DISTRICT HEATING

WEIGH THE ALTERNATIVES

4TH QUARTER 1981 VOL. 67 NO. 2

Trip Report of Visit to France and Denmark of the IDHA Representative to the Geothermal District Heating "Blue Ribbon Panel"

by **Norman R. Taylor**

I. Introduction

This delegation had as its objective the study of Geothermal sources of heat, facilities for the production of combined heat and power, utilization of urban waste, disposal of hazardous materials, and the appraisal of hot water based thermal distribution schemes.

The following participants comprised the U.S. delegation:

Stuart Sloame, Deputy Assistant Secretary for Community Planning and Development, U.S. Department of Housing and Urban Development (HUD), Washington, D.C.

Wyndham Clarke, Program Manager—District Heating, HUD, Washington, D.C.

Eric A. Peterson, Program Manager—Geothermal Systems, U.S. Department of Energy (DOE), Washington, D.C.

David Atkinson, President, Hydrothermal Energy Corporation, Los Angeles, CA

Gale C. Corson, President, Center 4 Engineering, Redmond, Arizona

Gordon Reistad, Associate Professor, Oregon State University, Corwallis, OR

Frank Childs, EG & G Idaho, Inc., Idaho National Engineering Laboratory, Idaho Falls, Idaho

Norman R. Taylor, Executive Director International District Heating Association, Washington, D.C.

II. Segment of Trip in France

This part of the tour was arranged by Trans Energy Systems through their French parent organization, Compagnie General de Chauffe, who guided the delegation to the various facilities. Compagnie General de Chauffe (CGC) is a very interesting organization and something of its background and capabilities is necessary to put French district heating and cooling (DHC) in the proper perspective. The headquarters of CGC is located at Saint-Andre-lez-Lille in Northern France, and the present corporate structure was created from the merging in 1960 of two specialized companies, one specializing in climatic engineering started in 1935 and the other in heating and air conditioning set up in 1944. The company has grown from 14 employees in 1935 to 4,400 in 1975. In France CGC is involved with 600,000 collective dwellings, 1,800 educational establishments, 900 public establishments, 350 hospitals, 118 swimming pools, and counts more than 50 district heating systems. They are involved in all phases of district heating, refuse energy and geothermal operations from design through day to day operations.

II—(1) Melun Facility—The Melun facility is a goethermal source district heating scheme, supplying 2,500 individual apartments. The system was designed by CGC, operated by the company and is about 10 years old. The geothermal source is two wells supplying water at 230°F to thin plate heat exchangers and it is then reinjected. An oil fired boiler plant is provided as back-up as well as an insulated above ground hot water storage tank. Hot water for space heating is via a steel pipe feed and return, insulated in rectangular cast concrete ducts. A separate single feed system supplied from an independent heat exchanger furnishes domestic hot water. There is no circulation in the space heating system during non-heating periods, but the domestic supply is continuous. Metering is at each building where a heat exchanger is located. The basis is quantity of heat using commercial electronic type meters. It is unique that a by-pass maintains a constant flow sufficient to keep the volume meter in motion and this quantity is not billed. Temperature control in the building is controlled through the operation of circulating water pumps in a zone arrangement. Domestic hot water is measured by a conventional water meter. The meter room and its equipment indicated excellent system maintenance.

II—(2) Bures-Orsay and Rungis Facilities—The Bures-Orsay system supplies 7,115 apartments and is an oil fired plant about 10 years old. It is not of CGC design but is operated by the company. It is a combined heat/power (cogeneration) facility of 10.7 MW electrical capacity. There are three additional heat only boilers that provide back-up and heat peaking capabilities. The distribution system is piped heat and return using pipe of about 8" diameter for transmission. There is no separate domestic hot water system at this facility. We were able to see the replacement of some lateral supply lines to an apartment building. The insulated lines were encased in a prefabricated concrete duct line and were equivalent to 3" standard pipe. The building heat exchanger station was similar to Melun but with more circulating pump capacity because of the larger systems. It was noted that valves are located on the supply and return water risers inside the building with extended stems passing through the wall and coded as emergency shut-offs.

Rungis is a commercial market and is fueled by solid waste developed within the facility. A central boiler plant receives waste via tractor drawn, side dumping trash receivers. These tip into a pit from which a clam-shell crane supplies the in-feed hopper. There is no sorting or selection process. The waste was high in wood content in the form of light crates, pallets and dunnage. The fire box

feed was a simple chain type, oscillating bed stoker with manual control through a closed circuit TV system monitoring the flame. The stack was equipped with precipitators and ash was conveyed to a ground level bunker. There was no odor from the storage as all combustion air is drawn across this area with controlled supply. Three oil fired boilers provide back-up and peaking supply. Buildings in the complex have one or more large heat exchangers of the tube type and are fed from a manifold of circulating pumps in an impressive zoned system. Metering is very sophisticated using electronic systems with remote registration to the central plant. Included in the remote system is a temperature and leak monitoring network.

II—(3) Lille-Saint Sauveur—This is a residential area system supplying 1,402 apartments and uses oil or natural gas as a heat source. It has been in service 15 years and was designed and is operated by CGC. The plant operates normally from natural gas and distributes water at 180°C (356°F). In other respects the system was similar to those in the Paris area.

II—(4) Roubaix—Roubaix is an oil fired district heating facility supplying 3,075 apartments, is twelve years old and was designed and is now operated by CGC. This system is being expanded and the construction of a new plant was evidenced, including the connecting transmission pipe systems. Fabrication of the lines indicated good procedure with weld testing, insulation and corrosion protection very similar to U.S. practice.

III. Segment of Trip in Denmark

This part of the tour was arranged by the Danish Board of District Heating. This is a non-profit organization that is a collective source representing most district heating know-how in the country. The Board had an informal reception of the delegation upon arrival in Copenhagen with relevant discussion of the energy situation in the country. Denmark has been in an unfavorable position as regards its dependency upon fuel imports. At a very early stage the value of district heating was recognized as both an intensive form of saving and as a socially positive means of making effective use of energy. The half century of district heating development in Denmark has provided an ideal test bed for continually improving district heating technology.

III —(1) Vestforbraending—This was a very modern refuse incineration plant on the outskirts of Copenhagen. This was a plant built by Volund and their personnel guided the delegation. The building was a clean, modern structure with a very high stack. The receiving area was large and a number of trucks were going through the weighing and tipping procedure without congestion or waiting. The incineration is by forward pushing step grates and there is no sorting process except that large, obvious non-combustibles are removed from the supply hopper. Siting of the plant is good with about one-half mile of open field separating it from built-up areas.

III—(2) Danish Ministry of Energy—The delegation was briefed on the energy policies of Denmark. At the time of the energy crisis Denmark was expending 40% of its energy in residential heating and that was 90% oil. In a 20 year plan, they expect 40% of the demand to be met by cogeneration schemes that involve electricity production, 20-25% to be met by natural gas, and the remainder, mostly remote areas, to remain on fuel oil. In large DH projects Denmark grants a 25% subsidy to the system, generally in the transmission piping, and the balance of the financing must be by local sources. Denmark has passed significant legislation related to DH and a translated copy is available at IDHA entitled "Act on Heat Supply, Act No. 258, 8th June, 1979." The country does not have a mandatory hook-up requirement, but DH is so advantageous that customers are eager to connect and communities vie for the supply system.

III—(3) ISS Clorius — The ISS Clorius Company is a very large Danish group with about 40,000 employees and operates building maintenance systems not only in Denmark but in many locations world-wide, including the U.S. and Canada. Among their systems are devices for the control and metering of hot water from DH systems. The various systems of energy management were demonstrated to the delegation.

III—(4) Danish Foreign Ministry—The Royal Danish Ambassador Ole Phillipson as well as others involved in energy matters met with the delegation at the Royal Danish Yacht Club in Copenhagen. Discussion indicated a national objective to reduce the dependence of the country on imported oil yet to preserve the high standard of living that has developed. The use of new supplies of natural gas was discussed as to its effect on the business community. In regard to the importation of coal, the present level is 10 million tons of coal imported yearly, 1 million being from U.S. sources. This is used primarily in the production of electricity at an efficiency of 36%. The importance of combined heat and power schemes to raise efficiency was stressed.

III—(5) Odense, Fynsvaerket—The delegation visited the Funen combined heat and power station. As an overview, a film of the operation was shown and the plant's history and development discussed. The tour was very complete and the extraction of DH from the electric production process described in detail. The system of pumping hot water for the distribution system proved interesting as they have found considerable development work necessary. At present, the pumps are variable speed motors. Departing and returning hot water lines are large 36" to 48" pipe equivalent and thoroughly insulated. Water chemistry is monitored and controlled.

In Odense the delegation was briefed on the city's plans for development, metering, billing and consumer relations. Data on cost and the method of financing together with several years' results were made available and are on file at IDHA. The enthusiasm of the local government was most evident and as the consumer's costs for space heating are about one-half of electric or oil costs, they are no marketing problems. The delegation visited a new individual residence and studied the DH facilities. This was a neat, well constructed masonry and

frame dwelling of about six rooms. The plumbing and other equipment was good by U.S. standards. Domestic hot water and space heating via radiation was well installed and very compact. This scheme does not use heat exchangers for space heating and billing is by volume of hot water used. Domestic hot water is measured separately on the return side of the exchanger. Thermostatic control was very good with night set back and modulation relative to outdoor temperature.

III—(6) Nyborg—This was the Kommunekemi Chemical and Waste Destruction Plant. It has the responsibility to dispose of all hazardous waste in Denmark. In an elaborate scheme of incineration wastes are destroyed without effect to the air quality and there is no discharge to rivers or streams. Waste heat recovery boilers are in place and develop hot water for the Nyborg DH scheme. There are additional facilities in this scheme for back-up and peaking.

The delegation visited a plant nearby that produces prefabricated DH pipe, fittings and asphalt products. The facilities are owned by the local authorities. Production was excellent with good facilities for testing and quality control. The plant is expanding to meet the needs of the growing DH systems.

III—(6) Aars—The delegation visited the factory complex of Danfoss, one of the world's largest manufacturers of automatic controls equipment used in DH systems. These devices range from simple non-electric room radiator controllers to very sophisticated building energy management systems. The Danfoss company is modern, now has a broad line of products, one of which being refrigeration compressors, and is marketing throughout the world.

While in this area the delegation was briefed on the working of the Fredericia DH system which is a co-operatively owned utility using as a heat source the reject heat from Superfos, a fertilizer manufacturer.

III—(7) Aarhus—At the offices of Brun and Sorensen the Public Works Department of the City of Aarhus discussed their DH scheme and details of its ownership and acceptability of customers.

In this area, the delegation visited the plant of Kamstrup Metro who are manufacturers of energy meters and control equipment, and to Redan, a manufaturer of heat exchangers.

IV. Summary

All areas visited have several items in common:

- Hot water district heating is installed, is working and is expanding in scope.
- DH is enthusiastically accepted by customers.
- Conservation of natural resources, reduction of oil imports and utilization of waste is a national objective.
- DH is good business, from the standpoint of the local government and the equipment suppliers.
- DH can be accomplished in today's financial climate.
- Hot water distribution schemes are not without mechanical problems.
- Simplicity is the key profitable operation.
- There has been impressive progress in accurate metering of energy.

IDHA has now published a "Directory of Products and Services" provided by member companies. Copies are available from the IDHA office:

1735 Eye St. N.W. Suite 611
Washington, D.C. 20006