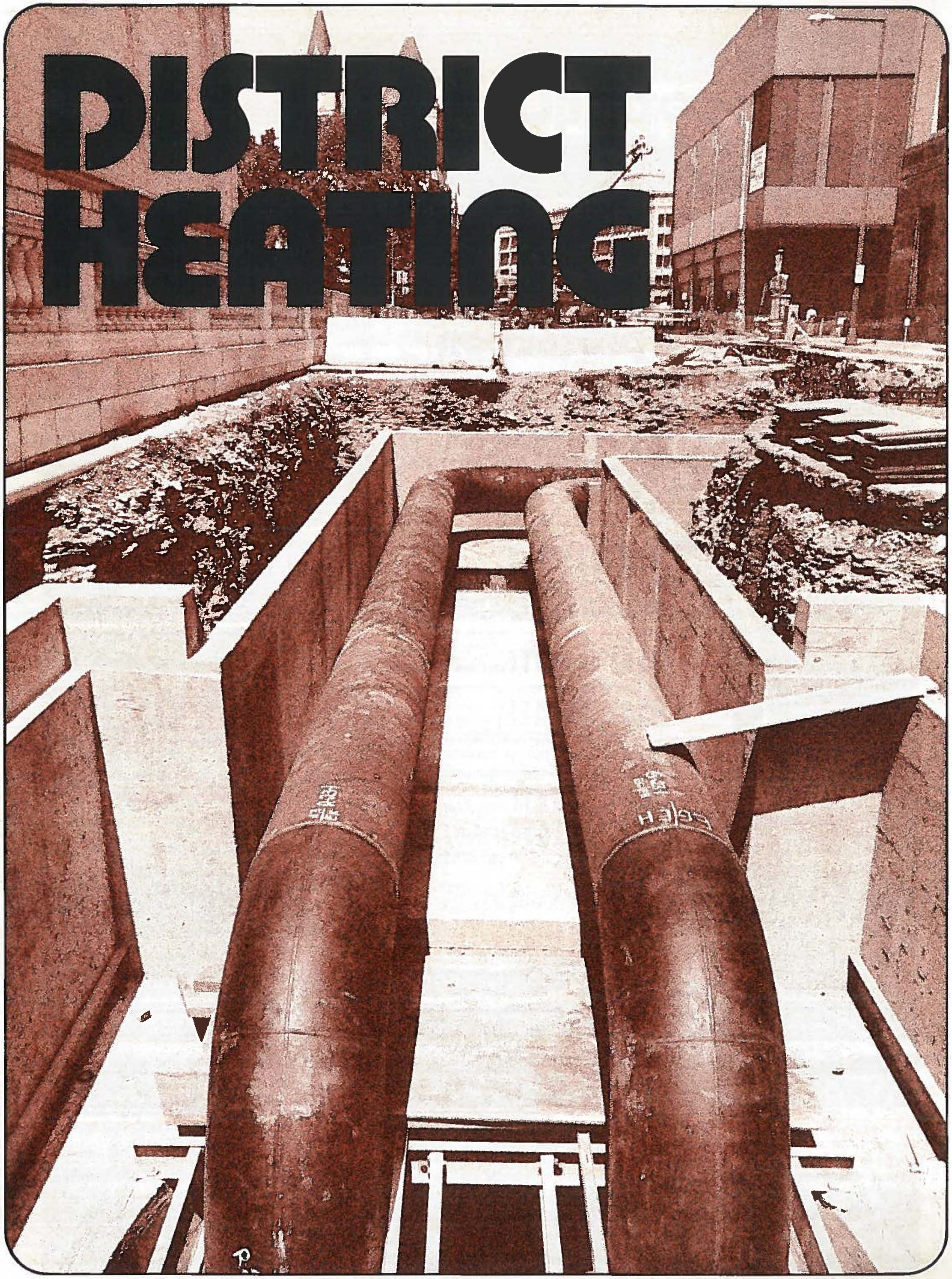
# DISTRICT HEATING



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# Report on Trip to Finland

**by Dorothea Stierhoff**

District heating is a technology that can be called truly international. What started as a unique American invention has been adjusted and expanded to meet the needs for many types of situations in the U.S., Europe and Asia. As energy needs change in different areas, ideas that have been developed for one situation can often be "borrowed" and applied to a different situation, sometimes directly and sometimes with certain modifications.

The following article reports on a trip taken this summer to Finland by Dorothea Stierhoff, Associate Editor for *District Heating* to the UNICHAL Congress. The conference and additional tours provided information that could be applicable to district heating development in the U.S. to make systems more efficient and economical.

UNICHAL (Union Internationale des Distributeurs de Chaleur) held their 21st congress in Lahti, Finland in June 1983. I attended the congress, met with representatives of the Finnish district heating industry along with journalists from several other countries courtesy of the Finnish Foreign Trade Office. Although many in the U.S. district heating industry are familiar with the basic concepts of European district heating, the trip brought to light several interesting concepts in system development and product marketing that would be applicable to the U.S.

The trip started with the UNICHAL Congress and meetings with manufacturers exhibiting there, and was followed by trips to several district heating plants and new distribution system installations in the area surrounding Lahti. It continued in Helsinki where the group met with officials of the Finnish Energy Department and the Technical Research Centre of Finland, and later with engineers at Ekono Inc., a major consulting firm.

There is a strong commitment to district heating development in Finland for many obvious reasons. The northern location and long winters mean there is an extended heating season and little need for air conditioning during the shorter cooler summers. There is little indigenous fuel in the country and a great dependence on imported fuel. As a country with a high energy use, Finland has had to focus on efficient energy use and development of technology to utilize what indigenous fuel it has in order to keep inflation in control and to stay competitive in the world market. Through increased use of domestic fuels and careful management of imported fuels Finland was able to reduce the share of energy consumption from imported sources from 73% to 68% between 1978 and 1981. The total volume of energy imported during that period only increased from 17.1 Mtoe to 17.2 Mtoe. Much of this control over their national energy use is due to recent developments in district heating.

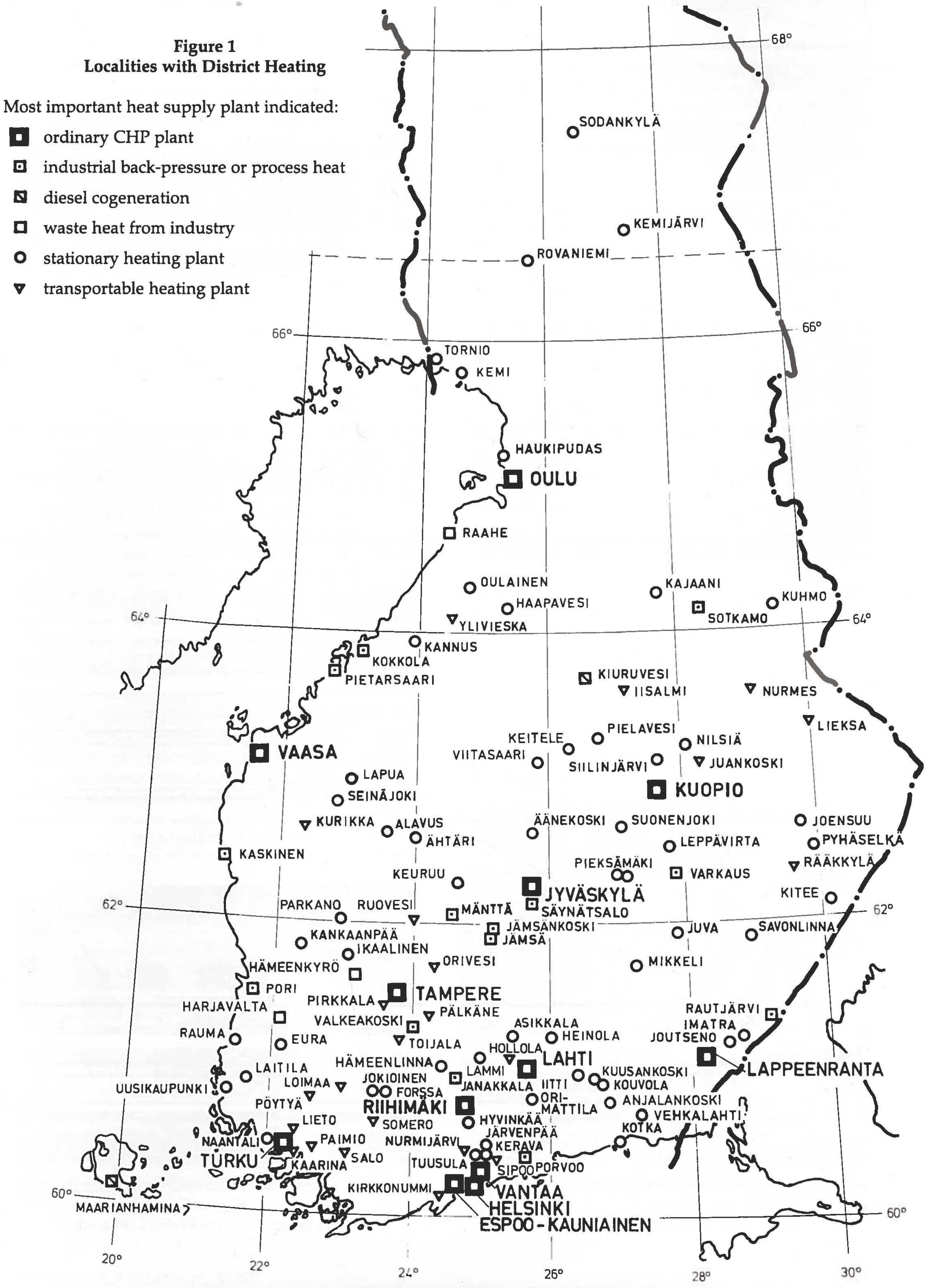
Figure 1 shows the location and different types of district heating systems throughout Finland. A closer look at the make-up of these systems will show the market development being pursued throughout the country. Table 1 shows the number of different types of networks in Finland as well as the number of customers served, the connected heat load and the miles of pipe. When looking at the penetration of district heating in the U.S., as represented by the utilities reporting their statistics to IDHA, we see only 596.5 miles of connected pipe compared to 2270 in Finland. In the U.S. there are 50 utilities serving 12,387 customers and in Finland there are 434 utilities and 37,245 customers. But the connected heat load in the U.S. is 26,615MW as compared to only 8,114 in Finland. The reason for this major difference in heat load is due to the types of customers served. 61% of the district heating sales in Finland are to the residential market and only 9% are to the industrial sector. The U.S. district heating market has a strong base in the industrial market and provides very little heat to the residential area.

There has been a strong commitment in Finland to developing residential district heating which has often been found to be uneconomical in the U.S. A major

**Table 1**
**DH Networks in Finland**
2270 miles of connected twin pipe

| Networks | | Consumers | |
|---|---|---|---|
| **Type** | **Number** | **Number** | **Connected Load** |
| Networks fed by at least one cogeneration plant | 35 | 24,148 | 6,318 MW |
| Networks without connection to power station but fed by at least one permanent heating plant | 103 | 7,165 | 1,140 MW |
| Networks whose heat supply is presently based on transportable heating plants | 290 | 5,932 | 654 MW |
| | 434 | 37,245 | 8,114 MW |

**Figure 1**
**Localities with District Heating**



reason for this is the housing shortage which still exists in Finland. Larger towns have been expanding their systems to new areas and new small town developments have been planned from scratch. The majority of new systems developed in the past 20 years has been in the communities ranging in size from 2,000 to 10,000 residents. Figure 2 shows the installation of the system developed for a new community. It is the first construction to take place, so installation costs are kept to a minimum. This development is on the outskirts of the city of Kouvola. It will initially be connected to a portable heating plant and later connected to the city-wide system.

A trip to the site of expansion for the system in the city of Lahti showed recent developments in low temperature hot water systems being developed for the residential market. Figure 3 shows the light weight flexible pipe to be used in a new housing development. The piping is laid in shallow trenches in a sinuous fashion to allow for expansion. It is then connected to distribution mains coming from the central plant (Fig. 4). The ease of installing this type of piping and the lower costs of the materials involved reduce the capital costs involved in expanding district heating to residential areas. These two sites in Lahti and Kouvola demonstrate the techniques and materials used to economically expand into the lower density residential market.

As stated earlier, Finland is greatly dependent on imported fuels and has few domestic energy sources. A visit to the Sahamaki Heating Center in Hyvinka demonstrated recent developments in utilizing domestic fuels. The center is a multi-fuel boiler plant equipped with a Pyroflow low pressure boiler which can be fired by coal, wood waste, peat, straw, municipal solid waste or oil. Combustion takes place in a sand layer floating in the air flow in the reactor part of the boiler. The operating temperature of the plant is 180°C/356°F and is connected to a heat exchanger. Send out temperature is 120°C/248°F. Figure 5 shows the wood pulverizing operation outside of the plant to reduce scrap wood to a uniform size for firing. The manufacturers claim 98% efficiency in this plant.

**Figure 2**
**DH Construction Site in Kouvola**

**Figure 3**
**Low-Temperature Hot Water Piping**

During the conference meetings were arranged with several manufacturers of district heating components including two pipe manufacturers and two boiler manufacturers. In their discussions of their products, the representatives stressed how they placed the district heating side of their production within a total product line. Of the two pipe manufacturers one developed their district heating line to complement their plastics division, and the other saw district heating products as an addition to their building construction division. The two boiler manufacturers were both ship builders and developed their district heating boilers in conjunction with the boilers needed for ships. When questioning their plans for development of new markets, only one manufacturer was interested in currently expanding into the U.S. market. The companies each had a clear picture of their market potential in various areas of Europe and the USSR.

A great deal of effort has been expended to make

**Figure 4**
**Low-Temperature Hot Water Connection**

district heating as economical and efficient as possible in Finland in order to keep energy costs within reason. Although the U.S. does have more indigenous fuel and is not going through as great of a building program as a nation, the modular concept of development and the less expensive low temperature hot water for use in residential development is applicable to many situations in the U.S. As the statistics show the industrial and commercial sectors are taking advantage of district heating in the U.S. although there is still room for expansion in this sector. What the experience in Finland shows is that the relatively untouched residential market has the potential to be an area of expansion in the U.S. under the right conditions.

**Figure 5**
**Pulverizing Wood Scrap**

(continued from p. 4)

haps even another chart, based on user response, that tells about service experience. Some day there will be a consumer group that will rate utility meters in just such a fashion. After all, utility bills are a bigger bite than a candy bar.

Before we go to work, if any of our meter experts have some definite ideas about how a Code for Thermal Measurement would best suit their needs, let us at IDHA know.

*Norm Taylor*



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district heat demand can be greatly out of phase, it has been suggested that thermal storage be employed in several Western European district heating systems utilizing industrial waste heat.

In addition, Western Europeans are undertaking RD&D programs in the field of interseasonal thermal storage technologies appropriate for holding very large amounts of low temperature industrial waste heat at high levels of efficiency over long period of time. The technologies under development use very low cost materials such as insulated earth, aquifiers, wells, rock bore holes, and excavated and insulated, earth-bermed reservoirs. These technologies offer the potential for very low cost thermal storage capacity, especially if designed to hold low temperature heat over long periods. If such technologies were to become commercially available, the overall level of recoverable industrial waste heat for use in district heating systems might be greatly expanded and the supply of industrial waste heat to individual district heating systems could be maximized.

Given the types of RD&D outlined above, the use of industrial waste heat supplied district heating might become widely applicable throughout heavily industrialized American cities. In the process, both the U.S. industrial base and the local economics of those urban areas served by such systems could undergo a significant revival.