**A Project of the
Urban Consortium
Energy Task Force of
Public Technology, Inc.**

City of Chicago
Richard M. Daley, Mayor

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DOWNTOWN DISTRICT COOLING:

A 21st CENTURY APPROACH

Conducted by:
Department of Environment
Henry L. Henderson, Commissioner

MASTER

Funded through the U.S. Department of Energy

CITY OF CHICAGO DOWNTOWN DISTRICT COOLING: A 21ST CENTURY APPROACH

**URBAN CONSORTIUM
ENERGY TASK FORCE**

Richard M. Daley, *Mayor*

Conducted by:

**Department of Environment
Henry L. Henderson, *Commissioner***

December 1995

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TECHNOLOGY,
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URBAN CONSORTIUM

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Background

URBAN CONSORTIUM

Public Technology, Inc. (PTI), is the non-profit technology organization of the National League of Cities (NLC), the National Association of Counties (NACo), and the International City/County Management Association (ICMA). PTI's mission is to bring technology to local governments. Through collective research and development efforts in its member jurisdictions, PTI creates and advances technology-based products, services, and enterprises for all cities and counties.

Four active task forces, each composed of members of PTI's Urban Consortium (UC)—which represents fifty of the nation's largest and most progressive cities and urban counties—drive PTI's research and commercialization efforts. One of these task forces is the Urban Consortium Energy Task Force (UCETF), which was established to address critical energy needs of urban America.

THE URBAN CONSORTIUM ENERGY TASK FORCE

The UCETF is the nation's most extensive cooperative local government program to improve energy management and technology applications in local governments. Its membership is composed of local government officials from America's large urban centers. The four major goals established by UCETF members are to:

1. Pursue collaborative solutions to interrelated energy, environment and economic development issues at the local level;
2. Improve energy efficiency, reduce costs and develop revenue from local energy assets;
3. Promote practices and efforts at the local level to assure that energy and environmental considerations are broadly integrated into local decision-making, and to address the interrelationships between energy, environment and economic policies; and
4. Act as the implementation arm for NLC and NACo policies.

Under an annual program partly funded by the U.S. Department of Energy (USDOE), a number of city and county projects propose to meet UCETF objectives. Projects selected for each year's program are organized in thematic units, such as Utilities/Buildings, Transportation, Sustainable Communities, and Technology Transfer, to assure effective management and ongoing peer-to-peer exchanges. The results of these research projects are documented in reports such as this one, and made available for broad dissemination among other local governments through PTI.

The research and studies described in this report were made possible by grants from the MUNICIPAL ENERGY MANAGEMENT program of the Office of Energy Efficiency and Renewable Energy of the U.S. Department of Energy.

The statements and conclusions contained herein are those of the grantees and do not necessarily represent the official position or policy of the U.S. Government in general or USDOE in particular.

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Dr. Charles Williams, Director of the Department of Environment's Energy Management Division provided overall direction for the implementation of this project. W. Dwight Bailey, Sr., Project Manager and principal author, was responsible for the day-to-day activities of the project.

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The McCormick Place Exhibition Authority deserves much credit for taking the bold step of adopting district energy for its exhibition facilities, including the new 1 million square feet expansion project. Also, the Trigen Energy Corporation and the Peoples Gas Light and Coke Company were responsible for, among other things, sharing their technical expertise on district energy development with the City, MPEA representatives and everyone else involved. In particular, we would like to thank Messrs. Tom Casten, President, Goren Mornhed, Project Manager, both of Trigen Energy Corporation, and Norm Sidler and Robert Capecius of the gas company. We are sincerely indebted to the Building Owners and Managers Association for providing us with valuable information on downtown chiller conditions.

Lastly, this project's success would not have been possible without the keen advice and insight of Jack Werner, Business Director for Public Technology, Inc.

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ABSTRACT

On December 1, 1992, the Board of Directors of the Metropolitan Pier and Exposition Authority (MPEA) met on Chicago's historic Navy Pier and ushered in a new era of competition for energy supply in Chicago. The MPEA, a state agency created for the purposes of promoting and operating fair and exposition facilities within the Chicago area (including the McCormick Place exposition center and Navy Pier), voted to accept a third-party proposal to provide district heating and cooling services to the existing McCormick Place facilities and a million square feet of new exposition space. The winning bidder was a joint venture between Trigen Energy, the nation's largest provider of district energy services, and Peoples Gas, the gas distribution company which serves Chicago.

This vote culminated two years of effort by the Energy Division of Chicago's Department of Environment to analyze the feasibility and promote the implementation of a district energy system to serve the expanded McCormick Place and its environs in the South Loop neighborhood. Initial services began in November, 1993, with a new hot and cold water piping system interconnecting the three existing exhibition facilities. The final buildout of the system, with a combined peak demand predicted at 160 MMBtu of heating and 15,920 tons of heating and cooling, is scheduled for completion in the summer of 1997.

The Trigen/Peoples district energy project heralded a new era of competition in the energy services market in Chicago. Commonwealth Edison Company (CECO), the electricity supplier for Northern Illinois, initially proposed all-electric energy systems for McCormick Place. When this proved uncompetitive with the cogenerated district energy system proposed by Trigen-Peoples, CECO also proposed a district energy system. Within months of the MPEA vote, CECO obtained legislative authority to create and provide capital funding for a non-regulated entity, "Northwind," to market district energy services in Chicago's downtown area.

The DOE Energy Division's first efforts at promoting district energy were directed towards an ambitious multi-use project, "Central Station", located north of the McCormick Place complex (see Chicago's Year 11 UCETF Project, "Central Station DHC Phase I Feasibility," 1989). Because of real estate market uncertainties, it soon became clear that commencement of a private district energy system in Chicago would be more likely to occur if an anchor load outside of Central Station could be established. Thus, our efforts subsequently focused on identification and acquisition of an anchor load.

As part of this Year 13 UCETF project, we originally planned to develop a marketing and business plan for downtown district energy. However, as the project progressed, our major efforts adjusted to support the adoption of district energy at

Project Overview

*“An
unusual
opportunity
for a large-
scale, state-
of-the-art
system
presented
itself.”*

the McCormick Place complex as an anchor load, with subordinate activities aimed at marketing efforts for connection to downtown buildings. We actively promoted the adoption of district energy at McCormick because of its inherent energy efficiencies, its environmental benefits, and its introduction of competition into Chicago's utility marketplace.

The success of this effort, which culminated in the MPEA vote, resulted in another shift in the focus of our efforts, when the success of Trigen-Peoples in securing the MPEA contract demonstrated the economic benefits of the technology, and spurred the entry of new players into the cooling market in Chicago. We shifted rather quickly from a role of fostering an innovative new technology in the Chicago market to the role fostering competition among entrants in what became very suddenly an accepted means of economically serving cooling loads and addressing the required transition from CFC refrigerants.

Energy staff spearheaded a Mayorally-sanctioned District Energy Policy that requires DOE to coordinate the City's review process for district energy system applications. This policy also addressed another key objective in the original project work program. The development of a proposal application for use of the Freight Tunnel System (as a distribution conduit) was another anticipated task for this Year 13 UCETF project. The District Energy Policy will enable the City to rationally consider applications for use of the Freight Tunnel System as well as all other public rights-of-way.

Although we succeeded in assisting the development of a district energy system, and all indications point towards continuance of such technology in the downtown and surrounding areas, much work remains to be done. In our new coordinative duties for application review, we must carefully weigh impacts any proposed downtown district energy system will have on land use, environmental resources, City permitting procedures and municipal revenue collections. All of this suggests that an exciting yet potentially tricky journey lies in wait for the relatively new Department of Environment.

PROJECT PURPOSE

The purpose of this project was to encourage development of a downtown district energy system, through facilitating the implementation of an initial system and development of a marketing and business plan for its expansion. The practicality of a Chicago area district cooling system, with ancillary heating loads, was confirmed in Chicago's 1989 UCETF Project, "Central Station DHC Phase I Feasibility," provided that an anchor load could be established. The study also concluded that a downtown district energy system would enhance the viability of a South Loop district energy system because of increased load diversity. Creation of either district energy system as a viable entity was clearly predicated on securing an anchor load such as the energy system which would serve the McCormick Place exposition center and its planned million-square-foot expansion. Therefore, our initial efforts on this project were devoted to working with our partners in the feasibility study, Trigen Energy and Peoples Gas, to encourage the MPEA Board to consider a district energy system.

Our efforts shifted from a focus on "what if" analyses circumscribed to the Central Station real estate development project to capturing the opportunity which was presented by the planned expansion of McCormick Place. Not only were one

million square feet of exhibition space to be developed, but the structure housing most of the existing heating and cooling plant was to be dismantled. An unusual opportunity for a large-scale, state-of-the-art system presented itself.

The Energy Division's ability to influence the heating and cooling decision toward a more efficient and environmentally benign system was enhanced by more than a decade's experience in analysis and feasibility assessments of district systems, and by existing interrelationships with the MPEA. The design and zoning approvals for the McCormick expansion were processed as a Planned Development (PD), as was the Central Station project. At the time of this project, the Energy Division was within the Department of Planning, and integrally involved with both projects. As part of the MPEA PD process, the City's Department of Planning and Development drafted a "McCormick Place Intergovernmental Agreement" to execute the PD. This legal contract, among other things, outlines the MPEA's responsibilities for developing the district energy system and gives the City of Chicago the opportunity to influence implementation of the district energy requirement.

A second, less direct, connection was provided through the City's governance relationship with the MPEA. The Mayor of Chicago is authorized by state statute to appoint half the board members of the MPEA. This eased access to MPEA decisionmakers.

The first stage of our involvement consisted of explaining the benefits of the DHC concept within City government to senior staff within the Department of Planning and Development, the new Commissioner of Environment, and most importantly, the Mayor. We wrote technical memoranda outlining the benefits derived from district energy in general and the estimated benefits of the specific Trigen/Peoples proposal to the MPEA, and participated in interdepartmental policy meetings. Once Planning staff and the Mayor's office sanctioned district energy exploration for the MPEA, we contacted the MPEA staff to initiate discussions. We encouraged the MPEA's Director of Development to evaluate centralized district heating and cooling. Shortly after the initial exploratory meeting with the MPEA, energy staff conducted research to address their operational concerns; we surveyed other managers/operators of convention centers served by district energy systems to determine their experience with cost and reliability, and shared that information with the MPEA.

The relationship cultivated between energy staff and Trigen energy and Peoples Gas Light and Coke company during the Central Station feasibility study phase enabled us to efficiently collect data, forthrightly question the partnership's plans and offer advice on how to educate the uninitiated on the intricacies of district heating and cooling services. We gathered information on downtown chiller loads in order to gauge the magnitude of downtown cooling potential. We assumed that chiller age would significantly affect a building owner's strategy to address the CFC issue.

We also wanted to demonstrate the efficacy of aggressive local government involvement in complex business development. In reality, the gulf between the public and private sectors is narrowing due to the interdependence of modern institutions and the increasingly complex technologies driving our economic growth. The City clearly has a role in DHC development because of its ownership of coveted right-of-way, its (building) permitting obligations and, in our case, its local environmental oversight.

"We also wanted to demonstrate the efficacy of aggressive local government involvement in complex business development"

REPORT ORGANIZATION

This report details the establishment of the Trigen/Peoples District Energy Company's system serving McCormick Place, the Northwind Company's proposal to provide district cooling in Chicago's Loop (downtown), and the City of Chicago's proactive responses to those and other district energy proposals by assessing the potential for such technology in our downtown.

- Chapter 1** Provides a brief summary of the project; its background, objectives and results.
- Chapter 2** Describes the McCormick Place and Northwind district energy district energy development processes and their respective technology applications. It elucidates the City's role in those processes and how this Year 13 UCETF project was instrumental in bringing competition into the Chicago energy industry.
- Chapter 3** Describes data collection activities from two major sources of downtown chiller loads and age. It discusses likely areas for downtown district energy development based on: the initial Northwind proposal, chiller loads and ages, and infrastructural constraints.
- Chapter 4** Discusses the inauguration of the Chicago District Energy Policy and how it will be implemented by the Department of Environment. It outlines the City interdepartmental fabric for consideration of district energy proposals focussing on proposed generation and distribution systems.
- Chapter 5** Discusses the future of district energy development in Chicago given our assessment of the indigenous opportunities and constraints. It outlines the lessons learned from this project and provides recommendations transferable to other jurisdictions where such technology will undoubtedly develop.

INTRODUCTION

This chapter first puts into historical perspective what we consider to be the modern inception of DHC in Chicago by briefly reviewing the City's promotion of DHC at the Central Station development. It provides the rationale for City promotion of district energy. It finally details, to the extent practicable, the respective district energy systems to be developed by both Trigen/Peoples and Northwind district energy companies.

2.1 POSTSCRIPT TO CENTRAL STATION FEASIBILITY

The Central Station DHC feasibility analysis, coordinated by City of Chicago Energy staff and partly supported by UCETF funds, indicated the Central Station endeavor could support a district heating and cooling system provided an anchor load be established prior to Central Station development.

In July, 1991, the State of Illinois General Assembly granted the Metropolitan Pier and Exposition Authority (MPEA) revenue bonding authority to proceed with construction of the third McCormick Place Exhibition complex. At the same time, Trigen Energy Corporation pursued a district energy option with the MPEA for all three complexes: McCormick Place I (North Hall), McCormick Place II (East Hall) and McCormick Place III (under construction). Energy staff coincidentally held discussions with Trigen Energy Corporation and Peoples Gas to devise a strategy for a district energy option approach to the MPEA. We initiated a letter, encouraging the consideration of district energy, from the City of Chicago Commissioner of Planning to the MPEA's Director of Development.

In Fall 1991, Trigen sent a letter of introduction to the same individual, advancing the concept of "trigeneration": production of electricity, steam/hot water and chilled water as an energy resource opportunity for the MPEA complexes. Since new construction planning was about to commence, it was important to integrate the district energy option at the earliest opportunity. Trigen, in collaboration with Peoples Gas, therefore proposed to provide the MPEA with a feasibility analysis for a facility that would preserve jobs (existing chiller and boiler plant operating engineers) and result in capital and operating life cycle cost savings. Peoples Gas' interest in the MPEA district energy option was presumably based on the early system design, i.e., natural gas fired turbines were the primary energy source for a cooling system with potential for expansion into the downtown area, a market which heretofore been almost exclusively served with electric chiller equipment.

Commonwealth Edison company (CECO) also provided the MPEA preliminary cost estimates for the energy expansion project. These cost estimates (for electrical distribution system expansion) were based on an all-electric heating/cooling alternative.

Current Chicago District Energy Trends

2.2 DEPARTMENT OF ENVIRONMENT'S PROMOTION OF DISTRICT ENERGY:

“Central utility systems are typically better maintained and operated than in-building systems.”

The MPEA staff was critically concerned about DHC reliability. On one hand, the MPEA wanted assurances that a district energy system would be large enough to meet peak cooling demand during large exhibition shows, and on the other, was concerned about unplanned outages. The Energy Staff, recently transferred to a newly-formed Department of Environment (DOE), immediately investigated and reported the experiences of other convention centers connected to district energy systems owned by either Trigen Energy Corporation or other companies. We provided the MPEA staff contact names with system descriptions and customer (convention centers) descriptions.

We aggressively urged the MPEA to seriously consider the DHC option provided their legal, financial and technical requirements could be met. During this period (approximately March 1992), Trigen submitted an “unsolicited pre-proposal” to the MPEA for consideration. Trigen Energy Corporation and Peoples Gas were contemplating a partnership as a means of formally approaching the MPEA for a service contract. In their discussions with DOE staff and the MPEA subsequent to the pre-proposal submission, the two parties devised strategies for lowering operating and capital costs for the convention complex.

Ultimately, we presented the MPEA staff with five succinct reasons why they should earnestly investigate district heating and cooling: 1) lower energy costs, 2) lower facility operating and maintenance costs, 3) lower capital costs for the planned expansion, 4) environmental superiority and 5) DHC’s historically high reliability. The bases for these arguments are provided below.

Lower Energy Costs

Inherent in the design of the system which will serve MPEA is a significant reduction in energy costs. “Trigeneration” of heating, cooling and electric power is inherently more efficient than separately maintained and operated systems. The thermal system addition obviates the needs to cycle equipment to meet the highly variable peak loads in a convention center, and will therefore further reduce costs through avoiding the demand charges associated with conventional utility arrangements. Further, there is no ongoing capital expense for maintaining and upgrading the installed excess capacity emblematic of in-building boilers and chillers.

Lower Operating and Maintenance Costs

A facility connected to a district energy system requires fewer trained on-sight maintenance and operating personnel, and lower annual operating costs. In addition, boiler and chiller operating expenses (that is, electricity, water treatment chemicals, insurance, refrigerant and make-up water, etc.) are virtually eliminated for the end-user.

Lower Capital Costs for Planned Expansion

The principal and interest payments, property taxes and insurance costs associated with new boiler and chiller installations are all eliminated with district heating and cooling. In most facilities connected to a DHC system, initial capital costs are dedicated to heat exchangers, related piping, and associated metering and valves.

Environmental Superiority

Central energy service from a thermal plant reduces the number of smokestacks and more importantly, because of inherent efficiencies, results in a net reduction of emissions. District energy eliminates concerns over fuel availability and storage, as well as other operating and maintenance responsibilities. Many central heating and cooling production plants have oil or gas pipelines to facilitate volume fuel delivery. Even when they are fueled with coal or municipal solid waste, central plants typically have state-of-the-art combustion and pollution control systems. Central cooling systems have the added advantage of making more feasible the substitution of environmentally benign refrigerants for ozone-depleting CFCs and HCFCs.

Reliability

Central utility systems are typically better maintained and operated than in-building systems. They are usually manned 24 hours a day by highly qualified operators. Reliability can be expressed as the ratio: 1 minus (the period of time of unplanned outages divided by total operating time). With DHC, this ratio amounts to well over 99% industry-wide.

2.3 PROPOSED TRIGEN/PEOPLES DHC SYSTEM

The McCormick Place complex consists of three facilities: East Hall, North Hall and the planned expansion—South Hall. The North Hall is currently heated and cooled from Donnelley Hall, a separate facility to be demolished. Without district energy, it will be necessary to relocate the equipment out of the building and construct a new plant, prior to demolition. The South Hall facility will require a new heating and cooling plant as well.

The Trigen-Peoples District Energy Company proposed to build, own and operate a district energy facility that offers centrally produced chilled water for air conditioning, computer cooling and process loads, and steam for heating and process loads. Trigen-Peoples collected energy use data from the MPEA and determined that, without district energy, the existing chilling capacity of more than 16,000 tons will be expanded (because of construction of the third exhibition complex—South Hall) to a total installed capacity of more than 25,000 tons. The installed heating capacity is expected to reach 320 MMBtu/hr.

The cooling and heating demands (including the expansion) for the complex were estimated at 19,900 tons and 200 MMBtu/hr., respectively. The combined peak demand was predicted to be reduced by diversification to 15,920 tons and 160 MMBtu/hr. after the completion of South Hall.

The proposal to build a new central plant included utilization of the existing East Hall plant for peaking and back-up requirements. This plant will be the primary heating and cooling provider during development of the system. After the central power plant is constructed, the East Hall plant will serve primarily in a back-up capacity, with the chillers operated during designated summer peak conditions. According to the Trigen-Peoples proposal, this arrangement reduces the amount of newly installed equipment. The MPEA will also enjoy compensation through a per annum lease or similarly contrived arrangement.

The district energy plant will be modularly designed, allowing Trigen-Peoples to initially serve McCormick Place and then add more modules to serve other

buildings in the area. Trigen-Peoples will design the plant according to the following general criteria:

- A staggered time frame for expansion of service into the Loop,
- Use of efficient energy production equipment,
- The system efficiency to be enhanced through cogeneration/"trigeneration"
- The use of natural gas as a primary fuel,
- The use of ammonia and/or lithium bromide (environmentally benign refrigerants) for cooling and
- The use of chilled water storage to maximize system efficiency.

The natural gas driven ammonia chillers connected to a chilled water storage tank are the key features of the system. According to design, the ammonia chillers with screw compressors will produce chilled water (34°F) which will be pumped to the storage tank. The tank will allow the chillers to operate continuously to meet high daytime demands. Consequently, the system will require less installed capacity than the peak load, and the chillers will operate at higher efficiency during the cool nights. Further, Trigen-Peoples predicts the chiller efficiency will be significantly higher than any CFC or HCFC machine currently on the market. Electricity will be used to produce the auxiliary power that drive pumps, fans and cooling towers. This configuration allows combined chilled water and electricity production.

As discussed in Chicago's Year 11 UCETF project, ammonia has been in use as a refrigerant since the early 1870's. The first mechanically chilled refrigerated air conditioning jobs were done with chilled water. The water was chilled by the same industrial ammonia compressors that were used in ice plants, breweries and cold storage in the late 19th and early 20th centuries. Currently, ammonia (NH₃ or R-717) is the refrigerant of choice in virtually all large food processing plants, cold storage, in many chemical plants, and in the dairy, red meat, poultry, beverage and fish industries. In the proposed chilling plant, each screw compressor and generator will be driven in combination by a gas turbine.

As previously mentioned, ammonia has high efficiency and low cost. The refrigerating effect of ammonia, under any given set of conditions is infinitely greater than any of the halocarbons. Consequently, fewer pounds of refrigerant vapor must be handled for a given tonnage in ammonia systems. Fewer pounds results in less "gas" horsepower (pounds and head) and friction horsepower. Cost for ammonia is favorable in comparison to halocarbons as well. Historically, halocarbons have been three to four times as expensive as ammonia. New taxes, plus the costs of capturing and recycling the halocarbons will increase the cost differential even more.

The proposed chilled water storage tank is also a critical component of the proposed district energy system. This eight million gallon structure will enable the chilling equipment to run 24 hours a day, thereby maximizing cooling equipment efficiency with one half the equipment that would otherwise be required for production capacity. Trigen/Peoples proposes to circulate chilled water through heat exchangers by cogenerated electric power.

The central plant will be located north of McCormick Place (see map page 10). The distribution system will consist of chilled water piping (supply and return) as well

as steam (supply and condensate) piping. The steam and chilled water will be delivered to each McCormick Place building at a point of delivery where the net energy used in the building will be metered.

2.4 PROPOSED NORTHWIND DISTRICT ENERGY SYSTEM

Northwind—a subsidiary of Commonwealth Edison Company or CECO (the giant electric utility serving Northern Illinois)—was created in response to Trigen/Peoples capture of the entire McCormick Place cooling load (approximately 16,000 tons). Commonwealth Edison gained legislative approval to create this non-regulated subsidiary in order to compete directly with its new competitors. Edison asserted that having to acquire regulatory approval for any and all its activities gives its competitors unfair advantage. For example, according to Edison officials, when they were invited to respond to the Trigen/Peoples proposal, they proposed a district energy system that “was competitive with Trigen’s,” but were turned down because they declined to sign an indemnity bond and would have had to seek approval from the Illinois Commerce Commission. That type of bond, which Trigen/Peoples did provide to the MPEA, would have required Edison to pledge ratepayer or stockholder revenue to make up for any service delays.

In November, 1993 Northwind representatives met with City officials, including the Department of Environment, to discuss its proposed business venture for downtown district cooling. The City considered this project as a Planned Development because of its potential impact on the surrounding area. Northwind acquired an existing six-story building (which is not expandable) for conversion into a district cooling plant. From this plant, the company plans to deliver only chilled water to a select group of customers representing approximating 7.5 million ft² of commercial space located near the plant.

The 21,500 ton plant will consist of three industrial grade 5000 ton ice machines driven by electric motors, and an ice storage system. The ice will be converted to chilled water through plate frame heat exchangers and serve to shift peak from CECO’s load. The chilled water will be pumped through 24" buried pipes at temperatures ranging between 36°F and 38°F and return at temperatures ranging between 50°F and 52°F. Northwind estimated that 110,000,000 ft² of cooling needs in the Loop will have to eventually be met.

Northwind will purchase off-peak electricity (when rates are substantially lower than during peak periods) from CECO to produce the ice that makes chilled water. Edison’s peak period is from 9 a.m. to 10 p.m. Monday through Friday, except for some holidays. All of Northwind’s customers will be Rate 6L, i.e., large commercial (peak demand > 1000 KW). Northwind predicts that it will be able to offer these customers costs lower than they would experience should they chose to retrofit their in-building chiller systems with either electrical—or gas-fired systems.

The company is staggering its time frame for expansion into the Loop. Northwind has initiated its first plant construction and plans to commence construction of the distribution system in August 1994. Plant operation is scheduled to begin in 1995. Northwind has identified, and is seeking approval for, a second site for an additional plant in the Loop. The company has negotiated a long-term public right-

“The refrigerating effect of ammonia, under any given set of conditions is infinitely greater than any of the halocarbons.”

right-of-way franchise agreement with the City for its initial 21,500 ton system, which has been enacted by City Council. In the future, this franchise will have to be amended to include additional rights-of-way necessary for system expansion.

INTRODUCTION

This chapter will first discuss a profile of downtown chiller data focusing on aggregate system and average age. It will briefly outline the two major sources for the chiller profile, then review the proposed (Loop) Northwind system location. Finally, other possible locations for DHC connections will be discussed.

3.1 CENTRAL BUSINESS DISTRICT PROFILE

In Chicago's UCETF Year 11 project, Loop (or Central Business District) permitted chilled water load (principally for air conditioning) capacity (based on City of Chicago chiller permits data) was estimated at 450,000 tons, considering only those units 400 tons or greater. Site visits of twelve facilities then revealed that installed capacity typically represents 50% to 70% of permitted capacity. Thus, in 1990, we estimated that the potential for downtown district cooling was approximately 270,000 tons.

A recent tabulation of two data files—one from the City of Chicago Department of Buildings (which was updated since the UCETF Year 11 study was conducted), and a survey obtained from the local chapter of the Building Officials and Managers Association (BOMA)—reveal that at least 140 million square feet of commercial space exists in the Loop area. This square footage comprises over 551,139 tons of chiller capacity, primarily for space conditioning. The chillers, most of which use R-11 and R-12 refrigerants, average about 14 years of age.

This compiled information shows approximately 312 buildings each with installed capacities equal to or greater than 400 tons totaling 523,454 tons and comprising approximately 145,000,000 ft² of commercial space (see Table 3.1 below).

TABLE 3.1 Loop Chiller Characteristics

FACILITIES > 400 TONS			
<u>NO. BUILDINGS</u>	<u>SQUARE FOOTAGE</u>	<u>TONNAGE</u>	<u>REFRIGERANT</u>
312	145,000,000	523,454	R-11, R-12, various others
ALL FACILITIES			
<u>NO. BUILDINGS</u>	<u>SQUARE FOOTAGE*</u>	<u>TONNAGE</u>	<u>REFRIGERANT</u>
582	—	551,139	various

*The majority of buildings with less than 400 tons capacity are derived from the data file where square footage was not indicated.

Source: Department of Environment, Energy Management Division

Marketing Potential for Downtown District Cooling

*“Directly
after the
flood,
there was
considerable
public
discourse on
the tunnel
system’s
potential as
a public
asset.”*

These two data sources were carefully scrutinized in order to merge and confirm information on Loop chiller capacity by age and address. We obtained the Department of Building’s data from the Mechanical Equipment Inspection Refrigeration Bureau’s permit records while the BOMA data emanated from a survey of its membership. In each case, staff requested and promptly received the data in ASCII text file on a 3.5 inch floppy disk. Hence, we were able to adequately introduce each data set into our Quattro Pro spreadsheet program for conversion into the desired format.

The City’s Department of Buildings (DOB) data set displayed information for each building by:

- address,
- tonnage of permitted units,
- number of installed units
- type of installed unit (i.e., AC—air conditioner or RF—refrigerator)
- type of refrigerant and
- permit date. The permit date was used as a proxy for chiller age.

Upon close examination, the capacity data did not appear to reflect Loop chiller conditions. While the veracity of chiller age data was established through comparison with other data sets, the records of large buildings indicated installed or permitted capacities below acceptable rules-of-thumb for space conditioning.

In cross-referencing the DOB data set with the BOMA data, we were able to determine that the DOB tonnage data was, in fact, deficient in air conditioning capacities but very accurate with respect to chiller age. The BOMA data set contained information by: building name, building square footage, building address, number and tonnage of chillers, age of chillers, and type of refrigerants. Assuming that approximately 300 tons of cooling is minimally required to serve approximately 100,000 ft² of commercial space, the BOMA chiller data (assuming a 20% average redundancy factor) corresponded to the square footage in over 90% of the cases. Using that rule-of-thumb, we estimated tonnage (where none was indicated) based on the square footage provided in the BOMA data set. We also consulted a listing compiled by the City’s Department of Planning and Development. This listing inventoried Loop building construction by address and square footage between 1897–1990. In an insignificant number of instances, we were able to add information on chiller age to our merged data base.

3.2 MARKETING DHC

Marketing is the process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services... (American Marketing Association). Most informed sources within the DHC industry agree that development of a privately owned and operated district energy system in large urban or suburban areas system will more likely occur with substantial support from the local government.

A downtown “marketing” strategy, promoting the evaluation of district energy as a regional long term hedge against halogenated refrigerants will convert the chiller data into information that depicts, by geographical construct, the probability of

chiller replacement/retrofit. To be of real use, the data will have to be supplemented by field visits for verification of installations. It would then provide a broad brush representation of conditions at a point in time. It can then be utilized to model potential thermal districts. This approach has value in particular for our Planned Development (PD) application procedure. While nothing intrinsic to district energy requires that it be handled as a PD, it is likely that most downtown district energy start-ups or expansions will be treated in the PD arena.

This exercise (compiling best available data on Loop chiller characteristics) was a first step towards understanding the potential for district energy expansion into the Loop. This data, along with other information, will enable the City to better gauge the astuteness of district energy proposals, and intelligently promote DHC to other public and private sector groups. Additionally, it will assist us in determining a building owner's long term strategy for refrigerant handling. Beyond self education, the City could share this data in a non-proprietary format to potential district operators, and/or to building owners/operators. The data could be aggregated so as not to reveal individual loads, number of units, type of chillers, etc. A "Cooling Activity Zone" (CAZ) File format could be established that aggregates chiller-related data by geography of no less than 15-25 buildings. This information could be made available through normal "Freedom Of Information" requests (see Example 3.1 below).

Many other factors come into play regarding the City's role as marketing agent for DHC. On its own, DHC invites many difficult and interrelated issues needing solution such as: ownership, operation, financing and regulation. Thus, in order for large scale, private sector district energy to be successful, utility regulators, government, building owners and customers must all be convinced that the technology can perform as construed.

As it now stands, potential district energy providers are approaching building owners/operators in a limited fashion to gauge their interest in connecting to a proposed system. We anticipate this activity accelerating due to the competition of the two known district energy providers in Chicago and the ensuing phase-out of large commercial air conditioning equipment refrigerants.

3.2.1 Freight Tunnel System

The UCETF Year 11 project identified the ancient but largely intact City's Freight Tunnel System (completed around the turn of the twentieth century), as a catalyst for DHC development in the Loop because of its adjacency to standing large commercial buildings that could defray expensive trenching costs for buried pipe. Subsequent to completion of the Year 11 project, staff determined that a DHC provider could gain access to the tunnel. There were no exclusive rights for utilization of the tunnel system as long as the conduit placement could be engineered so as to not disturb existing users.

In March 1992, the Tunnel System was accidentally flooded with hundreds of millions of gallons of Chicago River water. This catastrophe caused severe water damage to many of the downtown businesses connected to the tunnel system, in addition to the companies (primarily CECO, cable television and fiber optic companies) using the tunnel for distribution purposes. The City, in partnership with expert private sector engineering firms, eventually abated the breach after much damage was done. The installation of permanent bulkheads under the Chicago River crossings was one result of this unfortunate disaster (see Freight

EXAMPLE 3.1: Cooling Activity Zone (CAZ)

Example CAZ #102			
# UNITS	CAPACITY (TONS)	AGE	REFRIGERANT
	1,386		
3	2,600.0	R12	
1	30.0		
3	3,050.0	19	R11
2	800.0	18	FREON 12
50	458.2	R22	
NA	1,173.2		
NA	1,800.0		
NA	732.2		
3	1,800.0	1	Water & lithium bromide
NA	2,183.8	8	
2	1,700.0	9	R12
2	3,030.9	8	R12
3	1,650.0	23	R11 AND R12
3	2,930.3	8	R12 AND R11
NA	361.5		
TOTAL	24,299.984	11.7	N/A

Tunnel Map below). These bulkheads will prevent any future water migration into buildings connected to the tunnels. The flood also heightened the City's consideration for utility diversification. Directly after the flood, there was considerable public discourse on the tunnel system's potential as a public asset. Even prior to the flood, a Tunnel Committee (consisting of representatives from the departments of Transportation, Law and Revenue) was convened to optimize the system's revenue producing capabilities.

In December, 1992, DOE energy staff set up a meeting between the Committee and the Trigen/Peoples District Energy Company to discuss the potential for tunnel utilization as a DHC conduit. Trigen/Peoples indicated it could begin serving customers as early as Summer, 1995 and that the Tunnel System would provide optimal access to buildings in the Loop. Trigen also indicated it would like the City to establish: 1) a policy to allow tunnel access to all potential users, 2) a central city authority to coordinate all aspects of tunnel use, 3) a specific tunnel maintenance policy and 4) a compensatory rate structure that considers but is not limited to the alternatives of: a) percentage of gross receipts, b) annual fee and c) dollars per foot of tunnel.

FREIGHT TUNNEL MAP

Freight Tunnel System

Because of the space required by current tunnel users, i.e., the cable company operators, CECO, and fiber optic companies, and because of the recently installed permanent bulkhead structures, entry into the tunnel with large thermal energy pipes will be more constricted than previously anticipated. Subsequent discussions with both Northwind and Trigen indicate the companies are aware of these constraints, and as a result, must keep their options open for accessing the downtown buildings.

3.2.2 Northwind System Location

The initial Northwind Plant will serve some large commercial customers in the Loop area bounded by Adams, LaSalle, Madison and Wabash streets (see Northwind Distribution Map). The competitive implications of Northwind acquiring land, franchises and ultimately contracts for district cooling is intriguing in that Trigen/Peoples and, for that matter, any other prospective district energy company will have to adjust their marketing efforts to accommodate the quick inauguration of the Northwind system. Large downtown commercial customers will presumably benefit from the introduction of Northwind in competition with Trigen/Peoples for Loop air conditioning because the company that offers the best service in terms of reliability, energy costs and ability to meet peak demands will expand the most.

As of this writing, the customers and tonnages to be served by Northwind were treated as proprietary information. The chiller data base we manipulated picks up approximately only 8,000 tons of available chiller capacity (roughly 37% of total Northwind System peak capacity) along the illustrated routes on the Northwind Distribution Map. Again, this data reflects the information we accessed, not actual extant chiller loads. This very likely suggests significant gaps in the data base. For example, the three Federal buildings to be served by Northwind are not on the Department of Buildings data base (Federal facilities commonly exercise an assumed exemption from local building codes), nor are they included in the BOMA data base.

3.3 LIKELY EXPANSION ROUTES

Staff plotted the manipulated chiller data onto Grid maps, using the "Mapinfo" software package (see Chiller Load Maps #1 and #2 below). These maps indicate that the majority of the large loads are clustered in a 63 square block area bounded by S. Wacker Drive, Michigan Avenue, Van Buren Street and N. Wacker Drive.

As previously mentioned, Northwind plans to expand throughout the Loop area, and Trigen is interested in expanding into the Loop. From both an economical and engineering perspective, major marketing efforts will occur in this area.

NORTHWIND MAP

CHILLER LOAD MAP #1

CHILLER LOAD MAP #2

INTRODUCTION

The City of Chicago developed a policy for formally appraising district heating and cooling proposals submitted for confirmation. Based on expressions of interest by outside energy services companies, it became increasingly clear to City of Chicago policy makers that the City should contemplate district energy proposals in a standard fashion. This chapter will briefly review several “expressions of interest” for Loop district energy development and how they influenced the City’s decision to develop a cogent policy for considering district energy permit applications.

4.1 THE REACTION TO MCCORMICK PLACE DISTRICT ENERGY

The genesis of the Northwind project, discussed in Chapter 2, was but one response to the McCormick Place district energy preference. Other DHC considerations were proffered to the City. An Illinois-based cogeneration developer approached the Chicago Department of Transportation (C-DOT) to discern permitting procedures for locating DHC appurtenances in the Loop’s public right-of-way. After being apprised of C-DOT’S infrastructural permitting procedures, the developer contacted Department of Environment Energy Staff to acquire additional information on DHC development. We provided a (non proprietary) summary of Loop chiller information, in addition to outlining the City’s permitting process beyond C-DOT requirements, and attempted to discern his technology approach. The developer cursorily explained his approach as possibly being Freight Tunnel-dependent for steam pipes to provide both heating and cooling to end users. As it turned out, the consideration was dropped after the developer’s potential out-of-state partner changed ownership.

Another proposal for downtown district energy was directed to the Department of Environment from an official in the Mayor’s Office. The proposers, a real estate developer and an engineering firm, both from the Chicago area, envisioned conventional district cooling, i.e., siting a plant somewhere adjacent to the Loop and distributing chilled water to buildings via 36" pipes, and possibly some heating as a market opportunity. They made a formal presentation to the Department of Environment’s energy staff and senior managers, expressing an interest in the City granting them a public right-of-way franchise to market district energy. They suggested that the City, as a potential customer, strongly consider a “joint venture” with them. We informed them that their interest in DHC would be considered in earnest and assured them (as we have others) of any possible assistance in seeking solutions to system development. Staff had no further dialogue with this group which led us to believe that they dropped the DHC consideration. Both aforementioned proposers indicted they had informal

The Chicago District Energy Policy

“We made a solid argument that use of proper technology would support the Federal government’s goals to reduce air pollution while conserving energy resources.”

discussions with one or more potential Loop customers who in turn showed interest in further exploration of the feasibility.

4.2 THE CITY’S RESPONSE: A DISTRICT ENERGY POLICY

An accurate chronology of the City’s decision to develop a formal policy for dealing with district energy proposals must acknowledge Chicago’s Year 11 UCETF project as a point of inauguration. The findings of that project formed the basis for the City’s aggressive promotion of cogeneration and district energy for the Near South Loop area. We made a solid argument that use of proper technology would support the Federal government’s goals to reduce air pollution while conserving energy resources. We suggested that any cogeneration and DHC technology be examined in terms of its technical, economic, legal/regulatory and environmental impacts on the City of Chicago, its citizens and potential customers. We opined that these factors could not be considered independent of one another and further, that development of a large private-for-profit alternative energy enterprise would occur only with significant City involvement. We realized that development of a district energy system would require an extended involvement of private system designers, and City personnel who render permits and enforce public safety issues.

Under a directive from the Mayor’s Office, in Fall 1993, the Department of Environment convened a policy working group consisting of the following departments/agencies:

- Department of Buildings—regulates the Chicago Building Code through issuance of permits for new construction, renovation, etc., of all edifices in the city of Chicago,
- Office of Budget and Management—prepares and manages the annual City budget, under the direction of the Mayor,
- Department of Revenue—collects tax revenues, license fees, permit fees and other types of funds on behalf of the City,
- Department of Law—protects the rights and interests through litigatory defense, and issues opinions on matters affecting City business,
- Department of Planning and Development—supervises and coordinates the formulation and execution of projects and programs affecting Chicago’s existing and future physical environment,
- Department of Transportation—controls the design and construction of all public works projects; particularly local transportation projects constructed in Chicago; and manages activities conducted in the public way,
- Department of General Services—operates and maintains all city-owned buildings and facilities with minor exceptions and
- Department of Environment—enforces the City’s environmental regulations, oversees the municipal franchise with the electric utility, promotes and develops environmentally conscious programs for natural resources and implements a city energy policy.

4.2.1 District Energy Criteria

By December, 1993 this group drafted district energy policy criteria for consideration. These criteria were based on the recognition that the City had broader interests to accommodate than any single district energy vendor, and therefore was obligated to resolve certain issues during development of the district energy policy. Following is a brief summary of the cogent criteria that contributed to the development of the Policy.

1. Consistent application of a district energy policy will be achieved through central coordination of the City's review process.
2. Siting, construction and operation of district energy systems (including generation and distribution facilities) must comply with all applicable land use, zoning design building code, public safety and environmental standards, except where variances consistent with the proposed policy have been approved.
3. To the extent practicable, all uses of the public way by district energy systems shall be arranged so as to minimize interference with use by other authorized current and future occupants of the public way.
4. Compensation to the City from district energy providers shall be structured to be both technology and revenue neutral.
5. City departments operating and/or maintaining municipally-owned facilities shall be encouraged to evaluate the potential for utility cost savings through connection to DHC systems.

On February 3, 1995 a District Energy Policy was promulgated by the City. Appendix 1 contains the approved Policy and attendant Rules and Regulations.

INTRODUCTION

The chapter summarizes the lessons learned from this project and suggests how they can be transferred to other jurisdictions for application in their bid to proactively support and assist district energy development. The major successes of this project dealt with: 1) staff intermediating between the McCormick Place Exposition Authority and the Trigen/Peoples group to create one of the largest district heating and cooling systems in the country that spurred competitive development of the Northwind system (district cooling in the downtown) and 2) staff initiating the development of a downtown chiller data base that complements generation of an official City of Chicago District Energy Policy. The major problems associated with the project converged with the successes, that is, a lack of a comprehensive data set of Loop chiller conditions prevented us from further analyzing total Loop and adjacent chiller characteristics. However, the success of the award by MPEA of a contract to Trigen in spurring a competitive market for district cooling services has obviated the need for the City to proactively promote the optimal development of a single system. Rather, the economics of district cooling have proven to be so attractive that the City's role has been transformed into monitoring and guiding the competitive market, to ensure that the competitors have full and equal access to optimizing the number of customers who connect to their more efficient and environmentally benign cooling services.

5.1 FINDINGS

1. Data Needs

The City needs to improve its understanding of chiller characteristics. The chiller information developed from the BOMA and City Department of Buildings data sets was helpful in establishing Loop chiller conditions with respect to age, location and capacity of air conditioning. The BOMA data set provided very useful information on installed tonnage and age of units by address. On the other hand, the City's chiller data, organized from a Refrigeration Bureau permit file did not contain accurate tonnage data but the permit dates (used as a proxy for age) did correspond with the BOMA age data. The Department of Buildings inspects installation of chiller equipment and therefore maintains a file of the requisite information. Ordinarily, chiller age is not significant to that department's functions. It behooves the City, which has a rather comprehensive building data set, but not with reference to chiller information such as installed capacity, refrigerants and age, etc, to improve its chiller data base. The Department of Buildings only inspects installation of chiller equipment and therefore is not obligated to maintain chiller characteristics necessary for district energy analytical purposes.

Beyond the need to monitor or anticipate district energy applications, the envisioned CFC change outs (due to the gradual phase-out of ozone depletion refrigerants) will

Lessons Learned and Suggestions for Application

require the City to approve a considerable number of chiller renovation/installation permits over the next 5–10 years. In the near future, the Department of Buildings will revise its refrigerant code to allow use of alternatives such as HCFC-123 and HFC-134-A. Currently, an applicant has to get a variance from the Department to use these alternative refrigerants not currently recognized in the Code. An improved chiller data base will assist the Department of Buildings in processing information at an accelerated rate. The data can be obtained from building owners, managers and/or operators, and possibly manufacturers, through a mail-out survey process and through information obtained from chiller manufacturers and BOMA. The Department of Environment can assist Buildings in developing a survey.

2. DHC Marketing Considerations

The MPEA accepted the district energy option primarily because it deferred substantial capital costs. The expansion of the exhibition campus (McCormick Place 3) was limited by the revenue bond amounts authorized by the Illinois General Assembly. In order to adequately heat and cool the exhibition complex, substantial capital would have had to be expended for new plants. The marketing strategies employed by both the City (as promoter of DHC) and the Trigen/Peoples group in process of the McCormick Place district energy development were effective yet conventional. That is, ample rationale for considering district energy in the areas of environmental protection (elimination/reduction of CFCs, reduced NO_x emissions, less volatile organic compounds), lower energy costs and job development/business expansion were offered. However, the inducement of capital deferment through connection to a highly efficient energy resources delivery system proved more attractive to the MPEA.

While the MPEA did not dispute the importance of the environmental, lower energy cost and indirect economic development benefits, its primary incentive was to construct a new facility on time and within budget. Lower energy costs are not a primary concern for the MPEA since attributable heating/cooling and power costs are passed on to the vendors (exhibitors) in their respective rents.

Northwind similarly proposed many of the same advantages to potential downtown customers.

From a purely business standpoint, it behooves district energy providers (and their regulators) to look beyond the boundaries of energy, and power generation and distribution for marketing techniques. It is likely, in the intermediate future as customers' options increase among technologies and companies, that the traditional alternative energy marketing techniques (i.e., lower energy and operation and maintenance costs, reliability, etc) will prove insufficient to expand business opportunities. Therefore, as competition and options grow, opportunistic service providers will have to continually offer prospective customers new perspectives with which to view their products. It is reasonable then that DHC companies should study the sales and marketing techniques of totally unrelated growth industries. It is assumed that quality of service is the most critical element in maintaining and expanding a customer base.

3. Competition's Progression

Edison's decision to form a subsidiary to compete directly in the alternative cooling energy market was a clever marketing idea. Staff projected that Edison would lose about 20% of the electricity it sells to the MPEA due to the district energy decision; hardly a threat to the company's revenue base, or for that matter, to the city's

coffers (via the franchise fee and municipal utility taxes collected from the utility). At the same time, this all-electric district cooling solution, employing ice thermal storage—a technology which Edison has encouraged for individual buildings in the Least Cost Resource Planning context, and now embodied in their corporate stratagem Northwind/Unicom Thermal—serves to levelize the excess (off-peak) base load capacity in the Edison system.

Energy staff correctly assumed that a major new district energy system would introduce competition into the local energy industry. A potential bonus to customers occurred when CECO quickly decided to get into the business.

5.2 SUGGESTIONS FOR FUTURE APPLICATIONS

This project has huge transferability potential to other jurisdictions arbitrating district energy projects with private sector entities. Most, if not all projects of this type will require local government intervention particularly if there is a need to traverse public right of way, obtain building permits and other authorizations to operate. Also, governmental buildings are potentially attractive customers because they traditionally do not cease operation due to downturns in business cycles. We are confident that the recently passed Clean Air Act as it relates to the impending cessation of chloroflourocarbon manufacturing will encourage other private and public partnerships to explore the feasibility of district cooling.

It behooves any entity either public (as regulator or potential customer) or private (as energy provider) to initiate business planning at the earliest possible time. An economic feasibility analysis is the first step in influencing a decision to select the district energy option. This is because a district energy project as part of an overall development (presumably large commercial) will require a series of “give and take” sessions between the energy system designers and project development architect and engineer. The economic analysis will be factored by engineering or design solutions since district energy system development, from either the perspective of plant design or distribution system requirements, will not conform to “off the shelf” engineering solutions.

The City’s aggressive promotion of district energy and the concomitant results overwhelmingly suggest that any jurisdiction desiring to participate in such a project should learn everything it can about the state-of-the-art DHC technology, convince itself of DHC’s realistic merits and proceed to “market” development. In early discussions leading to the McCormick Place project, the City successfully convinced the MPEA that while it was possible the service proposers would only secure the MPEA’s facilities as customers, we were confident that a huge potential variable cooling and heating load was waiting to be captured for several reasons. We were able to conservatively quantify potential nearby cooling load and chiller age while simultaneously discussing recent or impending affective legislative transformations. The McCormick Place decision, thus, was relegated to a purely business calculus as we successfully assisted in leveling the reliability and expandability issues pertaining to this proposed plant. We strongly suggest that other jurisdictions similarly consider an assertive yet patient approach in supporting district energy development in their areas.

This Year 13 project, with particular reference to the McCormick Place DES, can specifically serve as a model for a large commercial (or industrial) development with potential capitalization constraints.

“We strongly suggest that other jurisdictions similarly consider an assertive yet patient approach in supporting district energy development in their areas.”

5.3 CONCLUSION

Over 35,000 tons of Loop and near-Loop district chilling capacity will be available for sale in the latter 1990's with more undoubtedly to be developed in the Twenty-first Century. The local utilities, Peoples Gas Light and Coke Company and Commonwealth Edison Company, the City of Chicago (particularly the Mayor and the Commissioner of Environment) among others, deserve much of the credit for this development. The City successfully carried out its research objectives with additional benefit accruing through development of a formal Chicago District Energy Policy. In the process, many individuals both within and without government were genuinely educated in vagaries of district energy.

Perhaps the greatest challenge facing the City is resourceful administration of the District Energy Policy. Just as modern DHC is new to the Chicago area, the associated permitting, remuneration and policy issues are novel affairs to the City of Chicago regulators. As it is implemented, the District Energy Policy will be fine-tuned to either capture factors previously unaccounted for, or to substitute elements non-essential to the policy execution. Also, energy staff will continue to upgrade the chiller data base which will assist the policy group in discerning proposed distribution routes and loads.

SUSTAINABLE COMMUNITIES

AUSTIN, TX - Sustainable Systems Rating Program

The city of Austin, long a pioneer in sustainable research planning and practice, developed a sustainability rating system that can be used as a marketing tool to encourage high levels of resource conservation, appropriate usage, and economic development through residential building.

91-302. \$15.00

PTI - How to Save Thousands - Even Millions of Dollars Through Energy Efficiency (Video)

Looking for ways to save energy and money? This Urban Consortium Energy Task Force Video shows several cost-conscious and earth-minded methods to do so. Examples include how Phoenix saved \$32 million through retrofitting and how New York City built a natural-gas-powered fleet to comply with the Clean Air Act.

92-402 FREE!

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SEATTLE, WA - Coordination of Energy and Air Quality

Learn how Seattle City Light (SCL) worked with industry to reduce air pollution emissions with positive economic effect. The study conducted during 1991 and 1992 resulted in a working relationship between two agencies (Seattle City Light and the Puget Sound Air Pollution Control Agency) with the same objective - to improve air quality and reduce energy consumption. Read about some of the difficulties encountered and lessons learned by SCL in accomplishing energy conservation among residential and commercial customers.

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MONTGOMERY COUNTY, MD - Energy Efficient Building design: A Transfer Guide for Local Governments

A proven "how to" guide for local governments and the private sector on the implementation of energy efficient construction programs.

91-317. \$7.50

SAN FRANCISCO, CA - Energy Management Action Plan

The City/County of San Francisco has developed a methodology for local government energy

ABOUT THESE PUBLICATIONS

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UCETF membership includes elected officials, management, and technical professionals from urban cities and counties. It links through the Urban Consortium and PTI to national organizations, such as the National Association of State Energy Officials (NASEO), the National League of Cities, the National Association of Counties, and the International City/County Management Association to ensure the widespread exchange of information and technology.

For more information about the Urban Consortium Energy Task Force (UCETF) or these guidebooks, contact Jack Werner, PTI Business Director, at 202/626-2421.

offices to use in designing Energy Management Action Plans (EMAP). The guide walks readers through the process of creating an EMAP: identifying barriers; researching a setting for the project; and generating ideas to remove specific barriers. Help create more effective facilities in your jurisdiction via a holistic methodology.

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Copies of the report are available from CONEG at (202)624-8450 for \$50 for the two volume set, \$20 for Volume I and \$40 for Volume II.

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- **Enable Practical Energy Management**
- **Reduce Pollution**
- **Save Money**

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Department of Environment
Henry L. Henderson, Commissioner
30 North LaSalle Street
25th Floor
Chicago, IL 60610**

Order No: DG/92-323

City of Chicago
Richard M. Daley, Mayor

Department of Environment

Henry L. Henderson
Commissioner

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CITY DEPARTMENTS' DISTRICT ENERGY POLICY AND RULES AND REGULATIONS

Preamble

The City Departments' District Energy Policy and accompanying Rules and Regulations, having been reviewed by the public pursuant to Chapter 2-30-030(12) of the Municipal Code of the City of Chicago, are being implemented as an interdepartmental joint agreement. This interdepartmental joint agreement establishes a consistent process by which applications for construction, installation, operation and maintenance of district energy systems will be reviewed, approved, and permitted by the City departments with appropriate responsibility.

Permitting authority for such systems shall remain with the current Departments as so designated. District energy systems shall comply with all applicable City permit requirements as set forth in the Municipal Code and with provisions of individual use agreements (franchises) granted by the City and approved by City Council.

All agreements for use of the public way and compensation, therefore, shall be subject to the approval of the City Council and subject to the approval of the Corporation Council as to form and legality.

Henry L. Henderson
Commissioner
Department of Environment

February 3, 1995
Date

CITY DEPARTMENTS' DISTRICT ENERGY POLICY

POLICY OBJECTIVES

It shall be the policy of the City of Chicago to encourage the development of cost-effective energy options in Chicago, including "district energy systems." In district energy systems (also called "District Heating and Cooling"), multiple buildings in an area (district) are provided with thermal energy (e.g., steam or hot or chilled water) from a central plant.

City actions regarding district energy systems shall advance the following goals:

- 1) enhance the City's economy and development by facilitating efficient energy use;
- 2) foster a competitive market for energy services;
- 3) achieve equitable treatment of competing energy service providers; and
- 4) meet or exceed environmental regulation requirements.

REGULATORY COMPLIANCE

Siting, construction, and/or operation of district energy facilities must comply with all applicable regulatory requirements. Variances from existing requirements may be granted, as allowed by Municipal Code. All variances must be in conformity with this Policy. Regulatory requirements may concern, but are not limited to, land use, building design, building construction, environmental and safety impacts, public infrastructure impacts (including public ways and public property), and revenue.

District energy systems shall comply with all applicable City permit requirements. Permitting authority for such systems shall remain with the current Departments.

IMPLEMENTATION OF THE POLICY

To ensure consistent application of this Policy, the Department of Environment ("DOE") shall coordinate the City's oversight of district energy systems. Applications for siting, construction, and/or operation of district energy systems shall be initiated with the Department of Environment. The Department of Environment shall assist

applicants and potential applicants seeking approval for installation, construction, and/or operation by determining the departmental approvals necessary for proposed systems.

The Department of Environment shall notify all appropriate departments of the initiation of each application. DOE also shall monitor the processing of each application.

Before an applicant begins construction, installation, and/or operation of a system or systems serving multiple buildings, the applicant shall obtain from DOE certification that its application:

- 1) has been reviewed by all appropriate departments, including the Departments of Planning and Development, Zoning, Buildings, Transportation, Revenue, Environment and the Board of the Underground; and
- 2) has received all necessary permits and approvals.

These permits and approvals may include, but are not limited to:

- 1) building permits, from the Department of Buildings;
- 2) permits for new boilers and/or chillers, from the Departments of Buildings and Environment;
- 3) a Special Use permit from the Zoning Board of Appeals or approval as a Planned Development for a stand-alone structure located in the central area, from the Plan Commission and City Council; and
- 4) use and compensation agreements for proposed occupancies of the public ways and/or public property, such as street cuts, tunneling under city streets, or use of freight or trolley tunnels.

Applications for installation, construction, and/or operation of district energy systems must describe in detail:

- 1) the scope of the planned system(s);
- 2) the service plan for the system, including whether the system will serve multiple buildings from an existing building; and

- 3) the distribution plan for the system, including a complete description of any required use of the public ways and/or public property.

For an approved system, routing plans for expansion of distribution facilities beyond those permitted for that system shall be subject to review and approval by the Department of Transportation, using, as appropriate, the same criteria applied to the applicant's approved distribution plan.

USE OF THE PUBLIC WAYS OR PROPERTY

Distribution facilities for district energy systems within the public ways or on public property shall be designed and constructed so as to:

- 1) avoid interference with existing authorized uses of the public ways and public property; and
- 2) minimize potential interference with future authorized uses of the public ways and/or public property, to the extent feasible (to be determined by the City).

These principles shall be implemented so as to maintain, to the extent feasible, equitable opportunities for access to public ways and public property by competing energy service providers. "First-in-field" district energy system providers shall not be granted preemptive rights to obstruct or prevent access to the public ways or public property by potential competitors.

Costs incurred to keep public ways and/or public property reasonably available for concurrent and future uses by other authorized occupants shall be borne by applicants. The City's right to govern future use of the public ways and public property shall not be limited by this Policy.

COMPENSATION PROVISIONS

To the extent feasible, compensation mechanisms used by the City as they relate to district energy systems' use of public ways and/or public property, shall be technology-neutral. The Department of Revenue shall devise a specific compensation mechanism for each district energy system provider, in cooperation with each such provider, depending on the provider's particular production characteristics and needs for access to public ways and/or public property. Such mechanisms shall provide reasonable compensation to the City and shall encourage efficient use of energy and cost-savings resulting from introduction of such systems into Chicago energy markets.

CITY BUILDINGS AS CUSTOMERS FOR DISTRICT ENERGY SYSTEMS

City departments that operate or maintain City-owned facilities shall cooperate with the Department of Environment to evaluate the potential for energy cost savings which may be achieved by taking service from district energy systems. Any proposed procurement of energy service from such systems shall be conducted by competitive bidding, in order to allow district energy system providers, conventional utilities, and other energy service suppliers to propose alternatives for consideration by the City.

Commissioner
Department of Environment

Director
Department of Revenue

Commissioner
Department of Transportation

Corporation Counsel

Commissioner
Department of Buildings

Director
Office of Budget & Management

Commissioner
Department of General Services

Commissioner
Department of Planning & Development

Date November 1, 1994

FEBRUARY 3, 1995

RULES and REGULATIONS for DISTRICT ENERGY SYSTEMS

Introduction

As a matter of policy, the City of Chicago encourages the development of cost-effective energy options in Chicago, including district energy systems. In district energy systems, one or more other buildings are provided thermal energy (e.g., steam, hot water, or chilled water) through pipes from a central plant.

Development of district energy systems involves complex engineering, regulatory, environmental and economic issues. Any applications of this technology must comply with all relevant regulatory requirements of the Municipal Code. In general, these requirements address land use, building design, building construction, environmental and safety impacts, access to the public way or publicly-owned or regulated structures below ground (e.g., freight or trolley tunnels), and public revenue.

District energy systems must be planned and constructed in a manner consistent with the goals of the City's Policy for District Energy Systems and applicable requirements of the Building Code and City Public Way access procedures. The following procedures have been instituted pursuant to Chapter 2-30-030(2 & 12) of the Municipal Code of the City of Chicago to define and to assure consistency in the City's review process for district energy systems.

Definitions

In these rules and regulations, the following definitions shall apply:

Business Plan -- the plan describing proposed business operations submitted to the Department of Environment to support the application for a specified plant or distribution facilities. The Business Plan must show the applicant's long range development/expansion plan, identify locations where initial service will be provided from the specified plant, and include letters of intent, showing the expected load each building will use. The City will review letters of intent at the applicant's offices if required to respect their confidentiality.

Distribution Facilities -- that portion of the district energy system used to deliver or to return steam, hot water, chilled water, or other thermal energy media to or from customers' buildings.

District Energy System -- a system, consisting of plant and distribution facilities, designed to provide thermal energy (e.g., via steam, hot water, or chilled water) through pipes to one or more other buildings from a central plant.

Plant -- the production and thermal storage equipment of the district energy system and the

structure(s) housing it.

Project—a project may consist of construction of: 1) a plant, which may include production and storage facilities, and the initial distribution facilities associated with that plant; 2) additional distribution facilities associated with a previously approved plant; 3) new facilities or an expansion of facilities installed in an existing building which will provide district energy to other buildings through adjacent buildings or building walls and does not use the public way; or 4) new facilities or an expansion of facilities installed in an existing building which will provide district energy to other buildings partly through adjacent buildings or building walls and uses the public way. Projects described in 1, 2, and 4 above shall require prior approval by City Council.

Application Review

1) All applications for siting, construction, expansion, or operation of a district energy system shall be initiated with the Department of Environment (DOE). Applications to be initiated with DOE cover projects one through four described in the definition of project above.

An applicant must notify the alderman of the ward in which a self-standing district energy facility will be constructed. The applicant must provide proof of this notification to DOE with the initial application. Proof of notification may be a postal or courier receipt.

2) The Department of Environment has been designated to coordinate the City's preliminary review of district energy system applications. The Department of Environment will also monitor the progress of applications through each later stage of review; DOE personnel will be available to help the applicant with inquiries at any stage of the review process. DOE will circulate an interdepartmental **Review and Sign Off** form to record the action of the various departments/bureaus on requests for approval of system development and operation.

3) At the earliest stage possible, an applicant shall initiate the district energy system application review process by providing to DOE preliminary plans for construction and installation of a district energy system (both plant and distribution routing). If a provider of district energy services applies for approval as a Planned Development, for a Special Use Permit, for a Building Permit, or for a permit for Access to or work in the Public Way before completing the preliminary review coordinated by the Department of Environment, the City department receiving the application shall refer the applicant to DOE.

The District Energy Working Group will conduct the preliminary review. This Working Group may include the Departments of Environment, Transportation (CDOT), Buildings (DOB), Law (DOL), Planning & Development (DPD), Revenue (DOR), Budget (OBM), General Services (DGS), and Water (DOW).

For prompt completion of the preliminary review, applicants must submit the following

materials and information¹ to DOE in a timely manner:

- I. Construction Plans - Plans must be drawn to scale, bear the stamp of a professional engineer or architect licensed by the State of Illinois, and show the following detail:
 - A. Site (a,c,d)
 - B. Landscape (a)
 - C. Floor (a)
 - D. Distribution network
 1. type, size of conduits and pipes;
 2. right-of-way² access required;
 3. routing map (a,b,c,d)
- II. Construction(Demolition) Methods and Schedules
 - A. For plant and/or distribution system; (a,b,c,d)
 - B. Public Way restoration, relating to installation of the distribution system. (a,b,d)
- III. Plant Production and Distribution Capacity Assessment (a,b,c,d)
 - A. Peak system capacity at total build-out (expressed in MMBtu/hr. for heating, and tons for cooling (a,c,d)
 - B. Number of buildings to be served; (a,b,c,d)
 - C. A full description of the energy delivery media to be used, e.g, steam (expressed in °F, psig and lbs. per hour), hot water (expressed in psig, °F and gallons per minute (gpm), or chilled water(expressed in °F, gpm, and psig at discharge and suction side of circulation pumps) (a,b,c,d)
 - D. Business Plan supported by letters of intent (may be made available for confidential review at the applicant's offices);(a,b,c,d)
 - E. M/WBE contracting plans (when required by public way use agreement); (a,b,c,d)
- IV. Environmental and Safety Issues
 - A. Mechanical Equipment (Applicant must provide sufficient information to address noise, air and water pollution concerns) (a,c,d)
 1. A review and analysis of exterior noise generated by equipment used in the proposed facility(a,c,d).
 2. Boilers (a,b,c,d)
 3. Chillers (a,b,c,d)
 4. Refrigerant (a,b,c,d)
 - B. Distribution
 1. Leak Detection System and Response Procedures (a,b,c,d);
 2. Material Safety Data Sheets for all chemicals to be used in the plant or in the energy delivery media(a,b,c,d);

¹ a = Plant and Associated Distribution; b = Distribution Only; c = Building Interconnects; d = Building Interconnects involving access to public way.

² For the purpose of the Policy for District Energy Systems, "Public Way(s)" means the surface, the air space above the surface, the area below the surface, and publicly-owned or regulated structures below ground of any rights-of-way or property over which the City has jurisdiction, including public utility easements.

3. Chemical composition of all media used (a,b,c,d).

4. Type of Corrosion Protection (a,b,c,d).

4) After the preliminary review, DOE will advise the applicant of the proper sequence for obtaining other approvals the applicant may need to begin any demolition or construction activity. DOE is not responsible for identifying each specific permit that the project may require.

5) Final certification by DOE that full review by all relevant departments has been completed shall be required before the applicant may begin actual construction on the project. DOE will give this certification when all permit application reviews are complete and conform with applicable City requirements.

Zoning

The project may need approval as a Planned Development or issuance of a Special Use permit as provided in the Zoning Code. If the Zoning Administrator determines that the district energy project needs to be processed as a Planned Development, the applicant must seek approval from the Plan Commission and the City Council. The applicant may obtain a Planned Development application from the Department of Planning and Development, Room 1003, City Hall. If the project requires a Special Use Permit, the applicant must seek approval from the Zoning Board of Appeals and the City Council. Special Use applications are available in Room 802, City Hall.

Distribution Design

1) Distribution facilities should be designed to minimize use and disruption of the Public Way. Construction plans for distribution facilities which require access to or use of the Public Way(s) should be designed as not to interfere with existing facilities using the Public Way(s) or prevent future access for such uses. To this end, an Information Retrieval request shall be made to the Board of the Underground (BOU) (Room 600, 320 N. Clark, 744-4828) and the results therefrom incorporated in the detail design drawings submitted to CDOT during the permit application process.

2) District Energy vendors, using the Public Way, are advised that the City reserves the right to exercise its police and/or proprietary powers and may modify, vacate or transfer what is now the Public Way for any lawful purpose.

3) Construction of distribution facilities within the Public Way(s) will be at the risk of the district energy vendor who must acknowledge and accept that the City has a predominant right to use of the Public Way and in the placement, maintenance and repair of sewers, water mains, telecommunications and other utility facilities.

Construction

1) When district energy services are provided through distribution facilities connected from an existing building to one or more additional buildings, appropriate building permits shall be required for all phases of the construction.

2) An applicant shall obtain all appropriate building permits from the Department of Buildings (DOB) in a timely manner throughout construction or expansion of district energy production and storage facilities, whether self-standing or providing new or expanded service from facilities installed in an existing building. Applicants are strongly urged to obtain a copy of the "Building Permits Guidebook" issued by the Department of Buildings. The Department of Buildings permit process covers:

- ◆ Initial Review
- ◆ Zoning
- ◆ Architectural
- ◆ Structural
- ◆ Plumbing
- ◆ Ventilation
- ◆ Environmental
- ◆ Refrigeration
- ◆ Fire Prevention
- ◆ Final Examination
- ◆ Permit Issuance

3) All **Electrical** work for heat, light or power requires a permit issued to a licensed contractor by the Department of Buildings, Electrical Bureau, (Room 803, City Hall 744-3464).

4) A tap into a city water main for supplying district energy facilities will require a **Water** Permit that can be obtained from the Department of Water (Room 103, City Hall, 744-7060).

5) Construction partially or wholly within a **Special Flood Hazard Area** requires a Flood Control permit. DOE issues Flood Control permits. Construction within 40 feet of a navigable waterway requires a Harbor permit. CDOT issues Harbor permits.

6) District energy facilities must comply with Illinois Environmental Protection Agency (IEPA) air emission standards. The IEPA determines whether it must also review plans for district energy facilities.

7) No construction within the Public Way will be allowed until all applicable permits required for any individual installation are obtained from CDOT.

8) Construction or expansion of any distribution facilities must be associated with a specific plant.

Public Way Access

1) If the applicant wishes to access or use some portion of the Public Way in the delivery of district energy services, the applicant must seek appropriate approvals and permits from CDOT. Additional approvals and permits are required for use of the Freight Tunnels or Trolley Tunnels. In any event, plans that an applicant submits must show precise locations of the proposed distribution system, detailing size and configurations of all pipes and conduits.

Applicants are strongly urged to obtain a copy of Standards and Specifications for Openings in the Public Way from CDOT.

2) Departmental approvals for any access to the Public Way for distribution facilities will be contingent on City Council approval. City Council approval may require a "use" agreement.

3) For facilities to be located beneath the surface of the public way, but not in Freight or Trolley Tunnels, prior review must be obtained from the BOU, which is under the jurisdiction of CDOT. The Board of Underground process begins with the applicant making an Information Retrieval request for utility location to the BOU and CDOT. The information provided must then be incorporated into the construction design, the design drawings, which along with relevant construction procedures will be submitted to the BOU for an Existing Facility Protection review. CDOT will not issue permits allowing construction until all conflicts with other BOU members are resolved.

4) The provisions of an executed Freight Tunnel Agreement governs use of the Freight and Trolley Tunnels. The Freight and Trolley Tunnel are under the jurisdiction of and permits for the use of tunnels are issued by CDOT. Confined Space Entry Plans must accompany any permit application.

5) The Chicago Utility Alert Network (CUAN) (Room 804, City Hall, 744-7000) must be notified no less than 48 hours (excluding weekends and holidays) prior to any excavation or opening in the Public Way for underground work, to allow all interested or affected utilities to be alerted.

Compensation

1) All permit fees assessed by CDOT for pavement openings in the public way, use of the Freight or Trolley Tunnels, Board of Underground and CUAN, must be paid in full prior to any construction involving the Public Way.

2) The Department of Revenue, in consultation with the Office of Budget and Management, shall determine the mechanism for compensation to the City for use of the Public Way. Compensation arrangements may be included in a negotiated Use Agreement (Franchise) or other format.