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District Heating/Cogeneration Application Studies for the Minneapolis–St. Paul Area

Institutional Issues of a New District Heating/Cogeneration System–Ownership Options, Barriers, and Implementation Strategy

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DISTRICT HEATING/COGENERATION APPLICATION STUDIES FOR THE MINNEAPOLIS-ST. PAUL AREA

INSTITUTIONAL ISSUES OF A NEW DISTRICT HEATING/COGENERATION SYSTEM — OWNERSHIP OPTIONS, BARRIERS, AND IMPLEMENTATION STRATEGY

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CONTENTS

ABSTRACT

Institutional issues were identified that might affect the ownership, operation, or growth of a district heating (DH) system in the Minneapolis-St. Paul metropolitan area. These issues included financing, taxation, regulation, pricing policy, allocation of costs and benefits between electrical generation and DH, capital investment recovery by building owners, hookup policy, and displacement effects on existing energy suppliers. For each issue several alternatives were identified and studied; next, various strategies (combinations of alternatives) were evaluated for their probable effect on development of the DH system. Additional economic analysis will be required to identify the best strategy.

FOREWORD

This report is one of a series of application studies of district heating/cogeneration for a U.S. metropolitan area. In addition to the technical and economic issues affecting the feasibility of a large district heating/cogeneration system, institutional issues — such as financing, ownership/operation structure, regulation, and taxes — were recognized as important ingredients of overall system feasibility. The Minnesota Energy Agency, which was instrumental in planning and supporting the application studies in the Twin Cities, conducted this study as a part of its policy analysis activities related to cogeneration/district heating for Minnesota communities. The study methodology and results are recommended for consideration in other states and communities with the potential for initiating district heating/cogeneration systems.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the many individuals who contributed to this study. The following members of the Steering Committee actively participated in the study process: Conrad Aas, Northern States Power; Larry Anderson, Minnesota Public Service Commission Director; Steve Chapman, Clean Air Clean Water; Ed Glass, Northern States Power; Herb Jaehne, Northern States Power; Ted Kolderie, Citizens League; James Kolb, ORNL; Ken Linwick, Manager, Central Heating Company, Minneapolis; James O'Gara, and Warren Soderberg, University of Minnesota; Ron Visness, MEA; Warren Waleen, Minnegasco. Dr. James Carter also participated significantly in conducting surveys at local institutions. Finally the guidance of James Kolb and Michael Karnitz of ORNL in managing the study and the support of Garet Bornstein and Dr. Alan Rubin of DOE are acknowledged.

1. INTRODUCTION

Community district heating (DH), using hot water from electric/thermal cogeneration, is an integral part of Minnesota's energy policy and conservation plan. Several studies have evaluated the technical, environmental and institutional issues that affect the development of the use of cogenerated hot water DH in Minneapolis and St. Paul.

The engineering technology for cogenerated hot water DH is transferrable from Europe to the United States. However, answers to institutional issues of financing, ownership, operation, regulation, taxes, and other concerns cannot be transferred. These issues are the subject of this study.

Issues that affect development, ownership, and economic risk of a metropolitan cogeneration DH system in Minneapolis and St. Paul were identified and analyzed. This report presents the methodology, results, and conclusions of the ten-month Institutional Issues Study. An appendix to this report contains issue papers summarizing the analysis of each issue. These issue papers are a resource of research material that will allow the results of this study to be applied to other communities and situations.

This report has been prepared for the Oak Ridge National Laboratory (ORNL) of the Department of Energy (DOE) by the Alternative Energy Division of the Minnesota Energy Agency. The principal participants in this work have been the Minnesota Energy Agency (MEA), ORNL, the consulting firm of Touche Ross & Co., and a steering committee representing local business, government, and regulatory agencies.

2. ACTIONS TAKEN AS A RESULT OF THIS STUDY

The following recommendations have been made by the Minnesota Energy Agency:

1. Problems in the development of a Twin Cities metropolitan DH system should be approached by first concentrating on a project of smaller scale.
2. A not-for-profit development corporation should be formed to complete the economic and technical feasibility studies necessary to select an owner/operator and a development strategy.

It was recommended that a demonstration project be designed to heat a significant portion of the central business district of either Minneapolis or St. Paul and that use be made of the cogeneration thermal capacity of existing plants. The perceived risk of such a project is less because the project does not depend on adding new generating units that require a certificate of need and other permits. St. Paul was recommended as the site for this project because the High Bridge Power Plant is near the central business district and the existing steam system needs replacing.

On July 1, 1979, the St. Paul District Heating Development Company (DHDC) was incorporated by the Mayor of St. Paul, the Director of MEA, and the Executive Director of the St. Paul Building Owners and Managers Association to resolve institutional issues identified and analyzed by this study. The DHDC Board of Directors represents business, government, energy users, and energy suppliers. It is a joint venture company organized for the purpose of building a demonstration hot water DH system in St. Paul. The anticipated life of the DHDC is at least one-and-one-half to two years. The company, or another owner/operator, will provide the expertise, staff, and continuity to complete the demonstration. The company or the system owner/operator should provide the means for the expansion of DH in the remainder of the metropolitan area.

The DHDC established an office in the St. Paul central business district on September 1. Operating funds for staff and consultants have been jointly provided by DOE, the Northern States Power Company (NSP), and the State of Minnesota.

The demonstration system designed for St. Paul will contain all of the elements of a full-scale system, including cogeneration, hot water transmission and distribution, and conversion of the heating systems in existing buildings. The area of the city selected for the demonstration system will become the nucleus of an expanded St. Paul system. It will be the first use of European DH technology in the United States.

3. SUMMARY

The objective of the Institutional Issues Study was to identify and evaluate those issues that might affect ownership, operation, or growth of a Twin Cities metropolitan DH system. The study was done by the MEA. The Minnesota office of Touche Ross & Co. analyzed the options and consequences of the identified issues. A steering committee consisting of representatives of local government, state regulatory agencies, electric and gas utilities, potential consumers, and the community established priorities for evaluating and reviewing the papers prepared by Touche Ross & Co.

Institutional issues were evaluated from the perspective of the corporate structure options for a new DH distribution company. Two ownership options were considered — a private owner/private operator and a public owner/public operator. The option of public ownership with private operation was considered as an issue under public ownership. The study assumed that cogeneration power plants owned and operated by an existing private electric utility (NSP) would provide most of the thermal energy.

It was assumed that development of DH would begin in the central business districts of Minneapolis and St. Paul. It would expand over 20 years to reach commercial and residential areas with lower thermal heat load density. Existing coal-fired power plants within the cities would be retrofitted to cogenerate electrical and thermal energy. When the DH load reached the thermal capacity of the existing power plants, additional coal-fired cogeneration units would be added to the plants.

A set of papers with a summary analysis of each issue resulted from the study. Issue maps were used to create potentially feasible scenarios for the development of cogeneration DH in the Twin Cities. Such a map depicts the relationships among major issues (i.e., the election of an alternative for a specific issue may limit the choice of alternatives for other issues). Issues analyzed included financing, taxation regulation, pricing policy, allocation of costs/benefits between electrical and DH, capital investment recovery by building owners, hookup policy,

and displacement effects on existing energy suppliers. For each issue, several alternatives were identified, researched, and analyzed as to their effect on development.

A feasible development scenario for each important issue is a selection of alternatives that would be best for a particular set of economic conditions. The economic conditions to which the scenario must respond results from an economic analysis of a specific project. Since a detailed economic analysis has not been done, an appropriate scenario cannot be chosen. Feasible scenarios were developed for a range of assumed economic conditions, and their evaluation led to the identification of issues that would impede development under various ownership options. Also important to consider are regulatory decisions that will be made in the near future.

In the most favorable situation, DH would be economically attractive without government subsidy or special treatment. In this case, the development strategy would be typical of an enterprise in which the expected returns are commensurate with the risk. If, on the other hand, the economics prove marginal, the development strategy would favor alternatives that would assist DH in competing with other ways of heating. The feasible scenario and owner/operator selected will be based on negotiations involving investment strategy, rate structure, and anticipated returns.

The Minnesota Energy Agency recommended that a not-for-profit development company be formed to deal with the issues. This company would serve as a task force that could act independently of state and local government to provide the technical and economic analysis required for an owner/operator to proceed.

4. STUDY CONCLUSIONS AND RECOMMENDATIONS

The study conclusions were developed from the issue papers and feasible scenarios presented in this report. The steering committee assisted by analyzing and reviewing the conclusions. Recommendations have been made by the MEA.

4.1 Conclusions

Many of the conclusions resulting from this study may seem self-evident (i.e., a DH utility must provide reliable, competitive service to its customers and an adequate return to its investors). In this study, eight conclusions were presented as necessary requirements for a favorable institutional environment for a new DH utility:

- Selection of an owner/operator must be based on negotiations among the parties (building owners, utility representatives, and city and state officials) regarding the investment strategy, rate structure, and anticipated returns.
- Development of cogeneration DH will require the financial stability of a private utility or an existing government body.
- The lack of an accepted methodology for allocating costs between the electric and thermal products of the power plant inhibits investor and consumer confidence.
- Economic regulation of the DH distribution system might adversely affect recovery of startup losses, limit operational flexibility, and, thus, discourage private investment.
- Incentives for voluntary hookup and long-term contracts with customers are needed to ensure a stable customer base.
- The uncertainty of the permitting process over the 20-year development period could have a negative effect on investor and customer confidence and might limit long-range development objectives.

- Present tax structures could inhibit the development of DH.
- It is uncertain whether research and development expenses incurred by utilities in the planning and development of a new DH system will be allowable expenses against the existing electrical rate base. This situation might discourage research and development investment necessary for development of cogeneration heat production plants for DH.

The relative importance of many of the issues and resulting conclusions depends on an economic analysis of a specific project. Issues that would impede the development of a large-scale Twin Cities metropolitan system would not necessarily impede a project of smaller scale. Barriers to the development of the metropolitan DH system must be eliminated to ensure investor and consumer confidence. Three issues were identified as barriers to be eliminated before long-range development can be assured:

- the lack of an accepted methodology for allocating electrical and cogeneration costs,
- the lack of a process by which permits for important components of the long-range development plan can be ensured, and
- concern that initial regulation of a new system by the Public Service Commission would limit operational flexibility and recovery of startup losses.

Because of these barriers, the perceived risk associated with a large metropolitan DH system with a 20-year development period is, at this time, too great for any party to assume the development burden. These barriers might be reduced by concentrating on a project of smaller scale and shorter development time. This smaller project could be the beginning of the larger regional system.

4.2 Recommendations

It is recommended that a legislative program be developed by the MEA and the Minnesota Public Service Department to resolve the cost allocation issue and to address the need for long-term permitting considerations. The legislation should emphasize state support for DH and authorize the Public Service Commission to establish rules for the allocation of costs to thermal energy at the power plant. These rules must be developed in time to allow an economic analysis of the proposed system options. Officials of the city, NSP, and the MEA, as well as representatives of potential customers, should participate in the rule-making process.

The DHDC will be responsible for permits needed for the demonstration project. A permitting process that will promote implementation of hot water, cogenerated DH in the Twin Cities must be developed. An environmental assessment worksheet must also be produced for the metropolitan system to determine the nature of the environmental impact statement required. A process must be developed and recommended to minimize the impact of the permitting process on the expansion of the DH system. Legislation should be developed to implement the permitting process needed to allow the orderly expansion of DH in the Twin Cities.

5. BACKGROUND AND BASE SCENARIO

Investigation of hot water cogeneration DH in the Twin Cities of St. Paul and Minneapolis began with a study funded by DOE through ORNL and conducted by Peter Margen of Studsvik Energiteknik. NSP, DOE, the MEA, and other local government and private organizations cooperated in this study and in several other important Phase I studies.

5.1 Background Studies

- Minneapolis/St. Paul District Heating Study,
  Studsvik Energiteknik (formerly AB Atomenergi, Studsvik, Sweden)
  ORNL Contract: s7339 (June 1979).
- District Heating and Cooling Systems for Communities Through Power Plant Retrofit Distribution Network,
  Minnesota Energy Agency, St. Paul,
  ANL Contract: EM78-C-02-4980 (Phase I, May 1979).
- District Heating Methods and Costs for Existing Buildings,
  Minnesota Energy Agency, St. Paul,
  ORNL Contract: s7339 (December 1978).
- Impact of District Heating on Air Quality,
  Oak Ridge National Laboratory
  (April 1979).
- Feasibility Study for Converting Existing Turbines for District Heating,
  Ekono, Helsingfors, Finland
  Sponsored by Northern States Power, Minneapolis,
  Contract: UE-78380 (December 1977).
- High Bridge Power Plant Retrofit,
  United Engineers and Constructors, Philadelphia,
  Sponsored by Northern States Power Company (February 1979).
- St. Paul District Heating Study,
  Charles T. Main, Inc., Boston,
  Sponsored by Northern States Power Company (June 1979).
- Coal Cogeneration Plant Assessment,
  Oak Ridge National Laboratory, Northern States Power Company and United Engineers and Constructors, Philadelphia, Pennsylvania,
  Sponsored jointly by ORNL and NSP
  (Scheduled completion May 1980).

5.2 Study Area

St. Paul and Minneapolis are part of a large contiguous metropolitan region that exceeds two million in population. The City of St. Paul, with a population of nearly 280,000, has a dense downtown area surrounded by an area containing industrial sites and high-density residential housing. Redevelopment of the downtown area includes both new commercial and residential units. Over 52,000 people work, and nearly 4,000 people live, in the central business district. This population density and the cold climate (more than 8000 degree days) give rise to a large heat demand.

A hot water DH system with full connection in the St. Paul and Minneapolis city cores, with partial connection in the areas containing small commercial buildings and multifamily apartments, would have a heat load of over 2500 MW.

At present, 80% of the heat demand is met by natural gas. Gas service for the larger customers is interruptible, so oil is used during the winter. A small steam DH system (60 MW) exists in downtown St. Paul. A newer system (about 80 MW, including some district cooling) in downtown Minneapolis and two systems at the University of Minnesota (about 177 MW, including some cooling) could eventually be connected to a Twin Cities metropolitan system. All existing systems use steam as the thermal medium and none use cogeneration, though a cogeneration proposal exists for the University system.

Both Minneapolis and St. Paul have coal-fired electric generating stations (owned by NSP) within the city boundaries — High Bridge in St. Paul and Riverside in Minneapolis. In addition, Black Dog is located 10 miles south of Minneapolis, and several newer coal-fired and nuclear plants are located at various distances outside of St. Paul. The Allen S. King plant, the closest of the nonmetropolitan plants, is 17 miles from downtown St. Paul.

The St. Paul and Minneapolis metropolitan area is ideally suited for development of hot water cogeneration DH because of six reasons:

- It has a cold climate.

- It has a city structure that will adapt to DH.
- It has a large potential heat demand.
- It uses fuels that will become increasingly expensive and scarce (natural gas and oil).
- It has generating stations that use coal as fuel, with some units suitable for conversion to cogeneration.
- It has a DH tradition.

5.3 Base Scenario

The major development assumptions used in the evaluation of institutional issues are based on the Minneapolis-St. Paul DH study by Studsvik Energiteknik. Preliminary plans and economics for the development of a metropolitan hot water DH system were presented in this study. Five major development assumptions are made:

- Base-load heat for the system would be obtained through cogeneration at existing NSP power plants.
- Development of the system would begin in the high-thermal-load areas of each city.
- Continued system growth over a 20-year development period would gradually include areas of medium load consisting of commercial and apartment buildings (Fig. 1).
- Additional cogeneration units would be added when the capacity of the present plants was reached.
- Existing steam DH systems in Minneapolis and St. Paul and on the University of Minnesota campus would be considered separate and independent systems.

The DH system would use reject heat from the two power plants within the Twin Cities. Two development scenarios were considered: Scenario A with a total thermal demand of 2600 MW, and Scenario B, a larger system that included additional hookup in low-heat-density areas. Figure 2

presents the projected heating load buildup with development time. This figure indicates the timing of the development of the cogeneration heat sources.

Over the 20-year development period, Scenario A would save the equivalent of 49 million barrels of oil. Some additional fuel must be used at the power plant to compensate for the small amount of electric capacity sacrificed to cogeneration. The net conservation of fuel is equivalent to 31 million barrels of oil. On an annual basis, over the 20-year period, the system would save enough energy to heat 200,000 homes. For Scenario B, the total net fuel savings over the 20-year period is about 30% greater than for Scenario A. The DH system would provide an 85% reduction in oil and gas used and a 57% net savings in fuels of all kinds.

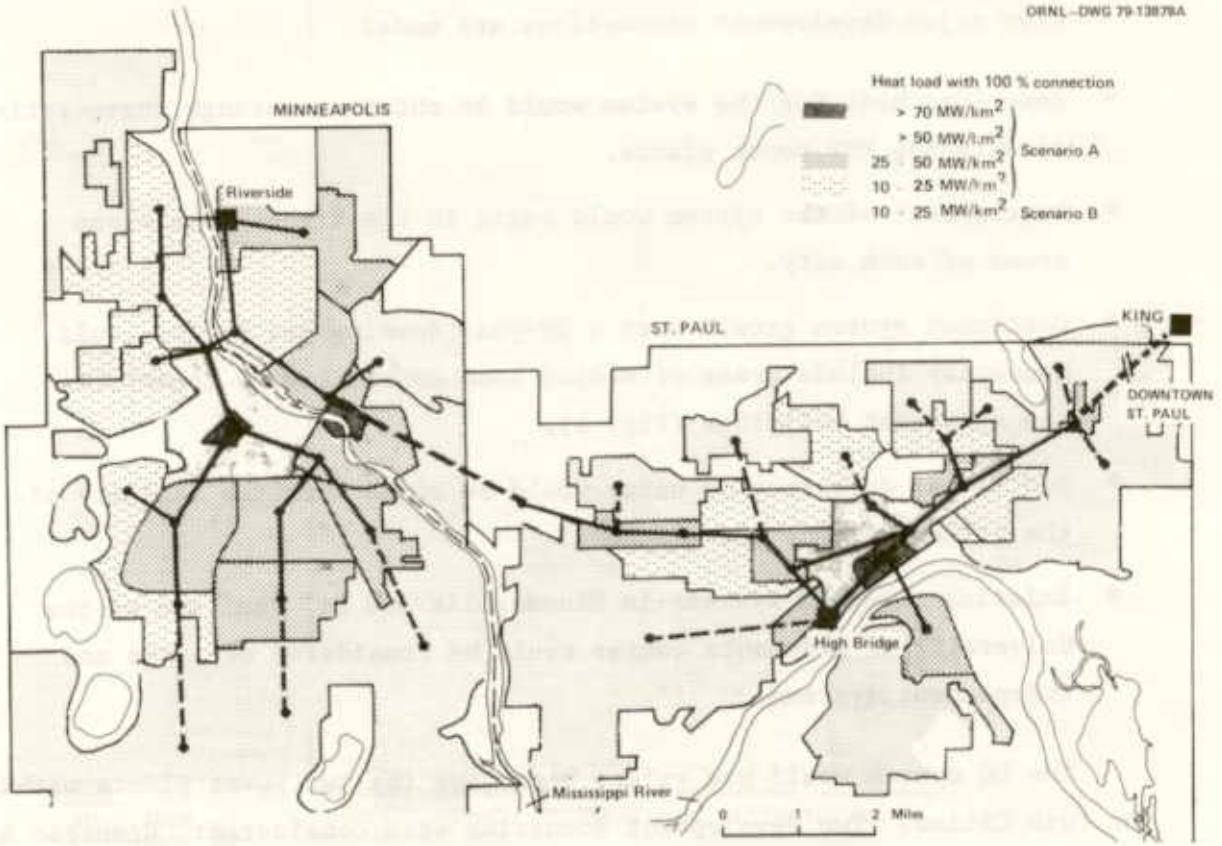

Fig. 1. Twin Cities regional district heating system heat load densities and possible distribution systems.

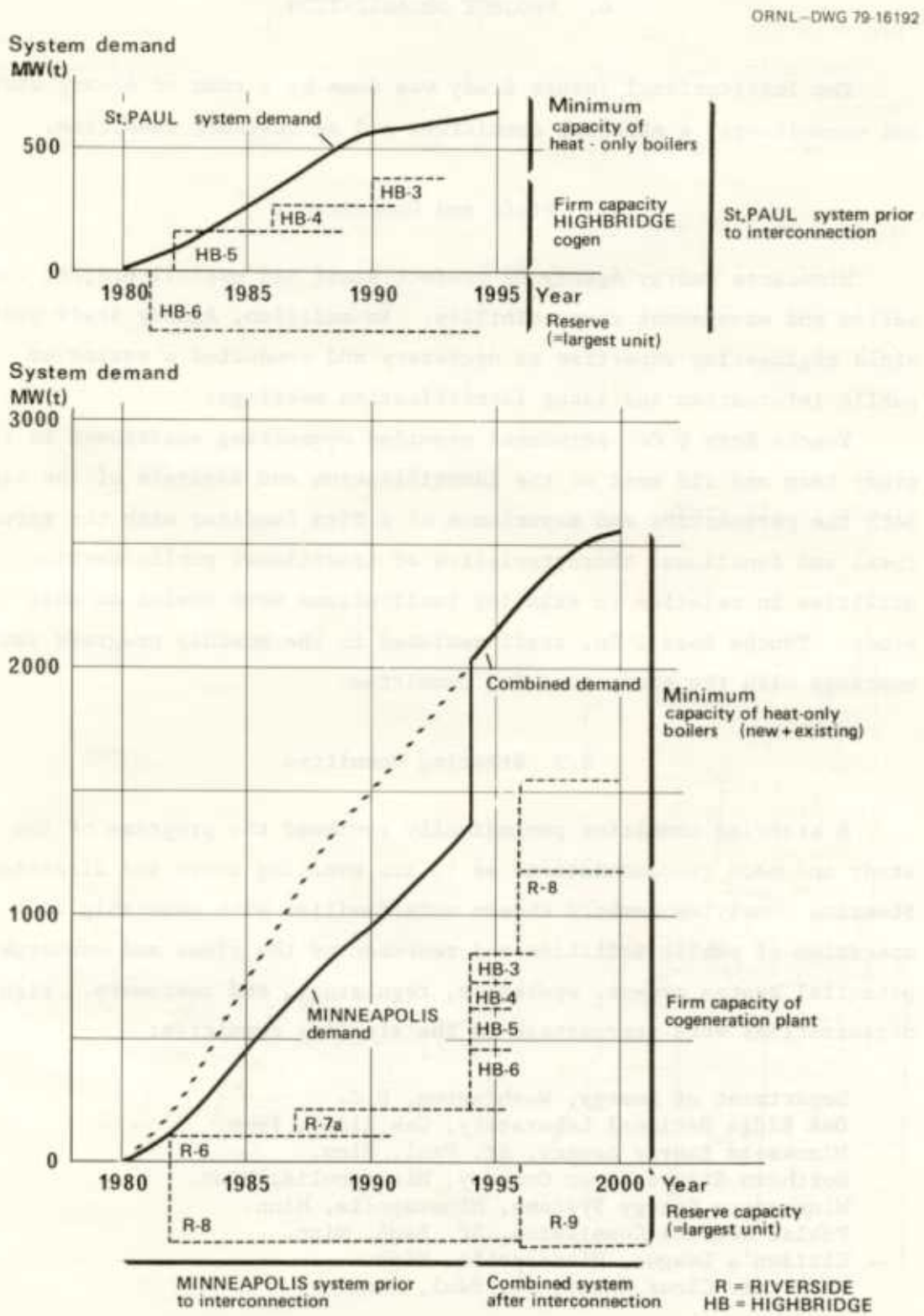

Fig. 2. System demand and development assumptions. Source: *Draft Minneapolis/St. Paul District Heating Study*, Studsvik Energiteknik AB, February 1979.

6. PROJECT ORGANIZATION

The Institutional Issues Study was done by a team of Agency staff and consultants, a steering committee, and an advisory committee.

6.1 Staff and Consultants

Minnesota Energy Agency DH project staff had overall project coordination and management responsibility. In addition, Agency staff provided engineering expertise as necessary and conducted a series of public information and issue identification meetings.

Touche Ross & Co. personnel provided consulting assistance to the study team and did most of the identification and analysis of the issues. Both the perspective and experience of a firm familiar with the structural and functional characteristics of traditional public service utilities in relation to existing institutions were useful to this study. Touche Ross & Co. staff assisted in the monthly progress review meetings with the study steering committee.

6.2 Steering Committee

A steering committee periodically reviewed the progress of the study and made recommendations as to its evolving scope and direction. Steering committee members chosen were familiar with ownership and operation of public utilities and represented the views and concerns of potential system owners, operators, regulators, and customers. Eight organizations were represented on the steering committee:

Department of Energy, Washington, D.C.
Oak Ridge National Laboratory, Oak Ridge, Tenn.
Minnesota Energy Agency, St. Paul, Minn.
Northern States Power Company, Minneapolis, Minn.
Minnegasco Energy Systems, Minneapolis, Minn.
Public Service Commission, St. Paul, Minn.
Citizen's League, Minneapolis, Minn.
Clear Air Clear Water, St. Paul, Minn.

6.3 Advisory Committee

An advisory committee composed of local civic, business, and government leaders was formed to act as a technical review committee. This group was assigned the informal role of reviewing the progress of the study. Each member of the committee was provided with an Issues Notebook that was updated as new issues were identified and assessed. Advisory committee members represented ten organizations:

Department of Energy, Washington, D.C.
Minnesota Legislative Staff, St. Paul, Minn.
Minnesota Environmental Quality Board, St. Paul, Minn.
Minnesota Pollution Control Agency, St. Paul, Minn.
Metropolitan Council, St. Paul, Minn.
Saint Paul City Council, St. Paul, Minn.
Public Service Department, St. Paul, Minn.
Hennepin County Commission, Minneapolis, Minn.
Building Owners and Managers Association, Minneapolis-St. Paul, Minn.
Minnesota Municipal Utilities Association, Buffalo, Minn.

6.4 Public Involvement

Public meetings attended by representatives from business and industry, state and local government, energy planners and suppliers, citizen and neighborhood groups, environmentalists, and labor leaders were held during the summer of 1978. Concerns expressed at the meetings were used to identify and establish priorities for the issues to be evaluated.

7. METHODOLOGY

The scope of the work of the Institutional Issues Study was defined by the MEA in coordination with DOE, ORNL, and the Touche Ross & Co. The objective of the study was to identify, characterize, and evaluate issues that would affect the development of a new cogeneration hot water DH system in the Twin Cities; to identify issues that would present barriers to development; and to develop feasible strategies for eliminating or reducing these barriers.

7.1 Ownership Options

System ownership and operation were determined to be the most significant variables against which all other issues should be evaluated. Three ownership options were selected based on compatibility with the proposed development model. In all three ownership options, NSP would own and operate the base-load cogeneration power plants, and individual customers could own and operate the heating equipment within their buildings. In the private owner/operator option, a new or existing private utility would develop, own, and operate the transmission and distribution system, and the peak-load equipment. In the public owner option, an existing level of government would build, own, and operate the distribution system and peak-load equipment. The public owner/private operator option was analyzed as an issue under public ownership. The system would be publically owned, and a private utility would contract to operate the system.

7.2 Types of Issues

Two categories of issues were identified. Traditional issues were defined as those commonly associated with the development, ownership, and operation of a business. The impact of traditional issues can usually be analyzed from an economic point of view. Perceived issues were defined as those issues generally arising from public perception of the purpose and impact of a large project such as development of DH.

7.2.1 Traditional issues

Each traditional institutional issue associated with a particular owner/operator option was evaluated in a series of issue papers according to the format described below:

Issue definition. Each issue or situation was defined with respect to its relevance as an issue, specific characteristics to be studied, and the limits of the concerns to be evaluated.

Reason that subject is an issue. The specific aspects of each subject were described in relation to the ways they would affect cogenerated hot water DH in the Twin Cities.

Impact. The probable effect of the institutional issue was described in relation to the situations it would affect.

Alternatives. Each reasonable alternative to resolving the issue was briefly described. Alternatives that seemed to be totally unrealistic were mentioned but were not described in detail.

Work required to determine consequences. A brief scope of work was proposed by which the consequences of each issue alternative could be researched and documented. If there were some question as to the significance of the issue, the work to this stage was reviewed by the steering committee to determine if an in-depth analysis were advisable.

Consequences. The consequences of each alternative to a particular issue were evaluated. Particular attention was paid to evaluating the effects of issues that might delay, block, or create significant risk to development, ownership, or operation of new cogenerating hot water DH systems in the Twin Cities.

7.2.2 Perceived issues

Most of the perceived issues were raised by the public and reflect concern about specific project sites or policies that have not been formulated. Ten perceived issues are typical:

1. purpose of cogeneration and DH,
2. private or public development,
3. public involvement in planning and development,
4. assessment of technological alternatives,

5. compatibility of the system with renewable energy resource fuels,
6. consideration of development alternatives,
7. determination of the status of development in relation to community growth,
8. safety and reliability of the system,
9. ability of the system to melt snow from city streets, and
10. magnitude of construction disruption.

No formal procedure was developed for evaluating the characteristics and effects of perceived issues. Rather, short essays were written describing the current status or understanding regarding some of the concerns (Appendix C). Other concerns must await the formulation of specific policies or projects before being answered.

8. RESULTS

The results presented in this section are the traditional issue paper abstracts, the issue maps, a description of relationships among issues, and the feasible strategies (including a discussion of each) for variations in economic scenarios.

For each issue analyzed, several alternatives were identified and their separate effects on development evaluated. Relationships among issues were analyzed to determine how the selection of a particular alternative limited the options for other issues. Feasible strategies were developed for a range of economic results. A feasible strategy is a set of alternatives for important issues that will promote a particular development strategy. Because the project was not designed to evaluate the effects of institutional issues on a specific proposed project, a range of economic circumstances was considered.

8.1 Issue Paper Abstracts

This section presents an index (Tables 8.1 and 8.2) and abstracts of the traditional issue papers that are included in Appendices A and B of this report. The index indicates the depth of analysis for each issue.

Table 8.1. Twin Cities district heating study institutional issues matrix if private ownership assumed

Issue number	Issue	Subissue	Stage of issue paper completion		
			Abstract	Alternatives	Consequences
I.A.1	Financing	Capital structure			a
I.A.2	Financing	Types of debt financing used			a
I.B.1	Taxation	Property tax		a	
I.B.2	Taxation	Sales tax		a	
I.B.3	Taxation	Selective and excise tax		a	
I.C.1a	Regulation-income and service	Regulation of the district heating company			a
I.C.1b	Regulation-income and service	Operating income regulation (revenue requirements)		a	
I.C.2	Regulation-income and service	Startup loss recovery			a
I.C.3	Regulation-income and service	Fuel heat source cost pass-through		a	
I.C.4	Regulation-income and service	Allowance for funds used during construction		a	
I.C.5	Regulation-income and service	Plant siting	a		
I.C.6	Regulation-income and service	Service area			a

Table 8.1 (continued)

Issue number	Issue	Subissue	Stage of issue paper completion		
			Abstract	Alternatives	Consequences
I.C.7	Regulation-income and service	Quality of service/ availability of service	*a*		
I.D.1	Pricing policy	Tariff classification		*a*	
I.D.2	Pricing policy	Pricing basis		*a*	
I.D.3	Pricing policy	Rate structure and market sensitivity		*a*	
I.E	Allocation of costs/ benefits between electrical generation and district heating				*a*
I.F	Capital investment recovery for building owners				*a*
I.G.1	Displacement effects on existing energy suppliers and their customers	Regulated heat sources (natural gas and electricity)		*a*	
I.G.2	Displacement effects on existing energy suppliers and their customers	Nonregulated heat sources (oil and existing district heating suppliers)		*a*	
I.H	Hookup policy				*a*
I.I.1	Regulation-permits and authorizations	Franchising by cities			*a*

Table 8.1 (continued)

Issue number	Issue	Subissue	Stage of issue paper completion		
			Abstract	Alternatives	Consequences
I.I.2	Regulation-permits and authorizations	Siting of peak-load plants and mobile boilers		[a]	
I.I.3	Regulation-permits and authorizations	Startup and construction			[a]

[a]End product completed for this issue paper.

Table 8.2. Twin Cities district heating study institutional issues matrix if public ownership assumed

Issue number	Issue	Subissue	Stage of issue paper completion			Reference issue paper
			Abstract	Alternatives	Consequences	
II.A.1	Form and structure	Responsible level of government			*a*	
II.A.2	Form and structure	Operating structure			*a*	
II.A.3	Form and structure	Policy decisions			*a*	
II.B.1	Financing	Capital structure			*a*	
II.B.2	Financing	Types of debt financing			*a*	
II.C	Taxation		*a*			
II.D.1	Pricing policy	Tariff classification		*b*		I.D.1
II.D.2	Pricing policy	Pricing basis		*b*		I.D.2
II.D.3	Pricing policy	Rate structure and market sensitivity		*b*		I.D.3
II.D.4	Pricing policy	Profit motivation		*a*		
II.E	Allocation of costs/benefits between electrical generation and DH				*b*	I.E

Table 8.2 (continued)

Issue number	Issue	Subissue	Stage of issue paper completion			Reference issue paper
			Abstract	Alternatives	Consequences	
II.F	Capital investment recovery for building owners				[b]	I.F
II.G.1	Displacement effects on existing energy suppliers and their customers	Regulated heat sources		[b]		I.G.1
II.G.2	Displacement effects on existing energy suppliers and their customers	Nonregulated heat sources		[b]		I.H
II.H	Hookup policy				[b]	I.I.2
II.I.1	Regulation-permits and authorizations	Franchising by cities	[a]			
II.I.2	Regulation-permits and authorizations	Siting of peak-load plants and mobile boilers		[b]		I.I.3
II.I.3	Regulation-permits and authorizations	Startup and construction			[b]	

[a] End product completed for this issue paper.

[b] Issue paper identical to paper completed under the private ownership assumption and listed in reference issue paper column.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUES ABSTRACTS

I. Ownership Assumption: Private

A. Financing: What are the methods and sources for financing startup costs and expansion of the DH system? Financing includes debt (loans and bonds) and equity (ownership). Financing is an institutional issue because the risks and capital requirements may impede implementation.

Subissues:

1. *Capital structure*
2. *Types of debt financing*

B. Taxation: Issues relating to the types of taxes paid by the DH company or purchasers of its services must be explored to determine the effect each tax has on the economic feasibility of the system. Property taxes, sales taxes, and selective and excise taxes will be studied, not only as applicable to the DH company but also as applicable to providers of alternative fuels, so that differential effects can be isolated.

Subissues:

1. *Property tax*
2. *Sales tax*
3. *Selective and excise tax*

C. Regulation — income and service: The DH company will be operating in an environment with regulated and nonregulated energy suppliers. Issues related to the regulatory question include

Subissues:

1 (a). *Possible regulation of the DH company*: Should the newly created district heating company be regulated as Minnesota electric and gas utilities are regulated?

(b). *Operating income regulation (revenue requirement)*: If the DH company is regulated, how should the revenue requirements be determined? What methods of determining income are appropriate?

2. *Startup loss recovery*: Assuming that the DH system experiences operating losses in the startup years (due to normal capacity-sales lag and other problems commonly experienced by new business ventures), how should those losses be recovered in a regulated environment? Alternatives might include making full operating costs available to current customers (thus risking loss of future business due to high prices) or recovering the startup costs from future customers. In the former alternative, the rates would be set to recover less than full costs; in the latter, future rates would return an amount greater than full operating costs.

3. *Fuel/heat source cost pass-through*: If the DH company is regulated and if rates are on a cost-of-service basis, should there be a fuel/heat source adjustment clause similar to the purchased gas adjustment and fuel adjustment clause now used by most regulated utilities?

4. *Allowance for funds used during construction*: During the initial construction phase of the DH system, there will be no customers, so all financing costs associated with construction must be capitalized. However, construction of the system will continue throughout the remainder of the century, and there are alternative approaches to handling these financing costs that may affect the overall economics and success of the system in a regulated environment.

5. *Plant siting*: A determination must eventually be made regarding which local power plants will supply heat to the DH system and when those plants and their individual units will be brought on line. Should these decisions be made solely by the DH company, or should the choice be regulated? Currently, the MEA is empowered to require a certificate of need for the construction of large energy facilities, including electrical generating plants. Should the MEA also regulate the selection of metropolitan power plants used for DH? If additional heat-generating capacity is required in the future, how should the needs of the DH system be compared with other considerations, such as air quality? How should plant-siting decisions be approached?

6. *Service area*: Should the service area of the DH system be regulated, or should the system be allowed to expand as the economics dictate? Should regulation of service area be used to encourage, define, or limit the expansions of the DH system? If so, what regulatory body should have such power, and what should the decision criteria be?

7. *Quality of service/availability of service*: To what extent and through what means should the quality of service of the DH company be regulated? Should the DH company extend service to all consumers who desire it, or should it be allowed to expand and provide service based upon its own needs and plans?

D. Pricing policy: Hot water DH services must be properly priced to compete in the marketplace of several alternative energy heating sources, including electricity, which is a coproduct of the DH cogeneration plant. The needed pricing policies require formalization of the characteristics, terms, conditions, and corresponding rates for the various services provided by the DH system in this competitive marketplace. Inappropriate

pricing policies may impede the establishment and operation of an otherwise feasible DH system.

Pricing policy issues that could affect the success of the DH system include

1. *Tariff classification*: The tariff classification specifies the products — steam or hot water, temperature, and pressure — that the DH system will provide to consumers. What are the possible "packages" of service characteristics, terms, and conditions of service?

2. *Pricing basis*: What are appropriate pricing criteria? (Examples include cost-based rates and competitively priced rates.) What technical approach to the pricing problem should be used?

3. *Rate structure and market sensitivity*: What will be an appropriate rate structure that is consistent with all relevant cost and use criteria? What are the potential market demand, price elasticity, and alternative energy cross-elasticity for the overall tariff classifications and prices?

E. Allocation of costs/benefits between electrical generation and DH: The way in which the costs incurred or revenues derived by the producer of hot water for the DH system are allocated between total electrical generation costs and total DH costs will affect the rates charged to electrical customers and to DH customers. The actual cost allocation may be determined by the Public Service Commission or by economic considerations which dictate the feasibility of marketing DH services.

F. Capital investment recovery for building owners: How can building owners be convinced to make the investment necessary for converting to DH when they may not have any way to recover the

costs of converting to a hot water system given the restrictions inherent in some building leases? Some owners may be obligated to pass on fuel/heating savings to tenants while being restricted from passing on any additional capital costs incurred in conversion.

G. Displacement effects on existing energy suppliers and their customers: District heating will displace gas, oil, and electrical heating by its very nature. A loss of sales to DH may affect total sales, net income, utility write-off on existing equipment, and the prices of alternative heating sources because of the spreading of fixed capital costs over a potentially smaller sales volume. Another possible outcome would be that the sale of fuels, such as natural gas, would remain constant, but become available in areas where they were previously unavailable. Displacement effects will be approached separately for regulated fuels and nonregulated heat sources.

Subissues:

1. *Regulated heat sources*: natural gas and electricity
2. *Nonregulated fuels*: oils and existing DH suppliers

H. Hookup Policy: District heating may not be economical below some critical level of demand due to high capital outlays. Should hookup to the DH system be voluntary (possibly risking the economic success of the system), or should consumers on DH lines be required to hook up? What incentives could be provided to encourage consumers to use DH services if hookup is voluntary? Who should pay conversion costs if hookup is involuntary?

I. Regulation — permits and authorizations: For the DH company to start operations, various permits and authorizations will be required from local municipalities, boards, and authorities.

Subissues:

1. *Franchising by cities*: To operate most economically, it might be necessary to grant the DH company a legal franchise to serve a given area and to use the community's streets, alleys, and thoroughfares. Should these franchises be exclusive? What rights should be granted? What should be the term of the franchise? Will this delay implementation?

2. *Siting of peaking plants and mobile boilers*: Peaking plants will be required in various locations of the DH system for efficient performance; on extremely cold days, when hot water demands exceed the system's capacity, these auxiliary boilers will operate to supply extra heat. How should these temporary or permanent peaking plants be located so that their heating effectiveness is maximized and disruption to residential areas is minimized? If currently existing boilers are used, how should the choice be made among alternatives? In addition, mobile boilers may be required to supply new service areas or large new buildings before the transmission lines are constructed. How should sites for these temporary facilities be selected? If selection of optimal mobile boiler sites conflicts with local zoning or land use plans, how should these problems be resolved?

3. *Startup and construction*: Numerous permits and authorizations will be required to ensure compliance with federal, state, and local pollution control requirements, construction design and execution requirements, and so on. The need to comply with a myriad of governmental restrictions will not only increase the uncertainty and risk associated with the project but will also add to the cost and could result in substantial delays in implementation. How can these costs and delays be minimized so that the benefits of a cogeneration DH system will accrue to the residents of the Twin Cities?

II. Ownership Assumption: Public

A. Form and structure: Several possible forms of public ownership exist. Operating constraints on the DH project may depend on the responsible level of government and the operating structure.

Subissues:

1. *Responsible level of government*: Should the DH system be owned by the state, county, or municipal level of government? Should a multijurisdictional entity be created to own the DH system (e.g., Minneapolis and St. Paul jointly owning the system in an arrangement similar to that for municipal power agencies)? Or should another metropolitan authority similar to the Metropolitan Stadium Commission or the Metropolitan Sewer Board be formed to own the DH system? How will this decision affect other institutional issues, such as financing regulation, and taxation?

2. *Operating structure*: Should the DH system be managed by the government owner, or should it be operated on a contract basis by a private company more experienced in running a pipeline or public utility? What other operating structures are possible at each level of government?

3. *Policy decision*: Who or what board will set management policy in the publically owned entity? Who should serve on the boards; how should they be chosen? How should the policy decision body be structured?

B. Financing: Financing is an institutional issue because the risks and capital requirements may be so great that implementation is impeded. What methods and sources may be used to finance startup

costs and expansion of the DH project? Financing may include governmental equity participation and debt.

Subissues:

1. *Capital structure*: How much public equity should be in the capital structure of the DH system? Should there be any restrictions on the capital structure of the publically owned system? Should the capital structure be established when the system is set up, or should the system build up equity over time to arrive at a particular capital structure?
2. *Types of debt financing*: What type of bonds could be issued? Examples include general obligation bonds, general obligation revenue bonds, and revenue bonds (which are not backed by the full faith and credit of the owner governments). What is the potential liability posed on the taxpayers by each of the types of debt? What are the consequences of a publically owned enterprise financed by tax-exempt debt competing with private sector heat suppliers? How will the type of debt selected impact system user costs?

C. Taxation: Issues relating to the types of taxes paid by the DH company or purchases of its services must be explored to determine the taxes that the system would likely pay at each level of government or the payments the system might have to pay in lieu of taxes. What is the impact of each on the economic feasibility of the system? Taxes applicable to both the DH company and to providers of alternative fuels will be studied to isolate differential effects.

D. Pricing policy: Hot water DH must be priced properly to compete in the marketplace with appropriate alternative heating sources, including electricity, which is a coproduct of the

DH cogeneration plant. The needed pricing policies require formalization of the characteristics, terms, conditions, and corresponding rates for the various services provided by the DH system in this competitive marketplace. Inappropriate pricing policies may impede establishing and maintaining an otherwise feasible DH system.

Pricing policy issues which could affect the success of the DH system include

1.* *Tariff classification*: The tariff classification specifies the products — steam or hot water, temperature, and pressure — that the DH system will provide to consumers. What are the possible combinations of service characteristics, terms, and conditions of service?

2.* *Pricing basis*: What are appropriate pricing criteria? (Examples include cost-based rates and competitively set rates.) What technical approach to the pricing problem should be used?

3.* *Rate structure and market sensitivity*: What will be an appropriate rate structure that is consistent with all relevant cost, market, practical, and use criteria? What is the potential market demand, price elasticity, and alternative energy cross-elasticity for the overall tariff classifications and prices?

4. *Profit motivation*: Should rates be set to generate profits or to break even? Should the DH system be a net revenue source to the governmental owner?

E.* Allocation of costs/benefits between electrical generation and DH: The way in which the costs incurred or revenues derived

*Essentially the same as under private ownership.

by the producer of hot water for the DH system are allocated between total electrical generation costs and total DH costs may affect the rates charged to electrical customers and to DH customers. The actual cost allocation may be determined by the Public Service Commission that regulates the producer or by economic considerations that dictate the feasibility of marketing DH services.

F.* Capital investment recovery for building owners: How can building owners be convinced to make the investment necessary for converting to DH when they may not have any way to recover the costs of converting to a hot water system given the restrictions inherent in some building leases? Some owners may be obligated to pass on fuel/heating savings to tenants while being restricted from passing on any additional capital costs incurred in conversion.

G.* Displacement effects on existing energy suppliers and their customers: District heating will displace gas, oil, and electrical heating by its very nature. This loss of sales to DH may affect total sales, net income, utility write-off on existing equipment, and the prices for alternative heating sources because of the spreading of fixed capital costs over a potentially smaller sales volume. Another possible outcome would be that sales of fuels such as natural gas would remain constant but become available in areas where they were previously unavailable. Displacement effects will be approached separately for regulated heat sources and nonregulated heat sources.

Subissues:

1. *Regulated heat sources*: natural gas and electricity

*Essentially the same as under private ownership.

2. *Nonregulated heat sources*: oil and existing DH suppliers

H.* Hookup policy: District heating may be uneconomical below some critical level of demand due to high capital outlays. Should hookup to the DH system be voluntary (possibly risking the economic success of the system), or should consumers on DH lines be required to hook up? What incentives could be provided to encourage consumers to use DH if hookup is voluntary? Who should pay conversion costs if hookup is involuntary?

I. Regulation — permits and authorizations: For the DH company to start operations, various permits and authorizations will be required from local and state agencies and authorities.

Subissues:

1. *Franchising by cities*: To operate most economically, it might be necessary to grant the DH company a legal franchise to serve a given area and to use the community's streets, alleys, and thoroughfares. Under what forms of public ownership will a franchise be required?

2.* *Siting of peak-load plants and mobile boilers*: Peak-load plants will be required in various locations of the DH system for efficient performance. On extremely cold days when hot water demands exceed the system's capacity, these auxiliary boilers will operate to supply extra thermal energy. How should the locations of these permanent peak-load plants be determined so that their heating effectiveness is maximized and disruption to residential areas is minimized? If currently existing boilers are used, how should the choice be made among alternatives? In addition, mobile boilers may be required to supply new service areas or large new buildings before the transmission lines are

*Essentially the same as under private ownership.

constructed. How should sites for these temporary facilities be selected? If selection of optimal mobile boiler sites conflicts with local zoning or land use plans, how should these problems be resolved?

3.* *Startup and construction*: Many permits and authorizations will be required to ensure compliance with federal, state, and local pollution control requirements, construction design, execution requirements, and so on. The need to comply with a myriad of governmental restrictions will not only increase the uncertainty and risk associated with the project but will also add to the cost and could result in substantial delays in implementation. How can these costs and delays be minimized to ensure that the benefits of a cogeneration DH system will accrue to the residents of the Twin Cities? Will public ownership of the DH system provide any advantages in permitting that would not be available to a private owner?

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*Essentially the same as under private ownership.

8.2 Issue Maps and Feasible Scenarios for Development

Issue papers (Appendices A and B) provide the research and background for the results and conclusions of this study. The issue map exercise presented in this section provides a means to link issues for a specific ownership option. The issue maps show how all of the various institutional issues relate to each other (Figs. 8.3 and 8.4). There is one basis for identifying the relationships: does the election of a particular alternative for a specific issue limit the choice of alternatives for other issues? Feasible strategies for an economic base are developed from the issue maps for specific ownership options.

The issue maps that follow present the effect of issue relationships on the investor's assessment of risk in the project. If the election of a particular alternative for a specific issue affects the choice of alternatives for another issue, this relationship is depicted by an arrow extending from the former to the latter. If, in turn, the latter affects another issue, this is also shown, and so on. For example, the choice of a particular capital structure directly affects the types and combinations of debt used to finance the project (through the risk allocation inherent in the capital structure decision), but it does not directly affect the choice of hookup policy.

In a sense, any alternative having economic consequences affects all other issues to the extent that it can affect overall feasibility. Theoretically, the hookup policy decision could be independent of the choice of alternatives on most other issues. However, if the choice of capital structure adversely affected the firm's ability to sell bonds, it might rule out the possibility of having the DH firm assume conversion costs. Although it is important to keep these indirect effects in mind when selecting an alternative for an issue, the issue maps would become meaningless if all such relationships were shown.

Relationships

The relationships among issues will be discussed by ownership assumption in the order of issue paper numbers (Table 8.3). If the choice of

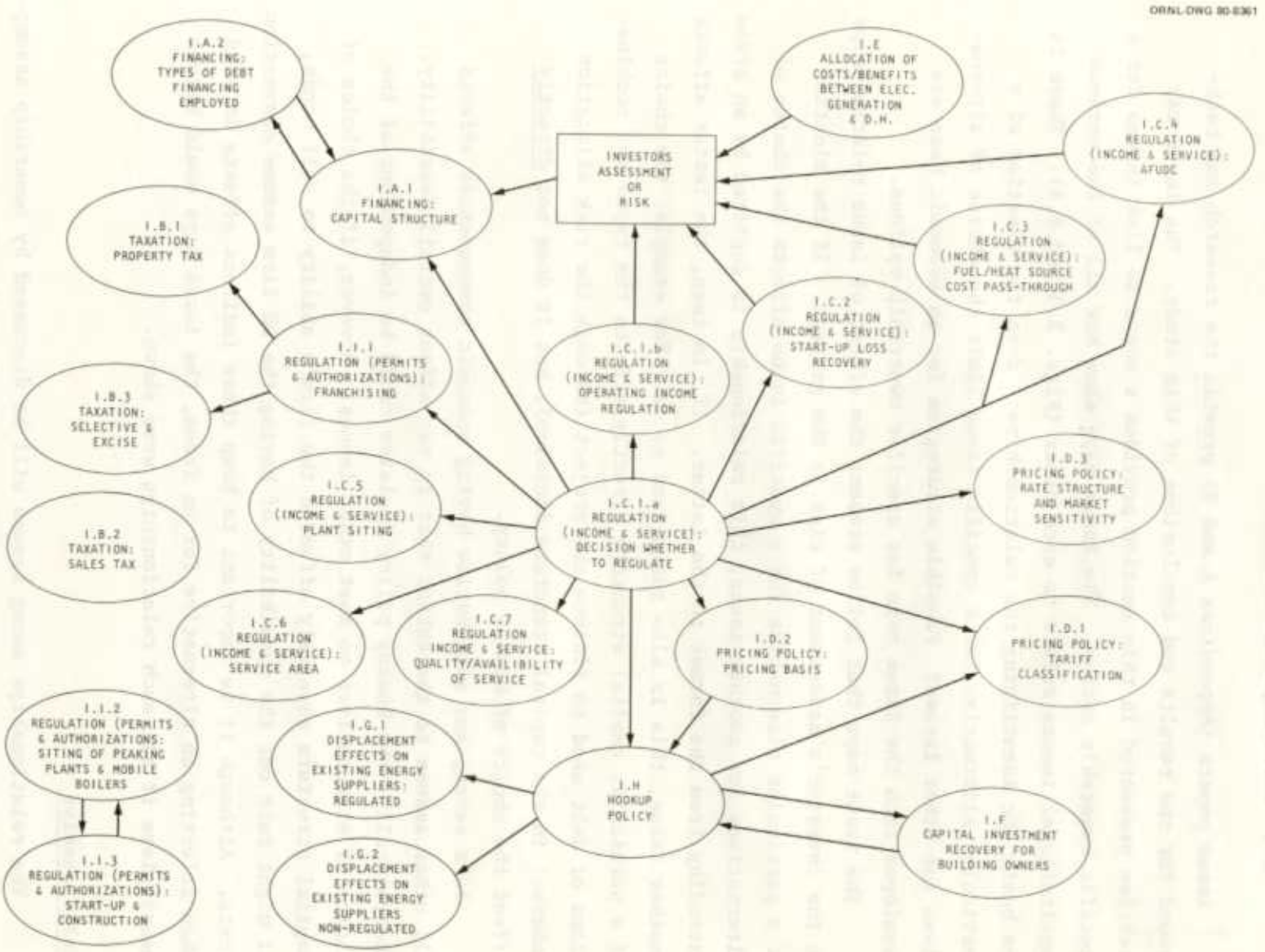


Fig. 8.3. Relationships of issues affecting a Twin Cities DH system under private ownership.

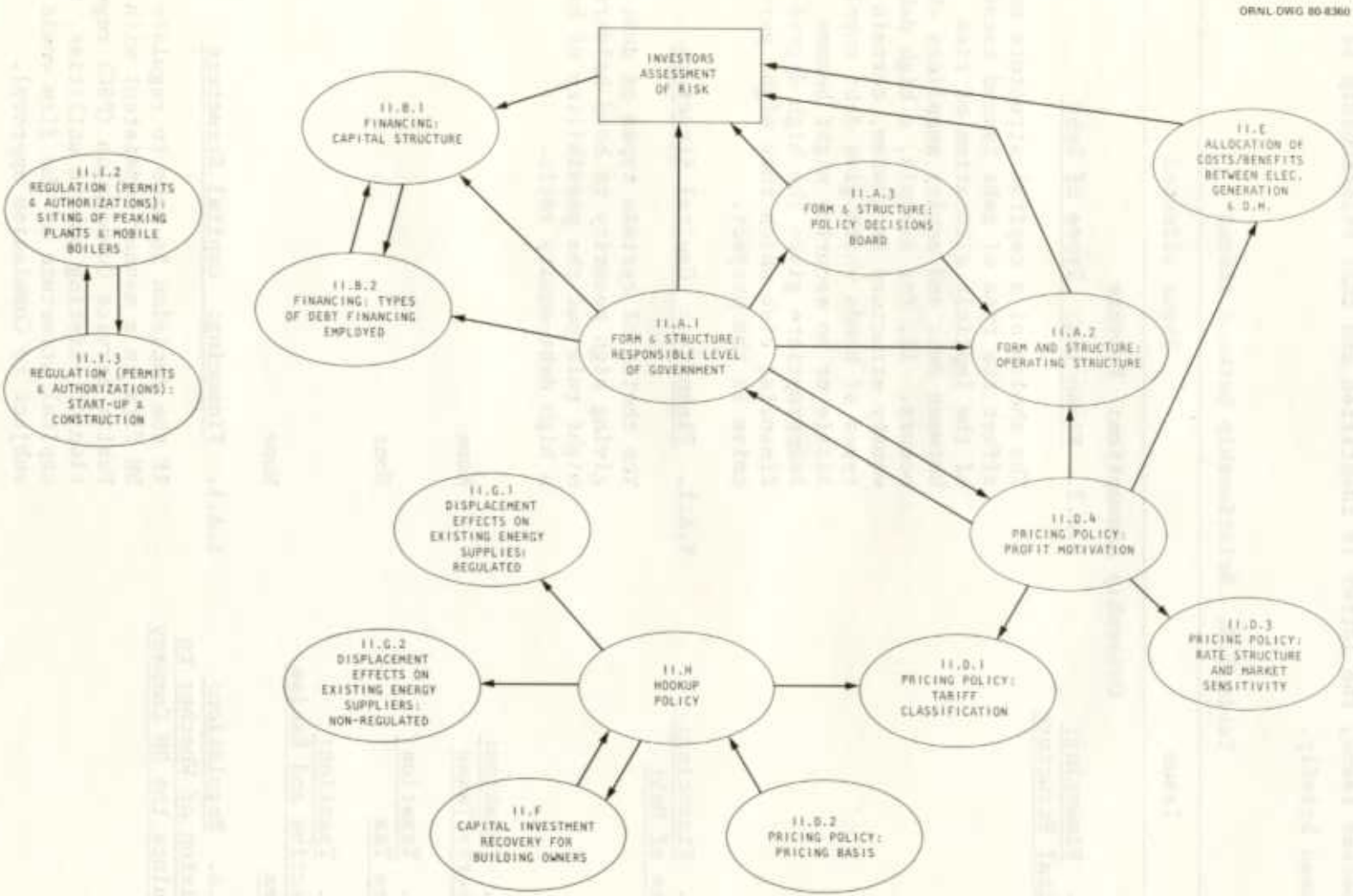


Fig. 8.4. Relationships of issues affecting a Twin Cities DH system under public ownership.

alternatives for a particular issue affects the choice of alternatives for another issue, the latter is identified and that relationship is discussed briefly.

Table 8.3. Relationship between issues

Issue	Issue affected
Ownership Assumption: Private	
I.A.1. Financing: Capital Structure	I.A.2. Financing: Types of Debt The choice of a capital structure may affect the type of debt issued because of the implicit allocation of risk between debt and equity suppliers which occurs. If, for example, a high debt-equity structure is chosen, certain types of bonds which give debt suppliers little or no security might become inappropriate given the high degree of financial risk which they might perceive in the project.
I.A.2. Financing: Types of Debt	I.A.1. Financing: Capital Structure The choice of certain types of debt giving high security to bond holders might rule out the possibility of having a high debt-equity ratio.
I.B.1. Taxation: Property Taxes	None
I.B.2. Taxation: Sales Tax	None
I.B.3. Taxation: Selective and Excise Taxes	None
I.C.1.a. Regulation: Decision of Whether to Regulate the DH Company	I.A.1. Financing: Capital Structure If the decision is made to regulate the DH firm in a manner consistent with Public Service Commission (PSC) regulation of existing public utilities, the capital structure of the firm would be subject to Commission approval.

Table 8.3 (continued)

Issue	Issue affected
	I.C.1.b. Regulation (Income and Service): Operating Income Regulation Public Service Commission regulation of the DH firm would regulate the operating income of the company; several alternative ways to regulate exist.
	I.C.2. Regulation (Income and Service): Startup Loss Recovery Public Service Commission regulation will need to address the question of whether startup losses will be recoverable from future rate payers and, if so, how.
	I.C.3. Regulation (Income and Service): Fuel/Heat Source Cost Pass-Through If regulation is chosen, the problem of passing fuel or heat source cost increases through to DH customers will have to be solved.
	I.C.4. Regulation (Income and Service): Allowance for Funds Used During Construction (AFUDC) If regulated, the Commission will need to establish rules for AFUDC.
	I.C.5. Regulation (Income and Service): Plant Siting Should an agency such as the Minnesota Energy Agency be granted authority to regulate cogeneration plant or unit selection? This type of regulation is possible regardless of whether the PSC regulates the company as a public utility, but may be more likely given PSC authority.
	I.C.6. Regulation (Income and Service): Service Area If regulated by the PSC, the service area of the DH company may also be regulated.

Table 8.3 (continued)

Issue	Issue affected
	I.C.7. Regulation (Income and Service): Quality and Availability of Service The PSC would also have authority to regulate the quality and availability of DH services, and several alternatives might be available.
	I.D.1. Pricing Policy: Tariff Classification The tariff classifications of the DH firm will have to be approved by the Commission if the regulation alternative is selected.
	I.D.2. Pricing Policy: Pricing Basis Pricing basis will be a matter for PSC review under the option of regulation, and many alternative bases are available.
	I.D.3. Pricing Policy: Rate Structure and Market Sensitivity If the DH firm is regulated, the company's rate structure will most likely be regulated; many alternatives are possible.
	I.H. Hookup Policy If the PSC regulates the DH company, the hookup policy may be determined by the Commission instead of by management.
	I.I.1. Regulation (Permits and Authorizations): Franchising The scope of the franchise will be different if there is PSC regulation of the DH firm.
I.C.1.b. Regulation (Income and Service): Operating Income Regulation	I.A.1. Financing: Capital Structure The feasible alternatives for a capital structure could be influenced by the form and degree of operating income regulation because of the effect that

Table 8.3 (continued)

Issue	Issue affected
	decision would have on the risks assumed by the capital suppliers.
I.C.2. Regulation (Income and Service): Startup Loss Recovery	I.A.1. Financing: Capital Structure The choice of a capital structure could be affected by the policy for recovery of startup losses; should startup loss recovery be disallowed, risks to capital suppliers would increase, and the mix and costs of capital would be altered.
I.C.3. Regulation (Income and Service): Fuel/Heat Source Cost Pass-Through	I.A.1. Financing: Capital Structure If cost pass-throughs are not allowed, the risk to capital suppliers would increase, the cost of capital would rise, and the optimum mix of debt and equity would likely change.
I.C.4. Regulation (Income and Service): AFUDC	I.A.1. Financing: Capital Structure The handling of AFUDC will also affect the capital structure decision through the risk/cost of capital mechanism.
I.C.5. Regulation (Income and Service): Plant Siting	None
I.C.6. Regulation (Income and Service): Service Area	None
I.C.7. Regulation (Income and Service): Quality and Availability of Service	None
I.D.1. Pricing Policy: Tariff Classification	None
I.D.2. Pricing Policy: Pricing Basis	I.H. Hookup Policy The choice of a pricing basis (e.g., cost-based pricing) could influence the hookup policy because of the impact that the latter could have on the cost and price of the service.

Table 8.3 (continued)

Issue	Issue affected
I.D.3. Pricing Policy: Rate Structure and Market Sensitivity	None
I.E. Allocation of Costs/ Benefits Between Electrical Generation and DH	I.A.1. Financing: Capital Structure The choice of a capital structure alternative may be influenced by the selection of a method of allocating joint plant and operating costs between electrical production and thermal production because that allocation methodology will affect the cost of DH and the amount of cash flow available for capital suppliers. This, in turn, could affect the capital structure decision.
I.F. Capital Investment Recovery for Building Owners	I.H. Hookup Policy If the hookup investment is attractive and the capital investment recovery alternative permits building owners to pass conversion costs through to tenants, the hookup policy may not be an issue. Alternatively, if owners cannot pass these costs on, the hookup policy may become important in establishing a customer base.
I.G.1. Displacement Effects on Regulated Heat Suppliers	None
I.G.2. Displacement Effects on Nonregulated Heat Suppliers	None
I.H. Hookup Policy	I.D.1. Pricing Policy: Tariff Classification The hookup policy will directly affect the choice of tariff classifications insofar as tariff classifications must discriminate among services provided to customers who own their heat exchanger and those who do not.

Table 8.3 (continued)

Issue	Issue affected
	I.F. Capital Investment Recovery for Building Owners The hookup policy could directly influence the capital investment recovery alternatives through its effect on hookup economics. For example, if the hookup policy eliminated the conversion investment for building owners, the capital investment recovery problems would be avoided.
	I.G.1. Displacement Effects on Regulated Heat Suppliers The hookup policy will directly affect the displacement issue because it will affect the amount of economic damage to other suppliers through its effect on competition for heat services.
	I.G.2. Displacement Effects on Nonregulated Heat Suppliers Same as I.G.1 above.
I.I.1. Regulation (Permits and Authorizations): Franchising	I.B.1. Taxation: Property Taxes The franchise agreement could alter or eliminate property taxes and substitute other taxes in their place (e.g., a gross earnings tax).
	I.B.3. Taxation: Selective and Excise Taxes A franchise agreement will likely entail the payment of a selective tax (gross earnings tax) on the value of DH sales, so the alternative for the franchising issue will affect the selective tax issue.

Table 8.3 (continued)

Issue	Issue affected
I.I.2. Regulation (Permits and Authorizations): Siting of Peaking Plants and Mobile Boilers	I.I.3. Regulation (Permits and Authorizations): Startup and Construction The alternative for handling the startup and construction permits could be influenced by the choice of alternatives for siting peak-load plants and mobile boilers because that choice could affect the design and the phasing of the system.
I.I.3. Regulation (Permits and Authorizations): Startup and Construction	I.I.2. Regulation (Permits and Authorizations): Siting of Peaking Plants and Mobile Boilers The approach to startup and construction permits could affect the choice of alternatives for siting peak-load facilities or temporary boilers because the design and phasing of the system could be affected.
Ownership Assumption: Public	
II.A.1. Form and Structure: Responsible Level of Government	II.A.2. Form and Structure: Operating Structure The choice of the mixture of public equity and debt financing used to establish the DH enterprise affects the operating structure decision because alternatives may have varying acceptability to the owning government depending on the level of ownership.
	II.A.3. Form and Structure: Policy Decisions Board The selection of the policy decisions board and the scope of its responsibilities will likely vary according to the levels of government ownership.
	II.B.1. Financing: Capital Structure The mix of government equity participation and outside debt financing will be directly affected by the level of government ownership and its capability to commit funds. It will also be affected through investors' assessment of risk

Table 8.3 (continued)

Issue	Issue affected
	because that will affect the financing options and cost alternatives.
	II.B.2. Financing: Types of Debt Financing Employed The choice of appropriate debt instruments will depend on the level of government which establishes or is created to operate the system because different instruments are sometimes available to different political bodies.
	II.D.4. Pricing Policy: Profit Motivation The decision of whether the enterprise should earn a profit will be determined by the owning government.
II.A.2. Form and Structure: Operating Structure	II.B.1. Financing: Capital Structure The selection of an operating structure for the firm will affect the capital structure decision through investors' assessment of risk. If investors perceive the operating structure to affect the business risk of the firm, the financing options and costs will be affected.
II.A.3. Form and Structure: Policy Decisions Board	II.A.2. Form and Structure: Operating Structure The policy decisions board alternative will directly affect the operating structure issue because definition of the scope of the board's role will delineate line management role.
	II.B.1. Financing: Capital Structure Because the alternative chosen for the policy decisions board issue will affect that board's responsibilities and authorities, the business risk of the firm will be affected. Through the investors' assessment of risk, this will directly affect the capital structure decision.

Table 8.3 (continued)

Issue	Issue affected
II.B.1. Financing Capital Structure	II.B.2. Financing: Types of Debt Financing Employed The choice of a capital structure may affect the type of debt issued because of the implicit allocation of risk between debt and equity suppliers which occurs. If, for example, a high debt-equity structure is chosen, certain types of bonds which give debt suppliers little or no security might become inappropriate given the high degree of financial risk which they may perceive.
II.B.2. Financing: Types of Debt Financing Employed	II.B.1. Financing: Capital Structure The choice of certain types of debt giving high security to bond holders might rule out the possibility of having a high debt-equity ratio.
II.D.1. Pricing Policy: Tariff Classification	None
II.D.2. Pricing Policy: Pricing Basis	II.H. Hookup Policy The choice of a pricing basis (e.g., cost-based pricing) could influence the hookup policy choice because of the effect that the latter choice could have on the cost and price of the service.
II.D.3. Pricing Policy: Rate Structure	None
II.D.4. Pricing Policy: Profit Motivation	II.A.1. Form and Structure: Responsible Level of Government The decision on profit motivation will affect the choice of a government owner because of the potential for various existing governmental entities to expect a contribution to their general fund. II.A.2. Form and Structure: Operating Structure The choice of a profit/nonprofit objective will affect the operating

Table 8.3 (continued)

Issue	Issue affected
	structure decision because the alternatives to the latter imply varying familiarity and capability to manage the enterprise with either objective.
	II.D.1. Pricing Policy: Tariff Classification The decision on profit motivation may affect the decision on tariff classification because of the potential for various services to be offered at a profit or at cost. If the enterprise seeks a profit on all services, services to certain classes of customers could conceivably be ruled out.
	II.D.3. Pricing Policy: Rate Structure and Market Sensitivity A decision to earn a profit on the DH investment will directly affect the cost of service; this profit must be apportioned through the rate structure, and it may not be spread evenly across all classes of customers.
	II.E. Allocation of Costs/Benefits Between Electrical Generation DH A profit objective may be incompatible in a competitive market with certain allocation methods due to their effect on the cost of service.
II.E. Allocation Between Electrical Generation and DH	II.B.1. Financing: Capital Structure The choice of a capital structure alternative may be influenced by the selection of a method of allocating joint plant and operating costs between electrical production and thermal production because that allocation method will affect the cost of DH and the amount of cash flow available for capital suppliers. This, in turn, could affect the risks perceived by investors and, thus, the capital structure decision.

Table 8.3 (continued)

Issue	Issue affected
II.F. Capital Investment Recovery for Building Owners	II.H. Hookup Policy If the hookup investment is attractive and the capital investment recovery alternative permits building owners to pass conversion costs on to tenants, the hookup policy may not be an issue. Alternatively, if owners cannot pass these costs on, the hookup policy may become important in establishing a customer base.
II.G.1 Displacement Effects on Regulated Heat Suppliers	None
II.G.2. Displacement Effects on Nonregulated Heat Suppliers	None
II.H. Hookup Policy	II.D.1. Pricing Policy: Tariff Classification The hookup policy will directly affect the choice of tariff classifications insofar as tariff classifications must discriminate among services provided to customers who own their heat exchanger and those who do not. II.F. Capital Investment Recovery for Building Owners The hookup policy could directly influence the capital investment recovery alternatives through its effect on hookup economics. If the hookup policy eliminated the conversion investment for building owners, for example, the capital investment recovery problem would be avoided. II.G.1. Displacement Effects on Regulated Heat Suppliers The hookup policy will directly affect the displacement issue because it will affect the amount of economic damage to other suppliers through its effect on competition for heat services.

Table 8.3 (continued)

Issue	Issue affected
	II.G.2. Displacement Effects on Nonregulated Heat Suppliers Same as II.G.1 above.
II.I.2. Regulation (Permits and Authorizations): Siting of Peak-load Plants and Mobile Boilers	II.I.3. Regulation (Permits and Authorizations): Startup and Construction The alternative for handling the startup and construction permits could be influenced by the choice of alternatives for siting peak-load plants and mobile boilers because that choice could affect the design and phasing of the system.
II.I.3. Regulation (Permits and Authorizations): Startup and Construction	II.I.2. Regulation (Permits and Authorizations): Siting of Peaking Plants and Mobile Boilers The approach to startup and construction permits could affect the choice of alternatives for siting peak-load facilities or temporary boilers because the design and phasing of the system could be affected.

8.3 Feasible Strategies for Base-Case Economic Scenarios

Issue maps help identify feasible strategies for development. For each issue, an alternative must be selected that is consistent with a given strategy. The worksheets that follow present alternatives for each issue and an indication of the effect of each alternative on system development (Tables 8.4 and 8.5). For instance, under the financing-capital structure issue, the alternatives range from 80% debt, 20% equity to 60% debt, 40% equity. The high-debt option would tend to minimize startup costs, operating costs, and startup risks. The higher equity option would tend to minimize delays, negative public reaction, and effects on existing institutions. The high-equity option would also promote long-term economic stability.

To identify a feasible strategy or combination of alternatives on a preliminary basis, seven steps must be taken:

1. assume an ownership option,
2. choose an initial issue,
3. select an alternative,
4. follow the arrows indicating a direct effect,
5. choose the "best" alternative for that issue,
6. proceed to the next issue, and
7. work backwards from the initially chosen issue to see if the choice of an alternative to that issue implies a particular choice on other issues.

The objective of this exercise is to stimulate discussion, challenge the relationships, and lead to an identification of an institutional framework (or set of such frameworks) that will minimize the risks from implementing cogeneration DH in the Twin Cities.

It is impossible to propose a feasible set of alternatives to the institutional issues without encountering the problems associated with underlying economics. Relationships among the issues appear to be weak compared with the economic consequences of the various alternatives. However, to focus on the relationships, some base-case economic scenarios are assumed.

Table 8.4. Twin Cities district heating study: feasible strategy worksheet (assuming private ownership)

Institutional issue	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
I.A.1 Financing: capital structure	1. 80% debt, 20% equity			X	X	X		
	2. 70% debt, 30% equity							
	3. 60% debt, 40% equity	X	X				X	X
I.A.2 Financing: types of debts	1. Mortgage bonds	X					X	X
	2. Debentures							
	3. Industrial development revenue bonds		X	X	X	X		
	4. Government guaranteed bonds							
I.B.1 Taxation: property taxes	1. No change	X					X	X
	2. Legislate to defer taxes							
	3. Lease government-owned facilities			X		X		
	4. Eliminate		X		X			
I.B.2 Taxation: sales tax	1. No change	X					X	X
	2. Lower or eliminate		X	X	X	X		
	3. Base on primary energy used							
I.B.3 Taxation: selective and excise taxes	1. No change	X					X	X
	2. Lower or eliminate tax on pipelines		X	X	X	X		
	3. Legislate to prohibit gross earnings tax on DH company		X	X	X	X		
I.C.1.a Regulation: income and service — decision whether to regulate	1. Do not regulate	X		X	X	X		X
	2. Regulate		X				X	
I.C.1.b Regulation: income and service — operating income regulation	1. Do not regulate	NA[a]		NA	NA	NA		NA
	2. Rate base, rate of return, and cost of service approach						X	

Table 8.4 (continued)

Institutional issue	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
	3. Cost index approach		X					
	4. Regulate income on cost of service approach, revenues by competitive price							
I.C.2 Regulation: income and service — startup loss recovery	1. No change	NA		NA	NA	NA	X	NA
	2. Capitalize initial losses							
	3. Government subsidy to cover loss		X					
I.C.3 Regulation: income and service — fuel/heat source cost pass-through	1. Automatic pass-through	NA	X	NA	NA	NA		NA
	2. No automatic pass-through						X	
I.C.4 Regulation: income and service — allowance for funds used during construction (AFUDC)	1. Capitalize AFUDC	NA		NA	NA	NA	X	NA
	2. Current customers pay AFUDC		X					
	3. Lease facilities from government							
I.C.6 Regulation: income and service — service area	1. Regulate service area	NA		NA	NA	NA	X	NA
	2. Do not regulate		X					
I.E Allocation of costs/benefits between electrical generation and thermal production	1. Do nothing	X						
	2. Legislate for rules hearing process				X		X	X
	3. Legislate methodology		X	X		X		
I.F Capital investment recovery for building owners	1. Do nothing							
	2. Negotiate with tenants						X	X
	3. Legislate to override lease provisions				X			

Table 8.4 (continued)

Institutional issue	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
	4. DH company pays conversion	X						
	5. Subsidize conversions		X	X		X		
I.G.1 Displacement effects: regulated suppliers	1. Do nothing	X	X	X	X	X		X
	2. Shield consumers from abandonment effects						X	
	3. DH company pays damage							
I.G.2 Displacement effects: non-regulated suppliers	1. Do nothing	X		X	X			X
	2. Purchase existing DH systems		X				X	
	3. Existing systems become customers					X		
I.H Hookup policy	1. DH company pays conversion costs	X						
	2. Customers pay conversion cost				X		X	X
	3. Conversion incentives/loans		X	X		X		
	4. Customers option to pay conversion							
I.I.1 Regulation: permits and authorization — franchising	1. Franchise in Minneapolis and St. Paul						X	X
	2. Franchise only in St. Paul	X	X	X	X	X		
I.I.2 Regulation: permits and authorizations — siting of peak-load plants and mobile boilers	1. Obtain exemptions				X			
	2. Emission offset							
	3. Advance assurance for future permits		X			X		
	4. Do nothing						X	X
	5. Limit system development to cogenerating capacity	X		X				
	6. Site peak-load facilities at power plant							

Table 8.4 (continued)

Institutional issue	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
	7. Fire peak-load units and mobile boilers with cleanest fuels							
I.I.3 Regulation: permits and authorizations — startup and construction	1. Do nothing						X	X
	2. Legislate to speed up process or to eliminate permits				X			
	3. "One-window" approach							
	4. Advance permits for long-range development		X			X		
	5. Limit expansion to existing units	X		X				

[a]Not applicable.

Table 8.5. Twin Cities district heating study: feasible strategy worksheet (assuming public ownership)

Institutional issue	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
II.A.1 Form and structure: responsible level of government	1. City	X		X				
	2. County							
	3. Multijurisdictional						X	X
	4. Metropolitan							
	5. State		X		X	X		
II.A.2 Form and structure: operating structure	1. Public operation	X						X
	2. Existing utility or DH company		X	X	X	X	X	
	3. New management company							
II.A.3 Form and structure: policy decisions board	1. Appointment with specified qualifications		X		X	X		X
	2. Appointment without specified qualifications	X		X				
	3. General election						X	
II.B.1 Financing: capital structure	1. Limit total indebtedness						X	
	2. Limit range of allowable capital structures							
	3. Leave decision to management and policy decisions board	X	X	X	X	X		X
II.D.2 Financing: types of debt financing used	1. General obligation bonds	X	X	X	X	X		
	2. Limited tax or special tax bonds							
	3. Revenue bonds						X	X
II.D.4 Pricing policy: profit motivation	1. "For-profit" enterprise							
	2. "Not-for-profit" enterprise	X	X	X	X	X	X	X

Table 8.5 (continued)

Institutional issues	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
II.E Allocation of costs/benefits between electrical generation and thermal production	1. Do nothing	X			X		X	X
	2. Legislate for rules hearing process		X	X		X		
	3. Legislate methodology							
II.F Capital investment recovery for building owners	1. Do nothing						X	X
	2. Negotiate with tenants				X			
	3. Legislate to override lease provisions							
	4. DH enterprise pays conversion	X						
	5. Subsidize conversions		X	X		X		
II.G.1 Displacement effects: regulated suppliers	1. Do nothing	X	X	X	X	X	X	X
	2. Shield consumers from abandonment effects							
	3. DH enterprise pays damages							
II.G.2 Displacement effects: non-regulated suppliers	1. Do nothing	X		X	X		X	X
	2. Buy existing DH systems		X			X		
	3. Existing systems become customers							
II.H Hookup policy	1. DH enterprise pays conversion costs	X						
	2. Customers pay conversion cost				X		X	X
	3. Conversion incentives/loans		X	X		X		
	4. Customer option to pay conversion							
II.I.2 Regulation: permits and authorizations — siting of peak-load plants and mobile boilers	1. Obtain exemptions				X			
	2. Emission offset							
	3. Advance assurance for future permits		X			X		
	4. Do nothing						X	X
	5. Limit system development to cogenerating capacity	X		X				

Table 8.5 (continued)

Institutional issues	Alternatives	Possible strategy to achieve stated objective						
		(1) Minimize delays	(2) Long-term economic stability	(3) Minimize startup costs	(4) Minimize operating costs	(5) Minimize startup risks for investors	(6) Minimize negative public reactions	(7) Minimize disruption to existing institutions
	6. Site peak-load facilities at power plant							
	7. Fire peak-load units and mobile boilers with cleanest fuels							
II.I.3 Regulation: permits and authorizations — start-up construction	1. Do nothing						X	X
	2. Legislate to speed up process or to eliminate permits				X			
	3. "One-window" approach							
	4. Advance permits for long-range development		X			X		
	5. Limit expansion to existing units	X		X				

Ownership assumption: Private

Feasible strategies (combinations of alternatives) are proposed for five base-case economic situations:

1.A. Economics of cogeneration DH are favorable without government subsidy or special treatment.

Customers have sufficient economic incentive to hook up without subsidy of conversion.

No special tax treatment.

No regulation by the Public Service Commission (PSC).

1.B. Same as 1.A but with regulation by the PSC.

2.A. Economics of cogeneration DH are favorable but expected returns are not commensurate with the project risk; investors need some reduction of risk before project can be implemented.

No regulation by the PSC.

2.B. Same as 2.A but with regulation by the PSC.

3. Economics are marginal, and risk is great enough that some form of government subsidy or preferential treatment is required.

Ownership assumption: Public

The base-case economic scenarios are as follows:

1. Economics of cogeneration DH are favorable without government subsidy. Customers have sufficient economic incentive to hook up without subsidy of conversion.

2. Economics are favorable given that certain institutional inducements or advantages can be provided; limited special treatment to encourage or ensure success of the enterprise is needed.

3. Economics are marginal, and some subsidy and special treatment are needed to make the concept successful.

8.4 Discussion of Feasible Strategies

Under the most favorable economic circumstances for private ownership (Table 8.6), the feasible strategy would not include any special treatment. The system could finance with normal debt and attract a high portion of the financing in equity. Customers could pay their own costs of hooking up to the system because the rates would provide adequate incentive. No special treatment would be required for taxes or permits. On the other hand, if the economics for DH are marginal, government-guaranteed bonds would be required for financing, exceptions to some taxes would be desired, and it would be necessary to provide additional incentives, such as low-interest loans or subsidy to customers to become part of the system.

Under the public ownership option, the comparison between the most favorable economic scenario and the situation with marginal economics is quite similar (Table 8.7).

The success in resolving issues that may impede development will determine the most appropriate set of alternatives for important issues. The feasible strategies developed represent a set of alternatives for each important issue appropriate to the economic and institutional climate of a particular project. These alternatives must be evaluated before a feasible strategy and an owner/operator can be identified.

Solving DH problems must be a cooperative effort involving government, industry, and consumers. A project team must be formed to negotiate with state regulatory agencies, the building owners, the utility, and the city. This cooperative effort can best result from a task force independent of state and local government but yet representing the interests of each of these groups. The goals and objectives of this task force would be to resolve the problems identified by the institutional issues study. The not-for-profit development corporation recommended as a result of this study would serve these purposes.

Table 8.6. Proposed alternatives for base-case economic scenarios (private ownership assumed)

Issue	Base-case economic situations[a]				
	1A	1B	2A	2B	3
I.A.1	3[a]	3	3	3	3
I.A.2	1	1	3	3	4
I.B.1	1	1	2	2	3
I.B.2	1	1	3	3	2
I.B.3	1	1	1	1	3
I.C.1.a	1	2	1	2	1
I.C.1.b	NA[b]	2	NA	3	NA
I.C.2	NA	2	NA	2	NA
I.C.3	NA	c	NA	c	NA
I.C.4	NA	1	NA	1	NA
I.C.6	NA	2	NA	2	NA
I.D.1	c	c	c	c	c
I.D.2	c	c	c	c	c
I.D.3	c	c	c	c	c
I.E	2	2	2	2	2
I.F	1	1	1	1	5
I.G.1	1	1	1	1	1
I.G.2	1	1	1	1	1
I.H	2	2	2	2	3
I.I.1	1	1	1	1	2
I.I.2	4	4	3	3	1
I.I.3	1	1	3	3	2

[a]The numbers in each base-case scenario column refer to the corresponding alternative for the issue listed on the worksheet (Table 8.4).

[b]Not applicable.

[c]Selection of any alternative to this issue would most likely be consistent with the base-case assumption. The alternative selected does not materially impact the choice of alternatives for other issues.

Table 8.7. Proposed alternatives for base-case economic scenarios (public ownership assumed)

Issue	Base-case economic situations[a]		
	1	2	3
II.A.1	*b*	*b*	*b*
II.A.2	*b*	2	2
II.A.3	*b*	*b*	*b*
II.B.1	3[a]	3	3
II.B.2	3	2	1
II.D.1	*b*	*b*	*b*
II.D.2	*b*	*b*	*b*
II.D.3	*b*	*b*	*b*
II.D.4	*b*	2	2
II.E	2	2	2
II.F	1	1	5
II.G.1	1	1	1
II.G.2	1	1	1
II.H	2	2	3
II.I.2	4	3	1
II.I.3	1	3	2

[a]The numbers in each base-case scenario column refer to the corresponding alternative for the issue listed on the worksheet (Table 8.5).

[b]Selection of any alternative to this issue would most likely be consistent with the base-case assumption. The alternative selected does not materially affect the choice of alternatives for other issues.

Appendix A

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.A Issue: Financing

I.A.1 Sub-Issue: Capital Structure

Issue Definition

Capital structure is the mixture of debt and equity which will be used to finance the start-up costs, expansion and working capital of the district heating system. For purposes of this study, it will be assumed that this mixture will remain approximately constant over the entire planning period.

Why Capital Structure is an Issue

Capital structure is an important financing issue because it has a direct impact on the cost of providing district heating services. The capital structure determines the amount of risk which must be assumed by debt holders and equity holders and thus dictates the interest rates which these investor groups will require. Equity is more expensive than debt and the higher the equity percentage the higher the weighted average cost of capital, all other things remaining equal. For the purposes of this study, it will be assumed that the firm will not issue preferred stock.

Impact

The capital structure decision will directly impact the financing costs for the D.H. company. Because debt and equity holders bear different amounts of financial risk, the returns they require also differ. In addition, the capital structure affects the financing costs through the interest deductibility feature for income tax purposes. The more debt the firm uses, the greater the interest deductions on its tax returns. Provided the firm is profitable and can use the tax deductions, substitutions of cheaper, tax-deductible debt for equity will lower the total costs of financing the firm, all other things remaining the same.

The capital structure decision may also impact the ease with which the firm can be financed. If the debt-to-equity ratio is too high, both debt and equity capital may become difficult to

obtain in the capital markets. Debt capital might become difficult to obtain because of the increased financial risk to debt holders, i.e., the increased risk of the firm being unable to meet fixed interest payments. Equity capital might also become difficult to raise because, as residual claimants, equity holders would have increased risk of not receiving their returns due to the large amount of fixed interest payments to be paid debt holders before any dividends could be distributed.

Alternatives

The debt/equity ratio or capital structure of the district heating company can be established in an infinite array of possibilities ranging from all debt to all equity. The most likely cases would probably range from 80% debt, 20% equity to 50% debt and 50% equity. The typical capital structure currently found for utilities is around 65% debt, 35% equity. (In 1977, for example, the debt/equity ratio for NSP and Minnegasco were 56/44 and 61/39, respectively.) The alternatives which will be analyzed for this study include two options for debt/equity ratios: 80/20 and 60/40 because these hypothetical capital structures lie within the range of reasonable expectations and will illustrate the salient financial effects.

Consequences

A simplified example will illustrate how the capital structure decision will impact the costs of providing district heating services.

For the sake of illustration, assume:

- Two alternative debt/equity structures: 80% debt, 20% equity and 60% debt, 40% equity.
- Cost of debt of 9.5%.
- Cost of equity of 14.5%.
- Total net investment (from Studsvick draft report, November 1978, Table 10):

  1985 - $86 million
  1990 - $171 million
  1995 - $353 million
  2000 - $549 million

- No federal, state, of local income taxes.

Then the weighted average cost of capital would be as follows:

Alternative 1:

Debt:	.80	@	9.5%	= 7.6%
Equity:	.20	@	14.5%	= 2.9%
Weighted Average Cost of Capital:				10.5%

Alternative 2:

Debt:	.60	@	9.5	= 5.7%
Equity:	.40	@	14.5	= 5.8%
Weighted Average Cost of Capital:				11.5%

A 1.0% (i.e., 11.5% - 10.5%) difference in the overall cost of capital on a $549 million investment in the year 2000 would have a $5.49 million impact on annual D.H. capital costs (assuming that there are no income taxes and that equity holders are actually paid their expected returns).

The above effects are illustrated for the first twenty years of the project development:

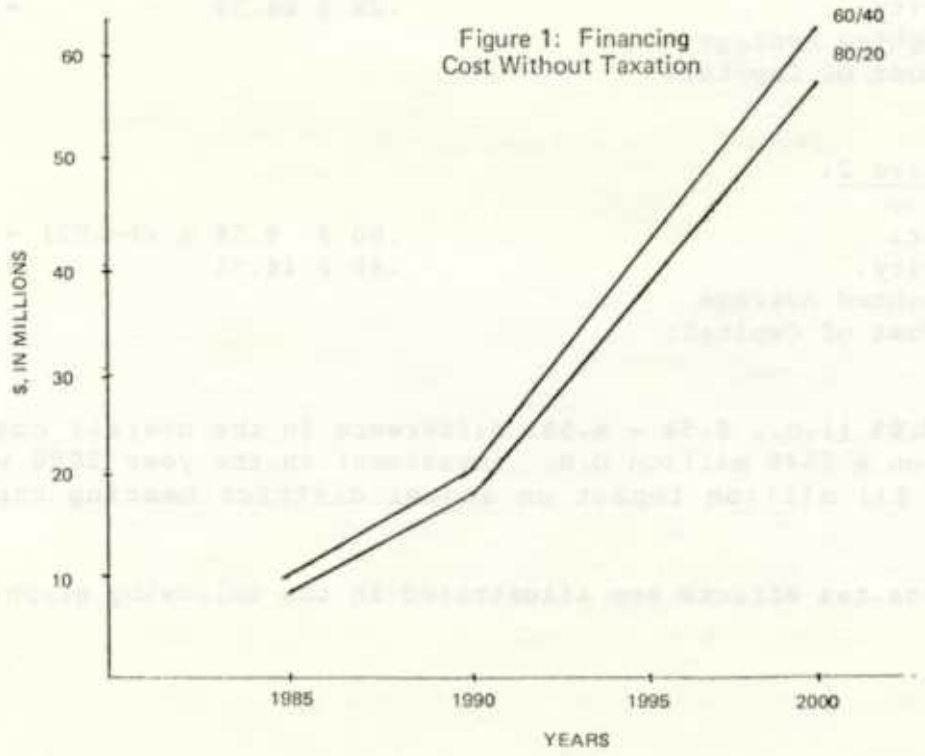


Figure 1: Financing Cost Without Taxation

Taxation effects. The above example is oversimplified in that it does not account for the income tax effect of interest expenses. Because interest expenses are deductible for tax purposes, the net cost of debt is less than what is actually paid out, assuming that the D.H. company is profitable and is subject to state and federal income taxes. Taking the tax effect of debt into account permits a lowering of the actual capital cost to the firm and an increase in the difference in the overall cost of capital between two alternative capital structures, as is shown in the following extension of the previous example.

For the sake of illustration, further assume:

- The D.H. system is profitable aqd must pay state and federal income taxes; and
- The combined tax rate for the firm is 52% of taxable income.

Then the effective weighted average cost of capital would be as follows:

Alternative 1:

Debt:	.80 @ 9.5% x (1-.52)	= 3.6%
Equity:	.20 @ 14.5%	= 2.9%
Weighted Average Cost of Capital:		6.5%

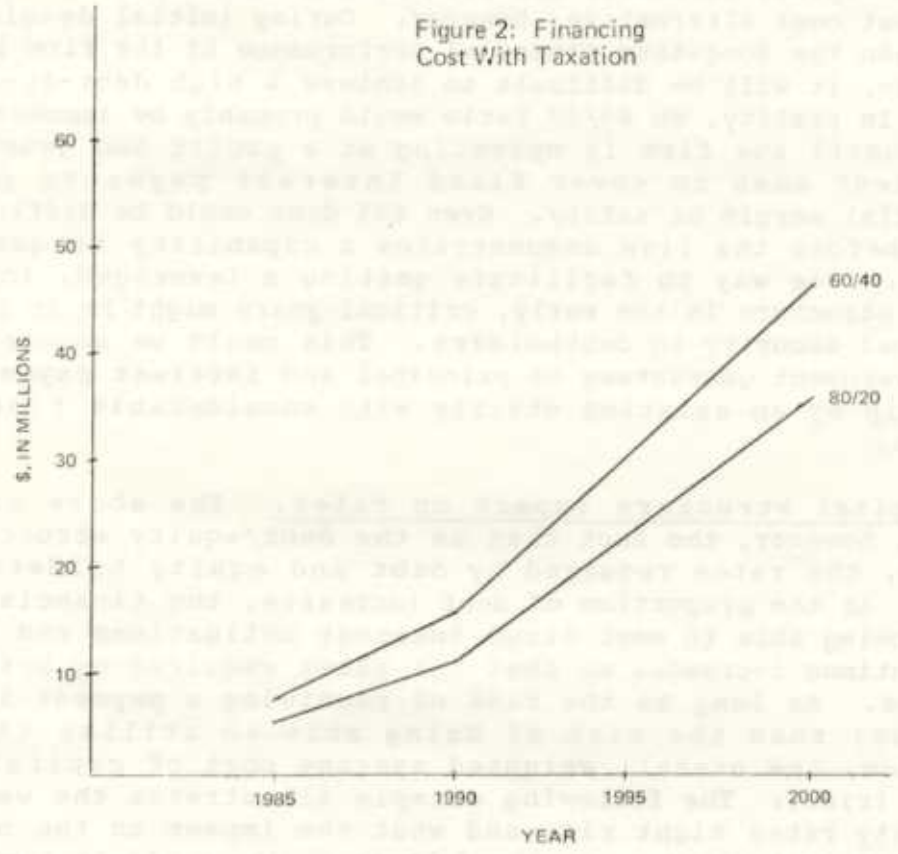
Alternative 2:

Debt:	.60 @ 9.5% x (1-.52)	= 2.7%
Equity:	.40 @ 14.5%	= 5.8%
Weighted Average Cost of Capital:		8.5%

A 2.0% (i.e., 8.5% - 6.5%) difference in the overall cost of capital on a $549 million D.H. investment in the year 2000 would have an $11 million impact on annual district heating capital costs.

These tax effects are illustrated in the following graph:

Figure 2: Financing
Cost With Taxation



When income tax effects are incorporated, the impact of the capital structure decision on capital costs becomes more pronounced. The higher the effective rate of tax that the firm must pay, the more critical this decision becomes. In the initial phases of expansion the district heating company will probably not operate at a profit, so a given change in the capital structure will not have as great a percentage impact on costs than if the firm were earning taxable income. However, it is during those early years that the firm will be least able to bear the sizeable capital costs so the capital structure decision will still be important. When the firm becomes profitable and can utilize the tax deductions for interest expenses, the cost implications of a capital structure change will be more critical.

The capital structure decision is not as simple as choosing the lowest cost alternative, however. During initial development years when the long-term financial performance of the firm is very uncertain, it will be difficult to achieve a high debt-to-equity ratio. In reality, an 80/20 ratio would probably be impossible to obtain until the firm is operating at a profit and generating sufficient cash to cover fixed interest payments plus a substantial margin of safety. Even 60% debt could be difficult to obtain before the firm demonstrates a capability to generate profits. One way to facilitate getting a leveraged, low-cost capital structure in the early, critical years might be to provide additional security to debtholders. This could be accomplished with government guarantees of principal and interest payments or ownership by an existing utility with considerable financial strength.

Capital structure impact on rates. The above example ignores, however, the fact that as the debt/equity structure is altered, the rates required by debt and equity holders also change. As the proportion of debt increases, the financial risk of not being able to meet fixed interest obligations and equity distributions increases so that the rates required by both also increase. As long as the risk of receiving a payment is less (greater) than the risk of being able to utilize the tax deduction, the overall weighted average cost of capital will decline (rise). The following example illustrates the way debt and equity rates might rise and what the impact on the overall cost of capital might be as the debt-to-equity ratio is increased:

50/50 Capital Structure:

Debt:	.50 @ 9.0% x (1-.52) =	2.2%
Equity:	.50 @ 14.0%	7.0%
Weighted Average Cost of Capital:		9.2%

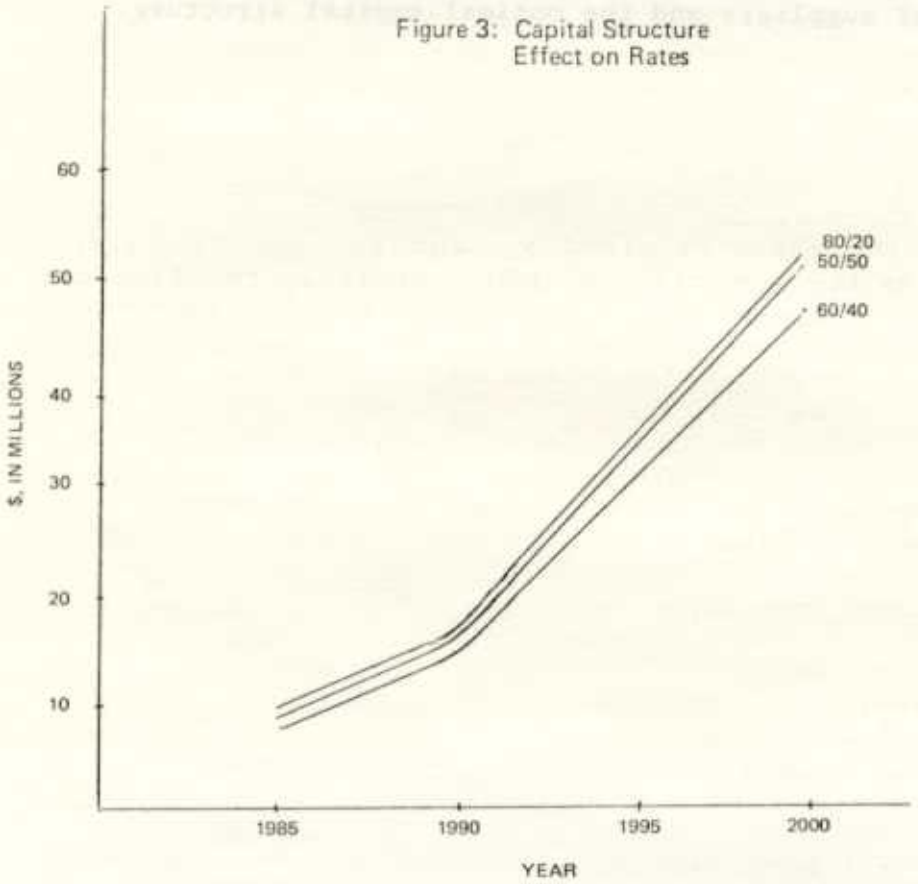
60/40 Capital Structure:

Debt:	.60 @ 9.5% x (1-.52) =	2.7%
Equity:	.40 @ 14.5%	5.8%
Weighted Average Cost of Capital:		8.5%

80/20 Capital Structure:

Debt:	.80 @ 14.0% x (1-.52) =	5.4%
Equity:	.20 @ 20.0%	4.0%
Weighted Average Cost of Capital:		9.4%

Figure 3: Capital Structure Effect on Rates



In summary, the basic consequence of the capital structure decision will be in terms of cost of capital. The precise impact will depend on the factors which determine the riskiness of the project, or the business risk of the D.H. system. The business risk will, in turn, influence the rates which debt and equity holders will require. Factors which will impact the business risk of the firm include:

- Market conditions--How certain are load projections? What is the hookup policy? What are supply and demand characteristics for competing heat sources?

- Start-up issues and problems--Is the company regulated? What taxes does the company pay? What is the cost of the hot water and is that fixed in the future?

The resolution of these issues and market conditions at the time capital is raised will jointly determine the rates required by capital suppliers and the optimal capital structure.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.A Issue: Financing

I.A.2 Sub-Issue: Types of Debt Financing Employed

Issue Definition

Debt represents capital loaned to the district heating firm for a specified period of time for a fixed rate of return. Debt claims on the firm do not represent any ownership rights in the firm and do not imply any control over the business or input into management decisions.

Why Type of Debt Financing is an Issue

The type of debt used to finance the district heating system is an important issue because:

- The amount of debt capital needed is likely to be large and the types of debt will have a significant effect on the cost of providing district heating services. Debt capital is available from different sources and has widely varying interest rates; for example, tax-exempt debt is issued by a taxing authority or other municipal authority and has lower interest costs than alternative sources.

- Different types of debt are used to finance different business needs and place varying restrictions and obligations on the issuer. In addition, different types of debt provide various levels of security for bond holders, and this factor will impact the ease with which the bonds can be sold and the rates which will be required. If the D.H. company is a new entity, certain types of debt may be unfeasible.

- The use of certain types of debt may have economic consequences for entities other than the D.H. system and may have different political acceptability. For example, although tax-exempt financing would produce lower interest costs for the D.H. system, there would be a loss of income tax revenue to the state. Because the D.H. system would benefit primarily Twin Cities residents, use of this type of financing could potentially be politically complicated.

Impact

The impact of the type of debt financing employed will be manifest in the interest rates the D.H. company must pay and the effect on capital costs of the firm. The higher the interest rate, the higher the total costs to system customers.

Alternatives

There are numerous sources and types of debt available in the market today; these are enumerated and discussed in the appendix. Some of these debt sources are clearly inappropriate for financing an investment such as a new district heating system. Others, however, should be studied and evaluated:

1. Mortgage bonds which are secured by the tangible assets of the company.

2. Debentures which are unsecured or issued solely on the general credit or earning power of the corporation.

3. Tax-exempt industrial development revenue bonds issued by the cities of Minneapolis and St. Paul; Hennepin and Ramsey counties; or the state of Minnesota.

4. Bonds issued by the D.H. company which are guaranteed as to principal and interest payments by the state or local government.

Consequences

The consequences of utilizing any of the above-mentioned alternatives can best be illustrated by showing the impact each might have on the total interest cost of the D.H. firm. It will be assumed for this illustrative example:

- Each type of debt would be the only type of debt issued by the firm and that debt would not have a sinking fund;

- The capital structure of the firm will be 60% debt, 40% equity;

- The total district heating investment will be equivalent to the net plant value taken from the draft of the Studsvik "Minneapolis - St. Paul District Heating Study" November, 1978 draft report (Table 10):

  1985 - $ 86 million;
  1990 - $171 million;
  1995 - $353 million,
  2000 - $549 million

- The firm will operate at a profit and will be able to use the interest tax deduction. Accordingly, the real interest rate to the firm will be equal to the nominal rate multiplied by one minus the marginal tax rate.

- The combined state and federal income tax rate will be 52%; and

- Based on advice from investment bankers in late October of 1978 and assuming an "A" bond rating, interest rates on the four alternatives might be:

  1. Mortgage bonds -- 9 3/4%

  2. Debentures -- 9 7/8%

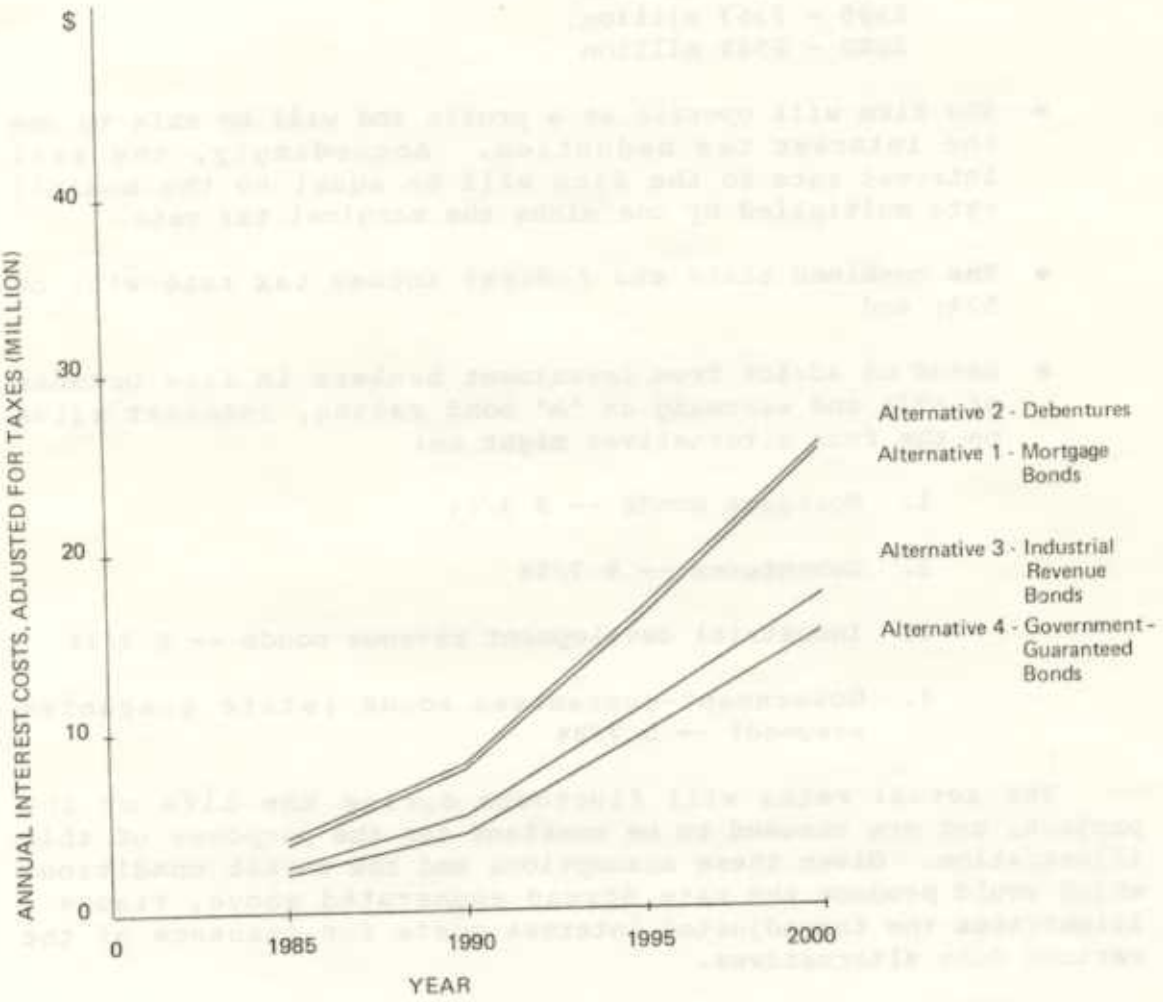
  3. Industrial development revenue bonds -- 6 3/4%

  4. Government-guaranteed bonds (state guarantee assumed) -- 5 7/8%

The actual rates will fluctuate during the life of the project, but are assumed to be constant for the purposes of this illustration. Given these assumptions and the market conditions which would produce the rate spread enumerated above, Figure 1 illustrates the tax-adjusted interest costs for issuance of the various debt alternatives.

The type of debt employed (and the characteristics of that debt issue, such as sinking fund provision, security, etc.) is extremely important in determining the capital costs to the D.H. firm, as is apparent in the above example. Depending on the overall economics of cogeneration district heating services, the type of debt instrument chosen and the resultant interest expense could be important factors to the competitive pricing of the product. This cannot be determined, however, without a complete economic feasibility and market study.

Figure 1: Tax-Adjusted Annual Interest Costs of Alternative Debt Issuances



The choice of a debt instrument is not quite so simple as selecting the lowest cost alternative as suggested by the above example. It will be difficult to predict the acceptability of a new district heating company's bonds in the marketplace, much less to predict the rates which would be required for any specific debt instrument. Supply and demand conditions in the bond markets may place premiums or discounts on various risk levels or characteristics of issues at any one time, so the offerings will always need to be tailored to those conditions. The spread between types of debt issues can fluctuate over time depending on market conditions, and this will impact interest costs and the choice of debt instruments and indenture provisions.

As the state and federal governments will not receive tax revenues from the interest payments on these securities, there may be social and political consequences as a result of their usage. At the present time, state statutes appear to include district heating systems for financing with industrial development revenue bonds, so legislative changes would not be required to accomplish this. State or municipal guarantee of an investor-owned corporation does not appear to be legal at this time, however, so legislation would be required to make this alternative a viable option. This latter alternative may not be politically acceptable, however, unless the chance of default on the bonds appears remote. Even if politically acceptable, passage of required legislation would cause further time delays to the project.

ALTERNATIVE FORMS OF DEBT

Bonds - Bonds represent a creditor relationship with the corporation and promise a fixed rate of return or interest on specified dates in the future; they have a fixed date of maturity but can be called under certain conditions prior to that maturity date. The bonds can either be sold to the general public or privately placed with an institutional investor, a small group of individual investors, or possibly with a government. Because bond holders do not have any ownership interests in the firm, they also do not have any direct control or voice in the management of the business; likewise, bond holders do not share in any residual earnings of the company. In the event of liquidation of the firm, debt holders' claims on assets must be satisfied before those of equity holders, so bond holders' investments are somewhat more secure than equity holders. The interest paid on the bonds by the corporation is deductible as an expense for income tax purposes. The following types of bonds might be considered to finance a district heating system:

Mortgage Bonds - Secured by specific tangible assets of the corporation which have a value equal to or exceeding the amount of the bond issue. In the event of default, the trustee for the bond holders can foreclose on the mortgage, sell the asset collateral and use the proceeds to pay the bondholders. Interest earnings are considered to be taxable income.

Debentures - Unsecured or general credit bonds of a corporation. Because the earning power of the firm is looked upon as the security for the bonds, the bond holders rank as general creditors in the event of liquidation of the firm. The indenture usually includes a "negative pledge" clause, however, which prohibits the borrower from pledging its assets to other creditors. Debentures are usually used only by well-established credit-worthy firms. Interest earnings are considered to be taxable income.

Subordinated Debentures - Like debentures, except that in the event of liquidation of the firm the holders' claims are subordinate to the claims of all other debt holders, requiring a higher interest rate than for straight debentures. Frequently, however, subordinated debentures are offered such that they are convertible into shares of common stock and this feature can cause the yield to be lower than what

would be available if the firm issued an ordinary debenture. Interest earnings are considered to be taxable income.

Collateral Trust Bonds - Bonds which are secured by stocks and bonds of other entities which are held by the corporation. The quality and interest rate of collateral trust bonds is very dependent on the quality of securities offered as security. Interest earnings are considered to be taxable income.

Income Bonds - Bonds which obligate the corporation to pay interest only when income is earned. For this reason, income bonds are usually issued only in reorganizations. Interest earnings are considered to be taxable income.

Equipment Trust Certificates - These debt instruments are sold to finance the purchase of equipment used by the issuing corporation. The bond proceeds pay for the equipment, title to which is held by a trustee; issuer makes lease payments to trustee sufficient to meet principal and interest payments. The trustee holds title to the assets until all principal and interest payments have been made at which time title passes to the issuer. Equipment trust certificates are used as a vehicle for financing the purchase of moveable, marketable equipment such as railroad rolling stock and airplanes. It is conceivable, however, that they could be used to finance district heating moveable boilers. Interest earnings are considered to be taxable income.

Convertible Bonds - Can be exchanged at the option of the bond holder for common stock of the corporation at a stipulated price. The convertible feature is used principally as a "sweetener" for bonds which might otherwise be unattractive to investors or which might require an interest rate in excess of what the corporation is willing to pay. Interest earnings are considered to be taxable income.

Tax-Exempt Industrial Development Revenue Bonds (IDR's) - Issued by a taxing authority to finance a loan to a non-governmental entity for the purpose of funding industrial development, hospital and health related projects, and polution control facilities. The issuer pays the bond proceeds to the entity being financed and receives in exchange a capital note and pledge of the revenues of that entity sufficient to satisfy principal and interest payment obligations. The corporation's interest expense is deductible for tax purposes and the bond holders' interest income is not subject to federal income tax or state income tax (if the

bondholder resides in the state where the bonds were issued). The obvious advantage of tax-exempt revenue bonds is that the interest cost to the firm being financed is much lower than if conventional, taxable, debt instruments were employed.

Government-Guaranteed Bonds - Bonds issued by a private corporation but guaranteed as to principal and interest payments by the federal, state or local government. This type of bond has been used especially in connection with ship financing, but conceivably could be utilized to provide security to the holders of the bonds issued by a large-scale district heating firm. The quality of the security or extent of any favorable impact on interest rates would depend, in large part, on the ability of the guarantor (i.e., the taxing authority) to back the guarantee with appropriations should the bonds go into default.

Mortgage Loans - A mortgage is a type of financing supplied by banks or other financial institutions; the loan to the corporation is secured by an equivalent or greater amount of real, fixed assets. Mortgages are typically employed to finance buildings and attached equipment which has a determinable market value. Because most of the assets of a new district heating system will be in the form of buried pipeline which can be presumed to have limited marketability, mortgage loans may be infeasible. Interest earnings are considered to be taxable income.

Commercial Paper - Commercial paper consists of short-term secured promissory notes issued by only the most credit-worthy companies. These notes, maturing in 270 days or less, are negotiable and sold in the money market principally to banks and corporations with idle cash. This means of financing which is used by industrial firms, finance companies, and utilities can be used to cover a short-term financing need or as permanent financing. A disadvantage of the latter usage is that the borrower who relies on commercial paper as permanent capital must be prepared to pay higher rates at certain times than could have been obtained on a long-term basis when the market conditions were favorable. It is assumed that commercial paper would be unavailable to the district heating system, at least in the early years, due to the inherent risk of the project. Interest is considered to be taxable income.

Other Loans - Money can be loaned to corporations by banks, financial institutions, or private lenders, usually for short to intermediate-term usage. These loans are usually secured by accounts receivable, inventories or other tangible assets or may

be made on the basis of the general credit worthiness of the borrower. Governments sometimes make loans to private individuals and small businesses to promote certain socially desirable causes, so it is conceivable that the state could lend to a district heating system.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.B Issue: Taxation

I.B.1 Sub-Issue: Property Tax

Issue Definition

Property taxes for commercial property in Minnesota are currently assessed on 43% of the limited market value, or taxable market value, of the property; a tax mill rate is then applied to this limited market value to obtain the amount of the tax to be paid. Each county collects the taxes which are levied by the various taxing authorities, including school districts, municipalities, county governments and watershed districts. The property taxes assessed in any given year are payable in two installments in the succeeding year.

Why Property Tax is an Issue

Property tax is an issue because the amount of the tax is a potential barrier to the economic viability of the district heating system. The D.H. system will be a capital-intensive operation with large investments for physical plant. The largest component of the total charge to customers is likely to be the returns to debt and equity holders financing the system (i.e., interest and dividend payments) and tax payments. The large capital or plant investment will represent a large tax base and consequently a sizeable property tax liability.

Impact

The impact of the property tax on the economics of a Twin Cities district heating system will primarily be felt in two ways:

- The property tax will add to the overall costs of providing district heating services; and
- The property tax could cause a substantial cash flow problem for the firm in the start-up years because taxes will be levied on a large investment which is generating little or no revenues. Even during the initial operating years, property taxes could conceivably exceed revenues due to the small customer base.

Alternatives

For the district heating system to succeed economically, its services will have to be priced competitively with other heat sources such as natural gas, oil, and electricity. Gas, oil, and electricity providers also pay property taxes, so there will likely be resistance to exempting a new hot water system which displaces those sources from such taxes. However, if society as a whole is to obtain the benefits from the heat which is otherwise rejected into the air or the rivers, then it may be necessary to grant some type of competitive economic advantage to the district heating system. One method of granting such an advantage might be through the property tax mechanism.

A range of alternative approaches to property tax treatment of the D.H. system can be enumerated at this time:

1. No change; tax the district heating system within the scope of existing legislation.

2. Assess property taxes on current basis but amend legislation to permit deferral of payment until the system generates sufficient cash to meet the obligation. Tax payment could be deferred for, say, five years, and then spread over a number of additional years to avoid large tax payments from coming due at some future point of time. Interest could also be assessed on these "legally deliquent" taxes.

3. Property tax expense could be eliminated or shifted by shifting ownership of the tax base properties; the state, municipality, or any other non-taxable entity could own the facilities and lease them, at cost, to the privately-owned D.H. company.

4. Property taxes could be eliminated altogether on the district heating system either for the startup period or indefinitely.

Work Required to Define Consequences

In order to define the consequences of each of the alternatives enumerated above, it will be necessary to:

- Investigate in greater depth the existing tax statutes in order to determine the economic impact on the D.H. company; many of the statutes pertain to steam or water distribution systems and it is not clear that they would all apply to a newly created hot water system.

- Estimate the amount of tax liability for each of the alternatives and define the finanical and cash flow implications; explore the economic sensitivity to several of the alternatives.

- Assess the potential political and social barriers to each alternative (eg., would local governments incur costs for which they were not reimbursed if property taxes were deferred or eliminated?)

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.B Issue: Taxation

I.B.2 Sub-Issue: Sales Tax

Issue Definition

Sales taxes are imposed on the total amount of retail sale by the state and/or local government. The sales tax is intended to be paid by the purchaser of a product or service but is collected by the seller. At present, Minnesota consumers of natural gas, coal, oil, electricity, steam, and hot or chilled water pay a sales tax on the retail value of the energy they use.

Why Sales Tax is an Issue

The sales tax is an institutional issue because the effect of the tax is to increase the overall cost of district heating services to consumers. In addition, private heating systems pay a sales tax on the fuel which they consume but not on the heat they produce; a district heating company might pay tax on the fuel consumed and then its consumers would pay again on the value of the heat sold, thus impacting the relative economics of one heat source versus the other. The sales tax is applied uniformly on the retail value of sale which itself is impacted by federal price controls, state utility regulation, and the characteristics and scarcity of alternative heat sources.

Impact

At the current rate, sales tax will increase the total cost of district heat to customers by 4%.

Alternatives

The current sales tax system does not address the problem of fuel conservation or usage in Minnesota because it applies uniformly to retail value and does not influence the allocation of scarce fuels or the amount of primary energy consumed to provide like amounts of space heat. Cogeneration district heating is fuel efficient because it utilized heat which would otherwise be rejected into either the atmosphere or rivers. One way of encouraging conservation of other fuels might be to insure that the cost of using cogeneration district heating is lower than the

cost of using any of the available alternatives. The sales tax applied to the value of D. H. services is one mechanism which affects that cost.

Alternatives for sales tax treatment of district heating hot water sales include:

1. No change in sales tax; sale tax base would remain the retail value of D.H. sale and would be collected by D.H. company;

2. Lower the sales tax rate from the present level or eliminate it in order to grant a competitive advantage to D.H. sales;

3. Restructure the sales tax on heating alternatives and base tax on the amount of primary energy consumed or amount of heat delivered to the conditioned space.

Work Required to Define Consequences

In order to explicitly define the consequences of the above alternatives, it will be necessary to:

- Develop a simplified heat consumption example to demonstrate the conservation or economic implications of utilizing alternative heat sources; use this model to test the sensitivity to changes in sales tax and in order to predict the response of consumers to changes in the sales tax structure.

- Assess economic impact on providers of alternative fuels caused by changes in the sales tax.

- Assess potential social and political problems or advantages to a change in the sales tax structure or application.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.B Issue: Taxation

I.B.3 Sub-Issue: Selective and Excise Tax

Issue Definition

Numerous states and municipalities impose selective or excise taxes on specific commodities or services in lieu of or in addition to general sales taxes. These selective taxes are commonly imposed on items of consumption such as tobacco, amusements, and motor fuel, but also appear in the form of personal property taxes on pipelines or gross revenue taxes in lieu of general sales taxes on public utility sales.

Why Selective and Excise Tax is an Issue

Selective and excise taxes, like sales and property taxes, are institutional issues because they, too, increase the cost of district heating services to the final consumer. In Minnesota, a personal property tax is levied on pipelines used for distributing steam or water, and because the bulk of the district heating company's assets will be in that form, the total tax liability is likely to be great. In addition, several metropolitan communities, including St. Paul, impose a gross earnings tax on electric sales and it is possible they would do the same on the district heating sales.

Impact

Although these taxes are imposed on the D. H. company, the incidence of the tax is on the users of the heat produced because the tax is passed on through the rates just like any other operating expense. Accordingly, the total cost of district heating to the community is increased by the full amount of tax. The St. Paul gross earnings tax is currently 8.7%.

Alternatives:

The alternative methods of handling selective and excise taxes are specific to the particular tax; options include:

1. Tax the D. H. transmission and distribution pipelines as provided for by existing statutes.

2. Lower tax rates or eliminate the personal property tax on cogeneration pipelines to encourage development.

3. Prohibit individual communities from assessing gross earnings taxes on sales of thermal energy produced by cogeneration.

Work Required to Define Consequences

To define the consequences of each of the above alternatives it will be necessary to.

- Determine the amount of the tax liability for each of the alternatives and define the economic and cash flow implications of each;

- Assess legal problems and ramifications of limiting local governments from passing selective taxes;

- Assess potential political and social barriers to each alternative.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.C. Issue: Regulation - Income and Service

I.C.1a. Sub-issue: Decision of Whether to Regulate the District Heating Company

Issue Definition

The district heating company may or may not be established as a public utility whose policy and operating decisions are subject to approval by a regulatory agency. In Minnesota, the Public Service Commission currently has authority to regulate public utilitites (i.e., gas and electric utilities) but is not empowered to regulate district heating companies. It has the authority to regulate public utility rates and revenues; to approve capital structures; to approve the issuance of securities; to establish depreciation methods and rates; to regulate the expansion of service to new customers; to prescribe standards of service; and to perform other specific regulatory responsibilities. For the purposes of this paper, it will be assumed that the Minnesota Public Service Commission would be the regulatory authority if the D.H. company was regulated.

Why the Decision of Whether to Regulate the District Heating Company is an Issue

The question of whether to regulate the district heating company is an important institutional issue because it could influence the acceptability of the project to the public and could have a direct impact on the cost of hot water services to its customers. If the D.H. company is regulated, that decision may contribute to the establishment of a degree of credibility and public acceptance of the project. However, it will also create an additional layer of expense due to increased administrative cost, rate case preparation and hearings expenses, and regulatory delays.

Impact

The impact of regulation will depend on the form and degree of that regulation. The impact it will have on the public's acceptance of the project or on the rates paid by customers cannot be precisely measured at this time. It could affect all aspects of the financing and economic feasibility of the project, however, if the regulation is extensive.

Alternatives

There are two basic alternatives to the regulation question:

1. Do not regulate the district heating company. The company's management would have complete authority and responsibility for setting prices and operating policies, as do other non-regulated companies. It would be assumed that competition from other fuel sources would be sufficient to assure that the public and consumer would be treated fairly.

2. Regulate the district heating company. The form and degree of regulation could be made the same as for public utilities by bringing D.H. company under current statutes, or the regulation could be modified in scope to permit more or less operating flexibility for the company.

Consequences

Alternative 1 - Do Not Regulate:

If the D.H. company is not regulated, it will theoretically be better able to respond to changes in its economic environment and to allocate resources according to management's perception of where it can obtain the highest return on the investment. Free market economic theory suggests that by allowing the firm to operate in such a manner, resources will be efficiently allocated and society will be better served in the long run.

A second implication is that without regulation, costs which would have been incurred in complying with regulation (both the company's cost and the state's cost) would be avoided, thus lowering the total cost of providing district heating services. Lower costs could lead to lower district heating rates and an enhanced competitive position for the firm.

The public might not be convinced that the economy operated efficiently and rationally, however, and might be concerned about the possibility of the district heating company earning excessive profits or of not serving the customers in an equitable manner. This concern is important because hookup is a long-term decision. Unless potential consumers feel assured that they will be treated fairly, they may be reluctant to convert, thus jeopardizing system development. In the absence of state regulation, other means might have to be developed for dealing with this potential consequence.

In the initial development phases, however, the customer base will likely be composed of large commercial and industrial users. These types of customers can be expected to be in a better bargaining position than small residential customers and, as such, will be less likely to need the protection of a state regulator. As the system expands and begins to serve small commercial and residential customers, regulation might become appropriate.

Once customers hook up to the district heating system, the firm might have the equivalent of a monopoly position due to the expense that customers would incur in reconverting to another heat source. If abuses developed as a result of this "locking in" effect (e.g., poor service or unjustifiably high rates), it might become appropriate to regulate the firm. It may be more likely, however, that the company's rates would be adequately constrained by the long-term contracts which are common between D.H. companies and their customers. Such contracts, up to twenty years in length, provide a mutually agreeable mechanism whereby certain cost escalations can be passed on to customers. Even more important in holding down rates is the specter of the firm losing its future markets as a result of a reputation earned for inequitable treatment of customers or rates higher than alternative heat sources. As long as competition exists for heat sources and as long as the D.H. company desires to expand, it appears unlikely that regulation of rates would be of much value to the consumer.

Alternative 2 - Regulate:

If the district heating company is regulated by the PSC, the firm might be in a less favorable position for responding to changes in its environment. Regulation of rates, for example, could prevent management from responding quickly to changes in the economic environment, which might dictate an immediate increase in rates. Under current regulation and application of statutes, a delay of three to four months could be expected for response to a rate request. This restriction of management action could represent increased risk for investors to bear and, consequently, could result in higher equity returns. Accordingly, D.H. rates to consumers might be higher with regulation than without regulation.

Regulation will also add to the cost of operating the D.H. system due to the compliance requirements, costs of preparing and filing rate requests, etc. Several large public utilities in Minnesota state that PSC regulation costs their customers an estimated $500,000 to $1,000,000 per year and that expenses attributable to regulation are increasing rapidly. Regulatory costs for the D.H. firm would probably be less, however.

In addition, regulation might reduce the capability of the D.H. firm to generate sufficient internal capital for expansion if it was required to charge customers lower rates than what the market would bear. This could force the company to obtain more funds for expansion from the capital markets than it might otherwise do, thus adding to the total cost of providing hot water. The effect of any of these increases in cost on D.H. rates might be mitigated, however, by any lowering of the return to investors which might be achieved through regulation and the resultant lowering of the risk to equity suppliers. No conclusive statements in this regard can be made at this time, however, and these matters would have to be studied in more detail.

Regulation could have a favorable impact on the public's acceptance of the project. If operating income and rates are regulated, it will, at the very least, give the appearance that the interests of the consumer are being protected and that the firm is not being allowed to earn "monopolistic" profits. If the regulation accomplishes its objective and actually lowers the profits and total costs of the D.H. system, then consumers will benefit.

Finally, regulation of the firm in a manner similar to current regulation of public utilities will present other problems which are addressed separately in other issue papers. These concerns include:

- Operating income regulation (Issue paper I.C.1b);
- Start-up loss recovery (I.C.2);
- Fuel/heat source cost pass-through (I.C.3);
- Allowance for funds used during construction (I.C.4);
- Plant siting (I.C.5);
- Service area regulation (I.C.6);
- Regulation of quality and availability of service (I.C.7);
- Allocation of cost/benefits between electrical generation and district heating (I.E.).

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.C. Issue: Regulation - Income and Service

I.C.1b. Sub-issue: Operating Income Regulation

Issue Definition:

If the district heating company is established as a public utility whose overall rates and revenues are subject to approval by a regulatory agency, it will not be free to set prices based upon management's assessment of price sensitivity of demand, competitive prices and its operating costs. The regulatory agency will be responsible for reviewing the company's application for price changes and for determining the company's allowable revenues and operating income. There are several methods or approaches which could be used by the regulatory authority to determine the company's authorized revenue and operating income requirement. For purposes of this study we will assume that the Minnesota Public Service Commission would be the regulatory authority if the D. H. company was regulated.

Why Operating Income Regulation is an Issue:

Operating income regulation is a significant institutional issue because the form and degree of regulation will impact the economic viability of the D. H. company and the overall public acceptance and attitude towards the D. H. system. An unregulated company theoretically is better able to respond to changes in its environment and to balance the current and future revenue requirements of the company with its long-range development goals. A regulated company may be subject to additional administrative costs and regulatory delays. However, regulation can contribute towards establishing a public credibility and acceptance by providing a mechanism for assuring the public that the utility is not earning excessive (monopolistic) profits and that management is acting in a prudent manner.

Impact:

The impact of the form and degree of regulation cannot be precisely measured but could affect all aspects of the financing and economic feasibility of the company. It will impact:

- Cost of financing (debt and equity);
- The type of financing;
- The initial pricing of D. H. services, and
- All changes in prices of D. H. services (timing and amount).

Alternatives:

There are two basic alternatives: either regulate operating income or allow the D. H. company to operate independently. However, there are several possible forms of regulation, for purposes of this study the following specific alternatives should be considered:

1. Do not regulate the company's operating income or revenues. The company's management would have complete authority and responsibility for setting prices as do other non-regulated companies. It would be assumed that competition from other fuel sources would be sufficient to assure that the public and consumer would be treated fairly.

2. Regulate the company's operating income and revenues using a rate base, rate of return and cost of service approach similiar to that being used to regulate other utilities within the state.

3. Regulate the company's operating income and revenues using a cost indexing approach. A cost index approach would allow the company to automatically increase rates whenever the return earned by the company fell below authorized levels. The regulating authority would establish the authorized return periodically and review the company's operations to make sure the company's expenses were maintained at reasonable levels.

4. Regulate the company's operating income based upon its cost of service (including capital costs) and regulate its revenues based upon competitive prices. Differences between revenues and cost of service would be paid to NSP as payment for heat source.

Work Required to Define Consequences:

In order to define the consequences of these alternatives it will be necessary to:

- Evaluate the impact of an unregulated company on overall consumer and public acceptance by meeting with selected customer groups (e.g. BOMA) and selected consumer organizations.

Work Required to Define Consequences (continued):

- Analyze projected costs and competitive prices to determine whether an unregulated company would potentially be in position to set prices above cost of service.

- Review existing D. H. systems to determine the nature of regulation (if any), the pricing practices of the companies, the role of competition, the extent of long-term contracts, and other pertinent factors.

- Establish a set of scenarios designed to show overall sensitivity of major economic factors to alternative regulatory approaches.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership: Private

I.C. Issue: Regulation - Income and Service

I.C.2 Sub-Issue: Start-up Loss Recovery in a Regulated Environment

Issue Definition

It is not unusual for a new business enterprise to experience operating losses during the initial years of existence. These losses are typically due to factors such as production capacity exceeding sales, initial organizational expenses, and large depreciation and interest expenses. Suppliers of capital, however, are willing to undertake such investments because they expect to more than compensate for those start-up losses with earnings after the business becomes established.

Why Start-up Loss Recovery in a Regulated Environment is an Issue

It is reasonable to assume that a new cogeneration district heating company will experience initial operating losses: The company will have to be in existence for one or two years in order to build the transmission and distribution lines and during this time the company is likely to have little or no revenue but will have substantial expenses. New customers will be connected gradually over a period of time and it is likely that sales will not reach a breakeven point for a number of years after the construction period.

In a regulated environment, a utility's rates to customers are generally based on current operating expenses and a return allowed to the suppliers of capital. It may not be economically sound to price district heating services to recover all costs during the start-up years; therefore, the district heating company may experience operating losses until the number of customers reaches a certain level. It is reasonable to assume that the company will require compensation for such losses. However, traditional regulatory practices do not provide a mechanism for recovery of past operating losses.

Impact

Unless the privately owned district heating company is allowed to recover initial operating losses or receives direct

government subsidy for those losses, it is unlikely that the business venture will be undertaken by anyone. The real issue, then, is probably how start-up losses can be recovered in a regulated environment as opposed to should the D.H. company be allowed to recover them.

Alternatives

Several approaches to the start-up loss recovery issue can be suggested:

1. Do nothing at this time and rely on the Public Service Commission to handle the problem when it occurs. Because initial losses are normal business risks, the suppliers of debt and equity capital are cognizant of the likelihood of that occurrence at the time they make their investments. Accordingly, these capital suppliers evaluate overall risk in that context and the initial losses should be reflected in the rates of return allowed equity and debt holders after the utility stabilizes. If the utility is regulated, it will be up to the Public Service Commission to set those rates in recognition of the need for higher returns.

2. Capitalize start-up losses. Initial losses or start-up expenses which are not covered by revenues can be treated in the same manner as construction work-in-progress which becomes part of the rate base when the plant is placed in service. Much of the start-up expense does not relate to current service but rather to future service, so these expenses could be collected in an account together with an allowance for funds used during start-up (similar to AFUDC) until such time that the portion of the system related to those expenses is placed into service. At that time, these capitalized expenses would become part of the rate base and would be amortized over a period of years.

3. Direct government subsidy of losses. In view of the intrinsic benefits to the Twin Cities, the state, and the country, the district heating company could be reimbursed by one or more levels of government for start-up losses.

Consequences

Alternative 1 - Do nothing:

Assuming that the cogeneration district heating system would be regulated by the state Public Service Commission in a manner

and scope similar to the regulation of existing public utilities, the problem that potential sponsors would face is one of predicting how the PSC would treat start-up losses. The Public Service Commission and staff have not had to deal extensively with regulatory problems of a start-up situation, so there are no clear precedents for treatment of initial losses. In normal situations, the Commission and its staff study the special problems and characteristics of a utility and then allow a rate of return commensurate with the risks inherent to the business. Current practice does not reveal what the rate will be in advance of a rate case filing, nor will there be any assurance that the rate will be maintained. Consequently, investors would have no indication of the rate of return which would be allowed on their investment or any assurance that the rate would be maintained in the future. This would probably render the investment incapable of being evaluated. Without rigorous analysis of the project economics and a degree of comfort in the assumptions, it is unlikely that anyone would be willing to make the required investment.

Another problem with Alternative 1, assuming a regulated environment, is that the Commission evaluates current risks when a rate case is heard and grants a rate of return based on what is required to attract new capital and to maintain financial integrity. Once the district heating utility is beyond the start-up loss period and is beginning to earn a return on its investment, the rate of return granted by the Commission based upon the conventional criteria would be insufficient for recovering past operating losses.

After the PSC grants a rate of return, the utility can then charge rates to customers which will generate revenues sufficient to produce the allowable rate of return. There is no assurance that the district heating company would be able to earn the allowable rate of return in the start-up years due to the fact that the price for district heating services will most likely be a function of what the market will bear. During those years, pricing D.H. services to generate that return would likely price the product out of the market. If the product is competitively priced, the allowable rate of return would probably not be earned. There are no provisions for recapture of these missed returns in the future, in the existing regulatory environment.

Potential project sponsors can be expected to recognize the problems associated with recovering start-up losses in the current regulatory environment and will need some assurance that the status quo determination of rate of return will not be applicable to them. The Commission would have to treat this public utility differently from all other public utilities under its jurisdiction and investors may be unwilling to take the risk of this happening.

Alternative 2 - Capitalize Start-up Losses:

This alternative suggests a variation of the current regulatory treatment for allowance for funds used during construction (AFUDC) whereby the earnings that investors would have earned (had their funds not been tied up in utility construction) are capitalized along with other new plant costs. Then, when the new plant is placed in service, the total construction costs plus the AFUDC becomes part of the rate base or total investment upon which the investors are allowed to earn a rate of return. In the district heating application, start-up losses could be treated in a similar fashion. Because the system would be operating at less than capacity during initial years, the difference between what the firm was allowed to earn and what it could actually earn would be capitalized. When the system reached a fully developed stage, the firm would earn a return not only on what it had invested in tangible assets, but also on foregone earnings. In essence, these foregone earnings would become part of the total investment.

This approach could have considerable impact on the ability of the company to attract capital at reasonable cost. The effect of the start-up loss capitalization is to guarantee investors an opportunity to earn a rate of return over the long term. Of course, anticipated returns might not be achieved if the system is intrinsically uneconomic, but the regulatory risk would at least be significantly reduced.

One problem with this approach is the method by which the amount of start-up losses to capitalize would be determined. Should all of the loss be capitalized, or only those losses up to a certain level? Should actual losses be capitalized or only planned or budgeted losses? How long should the company be allowed to capitalize losses? The Commission may wish to exercise some control over the operations of the D.H. company by limiting the amount of loss capitalized or the period over which this procedure would be permitted. If so, these conditions will most likely have to be specified in advance of a sponsor's committment to undertake the project.

Another potential problem with this alternative is the effect that the magnitude of capitalized losses would have on future district heating rates. Although the Studsvik draft report (November, 1978) indicated breakeven within a few years of start-up, losses could conceivably continue for five to ten years. Because the amount of capitalized start-up loss compounds with each succeeding year of operating loss, the cumulative effect could become very great over the start-up period and could become a serious burden to system customers in the future. An economic feasibility study will have to be performed to clarify this potential problem.

One additional problem which might be experienced with this approach is the degree of certainty of ever being able to recover the start-up losses, even given an initial favorable ruling. Should fuel price escalations turn out to be less dramatic than anticipated, market forces could postpone or even rule out recapture. Alternatively, a change in Commission sentiment and the rules could prevent further capitalization of start-up losses after the system was operating. Both of these risks are of the type with which the potential investors will be ill-equipped to deal, but which are very real.

The consequence of using this approach to the start-up loss recovery problem is that special legislation or PSC rules authorizing capitalization of initial losses, how the amount of loss will be determined, what the allowable period for capitalization is, and any other conditions, will be required before a sponsor could be expected to make a firm commitment to the project. Either method of specifying this special regulatory treatment will take from one to two years to accomplish.

Alternative 3 - Direct Government Subsidy:

The most obvious consequence of providing a direct government subsidy to cover the D.H. company's initial losses is that much of the economic uncertainty would be eliminated for potential investors and effectively shifted to some level of government which perceived the benefits to be derived. This alternative would probably maximize the probability of an investor committing to undertake the project.

Such an alternative also has its obvious problems. The most significant is the difficulty associated with getting approval and commitment from a government. Underlying this are other questions and problems of predicting the amount of loss and subsidy, the degree of risk sharing by the levels of government and the D.H. firm, the possibility of perpetual subsidy, and the fact that primarily commercial entities would have their heating costs subsidized. In view of all these problems and the inevitable political controversy, it is questionable whether this alternative would be viable.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.C. Issue: Regulation - Income and Service

I.C.3. Sub-issue: Fuel/Heat Source Cost Pass-Through

Issue Definition:

The major variable operating expense of the D. H. company will be the cost of its hot water (from NSP) and the fuel cost used for the peaking boilers. If the company is regulated and rates are set on a cost of service basis, it may be possible for the company to have a fuel/heat source adjustment clause similar to the purchased gas adjustment and fuel adjustment clauses now used by most regulated utilities.

Why Fuel/Heat Source Cost Pass-Through is an Issue:

A fuel/heat source cost pass-through clause will have a significant impact on the earnings stability of the D. H. company if fuel and heat source costs accelerate rapidly. Without such a clause, the company may be subject to frequent rate hearings and substantial delay in adjusting rates to reflect the increased costs. On the other hand, it may be argued that such clauses tend to circumvent the basic purpose of regulation and eliminate incentive for the company to properly control these costs. In addition, since NSP has a fuel adjustment clause, it is possible that there will be frequent increases in the base hot water charges from them to the D. H. company.

Impact:

If boiler fuel costs and NSP charges accelerate rapidly over an extended period of time, the D.H. company might not be able to earn an adequate return on investment if it cannot pass cost increases through to customers. This could make equity financing of a major system extremely expensive, if not impossible. On the other hand, frequent price changes triggered by the clause could severly impact the market and public acceptance of the D. H. system.

Alternatives:

There are two basic alternatives:

1. Incorporate an automatic fuel/heat source adjustment clause in the rates (including contract rates) established for the D. H. company.

2. Do not include an automatic fuel/heat source adjustment clause in the D. H. company's rates.

Work Required to Define Consequence:

- Review Studsvik draft report to determine relative significance of fuel/heat source cost on total costs of the D. H. company.

- Review projections for future costs of coal, oil and natural gas and develop detailed fuel cost/heat source projections for the D. H. company under a variety of assumptions.

- Develop scenarios showing potential financial impact of fuel/heat source cost adjustment clause alternatives.

- Evaluate market impact of frequent rate changes resulting from adjustment clauses.

- Evaluate public and political reaction to adjustment clauses.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.C. Issue: Regulation - Income and Service

I.C.4. Sub-Issue: Allowance for Funds Used During Construction

Issue Definition

An allowance for funds used during construction (AFUDC) is a non-cash item that utilities are commonly allowed to add to the construction cost of a facility to compensate for the "opportunity cost" of having funds tied up in building new capacity as opposed to earning a return in an alternative use. AFUDC is computed by applying an established percentage rate to the eligible construction work-in-process (CWIP) account balance. The resultant product is generally added to the CWIP account until the plant is placed in service, at which time the entire balance, CWIP and AFUDC, becomes part of the rate base.

For a regulated utility, CWIP and AFUDC are treated in one of three manners:

- CWIP is excluded from the rate base and AFUDC is not considered in determining revenue requirements.
- CWIP is included in the rate base and revenue requirements from current customers are reduced by the amount of AFUDC (method generally used by Minnesota PSC).
- CWIP is included in the rate base and no AFUDC is charged or capitalized.

Why AFUDC is an Issue

In the case where AFUDC is added to the CWIP account balance, it actually becomes part of the utility's investment and must be amortized over the life of the plant. Proponents of this approach argue that it results in spreading the total cost of the plant to those consumers who eventually use the plant's output. If AFUDC is not charged and CWIP is included in the current rate base, however, current utility customers must bear the opportunity cost of having funds tied up in construction. Proponents of this latter approach argue that a) the method provides immediate cash and reduces the need for raising capital, thus lowering

the overall cash and reducing the cost of capital, b) the plant expansion will benefit existing users, and c) inclusion of the AFUDC costs in the current rates will tend to dampen demand and cause future expansions to be smaller. The question of whether to capitalize AFUDC is an important institutional issue because of the impact that it would have on rates and on demand for D.H. services.

AFUDC impacts the economic viability of the district heating system because:

- Capitalization of AFUDC slows the cash flow to the D.H. company and cash flow is likely to be a significant start-up problem (assuming cost based rates);

- Capitalization will tend to lower rates in initial years and raise them when the construction projects go into service. This effect will tend to make capitalization of AFUDC more attractive to consumers on a cost basis and will tend to favor hookup over the situation in which AFUDC is charged to current customers.

In the initial start-up phase of the D.H. system during which there are no customers, capitalization of AFUDC is not an issue because all AFUDC will be capitalized. AFUDC will be an issue, then, only when there is an expansion of the system after startup.

Impact

AFUDC rates are currently in the 6% to 10% range and could increase total capital requirement by that amount.

Alternatives

The following alternatives to the AFUDC issue can be enumerated at this time:

1. Capitalize AFUDC and amortize over future based upon system usage; solve cash flow problem with permanent financing;

2. Charge AFUDC to current customers through rates, if feasible;

3. Have state ownership of facilities with D.H. company leasing or paying a use fee based on amount of usage by current customers; a use tax could also be paid to state by consumer but collected by the D.H. company.

Work Required to Define Consequences

In order to define the consequences of the above alternatives, it will be necessary to:

- Define the possible cash flow and rate impact of each alternative using base case expenses and construction cost assumptions;

- Assess the potential social or political barriers to the alternatives (eg: there may be resistance or legal barriers to the state owning an investment and leasing or renting to the D.H. company);

- Assess the sensitivity of rates to alternative amortization periods.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership: Private

I.C Issue: Regulation - Income and Service

I.C.6 Sub-Issue: Service Area

Issue Definition

The service area for the district heating firm can be defined to be that geographic territory encompassing the market or potential market of the system. The service area can be established on a de facto basis as that territory which the company actually serves or, by regulation, as that area which the firm is allowed to serve or is required to serve.

Why Service Area Regulation is an Issue

Service area regulation is an issue because a regulating body could require the company to serve customers or entire areas which management might not otherwise serve. This reduces management prerogatives and potentially increases risk to capital suppliers to the extent that the company is forced to serve non-economic areas.

The base case assumes that there will only be one owner of the Twin Cities district heating system. Should there be separate owners in Minneapolis and St. Paul, service area regulation may be more appropriate for defining the boundaries of their respective systems.

Impact

The impact of service area regulation will depend on the degree of such regulation. If the regulation was intended to provide an official challenge and approval process for managements' expansion plans and not to interfere with the actual determination of service area based on long-term economic considerations, regulation would likely entail little adverse impact on the viability of the system. However, if the regulatory officials were permitted to require the D.H. company to expand into marginally profitable or unprofitable areas in order to meet certain social goals (e.g., to provide inexpensive heat to housing projects or to encourage development in depressed areas), then service area regulation will add to the risk of the undertaking and may necessitate system expenditures which must be amortized over other customers.

Alternatives

Basically, there are two alternative methods of approaching the service area regulation issue:

1. Regulate service area; if the Public Service Commission is given the responsibility to regulate the D.H. service area, it would do so in a manner consistent with the enabling legislation and objectives of the Commission.

2. Do not regulate service area; if the company was not regulated, management would be free to expand service to new areas or to incorporate whatever buildings it deemed appropriate based upon its objectives and criteria for growth, profit, and financial stability.

Alternative 1 - Regulate Service Area:

The Public Service Commission would not be given authority to regulate the district heating company in a manner and scope similar to the regulation of other public utilities unless the public utility regulatory statutes were amended to so provide. At present, the PSC only regulates the service areas for electric utilities "in order to encourage the development of coordinated statewide electric service at retail, to eliminate or avoid unnecessary duplication of electric utility facilities, and to promote economical, efficient, and adequate electric service to the public..." (Minn. Sta. Ch. 216B.37).

If the state legislature perceives a need to expand the cogeneration district heating service as rapidly and as widely as possible, the statutes would have to be amended to include district heating as a public utility and to provide service area regulation. In that event, the Commission could require the D.H. company to serve marginally economic or uneconomic areas or buildings "consistent with the financial and economic requirements of public utilities" (Minn. Sta. Ch. 216B.01). It is possible that the limited resources of the new company would be stretched beyond what is appropriate. In addition, the company might lose control over which individual buildings would be connected, and this factor could be important if the D.H. company had to assume conversion costs (see Issue Paper I.H. - Hookup Policy). Together, these factors (or the possibility of their materialization) would tend to increase the risk of the business and would lead to higher capital costs. This, in turn, could lead to higher district heating prices for consumers.

Alternative 2 - Do Not Regulate Service Area:

Even if the Public Service Commission is granted authority to regulate the company's income and service, it need not be given a mandate to regulate service area. Currently, only electric utilities have service areas regulated in Minnesota.

Should the D.H. company be exempt from service area regulation, it will be free to allocate resources in order to expand service into new areas or connect new customers as management deems appropriate. This may be desirable for a new cogeneration district heating company because it would be able to expand service based solely on such long-run criteria as profitability instead of social good. To the extent that the firm is free to pursue actions which will result in financial stability and long-term growth, the community may be best served.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.D Issue: Pricing Policy

I.D.1 Sub-Issue: Tariff Classification

Issue Definition

A tariff classification is the "product line" of the district heating services which may be obtained by a consumer from the district heating system. Each individual service offering is described by specific terms, conditions and characteristics of the service.

Why Tariff Classification is an Issue

In order to be effective in the competitive marketplace, the district heating system must offer a flexible range of services under terms and conditions which are mutually consistent with market needs and system needs. The several temperature, pressures and flow rates which could be available to customers must be evaluated in terms of market impact. The availability of the services must be defined geographically and the applicability of the service to various end use patterns must be established to properly balance desirable system usages with potential needed customer usages. Any special conditions or restrictions on system operation, reliability, or safety must be properly identified and specified in the tariff classifications. Tariff classifications designed to promote specific system objectives must be established to assure economic operation of the system. Special contract services designed to meet unique heating needs must also be considered in developing appropriate pricing policies.

Impact

A number of examples can be given to illustrate the impact of inappropriate rate classification:

- Were the heating system to fail to distinguish between peak and off-peak services in its service classifications and subsequent pricing policies, on-peak customers would be inappropriately encouraged to use the system and off-peak customers would be effectively discouraged from using the system. This would create an undesirable system load pattern.

- Were the heating system to fail to distinguish between density of service areas in its pricing policies and service offerings, growth of district heating installation may be subsidized in the less dense areas relative to the more dense areas.

If the tariff classification is not well researched and designed, the district heating system will risk not properly matching its products with the needs of the marketplace, thus jeopardizing market acceptance and rapid system development.

Alternatives

Specific service offerings could be developed for an infinite variety of use patterns. At a minimum, the following structural variables should be considered in formulating study alternatives:

- Availability Condition Variables:
  - Segmented Market
    - .. Urban high density.
    - .. Urban low density.
    - .. Suburban density.
  - Average system density.
- Load Condition Variables:
  - Market Load Groups
    - .. Standard residential, volume, temperature, hookup and metering ranges.
    - .. Intermediate volume, temperature, hookup and metering ranges.
    - .. High volume, temperature, hookup and metering ranges.
  - Average system volume, hookup and metering.
- Load Timing Variables:
  - Peak Load Pricing
    - .. Peak period cogeneration service.
    - .. Off-peak period cogeneration service.
  - Annualized heating service.

- Wholesale/Retail

- Contract Provisions

Work Required to Define Consequences

In order to complete the analysis of the impact of alternative tariff classification schemes upon the marketability of district heating services it will be necessary to:

- Review existing tariff classification systems currently in use such as those employed by Central Heating Company, NSP, and other district heating services in the country.

- Establish revised service classification variables and alternatives consistant with above findings and Minnesota-specific district heating cogeneration considerations.

- Establish appropriate parameters of service availability, load ranges and load periods for the respective service variable classifications.

- Identify the potential markets associated with the alternative service classifications utilizing the results of the DOE/MEA Building Conversion Retrofit Study, other available market data and market questionnaires.

- Summarize the results of the service classification study.

  - Identify and discuss the potential customer markets and excluded customer markets under the alternative service classifications.

  - Prepare data for use in the study of Pricing Basis, and Rate Structure and Market Sensitivity sub-issues. (Issue Papers I.D.2 and I.D.3).

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.D. Issue: Pricing Policy

I.D.2 Sub-Issue: Pricing Basis

Issue Definition

The pricing basis is the method, or group of methods, employed to determine appropriate market prices for the district heating system services defined in the tariff classification. The primary bases of pricing include competitive service based pricing, cost based pricing, social cost/benefit pricing and practical constraint pricing.

Why Pricing Basis is an Issue

Energy prices are the subject of intense local and national scrutiny resulting from the increased cost of energy, supply limitations and other factors. Energy suppliers, whether directly regulated or not, are typically required to provide the rationale underlying their specific energy prices. The various methods employed in arriving at appropriate district heating system prices will likely produce substantially different prices and, as such, will be closely scrutinized and will be the subjects of considerable controversy. Different price levels will also impact the revenues available and the overall economic viability of D.H. system.

Impact

The upper level for the prices which may be charged for the various district heating services will be constrained to the prices that consumers will be willing to pay for the service plus any possible consumer subsidies which may be available. The lower level of prices is constrained by the costs and profit requirements of the system less any system subsidies which may be available.

The upper range or "ceiling" price for the district heating system is constrained by the competitive price of energy alternatives but is not necessarily equal to the current costs of alternative energy systems. Longer-term cash flow and discounting analysis must be conducted to determine "life cycle" costs for the district heating competitive alternatives. Considering the fairly broad range of estimates now available for long-term prices of gas, oil, electric and other heat delivery

systems, life cycle costs must necessarily be evaluated with several plausible scenarios. In addition, separate energy prices will exist for the various different service classifications of each energy source (e.g., Industrial Rates, Commercial Rates, Promotional Rates, etc.).

The determination of the price "floor" and intermediate cost-based prices for the various district heating services is complicated in that there are a number of "cost based" methods which may be used to develop "product or service" costs and each of the several methods are in themselves complex. Although an in-depth discussion of the various costing methods and their effects on service costing is beyond the immediate needs of this discussion, some background may be useful.

The costing methodologies which may be used in determining the costs of various services may be categorized with respect to the types of cost data used in the methodology and the methods employed to properly segregate the costs to specific services.

The alternative types of cost data frequently used in pricing/costing studies include:

- Accounting (book) data,
- Current or replacement cost data, and
- Discounted long-run cost estimates.

Methods which are employed in evaluating cost data and properly segregating cost into appropriate service categories include:

- Profit margin contribution analysis of variable costs,
- Full cost (fixed and variable) allocation (there are over twenty methods for determining full cost allocation), and
- Marginal cost allocation.

Socio-political influences are also factors which can impact the feasibility of the system. Energy prices, particularly for heating uses in cold climates, are a matter of considerable public interest with regard to the welfare and safety of the public and for energy conservation. Many people regard energy pricing as an issue which must be directly addressed by sociopolitical determinations. Consequently, these form an additional basis for pricing energy. In practice, these determinations result in economic subsidization of one or more

tariff classes at the expense of other tariff classes or the society as a whole. Typically, such subsidies are directed to residential customers or, more broadly, to life supporting uses. Specialized forms of subsidies have further delineated specific groups such as the elderly or welfare recipients.

Practical constraints play an important part in establishing specific rates (issue I.D.3 - Rate Structure) and, to a certain extent, also place limitations upon the underlying pricing methodologies used. The primary practical constraints are those associated with the gathering of statistics needed to utilize a methodology and the types of metering which can be economically employed in the system. Historical pricing precedents may also constrain the use of a particular methodology. For example, the concept of "postage stamp rates" has long been applied in pricing studies. Under this concept, consumers who live near a service source are priced the same as those of a like class who are remote from the service source. This is done for reasons of convenience, simplicity and social considerations. Practical considerations such as plant efficiency, safety, and competitive strategies also influence the selection and detailed design of a pricing methodology.

Alternatives

Several reasonable pricing basis methodologies should be selected for analyzing the impact of alternative pricing bases upon the feasability of the system. The following alternatives are suggested:

1. Utilize discounted life cycle costs for gas, oil, and electric heating systems for service classifications corresponding to those developed for the district heating system in order to establish ceiling prices. Optimistic, pessimistic and assumed mean price projections should be used.

2. Utilize profit margin contribution analysis of variable costs to establish floor costs/revenue requirements for district heating service classifications.

3. Utilize fully allocated discounted long-run costs to establish intermediate level revenue requirements for each service classification. The allocation analysis should encompass the complete cogeneration system and should be based upon the financial alternatives discussed elsewhere in this paper.

4. Utilize social policy options such as single and multi-unit residential rates pegged at the competitive price (with other classifications absorbing the subsidy), or utilize the social policy options developed for hookup policy.

Work required to define consequences

In order to complete the analysis of the effects of alternative pricing bases on the feasibility of the district heating system, it will be necessary to:

- Prepare life cycle cost projections of competitive energy sources appropriate to the district heating service classes.
- Identify representative capital and operational costs of the system.
- Conduct an analysis of variable costs by service classifications.
- Identify an appropriate demand allocation model and fully allocate the discounted projections of district heating system costs to the service classifications utilizing the various social policy options.
- Prepare appropriate descriptive and summary material which demonstrate the effects of the pricing basis alternatives on the feasibility of the district heating system.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.D. Issue: Pricing Policy

I.D.3. Sub-Issue: Rate Structure and Market Sensitivity

Issue Definition

Rate structure refers to the specific prices and billing approaches established for the various district heating services specified in the tariff classification. (For a discussion of the tariff classification, refer to Issue Paper I.D.1). The prices charged for these services must be consistent with service cost constraints which were discussed in Issue Paper I.D.2 - Pricing Basis, and also must be consistent with market sensitivity factors so as to attract a sufficient number of customers to assure the economic viability of the system.

Why Rate Structure and Market Sensitivity are Issues

The pricing structure must complement the tariff classification by encouraging desired system usage and discouraging undesirable system usage. For example, if district heating had a natural competitive advantage and industrial process applications did not, the district heating company might want to structure rates differently for those uses in order to make district heating an attractive alternative for both.

In order to properly balance the available supply of district heating services to the demand for services which exist at the various possible prices, a pricing analysis must be undertaken. This pricing analysis or market study must provide information regarding the potential demand for the possible services as well as an estimate of the price sensitivity of that demand. This information, then, would become the basis for determination of an appropriate rate structure.

An inappropriate pricing strategy, particularily at the onset of the new district heating service, could have long-term detrimental effects for the district heating company. Moreover, without some assessment of how (or if) potential consumers of the various services would respond to the district heating services offered at the specified prices, the economic feasibility of district heating cannot be assessed.

Impact

A number of examples can be given to illustrate the impact of pricing on the feasibility of district heating services:

- Were the heating system to charge "average prices" to all consumers, it is possible that certain potential consumers whose usage of services would be beneficial to the stability of the system, might not utilize the system. Prices nearer the variable cost "floor" might attract customer usages which would not otherwise be attracted.

- Prices which fail to properly distinguish between on-peak and off-peak demands may create a situation where the cogeneration plant is significantly underutilized in off-peak periods.

Alternatives

Rate structures and prices should be established and markets tested for each of the service classification alternatives. Alternative structures and prices which should be considered are:

1. Marginal cost floor prices (whereby certain services are priced according to their incremental service cost);

2. Average cost pricing (whereby prices for services are based upon the average cost for all customers and services); and

3. Competitive substitute pricing (whereby services might be priced according to the prices prevailing in the marketplace for similar services).

Work Required to Define Consequences

In order to complete the analysis of pricing, the following work tasks must be undertaken:

- Develop test rate structures and prices based upon:

  - A review of comparable pricing structures employed by Central Heating Co., NSP, and other central heating services in the country.

  - A review of rate structure innovations and strategies for competing heating sources.

- A review of the Pricing Basis Analysis results for district heating. (see Issue Paper I.D.2).

- Develop structured and open-ended questionnaires and survey the potential markets for the various district heating services using those questionnaires.

- Determine realistic revenue sensitivity measures of the various services based upon market survey and elasticity study results.

- Analyze available price elasticity and cross-elasticity studies for competing heating sources.

- Prepare a summary assessment paper on rate structures and market sensitivity.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.E. Issue: Allocation of Costs/Benefits Between Electrical Generation and District Heating

Issue Definition

The base load hot water for the district heating system will be produced by NSP utilizing existing generating plants. The price which NSP charges the D.H. system for this hot water allocates the costs and benefits of cogeneration between electric customers and district heating customers. There are two basic approaches for determining that price:

- A traditional cost-based public service approach to pricing; and
- A market-based pricing approach which recognizes that economic considerations dictating the feasibility of marketing district heating services in a competitive environment would be used as the pricing criteria.

Variations of either approach are discussed in Appendix 1.

Why Allocation of Costs/Benefits Between Electrical Generation and District Heating is an Issue

Allocation of the costs of cogenerating electricity and hot water to those respective systems is an important institutional issue because the price of the hot water may be critical to the financial feasibility of the project. It is possible that without assurances on how the raw material inputs to the district heating system will be priced, the degree of risk and uncertainty of the project will be great.

The public's perception of the benefits of district heating, their views as to what approach constitutes a "fair" costing, and the specter of electrical consumers subsidizing district heating customers is apt to generate considerable controversy. To some extent, the degree of public acceptability of the project will depend on how these issues are communicated to the public, how well they are understood, and how the pricing issue is resolved.

Under current regulatory practice in Minnesota, the Public Service Commission can establish prices for NSP as part of a rate case. The Commission decides on issues which are currently before it and does not rule on matters which may arise in the future. Therefore, there is no way to assure how the PSC will rule when it is faced with the allocation of costs between electrical generation and district heating.

The potential institutional barrier is really not which allocation methodology to use (even though that choice is probably critical to the system's economic feasibility) but what process would be used for selecting that method? That process must be a public process that gives all impacted parties an opportunity to affect the decision.

Impact

Unless agreement can be reached very early in the project's development on how the hot water will be priced, it is possible that the project will not be undertaken. Cost of the heat source to the district heating company could potentially be a major operating expense, and not knowing the price with some certainty in advance could jeopardize implementation.

Alternatives

Several approaches to the problem of choosing a methodology for allocation of costs/benefits between electrical generation and district heating can be suggested:

1. Do nothing, and let the Commission decide what is fair and reasonable when the matter comes up in a rate hearing.

2. Pass legislation which would mandate definitive authority to the Commission to establish the allocation methodology in advance through its rules hearing process.

3. Pass legislation which would establish the allocation methodology prior to further system development.

Consequences

The basic institutional barrier is the selection of a process to be used in establishing an allocation methodology.

All of the alternatives suggested above will eventually resolve the uncertainty as to which methodology would be acceptable in determining district heating costs, but the sequence of events leading up to the selection would differ.

Alternative 1 - Do Nothing:

If the allocation problem were ignored and the resolution of the issue was left to the rate case process, one possible outcome is that the district heating project might never be undertaken. This could occur if:

- The price of the thermal energy appeared to be a major component in total system costs;
- There was a substantial difference in the effects of the alternative allocation methodologies which, given a particular alternative, could make the price of hot water competitive or uncompetitive with other heat sources; and
- Potential owners/operators perceived that the risk of the Commission choosing a methodology which resulted in cogeneration district heating services to be priced out of the market was too great to justify the investment.

Another possible outcome, however, is that potential investors/operators would not perceive the risk of an adverse allocation ruling to be so great as to prevent system development. Between these two extremes is another possible outcome, that being that the system would not be developed until the economics were favorable enough to render the allocation choice immaterial.

Appendix 2 contrasts the possible impact that two different allocation methodologies might have on district heating prices. The illustrative example presented demonstrates that, given the assumptions, the cost of district heating services to consumers could conceivably be 20 to 25% higher using a full cost methodology instead of an incremental cost allocation methodology. The actual magnitude could be somewhat greater or lesser depending on market conditions. Consequently, the alternative of leaving establishment of the allocation methodology up to chance is probably not a viable alternative because it might result in no one being willing to take that risk of the Commission choosing a methodology which rendered the D.H. system economically unfeasible.

Alternative 2 - Assign Allocation Authority to PSC:

The Minnesota Public Service Commission currently has the authority through the rules hearing process to establish the methodology for allocating costs between electrical generation and thermal generation. It does not, however, have a clear mandate to do so because there are no large-scale cogeneration district heating systems in operation in the state. Accordingly, the Commission is unlikely, at the present time, to devote time and resources to the resolution of an issue which does not impact its decisions on current utility rate cases.

This potential barrier to the implementation of a cogeneration district heating system could be removed if the state legislature were to provide the mandate for a ruling. Legislation could give the Commission a clear directive to establish the allocation methodology within a specified time frame. Then, regardless of the ruling, potential D.H. promoters would be able to evaluate the economics of building the system and selling the thermal energy in a competitive environment.

One consequence of this approach is that the entire process could take up to two years to complete. The legislation itself could involve a year or more of delay, and the Commission rule hearing process could take an additional year. This delay may be preferable, however, to the uncertainty of having no established allocation methodology or the uncertainty of the Commission deciding to make a ruling without a legislation mandate.

This alternative does not give any assurance that the Commission would specify the methodology most favorable to district heating. The legislation could, however, provide some directive to the Commission in making its choice such that electrical consumers would be no worse off than they are under the status quo and that the economic benefits would be apportioned in a way that gave economic incentive to the establishment of cogeneration district heating systems.

Alternative 3 - Legislate Allocation Methodolgy:

An allocation methodology could also be established directly by means of legislation. This, too, would serve to dispell the uncertainty of not having an established methodology, but it would also take two or more years to complete. Legislation would have to be proposed and complete hearings would have to be conducted before the legislature could vote on a proposal. Even then, there would be no assurance that a specific proposal favorable to district heating would be adopted.

APPENDIX 1

Several methodologies are available for determining the price which NSP can charge for thermal energy. If the price of district heating services is cost based, the choice of allocation methodology will have a direct impact on the economic feasibility of the project. The approach which is used could contribute either to the determination of a competitive price which encouraged system growth, or, at the opposite extreme, to rendering the project infeasible due to the high cost of hot water. Ultimately, the resolution of this issue could decide whether or not Minnesota will be able to realize the conservation potentials of cogeneration.

It is reasonable to assume that any costing methodology which would result in higher cost per unit of electrical output would be unacceptable to the Commmission, to NSP, and to electrical customers. Because the High Bridge and Riverside plants are higher-cost plants in NSP's system, and because the cogeneration scheme will necessitate utilizing these plants more than NSP would in the absence of district heating, some costing approaches would result in higher per unit electrical costs. This effect could be compounded if the unit cost rose at other NSP sites due to the resulting lower levels of usage. Although these effects would likely be minor (because the Twin Cities plants are small relative to total system electrical production), the methodology chosen must, at the very least, allocate enough benefits to electrical production to offset them. This would rule out the possibility of electrical customers cross-subsidizing district heating. The problem then becomes how should the benefits of cogeneration be allocated so as to be equitable and to move High Bridge and Riverside up in the order of dispatch, thus giving NSP economic incentives favorable to cogeneration district heating.

Various alternative approaches can be suggested for allocating the costs/benefits of cogeneration between electrical generation and district heating. It will be assumed for all alternatives that costs which are directly related to district heating (e.g., costs of converting NSP facilities; start-up engineering and design work; preparation and filing expenses associated with the permit process; costs incurred by NSP due to changes in the load dispatch; etc.) will be charged accordingly. Alternatives include:

- Charge to district heating on an incremental cost basis. Electrical generation would be allocated all costs normally required for the generation of electricity, and any

additional expense would be considered the cost of producing hot water. These incremental costs would be those directly related costs, enumerated above, plus an adjustment for any derate in the electrical generating capacity caused by the conversion, less any savings brought about by the discontinuation of the use of the plant's condenser. For example, if conversion permitted only 75% of the normal electrical generation for a given amount of expense (due to extraction before the low-pressure turbine), then 25% of normal operating costs would be charged to district heating.

This type of cost allocation would require a fairly sophisticated simulation of NSP's costs and electrical output with and without the district heating load. The incremental costing alternative might be intuitively appealing because in the absence of district heating, the reject heat has no monetary value; accordingly, the true costs of the hot water can be considered to be the incremental costs. this methodology might be less theoretically sound, though, for application to any new facilities which were added at the cogeneration sites primarily for their contribution to district heating. In that case, an "equal discount" method might be employed which would give benefits to both systems and would provide thermal energy at a lower price than that obtained by separate generation.

- Charge the district heating company on an incremental cost basis, as outlined above, plus a service fee. The service fee paid to NSP would, in effect, serve to split the benefits of cogeneration between NSP and the D.H. company and would serve to lower the unit electrical costs at the plant, thereby encouraging use of that plant.

- Charge district heating for the fully absorbed cost of producing the hot water. All costs not readily assignable to a specific product would be pooled and then allocated to either electrical production or thermal production based upon some rational basis. This allocation could be based, for example, on the usable energy delivered in the form of a saleable product. Then, if 70% of the usable energy went to district heating and 30% to electrical generation, joint costs (such as fuel costs, boiler depreciation, debt service, maintenance, etc.) would

be allocated accordingly. Proponents might argue that, once converted, the power plants are dedicated to both electrical and hot water generation and, therefore, costs should be so divided.

- NSP and the district heating company could negotiate a sale price for the reject heat, and the revenue derived from those sales would serve to reduce the costs of electrical generation. For example, the thermal energy sale price might be based on an allocation of the savings due to cogeneration to electrical and hot water production. Regulatory authorities would then insure that the negotiated settlement was equal to or greater than the incremental cost to NSP of providing the heat so that electrical customers would not bear any burden as a result of district heating.

- Costs could be allocated to electrical generation and district heating based upon competitive considerations. District heating services might be priced to compete in the marketplace with other available alternatives. Then, total district heating costs - including depreciation on pipelines, debt service, maintenance, overhead, NSP direct district heating costs, other operating expenses and a reasonable profit - would be deducted, leaving the residual for payment to NSP. This amount would be deducted from total expenses of the cogeneration plant, and the remainder would be the cost of electrical generation. This alternative may have some appeal because of its simplicity and because it insures a competitive advantage for district heating. It does not guarantee that any benefits will accrue to electrical customers, but if the system is economically viable, electrical customers should receive some of the benefits of cogeneration.

The impact of the use of two different costing methodologies can be highlighted in an illustrative example. It will be assumed that:

- Separate Generation. If only hot water was produced at a district heating plant, the full cost (including full plant capital costs, maintenance of plant, etc.) would be approximately $2.20 per million BTU's.*

- Incremental Cost. If hot water was produced as the result of cogeneration, and the cost of the thermal energy was determined on an incremental basis, the energy would cost approximately $1.20 per million BTU's.*

- Full Cost. If the hot water was produced as the result of cogeneration and the cost of the thermal energy was determined on a full cost basis, the energy would cost approximately $2.45 per million BTU's.*

- Transmission, Distribution and Overhead. An additional cost of $4 per million BTU's would be required for the distribution, transmission, administation, marketing, etc.

Accordingly, the final cost to consumers per million BTU's might be as follows:

Separate generation:	$6.20
Incremental cost:	$5.20
Full cost:	$6.45

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* These estimates are borrowed from a draft report prepared for NSP and are used solely for the sake of illustrating the impact of the thermal energy on final cost to consumers. As such, they are not to be construed as definitive costs but only indicative of the approximate effects that the particular methodology would produce.

As indicated, full costing to district heating could conceivably result in cogeneration thermal costs in excess of what would be obtained by heat-only boilers. The incremental cost alternative, however, might cost as much as 16% less than for separate generation.

The reason for these extremes in results is that the allocation methodology apportions the benefits of cogeneration to either electrical customers or district heating customers. In the case of incremental costing, all the benefits go to district heating with the result that system development might be given maximum encouragement. The full costing, however, gives substantial benefit to electrical customers and results in a district heating price which is higher than the cost of separate generation. Some other costing methodology might result in giving some benefits to electrical generation (thereby encouraging the utility to use the plant for cogeneration) and giving some benefits to district heating (in the form of lower prices for thermal energy than what could be achieved through separate generation).

Although this example is simplified and based on preliminary findings, it does illustrate the importance of the institutional issue. More detailed analysis of the economics of the Twin Cities electric generating plants and the cogeneration proposal will help identify a costing proposal which would encourage cogeneration district heating and would not adversely affect electrical customers.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.F Issue: Capital Investment Recovery for Building Owners

Issue Definition

In order to implement the Twin Cities district heating scheme, existing buildings will have to be converted from their current gas, oil, or coal-fired heating system, from an electrical system, or from existing district steam systems. The cost of making these conversions--both purchase and installation of new equipment plus write-off of old equipment--must be absorbed by either the building owners, renters, or some third party.

Why Capital Investment Recovery for Building Owners is an Issue

Capital investment recovery for building owners is an important institutional issue because it addresses the question of whether the building owner must absorb the additional capital outlay or whether it can be passed on to tenants through higher rents. Some building owners may not have any way to recover the costs of converting given the restrictions inherent in some building leases. These restrictions can take the form of an obligation on the part of the owner to pass on to tenants any fuel or heating savings while at the same time prohibiting the passing on of any additional capital costs.

Impact

If such lease restrictions are prevalent in the Twin Cities area, the development of a cogeneration district heating system could be seriously impaired. Unless the conversions cost was very minor, the building owner might be inclined to remain with the existing system, thus eliminating the conversion advantages and savings for tenants and the Twin Cities as a whole.

Alternatives

There are several approaches to the problem of capital investment recovery which can be suggested at this time:

1. Do nothing with current leases. Leases could be allowed to run out, and conversion costs could be passed on to

tenants in subsequent leases. As leases expire they could be structured to include conversion cost pass-through.

2. Negotiate with tenants for nullification of such restrictions; tenants might agree if overall benefits were in their favor or neutral. D.H. company could guarantee rates which would cancel effects of conversion costs pass-through.

3. Legislate to override restrictive provisions of existing leases and allow building owners to pass through capital costs for D.H. conversion. Energy savings could be earmarked to offset additional capital costs so that the net effect for consumers would be a reduction or no change in energy cost.

4. Conversion costs could be paid by the D.H. company and passed on through the rates.

5. Conversion could be subsidized through a

   - State income tax credit; or

   - Full or partial state grant.

Alternatives 4 and 5 are discussed in issue paper I.H - "Hookup Policy." Alternatives 1 through 3 shall be addressed in this paper.

Consequences

Alternative 1 - Do Nothing With Current Leases:

Local building owners and owners' associations have indicated that most leases are written such that costs of capital expenditures cannot be passed on to current tenants, but that savings in fuel costs must flow through. In most cases, conversion costs would not be absorbed by current tenants until their leases expired and a new contract was negotiated to include such items. Then, new tenants would automatically have D.H. conversion costs included in the determination of their rents.

The average lease term for downtown office space is estimated to be five years, so the average remaining term is probably between two and three years. With sufficient advance planning, these current leases could pose little or no barrier to the timely implementation of the D.H. project. By the time that

permits are granted, construction is completed, and hookup is available, the majority of existing leases will have expired. If, in the meantime, these leases are rewritten to include provisions for allowing rental adjustments due to district heating conversion, building owners would be able to pass the conversion costs through by the time that district heating was actually available. Total pass-through will not be accomplished until all leases are renegotiated, but if such lease conditions were incorporated into new leases as soon as possible, the capital investment recovery problem would be significantly diminished.

It is unlikely to expect building owners to include such provisions in their leases without some outside persuasion. Proposals for such action should be presented to downtown building owners, should include a presentation of the net benefit of district heating, suggested lease provisions, and a convincing explanation of why such provisions would be of benefit to both the owners and their tenants. This educational process should begin as soon as the economic feasibility of district heating has been determined and a sponsor has indicated a willingness to proceed with final analysis and development. Unless building owners are convinced, in a timely manner, of the benefits of district heating and the importance of early hookup, they might not agree to include district heating conversion cost recovery provisions in their leases until the D.H. project is in operation. Failure to act will delay hookup and adversely affect the economic feasibility of the D.H. company.

Alternative 2 - Negotiate With Tenants:

The building owners could seek to obtain tenant approval for nullification of clauses prohibiting pass-through of capital expenditures for district heating. If district heating does produce savings in heating cost, then building owners should be able to effectively bargain with tenants at least insofar as to leave tenants no worse off than if the lease had not been changed. For this to be possible, annual depreciation on the conversion equipment plus the required return on that investment would have to be equal to or less than the savings achieved on heating bills.

Without a guarantee stating that they would be no worse off, tenants may be reluctant to renegotiate the lease. It may be necessary for the D.H. company to guarantee rates for the remainder of the lease term so that tenants could be assured that the conversion expense would be offset by the projected savings. Such an agreement, however, could be very risky for the D.H. company unless district heating rates were tied to the price escalation in fuels which buildings would normally use.

It is probably reasonable to assume that the lease renegotiations would have to precede the building owners' decision to convert. Tenants might hesitate to renegotiate if they perceived that the building was already committed to hooking up to district heating. If a building agreed to use district heating before negotiating with its tenants, the tenants would stand to lose only by agreeing to change the terms of their leases whereby they would absorb D.H. capital charges. Negotiations with tenants prior to hookup would be essential, and this could cause added delay in determination of the eventual thermal load of the system.

Alternative 3 - Pass Legislation Which Overrides Restrictive Provisions of Existing Leases:

Legislation might be passed which would nullify the restrictive lease provisions and allow building owners to pass conversion costs on to tenants. Such legislation would make district heating more attractive to building owners and would enhance the prospects of accelerated connection of the D.H. system.

Passing of the legislation will depend, in part, on public acceptance of the proposal. If tenant groups are adverse to government intervention in this area, are not convinced of district heating benefits, or are unconvinced that they will be relieved from bearing the perceived economic burden, they may actively oppose and prevent passage of such legislation. Accordingly, passage of such legislation cannot be assured. Moreover, the ability for such legislation to withstand a challenge in the courts is not certain, as legal counsel has indicated that courts are typically sympathetic to tenants.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.G. Issue: Displacement Effects on Existing Energy Suppliers and Their Customers

I.G.1. Sub-Issue: Regulated Heat Sources (natural gas and electricity)

Issue Definition

Existing suppliers of regulated heat sources--NSP, which supplies electricity and natural gas, and Minnesota Gas Company, which sells natural gas--will likely be affected by the large-scale expansion of district heating in the Twin Cities. Because the primary energy which fires the electrical generating facilities is used more efficiently when cogenerating, less energy in total will be required for space heating. This implies that one or more suppliers of alternative heat sources will lose sales. Current suppliers include gas, electric, fuel oil, and existing district heating companies. This issue paper deals with the suppliers which are regulated by the Minnesota Public Service Commission--natural gas and electric utilities. A separate issue paper (I.G.2) has been prepared for non-regulated suppliers.

Why Displacement Effects on Existing Regulated Energy Suppliers and Their Customers is an Issue

Economic impact or displacement effects on existing regulated energy suppliers and their customers is an important institutional issue because district heating will displace these suppliers to some extent, particularly in central commercial and industrial areas. This displacement will cause underutilization of existing capacity. If total gas or electrical consumption were to decrease due to district heating, the fixed costs of these systems might be spread over a smaller sales base, thus impacting consumers' rates.

The implementation of a large-scale district heating project could also shift or erode these companies' present or future markets. This factor represents the introduction of unforeseen and additional business risk which must be assumed by the investors in those respective companies but for which they may not be compensated in their regulated returns. Also, because these energy suppliers are regulated by the state's Public Service Commission, they are not free to compete for space heating market share by lowering the price of their products.

If the ecomonic effects on regulated energy suppliers are serious, these regulated companies may oppose development of the district heating system unless they are offered some type of compensation.

Impact

Implementation of the district heating system may impact the sales and space heating market share of the regulated energy suppliers. If total gas sales decline due to the installation of a cogeneration district heating system, the price of the gas to consumers would likely be forced higher (independent of other supply/demand factors affecting gas prices). This is because many of the costs of serving gas customers are fixed (distribution system depreciation, interest expense, etc.) and would be spread over a smaller sales base. Because natural gas supplies are already insufficient to satisfy consumer demand in Minnesota, it is more likely that the gas which would have been used by district heating customers would be made available to other customers. This scenario could make gas available for alternative uses: for new urban residential or rural areas, for existing customers who are currently served on an interruptible basis, or for delaying planned curtailment of existing customers. This potential shifting of gas sales could still cause an increase in rates if additional fixed investment in pipeline were needed.

NSP might lose electrical sales due to displacement of electrical heating by district heating, but these losses could be offset by increased electrical consumption by the distric heating pumps and other equipment. Significant loss of electrical sales does not appear to be very likely, however, because of the lack of use of the alternative for commercial space heating and the reduced likelihood of those customers hooking up due to the higher cost of converting. In the event that electrical sales were lost, however, the impact on rates would not be substantial because of the continued usage of the distribution equipment for non-heating uses.

Alternatives

Alternative approaches to the potential barriers caused by the economic displacement effects on regulated energy suppliers include:

1. Displacement effects on regulated suppliers of alternative energy sources could be ignored. Economic and social changes always generate benefits for some and costs for others, and cogeneration district heating is no

different. The fact that the district heating alternative is available and will bring about net benefit for society as a whole may be enough justification for proceeding. Adverse economic impact on suppliers of gas and electricity is merely an unfortunate side effect caused by conservation changes which are necessary and inevitable.

2. Shield consumers from the effects of any abandonment on their rates. A number of possible regulating actions or combinations of actions could be employed to completely shield consumers from adverse rate impact, to completely protect investors from economic loss, or to apportion the impact between the two groups through a compromise approach. Such a compromise approach might be to allow normal depreciation or accelerated depreciation on any abondoned facilities but to exclude the abandoned assets from the rate base.

3. Determine the economic loss caused NSP and Minnegasco and compensate them with a direct payment from the district heating company. This would assure that the D.H. company and its customers realized the full economic impact of any displacement effects on regulated energy suppliers.

Work Required to Define Consequences

In order to explicitly define the consequences of the alternatives enumerated above, it will be necessary to:

- Analyze existing sales of fuels for heating in those areas which will be affected by district heating.
- Analyze current fuel supplies and allocations.
- Meet with representatives of NSP and Minnegasco for assistance in identifying and analyzing consequences, both long-term and short-term.
- Estimate magnitude of displacement effects and economic effects on market participants.
- Estimate economic impact on the district heating company if it is forced to bear full economic burden. Estimate impact on rates to D.H. customers.
- Assess social and political implications of the alternatives.

Consequences

The consequences for this issue paper have not been evaluated or analyzed, at the request of the Steering Committee, because it is of the opinion that such potential displacement effects are quite common in our economic environment. In addition, it is believed that the consequences of implementing a large-scale Twin Cities district heating system would not be distinct from other current economic events such as the concurrent shifts from natural gas to oil due to price and availability factors.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.G. Issue: Displacement Effects on Existing Energy Suppliers and Their Customers

I.G.2. Sub-Issue: Non-Regulated Heat Sources (fuel oil and existing steam district heating companies)

Issue Definition

Existing non-regulated suppliers of heat sources--fuel oil companies, Central Heating Co., and NSP's St. Paul steam division --will be affected by the large-scale expansion of district heating in the Twin Cities. Because the primary energy which is used to fire the electrical generating facilities is used more efficiently, less energy in total will be required for space heating. This implies that one or more suppliers of alternative heat sources will lose sales. Current suppliers include gas, electric, fuel oil, and existing steam district heating companies. This issue paper deals with those suppliers which are not regulated by the PSC: fuel oil and existing steam district heating companies. A separate issue paper (I.G.1) has been prepared for regulated suppliers.

Why Displacement of Non-Regulated Heat Source Suppliers is an Issue

Displacement of non-regulated fuel oil suppliers and existing steam heating companies is an institutional issue or potential barrier to implementation of the cogeneration scheme because of the loss of market share which they will experience. Natural gas is very much in demand in Minnesota, so if gas sales in the D.H. service area are lost to district heating, the gas will probably be made available for new areas or alternative applications. In other words, the market for natural gas will probably shift because gas, being a clean, desirable fuel, would, in turn, displace other fuels. The fuel most likely to be displaced might be oil, but even that is uncertain because of the potential impact of price changes and available supplies.

Electricity sales may not be significantly affected because of the low usage of that source for commercial heating and the high cost of conversion.

Finally, the new cogeneration district heating company could place existing steam district heating companies at a competitive disadvantage, could limit their future market growth, and might even take away their existing customers as contracts expire.

Impact

The primary effect on fuel oil suppliers will probably be the substitution of hot water sales for fuel oil sales when oil customers hook up to district heating. A secondary effect will also occur if gas, which is also displaced by hot water, in turn displaces more fuel oil sales. Even if the entire displacement effect came to rest on oil suppliers, the total effect would probably not be felt by a single supplier. There are approximately fifty fuel oil suppliers in the Twin Cities area and it can be expected that the competition in that industry would spread the market loss over many sellers. Consequently, the total impact on any one supplier may be minor.

Because the cogeneration scheme will be implemented over a relatively long period of time, the displacement effects will be somewhat tempered or obscured by normal market saturation changes and other changes caused by the inevitable shifts in energy consumption. If fuel oil is used to fire mobile boilers or peaking boilers, this will also diminish, to some extent, the displacement effect on fuel oil suppliers.

The impact on existing steam district heating companies would be more direct. The heat source for the cogeneration system will be reject heat from NSP. Depending upon how the thermal energy is priced, the heat could possibly cost the new district heating company much less per BTU delivered than it currently costs existing steam district heating companies to operate heat-only boilers. Accordingly, these existing systems could be placed at a competitive disadvantage with the result that their current markets could be eroded and future markets limited. The problem will likely be even more serious if there is substantial government subsidization of start-up costs or special tax treatment allowed the cogeneration district heating company because these actions could be perceived as "unfair" competition or as government interfering with private enterprise.

One factor which will prevent loss of current customers of existing steam district heating companies is the usage of twenty-year customer contracts. These contracts have many years to run before expiration and will, at the very least, preserve current markets for these suppliers for a number of years to come.

Both existing district heating systems and the fuel oil suppliers can react to the displacement effects by competing for

market share by raising prices, by lowering their prices or by attempting to offer better service. If fuel oil companies reacted by raising prices to make up for lost sales, the adverse economic impact of district heating would effectively be shifted to remaining residential and commercial users of fuel oil. Lower prices could conceivably cause problems for both existing suppliers and the new district heating company--existing suppliers would have lower margins and profits and the cogeneration facility might be prevented from obtaining a sizeable customer base which will be necessary for the system's success. The existing district heating systems could also compete on service by offering chilled water, steam, or other products not supplied by the cogeneration company.

Alternatives

The alternative ways of dealing with the displacement of non-regulated energy suppliers include:

1. Do not attempt to alter the adverse economic displacement effects. American economic history is replete with examples of someone "building a better mousetrap" and adversely affecting the businesses of others. But adverse economic impact has not impeded progress in the past and should not jeopardize developments which will help Minnesota conserve energy.

2. Existing steam district heating systems could be purchased from their owners for their fair market value. Because the public at large will reap the net benefits of cogeneration, the state or federal government could purchase those displaced suppliers as going concerns. Alternatively, the D.H. company could purchase the two existing systems and incorporate them into the new system.

3. Existing district heating systems might find it economically desirable to become customers of the newly created cogeneration district heating system. Conceivably they could purchase steam or hot water and resell it to their existing customers.

Work Required to Define Consequences

In order to define more explicitly the consequences of the above-mentioned alternatives, it will be necessary to:

- Identify existing suppliers and estimate market penetrations.

- Meet with representatives of Central Heating Co., NSP, Koch Fuels, Inc. and other fuel oil suppliers or industry spokesmen to discuss likely displacement effects on their particular industries and businesses.

- Construct a hypothetical model demonstrating displacement effects caused by the cogeneration system during the system's development.

- Estimate the economic impact on non-regulated energy suppliers caused by implementation of the new system.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.H. Issue: Hookup Policy

Issue Definition

Hookup refers to the physical connection of a customer to the distribution line of the district heating system. Hookup policy relates, then, to the question of whether hookup should be voluntary or involuntary, to the conditions necessary before a customer can hook up, to the question of who bears the installation or conversion costs, and who will own the heat exchangers?

Why Hookup Policy is an Issue

Hookup policy is an important institutional issue because that policy could have a substantial impact on the economic viability of the district heating system. Due to the probable existence of high fixed costs for the system (depreciation expense and interest expense), operation of a totally new cogeneration district heating system will probably be uneconomical below some critical level of demand. Accordingly, the hookup policy must be structured to insure that the critical level of demand is either met or exceeded.

One of the most significant factors in analyzing such an investment will be how much demand for district heating services there will be throughout the life of the project and how the hookup policy affects that demand. It is improbable that demand could be assured by legislating mandatory hookup, so the hookup decision will likely be left up to the building owners. This latter approach could result in the project not being undertaken, because of the high cost of conversion for some buildings and the resultant uncertainty (and, therefore, revenues) of demand. It is possible that demand uncertainty could be so great as to increase the cost of capital beyond reasonable limits. To remove this uncertainty and to encourage hookup, it might be necessary to grant preferential loans, tax benefits, or some other incentive to building owners.

Impact

The impact of the hookup policy on system feasibility will depend on the relationship of total D.H. costs to the cost of other heating alternatives. If the economics of cogeneration district heating are either very favorable or very unfavorable, the hookup policy might have minimal impact on feasibility.

Alternatives

Alternative hookup policies which would impact the demand for district heating services include:

1. Have all conversion costs assumed by the D.H. company; the company would own the equipment and conversion cost would be capitalized and amortized over the life of the equipment. As such, amortization of conversion costs would be another operating cost of the D.H. company and would be reflected in the rates that customers paid for service. Variations such as paying for conversion costs in excess of a certain amount or paying only during the initial years of operation are also possible.

2. Have all conversion costs assumed by property owners.

3. Have all conversion costs assumed by the property owners, but encourage conversion through incentives (e.g., low interest loans through the D.H. company or state government; tax credits).

4. Give customers the option of either paying their own conversion costs or having the district heating company assume them. The tariff classification would then be established to charge different rates to the two classes of consumers.

There is also one additional alternative, that being to legislate mandatory hookup. This approach does not appear to be politically acceptable at this time and will not be considered as a viable alternative.

Consequences

Economic data from the MEA draft report on district heating conversion methods and costs for existing buildings (October 27, 1978) and the Studsvik draft report on the Minneapolis-St. Paul district heating study (November 1978) have been utilized in evaluating the alternatives. The data from the Studsvik study is based upon an assumption of 100% hookup, a condition which will probably not be realized. The data will nevertheless be used in order to illustrate certain concepts. In the absence of any analysis of the sensitivity of the percentage of hookup to various factors which might impact that decision, the scope of this issue paper will be limited to evaluation of hookup under the assumption that a building owner will choose district heating should the economics be favorable.

Alternative 1 - Conversion costs assumed by the D.H. company:

Based on estimates from the Minnesota Energy Agency draft building conversion study and the Studsvik draft district heating study, the total cost of converting buildings to accommodate the D.H. project would be approximately $160 million (in 1978 dollars) assuming 100% hookup. The actual conversion cost would be some function of this number. Under Alternative 1, these costs would be fully absorbed by the D.H. company over a twenty-year expansion period and would be passed on to consumers in the form of higher rates.

Based upon the assumptions outlined in the Studsvik draft report, this alternative would be very advantageous to customers of district heating. Because it is assumed that the rates charged by the D.H. company are based solely on competitive factors (i.e., 90% of the cost of the most economic alternative), then the consumer would neither bear the conversion costs nor pay higher rates for district heating than if he were to assume hookup costs. In effect, the entire economic burden would be shifted to the D.H. investors. The assumptions underlying this conclusion may be open to questions, however, and rates to customers would probably reflect these additional costs.

If the district heating rates are cost-based (i.e., district heating rates are set based on total costs incurred), the consumer rates will be proportionately higher than if the consumer were to bear the cost of conversion. The district heating company would capitalize all conversion costs, amortize them over the life of the asset, and pass them on to consumers through the rates. From a cash flow perspective, this approach could have appeal to consumers because, instead of paying a lump-sum at the time of conversion, the costs would be spread by means of the monthly district heating charge. This could be particularly attractive to owners of buildings with high-cost conversion requirements.

Economically, the D.H. consumer might gain if the cost of financing conversion was lower for the district heating firm than for the customer. This will depend on the cost of capital to the D.H. firm relative to the cost of capital for each customer. Because there will likely be a wide divergence in the cost of capital for various potential customers, the attractiveness of financing conversion through the D.H. firm will vary by individual customer. Should the district heating firm be allowed to finance conversion with a tax-exempt debt offering, all consumers would most likely benefit from such an arrangement.

Another economic effect will hinge on the characteristics of the heating systems of the potential customers and the resultant

cost to convert. As indicated by the MEA draft building conversion study, some buildings are more readily adaptable to hot water district heating than others, so the costs of converting can be quite divergent. Customers with a higher-than-average ratio of conversion costs to thermal usage might not connect to the system unless their hookup cost was lowered. Depending on the overall economics, the broadest base of customers might be achieved if the conversion costs for these customers could be spread over all users. The implication for customers with a lower-than-average ratio of hookup costs to thermal usage is that they would, in effect, subsidize other customers as a result of spreading all costs of conversion through the rates. This could conceivably result in a situation where high-cost conversion customers would hook up, thus lowering the average cost to other customers and encouraging system development. Other factors might offset this, however, so it is impossible to arrive at any definitive conclusions in the absence of a complete economic study.

In structuring the customer base, care will have to be taken to insure that the average conversion cost achieved is economically justified. If conversion costs are paid for all customers, the program will have to be structured so as not to attract a disproportionate share of buildings with high conversion costs. The issue might then become how to discriminate among customers for inclusion in the system.

Another potential problem with this alternative is having the D.H. firm own a portion of the heating equipment in a building. Normally a utility will not own any part of the heating system beyond the meter and, indeed, the base case scenario assumed the same. If the D.H. firm owned the heat exchanger and other equipment, it might be neccessary to grant unlimited access to the facilities for maintenance and repair purposes. This could present problems for building security and may not be acceptable, so it might be necessary for the contracts to specify that the building owner be responsible for all routine maintenance.

The estimated costs and timing of conversion expenditures are detailed in the Studsvik draft report. These conversion costs were estimated based upon data gathered and presented in the Minnesota Energy Agency draft report on building conversion. Appendix A of this issue paper illustrates the effect of conversion costs on district heating rates using data from those draft reports and under the assumption of cost-based rate setting. Based on this analysis, rates would have to be approximately 20% higher if the D.H. company assumed conversion costs than if each customer paid his own.

Alternative 2 - Conversion costs assumed by property owners:

If the costs of conversion are assumed by property owners, the cost of connection represents an added expenditure to consider when making the decision of whether or not to hook up to district heating. Theoretically, consumers would look upon this investment decision in a life cycle framework in order to evaluate current and future expenditures versus potential future savings. Consumers need to decide not only if the D.H. rates would be less expensive than alternative heating sources, but also if these savings are sufficient to justify the conversion expenditure. The decision to make the investment will also be influenced by each potential customer's assessment of the risk of achieving the projected savings, the financial stability of the D.H. firm, the reliability of district heating versus alternative heat sources, and the present condition of the building's heating system. Because conversion costs will differ according to the type of heating system, because the expected rate of return on investment by each consumer will vary, and because of all the other factors enumerated above, the decision to convert might be very unpredictable.

Alternatively, potential consumers might make the hookup decision based solely upon cash flow considerations. Should the conversion be expensive, some building owners might be unable to supply the funds, regardless of potential savings. If cash availability is a widespread problem, the consequence of having all conversion costs assumed by property owners could be a failure for the needed system loads to materialize. This, of course, will adversely impact the system economics and could conceivably render the project economically infeasible.

From the standpoint of the district heating company, having consumers pay conversion costs might be viewed as having some definite advantages. The cash requirements necessary to fund the conversions would be avoided, thereby reducing the company's financing needs and interest expense. Potential pricing problems due to differences in conversion costs among building owners would also be eliminated. The trade-off, however, is that the cash flow problem must be shifted to consumers.

In the event that the desired savings are not achieved, consumers may be induced to hook up by methods suggested in Alternative 3.

Appendix B illustrates an example of how the hookup decision under Alternative 2 might be viewed by a potential customer.

Alternative 3 - Conversion costs assumed by property owners, incentives added to encourage hookup:

Should consumers find conversion to district heating uneconomical, hookup might be encouraged by offering additional economic incentives. Such incentives might be in the form of preferential loans, tax credits, or other arrangements. These inducements would, in effect, reduce or defer the costs incurred by the district heating customer for initial conversion. The encouragement would be designed to make the venture attractive enough for customers so that they would convert to district heating and provide the thermal load which is critical to overall system feasibility.

The cost of hookup incentives has to be borne by either the consumer, the company, or the government. If conversion is encouraged with federal or state tax credits, government revenues will be reduced accordingly. If low-interest loans are employed, both the company and the consumers might bear part of the cost. Should the company be able to borrow for conversions at a lower cost than consumers, (for example, with tax-exempt borrowings) or should the company be granted any other incentives (such as special tax credits or government subsidy) then there may be a real economic advantage to the company's involvement in conversion financing.

Alternative 3 might be considered as a compromise between the alternatives of assumption of costs by the D.H. company and assumption of costs by D.H. consumers. Such measures could be used to divide the burden of hookup between both concerns so that the D.H. company would find it profitable to operate and the customer would find it profitable to convert to district heating.

Whatever incentives are devised to encourage hookup, the thrust of the policy will necessarily be to shift economic burden to others (e.g., through preferential tax treatment or subsidy) or to shift the burden in time (e.g., reflecting the conversion cost in the rates). Some of these incentives will affect primarily the economics of each particular customer's investment, whereas others will entail additional social and political consequences. In view of the perceived mood of the Minnesota public with respect to subsidization of a private district heating company, it is reasonable to assume that any proposed policy involving special treatment or government support will be difficult to support (refer to notes from Dr. James Carter interviews with public groups). As a result, conversion incentives may have to be confined to shifting the economic burden among potential customers.

One additional consequence of Alternative 3 is that any attempt to encourage district heating with government subsidy or special consideration will likely entail problems with political and public acceptance. The proposals will also take from one to two years for passage by the legislature.

Alternative 4 - Consumer Option:

If consumers had the option of paying their own conversion cost or having the D.H. company pay them and pass the cost on through the rates, it would be necessary to reflect that option in the tariff classification. Essentially, the company would provide a different level of service to the two classes of customers and the price difference would reflect the amortization of the conversion expenditure for all such customers.

The freedom to choose a conversion option would probably result in the low-conversion-cost customers paying their own way and the high cost customers seeking D.H. company assistance. If rates were cost based (as opposed to competitively determined), this could cause considerable differences in the rates for the two classes of customers. Conceivably, this might result in rates for conversion-paying customers below what the market would dictate and rates for others in excess of market alternatives. Should this be the case, it might be imperative to price the D.H. services on a competitive basis and this would rule out such an option.

Another form of this option which would perhaps avoid this problem might be for the company to offer financing for the conversion and then bill the customer for the loan repayment. In that case, it may be unnecessary to differentiate between the two classes of customers. A discussion of subsidized loans or other incentives can be found under Alternative 3.

EFFECT OF CONVERSION COSTS ON COST-BASED RATES

Cost-based rate setting for district heating implies that the rates which the D.H. company charges will be dependent upon the expected costs of supplying the heat. Methods of cost-based rate setting may be contrasted with competitively based rates, which are dependent on the rates which alternative suppliers charge for the same or similar services.

The Studsvik draft report (November 1978) assumes that district heating rates will be competitively based. This appendix, however, will present a framework for estimating the effect of conversion costs on district heating economics under the assumption of cost-based pricing. Although many forms of cost-based pricing are available, the actual methodology for setting rates is not as important as the basic principle that district heating rates will rise as the district heating costs rise. In addition, it follows that if district heating rates are dependent upon the costs incurred by the D.H. company, the rates would be proportionately higher if the D.H. company, as opposed to the consumers, assumes the costs of conversion.

For illustrative purposes, it can be assumed that, if district heating income statement costs contain a certain percentage of costs related specifically to hookup, district heating rates would be that percentage higher than if conversion costs were assumed by the consumer. Rough approximations of depreciation and interest charges attributable to conversion can be computed from the tables in the Studsvik report. Investment credit, income tax effects and operating costs related to hookup, however, cannot be determined from the Studsvik figures. In addition, the report assumes no administrative costs or property taxes, and both of these items will likely be incurred by the D.H. company. Because of these constraints, only depreciation and financing expenses will be used in illustrating the costs attributable to conversion.

Projected amounts from the year 1990 will be used for illustrative purposes. The following figures have been taken from the Studsvik report:

- Investment in conversion equipment through 1990 - $77.5 million (Table 3), based on 100% hookup,
- Useful life of conversion equipment - 15 years (Page 28);

- Interest on debt - 9.5% (Page 22);
- Return on equity - 14.5% (Page 27);
- Percentage of debt financing for a private utility - 50% (Page 27);
- Operating costs in 1990 - $35.5 million (Table 6).
- Total interest, depreciation, and taxes in 1990 - $40.8 million (Table 6).

Given these assumptions, the impact on cost-based rates would be as follows:

Depreciation on conversion equipment in 1990 -
$77.5 million/15 years = $5.2 million per year

Capital expense attributable to conversion equipment -
$77.5 million x .5 (.095 + .145) = $9.3 million per year

Total depreciation and capital expense attributable to conversion equipment -
$5.2 million + $9.3 million = $14.5 million per year

Total operating costs, interest, depreciation, and taxes for the firm in 1990 -
$35.5 million + $40.8 million = $76.3 million

Percentage of total costs due to conversion equipment in 1990 -
($14.5 million/$76.3 million) x 100 = 19.0%

Based on this methodology and the assumption of cost-based rate setting, district heating rates might be approximately 20% higher if the D.H. company absorbed conversion costs than if each customer paid for hookup.

As mentioned above, these figures ignore the following costs related to conversion: operating costs, property taxes, administrative costs, and related income tax effects. The actual conversion cost-to-total cost ratio would be adjusted accordingly to arrive at a more accurate percentage. What is important, though, is that if the cogeneration district heating company (with cost-based prices) must compete in an environment with other alternative heat sources, the determination of who pays for the hookup costs could be critical. On one hand, payment of conversion costs by the D.H. company might result in an uncompetitive price; on the other hand, it might eliminate a cash flow problem and potential barrier for customers.

CONVERSION COSTS ASSUMED BY PROPERTY OWNERS - AN ILLUSTRATIVE EXAMPLE

In deciding whether or not to convert to district heating, the potential customer could be expected to compare the potential savings in heat costs to the cost of conversion. A hypothetical example patterned after an actual building contained in the MEA draft conversion study report is presented herein. The building chosen is one with high costs of conversion, but with relatively high heat load.

DESCRIPTION OF BUILDING

Assume that a 525-unit apartment building with 750,000 square feet of space is considering whether it should convert to cogeneration district heating. The building currently has a steam system utilizing gas (on an interruptible basis) and oil for primary energy. The building has an average annual heating requirement of 50,000 million BTU's.

HEATING COSTS

Local fuel suppliers have estimated that the building could use gas approximately 70% of the time and oil 30% of the time. The cost of gas is assumed to be $2 per thousand cubic feet (Mcf), approximately the current rate for such customers. Oil is assumed to cost 40¢/gallon, or approximately $2.80 per one million BTU's. One Mcf of gas produces approximately one million BTU's, so natural gas is the least expensive alternative. District heating services will be assumed to cost 90% of the cost of the least expensive heating alternative.

OTHER ASSUMPTIONS

The building boiler is assumed to be 70% efficient in converting gas or oil into steam. Also, conversion costs to district heating are assumed to be approximately $250,000.

COMPUTATION OF COSTS

The average cost of one million BTU's of steam heat is computed as follows:

$2.00 (gas cost) x 70% (percentage used) =	$1.40
$2.80 (oil cost) x 30% (percentage used) =	.84
Average cost of fuel =	$2.24
Efficiency Adjustment ÷	.70
Average cost per million BTU's =	$3.20

For this apartment building, total annual heating costs using gas would be $3.20 x 50,000 = $160,000.

If district heating were used, the cost per million BTU's used is assumed to be 90% of the cost of the least-expensive heating alternative. This assumption, adopted from the Studsvik draft report, will result in an assumed district heating rate of $2.57 per million BTU's, taking gas as that alternative:

$2 ÷ .7 x .9 = $2.57/million BTU's.

The resultant average annual heating cost using district heating would be:

$2.57 x 50,000 = $128,500.

Cogeneration district heating would result in annual savings of approximately:

$160,000 - $128,500 - $31,500,

A $31,500 return on a conversion investment of $250,000 would yield a before-tax return of 12.6%. This yield may or may not be acceptable to the hypothetical building owner depending upon the availability of funds for conversion, the investor's required rate of return, the availability of alternative investments, the write-off on existing heating equipment and boilers, and the tax effects. In addition, any potential constraints on investment recovery for building owners and fuel savings pass-through provisions contained in existing leases will also impact the decision. These latter problems have been addressed in Issue Paper I.F.

This analysis is somewhat simplistic in that it does not consider the investment in a life cycle framework. Because fuel prices will likely continue to fluctuate in the future and the percentage of gas or oil burned might also change, the returns on

the investment for just one year could be misleading. A set of assumptions must be compiled by each owner and then the potential savings should be discounted back to the present to determine the net present value of the investment.

Because the economics of the hookup question are influenced by so many factors, it may be very difficult to predict the impact of any given hookup policy on the conversion rate.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.I. Issue: Regulation - Permits and Authorizations

I.I.1. Sub-Issue: Franchising of District Heating by Cities

Issue Definition

In order to provide services in a particular city, a public utility is usually required to obtain a grant of special privileges from the municipal authority. These privileges typically include:

- The right to construct, operate, repair, and maintain utility facilites on city property;
- Permission to operate as a supplier of a specified service for a specified period of time (life of the franchise); and
- Protection from bearing the cost of indiscriminate relocation caused by city mandate.

In return for these privileges, the city may include sections in the franchise which provide for the following:

- Indemnification of the city in case of accidents caused by utility construction or operation;
- Regulation of the rates of a franchisee by a city utilities board; and
- Imposition of a franchise fee such as a gross earnings tax on the utility.

The franchise agreement is negotiated with representatives of the city and becomes a legal contract after passage of a municipal ordinance. In return for the privilege to operate in the city, the utility usually agrees to tax provisions and conditions relating to safety and adequancy of service, but often also to reporting requirements, arbitration of labor disputes, and free or special services provided by the city to the utility.

The city of St. Paul requires that all public utilities have a franchise. The St. Paul City Council has passed ordinances authorizing franchises with NSP for steam, gas, and electricity sales.

In contrast, the city of Minneapolis does not currently require utilities to obtain franchises. Minnegasco has, however, negotiated a franchise agreement with the city as it believes that the franchise rights granted are beneficial to the company. Minneapolis has also passed an ordinance that charges NSP for the use of city streets. This ordinance replaces an earlier franchise agreement but contains provisions which are similar to those contained in the Minnegasco franchise.

Why Franchising of District Heating by Cities is an Issue

Franchising is important as an institutional issue because:

- The gross earnings tax would add another significant cost element to the D.H. project;
- Even if the Public Service Commission did not set the D.H. company rates, district heating rates might neverthe- less be subject to review by a municipal utility board as established by franchise provisions; and
- The granting of the franchise and its terms must be relatively certain to justify the substantial preparatory work required and to insure that the system implementation will not be jeopardized by franchise delays.

Impact

Franchises will provide operating and construction assurances to the D.H. company. Without such assurances, potential owners may be unwilling to commit the substantial resources which are required to develop the district heating system.

If the cities are granted rate-setting powers, the D.H. company may be constrained in its ability to respond to market factors. In addition, the gross earnings tax will create further cost constraints on the D.H. company. Without proper consideration, either factor could contribute to rendering the district heating project infeasible.

Alternatives

The alternatives to the issue of franchising are as follows:

1. Franchise the district heating company in both Minneapolis and St. Paul; and

2. Franchise the D.H. company only in St. Paul. (As explained in the consequences section of this issue paper, a waiver of the St. Paul franchising ordinance does not appear to be a feasible alternative, at present.)

Consequences

Alternative 1 - Obtain Franchises From Municipalities:

The consequences of obtaining a franchise fall into two categories: a) preparation and processing time, and b) rights, restrictions, and costs.

a) Preparation and Processing Time:

If a franchise is to be obtained, then the actual construction of the project cannot begin until the franchise is granted. Preparation of the franchise agreement should take no longer than two man-months and should not be a significant cost. The processing of the franchises - including negotiation, hearings, and final approvals - might take three to six months, in the absence of any major controversies.

The obtaining of franchises will follow the granting of other permits and authorizations (see issue paper I.I.3, "Regulation: Permits and Authorizations - Start-up and Construction"). Accordingly, the franchise delay will further postpone the beginning of construction. Throughout the permitting process, though, it is likely that many problems associated with the project will have surfaced, and by the time the question of franchising arises, most of these problems will have been alleviated.

b) Rights, Restrictions, and Costs:

In evaluating the consequences of franchise provisions, the rights, restrictions and costs in current franchise agreements, along with their effects, must first be examined. They are as follows:

- Right to Construct, Operate, Repair and Maintain Utility Facilities:

This franchise provision allows a company to construct, operate, repair and maintain utility facilities in, on, over, and under public grounds and streets. These are the franchise rights which are of major benefit to the utility. Often, such assurances are considered so critical that a utility will negotiate a franchise even when it is not mandatory.

These operating rights will also serve as security for investors and bankers who may be seeking assurances against potential operating or legal problems.

- Life of the Franchise:

The state of Minnesota prohibits the issuance of perpetual franchises (Mn. Stat. §410.09). The city of St. Paul further stipulates that "no franchise for a term exceeding twenty years shall be effective until approved by a majority of electors voting thereon" (City Charter, Section 16.02). Minneapolis does not specify any such limitations, but the city grants the term of the franchise on the basis of the needs of the project.

Current franchise agreements in Minneapolis and St. Paul range from ten to twenty-five years. Although the D.H. project will not be able to obtain a franchise of perpetual or indeterminate length, it should be able to obtain a franchise for the ititial 20-year construction period. This length should be sufficient to determine the merits and viability of district heating and should be easy to renew upon its expiration providing that the system is rendering adequate service to the community. The franchise should also provide investors with the assurance that the company will have the ability to operate with fewer uncertainties.

- Cost of Relocation:

Provisions of the Minnegasco franchise with Minneapolis provide that the city reimburse the company for relocation costs when the relocation is for reasons other than improving streets or sewers. A similar agreement would assure that the city could not indiscriminately require the district heating company to relocate piping at the expense of the company.

As with the life of the franchise, the provisions relating to relocation costs would reduce uncertainties surrounding the project and could increase the attractiveness of district heating to potential investors.

- Indemnification of City:

A standard clause within franchise agreements holds the city harmless from liability on account of injury or damage due to construction, maintenance, or operation of the franchisee's property located on the city grounds. It is likely that a district heating franchise agreement would be unacceptable to a city without such a provision.

The inclusion of an indemnification clause should not pose a barrier to the D.H. project. Such "hold harmless" arrangements will impact the project only in the case of unforseeable accidents. Exclusion of such a clause would indicate that the city would be willing to absorb some of the potential liability for such occurrences. While this would be more attractive for the project, it is unlikely that a city would be willing to omit an indemnification clause.

- Rate Setting:

Under current law (Minn. Stat. Ch. 216B - Public Utility Regulation), the district heating company is not considered to be a public utility and its rates would not be set by the Public Service Commission (see issue paper I.C.1a entitled "Decision of Whether to Regulate the District Heating Company"). Accordingly, provisions in the franchise would have to specify whether or not the city could exercise regulatory authority. The St. Paul city charter states that the city has authority to include, in any franchise, procedures for regulating and establishing reasonable rates to be charged by the grantee. Prior to the establishment of the Public Service Commission, the city of Minneapolis also included rate-setting provisions in many of its franchises.

The consequences of either regulation or nonregulation by cities are similar to the consequences enumerated in issue paper I.C.1a, "Decision of Whether to Regulate the District Heating Company."

The district heating project will be serving primarily commercial and industrial users in the first twenty years of operation. Due to the size of these customers and the existence of competitive heat sources, these users will be able to negotiate rates with the D.H. company more effectively than homeowners and other small users. Therefore, the company's customers may not

require city assistance in assuring that the D.H. company charges them reasonable rates. The city of St. Paul currently regulates the rates of NSP's steam division but no such regulation is mandated for Central Heating Co. in Minneapolis.

- Gross Earnings Charge:

St. Paul requires that all franchised companies pay the city a franchise fee of at least five percent of gross earnings. Currently, an 8.7% year earnings fee is placed on franchised St. Paul utilities. Franchised utilities in Minneapolis are assessed a 3% gross earnings charge, although city ordinances do not actually require such a fee.

If a franchise fee is assessed, either the D.H. company, the district heating consumers, or both, will absorb this additional cost. The extent to which the consumer and the company bear this cost will depend on various supply and demand factors. The gross earnings taxes paid to the cities could amount to approximately $1.6 million in 1985 and $16 million in the year 2000 (based on revenue projections from the November, 1978, draft of the Studsvik "Minneapolis - St. Paul District Heating Study" and a 3% and 8.7% franchise fee in Minneapolis and St. Paul, respectively). The actual franchise cost must be considered with all other costs in determining the economic viability of the D.H. project and the competitiveness of this heat source in the marketplace.

If the economics of the project were marginal, an exemption from the franchise fee might allow the D.H. company to compete with alternative heating sources. An exemption, however, would give district heating a competitive advantage over other franchised utilities, and such an exemption might be unconsitutional. An exemption might also be unattractive to the franchising cities as they may actually experience a decrease in revenues due to the D.H. project taking business away from utilities which are already franchised and paying a gross earnings fee.

For additional discussion of the gross earnings tax, please refer to Issue Paper I.B.3 - Taxation: Selective and Excise Tax.

Alternative 2 - Operate Without Obtaining Franchises

Current provisions in St. Paul would require the D.H. company to be franchised in that city. It appears reasonable to believe that governmental, corporate, or public pressures would prevent the district heating company from gaining an exemption from franchising. At the current 8.7% franchise fee rate, St. Paul would receive approximately $600,000 in 1985 and $9.3 million in 2000 from D.H. company (based on revenue projections from the November, 1978, Studsvik draft report).

Should the D.H. company operate without a franchise in Minneapolis, the company would not be guaranteed all the operating rights that would otherwise be granted. Certain existing non-franchised utilities have been granted encroachment permits for specific projects without any problems. The consequences of these and other necessary easement permits are discussed in issue paper I.I.3, "Regulation: Permits and Authorizations - Start-up and Construction."

The major benefits of not franchising in Minneapolis would be the exemption from paying the gross earnings fee and the freedom from city rate-setting power over the utility. These benefits would allow the D.H. company to better react to market conditions and constraints in setting prices for district heating services.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.I. Issue: Regulation - Permits and Authorizations

I.I.2. Sub-Issue: Siting of Peaking Plants and Mobile Boilers

Issue Definition

Efficient and economical design of a cogeneration district heating system required that the base cogeneration facilitiy be capable of supplying most of the thermal energy required and that "peaking plants" be employed to generate additional thermal energy on very cold, high thermal-demand days. This arrangement is most economical because peaking capacity costs only about ten percent as much as cogeneration capacity, so overall system costs are lower than if all thermal energy is produced by the cogeneration facitities. In addition, mobile boilers may be needed to service the heat loads of new buildings before the transmission and distribution lines are constructed in the vicinity. Both of these types of auxiliary heat-generating facilities will require obtaining various siting and operating permits.

Why Siting of Peaking Plants and Mobile Boilers is an Issue

The siting of peaking plants and mobile boilers is an institutional issue because:

- Delays and other problems associated with obtaining such permits could significantly impact the cost, timing and public acceptance of the project.

- Uncertainties associated with gaining site approval from city authorities and state pollution control authorities will add to the overall risk of the project.

- The Twin Cities area is classified as a non-attainment area in both particulates and sulphur dioxide. Peaking plants will produce additional undesirable emissions and will likely present some difficulty in getting PCA approval. These facilities, however, are essential to the efficient operation of the district heating system.

- If mobile boilers should ever be required in a residential area, challenge from local inhabitants should be expected. Such siting challenge or even the possibility of it occurring will necessitate expenditures for public awareness and education and could also cause substantial legal expense or delay to individual phases of the project.

Impact

The principal impact of the peaking plant and mobile boiler siting issue will be to increase the uncertainty of the project. If siting becomes a major problem, increased costs can be expected as well as delays in implementation or expansion of the whole project. In addition, delays in siting peaking or mobile boiler facilities could adversely affect long-range system load growth as potential customers become aware of the problems and opt for alternative heating sources.

Alternatives

Alternatives to the peaking plant and mobile boiler siting problem include:

1. Obtain exemptions from emission requirements. The peaking plants will only operate on the coldest days and should not pose any serious problems for air quality; consequently, an exemption from normal requirements might be appropriate. Mobile boilers would only be used for temporary service--say, two to three years--and an exemption might be appropriate for their operation, as well.

2. Develop an emissions offset; by engineering an air pollution abatement for an unrelated local industry the overall efffect of the D.H. project on Twin Cities air quality might be structured to be positive.

3. Obtain advance assurances or permits for peaking plant or mobile boiler sitings and operation in order to eliminate the uncertainty that those future permit processes create.

4. Make whatever investment is necessary to reduce the peaking plant emissions to acceptable levels.

5. Limit system load development to the cogenerating capacity of existing NSP plants, thereby eliminating the need for peaking plants. This alternative would involve using expensive cogeneration capacity for serving temporary

peaking needs, and would eliminate the peaking plants altogether.

6. Site all peaking plants at the power plant site, if possible, and utilize NSP's existing sophisticated pollution control equipment. If other existing boilers away from the power plant are needed for peaking capacity (e.g., Central Heating Co. facilities), the siting problem might be eliminated.

7. Fire mobile boilers or other existing boilers and peaking plants with natural gas. Extreme care could also be taken to insure safety to the surrounding areas and to eliminate noise from pumps, valves, etc.

These alternatives are not all mutually exclusive, but indicate a range of possible approaches to the problem.

Work Required to Define Consequences

In order to define the consequences of the siting alternatives, it will be necessary to:

- Explore in more detail the system characteristics such as the number and capacity of the peaking plants, projected emissions, and characteristics of the mobile boilers.
- Review MEA district heating air quality study.
- Estimate the time delays and expenses which might be incurred as a result of siting problems being experienced.
- Estimate the likelihood of the project being jeopardized as a result of active oppostion to siting.
- Investigate possibilities for emission exemptions.
- Explore possibilities for creating an emissions offset; review experience in other cities.
- Estimate impact on D.H. system economics and system reliability if no peaking plants are used.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

I. Ownership Assumption: Private

I.I. Issue: Regulation - Permits and Authorizations

I.I.3 Sub-Issue: Start-Up and Construction

Issue Definition

Start-up and construction permits denote all authorizations required from federal, state, and local governmental and regulatory agencies for implementation of the cogeneration district heating project. Such permits are mandatory prior to commencement of project construction or may be required for a specific phase of the project.

Why Start-Up and Construction Permits and Authorizations is an Issue

Obtaining start-up and construction permits is an issue or potential barrier because:

- Some of the permits needed for the cogeneration district heating system relate to specific project phases five or ten years after the initial construction has begun. Before commitment to the total project can reasonably be expected to occur it may be necessary for system developers to have advanced assurances that the permits and authorizations will be granted on those future project phases. For example, the size of the transmission system pipe is, in part, contingent upon the amount of heat available at the power plant. This design decision will become more difficult without assurances that permission to increase power plant capacity will be granted in the future.

- The number of permits, along with the preparation and filing process, could result in excessive time delays. Until certain permits are granted, no construction can be performed. In addition, certain permits cannot be granted until other authorizations are received. (For example, environmental permits cannot be obtained until an Environmental Impact Statement is approved.)

- Additional construction and preparation costs will result from the current permit process. Price escalation on new construction, alone, could add ten percent per year to total project costs. These costs would add substantially to the total system investment and would ultimately result in higher rates for district heating services. The costs will also have an undesirable impact on the district heating company's cash flow because they must be paid in the initial stages of system development.

- The uncertainties associated with the permit cost and time requirements introduce additional risk factors into the project. This increased uncertainty may cause investors to require a higher rate of return which will, in turn, result in higher debt service costs for the D.H. company. In the extreme case, the risk inherent in the permit process could prevent the project from being undertaken by private investors.

Impact

The process of obtaining start-up and construction permits may delay the construction start date by several years and add significantly to its cost. Actual time and dollar costs will vary according to the final system design, construction plans, and degree of public and governmental acceptance of the cogeneration concept.

Alternatives

Alternative approaches to dealing with this potential institutional barrier include the following:

1. Allow the permitting process to operate in its normal manner. No exemptions would be legislated for the district heating project and the project developer would go through the normal permit process.

2. Obtain legislation which would streamline and speed the state permitting process. For example, earlier deadlines could be imposed upon the state regulatory agencies to rule on applications or the project could be exempted from certain permits and/or permit costs. NSP could possibly be exempted from submitting a Certificate of Need for future additions to the High Bridge or Riverside Plants. The D. H. company could possibly be exempted from paying fees such as for the "Utility Crossings of Public Lands and Waters" or other permits.

3. Implement a "one window" approach: Delegate the permitting process to a central governmental authority, such as the State Planning Agency (SPA). The SPA could extend its Master Application Process for Environmental Permit Coordination to cover the district heating project. The SPA would then be charged with the responsibility of preparation and application for permits, scheduling joint hearings, elimination of duplicate information requirements, minimization of processing time, etc.

4. Provide advance permitting of long-range development plans of the district heating project to aid in the efficient design and development of the system and removal of the risk inherent in the uncertain outcome of the permit process.

5. Drop plans for construction of additional cogeneration capacity at Riverside and High Bridge, thereby eliminating the constraints imposed by permits and authorizations required for "Large Energy Facilities".

Consequences

The consequences of each of the alternatives, in large part, result from the conditions suggested by that specific alternative. They are not independent, though, of the overall approach which a company might take in "marketing" the concept to the public. A critical factor in assessing the permitting process as a potential institutional barrier is the acceptability of the project in terms of environmental impact, routing of transmission and distribution lines, and the need for additional cogeneration capacity. Should the project be assessed as having no adverse environmental consequences, as being properly routed, and essential to state energy conservation objectives, the authorizations will present minimal problems. However, if there is sufficient doubt raised about the impact of the project, the permits may become difficult to obtain due to challenge by public interest groups and other affected concerns. Recognition of the various potential problems in advance and communication to the public of the tradeoffs inherent in the project can result in a higher probability of the project being undertaken.

Alternative 1 - Normal Permit Process:

Time delays, permit preparation expenses, and cost escalation will be greatest if the permit process is approached in the current environment. As shown in the accompanying illustrations (see "Pessimistic and Optimistic Time Frames"), the permit period will be approximately five years, from the

preparation of the Certificate of Need through the obtaining of all other permits, easements, and authorizations. This scenario assumes that all permits required for the expansion projected for High Bridge and Riverside would be obtained before the system was designed or construction initiated. In the current permitting environment, it appears that the total permit time frame would be fully two years longer than if that process could be accelerated, and three years longer than if plans to expand cogeneration capacity were abandoned.

Assuming a total project investment of about $500 million and a construction cost escalation factor of ten percent per year, permit delays could add $50 million to total system costs per year. This implies that permitting would, in effect, add $250 million to project costs if the approval process was as long as estimated and assuming that the entire project was pushed back as a result. These costs would all have to be recovered through the rates paid by the D.H. system customers.

In the current regulatory environment, permits and authorizations are basically approached on a piecemeal basis and little weight is given to the acceptability or desirability of the project as a whole. Rather, a project may be abandoned because of failure to obtain one or two critical permits in a timely manner. This problem is very apparent in the case of the cogeneration district heating project where total system development will span twenty-five years or longer. The need to obtain encroachment permits, construction permits, easements, power plant siting permits, or other needed authorizations many years in the future introduces such substantial uncertainty that it may be extremely difficult for any private investor to assume the risks. In effect, potential investors may be unable to evaluate the attractiveness of the investment due to lack of knowledge about the future market, uncertainty about operating constraints, and unpredictability of the regulating environment.

Alternative 2 - Streamline Permit Process:

If the entire permitting process were streamlined as suggested in the second approach, the time delays and cost escalations could be limited. This assumes that all fundamental steps in the process of challenging the need and impact would remain and that essential permits would be applied for or would be handled in an "overall project" context. In addition, the legislation would accelerate the timetable. Considerable project risk would continue to exist, however, because of the remaining uncertainty about the outcome of the various permit applications in future project phases. This second alternative could result in a permit and authorization time frame similar to the first

Optimistic Time Frame shown in the illustration, or slightly in excess of three years duration. Accordingly the process could still result in total project cost escalation of $150 million.

Alternative 3 - One Window Approach:

Limitation of permitting costs and time delays might also be accomplished by delegating the entire process to a central governmental authority with a specifically mandated timetable for completion. Alternative three could eliminate some of the cost of application preparation and would compress the processing time somewhat. It would not, however, alter any of the fundamentals of the permitting process or remove any of the uncertainty surrounding permits needed in the future. This alternative might also produce a time frame similar to the first Optimistic Time Frame shown in the illustration.

Alternative 4 - Advanced Permitting:

Alternative 4 would have the greatest impact on reducing project risk and cost because it would approach the permit process on a project basis instead of on a piecemeal basis. This would provide potential investors with advanced assurance that the project could be designed on a system basis and that future phases would not be encumbered or jeopardized by the permit process. Not only would this facilitate development of the DH system on as large a scale as possible, but it would also permit the maximum conservation of natural gas. And if this concept was integrated with alternatives for compressing the permit filing and processing time frame, costs and time delays due to permitting might be minimized. Under this latter scenario, total permitting time might be constrained to two years or less.

Alternative 5 - Alter Scope of District Heating Plan:

Finally, alternative 5 suggests that a way to avoid the problems associated with potentially the most troublesome permits is to design around them. By eliminating plans for additional cogeneration capacity at Riverside and High Bridge, many of the environmental evaluations and permits (such as Certificate of Need for power plant expansion, siting approval, emissions requirements, etc.) would become unnecessary. This would also remove much of the uncertainty created by the need to obtain those permits in the future. The most obvious consequence to this approach is that the system would serve fewer customers and would result in less energy being conserved through cogeneration.

Social and Political Consequences:

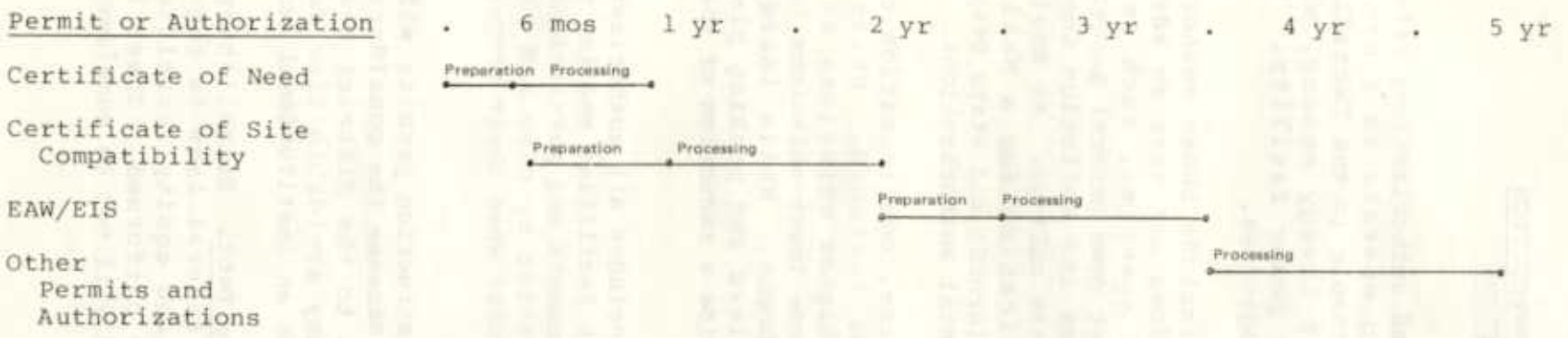
The social and political consequences of the five alternatives will probably vary according to the sensitivity of the public to the specific changes made in the normal permitting process. If the status quo is assumed and the project is not implemented, the social and political problems are effectively shifted into the future and will be associated with dwindling gas supply problems, curtailments, etc. If alterations are proposed to insure implementation of the system, however, someone may be adversely affected. That occurence represents a real social consequence which might have negative political impact.

The more sensitive issues will likely be environmental concerns and the granting of easements. Alternatives 2, 3, and 4, which involve alterations in the evaluation of projects having potential impact on the environment, are the approaches to the permit issue which could lead to the greatest public challenge. Significant opposition should be anticipated if any alteration in the permitting process even gives the appearance of favoring the DH developer over environmental quality. And the need to gain easements on private property for placement of pipelines could spark intensive neighborhood resistance. Regardless of the actual impact of the project or the potential positive outcomes of the project, any adverse impact could develop into political controversy.

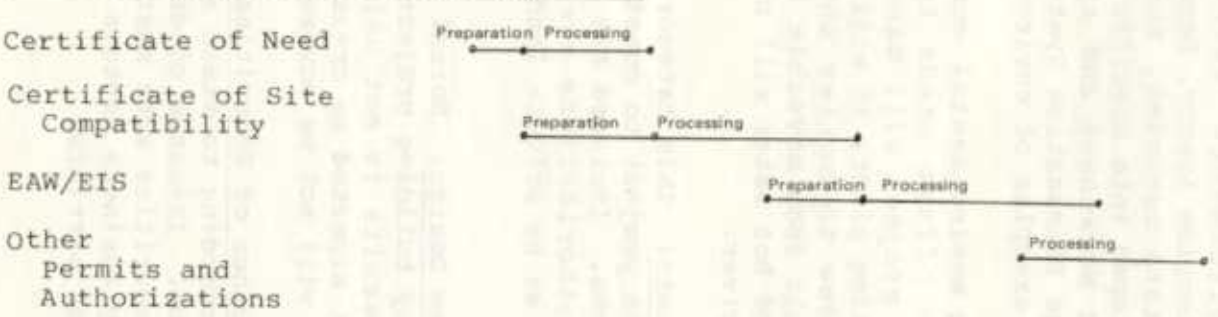
There is substantial risk in altering the normal permitting process because the resultant controversy, legal challenge, time delay, and additional expense could become more expensive and time-consuming than the normal process.

TWIN CITIES DISTRICT HEATING STUDY
START-UP AND CONSTRUCTION PERMITS AND AUTHORIZATIONS
PESSIMISTIC AND OPTIMISTIC TIME FRAMES

PESSIMISTIC TIME FRAME



OPTIMISTIC TIME FRAME (1)



OPTIMISTIC TIME FRAME (2)

(1) Assuming project is classified as a "Large Energy Facility"

(2) Assuming project is not classified as a "Large Energy Facility"

CATEGORIES OF START-UP/CONSTRUCTION PERMITS AND AUTHORIZATIONS

Operating Permits: Operating permits and authorizations refer to all approvals allowing the project to operate as a heating facility for the specified areas. An example is the Certificate of Need, obtained from the Minnesota Energy Agnecy, which justifies the construction of a new power facility. Most operating permits are granted by state agencies.

Environmental: Environmental permits include those authorizations which certify that the project does not have an adverse effect on the environment. Federal agencies, such as the Environmental Protection Agency, have set down general guidelines which Minnesota state agencies, such as the Pollution Control Agency, have developed into specific state rulings. An Environmental Assessment Worksheet and application for a National Pollution Discharge Elimination System (NPDES) and State Disposal System Permit are examples of environmental authorizations.

In evaluating environmental concerns, consideration of an implicit emission offset needs to be included. While the district heating project will cause higher emissions at the electrical generating plant, it will cause lower emissions in the downtown areas due to boiler shutdowns. While increased emissions may result from moveable boilers and peaking plants, the distribution of hot water will provide a reduction of thermal pollution in the river.

Use of Land/Easements: This category includes all authorizations needed to allow the project to construct facilities and lay pipes in desired locations. Included are easements and permissions for right-of-way. Authorizations are granted by city and county agencies, as well as by private land owners when their properties are affected.

Construction/System Design: Normal construction permits will be required as for any building project. Because the consideration of construction permits is not unique to the district heating project and is not expected to create any avoidable time delays or problems, they will not be covered as an institutional issue.

Incorporation/Issuance of Securities and Debt: Establishment of the corporation according to state and federal laws is required before construction. Issuance of debt and equity securities in accordance with securities acts must be performed. These items are typical of any business venture and will not be considered as major institutional barriers.

TWIN CITIES DISTRICT HEATING STUDY

SUMMARY OF PROJECTED PERMITS AND AUTHORIZATIONS

Permit	Applicability	Estimated Time		Estimated Cost		Processing Will Follow
		Preparation	Processing	Preparation	Filing	
Certificate of Need (Minnesota Energy Agency)	Applies	1-3 months	6 months	$15,000-$30,000	$20,000-$50,000	Initial Step
Certificate of Site Compatibility (Minnesota Environmental Quality Board)	May Apply	2-6 months	12 months	$20,000-$40,000	$15,000-$30,000	Application for Certificate of Need
Environmental Assessment Worksheet Environmental Impact Statement (Minnesota Environmental Quality Board)	Applies	3-6 months	9-12 months	---	$20,000-$50,000	Certificate of Site Compatability
Water Appropriation Permit (Department of Natural Resources)	Most Likely Applies	Minimal	1-3 months	Minimal	Minimal	Environmental Impact Statement
Work in the Beds of Public Waters (Department of Natural Resources)	Most Likely Applies	Minimal	1-3 months	Minimal	Minimal	Environmental Impact Statement
National Pollution Discharge Administration System and State Disposal System (Pollution Control Agency)	Applies	Minimal	3-9 months	Minimal	Minimal	Environmental Impact Statement
Utility Crossings of Public Lands and Waters (Department of Natural Resources)	Applies	Minimal	1-4 months	Minimal	$100-$1,000	Environmental Impact Statement
Gaseous Waste Disposal (Pollution Control Agency)	May Apply	Minimal	1-2 months	Minimal	Minimal	Environmental Impact Statement
Burning Permit (Pollution Control Agency)	May Apply	Minimal	1-2 months	Minimal	Minimal	Environmental Impact Statement
New Source Review (Environmental Protection Agency)	Applies	Minimal	1-3 months	Minimal	Minimal	Environmental Impact Statement
Significant Deterioration Review (Environmental Protection Agency)	Applies	Minimal	1-3 months	Minimal	Minimal	Environmental Impact Statement
Solid Waste Disposal - Ash Storage	May Apply	Minimal	1-2 months	Minimal	Minimal	Environmental Impact Statement
Rivers and Harbors Act Permit (U.S. Army Corps of Engineers)	Applies	Minimal	1-3 months	Minimal	Minimal	Environmental Impact Statement
Granting of Easements	Applies	3-6 months	1-2 months	Unknown	Minimal	Environmental Impact Statement
Utility Permit on Trunk Highway (Department of Transportation)	Applies	Minimal	2-6 months	Minimal	Minimal	Environmental Impact Statement
Permit to Use Airspace Above or Subsurface Below Trunk Highway (Department of Transportation)	Applies	Minimal	2-6 months	Minimal	Minimal	Environmental Impact Statement
Encroachment Permit (City of Minneapolis)	May Apply	Minimal	1 month	Unknown	Minimal	Environmental Impact Statement
Application for Underground Utility Permit (City of Minneapolis)	May Apply	Minimal	1 month	Unknown	Minimal	Environmental Impact Statement
Permit for Utility Right of Way (City of St. Paul)	Applies	Minimal	3 months-1 year	Unknown	Minimal	Environmental Impact Statement

SUMMARY OF MAJOR START-UP/CONSTRUCTION PERMITS AND AUTHORIZATIONS

OPERATING PERMITS

Requirement: Certificate of Need

Regulating Authority: Minnesota Energy Agency (MEA)

Citing: Minnesota Statute §116.H.13

Purpose: The Certificate of Need is granted to a new "large energy facility" which is deemed to provide socially beneficial services (including environmental quality protection) and/or positively affects energy conservation programs or future energy demands. "Large energy facility" predominantly relates to 50 megawatt electric power generating plants; high voltage transmission lines; and pipelines or storage facilities for coal, oil, and gas.

Submission Requirements: The MEA develops agency rules governing contents for Certificates of Need. Rules for large electric generating facilities are found within 6MCAR §2.0609 et seq. Contents include a description of the facility, discussion of alternatives, a map of the system, forecasts of usage, capacity, environmental data, and any other information relevant to the consideration of the facility's need.

Actual applications have ranged from 50 to 300 pages in length.

Time Element: Estimates of one to three months preparation time have been suggested, requiring a maximum effort of two man-years. The application must be approved or denied within six months of submission.

Cost Element: In addition to preparation costs, a filing fee of $10,000 plus $50 per megawatt is required.

Effect on District Heating: A preliminary assessment must be made regarding the nature of the district heating project. The key concept is that of "large energy facility." None of the criteria for a large

OPERATING PERMITS (Continued)

energy facility directly relate to hot water heating. The installation of additional turbines at Riverside or High Bridge would present the only cause for submission of an application (Subd.5.(a) "Any electric power generating plant [or expansion]...with a combined capacity of 50,000 kilowatts or more"). Additional turbines will provide well over 50,000 kilowatts of additional capacity.

The ramifications of the large energy facility classification extend beyond the Certificate of Need. Power plant siting and environmental review processes will vary accordingly. The time element is further complicated by the fact that the Certificate of Need application must be submitted first and the processing of other permits may or may not be conducted concurrently. Benefits of concurrent processing include both a speedier approval process and an opportunity for simultaneous public review of complementary permit applications. Disadvantages include the possibility of lost costs of processing other applications in the event of Certificate of Need denial.

The installation of additional turbines will be performed in later phases of the project. If each phase of the project is considered autonomously, the earlier phases--predominantly retrofitting operations--would not require a Certificate of Need. After using the earlier phases to determine actual effectiveness of the project, certification of additional turbine need could be applied for in later phases. However, the uncertainty associated with future approval may impact system design and economic viability.

Another item for consideration is that the turbines will presumably be the property of NSP, not district heating. The process of this certification may therefore be placed upon NSP, with district heating as an interested party. Regardless of who has to prepare the application, the timing constraints on the project should remain the same. For allocation of this cost, please refer to Issue Paper I.E.: "Allocation of Costs/Benefits Between Electrical Generation and District Heating".

OPERATING PERMITS (continued)

As mentioned above, the current Certificate of Need guidelines of the MEA do not relate directly to a district heating project. Future Agency decisions may expand the definition of large energy facility to include the D.H. project. If this occurs, application for the Certificate of Need will automaticlly be required from the outset of the project.

Requirement: Certificate of Site Compatibility

Regulating Authority: Minnesota Environmental Quality Council (MEQC).

Citing: Power Plant Siting Act, Minnesota Statute §116.51 et seq.

Purpose: It is "the policy of the state to locate large electric power facilities in an orderly manner compatible with environmental preservation and the efficient use of resources. In accordance with this policy, the board [MEQC] shall choose locations that minimize adverse human and environmental impact while insuring continuing electric power system reliability and integrity and insuring that energy needs are met and fulfilled in an orderly and timely fashion" (MN Statute §116C.53).

Submission Requirements: The MEQC prescribes the specific form and manner of the application. The application must contain at least two sites which must be compatible with areas previously included in the MEQC's inventory of study areas. Adequate reasons for variation must be specified.

Every other year, utilities which own or operate, or plan within 15 years to own or operate large electric power generating plants, must submit fifteen-year forecasts of expansions, demand, capacity, and other relevant factors.

Time Element: Preparation of a proposal for the certificate could require 2-6 months and a maximum effort of 8 man-years. The review process entails a year of consideration by the MEQC, various hearings, and an appointed Site Evaluation Committee. An

OPERATING PERMITS (Continued)

additional six months extension could occur, but is rarely required.

Permits requiring emergency certification may be issued in no more than 195 days after the MEQC accepts the application and determines that an emergency situation exists.

The Certificate of Site Compatibility will be applied for between the time of filing and approval of the Application for Certificate of Need. This timing will depend on the prospects for approval of the Certificate of Need.

Cost Element: Along with preparation costs, the site application fee is "$500 for each $1,000,000 of production plant investment in the proposed installation as defined by the Federal Power Commission Uniform System of Accounts" (MN Statute §116.C.69 Subd.2.).

Effect on District Heating: The act is only applicable for large electric generating plants. The High Bridge and Riverside facilities were constructed before the siting act, and they may operate freely as long as their capacity is not increased. Divisibility of the project, as described in the discussion of the Certificate of Need, appears as an alternative to allow for gradual development of the project without initial certification delays.

Because the MEQC requires two proposed sites in site applications, the possibility exists that the alternative site may be selected for the project. The district heating project, however, poses little or no opportunity for alternative siting because D.H. system design depends heavily on the point of heat generation.

The Power Plant Siting Act, like the Certificate of Need, is not geared specifically to district heating. Legislation or interpretation may increase the scope of the act to include district heating.

ENVIRONMENTAL PERMITS

Requirement: Environmental Assessment Worksheet(EAW)/ Environmental Impact Statement (EIS)

Regulating Authority: Minnesota Environmental Quality Council (MEQC)

Citing: 6MCAR §3.021 et seq.

Purpose: The environmental review process begins with the completion of an Environmental Assessment Worksheet (EAW)--a document, in worksheet format, which provides basic summary data on the proposed project. This data is circulated among state agencies and local governments which evaluate the project in terms of any potential significant environmental effects. An environmental impact statement (EIS) should be prepared if the project is found to present such potential. "The purpose of an Environmental Impact Statement is to provide information for agencies and private persons to evaluate proposed actions which have the potential for significant environmental effects, to consider alternatives to the proposed actions, and to institute methods for reducing adverse environmental effects.... It is to be utilized as a guide in issuing, amending, and denying permits and carrying out the other responsibilities of public agencies to avoid or minimize adverse environmental effects and to restore or enhance environmental quality consistent with the Act" (6MCAR §3.021).

Submission Requirement: Contents of the EAW include an activity description, a standard worksheet and checklist, and an assessment of potential environmental impact. Submission of the EAW may be waived in cases where it is evident that an EIS will be required. In cases where an EIS is not required, the EAW will include a negative declaration notice, indicating this exemption. (The University of Minnesota issued an EAW with a negative declaration notice on its GRID ICES program. In addition, it submitted a preliminary environmental assessment, an environmental review, and an emission analysis.)

An EIS is prepared for a project by a responsible government unit. The Sherco 3 and 4 EIS, for example, was prepared by the Minnesota Pollution Control Agency (MPCA). Both a draft and a final EIS are prepared. The draft EIS includes a project description,

ENVIRONMENTAL PERMITS (Continued)

environmental impact, commitments of resources, alternatives, and impact on associated governmental controls. The final EIS includes the draft EIS, comments and summaries thereof, and the responsible agency's response to significant environmental issues raised during draft and review.

Time Element: The EAW/EIS must be submitted after the Certificate of Need because the contents must relate to the environmental review prepared by the Minnesota Energy Agency. After processing the site certificate, the MEQC determines whether an EIS is required. No environmental permits may be submitted until the EAW/EIS process is completed.

See the accompanying chart of the review process for illustration of review process timing.

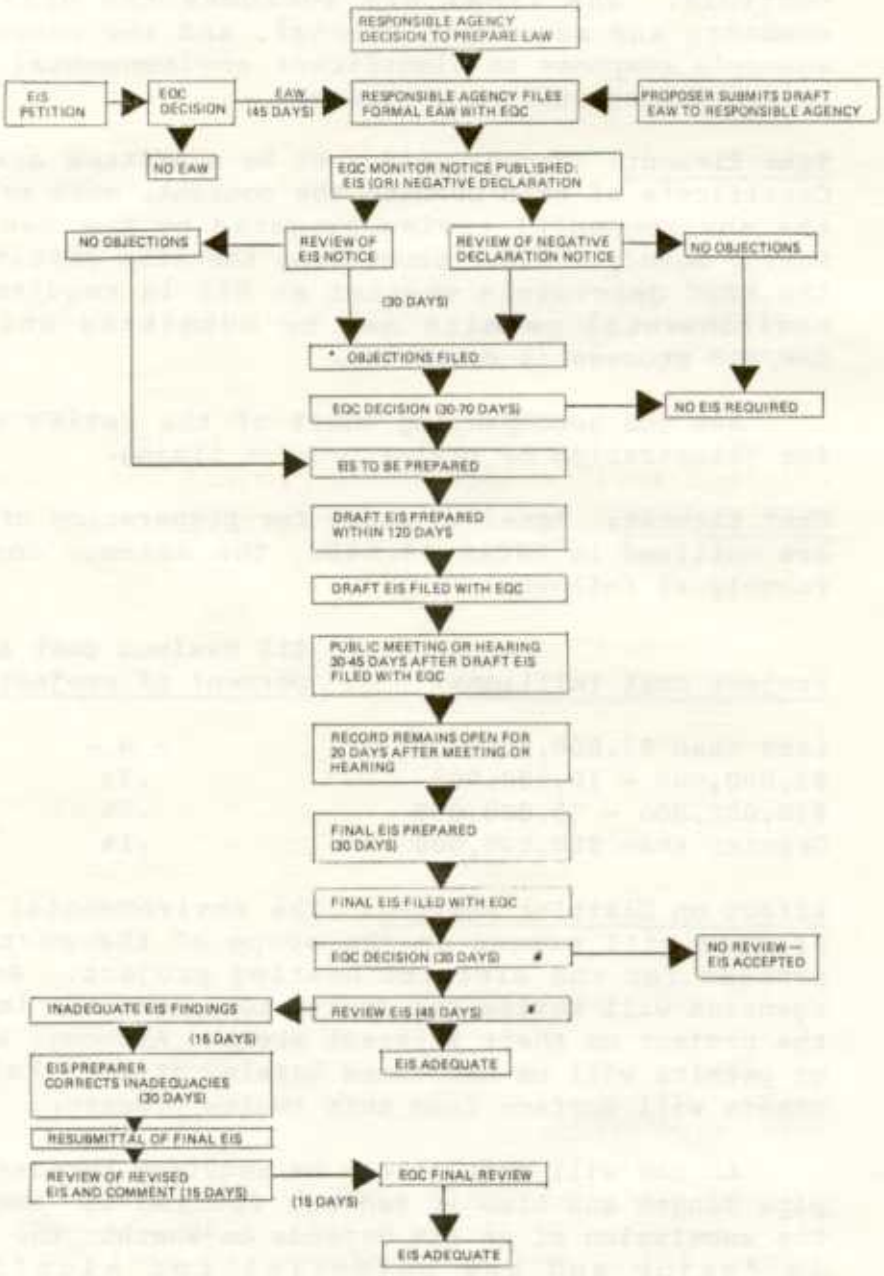
Cost Element: Assessed costs for preparation of an EIS are outlined in 6MCAR §3.042. The maximum costs are roughly as follows:

Project Cost (millions)	EIS Maximum cost as a percent of project cost
Less than $1,000,000	- 0 -
$1,000,000 - 10,000,000	.3%
$10,000,000 - 50,000,000	.2%
Greater than $50,000,000	.1%

Effect on District Heating: The environmental review program will expand on the scope of the permitting process for the district heating project. Relevant agencies will review the drafts to assess the impact of the project on their interest areas. Although a number of permits will be mentioned herein, it is likely that others will surface from this review process.

An EAW will most likely be required because of the pipe length and also if federal funding is employed. The submission of an EIS depends on whether the project is "major and has potential for significant environmental effects." (6MCAR §3.025). If the large energy facility classification would apply, an EIS would most likely be required (for certain, an EIS will be required for construction of additional generating capacity at High Bridge or Riverside). Without the requirement of an EIS, the permitting process could conceivably be shortened by up to one-half year.

MINNESOTA ENVIRONMENTAL REVIEW PROCESS



Review time variable dependent upon meeting or hearing schedule

* From pertinent agencies, petition or developer

ENVIRONMENTAL PERMITS (Continued)

Requirement: Environmental Permit Coordination

Regulating Authority: MEQC

Citing: 6MCAR §3.101 et seq.

Purpose: An optional procedure has been established to allow a project to coordinate all environmental permitting. This would be performed through the State Planning Agency's Permit Coordination Unit (PCU).

Submission Requirements: An applicant sends in a Master Application Permit, Local Certification Form, and EQB Certification that an EIS was filed or waived. The PCU gives public notice of this application and interested agencies then send the PCU notice of required applications. The project must submit all permits requested.

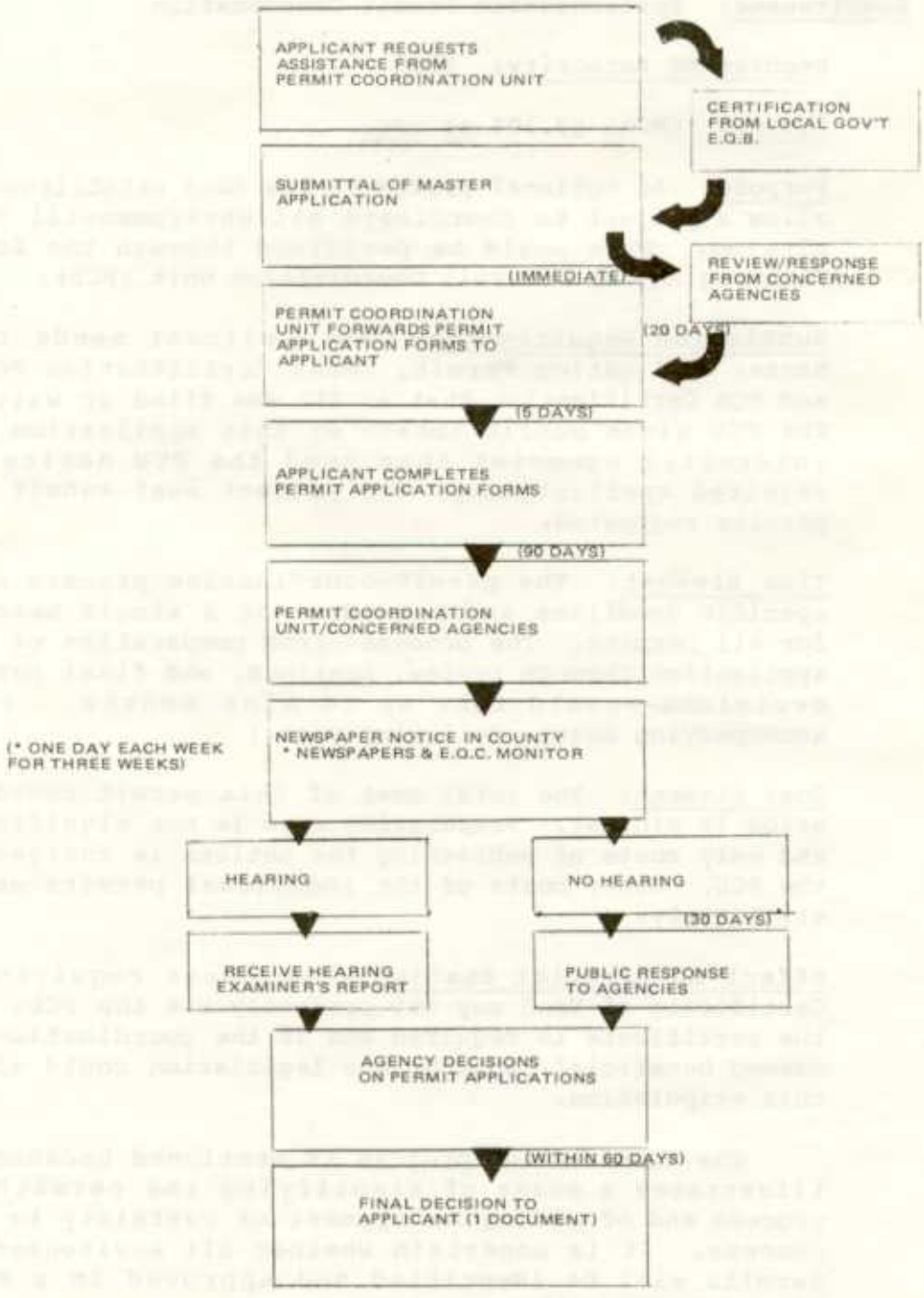
Time Element: The permit-coordination process sets specific deadlines and provides for a single hearing for all permits. The process--from preparation of the application through review, hearings, and final permit decisions--could take up to nine months. (See accompanying chart, following page.)

Cost Element: The total cost of this permit coordination is minimal. Preparation cost is not significant and only costs of publishing the notices is charged by the PCU. Other costs of the individual permits would still apply.

Effect on District Heating: Projects requiring a Certificate of Need may not presently use the PCU. If the certificate is required and if the coordination is deemed beneficial, appropriate legislation could alter this stipulation.

The coordinating program is mentioned because it illustrates a means of simplifying the permitting process and of adding an element of certainty to the process. It is uncertain whether all environmental permits will be identified and approved in a more timely manner without such a process.

MASTER APPLICATION PROCEDURE



ENVIRONMENTAL PERMITS (Continued)

Requirement: Water Appropriation Permit and Work in the Beds of Public Waters Permit

Regulating Authority: Department of Natural Resources (DNR)

Citing: MN Statute §105.41 and 105.42

Purpose: The objective is to "develop and manage water resources to assure a supply adequate to meet long-range seasonal requirements....and quality control purposes" (§105.405). The permits allow for parties to appropriate large amounts of public water and to work in beds of public water.

Submission Requirements: Standard permit forms must be submitted. No special or unusual submission requirements are expected.

Time Element: No significant preparation time is required. One to three months processing time may result.

Cost Element: Minimal.

Effect on District Heating: Although submission may be necessary prior to expansion at High Bridge or Riverside, the permits do not appear to pose significant barriers to the project.

Requirement: National Pollution Discharge Elimination System (NPDES) and State Disposal System

Regulating Authority: Minnesota Pollution Control Agency (MPCA)

Citings: PL92-500 and MN Statute §115.07

Purpose: The objective is to provide for the construction of wastewater treatment facilities and the discharge of wastewater to surface waters of the state.

Submission Requirements: Submission of MCPA Form 7550 is required. This contains general information regarding the nature and usage of the disposal system.

ENVIRONMENTAL PERMITS (Continued)

Time Element: No significant preparation time is expected. Three to nine months processing time may result, depending on PCA hearings.

Cost Element: No significant cost of permitting is noted. However, additional project expenditures are possible. Construction of additional cogeneration capacity will necessitate expenditures for additional water treatment facilities and cooling towers. Such expenditures could add hundreds of thousands of dollars to the project and consume 5% of the plant's energy for operation. Even though the district heating plan provides for an alternative channeling of the reject water, (that is, the D.H. system replaces the power plant condenser) the treatment will likely be needed in summer months when the D.H. system might have a very low load.

Effect on District Heating: The permits are applicable only if additional wastewater treatment facilities are required. Even with the addition of turbines, no material problems in obtaining the permits are foreseen. Additional costs noted above might provide the only problems.

Requirement: Utility Crossings of Public Lands and Waters

Regulating Authority: DNR

Citing: MN Statute §84.415

Purpose: The permit attempts to regulate utility crossing of public lands and waters in order to preserve the environment and minimize adverse effects.

Submission Requirements: For environmental standards in the areas of route design, structural design, construction methods, safety consideration, and right-of-way maintenance, the application must state whether environmental standards are satisfied.

Time Element: Preparation time does not appear to be material. The process could require one week to four months depending upon the urgency of the permit.

Cost Element: Minimal application fees apply. Rate tables have been developed for utility crossings at the

ENVIRONMENTAL PERMITS (Continued)

edge of public waters. The fee is approximately $25 per 100 feet of underwater pipeline. This is measured by the number of feet between banks or shores.

Effect on District Heating: This permit requires numerous environmental considerations. The route and design of the project may require alternation in order to comply with the standards.

Requirement: Clean Air Act and relevant Air Pollution Control Permits

Regulating Agencies: Environmental Protection Agency (EPA) and PCA - Air Quality Division

Citings: Clean Air Act and its Amendments, and the Air Pollution Control (APU) Rules, Regulations, and Air Quality Standards.

Purpose: The purpose of these acts is to prevent, abate, and/or control air pollution.

Submission Requirements: Project emission levels and air pollution control designs must be presented and must conform to specified guidelines.

Time Element: For facilities which add to the air emissions, permits for burning and gaseous waste disposal must be obtained before construction. Processing time should not pose a significant barrier.

Cost Element: Costs of testing for actual emission levels will be required, but no material costs are foreseen.

Effect on District Heating: Effects of district heating on air quality will be more fully covered in the MEA special report on this topic. It may be noted that certain displacement consequences arise in transferring the power generation to the High Bridge and Riverside plants. District heating will create new air polluting facilites, when additional turbines are constructed, and when peaking plants and mobile boilers are used.

USE OF LAND/EASEMENTS

Requirement: Easements

Regulating Authority: Not applicable; easements granted by private land owners.

Purpose: Easements will allow access across privately owned property. The D.H. company will enter into easement agreements with companies or individuals whose property will be crossed in project construction.

Submission Requirements: Legalities will involve agreements to be drawn up between the district heating company and the private party. Actual details will vary between parties. Easements must be filed with the County Recorder.

Time Element: After deciding on the specific piping route, the project will need to gain easements from all parties whose property is crossed. The time involved is entirely dependent upon the agreability of the parties. Experience of other utilities has been fairly good, but if problems arise, the process could take six months or more.

Cost Element: The negotiation of easements would involve normal legal fees. Conciliatory costs for such displacements as parking spaces could arise. (For example, if construciton would block ten spaces, the project could pay daily parking costs for these spaces.)

Effect on District Heating: The necessity of such easements (and city permits, to be mentioned later) should affect the routing plans of the project. Routes should be selected in light of the need for such agreements. Optimistically, the affected parties will be amenable to the use of their property. Pessimistically, the project will cause unforeseen problems to the parties, and either re-routing or extensive negotiation or compensation will be required.

Requirement: Right of Eminent Domain

Regulating Authority: State of Minnesota

Citings: MN Statutes §116.C.63, §117, §300.04 and §453.56

USE OF LAND EASEMENTS (Continued)

Purpose: Construction and land use which is considered to be in the public interest and necessary for public welfare is granted the right to use another party's property for its own purposes. The other party will be compensated for this usage.

As provided by §300.04, a "public service corporation" may acquire private property by right of eminent domain to transact its public business.

Submission Requirements: (Proceedings are fully discussed in §117.) The process requires filing of a petition of eminent domain with the district court 20 days before presentation to the property owner and a notice of possession with the owner of the property at least 90 days before possession. The court decides on the necessity of the proposal and, upon granting easement permission, appoints three commissioners to decide on compensation. Within 90 days, the commissioners file their decision on compensation. The petitioner then notifies the owners within 10 days and either the owners will receive the compensation, or one of the parties will appeal this decision within 40 days. The appeal will result in a jury trial, which will decide the outcome.

Time Element: Without appeal, the process may require nine months before eminent domain is assumed. With appeal, the jury trial could last indefinitely.

Cost Element: Costs determined by the commissioner include fair value, damages, reasonable appraisal fees, and taxes and assessments. The actual cost to the district heating project cannot reasonably be prepared until more information on the proposed route is available.

Effect on District Heating: If the district heating company is considered to be a public service corporation, it will possess the right of eminent domain as a regulated, franchised facility. If the necessity of gaining access to routes through the use of eminent domain arises, the D.H. company would possibly be constrained to being a regulated and franchised utility.

USE OF LAND/EASEMENTS (Continued)

Eminent domain is considered a "last resort" method of gaining access to property. Obtaining easements from the owners is normally attempted first. Where no problems are anticipated, avoidance of the court system through easements should take less time and provide a friendlier atmosphere between parties. In the event that problems arise, eminent domain may be invoked.

The right of eminent domain may facilitate the gaining of easements. With the knowledge that eminent domain can be invoked, owners of property will be more willing to settle with the D.H. company than to resolve the dispute in court.

Requirement: Utility Permit on Trunk Highway and Permit to Use Airspace Above or Subsurface Below Trunk Highway

Regulating Authority: Minnesota Department of Transportation (DOT), Highway Division

Citing: MN Statue §161.433 and Chapter 500 Laws of 1959, MN Reg. Hwy 33

Purpose: The objective of the permit is to enable joint development on highway properties. The D.H. company will apply when it is either attaching pipes to a highway structure or running pipe under a trunk highway.

Submission Requirements: Standard applications are required, explaining the project description, design, and routing affecting the highways.

Time Element: The application may require approval of the DOT, Federal Highway Administration, and local authorities, and could cover two to six months.

Cost Element: No significant cost noted.

Effect on District Heating: The permits will be required as applicable. No unusual problems are foreseen with obtaining the permit.

USE OF LAND/EASEMENTS (Continued)

Requirement: Encroachment Permit (Non-Franchised Utility) and Application for Underground Utility Permit (Franchised Utility).

Responsibile Municipality: City of Minneapolis

Citing: City Ordinance 95 (Enchroachment Permit)

Purpose: Permission from the city is required when laying pipe on/under public land.

Submission Requirements: For an Encroachment Permit, a letter must be sent to the City Council explaining the nature of the project. For an Application for Underground Utility Permit, a City Form 100 must be filed which also describes the project and its route.

Timing Element: Approval of these is fairly fast (one week to one month).

Cost Element: Costs are minimal. Displacement costs may occur as noted in Easement discription.

Effect on District Heating: See discussion in Easement description.

Requirement: Permit for Utility Right of Way

Responsible Municipality: City of St. Paul

Citing: St. Paul Administrtive Code, Chapter 5

Purpose: The purpose of the process is to allow for proper and orderly construction of utility work on city property.

Submission Requirements: The project submits its construction plans to the city. These are reviewed by Public Works, which then prepares its recommendations.

Time Element: A new city ordinance will be required for this project, as it would be a new utility. Due to the review and hearings process, the ordinance could take three months to a year to process.

Cost Element: See discussion in Easements description

Effect on District Heating: See discussion in Easements description.

Appendix B

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

II. Ownership Assumption: Public

II.A. Issue: Form and Structure

II.A.1 Sub-Issue: Responsible Level of Government

Issue Definition

The responsible level of government is that level which will own the district heating project. Each government level has different laws which relate to the establishment and operation of enterprises under its jurisdiction. The laws applicable to a publicly owned district heating enterprise will depend on which government level assumes ownership of the project.

Why Responsible Level of Government is an Issue

The level of government which owns the district heating enterprise is an important institutional issue because it may determine who bears some of the financial risk associated with the project. The level selected may be responsible for the costs of debt and equity that exceed district heating revenues.

The responsible level of government is also an issue because existing legislation imposes different restrictions on governmental levels, especially in the areas of financing and taxation, (e.g., municipalities generally have broader taxing and financing powers than do metropolitan agencies).

Impact

The responsible level of government will impact the D.H. project's debt financing, taxing power, structure, enabling legislation, and public acceptance.

The characteristics and powers of each level of government will vary on these issues, especially in regards to the following items:

- Debt Financing - The types of issuable bonds, (e.g., general obligation bonds, general obligation revenue bonds, or revenue bonds) will vary. Each level of government may have a different credit rating and, consequently, a different interest rate. In addition, the

level selected will impact who is liable for principal and interest payments on general obligation of bonds.

- Taxing Power - The district heating company may or may not be allowed to levy taxes for start-up costs, debt retirement, or operations. The tax bases of existing levels of government differ (e.g., income tax and sales tax for state government; property tax for municipalities and other political subdivisions), so the type and amount of tax available will vary accordingly. Conceivably, another level of government or unit of government could tax on behalf of the district heating company, either to secure bonds, to loan to the D.H. system, or to make outright grants.

- Structure - The level of government will impact whether the district heating company is created as a public corporation, a commission, an agency, or some other formation.

- Enabling Legislation - The level of government will determine whether entirely new legislation, moderate changes in legislation, or minimal changes to existing statutes must be proposed to establish the D.H. company.

- Public Acceptance - The degree of acceptance of the project will depend on the public's willingness to accept its risks. The level of government ownership will not exactly match the type or degree of benefit, so the possibility exists that those who benefit will not be the same as those who own or who might bear risk.

Alternatives

Alternative levels of government which could own the project include the following:

1. City - the entire enterprise could be owned either by Minneapolis or St. Paul. The base case assumes that the entire system will have a single owner. Even though it would serve both cities, the D.H. company could be owned by one city. Alternatively, each city could own its own system.

2. County - either Hennepin or Ramsey County could own and operate the entire system. Alternatively, each county could own its own system.

3. Multi-jurisdictional - a new public corporation could be created by statute to own the D.H. system. This special

district, encompassing the areas of two or more existing political subdivisions (e.g., a Minneapolis - St. Paul combination), would obtain its authority from each of the municipalities in which the system was established. The new governmental unit could be endowed with whatever powers were necessary for financing, taxing, etc.

4. Metropolitan - a metropolitan agency (similar in concept to the Metropolitan Waste Control Commission or the Metropolitan Airport Commission) could be established by legislation to own the district heating system. This new political subdivision could be granted whatever authority and power was necessary to create and expand the D.H. system for the benefit of the entire metropolitan area.

5. State - an existing or newly created state agency or board (similar in concept to the Minnesota Zoological Garden) could own the metropolitan D.H. system and any other district heating system for the benefit of the entire state.

Federal ownership will not be considered as an alternative.

Consequences

Alternatives 1 and 2 - City or County ownership:

- Financing:

Existing legislation for municipal public utilities would limit taxpayers' liability to the D.H. project by allowing only 20% of construction to be funded by general obligation bonds. Such limitation may be attractive to taxpayers, but it also reduces debt structure flexibility and it dictates that the bulk of debt funding be accomplished through higher-interest revenue bonds.

- Taxing Power:

If general obligation bonds were used to help finance the publicly owned D.H. system, the nature and size of the tax base would become relevant in determining the security behind the bonds and the interest rates. Municipalities obtain most of their tax revenues from property taxes and, in doing so, compete with numerous levying authorities for these revenues. The state, however, relies on broader bases: income taxes and sales taxes. Conseqently, municipalities may be in a less advantageous position for providing security for general obligation bonds.

- Structure:

The base case scenario assumes that the entire Twin Cities district heating system would be owned by one entity. Conceivably, either Minneapolis or St. Paul could own the system and provide service to the other, but this could present problems. The possible funding of initial start-up expenditures with appropriations, treatment of operating deficits or surpluses, franchise fees and agreements, regulation of rates, hookup policies, and security for general obligation bonds are some of the issues which could make such an arragement politically unacceptable for residents of either city. As a practical matter, then, separate systems would probably be created for both cities or counties. The resultant system segregation, loss of economies of scale, and management redundancies could adversely affect the economics of the project.

For examples of ownership forms and governing boards, see descriptions of Municipal Public Utilities, Minneapolis Water Works, St. Paul Water Utility, and Port Authority in the Appendix.

- Enabling Legislation:

Legislation currently exists for the establishment of a municipal public utility, including guidelines for financing and taxation (see Appendix). Existence of appropriate legislation favors city or county ownership in that few changes in current law would be needed to facilitate construction of a district heating project.

- Public Acceptance:

City or county ownership would perhaps place the district heating company on a level of government most closely tied to the incidence of D.H. benefits. Publicly owned water and electric systems are owned by the citizens of the same political subdivision which receive utility services. City utility ownership can be locally traced to the waterworks, which both Minneapolis and St. Paul have owned for many years, each in a somewhat different fashion. (See Appendix for more detail.)

Alternative 3 - Multi-jurisdictional ownership:

- Debt Financing:

The multi-jurisdictional form of government is exemplified by the municipal power agency (MPA). An MPA is limited in that it may issue only revenue bonds secured by the revenues from electricity sales. Depending on the specific needs of the D.H. project, general obligation bonds may be considered for its funding. If issued by a multi-jurisdictional agency, the bonds' interest rates may be somewhat higher than rates for metropolitan or state general obligation bonds. This is because of the smaller property tax base and resultant reduction in security to bond holders.

- Taxing Power:

MPA's may neither tax nor require a municipality to tax on its behalf. Should general obligation bonds be issued, the multi-jurisdictional D.H. company would require authority to levy taxes for their retirement.

- Structure:

Multi-jurisdictional MPA's are currently established as political subdivisions and municipal corporations.

- Enabling Legislation:

Specific laws have been established for MPA's, although no general laws regarding multi-jurisdicitonal public utilities exist. Modifications in this legislation would be required for a multi-jurisdictional D.H. company to be created. Alternatively, new legislation could be passed which would be specific to the needs of a D.H. company.

- Public Acceptance:

Multi-jurisdictional ownership would allow Minneapolis and St. Paul or Hennepin and Ramsey counties to jointly own the district heating company. As with city ownership, the municipalities receiving direct benefits from the enterprise would both own the utility and pay any taxes which might be levied for retirement of bonds or subsidization of operations or start-up. Alternatively, any surpluses generated would also accrue to the owning cities or counties.

Alternative 4 - Metropolitan ownership:

- Debt Financing:

  Debt provisions are established by specific enabling legislation and differ for each commission or authority. The amounts of issuable revenue or general obligation bonds also vary by authority. Because of the larger tax base, general obligation bond interest rates on the metropolitan level may be lower than for cities or counties.

- Taxing Power:

  For debt security or retirement, certain commissions may levy property taxes or other taxes (e.g., wheelage or on-sale liquor taxes); other commissions may not. The tax base is generally larger and taxing methods are more diverse on the metropolitan level than on the city, county, or multi-jurisdictional level, but usage of tax revenues is more restricted.

- Structure:

  Many different forms of metropolitan government are established. Examples include the Metropolitan Transit Commission, Metropolitan Sports Facilities Commission, and Metropolitan Airport Commission. The Metropolitan Council serves as a guiding agency for metropolitan commissions. In addition, there appears to be great flexibility in commission boards and powers.

- Enabling Legislation:

  Specific legislation would be required for the establishment of a district heating agency on the metropolitan level. This legislation could be modeled after statutes establishing current metropolitan commissions. (See Ownership Form and Governing Board of Metropolitan Airports Commission and Metropolitan Sports Facilities Commission in the Appendix.)

- Public Acceptance:

  The metropolitan level of government is well established in Minnesota. This level has been used extensively to provide services which are best administered and financed for the seven-county metropolitan area.

Because the district heating company will provide hot water for only Minneapolis and St. Paul, the entire seven-county area will not receive direct benefits from the project. This could affect the project's acceptability for metropolitan ownership. However, certain indirect benefits from Minneapolis and St. Paul are opportunities; (fuel conservation), and the benefits from district heating would thereby extend to the outlying counties.

Alternative 5 - State ownership:

- Debt Financing:

Various forms of debt financing are available. The state's credit and resources for backing general obligation bonds would be stronger than lower political subdivisions, and would therefore be more attractive to investors.

- Taxing Power:

The state has the power to levy various taxes (e.g., income, sales) directly or to levy taxes (e.g., property) through other governmental levels. These taxes would be spread over a much broader area than any other political subdivision.

- Structure:

A state-owned D.H. company could be established as either a state board or agency. (For an example of a state-run board, see Ownership Form and Governing Form of Minnesota Zoological Garden in the Appendix.)

- Enabling Legislation:

Ownership of a project such as district heating would be new to the state. Although various other boards and agencies exist on the state level, the effort expended to form enabling legislation for a state-owned D.H. project would likely be greater than for any other level of government.

- Public Acceptance:

State ownership of the Twin Cities district heating system might be attractive because at that level of government exists the broadest financing and taxing capabilities. However, state ownership might be unattractive to a large segment of the population living

outside the system's service area. If benefits to the outlying metropolitan area are indirect, then benefits to other outstate areas are even less visible. Accordingly, residents of these areas might be reluctant to provide any start-up financing, operating subsidy, or guarantee for the system's debt.

One consideration not to be overlooked, however, is the fact that other out-state district heating projects are being investigated. A state-owned agency would have the advantage of centralizing management of all D.H. systems and directing them in a consistent and efficient manner. The emergence of other D.H. systems could add to the acceptability of state ownership.

SELECTED GOVERNMENT-OWNED ENTERPRISES

MUNICIPAL PUBLIC UTILITIES

Enabling Legislation - Mn. Stat. Chapt. 452

Ownership Form - No single form specified. See forms of St. Paul and Minneapolis Water Utilities as examples.

Governing Board - No single form specified. See boards of St. Paul and Minneapolis Water Utilities as examples.

Debt Provisions:

1) General Obligation Bonds - In order to acquire or build a public utility, the city may issue general obligation bonds not to exceed one-fifth of the cost thereof. This may be done only when the certificates of indebtedness which supply the funding for the remaining four-fifths of the cost are approved by majority vote of the electors and three-fifths of the city council.

2) Revenue Bonds - The city may issue revenue bonds, which are secured by the revenues of the utility and are a lien against the public utility property, for the acquisition or construction of such property.

Taxing Power - No actual taxing power is cited.

MINNEAPOLIS WATER WORKS

Enabling Legislation - Established by City ordinance

Ownership Form - The water works operates as an enterprise fund within the City Public Works Department.

Governing Board - The water works is steered by the Transportation and Property Services Committee of the City Council.

Debt Provisions - General obligation bonds have normally been issued by the city. Revenue bonds are currently being considered.

Taxing Power - The water works is not a taxing authority.

ST. PAUL WATER UTILITY

Enabling Legislation - Laws of 1881

Ownership Form - The utility operates as a corporate entity.

Governing Board - The Board consists of five members appointed by the mayor and approved by the city council. Three members are from the city council, and two are interested St. Paul residents.

Debt Provisions - The utility normally issues revenue bonds. The city assumes no liability for these bonds. On rare occasions, the city has issued general obligation bonds.

Taxing Power - The utility is not a taxing authority, and the city has never levied a tax on its behalf.

PORT AUTHORITY

Enabling Legislation - Mn. Stat. Chapt. 458

Ownership Form - A port authority is considered a "body politic and corporate in the state." It is also a political subdivision.

Governing Board - Once established, a port authority has seven members chosen by the mayor and approved by the city council. Two of the members are from the city council.

Debt Provisions

1) City General Obligation Bonds - In anticipation of appropriations and revenues, the port authority may issue bonds whose principal amount, form, and interest rate are authorized by the city. These bonds are secured by the "full faith, credit, and resources of the city."

2) County General Obligation Bonds - When a city council has voted to issue general obligation bonds, the county board of commissioners may also vote to issue general obligation bonds for the port authority if it believes the general welfare and economic well-being of the county is served by the port authority.

PORT AUTHORITY (Cont.)

3) Revenue Bonds - A port authority has the power to issue revenue bonds to provide funds for operations or expansion. These are not a liability of the city, county or of any other political subdivision.

Taxing Power - A port authority has no inherent taxing power. The city may levy a property tax on behalf of the port authority for the following purposes:

1) To fund operating costs in excess of revenues, not to exceed 5/100 of one mill per dollar of assessed valuation;

2) To provide for industrial development, not to exceed 7/60 of one mill per dollar of assessed valuation; and

3) To pay off principal and interest charges.

MUNICIPAL POWER AGENCY

Enabling Legislation - MN. Stat. Chapt. 453

Ownership Form - Two or more cities may form a Municipal Power Agency (MPA). The MPA becomes both a political subdivision of the state and a municipal corporation.

Governing Board - The board of directors has at least five members and is elected by the MPA's member cities.

Debt Provisions - MPA's may issue revenue bonds for capital expenditures and operations. Neither the state nor its subdivisions are liable for this debt.

Taxing Power - The MPA has no inherent taxing power. Cities may levy taxes to pay for services received from the MPA.

METROPOLITAN AIRPORTS COMMISSION

Enabling Legislation - Mn. Stat.§473.601

Ownership Form - The Metropolitan Airports Commission (MAC) is established as a public corporation and has both taxing and bonding powers.

Governing Board - The governing body of commissioners is comprised of 15 members, including the mayors of Minneapolis and St. Paul, city council and park board members, and additional metropolitan area members. The chairman is appointed by the governor.

Debt Provisions - In anticipation of revenues, the MAC may issue up to $125 million in general revenue bonds for capital expenditures. The bonds are secured by the full faith, credit, and resources of the cities served by the MAC.

The commission may also issue general obligation bonds for the betterment of air facilites and refunding of bonds. These are secured by the full faith and credit of the commission.

Taxing Power - The commission may levy a property tax to fund repayment of debt financing. It may also levy an additional tax not to exceed 1/20 of one mill on the assessed valuation of taxable property for other purposes.

METROPOLITAN SPORTS FACILITIES COMMISSION

Enabling Legislation - Mn. Stat. §473.551

Ownership Form - The commission operates under the guidance of the Metropolitan Council. The commission itself is not a political subdivision of the state.

Governing Board - Seven members, including a chairman, are appointed by the governor.

Debt Provisions - The Metropolitan Council may authorize the sale and issuance of revenue bonds to provide for the acquisition or betterment of sports facilites; to refund bonds issued; and to fund judgments entered by any court

METROPOLITAN SPORTS FACILITIES COMMISSION (Cont.)

against the commission. No election is required, and the debt is not a general obligation of the state or any of its subdivisions. Limits on issuance range from $37.5 to $55 million depending upon the final stadium proposal.

Taxing Power

1) The Metropolitan Council has levied a two percent on-sale liquor tax, effective until August 1, 1980. After that time, it may levy a similar tax to produce revenues to pay off revenue bond principal and interest, but not to exceed $4.5 million in any year.

2) The commission has imposed a three percent admission tax to activities held at metropolitan sports facilities. An additional seven percent tax will be imposed on activities conducted at the newly built or remodeled stadium.

MINNESOTA ZOOLOGICAL GARDEN

Enabling Legislation - Mn. Stat. Chapt. 85A

Ownership Form - The State Zoological Board operates the Minnesota Zoological Gardens as an agency of the state government. A Minnesota Zoological Garden general account is established, and board members are employees of the state.

Governing Board - Eleven members are selected for the State Zoological Board by the governor and approved by the senate. The board selects one of its members to be its chairman.

Debt Provisions - To provide money for capital expenditures, the board may request that the state issue state zoological garden bonds. Approximately $25 million in bonds has been authorized. The state has pledged its full faith, credit, and taxing power.

Taxing Power - The state annually levies a property tax to cover bond principal and interest payments.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

II. Ownership Assumption: Public

II.A. Issue: Form and Structure

II.A.2 Sub-Issue: Operating Structure

Issue Definition

The operating structure refers to the actual direction of the day-to-day activities of the district heating company. Public ownership of the district heating project allows for either public or private operation of the company. This may be contrasted with private ownership, which would imply only private operation.

Why Operating Structure is an Issue

Every operating structure has its own unique characteristics. Hiring practices and available expertise; operating constraints; and public acceptance will vary according to the type of operating structure adopted. The D.H. enterprise must be established with an operating structure which will attempt to optimize all of these factors and maximize the chances of the system's success.

Impact

Selection of the most favorable operating structure will allow the D.H. enterprise the following benefits: efficient and effective operation, public satisfaction, access to competent employees, funding capability, and technical support. Without a suitable operating structure the chances of success in a competitive environment will be impaired.

Alternatives

The basic alternatives to the operating structure question include the following:

1. Public operation of the district heating company. The D.H. enterprise would be both owned and operated by the appropriate government agency, commission, or governing board.

2. Operation of the cogeneration district heating company by an existing utility or district heating company, such as by NSP or Minnegasco, or a joint venture. The enterprise would be publicly owned but would be operated by professionals on a contract basis.

3. Operation of the district heating company by a newly created, privately owned management company.

Consequences

Alternative 1 - Public operation:

Consequences of government operation of a publicly owned district heating company include the following:

- Hiring Practices and Available Expertise:

  The hiring of employees in the public sector may involve use of the civil service or some other merit system. This will insure defined jobs and job categories and will give applicants sufficient information regarding qualifications, wage rates, and benefits.

  One possible consequence of the use of a civil service or merit system is that it might reduce the flexibility with which management assigns employees to tasks, creates new positions, or eliminates old positions. The degree to which this might occur is difficult to predict, but in any case, the system should be structured to minimize such adverse effects.

  Hiring within the public sector usually entails the possibility of political considerations entering into the selection process. If the hiring of employees is overly burdened by political ramifications, the process will not facilitate the selection of the most competent persons for available jobs. Although some type of merit system would contribute towards alleviating this problem, it creates further problems. A merit system may make the entire hiring and promotion system more cumbersome and may leave managers less discretion in filling positions. The ability to hire and retain competent and capable personnel could be critical to the operating success of the system, so this must be carefully examined.

  The degree to which a civil service or merit system is effective will depend, in part, on its appeal to potential employees. The prospects for promotion, which are based largely on seniority, and wages, which are

based on government guidelines, may limit the attractiveness of such systems.

Because the public sector experience is confined mainly to operation of utilities such as water works, it would have to seek experienced persons from outside the government to operate the district heating system and to train employees. In contrast, existing privately owned utilities have the potential for transferring current personnel to similar district heating jobs. This difference between public and private operation implies that the public sector will have to expend comparatively more time and money for recruiting and acclimating employees into a new operating environment.

- Operating constraints:

There is one clear advantage to having a government operating structure for a government-owned district heating system. The operating management and the governing board will both represent and presumedly act in the interests of the public. Any potential for disharmony between a governing board representing public owners and the operating management should be minimized.

One disadvantage and potentially serious operating constraint is that the public enterprise would have no in-house body of persons experienced in operating a large-scale utility or district heating system from which to draw. As mentioned previously, this will necessitate the hiring of these persons from the outside and of training new employees. Although the problem might only be experienced in the initial development years, it is important. Adequate maintenance, safe operation, and reliable service will be required not only for the satisfaction of the public, in general, but also because of the implications for development of the market.

- Public Acceptance:

Public confidence in the government's ability to operate a large-scale D.H. system might prove to be the most significant factor in deciding whether to have government operation. Because the local governments are relatively inexperienced in operating such a system, there may be considerable public concern about the ability of a government-owned entity to manage the business. In addition, it is possible that there will be considerable concern about the government's ability to avoid operating at a loss, much less at a profit.

Alternative 2 - Operation by an existing company:

Consequences of operation of a government-owned district heating enterprise by an existing utility include the following:

- Hiring Practices and Available Expertise

  Current hiring practices of existing utilities should adequately facilitate the selection of operations personnel. Personnel departments in companies such as Minnegasco and NSP may be better equipped than government agencies to prepare job descriptions, recruit candidates, and select personnel for utilty operations jobs.

  If the management contract for the district heating service is negotiated with existing utilities, it will afford the opportunity for present personnel to transfer into the new D.H. utility. Such a change would be less dramatic and less costly than attempting to hire all new employees. Transfers will also allow for the district heating company to operate in a manner similar to the existing utility, should that be warranted. These factors should contribute to reducing initial costs of start-up and training and would most likely result in staffing management and operations positions with capable personnel.

- Operating Constraints:

  An existing utility will be capable of extending its expertise into the operations of the D.H. enterprise. These companies are experienced in the utilities area and are accustomed to operating with a profit motivation. These factors favor use of NSP or Minnegasco for operation of the D.H. utility. But certain problems could also result from this relationship. Segregation of ownership and management, one with a not-for-profit objective and the other with a for-profit background, could conceivably lead to conflicts on operating procedures and policies. To prevent any conflicting interests from encroaching or hampering the contracting management from operating the system in its best judgement, the contract will have to be very explicit. The scope of the operating management's responsibility and authority will need to be carefully defined, and then honored.

  Private management of government-owned enterprises is not a unique concept. Locally, the Metropolitan Transit Commission is so operated and other examples can

be identified on a national scale (e.g., the Louisiana Superdome).

- Public Acceptance:

  As Minnegasco and NSP are involved in such a large portion of the Twin Cities heating market, the operation of the D.H. enterprise by either might be viewed as an attempt by them to further monopolize or control the market. Such adverse public reaction could spill over and influence the acceptability of government ownership to the general public.

  Alternatively, the fact that these companies have operated utilities for an extended period of time lends credibility to their ability to operate the district heating company. Such a track record will be desirable to investors and will tend to reduce the risk in a project which might otherwise be viewed as very risky.

Alternative 3 - Operation by a new private company:

The consequences of operation of a publicly owned district heating utility by a newly created management firm include the following:

- Hiring Practices and Available Expertise:

  While a new private company will not be constrained by hiring practices of government-operated enterprises, neither will it have the established hiring procedures and available expertise of an existing utility. The company will have to establish its own hiring policies and create an entirely new organization. Recruiting and training costs will be comparable to those which would be incurred by public operation of the D.H. enterprise. Unless key personnel in this contracting management firm had expertise in operating a district heating system elsewhere, it is unlikely that this alternative would be acceptable.

- Operating Constraints:

  A new private company will require the formation of unique policies and procedures for its operations. It will not have the established structure and resources of an existing public utility. These details will need to be formulated prior to the commencement of operations. Added to the multitude of other start-up problems, this might be an unacceptable risk for the public to assume.

A new private company may encounter management conflicts similar to those described under operation by an existing public utility. As previously mentioned, public ownership and private operation may create redundancies in decision-making and might otherwise inhibit the management process.

This alternative also implies that the enterprise will find it relatively more difficult to raise capital than an existing utility. A new enterprise is inherently risky and poses definite financing problems. If, in addition, the operating management firm is new and possibly inexperienced, these financing problems will be magnified.

- Public Acceptance:

Operation by a new privately owned management company may create certain perceived benefits for the district heating project. Because the operations would be out of the hands of existing utilities (NSP and Minnegasco), the public may be less apt to be suspect of management's motives. If the firm is created solely for the purpose of operating the Twin Cities D.H. system, it may even be perceived as performing a needed public service by isolating political consideration from the management of the company. These factors may also be true for Alternative 2, however.

The major public acceptance risk, of course, is that the firm may be perceived as lacking necessary operating expertise and qualified, experienced personnel. This alternative could prove to be unacceptable to the public for this reason alone.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

II. Ownership Assumption: Public

II.A. Issue: Form and Structure

II.A.3 Sub-Issue: Policy Decisions Board

Issue Definition

The policy decisions board is that group which will formulate policies and resolve issues concerning management and operation of the district heating enterprise. Legislation for board member selection will need to address the following items:

- Selection process - election or appointment;
- Number of persons serving on the board;
- Board member term length; and
- Chairperson selection process.

In addition, the following items might also be included in the legislation:

- Residency requirements - for example, three board members might be required to reside in Minneapolis, three from St. Paul, and one from out-state Minnesota, or some other suitable arrangement dictated by the level of government owning the system; and
- Qualifications - technical capabilities, governmental or administrative experience, etc.

Why the Policy Decisions Board is an Issue

The selection of a policy decisions board is an institutional issue because the procedures established must insure that qualified and politically acceptable persons are identified and chosen. As the board must resolve problems specifically related to district heating, must be capable of representing the interests of a broad segment of the public, must work within the constraints of the government organizational structure, and must be able to communicate effectively with management and consumers; the board members should be selected on their ability to handle these matters. Selection procedures which are designed to increase the

likelihood of selecting competent, capable board members will contribute toward the establishment of public confidence in the government ownership concept and will increase the chances of efficient and reliable performance of the enterprise.

Two of the items included in policy decisions board legislation, selection process and qualifications, are of major importance and will be explored in this paper. The other four topics, number of persons, term length, chairperson selection, and residency requirements, will not be discussed in this issue paper.

Impact

Providing the most suitable means for selecting a policy decisions board will allow for the appointment of qualified persons to direct the D.H. utility. Although the selection process will be essentially a political process, adequate care must be taken to select qualified, capable board members. Public confidence in the D.H. enterprise may be affected if inadequate consideration is given to board members' qualifications.

Alternatives

Legislation pertaining to the selection process and qualifications of the policy decisions board could include the following alternatives:

1. Appointment of the board and specification of qualifications. Board members would be selected by existing executives or legislative bodies of the owning government (or governments encompassed by a metropolitan or multi-jurisdictional political subdivision) and approved by that level's legislators. Candidates would be selected on the basis of technical qualifications which have been pre-specified.

2. Appointment of board members without specification of qualifications. The determination of the qualifications for board members would be left to the discretion of the responsible public officials.

3. Election of the board. Board members would be selected by vote of the electors on that level of government (or those political subdivisions encompassed by a newly created level of government) which owns the district heating utility. Under this alternative, no technical or administrative qualifications would be legislated.

Consequences

Alternative 1 - Appointment of the board and specification of qualifications:

Current legislation almost exclusively employs appointment of board members for publicly owned agencies (See Appendix to Issue Paper II.A.1 - Responsible Level of Government). Such appointments are often made by the governor or mayor and approved by the appropriate legislative body, such as the senate or city council. Metropolitan boards are typically selected by the Metropolitan Council. Such procedures are aimed at providing for legislative and executive balance in the selection process.

In the case of multi-jurisdictional ownership of the D.H. company, selection of the board membership could be divided between the two municipalities encompassed by the newly created political subdivision. To avoid disputes regarding equality of voting power between the municipalities, selection of one board member could be delegated to the other members of the board. This would allow for each municipality to have equal representation, while providing for an odd number of board members. Alternatively, an extra member could be specified for that municipality with the greatest heat load on the system.

Appointment of the board would allow for governmental officials to thoroughly investigate, with the help of a selection committee, the capabilities of board aspirants. Public reaction to the process should be favorable if the specification of qualifications and if initial appointees meet public expectations.

Specification of qualifications for board members has precedents in existing government agencies. The laws for selection of the Public Service Commission include special consideration "to persons learned in law or persons who have engaged in the profession of engineering, public accounting or property and utility valuation as well as being representative of the general public." Mn. Stat. §216A.03.

Legislated technical qualifications for all or a portion of the board members would promote candidate selection on the basis of their ability to specifically direct and manage the district heating enterprise in a business-like manner. This would encourage the selection of more qualified persons, and it would enhance public confidence in the board.

One problem with such provisions is the degree to which compliance with the qualifications can be enforced. In the provisions for the Public Service Commissioners, the aforementioned qualifications must be "considered", but the final selection of board members need not be based on these factors. In order to strengthen such provisions, legislation for the D.H. project could specify that selection of board members be based on, as opposed to being considered in light of specific criteria.

Alternative 2 - Appointment of the board without specification of qualifications:

The consequences of appointing the board have been enumerated in Alternative 1. Without specification of qualifications, the member selection would not be based on any predetermined criteria.

To work in the interest of both the D.H. company and the public, the selection process should be conducted in the same manner as under Alternative 1. Whether or not qualifications are specifically legislated, the technical merits of candidates should be carefully examined by conscientious executive and legislative branches of government. Such procedures will promote public confidence in the policy decisions board and best aid the D.H. utility.

The flexibility provided by the omission of qualifications could conceivably benefit the D.H. enterprise, however. If applicants were well-suited for the position but did not meet exactly designated qualifications, omission of such legislation would allow for the appointment of such candidates. Competent and experienced management will be essential for the successful implementation, operation, and expansion of a new publicly owned district heating system. Responsible public officials will be aware of this need and should perhaps be given some degree of latitude in determining qualification for board members.

Alternative 3 - Election of the board:

Election of the board would put this decision-making process into the hands of the electorate. As the electors at each responsible level of government would directly select the policy decisions board, this alternative might promote the maximum degree of responsibility to the public.

As a practical matter, statutes pertaining to board member elections would not contain technical or expertise requirements for candidates. Determination of candidate qualifications would be left up to voter discretion. As management of the district heating project is, at least partly, of a technical nature, many voters might be unable to adequately judge the capabilities of candidates.

As mentioned earlier, board members of publicly owned companies are frequently appointed. Election of policy decision board members is not a widely used option among state and municipal agencies.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

II. Ownership: Public

II.B. Issue: Financing

II.B.1. Sub-Issue: Capital Structure

Issue Definition

Capital structure is the mixture of debt and equity which would be used to finance the start-up costs, expansion, and working capital of a government-owned district heating system. Initial equity would have to be contributed by another level of government (e.g., a state grant) and operating earnings (or losses) would add to (or deplete) that equity. Debt capital could be obtained from another level of government or from the capital markets.

Why Capital Structure is an Issue

The capital structure of a government-owned district heating system is an institutional issue, particularly during the start-up years, because it provides an indication to the capital markets about the degree of government committment to the project and financial stability of the enterprise. This can be very important in terms of the ease with which additional funds can be raised in the debt capital markets and in terms of establishing favorable arrangements with suppliers and creditors.

Once the enterprise is established and operating at a profit, the capital structure may become important for a different reason. As the utility retains earnings or begins to retire debt, the debt-equity ratio will decline. Then the question may become "should the D.H. system retire debt, eliminate interest expense, and lower service charges (thereby lowering the debt-equity ratio), or should earnings be transferred to the general fund of the owner government, leaving the capital structure relatively unchanged?" The answer to this question might depend on such factors as whether general obligation bonds were used to finance the project, whether there was an initial contribution or advance from another level of government, and what the capital needs and expansion plans for the system were.

The issue of capital structure is also important from the standpoint of the operating flexibility of the enterprise. It is not uncommon for political subdivisions or public corporations to

have statutory limits on their indebtedness. Given a fixed initial equity base, a debt limitation, and operating earnings or losses, the capital structure will be determined and management may have little flexibility to alter it.

The capital structure of the enterprise is also an issue because it has an effect on the cost of district heating services. Government equity in the enterprise can be looked upon as "cost-free" capital because public corporations typically do not pay any return to the contributors of that equity, but rather give "dividends" in the form of providing needed services to the public. Therefore, the greater the amount of public equity and the lesser the amount of interest-bearing debt that can be employed, the lower the cost for services should be.

Aside from the problems associated with an improper mix of debt and equity and the effect on costs, another potential major issue is how should the capital structure decision be made and who should have that authority?

Impact

The capital structure of the district heating firm will directly impact the enterprise's financing costs and flexibility. Because government equity has no explicit cost and public debt issues do, the weighted average cost of capital will be lower with increasing proportions of equity. As the debt-equity ratio increases, however, rates required by debt holders will tend to increase because of the increasing amount of risk they would have to assume. A more complete discussion of these effects can be found in the issue paper on capital structure under the private ownership assumption (I.A.1).

The flexibility of the enterprise to issue debt will also be affected as the capital structure varies. As the proportion of government equity in the enterprise is lowered, the degree of commitment of the owning government may be perceived to be reduced. This increased risk for debt will likely result in prospective bond buyers requiring additional security in the debt instruments themselves. For example, if the market perceived the debt-equity ratio to be too high, general obligation revenue bonds might have to be offered instead of regular revenue bonds. (For a discussion of debt instruments, see Issue Papers I.A.2 and II.B.2.)

As the debt-equity ratio rises (due to additional debt offerings or operating losses), the enterprise's relationships with suppliers and creditors will also be affected. Because suppliers are generally unsecured creditors and because the financial risk they bear rises as the proportion of debt rises

(due to increasing risk of cash insolvency or bankruptcy), creditors will tend to require more stringent terms as they begin to perceive increased risk. This can take the form of requiring payment upon delivery of goods, higher prices, and possibly shrinkage in the number of vendors willing to sell to the D.H. utility. In an extreme case, the ability of the firm to continue to conduct its business could be severely hampered if the capital structure was not properly managed.

Alternatives

The alternatives suggested below deal with methods of controlling the debt-equity ratio once the system is in operation as opposed to suggesting the "right" mixture of debt and equity at start-up. It will be presumed in all cases that the government-owned D.H. enterprise will receive an initial infusion of equity capital from another level of government (perhaps in the form of a state or federal grant or municipal contribution).

1. Specify the amount of debt that the district heating enterprise can issue in the enabling legislation in order to limit the total indebtedness and, thus, control the capital structure.

2. Specify a range or limit to the allowable capital structure in the enabling legislation. For example, allow the enterprise to issue debt in any amount so long as a specified debt-equity ratio or interest coverage ratio is never exceeded.

3. Leave the capital structure decision to the discretion of management and the policy decisions board.

Consequences

Alternative 1 - Debt Ceiling Approach:

The most obvious reason for placing limits on the amount of debt that a new D.H. enterprise could issue is that it is a simple way to control the liability of the owner government. If the enterprise becomes a financial failure, this could prevent the situation from getting out of hand as a result of the issuance of large amounts of debt. If the enterprise proves to be financially viable, the legislating branch of the owner government could raise the debt limits as appropriate. For a new enterprise, this alternative might have political and public support.

Significant disadvantages also exist, however. This alternative will not control the capital structure, as operating results

will either add to or deplete the equity base, thus causing the debt-equity ratio to change. If the system earns a profit, the debt ceiling can cause the debt-equity ratio to fall. If the enterprise is already at its debt ceiling, this will prevent management from exercising appropriate control over the capital structure. It could also prevent expansion of the system when such expansion is warranted. This limitation in management discretion as a result of the debt ceiling could conceivably work to the detriment of the community which the system is meant to serve.

A further consequence of this approach is that, should management be operating at its debt ceiling and wish to make a capital structure alteration, it would have to request the state legislature to either raise the debt limit or appropriate additional equity capital. This would give elected officials some degree of control over the capital structure decision.

Alterations in this approach could be devised to mitigate some of these undesirable constraints. The legislative body could consider placing limits on only certain types of debt (e.g., general obligation bonds or general obligation revenue bonds) while leaving management free to determine the appropriate amount of other debt offerings which do not obligate the government (e.g., income bonds or revenue bonds).

Alternative 2 - Control Capital Structure:

The legislative body of the owner government could provide more operating flexibility to the D.H. enterprise management by tying the indebtedness limitation to the amount of equity. The firm's management might be allowed to issue debt so long as a certain debt-equity ratio or interest coverage ratio is not exceeded. Then the government could set that ratio corresponding to the riskiness of the business and the degree of certainty in the management's cash flow and income projections.

As further refinement of this alternative, debt-equity ratios or absolute levels for specific types of debt could be legislated in order to control the government's liabilities. For example, the amount of general obligation bonds might be limited to some specific amount, and then the amount of revenue bonds limited to a certain percentage of equity.

The major problem with this alternative rests with the implications for the firm should it incur operating losses and experience a decline in its equity base. If the enterprise issues debt up to its statutory debt-equity ratio limit and then incurs a loss, the limit will be exceeded. It would most likely be

appropriate for the firm to call a portion of its debt in such circumstances, so provisions or exceptions for such occurrences would need to be specified in the legislation.

Alternative 3 - Managment Decision:

If the capital structure decision is left entirely to operating management and the policy decisions board, those persons most knowledgeable about the needs and circumstances of the firm would be responsible. This does not guarantee that these individuals would also be objective and act in the best interests of the public (the owners), but the capital structure decision is customarily left to these persons in the private sector.

In actuality, management would only be able to control the amount of debt, as a public corporation does not sell stock to the public or other governments. Because additional equity would have to come either from further government contribution or from retained earnings, management could only exercise limited control over the capital structure.

If management is empowered to freely issue debt, it may be desirable to restrict the types of debt issued so that taxpayers would not be obligated. This might effectively limit management's control over the capital structure to control over the amount of revenue bonds issued, and the real capital structure decisions would be made by elected officials. One potential consequence of this alternative is that management might find it expedient to issue revenue bonds whenever possible to circumvent political or legislative problem, and this could entail higher interest costs for the D.H. system.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

II Ownership: Public

II.B. Issue: Financing

II.B.2. Sub-Issue: Types of Debt Financing Employed

Issue Definition

Debt represents capital loaned to the district heating enterprise for a specified period of time for a fixed rate of return. Debt claims on the enterprise do not represent any ownership rights and do not imply any control over the business or input into management decisions. Interest earned on debt instruments issued by governments or special authorities is exempt from federal and state income taxes.

Why Type of Debt Financing is an Issue

The type of debt used to finance the district heating system is an important issue because:

- The amount of debt capital needed is likely to be large and the types of debt will have a significant effect on the cost of providing district heating services. Debt instruments which can be issued by a government or financing authority have widely differing security characteristics and, thus, widely varying interest rates. For example, general obligation bonds issued by a city usually can be offered at one to two percentage points lower interest than revenue bonds issued by the same entity.

- Different types of debt are used to finance different financial needs and, thus, place varying restrictions and obligations on the issuer. In addition, different types of debt provide various levels of security for bond holders, and this factor will impact the ease with which the bonds can be sold and the rates which will be required. As the D.H. utility will be a new entity, certain types of debt may be infeasible.

- The use of certain types of debt may have economic consequences for entities other than the D.H. system and may have different public acceptability. For example, general obligation debt issued by a municipality to finance a new district heating utility would give that utility its

lowest interest costs but could result in higher interest costs for the city as a whole. This would occur as a result of the spreading of the property tax base over a greater amount of debt service liability. Consequently, use of this type of debt may be unacceptable to the public.

Impact

The impact of the type of debt financing employed will be manifest in the interest rates the D.H. enterprise would be required to pay and the effect on capital costs of the system. The higher the interest rate, the higher the total costs to system customers.

The choice of debt instruments may also impact the interest rates on other debt issued by the same owner government.

Alternatives

There are numerous types of debt instruments which could conceivably be used to finance a government-owned district heating system, but they can be grouped into three main categories according to the nature of the security provided and the revenues specified for retirement. The groups which should be considered are:

1. General obligation bonds;
2. Limited tax or special tax bonds; and
3. Revenue or self-financing bonds.

Consequences

The consequences of the various types of debt financing cannot easily be demonstrated in terms of cost impact on D.H. services due to the myriad of possibilities for security and, more fundamentally, the difficulty in estimating the impact of those characteristics on interest rates. Revenue bonds, in particular, are difficult to draw any conclusions about because of imprecise estimates at this time about the amount of revenue or of its certainty. The reader might wish to refer to Issue Paper I.A.2 for an example of how differences in debt type might impact interest cost, given a privately owned system.

The following discussion examines the consequences of the alternative forms of debt suggested in generic terms and attempts to illustrate the salient features of each.

Alternative 1 - General Obligation Bonds:

General obligation bonds are debt securites which are backed by the full faith and credit and financial resources of the issuing government. This means that the bonds are backed by authority to levy unlimited ad valorem property taxes for payment of interest and retirement of the principal. Because of this security, these bonds can be offered at the lowest interest rates of any tax-exempt debt.

General obligation bonds cannot be issued in all cases, however. In order to issue "G.O.'s", the governmental entity must first have statutory authority to do so and, secondly, must not have exceeded any statutory limits on the amount of such indebtedness. Cites, counties, and many special districts are empowered to issue such bonds and to levy property taxes for payment of debt service. Not all special districts or authorities have this privilege, however, and many which do are limited as to the amount of indebtedness or the use of the funds.

For the district heating enterprise to be financed with G.O.'s, then, it would have to be an endeavor of an existing levying authority or be created by a special act of the state legislature as a separate political subdivision with taxing and bonding powers. Given that the D.H. system would benefit mainly commercial and industrial users, it may be unlikely that the enterprise would be granted these powers to obligate all property owners.

Variations in the general obligation bonds might be more appropriate, however. A levying authority does have the option of issuing a "G.O. revenue bond" which is a form of self-supporting debt. Revenues from the project serve as the primary security of the bonds but, in the event they are insufficient, property taxes can be levied for debt service needs. The real security for such bonds is really the full faith and credit of the issuer and the interest rates will be comparable to that issuer's G.O. debt.

G.O. revenue bonds are sometimes referred to as "double barrel" bonds because of the "double" security. Another way to provide double security is to incorporate the new district heating utility in the operations of another existing utility (such as a water works or sewer district) and pledge the revenues of both enterprises plus the full faith and credit of the government for repayment of the D.H. debt. Of course, sufficient earnings from the other line of business would be necessary for this approach to reduce the likelihood of ever having to levy a tax for debt service purposes.

These latter two types of G.O. debt can be useful to a government which wanted to institute a new service that required a large initial investment in facilities, but which would not be initially self-supporting. They do not eliminate the potential liability for property tax payers but they implicitly provide a public acknowledgement that the project is intended to pay its own way. This factor could be important in gaining public support for any general obligation debt.

Alternative 2 - Limited Tax or Special Tax Bonds:

One step removed from general obligation debt is limited tax and special tax bonds. In lieu of providing authority to levy an unlimited ad valorem property tax, special districts are often created with the ability to issue limited tax debt in an amount which can be serviced by a specified mill rate on the affected real property. This device is usually employed to limit the amount of indebtedness, rather than to restrict the ability of the district to meet debt service needs after the bonds have been sold.

Special tax bonds are similar in that there is only a limited authority to levy property taxes, but they differ in that an alternative tax base is utilized for debt service requirements. It is common for special sales taxes, liquor taxes, gross receipt taxes, or special assessment property taxes (on those properties in the district heating market area or located on the distribution lines) to be earmarked for meeting special tax debt service needs.

Either of these types of bonds could conceivably be used in the government-owned district heating company financing package. Both provide bondholders with a degree of security which is somewhat less than for G.O.'s but certainly stronger than for revenue bonds. Most likely, however, they would be used to finance only a portion of the total debt capital requirement. If a combination of G.O.s and revenue bonds were issued, it would be advantageous from the standpoint that total revenues would be available as security for revenue bonds while, at the same time, a demonstration of government commitment to the project would be provided by the G.O. issuance.

Alternative 3 - Revenue or Self-financing Bonds:

Revenue bonds, sometimes referred to as "self-financing" bonds, are so called because the revenues from the project or enterprise are the sole security for the bondholders. Consequently, the risk of default and interest rates on the bonds are largely determined by the risks of the project cash flows. The rates will be higher than those for G.O.'s or special tax

bonds. If the project is a new venture with relatively risky cash flows, the rates on revenue bonds might be prohibitively high.

In order to enhance the attractiveness of revenue bonds to potential buyers, certain characteristics are often incorporated which add to the security of the issue. Most common of these enhancements is a mortgage on all or substantially all of the revenue-producing property of the enterprise. In the case of a cogeneration district heating company, this feature might offer little additional security because of the limited usefulness of the assets for other purposes in a market which might prove to be uneconomical for cogeneration.

Additional security can also be supplied by offering general obligation, special tax, or limited tax backup in the event of default. These types of bonds, discussed under Alternatives 1 and 2, are more easily sold in a competitive market and will result in lower interest cost for the enterprise. The difference in rates between revenue bonds and revenue bonds with tax guaranty will depend on the the riskiness of project cash flows, the size of the backup tax base, and the existing debt level and credit rating of the guarantor.

TWIN CITIES DISTRICT HEATING STUDY
INSTITUTIONAL ISSUE PAPER

II. Ownership Assumption: Public

II.D Issue: Pricing Policy

II.D.4 Sub-Issue: Profit Motivation

Issue Definition

The issue of profit motivation involves the determination of whether or not a government-owned district heating company should seek to earn a profit. The D.H. utility may either earn a return on its investment or collect just enough revenues so as to break even.

Why Profit Motivation is an Issue

Under public ownership, the D.H. enterprise can be established either as an entity with a profit or a break-even objective. If the project were privately owned, the project would only be undertaken with a profit motivation. Because of available resources and inherent powers, government ownership allows the additional alternative of operating with the philosophy of only breaking even on its investment.

Profit motivation poses a potential institutional barrier because of the inherent conflict with existing institutions and businesses. Normally, government-owned utilities are established with the objective of providing needed services to the public on a break-even basis. These utilities are usually established for water, sewer, and occasionally to provide electrical services and, as such, are customarily not in direct competition with investor-owned utilities. A government-owned cogeneration district heating utility, however, would be in direct competition with other investor-owned, profit-motivated utilities such as gas companies, oil suppliers, electric utilities, and other steam district heating companies. Accordingly, it will be necessary to determine which philosophy, profit or non-profit, is more compatible with a competing government-owned utility.

Impact

If the company is created with a profit objective, it would presumably seek to maximize those profits within existing competi-

tive constraints. The utility would most likely be established with an initial infusion of capital either from appropriations or borrowings and then revenues would provide for repayment of that initial contribution, as well as for covering operating expenses. Over time, the enterprise would accumulate earnings from operations just as would a privately held concern. The enterprise would attempt to be completely self-supporting and, over the long term, might even make a contribution to the owner-government's general fund.

In contrast, the D.H. utility may assume a break-even philosophy. Under this alternative, rates would be set so as to recoup original investments without allowing for a profit factor. Additions to the system would have to be financed by a somewhat reduced internal cash flow because of the absence of the return on investment. Because of the break-even objective, there would be no contribution to the general fund of the owning government.

The issue of profit motivation will impact the rates for district heating services. District heating rates will necessarily be higher for a profit-making utility than for a non-profit entity, assuming that this feature has no great impact on the company's motivation for holding down costs.

The issue will also impact the methods by which the D.H. utility will replace the system when it becomes obsolete. Under break-even motivation, no excess funds will be accumulated for future replacement needs. Such projects will require either additional debt funding or appropriation from the legislative body. If profit-motivated, the D.H. utility would be able to internally generate some or all of the resources to provide for such expenditures.

Alternatives

The alternatives to the issue of profit motivation include the following:

1. Operate with a break-even philosophy. Establish rates which will cover only operating, capital, and other costs.

2. Operate with a profit motivation and include an element of profit in the determination of rates.

Work Required to Define Consequences

In order to define the consequences of the above alternatives, it will be necessary to:

- Discuss the problems of operating a publicly-owned entity on a profit-making basis with responsible government officials;

- Discuss the issue of operating a utility on a break-even basis with local utility representatives;

- Estimate the impact on rates which would result from inclusion of a profit element; compare such rates with costs of using alternative fuels; and

- Assess potential political or social barriers to the alternatives (e.g., there may be resistance to a new publicly-owned, profit-making entity).

Appendix C

TWIN CITIES DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: Purpose of Cogeneration and District Heating

Issue Definition

Questions have been raised by the general public and by various public interest groups regarding the purpose of cogeneration and district heating in relation to public support and encouragement of such a system in the Twin City Metropolitan Area. Basically, the questions relate to whether such a system is being proposed as a new capital venture for an existing or new utility, or whether the purpose of such a system would be to conserve and reallocate scarce naturally occurring space heating fossil fuels.

Issue Discussion

Development of a Twin City Metropolitan area wide co-generation and district heating system would require some form of utility ownership and operation, however, the purpose of a cogeneration and district heating system would very definitely be to reallocate and conserve natural gas and fuel oil.

Recent MEA estimates suggest that roughly 25% of the fossill fuels utilized in Minnesota are devoted to space and water heating and, of that energy, roughly 88% is derived from fuel oil and natural gas. Recent studies conducted by the MEA suggest that roughly 90% of the space and water heating requirements of buildings in and adjacent to down-town central business districts in the Twin Cities are served by natural gas. Fuel oil serves as a secondary fuel for buildings on interuptable gas supplies, and as a primary fuel for the remainder of the buildings.

The draft of the final report of a Minneapolis/St. Paul District Heating Study conducted for the Federal Department of Energy by Studsvik Energiteknik AB, estimates that coal

fired cogenerated district heating of buildings in and adjacent to central business districts in the Twin Cities would replace the equivalent of enough natural gas to heat about 45,000 homes during the first ten years of system operation. Over the twenty year system development period, coal fired cogeneration and hot water district heating should replace enough natural gas to heat 80,000 homes, an equivalent of about thirty five million barrels of fuel oil.

The report suggests the need for oil fired peaking boilers to assure system efficiency and reliability during periods of cold weather, however, due to the efficiencies of scale involved, less oil would be burned in one peaking boiler than would be burned in numerous scattered building boilers.

TWIN CITIES DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: Fuel and Heat Source Alternatives

Issue Definition

Concern has been expressed by numerous private citizens and public interest groups regarding the fuel and heat sources which are being considered for use in a Metropolitan area-wide hot water district heating system. On the one hand are concerns that too much consideration is being given to the use of coal fired cogeneration as the primary fuel and heat source, and that too little consideration is being given to the use of municipal refuse, wood wastes, methane, or solar as fuel and heat sources for a major system. On the other hand are concerns that the thermal requirements of an expanding district heating system may be used to justify the use of existing, or the construction of new, nuclear power plants for use as fuel and heat sources.

Issue Discussion

District heating in the Twin City Metropolitan area will require large amounts of heat which should, for efficiency purposes, be produced at relatively centralized locations. The use of low quality surplus heat from existing local coal fired power plants is being considered as the primary, or base load, fuel and heat source for a metropolitan area district heating system for several reasons:

First, the coal fired power plants which would supply the initial system with thermal energy (heat) already exist, as does the technology required to convert them to cogeneration plants producing both electricity and useable hot water district heat.

Second, a major purpose of the studies under way is to determine the most efficient way to capture and utilize

the large amount of low quality surplus heat produced as a by-product of electrical generation at local power plants. The process of converting fuel to electricity in most steam-electric power plants occurs with an efficiency of roughly 33%. On the average, each unit of fuel burned to produce a megawatt of electrical energy also results in the production of two megawatts of surplus heat energy. This surplus heat is currently wasted by exhausting it to the environment. Power plants which cogenerate are able to utilize the surplus heat and are therefore able to convert fuel to electricity as well as usefull district heat energy with an efficiency of about 66%.

Third, cogenerating coal fired power plants will be capable of providing consumers with a stable reliable source of heat derived from proven domestic fuel reserves based upon proven available technology. Conversely, the use of various fuel or heat sources such as municipal solid waste (garbage), wood wastes, methane, or solar are not believed to be capable of providing the stable reliable base load thermal characteristics required for a major Metropolitan area-wide system. There is, however, a distinct possibility that these alternative fuel or heat sources could be used in peaking boilers or modular heat only units as the system evolves and expands.

There are no current plans to use existing or new nuclear power plants as fuel or heat sources for cogenerated hot water district heating. From a purely technical point of view, however, there is no logical reason why surplus heat from nuclear power generation could not be captured and utilized in community district heating.

TWIN CITIES DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: System Safety and Reliability

Issue Definition

The issue of the safety and reliability of co-generation and hot water district heating versus traditional space heating has been raised on numerous occasions. Of particular concern are factors relating to transmission and distribution temperatures, and the ability of the system to maintain reliable cold weather service.

Issue Discussion

District heating water transmission, distribution, and return temperatures and pressures will vary depending upon the size and complexity of the system and the special situations at any particular point of concern within a system. However, experiences gained from the optional standardization of Swedish systems may give an indication of those temperatures and pressures which might be used in local systems.

In Sweden, hot water transmission temperature and pressure (from a power plant to a distribution system) is commonly 300°F at 230 pounds per square inch (psi). Primary distribution (from a transmission system to a building) and secondary distribution (within a building) temperature and pressure is commonly about 240°F at a pressure of 60 - 70 psi. Return water temperature and pressure (from a building back to the power plant) should be as low as possible, and frequently is about 140°F at 60 - 70 psi.

Hot water district heating systems have an exceptionally high safety factor. Although the water within an operating system is under temperature and pressure, there is virtually no possibility for an explosion to

occur in a well designed hot water system. Conversely, explosions have been known to occur in steam and gas heating systems. The most common operational problem in a hot water heating system involves valve and expansion joint leakages.

Community district heating systems which utilize cogenerated hot water have a high degree of operational reliability. All portions of the transmission, distribution, and return water subsystem are designed as a series of loops which can be isolated or fed from either end in case of emergency. In the remote case of a broken main pipe, for example, Swedish experience has shown the break to be isolated, repaired, and returned to service within twenty-four hours. Electrical failures do not result in heating failures because the cogeneration boilers continue to supply thermal energy to the system. System peaking heat during periods of intense cold or emergency boiler maintenance is provided by modular heat-only boilers distributed at various points throughout the system.

TWIN CITIES DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: Construction Disruption

Issue Definition

The issue of construction disruption relates to the probable extent and duration of physical disruption and inconvenience to be expected during pipe laying and building conversion. In addition, are the questions of how district heating transmission pipe corridors will be chosen, and whether system construction can be phased together with other project development, or with routine street or utility maintenance, in order to reduce the frequency or cumulative effects of disruption.

Issue Discussion

The probable extent and duration of construction related disruption of a major district heating system can only be estimated at this point in time. Engineering calculations will have to be made of the specific buildings to be connected before relativly firm estimates of the extent or magnitude of the disruption at any one point can be made.

European experience with hot water district heating systems construction suggests that the use of prefabricated pipe trenches and manholes, and prefabricated and pre-insulated pipes, valves, and expansion joints saves a considerable amount of time and effort. Routing pipes and equipment through basements instead of through streets in central business districts reduces disruption. Where street routing is the only alternative, disruption may vary from over night, in the case of intersection crossings, to between a week to a month in other areas, depending upon the size and complexity of the equipment being installed.

Most buildings are converted to district heating in the summer when their heat requirements may be minimal, however, disruption of building activity is dependent upon the site, specific size, and complexity of the work.

From a purely technical perspective, hot water transmission and primary distribution pipe sizes and corridors are chosen based upon technical considerations relating to the number and size of buildings to be served, their heating requirements, their locations, and so forth. In actual practice, the various technical requirements of pipe size and location will probably be integrated with local and regional planning and zoning guidelines and requirements in order to determine where actual corridors will occur.

As studies progress to the point where project feasibility is determined and reliable schedules can be proposed, effort will be expanded to integrate district heating development with the major community development or maintenance work in other to reduce the cumulative effect of construction related disruption and inconvience.

TWIN CITY DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: Public Involvement

Issue Definition

The issues surrounding public involvement relate to the timing and process by which the public is involved in a constructive manner in project feasibility and planning studies and implementation processes. The goal is to identify and implement an effective and continuing dialogue with individuals and groups who can affect system development and who will be affected by system operation.

Issue Discussion

One of the MEA goals in relation to the various cogeneration and district heating studies which are currently under way, is adequate and effective public involvement in the planning and decision making process. To this end, both a Steering Committee and an Advisory Committee were formed representing the views of public, private, special interest, and consulting groups in relation to the first phase of project related studies.

First phase efforts have revolved around the development of models, and the study of generic feasibility and institutional issues surrounding cogenerated hot water district heating in the Twin City Metropolitan area. Steering Committee members worked directly with the study team in order to identify and anlayze various issues. Advisory committee members were kept informed of progress and were encouraged to comment upon or suggest alterations to the studies under way. In addition to this involvement, over two dozen meetings and informal discussions were held attended by about two hundred business, governmental, environmental, citizen, energy and labor leaders from around the Twin Cities. The purpose of these meetings was to inform the general public as to the purpose of the studies under way, and to receive and respond to comments.

Finally, the various studies under way heve been reported in newspapers around the state.

An interim phase of work is scheduled during which time the generic studies will be refined through site specific work. A final phase of work, scheduled to begin about 1980, will look at establishing demonstration projects. Continued public involvement in the detailed planning and implementation phases of the project is anticipated. In addition to direct public and concerned group involvement, plans are being developed for a cogeneration and hot water district heating related public education effort.

TWIN CITIES DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: Centralized versus Decentralized Space Heating

Issue Definition

This issue relates to the concept of community or utility ownership and operation of a hot water district heating system or utility rather than the more traditional individual ownership and operation of scattered individual furnaces and boilers.

Issue Discussions

The technology of district heating is in existance and in use in one form or another in many of the world's cities, including Minneapolis and St. Paul. The development and expansion of hot water district heating in the Twin Cities, as proposed, will require the social acceptance of a change in technology rather than the acceptance of a totally new technology.

Community hot water district heat provided through cogeneration will require replacing individually owned and operated furnaces and boilers with individually owned and operated heat exchangers. Most commercial, industrial, and residential space heating is already based on some form of central heating. District heating is essentially the same concept, on a larger scale, using a larger more efficient heat source. Community hot water district heating provided through cogeneration will also require replacing inefficient individual competition for equitable supplies and prices of traditional space heating fuels, with long term reliability and stability of thermal energy supplies and prices.

TWIN CITY DISTRICT HEATING STUDY

INSTITUTIONAL ISSUE PAPER

Issue: Snow Melting

Issue Definition

This issue relates to the ability and feasibility of a district heating system to provide thermal energy for melting snow from streets and sidewalks in the central business districts and major traffic areas of the Twin City Metropolitan area.

Issue Discussion

Snow melting using some of the residual thermal energy of a district heating systems return water is possible, however, several trade-offs should be considered before making a determination of feasibility.

The heat supplied to customers from an operating district heating system results in a drop in temperature between the water supplied to the system by a power plant and the water returned to the power plant. Efficient opperation of the cogeneration turbines at the power plant, in fact, requires such a temperature difference. However, each unit of heat removed from the system must be replaced by the combustion of several units of fuel in order to maintain a functional thermal balance. Each incremental unit of residual return water heat utilized for snow melting will have to be replaced by the combustion of some additional incremental units of fuel. Therefore, the need for and feasibility of snow melting should be considered on a site specific basis after determining the technical, environmental, economic, and social consequences or benefits which may result.

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