations, 130,000 TWh (468,000 TJ) of electricity is simultaneously produced. The total length of the district heating pipelines is about 48,000 miles (80,000 kilometers), through which an average of 25 TJ per kilometer is delivered annually. Figure 1 demonstrates that district heating enjoys a steady growth in Europe. Table 1 outlines the district heating capacity within each country.

One of the conference's recurring themes was the problems East-European district heating companies face in turning a company led by state institutions into a business managed on the basis of sound market principles. The following article reflects our impressions of the UNICHAL Congress, and forges a comparison with the European and Dutch district heating situation. But before going into this more extensively, first something about UNICHAL and the meaning of district heating for the environment.

UNICHAL's Objectives and Activities

In 1954, UNICHAL (Union International de distributeurs de Chaleur or International Union of Distributors of Heat) was founded in Paris by eight large European cities with district heating. The goal of the organization is to promote the study of district heating and the mutual exchange of knowledge and experience between district heating companies. Until recently, most of the membership was comprised solely of West-European district heating companies. Soon after the breakup of the Iron Curtain, East-European countries became members of UNICHAL in quick succession.

Presently, UNICHAL has more than 170 members from more than 18 countries. Apart from the collection of statistic data on relevant subjects, UNICHAL maintains contacts with a large number of national and international organizations to promote further district heating development. Contacts exist with (1) the European Committee; (2) the American district heating organization, IDHCA; (3) the "District Heating Committee" of the IEA that is oriented towards the western industrial countries; and (4) the East-European district heating organization, the IDHC. The increasing cooperation with the IDHC is expressed by the fact that the 25th UNICHAL Congress and the 8th IDHC Congress this year fell together under the flag of UNICHAL.

New Developments and Techniques Presented

The presentations at the 1991 Congress were spread over three days. The topics ranged from general and environmental problems, home installations, delivery stations, marketing matters, heat transport, heat distribution and heat generation.

Among other things, contributions from The Netherlands to the conference concerned the optimal size of the new Dutch district heating projects, a new method to chart the demand for heat, the environmental aspects of district heating in relation to those of gas heating and the combination of district heating with waste burning. An interesting leak detection method was described, which is based on taking thermographic photographs of district heating pipeline routes from airplanes. Another Dutch innovation concerns a temperature and power regulator for the flattening of power peaks in district heating system substations. This enables better adjustment of the production and consumption of heat to each other.

We also reported on the results of the Dutch "campaign for district heating" in-

Congress Highlights Eastern Europe

Table 1
District Heating Data from the European District Heating Countries

Country	Capacity (MW)	Energy (TJ)
Austria	4,715	28,547
Belgium	13,267	197,000
Switzerland	1,673	10,920
Czechoslovakia	68,871	535,465
Germany	55,166	335,062
Denmark	15,000	82,900
France	18,785	99,000
Hungary	12,700	83,384
Italy	1,136	6,020
Norway	694	3,130
The Netherlands	3,383	12,278
Poland	44,500	338,000
Sweden	26,605	128,500
Finland	15,220	79,710
Soviet Union	2,160,000	11,000,000
Yugoslavia	10,500	49,060

stituted by VESTIN over the past five years. As shown in Table 2, research proves that the opinion of district heating has strongly improved during the last five years.

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One of the UNICHAL study committees reported that heat transport, particularly the linking together of more areas of consumers, is gathering much attention since this may enlarge both the profitability and reliability of heat delivery. In another committee, the fluidized-bed technique was the main topic of discussion. It was concluded that fluidized beds are a possibility with smaller units, but that in the case of the larger units, gas-fired units or combined gas turbine and steam turbine units with coal gasification are more profitable.

One of the new products exhibited at the conference was a distribution pipeline that had an inner pipe made of flexible artificial material rather than steel. Since this product is delivered on reels, a large length can be laid at one time in a narrow ditch so that the costs of construction are greatly reduced. An international district heating dictionary and a list of district heating terms were published and distributed at the Congress. At the same time, a booklet with concise descriptions of the district heating industry in 14 different countries, including five East-European countries, was published. Also, a UNICHAL yearbook was published which contains recent news on district heating.

District Heating Good for the Environment

The Congress emphasized once more that district heating is specifically an urban phenomenon. Large cities such as Berlin, Paris, Helsinki, Copenhagen, Moscow and Sophia have had extensive networks of district heating for decades. In cities, with their relatively high level of emission because of their intensive traffic, the advantages of district heating are most attractive. Instead of many individual heat sources and a corresponding number of local sources of emission, there is one central heat source from which the heat is delivered to the consumers by a piping transportation and distribution network. Such a system offers the ability to use a variety of fuel sources, including:

- geothermal (France, Iceland)
- waste (Scandinavia, The Netherlands, Germany)
- residual heat of power stations (applied generally)

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- industrial residual heat (especially in Eastern Europe)
- coal, oil, natural gas, biogas, solar energy

Central heat sources help decrease harmful emissions more cost effectively and efficiently than individual heating systems. Although heat is generated separately in a number of countries (in France almost exclusively), in most cases, heating is combined with the generation of electricity. In this way considerable energy is saved and, furthermore, a better environmental effect is obtained.

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At the Congress there was, therefore, a clear tendency toward combined generation with a power profitability that is as high as possible using natural gas as the preferred fuel. Fuels such as timber waste and domestic waste can only be used if extremely careful attention is paid to the resulting emissions. In smaller systems, fluidized-bed boilers can play a role in this.

The Dutch contingent also presented results from a study regarding the environmental effects of district heating and gas heating. This study shows that district heating emissions are lower than in the case of gas heating (Table 3), and the levels of immission are even more favorable (Table 4).

Table 2
Opinions on District Heating in The Netherlands

	1985 (%)	1990 (%)
I sympathize with [support] district heating.	60	83
I wish to be connected to district heating.	40	55
I wish to be connected to gas.	34	19
District heating should be applied more.	68	82
I read negative reports on district heating in the press.	72	26
I read positive reports on district heating in the press.	28	74
District heating is cheaper than heating using gas.	19	29
Gas is cheaper than district heating.	44	19

Table 3
Emission Comparison (in g/GJ useful heat)

	NO_x	SO_2	CO	CO_2	C_xH_y
Heating by gas	43	0	43	69,000	6
District heating	20	-172	0	-15,000	0

Table 4
Immission Comparison (in micrg/m^3)

	NO_x	SO_2	XO	C_xH_y
Heating by gas	5.8	0	6.6	1.0
District heating	0.7	-0.01	0	0.02

District Heating in Eastern Europe — Precarious

Although Western Europe and the United States are working towards the perfection of district heating through new technical innovations such as distance measurement, flexible pipes of artificial material, etc., district heating's situation in Eastern Europe is, at the moment, precarious. As is the case in so many matters, district heating, too, suffered from the East-European planning economy.

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The history of East-European district heating can be traced back to the Moscow civil engineering professors, Kopiov and Sokolov. In one of their standard works, district heating was addressed in all its aspects from principle to practical construction prescriptions. According to insiders, the idea of energy saving and the improvement of the climate of living in large cities is central to this work. Their precept was that heat generation would have to take place in combination with the generation of electricity as much as possible. So far so good. What went wrong?

At the Congress, the absence of economic stimuli was stated to be the most important reason district heating and combined heat and power have not flourished. Within the philosophy of the planning economy, everyone is entitled to an in-house climate of about 20 degrees Celsius. In exchange for this, the consumers pay regular fees that only depend on the volume that is heated. The producer of the heat can charge the competent authorities for the costs of the generation, transportation and distribution. Because of this a

situation has been created in which the profits no longer cover the costs. The difference is paid in the form of subsidies. Within this structure the consumer is not stimulated to save energy and the producer is not stimulated to work efficiently.

In practice, other matters, too, played a role. Since the political authorities have to approve the declarations by the producers, sometimes priorities were established that were not necessarily sound. A number of district heating projects were implemented with only a low share of combined heat and power or entirely without a link to the generation of electricity.

Another method to limit costs and to accelerate projects is the use of a single-pipe system with constant speed of flow. All houses are connected in a sequence. Consumers can exercise no influence at all on the delivery of heat. If it becomes too warm, one can only open windows. Another consequence related to the fact that the occupant is not confronted with his own consumption, is reflected in the story of the Hungarian deputy-minister of Energy who said that it is a common practice to warm up cartons of milk by placing them under the open hot water tap, since gas for cooking is charged per unit. It is, therefore, not surprising that the average consumption per house is about 100 GJ (27,778 kWh) per year, of which 25 GJ (6,944 kWh) is for heating.

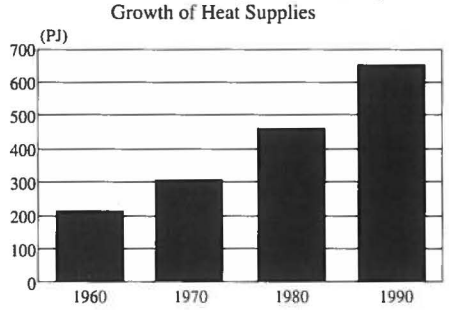
How can this situation be improved? According to Mr. Liptak, a renowned Hungarian expert on district heating, not everything has been without positive outcome. There are various ways to improve the situation. Of course, the interest of the consumer deserves priority. A consumer should be able to count on a reliable and payable supply of heat. For this to happen, the cost of heat must fall since subsidies are gradually abolished. On the one hand, this can be done by preventing the wasteful use of heat and decreasing consumption; on the other hand, it may be accomplished by lowering generation costs.

It is crucial that costs are charged in proportion to the consumption. For this purpose, heat meters should be placed at least one per group of occupants; heat cost allocation systems should also be set up within the individual units in the apartment buildings. At the same time, it is important to investigate cost-effective insulation measures that can be implemented so heat is not transferred between apartments.

In regards to generation, the possibility of installing gas turbines in front of existing boilers in steam turbine plants was emphasized. In combination with a lowering of the supply temperature (now still 150 degrees Celsius), profitability could be improved. Apart from this, replacing piping networks which were installed without a corrosion-resistant outer layer must also be considered. This is undoubtedly an interesting market for producers of pipes with a cover of artificial material.

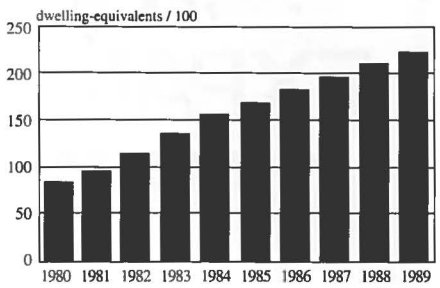
Finally, linking district heating areas together that now still are functioning separately from each other may contribute to district heating's growth. Of course this requires enormous capital. It appears, however, that the World Bank may be willing to supply credit for this effort.

Figure 1



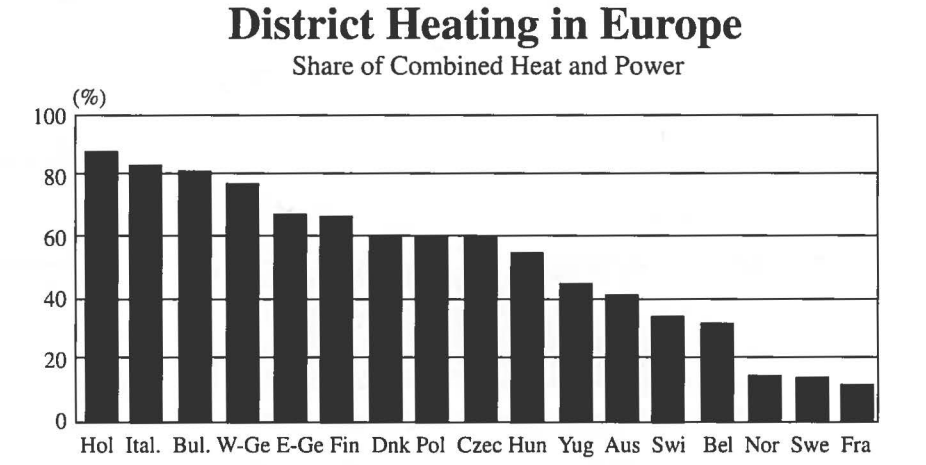
Courtesy of UNICHAL

Figure 2



Courtesy of VESTIN

Figure 3



Courtesy of UNICHAL

Linking district heating areas together that now still are functioning separately from each other may contribute to district heating's growth.

The Netherlands and Western Europe: A Comparison

If one compares district heating in the various European countries to that in The Netherlands, it is striking that district heating for space heating in the Netherlands has a very modest market share of only 2.6 percent. In contrast, 7 percent is the average in the rest of Europe. However, The Netherlands does have the highest share of

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combined heat and power and the highest share of natural gas as fuel for its heat production installations.

The Netherlands has a relatively low heat supply temperature per kilometer of district heating pipelines and a relatively high loss of heat. The average loss of heat of the European countries surrounding us is between 6 to 13 percent. The Netherlands stands out with a 24 percent heat loss factor. There may be two primary reasons for this anomaly. As a result of the relatively low passing of heat through the pipelines, the loss is relatively high. Currently, piping diameters are generally quite large in comparison to capacity, resulting in slow circulation. This is related to the fact that a part of the heat supply, specifically in the lower operating range of heat meters, is technically difficult to measure. Work is being done to improve this. The most important means of decreasing the losses in existing situations is by connecting more buildings. For new projects, it is important to search for locations with high heat density.

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Conclusion

With its advantages in the areas of energy saving and the environment, district heating is the focus of attention around the world. In the East-European countries, this form of energy may be more common than in the West-European countries, but much can still be improved with respect to consumption, tariffs, regulation technique and management.

The next UNICHAL Congress will be held in Paris from June 15 to 17, 1993.

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