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DESCRIPTION OF DISTRICT HEATING: U.S. HISTORY AND CURRENT STATUS*

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ABSTRACT:**

The history of district heating includes both the birth of the district heating industry in the United States and the modern systems now being developed in northern Europe. During the early part of the twentieth century, the first small cogeneration/district heating plant came into existence. These systems used exhaust steam from small dual-purpose power plants to heat buildings in the nearby business district. As a result, steam district heating combined with cogeneration was widely accepted. During the late 1940s the situation changed when the introduction of inexpensive oil and natural gas for space heating reduced the rapid growth of district heating. Presently many U.S. steam district heating businesses are not profitable and are in total disrepair. The history of district heating in Europe is somewhat different than that in the United States. The development of district heating networks in northern and eastern Europe started in the early 1950s. Hot water, rather than steam, was used as a transport media. European systems tend to have larger service areas than those in the United States. They serve lower heat load density regions and use remotely located cogeneration power plants.

District heating and cooling systems perform a localized, specialized role in providing thermal energy service to a community. District heating and cooling should not be considered as a competing alternative to oil, natural gas, coal, or synthetic fuels: rather it should be considered a flexible energy distribution technology designed to take and transport thermal energy. The advantages of district heating include:

(1) The national level benefit of displacing oil and natural gas,

(2) The community level creation of jobs within the community, and the making of the city more competitive with the suburban area, and

(3) The advantages to the consumer of more simplistic and more reliable space heating equipment (heat exchangers vs. boilers).

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DISCLAIMER

DESCRIPTION OF DISTRICT HEATING, U.S. HISTORY AND CURRENT STATUS

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DISTRICT HEATING IS THE DISTRIBUTION OF THERMAL ENERGY FROM A CENTRAL SOURCE FOR RESIDENTIAL AND COMMERCIAL SPACE HEATING AND HOT WATER HEATING.

- o DISTRICT HEATING IS A DEVELOPED TECHNOLOGY
- o STEAM SYSTEMS IMPLEMENTED IN THE U.S. IN EARLY 1900s
- o HOT WATER SYSTEMS IMPLEMENTED IN EUROPE DURING 1950s AND 1960s

DISTRICT HEATING HAS NOT BEEN SUCCESSFUL IN THE U.S. BECAUSE:

- o ABUNDANT CHEAP ENERGY HAS BEEN AVAILABLE
- o STEAM TECHNOLOGY LIMITS TRANSMISSION DISTANCE
- o SERVICE AREA RESTRICTED TO VERY DENSE DOWNTOWN AREAS
- o MOST SYSTEMS ARE OLD AND INEFFICIENT

DISTRICT HEATING HAS BEEN SUCCESSFUL IN EUROPE BECAUSE:

- o ENERGY ALTERNATIVES ARE LIMITED AND EXPENSIVE
- o HOT WATER TECHNOLOGY INCREASES ECONOMICALLY VIABLE DISTRIBUTION AREA (SYSTEMS HAVE THE FLEXIBILITY TO CHANGE AS COMMUNITY CHANGES)
- o HOT WATER ALLOWS LONGER TRANSMISSION DISTANCES

U.S. HISTORY EMPHASIZES ELECTRIC UTILITY'S ROLE IN DEVELOPING STEAM DISTRICT HEATING

- o 1877 — BIRDSILL HOLLY INSTALLS FIRST SYSTEM IN LOCKPORT, NY
- o ≈1890 — NEW YORK, PHILADELPHIA AND MANY OTHER U.S. CITIES INSTALL DISTRICT HEATING SYSTEMS
- o 1890 TO 1920 — ELECTRIC UTILITIES BECOME COMMITTED TO DISTRICT HEATING
  - EXHAUST STEAM FROM RECIPROCATING ENGINES USED
  - STEAM SERVICE PROVIDED AS INCENTIVE TO BUY ELECTRICITY
  - COGENERATION PROCESS INTRODUCED
- o 1920'S AND 1930'S — COGENERATION/DISTRICT HEATING SYSTEMS EXPERIENCE A POSITIVE GROWTH TREND

U.S. HISTORY (CONT'D)

- o BY 1930 — ELECTRIC POWER GENERATION IMPROVEMENTS HAD AN ADVERSE AFFECT ON DISTRICT HEATING
  - CONDENSING STEAM TURBINES REPLACE RECIPROCATING ENGINES
  - LONG DISTANCE ELECTRIC TRANSMISSION BECOMES MORE EFFICIENT
  - LARGER SUBURBAN POWER PLANTS REPLACE SMALLER IN-TOWN PLANTS
- o BY 1950 — RAPID EXPANSION IN USE OF "CHEAP" OIL AND NATURAL GAS CAUSED A FURTHER DECLINE IN DISTRICT HEATING
- o 1973/74 — OIL CRISIS RESULTS IN INCREASED CONSERVATION EMPHASIS
- o TODAY — RENEWED AWARENESS OF DISTRICT HEATING POTENTIAL

THE CURRENT STATUS OF DISTRICT HEATING IN THE U.S. INDICATES THAT IT HAS NOT REACHED ITS FULL POTENTIAL

- STEAM DISTRICT HEATING SYSTEMS ARE USED EXCLUSIVELY IN U.S. CITIES
  - NEW YORK, PHILADELPHIA, DETROIT, BOSTON, INDIANAPOLIS, ETC.
- A FEW EXAMPLES OF U.S. HOT WATER DISTRICT HEATING SYSTEMS EXIST
  - SEVERAL UNIVERSITIES: OHIO STATE, NEW YORK UNIVERSITY
  - SEVERAL CITIES (CONCEPTUAL PHASE): ST. PAUL, MINNESOTA; PIQUA, OHIO; DETROIT, MICHIGAN, ETC.
- DISTRICT HEATING IN THE U.S. HAS ONLY REALIZED ≈10% OF ITS POTENTIAL
  - DISTRICT HEATING CURRENTLY SUPPLIES ≈1% OF U.S. ENERGY DEMAND

DISTRICT HEATING OFFERS THE CONSUMER MANY ADVANTAGES
(CONSUMERS HEAT EXCHANGER VS. INDIVIDUAL BUILDING BOILERS)

- o COMPETITIVE SPACE HEATING ENERGY PRICES
- o SIMPLICITY OF BUILDING EQUIPMENT (RELIABLE)
- o LOWER CAPITAL COST FOR NEW BUILDINGS CONNECTING DIRECTLY TO THE SYSTEM
- o SOMEWHAT SAFER
- o USES LESS FLOOR SPACE

DISTRICT HEATING OFFERS ADVANTAGES THAT ADDRESS IMPORTANT NATIONAL CONCERNS

- o DISTRICT HEATING COULD LESSEN OUR REQUIREMENT FOR IMPORTED OIL
  - CURRENTLY SPACE AND WATER HEATING ACCOUNTS FOR 20% OF U.S. ENERGY CONSUMPTION (15 QUADS) AND OVER 90% OF THESE NEEDS ARE MET BY OIL AND NATURAL GAS
  - THE CENTRAL SOURCE THAT SUPPLIES THE THERMAL ENERGY CAN USE A VARIETY OF MORE PLENTIFUL DOMESTIC FUELS
  - EXAMPLE: THE MINNEAPOLIS-ST. PAUL AREA
    57% REDUCTION IN SPACE HEATING BURN
    87% SCARCE FUEL SAVINGS
- o DISTRICT HEATING COULD BE BENEFICIAL TO OUR ENVIRONMENT
  - IMPROVE URBAN AIR QUALITY
  - REDUCE THERMAL POLLUTION

DISTRICT HEATING CAN BRING MANY U.S. CITIES MAJOR SOCIAL, ECONOMIC, ENVIRONMENTAL, AND ENERGY BENEFITS

POSITIVE POINTS:

DISTRICT HEATING IS ONE WAY OF CONVERTING THE HEATING SYSTEM IN URBAN AREAS TO COAL WITHOUT SEVERE ENVIRONMENTAL PROBLEMS

DISTRICT HEATING COULD SAVE SCARCE FUEL (OIL & NATURAL GAS)

DISTRICT HEATING SYSTEMS WILL PAY FOR THEMSELVES

DISTRICT HEATING WILL HELP STABILIZE HEATING COSTS TO CONSUMERS

DISTRICT HEATING PROJECTS WILL CREATE JOBS FOR SEMI-SKILLED, LOW-INCOME, AND MINORITIES

DISTRICT HEATING CAN MAKE CITIES MORE COMPETITIVE AND HELP RETAIN AND EXPAND TAX AND EMPLOYMENT BASE

DISTRICT HEATING CAN PROVIDE DRAMATIC IMPROVEMENTS IN GROUND LEVEL AIR QUALITY

DISTRICT HEATING IS A PRACTICAL WAY OF GIVING CITIES FULL ACCESS TO ALTERNATIVE AND RENEWABLE ENERGY SOURCES

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DISTRICT HEATING CAN BRING MANY U.S. CITIES MAJOR SOCIAL, ECONOMIC, ENVIRONMENTAL, AND ENERGY BENEFITS (CONT'D.)

NEGATIVE POINTS:

MOST ELECTRIC UTILITIES ARE NEGATIVE

FEDERAL POLICY AT PRESENT DOES NOT SUPPORT DISTRICT HEATING

DISTRICT HEATING FEASIBILITY STUDIES ARE EXPENSIVE AND TIME CONSUMING