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ENERGY CONSERVATION

COO/4212-1/2

TRENTON ICES

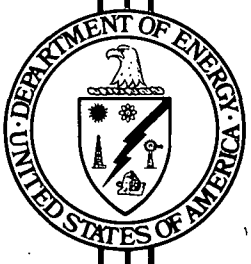
Volume 2. Phase I, Final Report

MASTER

July 14, 1977

Work Performed Under Contract No. EC-77-C-02-4212

Department of Planning and Development
City of Trenton
Trenton, New Jersey



U. S. DEPARTMENT OF ENERGY

Division of Buildings and Community Systems

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Phase I Final Report Volume 2

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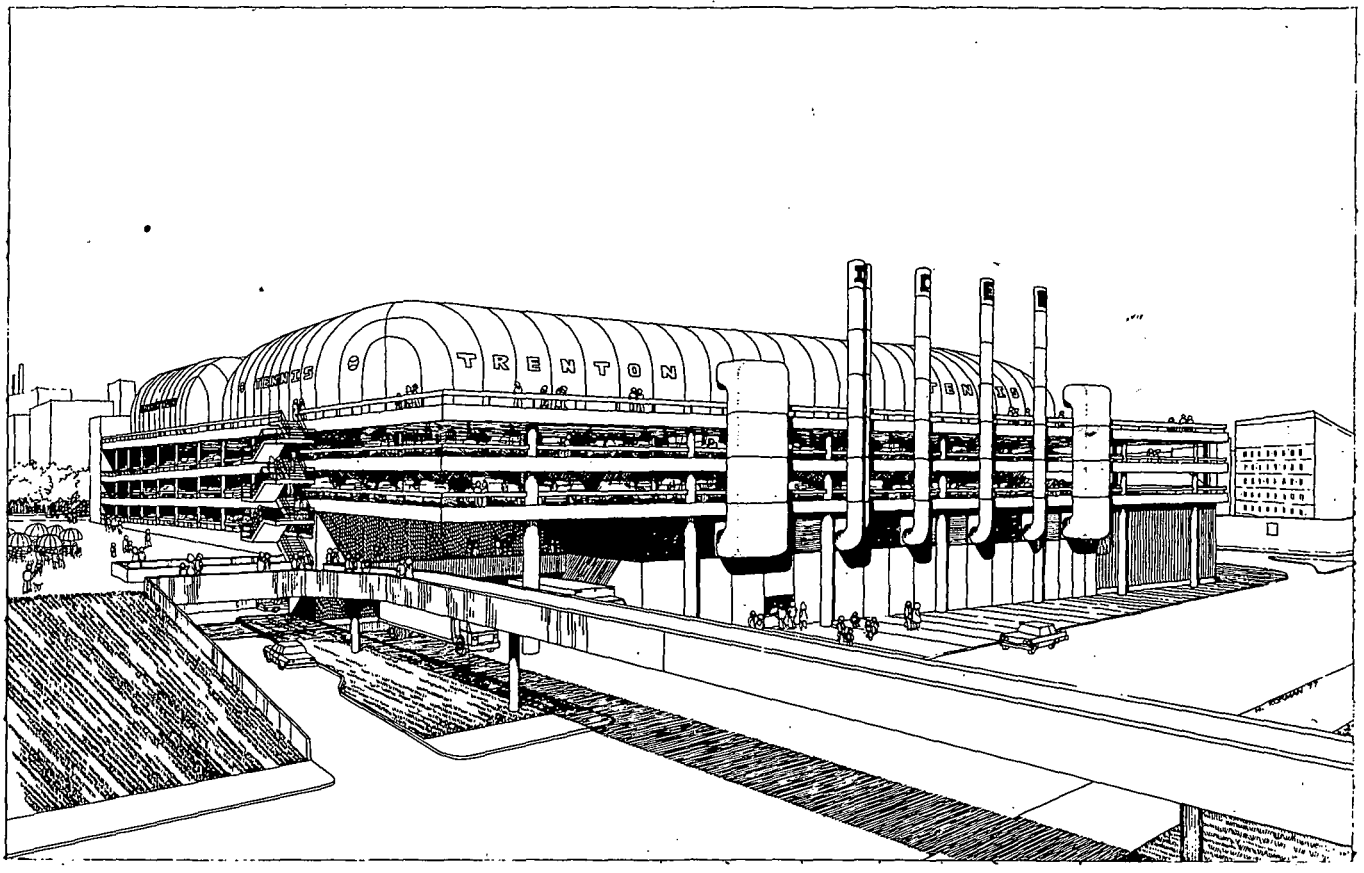

City of Trenton
Department of Planning & Development

Public Service Electric & Gas Co.
Richard G. Stein & Partners
Turner Construction Co.
R.G. Vanderweil, Inc.

14 July 1977

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ABSTRACT

Phase I Preliminary Design and Evaluation for a Grid Connected Thermally Controlled Integrated Community Energy System (ICES) for the City of Trenton, New Jersey has been carried out. The findings of the study are:

It is technically feasible, utilizing commercially available hardware.

It is economically competitive with conventional alternatives for heating and cooling buildings.

It will produce an overall reduction in fuel consumed of 32 to 43 percent when compared with conventional alternatives for heating and cooling buildings.

It will consume 4 to 9 percent more oil than will conventional alternatives for heating and cooling buildings.

It should be owned and operated by PSE & G. No major institutional impediments have been discovered under this arrangement.

It can provide thermal energy 21 months after the start of Phase II and electrical energy 32 months after the start of Phase II.

This study is site-specific and of a small size project. Its installation will not alter the planned PSE & G capacity expansion program. The economic evaluation results of the report cannot be extrapolated for numerous co-generation installations that would affect the PSE & G planned capacity expansion program.

On the basis of the above findings, the members of the Phase I Demonstration Team for Trenton ICES analysis are positively disposed toward proceeding with the Phase II design of the plant in order to conclusively test system viability with the ultimate goal of plant construction.

task I

preliminary energy assessment

1.1 SITE LAYOUT

Community

The geographic area of the community served by the Trenton Integrated Community Energy System (ICES) plant is roughly contained by isosceles triangle, having a base of 4,400 feet and a height of 1,400 feet. The community is comprised of 1,884,025 square feet of floor area of existing building, and 1,251,500 square feet floor area of new construction is projected for completion by 1982. This results in a demonstration community of 3,135,525 square feet floor area on which the ICES is modeled.

There are 18 existing buildings which would be served by the ICES plant. However, since these buildings share several common boiler plants, only four connections to the ICES plant are required. The longest of these connections is approximately 2,000 feet to the Statehouse complex. The total distribution distance to all existing buildings is approximately 3,400 feet. The four existing building groupings are as follows:

Statehouse Complex
- Statehouse (offices)
- Statehouse Annex (offices)
- State Library
- Museum
- Planetarium
- Auditorium
- Education Department (office)
- War Memorial (public assembly)

Labor and Industry office building and Health and Agriculture office building and Laboratory

Detention Center

Kingsbury I housing including two high-rise buildings and four blocks of garden apartments.

The projected new construction includes the following buildings or building groupings:

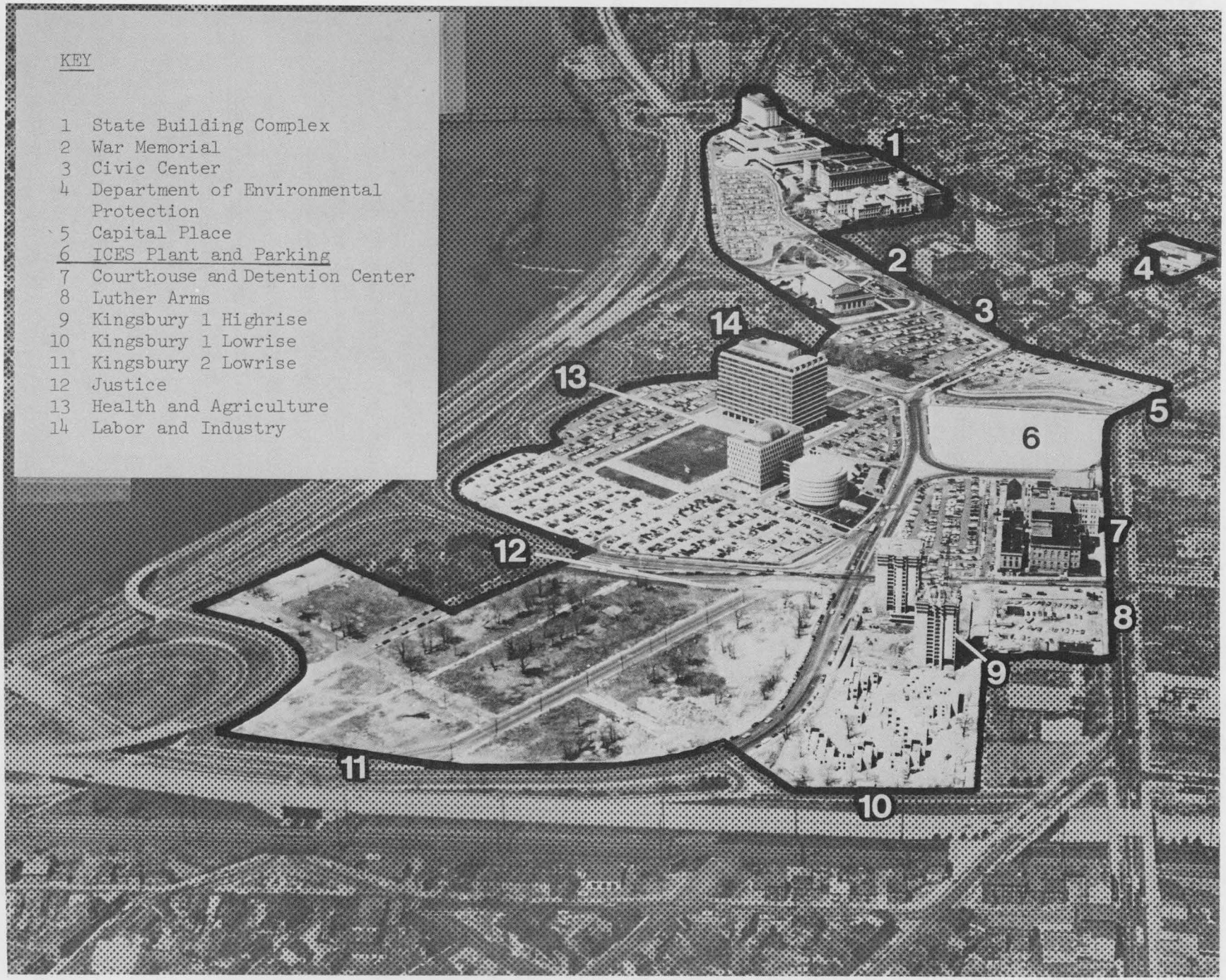
Luther Arms (high-rise residential)
Detention Center additions
Firehouse
Justice complex including court building and commercial space
Kingsbury II low-rise housing
Capitol place complex including office and commerical space
Civic Center (public assembly)
Department of Environmental protection (office building)

The information describing the buildings which make up the Demonstration Community is summarized on page I-19, and the locations are shown on page I-5.

Existing Systems

A primary criterion for the ICES System is to minimize disruption resulting from the connection of existing buildings to the system.

Due to the fact that the primary approach includes electric supply by PSE & G through its existing grid, the only systems which affected ICES decisions were those with thermal demands. The Statehouse Complex and the Labor and Industry and Health and Agriculture buildings are served by boilers providing 125 psig steam, and the Kingsbury I Complex is served by boilers providing low pressure steam. In order to permit


KEY
1 State Building Complex
2 War Memorial
3 Civic Center
4 Department of Environmental Protection
5 Capital Place
6 ICES Plant and Parking
7 Courthouse and Detention Center
8 Luther Arms
9 Kingsbury 1 Highrise
10 Kingsbury 1 Lowrise
11 Kingsbury 2 Lowrise
12 Justice
13 Health and Agriculture
14 Labor and Industry

direct connection to the Statehouse Complex and the Health and Agriculture/Labor and Industry Complex, a system delivering 125 psig steam was selected. The adoption of this approach places considerable limitations on the technologies utilized for electric and thermal generation as it emphasizes the demand for high temperature heat. It was decided that since these building complexes represent 40 percent of the total Demonstration Community and additionally demonstrate the State's commitment to a co-generation approach, their inclusion represents a net benefit to the ICES project when weighed against the limitations imposed on the system.

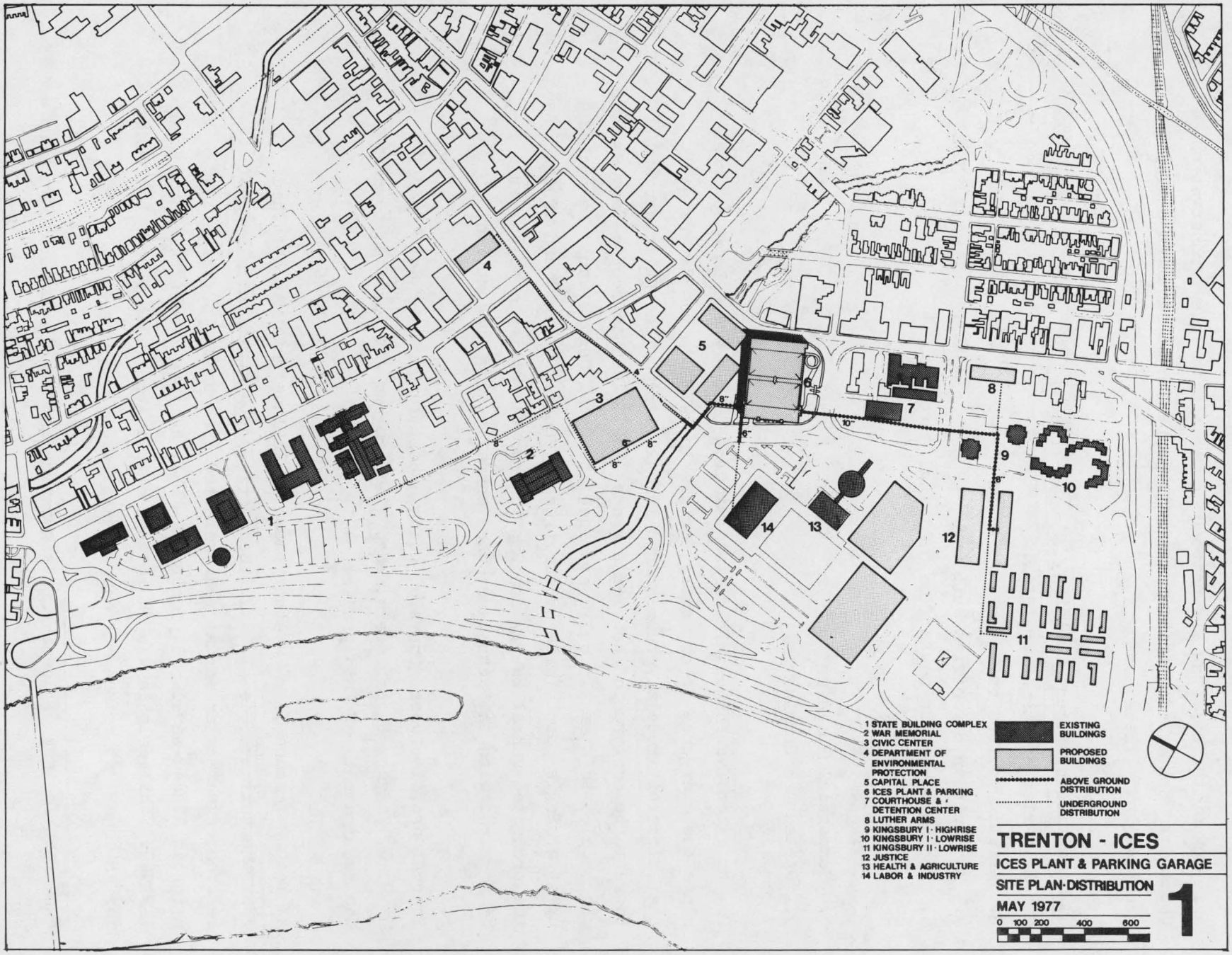
The Demonstration Community was then modeled in order to determine the demand for thermal energy which will be created on the ICES system.

1.2 DEMAND PROFILES

An annual profile was modeled on an hour-by-hour basis for the thermal energy requirements of the 15 buildings or groups of buildings which form the Demonstration Community (see page I - 19).

Thermal load will control the output of the ICES plant. The initial feasibility analysis was based on PSE & G ownership and operation of the ICES plant. In this case the entire electric output of the ICES plant is fed into the PSE & G grid and the electrical needs of the Demonstration Community are served from this grid. Because of this, the electric demands of the Demonstration Community are not relevant in making a comparison since they will be provided in the same manner and at the same cost to the user under ICES or conventional options.

The thermal demand profile of the Demonstration Community is unaffected by the options selected. However, in order to facilitate the modeling, the thermal storage (see page I-17) was included as a portion of the Demonstration Community so that the resulting profiles represented the net demand on the central ICES plant.


1 STATE BUILDING COMPLEX
2 WAR MEMORIAL
3 CIVIC CENTER
4 DEPARTMENT OF ENVIRONMENTAL PROTECTION
5 CAPITAL PLACE
6 ICES PLANT & PARKING
7 COURTHOUSE & DETENTION CENTER
8 LUTHER ARMS
9 KINGSBURY I - HIGHRISE
10 KINGSBURY I - LOWRISE
11 KINGSBURY II - LOWRISE
12 JUSTICE
13 HEALTH & AGRICULTURE
14 LABOR & INDUSTRY
EXISTING BUILDINGS
PROPOSED BUILDINGS
ABOVE GROUND DISTRIBUTION
UNDERGROUND DISTRIBUTION
TRENTON - ICES
ICES PLANT & PARKING GARAGE
SITE PLAN-DISTRIBUTION
MAY 1977
0 100 200 400 600
1

A review of the existing and proposed buildings for the Demonstration Community identified nine basic building types which required energy use modeling. These are:

1. Low-rise apartment building.
2. High-rise apartment building.
3. Existing office building.
4. Square-plan new office building.
5. Rectangular-plan new office building.
6. Court building.
7. Civic Center.
8. Commercial Building
9. Statehouse Complex.

Due to extensive changes in office building design which have occurred since the emergence of the energy crisis in 1973, it was determined that different models were required for existing office buildings and those to be constructed between now and 1982. The Statehouse Complex was modeled as a single building since its total demand would be picked up at a single point (site of the present central boiler) and since the projected annual energy consumption for the entire complex could be compared with the actual recorded annual energy consumption.

Thermal profiles were generated using a computer program developed by R. G. Vanderweil Engineers, Inc. The program was modified to meet the requirements of this project.

A "Test Reference Year" weather tape for Philadelphia was obtained from the National Oceanic and Atmospheric Administration. The test reference year is an actual year selected from among 28 years (1948 - 1975) using an ASHRAE*-developed procedure. Philadelphia's Test Reference Year is 1969. Philadelphia was chosen since it is the closest city to Trenton for which a Test Reference Year was available.

*American Society of Heating Refrigerating and Air Conitioning Engineers.

The tape was read into the computer and the following data were extracted and stored for every hour of the year.

1) Dry bulb temperature
2) Wet bulb temperature
3) Cloud cover modifier

The cloud cover modifier was calculated using the procedure described in Computer Program for Analysis of Energy Utilization in Postal Facilities.*

In order to simplify generation of the thermal profile, it was assumed that the community could be modeled as consisting of several types of buildings and that thermal requirements for each type of building would be proportional to gross floor area.

A thermal profile would be developed for one square foot of floor area for each building type. Composite profiles could then be developed by multiplying these profiles by the appropriate total floor areas.

Seven "typical" buildings were created using ASHRAE 90-75 as a guide and assuming users of the buildings would be energy-conscious. The existing buildings do not conform to these criteria. We originally planned to apply factors to the profiles to make them fit the known thermal demands of the existing buildings. It became apparent that this procedure would not give realistic results for office buildings since the profiles for the energy conscious office buildings were shaped much differently from profiles of most existing office buildings.

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*Computer Program for Analysis of Energy Utilization in Postal Facilities, U.S. Post Office Department, Bureau of Research and Engineering, Washington, D.C.

Therefore, another building type was created for existing office buildings. However, the factoring method was used for existing residential buildings.

The background assumptions and hourly Building Thermal Gain profiles are in Appendix D/1, pp 1 - 17. On the basis of the initial modeling, a storage system was developed to eliminate hourly peak demands such that the peak demand on the ICES plant was never greater than the average daily demand for the worst day. Decentralized storage of unpressurized heated or chilled water for clusters of buildings having physical proximity was provided and, in the case of proposed buildings, a common chiller. The advantages to this approach as compared with centralized storage are:

1. Reduction of distribution network size.
2. Reduction of heat exchanger and chiller sizes.
3. Lower temperature differential between storage and ambient.
4. Simple proven technology.

The criteria for modeling the effect of storage and the resulting hourly Steam Demand profiles are in Appendix D/1, pp. 23 - 36.

With the establishment of the storage system, a new set of profiles showing demand for thermal energy on the ICES plant were generated. These profiles were run in conjunction with the primary track ICES plant technology (combustion turbines) for the model year to produce the plant thermal and electric outputs and associated fuel input requirement.

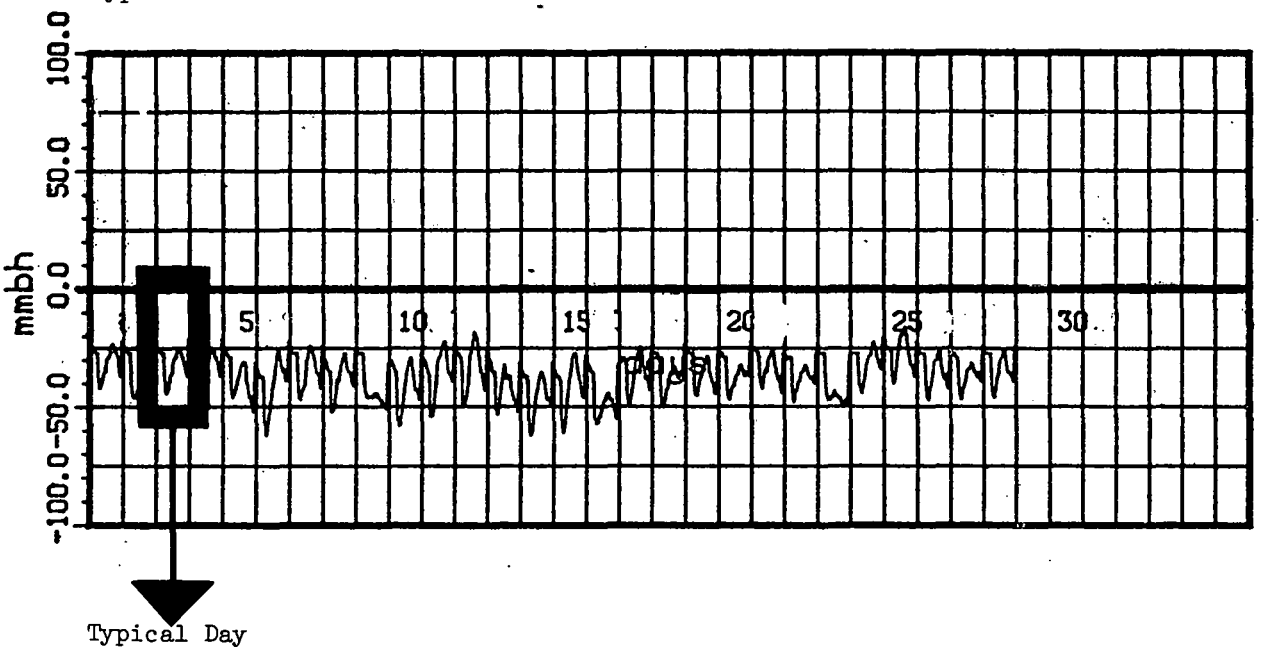
The hourly Electric Generation profiles are in Appendix D/1, pp. 37 - 47.

Appendix D/2 contains daily profiles showing maximum and average thermal demand versus equipment capacity maximum and average electric energy generation maximum and average community thermal load.

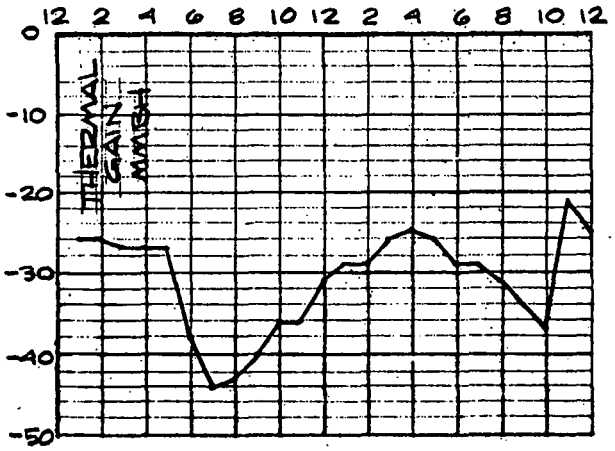
The simulations show a peak coincident Thermal Gain of 79 x 10^9 Btu/hr compared with a total for the individual buildings of 87 x 10^9 Btu/hr. (See page D/1 - 46.)

Sample
Building Thermal Gain
Profiles

Typical Month



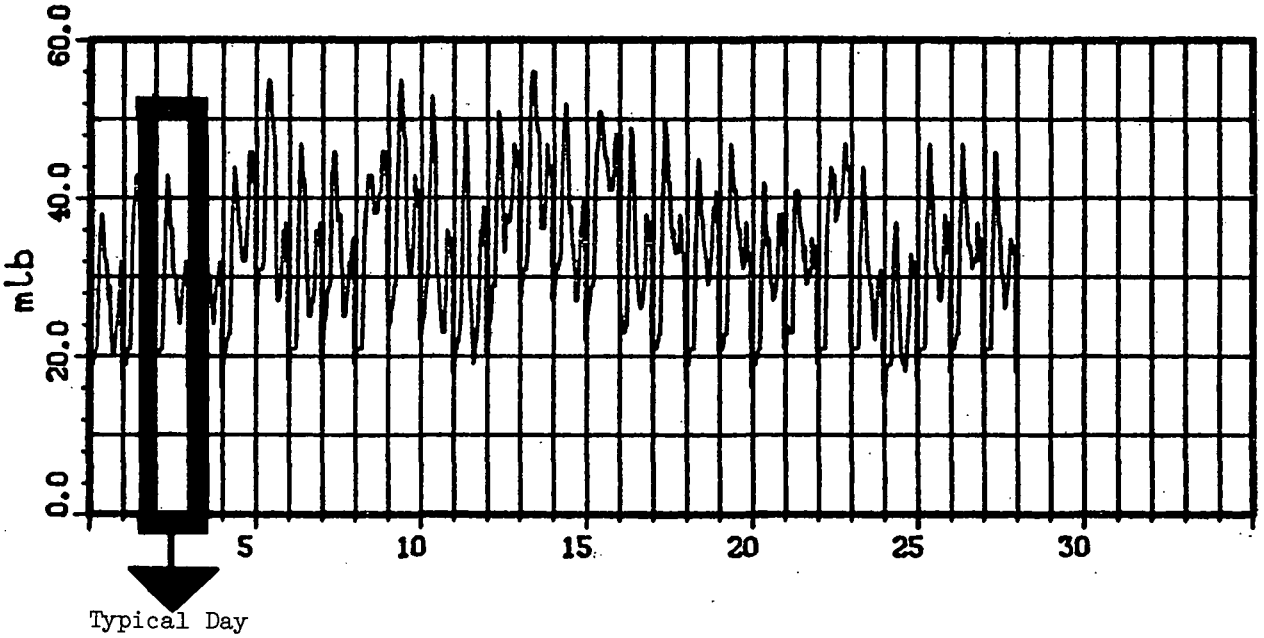
Typical Day



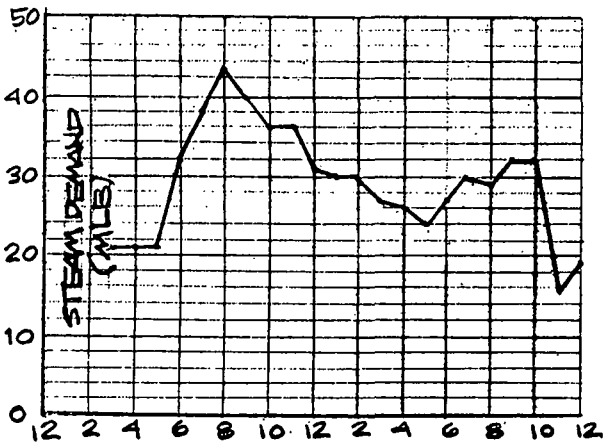
From Appendix D/1

Sample
Building Steam Demand
Profiles

Typical Month



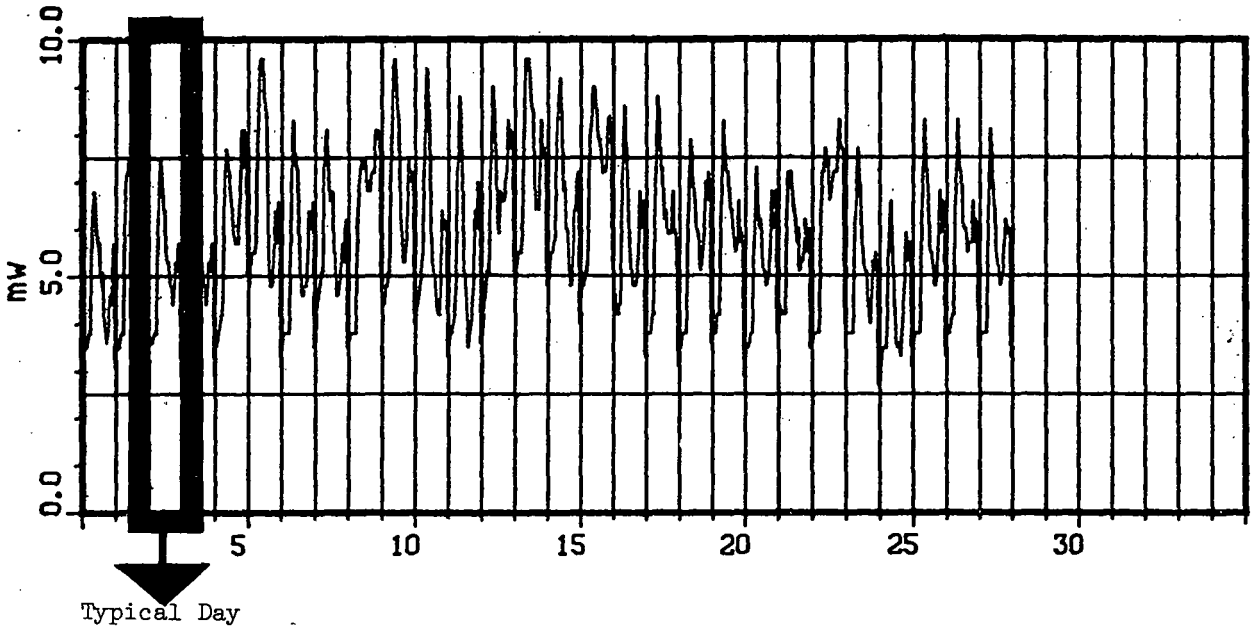
Typical Day



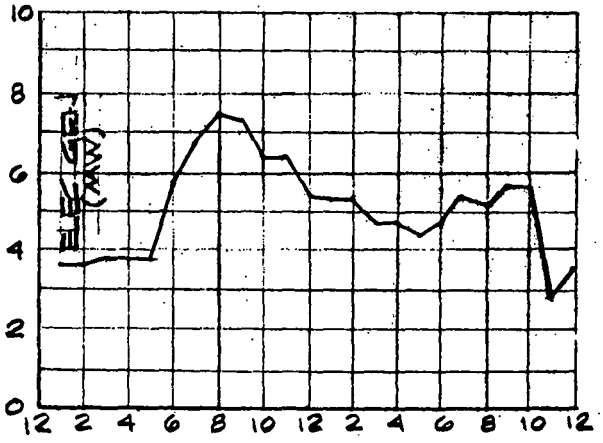
From Appendix D/1

Sample
Building Electrical Generation
Profiles

Typical Month



Typical Day



From Appendix D/1

1.3 PROJECTED GROWTH

The initial feasibility analysis is based on an evaluation of the community as it is projected in 1982. However, as described earlier, the model has been designed to permit the exclusion or inclusion of any quantity of any of the building types in the Demonstration Community. Page I-19 indicates the projected schedules for the development of the Demonstration Community. The demand profile for each stage of development must be generated to determine the impact which it has on the ICES plant. A three-year set of profiles is required as a portion of the next phase of analysis.

The possible expansion in the size of the Demonstration Community after 1982 will require an analysis as the project proceeds. The capability of the plant to serve a larger community has been provided in several ways.

The distribution system can accommodate a 25 percent increase without modification.

Space in the plant has been allowed for an additional turbine/boiler module.

Space is provided in the existing module enclosures so that one or more of the 2.5 megawatt modules could be replaced with a 5 megawatt or 7.5 megawatt unit.

It is anticipated that much of the existing Demonstration Community will undertake energy conservation procedures in the next 10-year period. This reduction in demand from the existing community will free capacity for an expanded service area.

1.4 CONVENTIONAL ENERGY SYSTEM

Two "conventional" - that is, non-ICES approaches for the provision of thermal energy to the Demonstration Community - were evaluated. One system includes oil-fired boilers and electric chillers, the other uses electric heat pumps. The energy inputs to each system were determined by the thermal demand profiles generated for the Demonstration Community (see Appendix D/1). This, in turn, generated annual fuel costs. The levelized annual costs in 1982 dollars established for these two conventional systems were used as the basis for comparison for PSE & G ownership of ICES plant.

The conventional alternative systems were subjected to the same analysis as ICES. Computer modeling was required for both existing and new buildings in order to permit the same hour-by-hour evaluation which permits the identification of on-peak and off-peak energy value and fuel type use. The basis for simulation of existing buildings was imperical data gathered from building management and PSE & G billing records. The monthly energy consumption and demands were verified against these recorded data. The background data are in Appendix C.

Oil-Fired Boilers

The basic comparison was made between ICES and the oil-fired conventional approach. In the conventional approach the existing buildings were considered as remaining unchanged and basic mechanical plants were designed for each of the proposed new buildings. These plants were evaluated for capital cost using the same methodology applied to the ICES plant (See Appendix F/1). Annual fuel consumption was determined by applying the Demonstration Community demand profiles without storage to the conventional system. The building equipment assumed for the analysis is outlined in Appendix F/2, page 2.

Electric Heat Pumps

An alternative conventional system, electric driven heat pumps, was also reviewed. The general methodology for making the comparison remains the same.

The results of the analyses of the conventional system and comparisons with the ICES system are contained in Section III.

The initial economic considerations involve the establishment of the methodology for comparing the ICES to a conventional system. A "Total System" approach was utilized in which the overall annual costs to the users are compared. The following items were used in the comparison.

ICES

1. ICES Energy Production
   (a) Capital
   (b) Fuel
   (c) Operating and Maintenance

2. Reduced Electrical Energy Demand
   (ICES versus Conventional)

3. PSE & G Replacement Energy and Capacity Credit

4. PSE & G Transmission and Distribution Savings Credit
   (a) Energy Loss Reduction
   (b) Long Range Investment Savings

CONVENTIONAL SYSTEM

1. Steam Production
   (a) Capital
   (b) Fuel
   (c) Operating and Maintenance

It should be noted that under ICES, Items 2, 3, and 4 represent credits to this system. Item 2, reduced electrical energy, results from the

fact that under ICES new buildings utilize steam absorption chillers rather than electric chillers, thereby reducing their consumption of electric energy. It should be noted here that the ICES fuel consumption will reflect that steam required for the absorption chillers.

Item 3, replacement energy and capacity represents the value of the electric energy produced plus the value of the ICES generating capacity to the PSE & G system.

Item 4 represents the savings in energy and in capital requirements for distribution equipment resulting from the proximity of the plant to the point of use.

The capital, fuel and replacement energy sections under ICES require that considerable modeling be done in order to determine with any degree of confidence the costs associated with these items. As these constitute the major portion of the ICES operating costs, it was decided to postpone the economic analysis until the schematic design of the plant be completed and a simulation of a year's operation had been performed. This analysis will be carried out as part of Task III.

1.5 ICES CANDIDATE SYSTEM

Following the modeling of the Demonstration Community with storage, a preliminary review of generation/heat recovery technologies was made. Only conventional technologies and equipment were considered in this analysis. For a preliminary analysis, the Solar Centaur gas turbine and the Colt-Pielstick PC-23 diesel modules were reviewed. The comparative cycles of the two modules are shown on pages 39 and 40. Two facts are immediately apparent in these tables. First, due to the requirements for high grade waste heat brought about by the use of 150 psig steam, gas turbines provide greater overall thermal

efficiency. Second, the gas turbines deliver 5.4 pounds of steam per net kilowatt hour as compared with 1.3 pounds of steam per net kilowatt hour for diesels, thus requiring a significantly smaller plant to meet the thermal demands of the community. Since the plant is thermally controlled and will therefore have only seasonal operation, it appears advantageous to minimize the capital costs of the generating plant. On the basis of these considerations, gas turbines were selected as the primary track ICES plant technology.

A review of the performance characteristics of the candidate system revealed two potential problems related to turbine inlet air temperature (and therefore outside air temperature). As turbine inlet air temperature drops, the overall thermal efficiency drops and the exhaust heat available for recovery also drops. This information can be seen on page A-7 by noting the two conditions identified along the 2,500 kw line (generator capacity). For an inlet temperature of 0 degrees F., the waste heat recoverable as 150 psig steam would be given by the formula:
$Q = 156{,}000 \times 0.25\ (700 - 460)\ 0.95 = 8.9 \times 10^6$ Btuh thermal.

At an air inlet temperature of 80 degrees F., the waste heat recoverable at 150 psig steam would be:
$Q = 156 \times 0.25\ (850 - 460)\ 0.95 = 12.6 \times 10^6$ Btuh thermal.

The electric production (2,500 kwh) would remain constant adding 8.5×10^6 Btuh Electric for each case, making the total output 17.4×10^6 Btuh for an inlet temperature of 0° F., and 21.1×10^6 Btuh for an inlet temperature of 80° F. The fuel requirement for an inlet temperature of 0° F. is 40×10^6 Btuh and for an inlet temperature of 80° F. is 37.3×10^6 Btuh, resulting in an overall thermal efficiency of 44 percent for the zero degree condition and 57 percent for the 80 degree condition.

These findings led to a decision to preheat the inlet air using low grade waste heat from the generator and lubricating oil coolers.

It was found that these rejected sufficient heat (approximately 900,000 Btuh) to raise the required quantitites of combustion air approximately 40° F. This is approximately half the capacity required for design condition operation. An additional source of low grade heat is the exhaust gas downstream from the unfired heat recovery boilers (approximately 460° F). Assuming a final exhaust gas discharge temperature of 320° F., there are approximately 4.5×10^{6} Btuh available for recovery. The cycle was revised to inlude preheating of condensate return, preheating of incoming combustion air, and heating of air to be used for space heating for an indoor tennis facility immediately adjacent to ICES plant. The revised cycle is shown on Figure A-4 which indicates a peak thermal efficiency of approximately 65 percent. This cycle serves as the basis for the initial ICES plant design. See Appendix A.

1.6 THERMAL DISTRIBUTION

Thermal distribution will be carried out delivering 125 psig steam for compatibility with presently existing terminal equipment in the Statehouse, Health/Agriculture and Labor/Industry complexes. Buildings will be provided with heat exchangers to permit the conversion of the delivered steam to a form compatible with the local heating and hot water systems. Existing buildings will utilize the chillers which are presently installed. New buildings will be provided with two-stage absorption chillers permitting the direct use of the 125 psig steam for the production of chilled water.

The distribution system is described in detail in Section III.

1.7 THERMAL STORAGE

Thermal storage (described in detail in Appendix D/1, pp. 23 - 36) will be insulated steel tanks buried adjacent to the buildings or

terminal equipment which they service. They will store heated water during the winter and chilled water during the summer. The connection of the storage capacity into the system is shown in Appendix B.

The installed cost for the storage system is estimated at $590,000 in 1977 dollars (see Appendix F-2, page 2). The inclusion of this storage permits the plant to exist with one fewer generator/boiler module than would otherwise be the case. The four module plant is estimated at $6.6 million in 1977 dollars. On this basis the inclusion of the thermal storage facility reduces the central plant cost by more than $1 million.

The approach chosen for thermal storage has several distinct advantages to any others. The components are readily available and are used in conventional fashion, facilitating installation and maintenance. The fact that storage is at the terminal rather than at the supply reduces the peak demand on the distribution system as well as on the generation equipment which, in turn, permits both of these systems to be reduced in size. In addition, the storage falls between the points of end use and the chillers which also reduces the size requirement for these units. While the initial decision to utilize remote thermal storage was based on a comparison between the cost of the thermal storage and the central plant equipment, its use also reduces distribution and terminal requirements which, in turn, show added benefits to ICES.

A description of the modeling procedures and results of simulations using storage are shown in Appendix D/1.

1.8 ELECTRIC POWER DISTRIBUTION

The Trenton ICES described in this report is based on PSE & G ownership and on the supply of electricity to the Demonstration Community from the PSE & G grid. Since electrical distribution remains unchanged in the ICES or conventional approaches, no special ICES electrical distribution system has been developed. The existing system is described in Appendix F/2.

DEMONSTRATION COMMUNITY

Existing Buildings	SQ FT
Kingsbury I Towers	280,000
Kingsbury I Lowrise	74,500
Mercer Co. Detention Center	160,000
Mercer Co. Courthouse	130,000
Labor and Industry	300,000
Health and Agriculture	144,000
Statehouse Complex	795,525
	1,884,025

Proposed Buildings		Construction Start	Construction Completion
Lutheran Arms	91,500	1977	1978
Capitol Place	155,000	1977	1979
Capitol Place Commercial	50,000	1978	1979
Justice Department	350,000	1978	1979
Justice Commercial	50,000	1978	1979
Firehouse	5,000	1978	1979
Kingsbury II	200,000	1980	1981
Civic Center	100,000	1981	1982
Dept. of Environmental Protection	250,000	1981	1982
	1,251,500		

Total: 3,135,525 SQ FT

task II

institutional assessment

INTRODUCTION

The following report analyzes the legal and some related practical considerations pertinent to a fundamental decision as to role allocation of authority, responsibilities and cost of the creation and obligations of an Integrated Community Energy System (ICES) of Trenton, New Jersey, culminating extensive research through a side spectrum of such legal problems as can be foreseen at the pre-planning phase of the ICES project. The present report, while continuing to touch upon the full range of considerations, focuses more closely upon those which we anticipate having greater relevance to the project format which appears to be most advantageous.

The report is characterized primarily by reference to the identity of the primary owner and/or operator of the ICES plant. The discussion in consideration thereof attempts to follow the order suggested by Exhibit I, Task II, Preliminary Institutional Assessment.

The conclusion reached through an assessment of the report is that ownership and operations by Public Service Electric and Gas Company of the ICES is the preferred ownership alternative for each of the principal parties involved in the Demonstration Team. This ownership alternative not only rests ownership in the hands of a highly experienced party, it by-passes extensive regulatory initiative to establish a new utility company, and to interject it into an area already served by a commercial utility, and it provides a precedent to other utility companies throughout the nation of involvement in

"co-generation," establishing a track record which other utilities can evaluate in the light of their own experience.

Note: Copies of relevant sections of Codes and Regulations are included in Appendix L.

GENERAL CONSIDERATIONS WHICH HAVE APPLICATION REGARDLESS OF THE IDENTITY OF THE OWNER OR OPERATOR

Environmental Regulations

Regardless of which institution or combination of institutions should own or operate an ICES Plant, there will exist the need for reconciling certain obviously offensive characteristics of an electrical generating plant to the system of state and local laws and administrative regulations which are designed to minimize their presence, expecially in densely populated areas.

The proposed Trenton ICES design would place the ICES plant in a fully developed central business district of the New Jersey capitol city and within a short distance from the Assunpink Creek and the Delaware River. Existing environmental regulations impact upon the ICES project in the same manner that they presently impact upon all aspects of electrical generation using the combustion of fossil fuels. The primary areas of environmental concern are: (a) atmosphere, (b) water, and (c) noise.

(a) Atmosphere - the design of ICES for the Trenton Central Business district calls for a plant capable of burning conventional fuels. While heat emissions from an ICES system can be expected to be reduced to lower levels than experienced in non-ICES plants, smoke emissions will undoubtedly remain unabated.

The New Jersey Department of Environmental Protection (NJDEP) has promulgated regulations which govern the clean air standard for the State of New Jersey. The regulations contained in New Jersey Administrative Code (NJAC 7:27-8) have been abstracted and are presented on the page L-1 of Appendix L for ready review. Attention is called to the

requirements of the Administrative regulations for the monitoring and control of smokestack emissions for a variety of pollutants.

In addition to the State regulatory scheme administered and enforced by the New Jersey Department of Environmental Protection, we have, in the City of Trenton, Ordinances (RGO 9-3.3) which very broadly, and without the systematic organization of the New Jersey Administrative regulations, penalize the pollution of the air within the municipality. The City ordinances are enforceable initially by the order of the City Health Officer. While in the interest of thoroughness the existence of the Trenton ordinances are noted, the owner-operator would be well advised to concentrate on compliance with State regulations.

(b) Water - because the site for the ICES plant in Trenton would be very close to both the Delaware River and the Assunpink Creek (a course of water which drains large areas of Mercer County into the Delaware River) the design of the ICES plant should consider the possible need for some insignificant discharge of heated water into one or the other of the rivers. The design of the plant would have to provide a means for monitoring the heat of such waters and other qualities of the discharge which may adversely affect the purity of the rivers. Any consideration relating to the use of the Delaware River as a discharge point would entail dialogue with the Delaware River Basin Commission, a joint Federal-State-Regional Commission (Pennsylvania, New Jersey, New York and Delaware) which monitors discharges of waters and other materials into the Delaware River (which constitutes the border line between New Jersey and Pennsylvania). The NJDEP, as well as the City of Trenton (by Ordinance RGO 7-15.12) also monitor such discharges. The New Jersey

Environmental Regulations governing water are also appended hereto (following the regulations pertaining to the atmosphere). Intake water is supplied from the Trenton Water Utility and no cooling water is required.

(c) Noise - the sound level typical of major generating plants can be reasonably presumed to require an ICES plant design which emphasizes the use of sound proofing materials and sound suppression systems to meet existing environmental regulatory standards, but, if possible, to surpass such standards in the interest of neutralizing one predictable issue of public adversity to the ICES concept. Considering the level of daytime population within the Trenton central business district and the degree to which the surrounding buildings are devoted to office uses (as opposed to industrial), the installation of an ICES plant not capable of containing the noises of electricity generation may meet very difficult public opposition.

The appropriate State Environmental Protection Regulations concerning noise are appended following the materials on water.

Even with Public Service Electric and Gas Company ownership of the plant, it would appear desirable for the City of Trenton to aid in expediting Public Service Electric and Gas Company's applications for all necessary regional, state and local environmental permits.

PUBLIC UTILITY COMMISSION JURISDICTION

Regardless of whether the ICES project is owned or operated by the Public Service Electric and Gas Company or by the City of Trenton,

the ICES plant will most likely* be subjected to the jurisdiction of the New Jersey Public Utilities Commission.

PUC procedures are contained in the New Jersey Adminstrative Code (relevant portions of which are abstracted and presented in the pages following this section of the report) and can be outlined as follows with respect to the need for PUC approval for any activities initiated by the City of Trenton as the owner-operator and for such additional activities to be initiated by PSE & G such as steam distribution.

a. Petition the Public Utilities Commission for franchise approval pursuant to NJAC 14:1-6.13.

b. Petition the PUC for approval of stocks, bonds, notes, etc. NJAC 14:1-6.13.

c. The administrative regulations regarding construction and operational requirements are contained in NJAC 14:3-2 and 14:3-14. The jurisdiction of the Public Utilities Commission naturally will be invoked, if necessary, to resolve any contest between the existing franchise holder (Public Service Electric and Gas Company) and the City of Trenton. Barring an amicable arrangement between City officials and representatives of Public Service Electric and Gas Company, territorial acquisition by the City of Trenton, at the

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*By virtue of New Jersey Laws (NJSA 40:62-23), a municipality operating a generating plant entirely within City boundaries and servicing no county public buildings, is exempted from PUC jurisdiction. Nevertheless, it is hardly unlikely that the City of Trenton would actually operate a generating station in the Capitol City without servicing County buildings since the City of Trenton serves also as the seat for Mercer County Government and such buildings appeared to be very closely grouped within the areas surrounding the proposed plant site.

expense of the present franchise holder, would entail review and decision-making by the PUC and will additionally entail resort to litigation in Superior Court over the issue of compensation. Compensation would obviously be owing by the City of Trenton to the existing franchise holder as a consequence of the taking by the City of property rights in the form of the franchise territory. Damages to PSE & G would include, naturally, the loss of prospective income, measured, in part, by current consumer demand and the projected increases presently contemplated in consumer demand related to the development in the vicinity of the plant site, as well as existing subtransmission, distribution and metering facilities.

FEDERAL POWER COMMISSION JURISDICTION

Regardless of the ownership status of the ICES plant, since there will be energy interchanges between the plant and the PSE & G system, the Federal Power Commission (FPC) jurisdiction will probably apply and the Federal Power Act may require the filing of any contract between PSE & G and other parties involved in the ICES.

PUBLIC SERVICE ELECTRIC AND GAS OWNERSHIP-OPERATION

The selling of steam would be within the scope of PSE & G's charter powers. The Restated Certificate of Incorporation provides that PSE & G may engage in any activity for which corporations may be organized under the New Jersey Business Corporation Act. The Act permits incorporation thereunder for any lawful purpose, except to do in New Jersey any business for which organization is permitted under any other statute unless such other statute permits organization under said Act.

RS 14:2-2 permits incorporation under the old Title 14 inter aria, of a corporation for the purpose of the production, transmission,

distribution and supplying steam heat and power, or steam power.

In addition to the considerations advanced supra., the following legal considerations have been reviewed from the perspective of exclusive ownership and operation of the ICES plant by the existing franchise holder for the areas in which the City of Trenton is located, Public Service Electric and Gas Company.

A. The State Laws Governing the ownership and operations of public utility generating plants contain no prohibition or limitations upon Public Service Electric and Gas Company, which would prevent PSE & G from having exclusive ownership and operation of an ICES plant in the central business district of the City of Trenton. Likewise no local ordinances would prohibit such ownership or operations (setting aside temporarily the question of local zoning ordinances which are discussed below). A determination by Public Service Electric and Gas Company to acquire the requisite land, to construct facilities and to operate an ICES plant would be a matter solely within the discretion of its governing board. With respect to the steam component to the ICES generation concept (as reviewed in Sections I and II of this report), the existing regulations of the Public Utilities Commission would require submittal of the appropriate applications and would require the appropriate review processes to extend its existing electrical and gas franchises to include the delivery of steam. Likewise, as reviewed by PSE & G, the utility would certainly face the related question of refusing certain prospective steam customers due to an obvious limitation on its ability to generate and deliver steam which appears to be substantially different from its ability to deliver electrical and gas supplies as a common carrier. Rate structuring is clearly a matter for PUC review.

B. Zoning - Since the ICES site, site plan review and conditional use as proposed, falls within a Business "A" Zone of the City of Trenton, one of the earliest formal actions to be taken by PSE & G would be an application to the Planning Board of the City of Trenton for a conditional use approval which would permit the otherwise non-conforming electrical generating plant within the "Business A" district. Based upon local experience with the Trenton Planning Board, such an application should be submitted only after the applicant is prepared thoroughly to present to the Board a comprehensive report on the environmental protective features of the proposed plant. Present experience indicates the likelihood of at least a sixty-day processing period prior to final approval, excluding any considerations of time delays occasioned by appeals from an either positive or a negative determination by the Planning Board. Such appeals would first be taken to the Public Utility Commission and, if necessary, to Superior Court Appellate Division of the State Court system and would be subject to further review by the New Jersey State Supreme Court.

C. Urban Renewal Plan Amendment - Since the ICES site is in a designated Urban Renewal Area, and since the City of Trenton has filed an Urban Renewal Plan which did not include the ICES, an amendment must be made. The Department of Planning and Development must prepare the amendment documents and present them to the Trenton Planning Board for approval. The Planning Board must hold public hearings and a majority of its members must vote for recommendation to approve the change. The Planning Board's recommendation is then forwarded to the City Council for their review. A majority of the Council must vote for a resolution (not subject to public hearings). After Council has approved the resolution, the amendment documents with supporting documentation and an

"environmental assessment" must be submitted concurrently to both the U.S. Department of Housing and Urban Development and to the A-95 review agencies, the Delaware Valley Regional Planning Commission, Philadelphia, Pennsylvania and the New Jersey Department of Community Affairs for their review and approvals.

D. Labor - The exclusive, private ownership and operation of an ICES plant by PSE & G would, in all foreseeable aspects, be identical to those relating to other operations by PSE & G. By comparison to a municipal operation, the construction and operational phases of the project under a PSE & G management would avoid the time delays and other drawbacks of the public bidding procedure and the newly inaugurated financial control systems imposed upon municipal construction contracting by the State of New Jersey, Department of Community Affairs, Division of Local Government Finance, NJAC 5:30-14.4 (effective April 15, 1977 which places a certain monetary restriction on the supervision of ongoing construction contracts by municipalities to the extent that certain change orders, barring emergency circumstances must have the review and approval by the governing body of the City of Trenton as proposed to the Administrative and executive officials who formally had the discretionary authority to authorize an interim change order during construction phases of City contract. Further, by comparison to municipal ownership and operation, the benefits which are flowing from the private enterprise aspects of PSE & G construction procedures should be measured in terms of the cost of operating (including maintenance and repair) by resorting to private enterprise employment as opposed to Civil Service employment under New Jersey Civil Service requirements. The comparable cost of the private and civil service labor are subjected

to much uncertainty at this point. Clearly PSE & G's expertise would yield a lower overall operating and maintenance expenses regardless of any difference in labor costs.

E. Taxation and Finance - Exclusive PSE & G ownership and operations will certainly subject that franchise holder to the same kind of taxation presently imposed upon PSE & G property and revenue, with the exception of the possible reduction in real estate taxation due to the location of the ICES plant in an Urban Renewal Area. The ability of the Public Service Electric and Gas Company to finance the acquisition of real estate and purchase and construction of the appropriate facilities comprising the ICES plant is available through regular company procedures and company financial resources, subject to overall company financial needs. One related issue is the question whether without PSE & G ownership of the land the capitalization for the ICES plant is bondable.

F. Steam Rates - Appropriate steam supply rates must be filed with and approved by the Public Utilities Commission (PUC). As an alternate to standard rates, the steam service could be based on individual contracts subject to PUC approval; in such case, the service contract may be made with the Demonstration Community as an entity or separately with each customer.

OWNERSHIP AND OPERATION BY THE CITY OF TRENTON

As one of the three fundamental alternatives to the creation and operation of an ICES plant in the City of Trenton, municipal ownership and operation can be studied very easily and planned with reference to existing state and local laws. A comparative evaluation of the

several benefits and several disadvantages reflected by each of the exclusive ownership-operation alternatives is difficult, especially in areas which are not susceptible to scientific analysis (such as the comparison between a private and municipal employment of the work staff necessary to operate and maintain the ICES). The following points outline the pertinent laws and administrative regulations effecting exclusive municipal management.

A. State Enabling Legislation - clearly permits the ownership and operation of a generating utility plant by municipality (NJSA 40:62-12 et seq.). The language of that Statute is obviously broad enough to encompass a wide spectrum of utility generating activities sufficient to include the operation of proposed ICES plant. One drawback of the municipal operation would be the need to subject to public referendum at a general election the question of whether the City of Trenton ought to get involved in an ICES project as a prerequisite to municipal ownership or operation. The adverse aspects of the political process underlying the public referendum procedures need not be recited in detail. As discussed initially, ownership and operation by municipality may in all likelihood include Public Utility Commission jurisdiction and the problems (also discussed above) of the intertwining of municipal and Public Service Electric and Gas operations within the center City.

B. Zoning Ordinances - Because the proposed ICES site lies within a "Business A" Zone, municipal ownership would avoid the detail of pursuing a zoning variance as a prerequisite to the installation of the ICES plant. Our State Courts have consistently upheld the right of municipal government to be immune from local zoning regulations. Rutgers vs. Peluso, 60 NJ 147 (1972), Skotch Plains Township vs. Westfield, 83 NJ Super. 323 (Law Div. 1964).

However, a separate question arises because of the fact that the site also lies within an Urban Renewal District, the current plan for which would require certain amendments and administrative approvals pursuant to the regulations of the Department of Housing and Utban Development of the Federal Government. As discussed above, the urban renewal planning requirements affect both Public Service Electric and Gas Company as well as the City of Trenton, and although it is believed at this point that practical considerations indicate no major obstacle toward achieving final urban renewal approval, the procedures may not be overstepped.

C. Labor - Every step of the project commencing with the retention of design engineers and culminating in the staffing of personnel for the operation of the completed plant would entail strict compliance with several New Jersey Laws dealing with the ability of a municipality to a contract for the provisions of services and supplies. The Local Public Contracts Law (NJSA 40A:11-1) governs extensively all aspects of construction of contracting including preliminary professional services which law, in turn, would require full compliance with all state and federal laws governing equal employment practices and wage and hour regulations. Most recently, the state has promulgated regulations governing affirmative action plans required to be monitored and enforced by municipalities against all public contractors having five or more employees, such regulations being designed to require such contractors to demonstrate actual efforts leading to improving racial and other balances within their employment ranks. Public bidding laws present certain minor scheduling difficulties and occasionally, entail litigation over the City's determination as to the "lowest responsible bidder." The operations of the ICES plant as a municipal project would

entail full compliance with Civil Service rules and regulations under New Jersey Statutes NJSA 11:1-1 et seq. which provides generally for the selection of personnel for employment on the basis of "merit and fitness" using the basic approach of qualifying examinations both for initial appointments and for subsequent advancement, and using quasi-judicial proceedings (subject to appellate review) of disciplinary actions including employee suspension and determination. Employees assigned by Trenton to the ICES project would have the right to union organization (NJSA 34:13A-1) and the right to choose any labor representational team chosen by the majority of the employees including the IBEW.

D. Taxation - Municipal ownership would result in a tax exempt status for the ICES plant and its real estate in the same manner in which the Trenton Water Utility and Trenton Parking Utility operate on a tax exempt basis. Such a tax exempt status might appear to be an advantage to the municipal ownership of the ICES; however, it would result in a loss of tax revenue to the City.

JOINT TRENTON AND PSE & G OWNERSHIP-OPERATION

This final category outlines the existing state legislation which expressly permits the combination of municipal and private enterprise resources toward a theoretically optimum management of an ICES plant. Our analysis indicates that, while a blending of benefits perculiar to municipal and to private ownership and operation may enable the ICES project to slalom through some of the fundamental administrative and legal roadblocks discussed throughout this report, the legal considerations and some of the practical considerations of properly uniting the City of Trenton and Public Service Electric and Gas Company in an efficient joint venture may prove to be more troublesome

than the roadblocks sought to be avoided. The City of Trenton does have the experience in the design of inter-institutional cooperative agreements, having pioneered in this area with the State's first inter-municipal solid waste transfer facility (between the City of Trenton and the Township of Ewing). However, building from that experience (in which the City successully designed a contract to allocate equitably the cost of construction and operating a utility) we have a practical appreciation for the diffculties inherent in such long-term, capital intensive arrangements including not only the primary consideration of dividing the burden of capital financing and the authority for making final design and operational decisions but also, and perhaps of equal importance, the problems associated with termination and dissolution of the arrangement. Nevertheless, the pertinent statutory references and other pertinent considerations are outlined below.

A. State Laws Governing - Existing state enabling legislation permits the combination of the municipal and Public Utility Companies under a contract which would prescribe precise relationship between municipality and the Utility Company in all aspects of construction and operations of the facility (NJSA 40:62-25.2).

This statute permits a long term contract equalling the anticipated useful life of the facility. It expressly eliminates the need to submit the question to referendum, a legislative indication of a state policy liberating a municipal government from some several decades earlier. The legislative encouragement is also strongly evidenced by the express exemption from adhering to the public contracts law (public bidding).

B. Zoning - Although the matter appears not to have been ajudicated to date by any New Jersey court, it would appear that even a partial municipal ownership of the facility would carry with it the exemption from zoning variance approval which otherwise would be required if the facility was owned solely by PSE & G. In either event, approval for an amendment to the Urban Renewal district would still be required.

C. Labor Considerations - Under a joint ownership and operation plan, labor procurement (both in the construction phase and the operation phase) would be a factor of the allocation of responsibility contained in the contract between the City of Trenton and PSE & G. Obviously, to pursue a joint ownership plan, the desire would be to allocate the responsibility for labor procurement to PSE & G unless it should be approved that the municipal, Civil Service and Public Contract Law system provides for more efficient and less expensive labor.

D. Taxation - No final meaningful conclusions as to taxation could be reached without the benefit of a draft intra-agency contract to determine the responsibility for ownership and operations.

PUBLIC INFORMATION PROGRAM

The Demonstration Team began its Public Information Program even before it was selected as a contractor by ERDA. As early as November 13, 1976, actually prior to the Team's submittal to ERDA, the local newspapers were informed of the Team's intention to perform the feasibility study. When ERDA made their selection of the Trenton ICES Team, again the newspapers were informed. Also, at various intervals, the local news media were kept up-to-date on the progress of the feasibility study and both local newspapers attended the mid-term progress report which the Team made to ERDA officials on April 7th, 1977. Copies of these newspaper articles are presented in Appendix G.

In order to gain further dissemination of information about the Trenton ICES, the Team produced a two-color brochure describing the ICES system and benefits for a mailing to environmental groups, labor unions, politicians, members of the business community, civil servants, professional and trade associations and citizen's groups. (See Appendix G). In addition, the Trenton ICES team participated in the Second Annual New Jersey Energy and Conversation Conference and Exposition held March 29th and 30th at the Cherry Hill Hyatt House in Cherry Hill, New Jersey. The Team prepared two panels displaying the information presented in the brochure. The Team displayed these panels in a manned booth of the Conference and distributed literature to interested parties. John P. Clarke also gave a presentation of the ICES concept in the March 29th afternoon workshop/panel discussion to the assembled conference.

The ICES Team expects to continue to inform the public via the local news media. Since the City of Trenton is a part of the ICES Team, reports to the City Council are a matter of course and of public record.

The ICES Team will pursue a course of speaking before civic, business, professional and trade associations to explain the concept and progress of the Trenton ICES. The first of these meetings was held on May 18th, when Clark Gellings of PSE & G and James Greenberg of the City of Trenton spoke before the Mercer County Chamber of Commerce at their monthly luncheon meeting.

Perhaps the most innovative aspect of the Trenton ICES Public Information is that the ICES plant itself is being designed as an educational device about energy and electricity. The ICES plant is integrated into a large public parking structure through which passes an elevated public walkway connecting two urban plazas. When people pass the ICES along this walkway, they will be able to

see the ICES plant through vision panels. The mechanical equipment piping and ducting will be color-coded and explanatory signs and diagrams along the walkway will describe the workings of the plant. Thus, the entire ICES will beocme a learning laboratory where adults and classes of school children can readily learn about the technology which supplies the needs of modern society.

task III

conceptual design

ICES plant

The Conceptual Design of the ICES plant is based on the considerations outlined under Task 1. The primary generation technology is combustion turbine with the exhaust passing through unfired heat recovery boilers. These are two-stage boilers with the first (high temperature) stage generating 150 psig steam and the second stage producing 230-degree hot water. An auxiliary boiler is provided to give thermal stand-by reserve equal to the output of two turbine/heat recovery boiler modules. In addition, this auxiliary boiler will provide capacity to handle exceptional thermal peaks.

The basic module is a 2.5 megawatt gas turbine/generator set with a capacity to satisfy approximately 25 percent of the peak thermal demand. Four modules are provided. Redundancy and exceptional peak capacity are provided by the auxiliary boiler. This configuration permits a large degree of operational and expansion flexibility. The ability to function on fewer than four turbine/generator sets permits plant operation at less than peak demand while maintaining a high plant efficiency due to the heavy loading on those pieces of equipment which remain in operation.

The decisions leading to the selection of the technology described above and the basic thermal cycles of the configuration employed are described in Section 1.5. A more complete description of plant function is contained in Appendix A, and a description of the specific characteristics of the equipment (outline specification) are found in Appendix F.

The enclosure for the ICES plant is integrated into a parking garage with 1,200 vehicles to service the Capitol Place Complex with capacity for Labor and Industry, Health and Agriculture, the Detention Center and commercial buildings adjacent to the Demonstration Community.

In addition, the ICES plant will serve a proposed Civic Center primarily in the evenings. In order to facilitate pedestrian movement from the garage to these places, an elevated sidewalk system to the adjacent sites is provided permitting the thermal distribution from the ICES plant to these adjacent sites to be run in chases provided beneath these walkways, thereby minimizing the excavation of public streets and facilitating future maintenance.

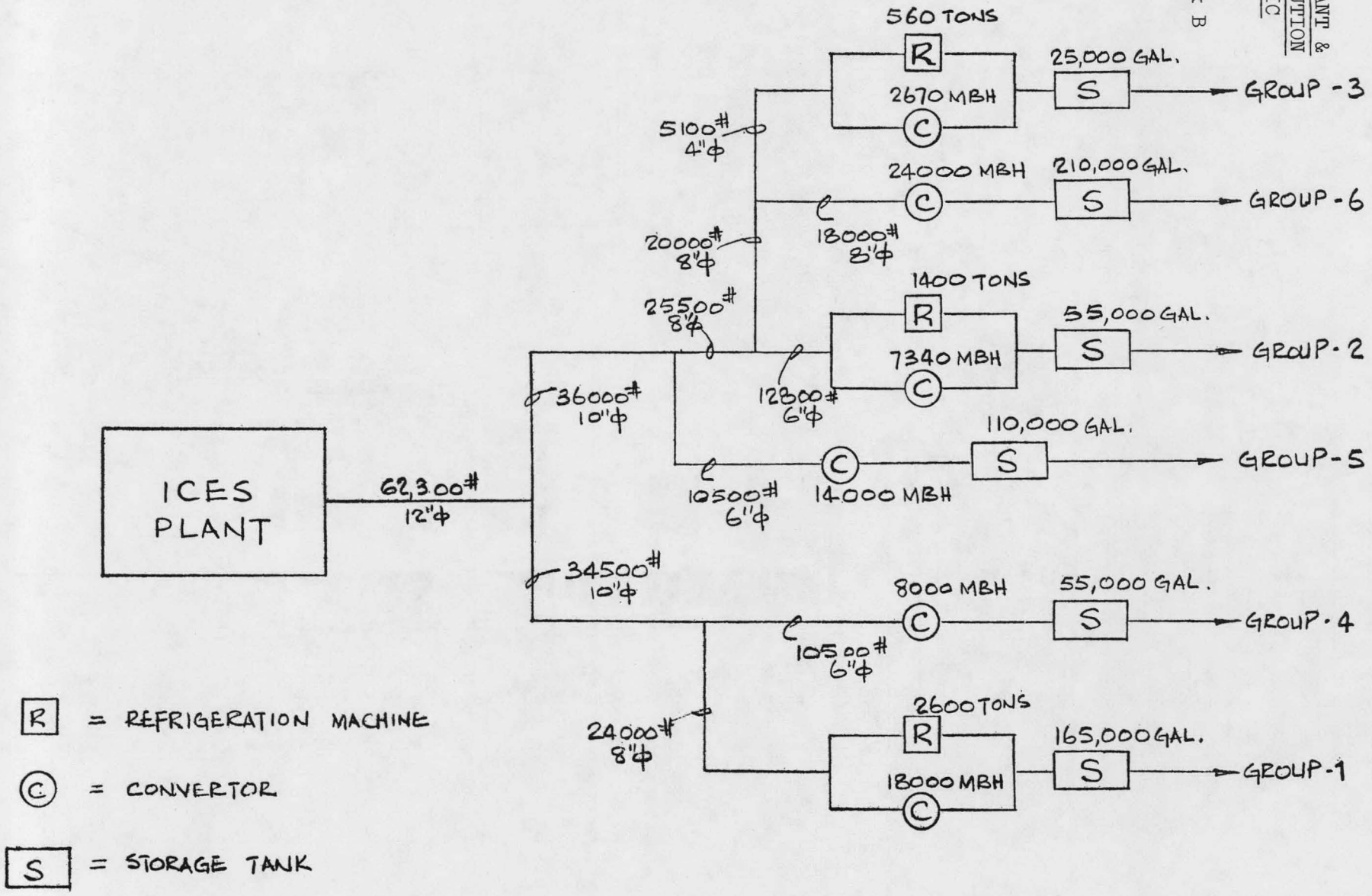
Energy Information Center

An additional benefit resulting from the placement of the ICES plant in the center of an intensively used circulation route is that it will serve as an "Energy Information Center." The ICES plant will be a highly visible building in Trenton, the New Jersey State Capitol. (see page III - 11.) The elevated sidewalk and the ICES plant will be separated by a wall of acoustical glass. The equipment will be color coded. Explanatory placques and diagrams along the sidewalks will explain the function of the plant equipment as well as the basic concepts of ICES. Display cabinets and panels will house energy related exhibits and information describing energy conservation techniques. Graphic material describing the ICES plant is included on pages

Thermal Distribution

The basic distribution system consists of primary 150 psig steam distributions to six central equipment centers which utilize the steam to produce hot water for heating, domestic and process use, reduced pressure steam for process use, and chilled water for space

TRENTON
TIGERS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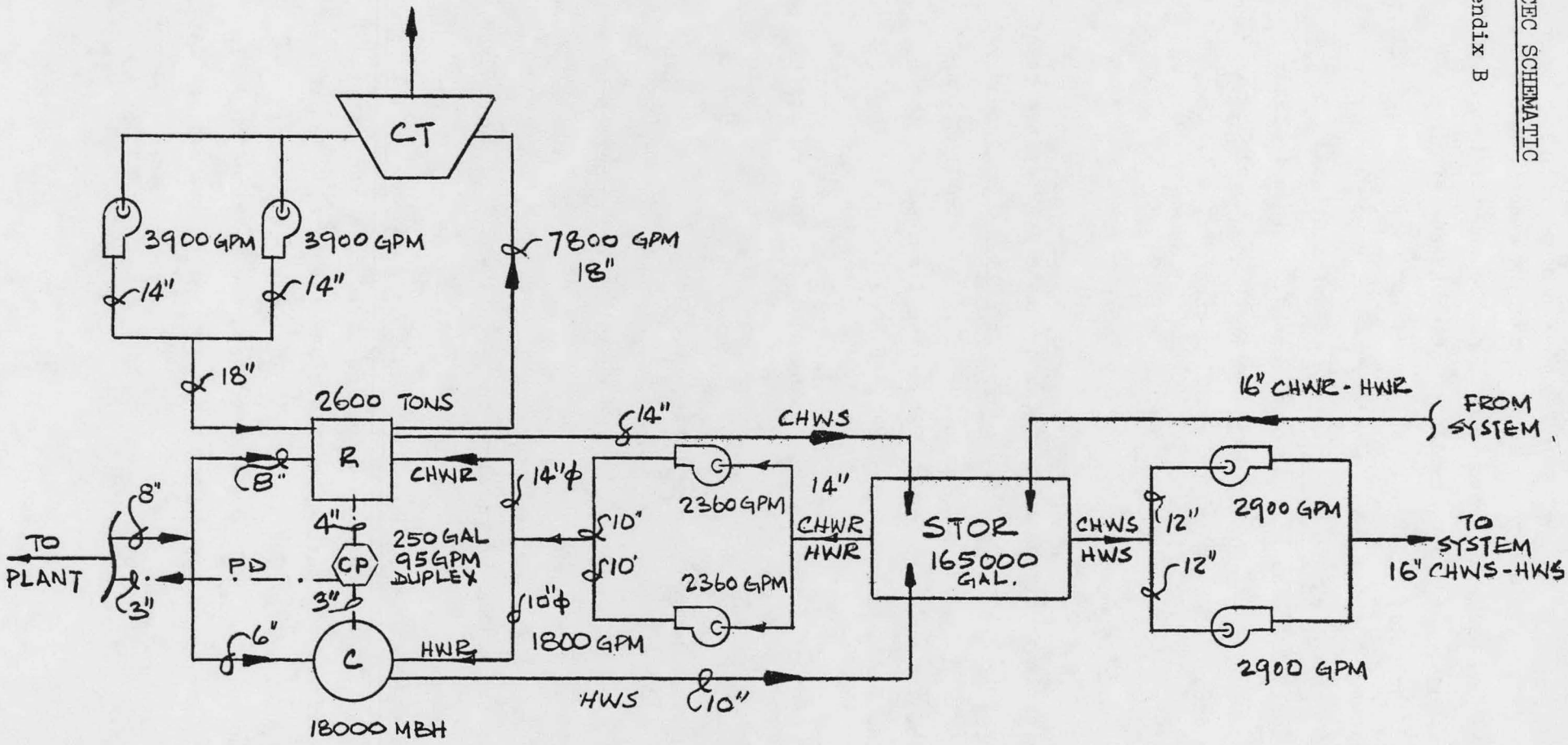
R = REFRIGERATION MACHINE
C = CONVERTOR
S = STORAGE TANK

TYPICAL CEC SCHEMATIC

from Appendix B



CEC = CENTRAL EQUIPMENT CENTER

CT = COOLING TOWER

R = REFRIGERATION MACHINE

CP = CONDENSATE RECEIVER/PUMP.

C = CONVERTOR

PD = PUMP DISCHARGE

STOR = STORAGE TANK

cooling. Each central equipment center will contain steam - hot water converters, two-stage absorption chillers, condensate receivers/ pumps, cooling towers, pumps and auxiliary equipment and storage capacity. The distribution system is described in detail in Appendix B. It is anticipated that as the project proceeds, some changes in the distribution concept may be required due to institutional problems that result from the sharing of a central equipment center by buildings under different ownership. The system as modeled, however, serves as a useful basis for modeling energy flow in the entire ICES system.

Capital Costs

The preliminary estimate of the cost of the complete ICES system based on the design described above and the equipment outlined in Appendix E is $8,038,800 in 1977 dollars and exclusive of normal construction overhead, profit, and contingencies. With these items added, the total cost of the ICES system becomes $11,138,800.

The cost of the central ICES plant including heat recovery equipment is $6,655,100.

The cost of the distribution system is $1,464,700.

The cost of the terminal equipment at the buildings being served by ICES is $3,019,000.

This information is further broken down on pages 1 and 2 of Appendix F/2.

Energy Input/Output

In order to complete the economic evaluation of ICES, a fuel input/ energy output analysis was developed. This was simulated on an hour-by-hour basis for a typical year. The simulation procedures are described in Appendix D/1. The basic results are summarized on Table 13, page 39; and the conclusions when subjected to turbine availability

factors are shown on page 38. For the year simulated, the oil consumption for the ICES plant is 73,364 barrels, and the total electrical output is 28,079 megawatt hours.

The simulation identifies whether the electricity is produced during on-peak or off-peak hours, and the value assigned to the electricity is based on the time of day of production.

Other Costs

Operation and maintenance costs are assigned to ICES based on the utility's experience and on a careful analysis of the type of staff and maintenance procedures required by this particular installation. Credits are assigned to the capital value of the ICES plant to the Utility. This material is summarized on Tables 1 and 2 of Appendix F/1. The backup material for this analysis is contained in Appendices F/1 and F/2.

Similar analyses were performed for conventional supply of thermal energy using oil-fired boilers in one case and electric driven heat pumps in another.

Economic Analysis

A "total system" approach was applied in which the total costs of the ICES were compared to those of a conventional system. The costs for the ICES and conventional system follow:

ICES Costs

1. Those costs associated with the total ICES energy production including capital, fuel, operating and maintenance.

2. The savings associated with supplying less electric energy required by the community, as compared to the conventional system, at the applicable rates.

3. A credit for the value to PSE & G of the energy and capacity provided by the ICES plant.

4. A credit for PSE & G transmission and distribution long term savings resulting from the operating of the ICES plant.

Conventional System Costs

1. The costs associated with the conventional heating facilities to provide steam output equivalent to that of ICES, including capital, fuel, operating and maintenance.

The ICES shows a competitive economic position compared to both conventional alternatives. The Phase I analysis shows a marginal annual penalty to ICES of $100,000 as compared with the oil-fired conventional system and $260,000 as compared with the electric heat pump conventional system viewed in 1982 dollars. Based on a 1982 capital value of $14,215,000 these differences are less than the anticipated error in this preliminary economic evaluation.

The methodology for the economic analysis takes into account the financial requirements for PSE & G to undertake a capital project. Thus, an analysis showing a break-even condition between ICES and the conventional systems demonstrates economic viability from the utility's point of view.

Fuel Analysis

The analysis of fuel use made for the economic evaluation also permits the following energy comparison for the three approaches.

The ICES system requires a total annual fuel input of 73,365 barrels of oil (425.5×10^9 Btu) to produce its total electric and thermal output.

The conventional system using oil-fired boilers requires an annual input of 40,975 barrels of oil (243.5×10^9 Btu) for the provision of thermal energy alone. This thermal energy is somewhat less than the thermal output of the ICES plant due to the use of electric vapor

chillers. Based on PSE & G's present and projected generation mix, incremental electricity during on-peak hours will be produced by oil-fired plants and during off-peak hours will be produced by coal-fired plants. The conventional community simulation permits the identification of on-peak and off-peak usage. Based on the above, the annual fuel use due to this electrical production is 27,779 barrels of oil (166.7×10^9 Btu) plus 6,440 tons of coal (27,903 equivalent barrels of oil or 167.4×10^9 Btu). In other words, the total oil input for the conventional system with oil-fired heating to provide the equivalent output of ICES is 68,754 barrels of oil plus 6,440 tons of coal or a total of 96,657 equivalent barrels of oil or 579.9×10^9 Btu.

Based on the same methodology the conventional system using electric heat pumps in the proposed buildings shows a total annual fuel use of 32,802 barrels of oil (194.6×10^9 Btu for the provision of thermal energy). The electricity demand of the community requires a fuel input of 34,353 barrels of oil (206.1×10^9 Btu) plus 7,960 tons of coal (34,500 equivalent barrels of oil or 207.0×10^9 Btu). This amounts to a total annual fuel input of 67,155 barrels of oil plus 7,960 tons of coal or 101,655 equivalent barrels of oil or 601.0×10^9 Btu.

ICES Versus Conventional System Fuel Use

A comparison of the three analyses shows the ICES plant consuming slightly more oil per year than the conventional alternatives and considerably less total fuel.

The conventional oil-fired system consumes 4,610 barrels of oil (6 percent) less than the ICES plant. The conventional oil-fired system consumes 23,293 equivalent barrels of oil (32 percent) more than the ICES plant.

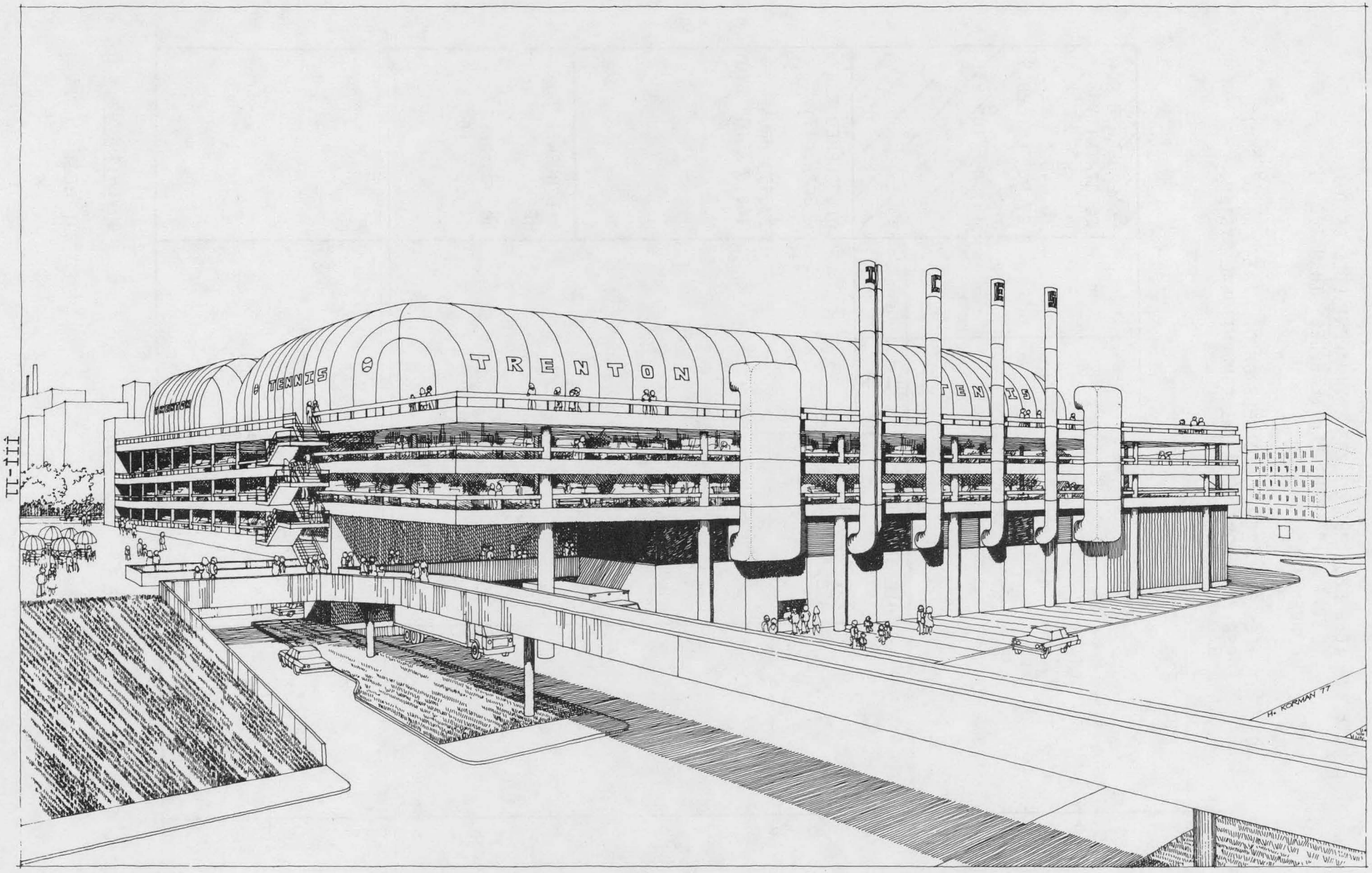
The conventional system with electric heat pumps consumes 6,209 barrels of oil (9 percent) less than ICES. The conventional system, utilizing electric heat pumps, consumes 28,269 equivalent barrels of oil (39 percent) more than ICES.

The above information compares volume of different grades of oil. If the same comparison is made using the thermal content of the oil used, the results are as follows:

The conventional oil-fired system consumes 15.3×10^9 Btu (4 percent) less oil than ICES. The conventional oil-fired system consumes 152.1×10^9 Btu (36 percent) more fuel than ICES.

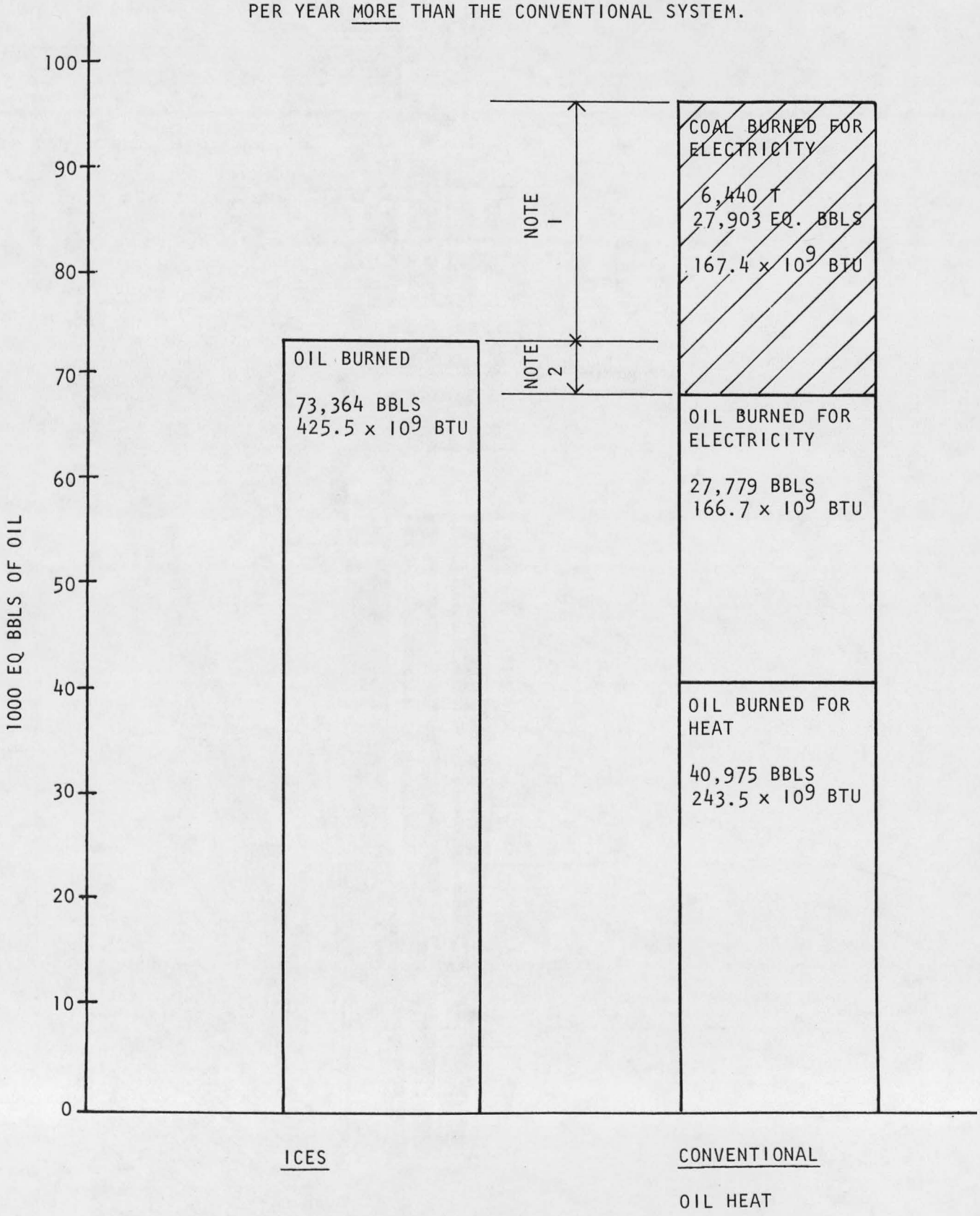
The conventional system with electric heat pumps consumes 24.8×10^9 Btu (6 percent) less oil than ICES. The conventional system with electric heat pumps consumes 182.2×10^9 Btu (43 percent) more fuel than ICES.

This information is represented graphically on pages III - 2 and III - 13.


TRENTON
TENNIS
H. KORMAN '77

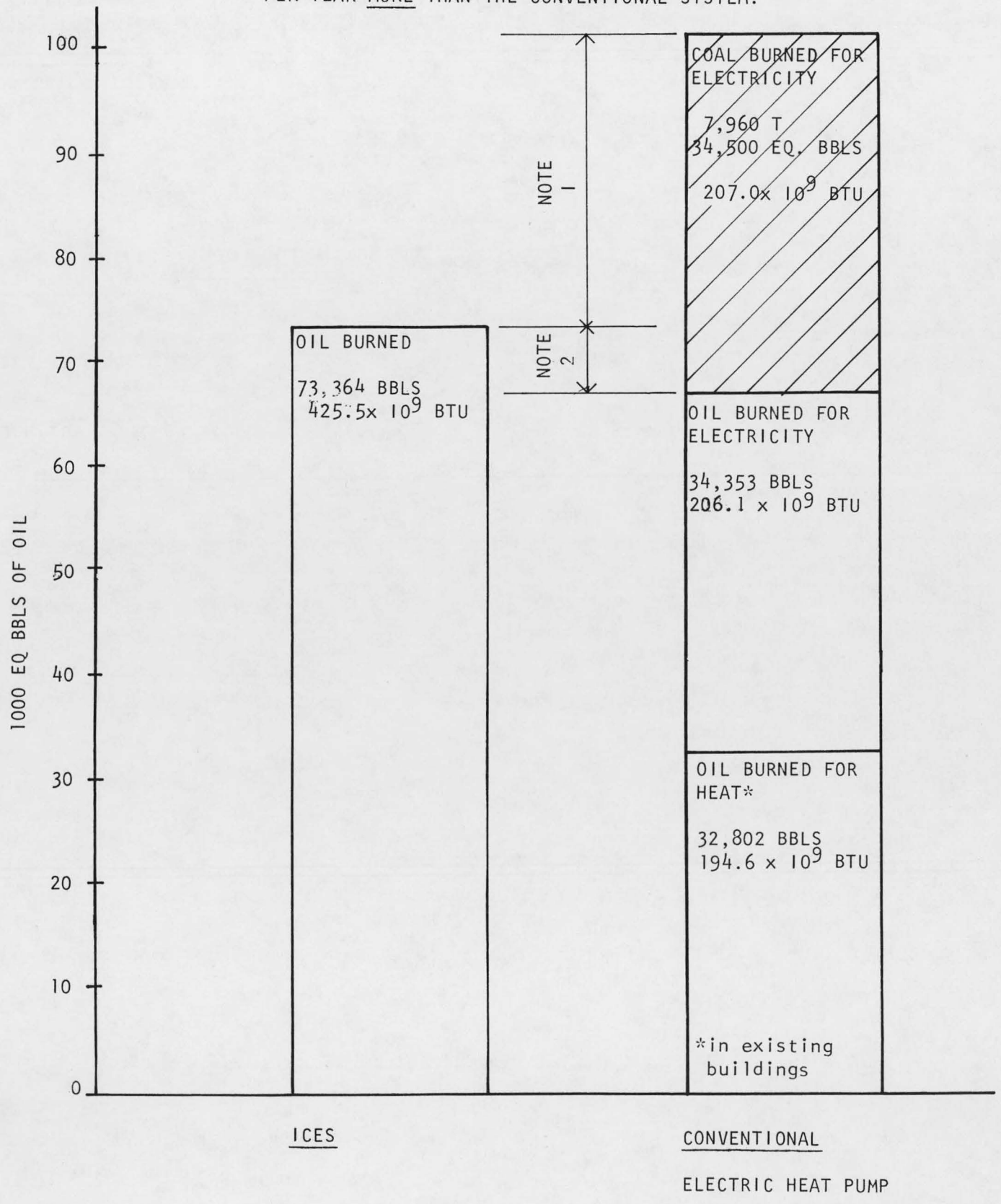
NOTE 1: ICES REQUIRES 23,293 EQUIVALENT BBLS OF OIL (152.1×10^9 BTU) PER YEAR LESS THAN THE CONVENTIONAL SYSTEM.

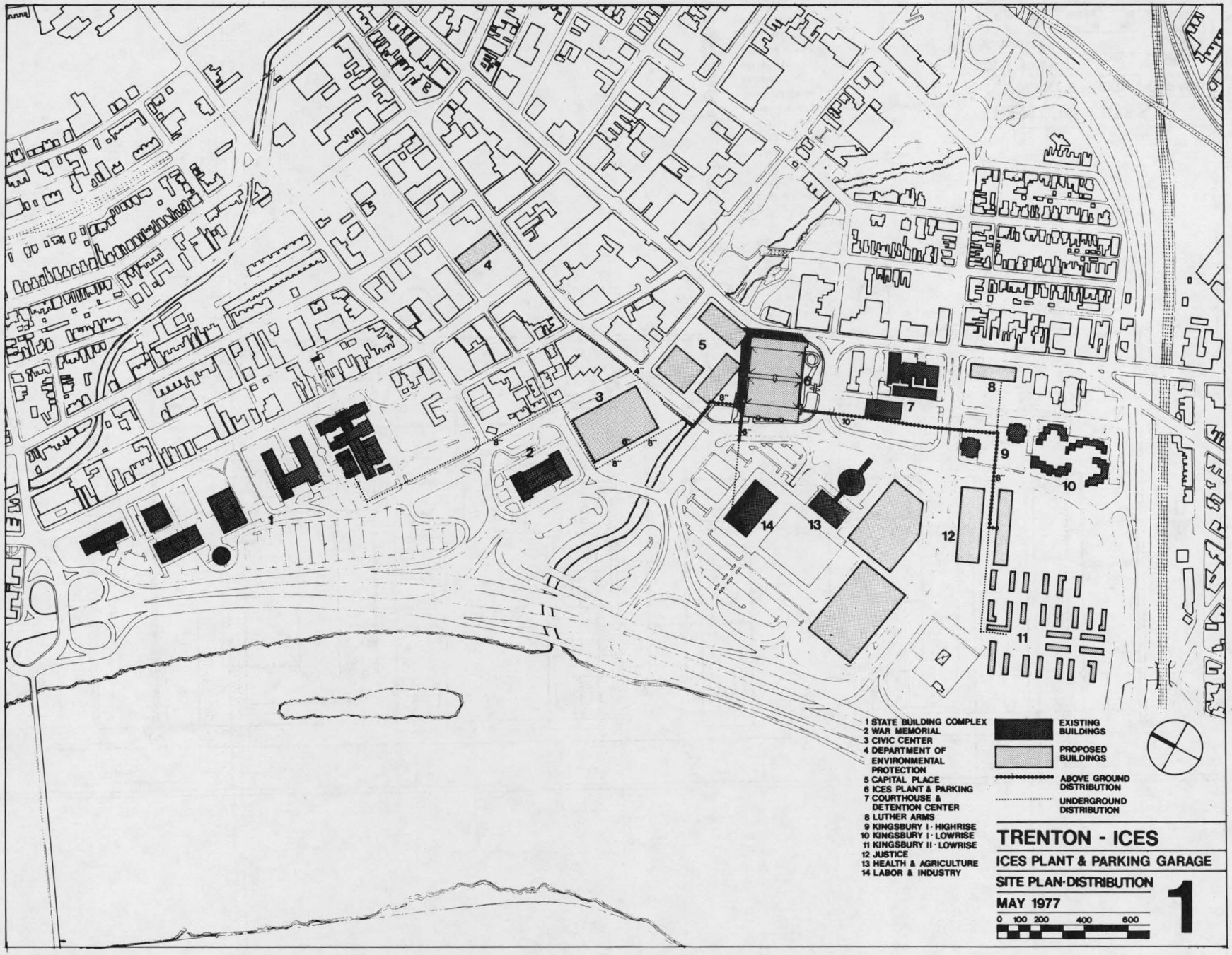
NOTE 2: ICES REQUIRES 4,610 BBLS OF OIL (15.3×10^9 BTU) PER YEAR MORE THAN THE CONVENTIONAL SYSTEM.



NOTE 1: ICES REQUIRES 28,291 EQUIVALENT BBLS OF OIL (182.2×10^9 BTU) PER YEAR LESS THAN THE CONVENTIONAL SYSTEM.

NOTE 2: ICES REQUIRES 6,209 BBLS OF OIL (24.8×10^9 BTU) PER YEAR MORE THAN THE CONVENTIONAL SYSTEM.




1 STATE BUILDING COMPLEX
2 WAR MEMORIAL
3 CIVIC CENTER
4 DEPARTMENT OF ENVIRONMENTAL PROTECTION
5 CAPITAL PLACE
6 ICES PLANT & PARKING
7 COURTHOUSE & DETENTION CENTER
8 LUTHER ARMS
9 KINGSBURY I · HIGHRISE
10 KINGSBURY I · LOWRISE
11 KINGSBURY II · LOWRISE
12 JUSTICE
13 HEALTH & AGRICULTURE
14 LABOR & INDUSTRY
EXISTING BUILDINGS
PROPOSED BUILDINGS
ABOVE GROUND DISTRIBUTION
UNDERGROUND DISTRIBUTION
TRENTON - ICES
ICES PLANT & PARKING GARAGE
SITE PLAN·DISTRIBUTION
MAY 1977
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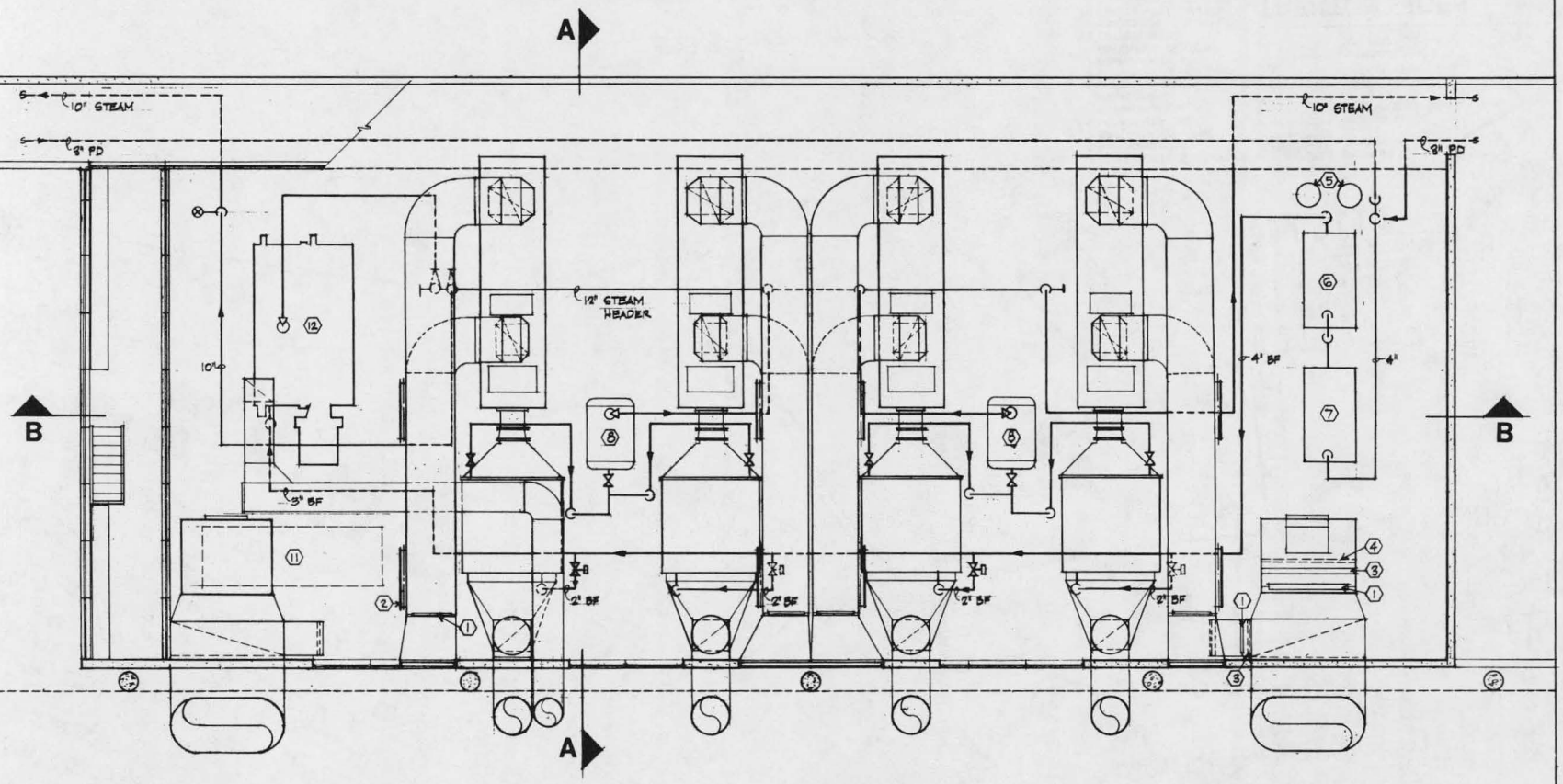

LEGEND

1. AUTOMATIC CONTROL DAMPER
2. REGISTER
3. FILTER
4. HEATING COIL
5. CHEMICAL TREATMENT TANK
6. DEAERATOR TANK & B.F. WATER PUMPS
7. CONDENSATE ACCUMULATOR TANK & TRANSFER PUMPS
8. STEAM SEPARATOR
9. SILENCER
10. OIL COOLER
11. OPTIONAL SINGLE STAGE ABSORPTION CHILLER
12. AUXILIARY BOILER
13. BOILER FEED WATER

TRENTON - ICES

ICES PLANT & PARKING GARAGE

ICES PLAN

MAY 1977

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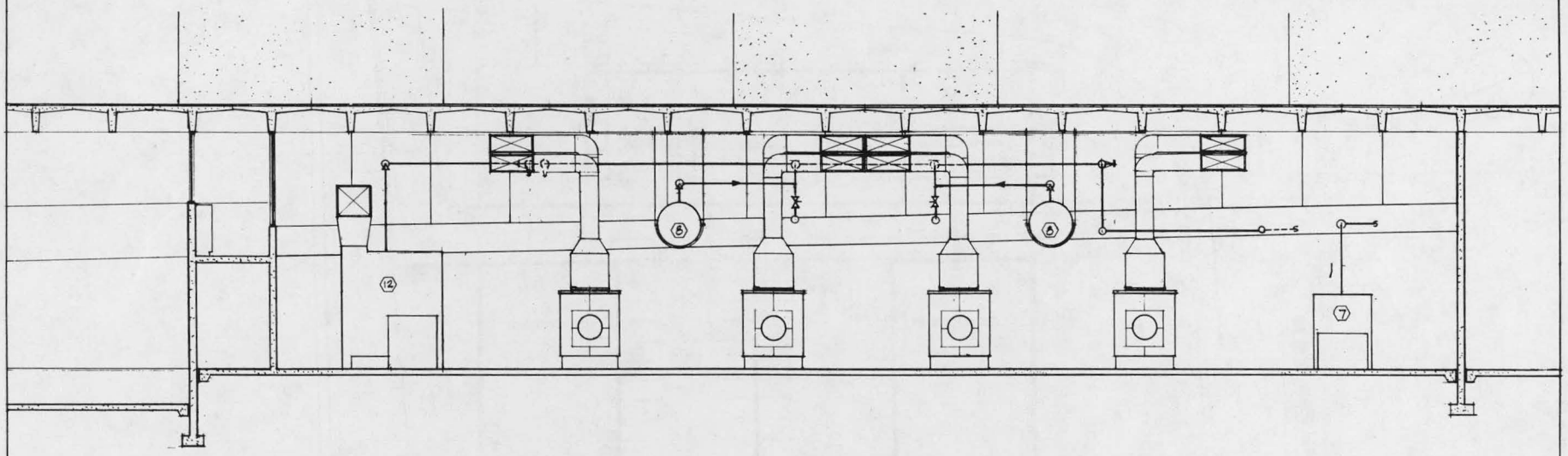
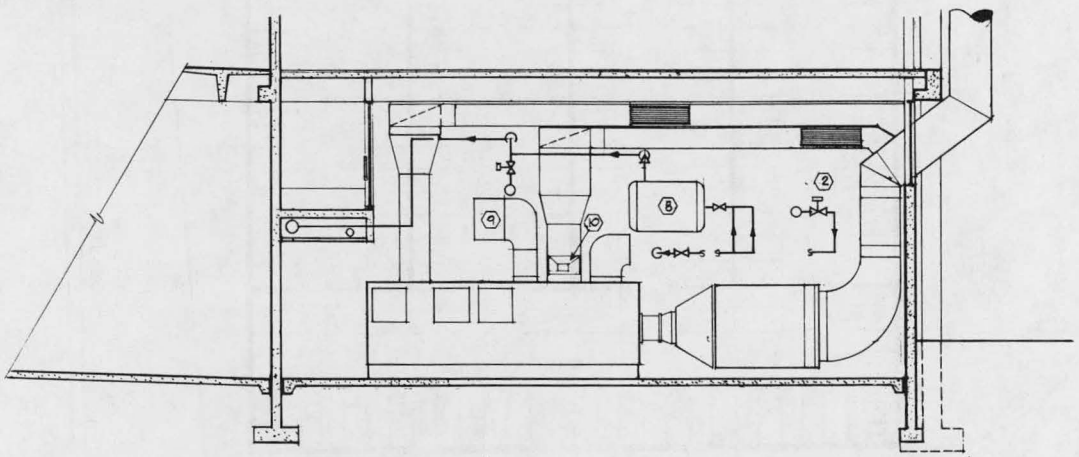
2



SECTION B



SECTION A

TRENTON-ICES

ICES PLANT & PARKING GARAGE

ICES SECTIONS

MAY 1977

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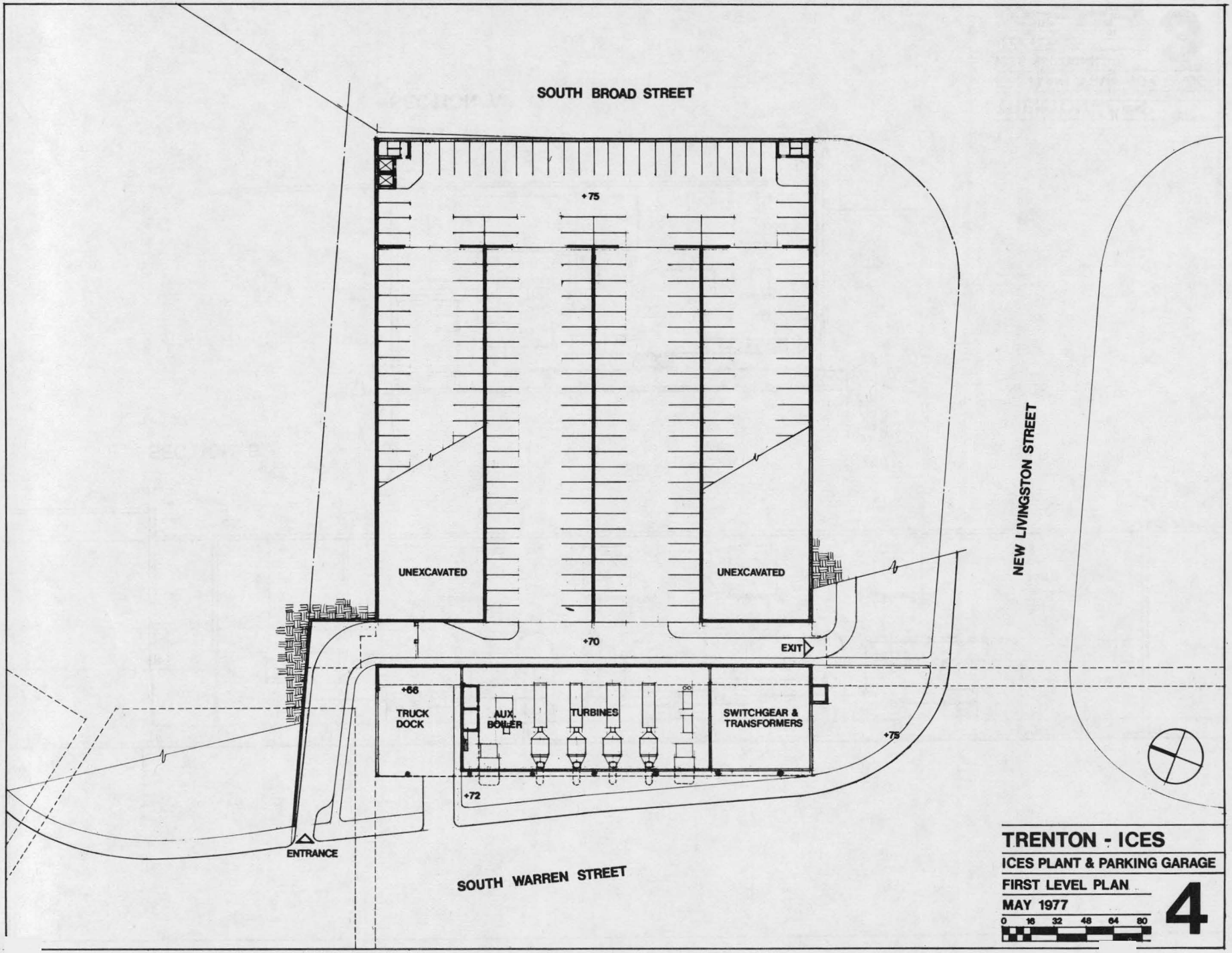
3



TRENTON - ICES

ICES PLANT & PARKING GARAGE

FIRST LEVEL PLAN

MAY 1977

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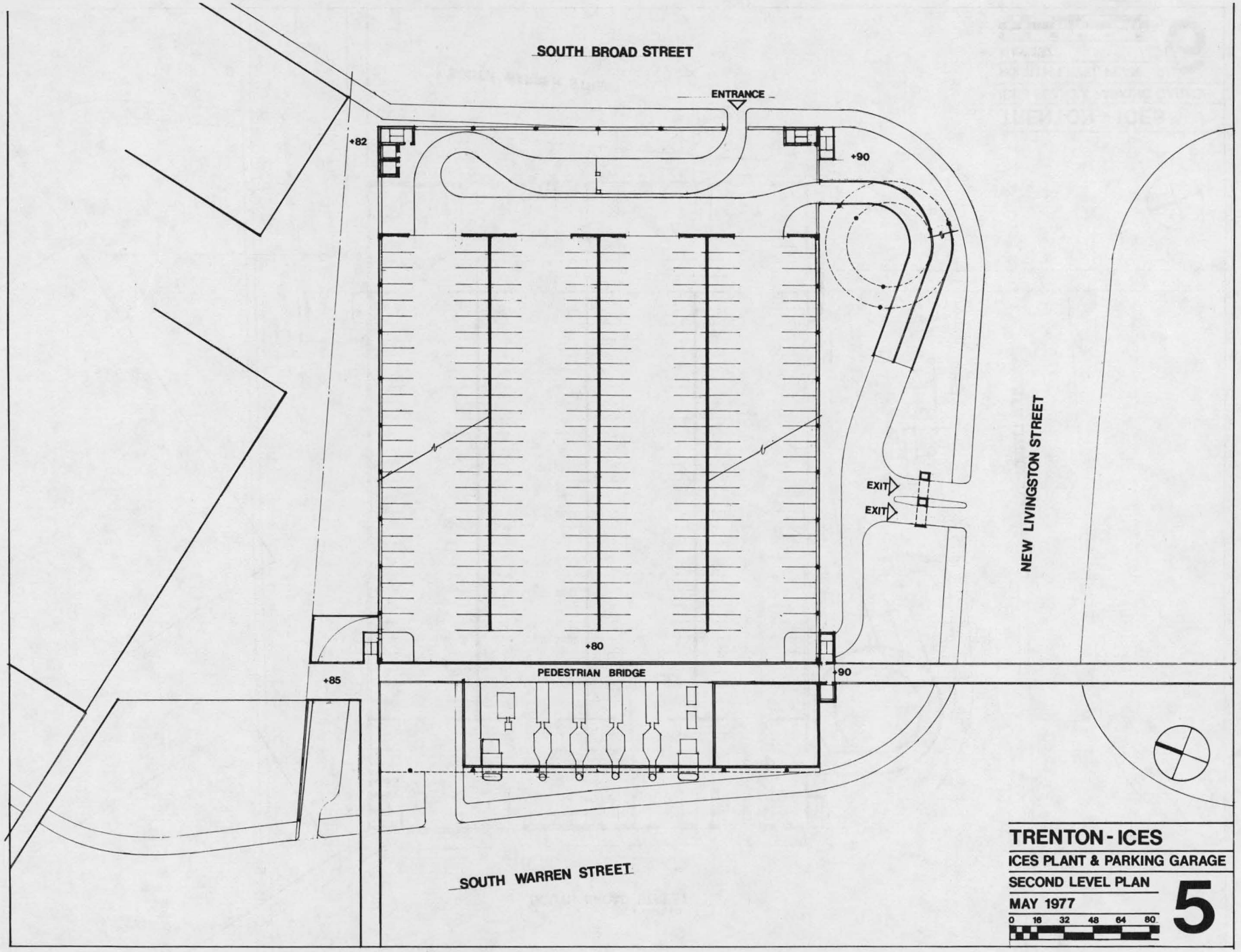
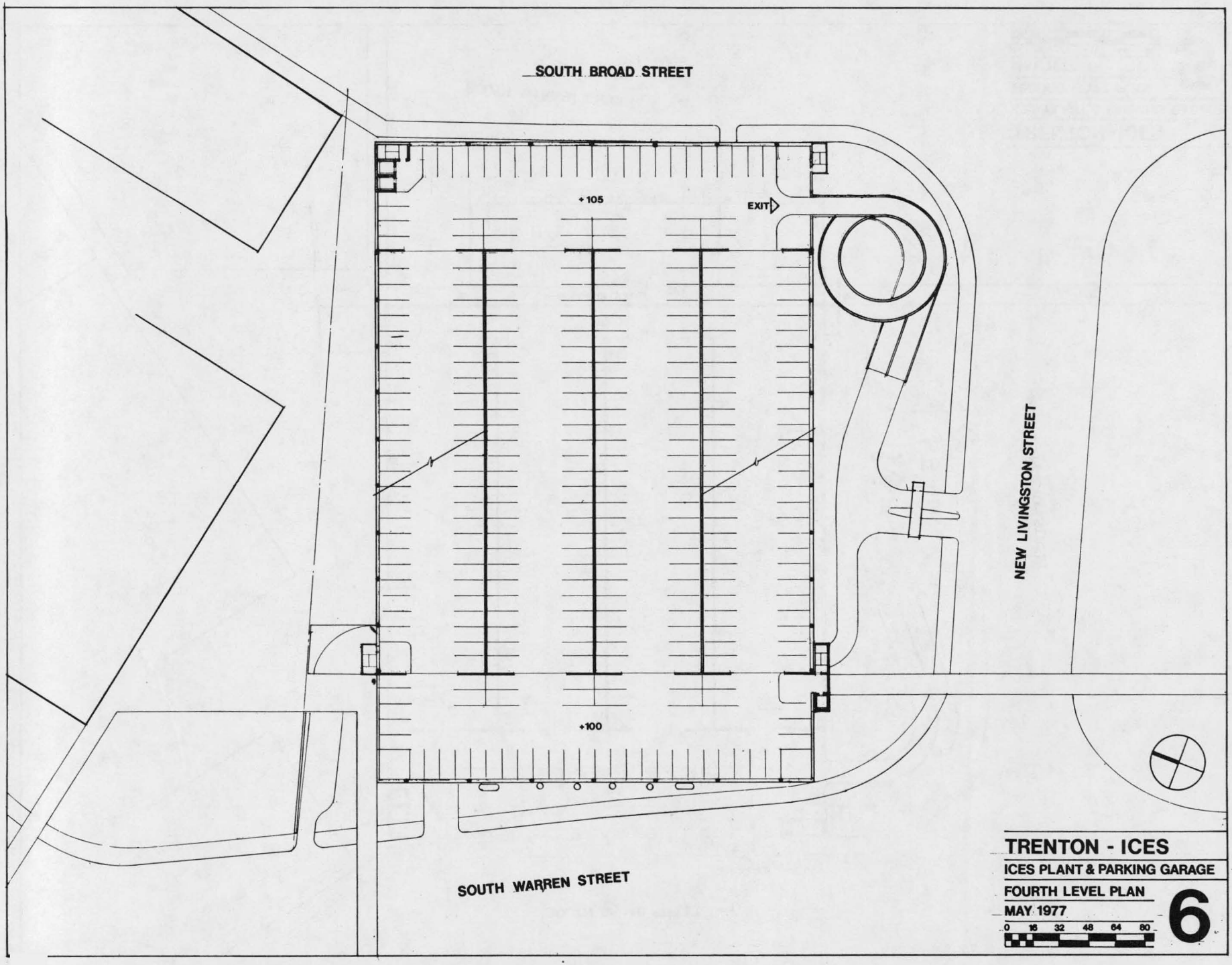
4


SOUTH BROAD STREET
ENTRANCE
+82
+90
NEW LIVINGSTON STREET
EXIT
EXIT
+80
PEDESTRIAN BRIDGE
+85
+90
SOUTH WARREN STREET
TRENTON - ICES
ICES PLANT & PARKING GARAGE
SECOND LEVEL PLAN
MAY 1977
0 16 32 48 64 80
5


SOUTH BROAD STREET
+105
EXIT
NEW LIVINGSTON STREET
+100
SOUTH WARREN STREET
TRENTON - ICES
ICES PLANT & PARKING GARAGE
FOURTH LEVEL PLAN
MAY 1977
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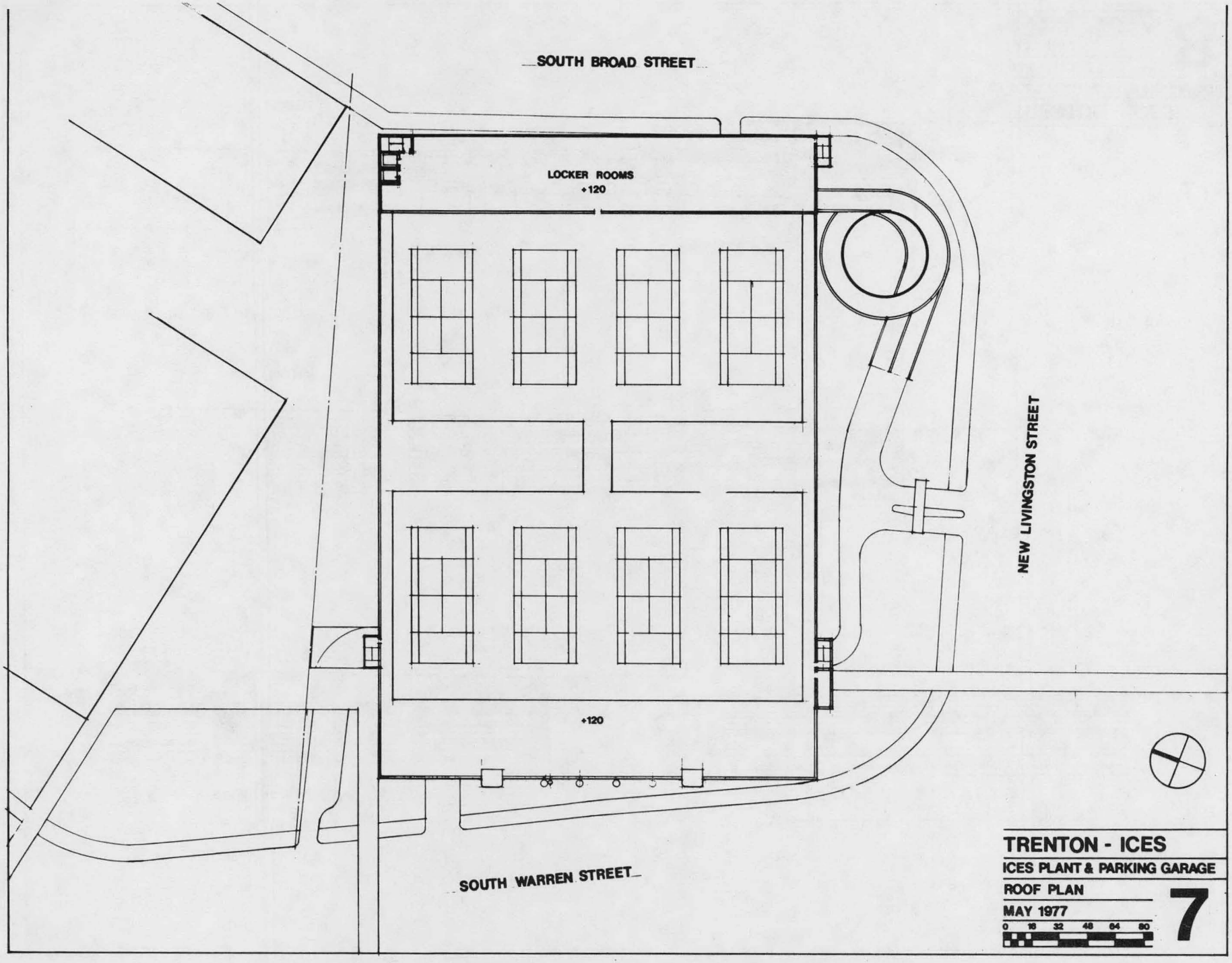
6


SOUTH BROAD STREET
LOCKER ROOMS
+120
NEW LIVINGSTON STREET
+120
SOUTH WARREN STREET
TRENTON - ICES
ICES PLANT & PARKING GARAGE
ROOF PLAN
MAY 1977
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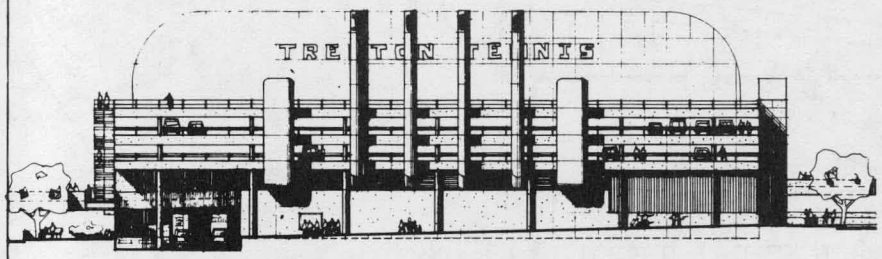
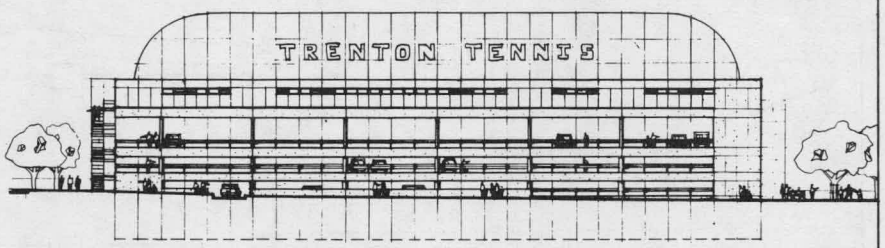
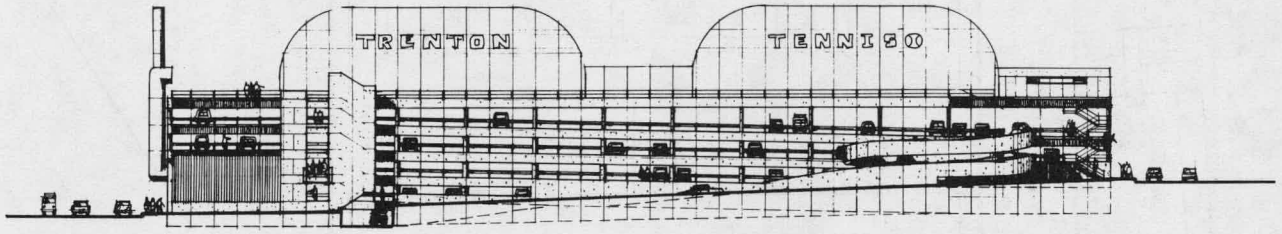


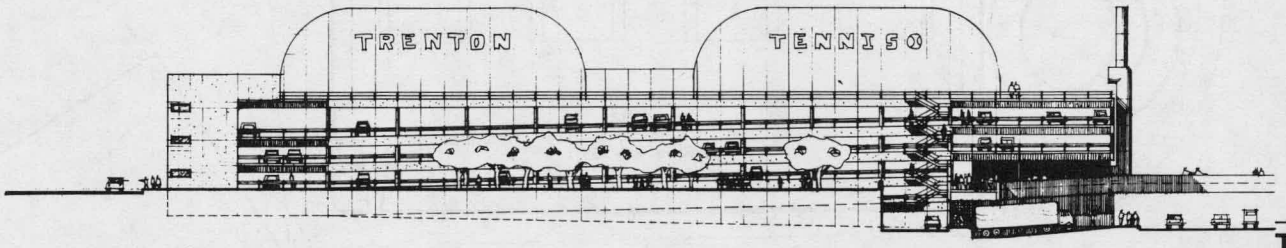
WEST



EAST



SOUTH



NORTH

TRENTON - ICES

ICES PLANT & PARKING GARAGE

ELEVATIONS

MAY 1977

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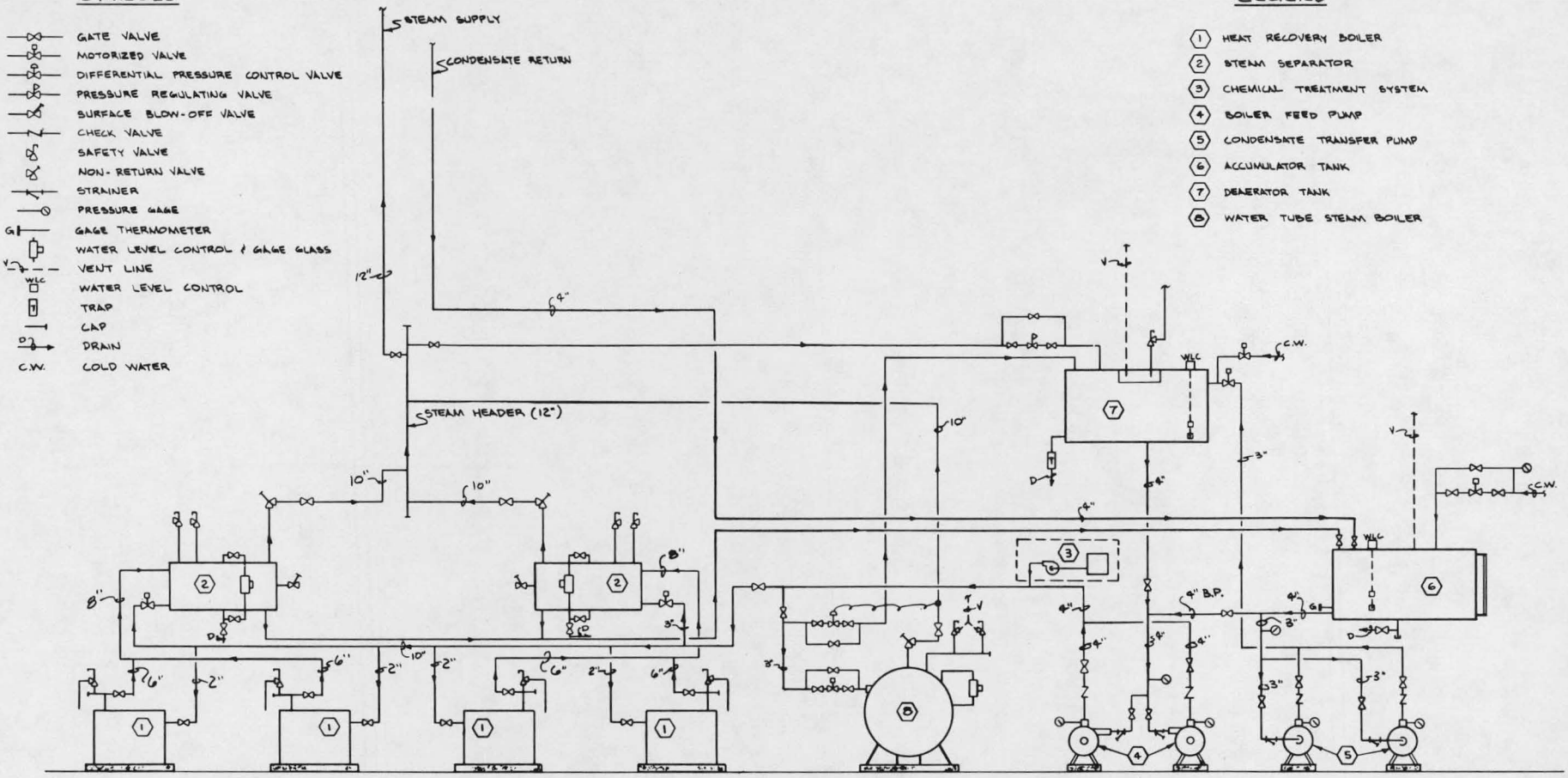
8



ICES PLANT THERMAL SYSTEM SCHEMATIC

TRENTON - ICES
ICES PLANT & PARKING GARAGE
ICES THERMAL SYSTEM
MAY 1977
9

task IV

firming up commitments

INTRODUCTION

The Demonstration Team has considered three areas where essential commitments must be made in order that the ICES system reach the implementation stage. The first area is securing the commitments from the principal parties involved in the Demonstration Team as to their continued participation in this Demonstration Program. The second area is securing the commitment on the part of the customers to receive the service. The third group of commitments to be secured are those from the various regulatory agencies identified in Task II Institutional Assessment.

DEMONSTRATION TEAM

All of the participants in the Demonstration Team are committed to performing the Phase II contract and are optimistic that the detailed feasibility study of Phase II will confirm the preliminary feasibility analysis which shows that the Trenton ICES not only saves fuel but also will provide thermal energy to customers at a competitive cost while providing Public Service Electric and Gas Company a reasonable return on investment. Letters from Mayor Arthur J. Holland, Mayor of Trenton; John P. Clarke, Director, Department of Planning and Development; Steven A. Mallard, General Manager-Planning and Research, PSE & G; and Richard G. Stein, Richard G. Stein and Partners are presented in Appendix H/1, which demonstrate the levels of commitment by the various Team members.

DEMONSTRATION COMMUNITY

The Demonstration Team has kept the observer-participants informed as the project has proceeded. An introductory working session was held on February 16th, 1977 when representatives of the various ICES Demonstration Community owners attended a briefing session with the working members of the Demonstration Team. These representatives, along with several other interested parties, attended an executive summary session of the mid-term review with ERDA officials, held on April 7th, 1977 at Trenton, New Jersey. Based on the preliminary feasibility study Phase I, the Demonstration Community customers are prepared to commit themselves to joining the system to the extent expressed in the letters: from Governor Brendan Byrne; John W. Cantwell, Chairman, Mercer County Improvement Authority; Arthur Sypek, Mercer County Administrator; Philip B. Caton, Executive Director, New Trenton Corporation; Eugene Grant, Capital Place Associates; John V. Curry, Chairman, War Memorial Commission; William F. Johnson, Executive Director, New Jersey Housing Finance Administration; James Waldron, President, Kingsbury Housing Corporation; the Reverand F. Kenneth Shirk, Secretary, Lutheran Housing Corporation presented in Appendix H/2.

REGULATORY BODIES

In order to secure initial review and commitment from the various regulatory agencies, the Demonstration Team contacted appropriate agencies to meet with them and to discuss the ICES concept, its application in downtown Trenton, the ramifications to those agencies and its requirements for approvals. The following agencies were contacted:

1. The New Jersey Department of Environmental Protection
2. The Delaware Valley Regional Planning Commission
3. The Delaware River Basin Commission
4. The New Jersey Public Utilities Commission
5. The New Jersey State Energy Office
6. The Trenton Planning Board
7. New Jersey Department of Labor and Industry, Mechanical Inspection Bureau

In each case the Demonstration Team found the regulatory agencies helpful in their suggestions and guidance in meeting their review requirements. No serious difficulties were encountered at this preliminary review stage.

The correspondence presented in Appendix H/3 is a partial documentation of these encounters and the degree of commitment which these regulatory agencies are prepared to make. This correspondence includes letters from the New Jersey Environmental Protection Agency, the Delaware Valley Regional Planning Commission, the New Jersey Public Utilities Commission, the New Jersey State Energy Office, the City of Trenton Planning Board.

FINANCING

The Demonstration System will be owned and operated by Public Service Electric and Gas Company. As part of their large electric and gas utility system (third largest in the nation) the project would be financed by its normal process of issuing securities and using internally generated funds. However, the Demonstration Team recognizes that in order to increase the margin of economic feasibility of this Demonstration Project and thereby insure its success, alternative means of financing which could lower the cost of money to PSE & G will be explored.

One potential method of financing is New Jersey Economic Development Administration Bonds. These bonds, with approximately an 8 percent interest charge, are available to develop industrial uses in certain designated cities in New Jersey when such an investment is likely to foster the redevelopment of that City. Since Trenton is one of those designated cities and since the Department of Planning and Development believes that the construction of the ICES in the downtown will have a positive effect on future redevelopment, the Demonstration Team plans to explore the feasibility of this financing alternative.

The literature describing the Economic Development Administration program is presented in Appendix H/4.

FUEL ALLOCATION

At this time it is not possible to get a definite statement from the Federal Energy Administration that oil will be allocated to PSE & G for the ICES plant. President Carter's energy message indicates that electric utilities will be admonished to convert to coal where possible. However, PSE & G's experience in this area indicates that oil will be readily available to fuel this plant. Since the fuel will be consumed so efficiently that it will conserve fossil fuel in the form of coal for use elsewhere, the Demonstration Team feels confident that there will be an adequate supply of fuel oil for this project.

Also, the present natural gas supply situation would not allow PSE &G to use gaseous fuel for combustion turbine. However, if additional gas supplies could be made available from new sources, such as Atlantic off-shore drilling, coal gasification, etc., then gas may be considered as a viable future fuel supply for the ICES plant in order to conserve oil. With minor modification combustion turbine can be converted to burn either oil and gas.

OWNERSHIP AND OPERATION

The Trenton ICES Demonstration Project will be owned and operated by Public Service Electric and Gas Company as a part of the overall power generation system of PSE & G and the Pennsylvania-New Jersey-Maryland (P-J-M) Interconnection Power Pool. PSE & G will operate the system in response to thermal demand in accordance with the ICES concept with the possible exception of an emergency situation when all other PSE & G and P-J-M peaking generators are on line and additional electrical system demand must be met on a short term basis. For a statement of PSE & G's commitment to own the plant, see the letter in Appendix H/1.

CUSTOMER INDUCEMENTS

Decision Process

Choices for energy supply to buildings for use in heating, ventilating and air conditioning (HVAC) System are usually based on one or more of the following parameters.

1. Capital cost of the system
2. Fuel cost and availability
3. Life of equipment
4. Ease of maintenance and complexity of the system
5. Operating and maintenance expenses (O & M)
6. Reliability, noise, aesthetics, ease of control, etc.

The interaction of these parameters impact on the building owners' decision process based on yet another group of parameters.

1. How is the capital generated? Is capital money more easily obtained than operating subsidies?
2. Does the owner also operate the system?
3. Does the owner/operator have a more favorable investment alternative available to hire? (e.g. another apartment rather than an expensive HVAC System)
4. What is the "tax life" of the project?
5. What is the total cash flow of the project and what percentage does the HVAC alternative represent?

With some variations, decisions regarding HVAC Systems and their energy supply are made based on a life-cycle cost analysis. Using this approach, the capital, O & M and energy costs are evaluated for available fuels using the tax-life of the project. The study which yields the lowest present worth of all future costs is usually chosen. The difference between alternatives, must however, be significant enough to off-set or control the other parameters mentioned above.

ICES Inducements

It would appear that many of the above parameters must prevail to induce members of the Demonstration Community to become a thermal customer of the ICES plant. Specifically a life-cycle cost analysis must reveal a favorable margin when compared to conventional alternatives. For the existing buildings, this analysis will be made using a comparison between the customer's present energy supply and associated costs and the conversion, operating, maintenance and thermal costs of an ICES system. The two most sensitive areas in this analysis are the capital conversion costs and the thermal costs including contract duration, minimum charges and termination costs.

For the new buildings, a much more advantageous economic position is possible for ICES due to the complete capital amortization of both terminal systems. In this case, thermal costs alone are the most sensitive area.

In addition, some members of the Demonstration Community may find social and political advantages to becoming part of ICES. Trenton ICES would be somewhat a first of its kind and does have certain implications in saving energy. Both of these aspects are newsworthy.

Conclusion

With an eye towards customer inducement, the ICES project team must develop steam rates or contracts which will accomplish the following:

1. Offer some margin of life cycle cost advantage over conventional systems.
2. Encourage summer and winter use of thermal energy consistent with user needs.

In addition, the use of a non-restrictive policy must be evaluated and established regarding the conversion costs for existing buildings.

task V

work management plan

ORGANIZATION OF FUTURE WORK: BY PHASE AND BY TASK

In order to meet the stringent time requirements necessary for the Demonstration System to be on line when the first new portions of the Demonstration Community are constructed, a very aggressive time schedule has been established.

Capital Place I will be ready for occupancy in May 1979, therefore, the Work Management Plan consists of a two-tiered fast track approach. The Demonstration System must have thermal capacity available by May 1979; this means that the plant enclosure including the parking garage of which it is an integral part by the nature of its urban design, the back-up boiler system and the first portion of its distribution system must be completed by that date. We have therefore established two stages of construction for the Demonstration System: Stage "A" which consists of the back-up boiler (used to provide steam to Capital Place I, Luther Arms and the Justice Complex until the turbines-generators and waste heat boilers are on line), the portion of the distribution system serving Capital Place I, the Mercer County Detention Center-Courthouse Complex, Kingsbury I, Luther Arms and the Justice Complex, and the plant enclosure including the parking garage; and Stage "B" which consists of the electrical generation and waste heat recapture systems, controls, etc. and the remainder of the steam distribution network.

WORK-MANAGEMENT PHASE II

DPD - City of Trenton, Department of Planning and Development

PSE & G - Public Service Electric and Gas Company

RS/RV - Richard G. Stein & Partners/R. G. Vanderweil, Inc.

Turner - Turner Construction Company

TASK I Energy Analysis

A. Reassessment of Phase I Work

1. Reassessment of the Demonstration Community and modification of the energy profiles as required.

DPD	10 hrs
PSE & G	35 hrs
RS/RV	50 hrs
	95 hrs

2. Investigation of possible use of coal technology as a retrofit to the operating system, including on-site coal gasification and/or use of PSE & G gas supply consisting of multiple sources including coal gasification.

PSE & G	200 hrs
RS/RV	150 hrs
Turner	25 hrs
	375 hrs

3. Assessment of the impact for future growth. Determine how suitable the preliminary design is to accommodate future growth by modular steps.

PSE & G	40 hrs
RS/RV	80 hrs
	120 hrs

B. Further Investigation of Economic Parameters

1. Investigation of the appropriate size module for potential incremental growth of the Demonstration System. Examine potential growth in the Demonstration Community for timing and intensity and estimate future demands on the System.

DPD	40 hrs
PSE & G	100 hrs
RS/RV	200 hrs
Turner	20 hrs
	360 hrs

2. Development of demand profiles year by year as the Demonstration Community develops. Study of the annual energy cost needs of the System as it grows year by year.

DPD	20 hrs
PSE & G	200 hrs
RS/RV	100 hrs
Turner	20 hrs
	340 hrs

3. Investigate alternate designs for the ICES plant enclosure to minimize its cost and to meet environmental constraints and other requirements for future growth.

DPD	20 hrs
PSE & G	200 hrs
RS/RV	120 hrs
Turner	30 hrs
	370 hrs

4. Reassessment of ICES economics including a sensitivity analysis of the variations of significant parameters.

PSE & G	200 hrs
	200 hrs

TASK II Institutional Assessment

A. Development of draft forms of agreement where necessary:

1. Urban renewal parcel land disposition agreement between the City and the PSE & G.

2. Easements and rights-of-way off the thermal distribution network and the storage system.

3. Five-year customer service agreements or other reasonable forms of agreement between PSE & G and ICES Demonstration Community members.

DPD	60 hrs
PSE & G	180 hrs
	240 hrs

B. Preliminary approval of oil allocation from the U.S. Federal Energy Administration.

DPD	10 hrs
PSE & G	70 hrs
	80 hrs

C. Amendment of the John Fitch Way Urban Renewal Plan. Application to the Trenton Planning Board for Preliminary Site Plan Approval and Conditional Use approval.

DPD	as necessary; not reimbursible as a project cost.
PSE & G	40 hrs
RS/RV	20 hrs
	60 hrs

D. Evaluation of alternative financing arrangements. Investigation of Economic Development Administration bonding through the New Jersey Department of Labor and Industry. Conventional PSE & G financing or other innovative financing methods.

DPD	80 hrs
PSE & G	160 hrs
	240 hrs

E. Draft environmental assessment. Make presentations, reports and applications as necessary to various regulatory agencies.

DPD	60 hrs
PSE & G	200 hrs
RS/RV	100 hrs
	360 hrs

F. Determination of PSE & G steam service policy.

1. Service application procedures
2. Inspection of customer's facilities
3. Service additions and alterations
4. Access to customer's premises
5. Metering and service configuration

PSE & G	100 hrs
	100 hrs

G. Determination if rates or contracts will be applied to steam sales. Draft preliminary steam rates (contracts) and submittal to the Public Utilities Commission for review and Preliminary approval.

PSE & G	180 hrs
	180 hrs

H. Analysis, party-by-party, the effect of building the ICES Demonstration System.

1. PSE & G: financial analysis
2. Each customer: life cycle cost study
3. City of Trenton: tax benefit analysis

DPD	30 hrs
PSE & G	200 hrs
RS/RV	150 hrs
	380 hrs

TASK III Preliminary Engineering Design

A. Preliminary design of power and thermal systems, sub-systems and controls.

PSE & G	4,000 hrs
RS/RV	4,100 hrs
Turner	200 hrs
	8,300 hrs

B. Preliminary design of steam distribution and thermal storage systems.

PSE & G	2,200 hrs
RS/RV	2,900 hrs
Turner	200 hrs
	5,300 hrs

C. Preliminary design of the ICES plant enclosure including the elevated walkways.

PSE & G	800 hrs
RS/RV	1,400 hrs
Turner	100 hrs
	2,300 hrs

TASK IV Final Engineering Design of the Stage "A" Construction Including Construction Documentation

A. Final engineering and architectural design of the standby boiler (which will provide thermal service until the entire Demonstration System is operable), the Stage "A" thermal distribution and storage network (to serve Capital Place I, the Mercer County Detention Center and Courthouse, Kingsbury I, Luther Arms and the New Jersey State Justice Complex) and the ICES plant envelope. Completion of all plans, specifications, schedules, etc. for bidding or negotiating construction contract.

DPD	as required, not an ICES project cost
PSE & G	1,000 hrs
RS/RV	4,200 hrs
Turner	200 hrs
	5,450 hrs

TASK V Customer Liaison

A. Establishment of contract with the necessary operating and management personnel for each member of the Demonstration Community. This contract will be used for liaison during construction and ultimately operation, and will be established by the PSE & G Marketing Department.

DPD	20 hrs
PSE & G	60 hrs
	80 hrs

B. Obtain any necessary final commitments and arrange for customers to allow ERDA to conduct end-use tests as a contract contingency. Determine final financial status of each customer. Determine what deposits or bonds will be required, if any. Execute final agreements.

PSE & G	80 hrs
	80 hrs

Phase II Summary

DPD	350 hrs
PSE & G	10,245 hrs
RS/RV	13,620 hrs
Turner	795 hrs
	25,010 hrs

PHASE III

TASK I Final Design and Construction Documentation

A. Final design and construction documentation of power and thermal systems, subsystems, components and controls including final cost estimates.

PSE & G	3,200 hrs
RS/RV	6,400 hrs
Turner	300 hrs
	9,900 hrs

B. Final design and documentation of thermal distribution and storage systems.

PSE & G	1,500 hrs
RS/RV	3,500 hrs
Turner	200 hrs
	5,200 hrs

TASK II Construction of the Stage "A" Demonstration System

A. Receive bids and/or negotiate construction contracts and construct the Stage "A" Demonstration System as described in Phase II, Task IV above.

DPD	as required, not ICES cost
PSE & G	3,000 hrs
RS/RV	750 hrs
Turner	8,000 hrs
	11,750 hrs

TASK III Operation and Maintenance Procedures

A. Prepare a detailed operations and maintenance procedure manual for all systems, subsystems, components and controls detailing procedures, schedules and emergency measures.

PSE & G	1,000 hrs
	1,000 hrs

TASK IV Customer Liaison

A. Continue customer liaison to define customer's requirements for end-use equipment and metering

PSE & G	80 hrs
	80 hrs

Phase III Summary

DPD	as required, not an ICES cost
PSE & G	8,780 hrs
RS/RV	10,650 hrs
Turner	8,500 hrs
	27,930 hrs

PHASE IV

TASK I Construction Management

A. Preconstruction planning and activities plus management of the construction process.

Turner	14,000 hrs
	14,000 hrs

TASK II Construction

A. Perform the Stage "B" construction while monitoring the fabrication and installation of systems and components, checking shop drawings, etc.; obtain final approval by all applicable regulatory bodies.

PSE & G	3,800 hrs
RS/RV	2,200 hrs
	6,000 hrs

TASK III Customer Liaison

A. Continuation of customer liaison to coordinate service connection.

PSE & G	80 hrs
	80 hrs

TASK IV Billing Procedure

A. Establishment of meter reading and billing procedures as well as record-keeping for steam service supply.

PSE & G	100 hrs
	100 hrs

B. Train appropriate customer accounts personnel.

PSE & G	20 hrs
	20 hrs

Phase IV Summary

PSE & G	4,000 hrs
PSE & G with RS/RV	2,200 hrs
Turner	14,000 hrs
	20,000 hrs

PHASE V

TASK I System Installation Tests

A. Testing to verify that the equipment installations have been made in accordance with the construction documents

PSE & G with RS/RV - as necessary

TASK II Start-Up Tests

A. Preparation of schedule of start-up tests.

PSE & G with RS/RV - as necessary

B. Conduct Start-up Tests with U.S. ERDA concurrence.

PSE & G with RS/RV - as necessary

TASK III Installation of Monitoring Equipment

A. Design and installation of Monitoring Instrumentation Systems (MIS) for detailed data collection. MIS shall meet U.S. ERDA's specifications for sensors, signal conditioners and data acquisition systems.

PSE & G with RS/RV - as necessary

TASK IV Performance Test

A. Provide for and perform a 1-year performance test of the ICES Demonstration System.

PSE & G with RS/RV - as necessary

TASK V Customer Liaison

A. Continued customer liaison to assure proper communications and billing.

PSE & G - as necessary

Phase V Summary

PSE & G with RS/RV - as necessary
approximately 3,000 hrs

PHASE VI

TASK I Operation and Maintenance Management

A. Operation and maintenance of the Demonstration System according to the schedule established in Phase III, Task III above.

PSE & G - as necessary

TASK II Long Term Demonstration Evaluation

A. Preparation of reports as directed by ERDA to evaluate the Demonstration System.

PSE & G - as directed

TASK III Post Contract Operation

A. Preparation of a post contract program plan for the continued operation of the Demonstration System, to include an informational, public relations and educational program for the Demonstration Community customers and the public-at-large. Establishment of a continuing liaison program with appropriate regulatory bodies, environmental groups, trade associations, etc. Establishment of a continuing fuel allocation and procurement program. Continuation of operations and maintenance program and modification as necessary. Development of a program to insure that the operations of the Demonstration System will not be imperilled by lack of sufficient revenues.

PSE & G - as necessary

TASK IV Customer Liaison

A. Continuation of on-going customer liaison program.

PSE & G - as necessary

Phase VI Summary

PSE & G - as necessary (1,500 hrs approximately)

Note: A PERT chart for phases II through VI is included on page V - 20.

ICES DEMONSTRATION PROGRAM COST ESTIMATES PHASE II THROUGH VI

Note: All costs are in 1977 dollars.

Phase II

Task I Energy Analysis

A.	$21,800
B.	46,700
	$68,500

Task II Institutional Assessment

A.	$ 8,900
B.	3,000
C.	2,200
D.	8,900
E.	13,300
F.	3,700
G.	6,700
H.	14,100
	$60,800

Task III Preliminary Design, Stages "A" and "B"

A.	$307,100
B.	191,100
C.	85,100
	$583,300

Task IV Final Design, Stage "A"

$201,600

Task V Customer Liaison

$ 5,900

Phase II Total Estimated Cost

$920,100

Phase III

Task I Final Design, Stage "B"

A.	$ 366,300
B.	192,400
	$ 558,700

Task II Construction, Stage "A"

$2,828,250*

Task III Operations and Maintenance Procedures

$ 37,000

Task IV Customer Liaison

$ 3,000

Phase III Total Estimated Cost

$3,426,950

*Includes $2,489,500 in capital costs.

Phase IV

Task I Construction Management

$ 350,000

Task II Construction, Stage II

$7,469,200*

Task III Customer Liaison

$ 3,000

Task IV Billing Procedures

A. $ 3,700

B. 700

4,400

Phase IV Total Estimated Cost

$7,829,600*

Phase V

Phase V Total Estimated Cost

$ 111,000

Phase VI

Phase VI Total Estimated Cost

$ 55,000

*Includes $7,469,200 in capital costs

DEMONSTRATION COST ESTIMATE SUMMARY*

NON-CONSTRUCTION DEMONSTRATION COSTS

Phase	ERDA Share	ICES Demonstration Team Share
I	$176,900	---
II	$920,100	---
III	---	$937,450
IV	---	$360,400
V	---	$111,000
VI	$ 10,000**	$ 45,000

CONSTRUCTION COSTS

Phase	ERDA Share	ICES Team Share
I	---	---
II	---	---
III	---	$2,489,500
IV	($120,000)+	$7,439,200
V	Cost of MIS++	---
VI	---	---

* Note: All costs in 1977 dollars.

** Costs to vary with the reporting requirements of ERDA.

+ Possible ERDA subsidy to existing buildings for capital costs of connection to the Demonstration System, if the New Jersey Public Utilities Commission will not permit differential steam contract rates for new and existing construction.

++ Monitoring Instrumentation Systems as required by ERDA or the National Bureau of Standards.

DEMONSTRATION TEAM ORGANIZATION

The Trenton ICES Demonstration Team will remain in the same structural organization in Phase II as in Phase I. The City of Trenton, Department of Planning and Development will be responsible for coordinating the Team effort and for portions of the Institutional Assessment, the Stein/Vanderweil Team and PSE & G will be sharing the responsibilities for the engineering design, PSE & G as the "client" will take the lead responsibility, Stein/Vanderweil will provide the consulting services, and Turner Construction Company will provide the construction management and cost estimating expertise throughout the various phases of the Demonstration Project.

In Phase III and beyond, PSE & G will become the direct prime contractor with U.S. ERDA for the completion of the Project. Stein/Vanderweil will be consultants to PSE & G and will remain consultants to the City of Trenton, as the architect/engineers of the parking structure. Turner Construction Company will likewise be Construction Managers for both PSE & G for the Demonstration Project and the City of Trenton for the parking garage.

After Phase II the only relationship between the City of Trenton and PSE & G will be their respective contractual obligations under the Urban Renewal Land Disposition Agreement.

The following officials will be responsible to their respective organizations for the ICES Demonstration Program:

City of Trenton:

John P. Clarke, Director, Department of Planning and Development

Public Service Electric and Gas Company:

Steven A. Mallard, General Manager-Planning and Research

W. S. Ku, Transmission Planning Engineer

Richard G. Stein and Partners:

Richard G. Stein, Partner

Carl Stein, Partner

R. G. Vanderweil, Inc:

Gary Vanderweil, President

R. G. Vanderweil, Vice President

Turner Construction Company:

George Snyder, Project Manager

MANPOWER RESOURCES AND KEY PERSONNEL

The following personnel will have responsibilities to either perform or supervise the performance of work according to the following allocation of Phase II tasks:

For the City of Trenton, Department of Planning and Development

James Greenberg	310 hrs	Project coordination Institutional Assessment
John P. Clarke	40 hrs	Institutional Assessment

For the Public Service Electric and Gas Company

W. S. Ku	300 hrs	Project Management Financing Draft Forms of Agreement Oil Allocation
R. F. Dittrich, et al	600 hrs	Energy Analysis Economic Analysis
C. W. Gellings, et al.	1,100 hrs	Customer Liaison Marketing Rates and Contracts Energy Profiles Institutional Assessment
H. B. Baranek, Tarlock Shahansra, et al.	8,245 hrs	Cost Analysis Supervision Energy Analysis Engineering Design

For Richard G. Stein and Partners

Richard G. Stein	200 hrs	Energy Analysis Institutional Assessment Preliminary Design
Carl Stein	720 hrs	Energy Analysis Institutional Assessment Architectural and Engineer Design
Cyril Beveridge	1,200 hrs	Project Architect
Doris Nathan, Mary Buckley, et al.	2,500 hrs	Architectural Design and Construction Documents

For R. G. Vanderweil, Inc.

R. G. Vanderweil	260 hrs	Energy Analysis Institutional Assessment Engineering Design
Gary Vanderweil	540 hrs	Engineering Design Energy Analysis
Joseph Donahue	700 hrs	Energy Analysis Institutional Assessment
K. M. Win	1,200 hrs	Project Engineer
David Astle, R. Crowninshield, Eli Segel, et al	6,300 hrs	Engineering Design

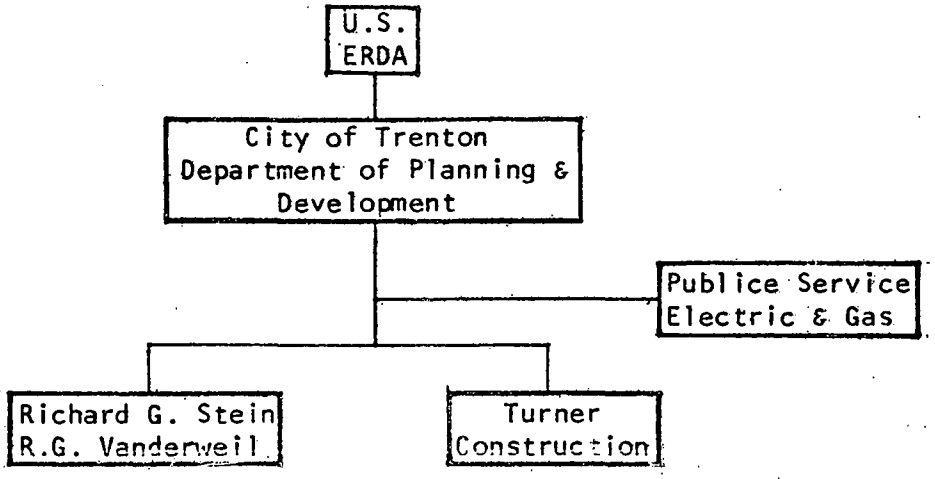
For Turner Construction Company

George Snyder	225 hrs	Project Management
Staff	570 hrs	Construction Management

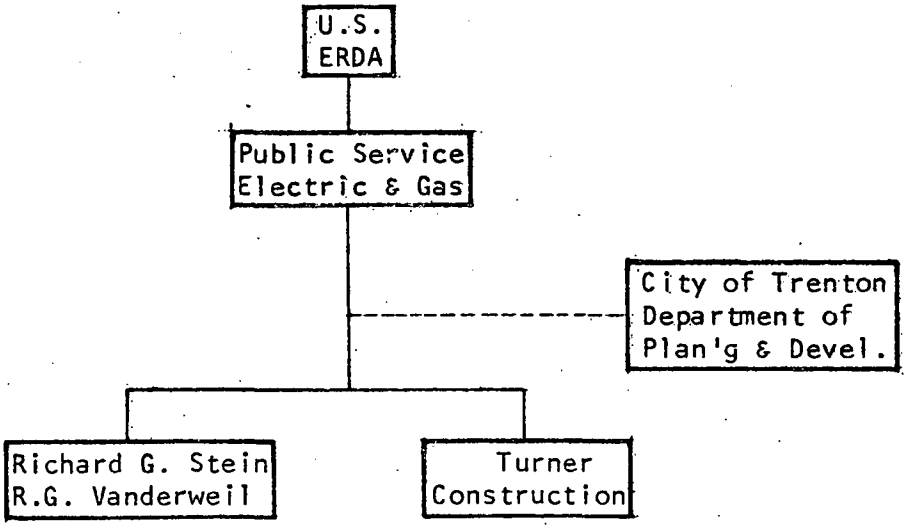
The curricula vitae for the key personnel are found in Appendix J.

Trenton ICES

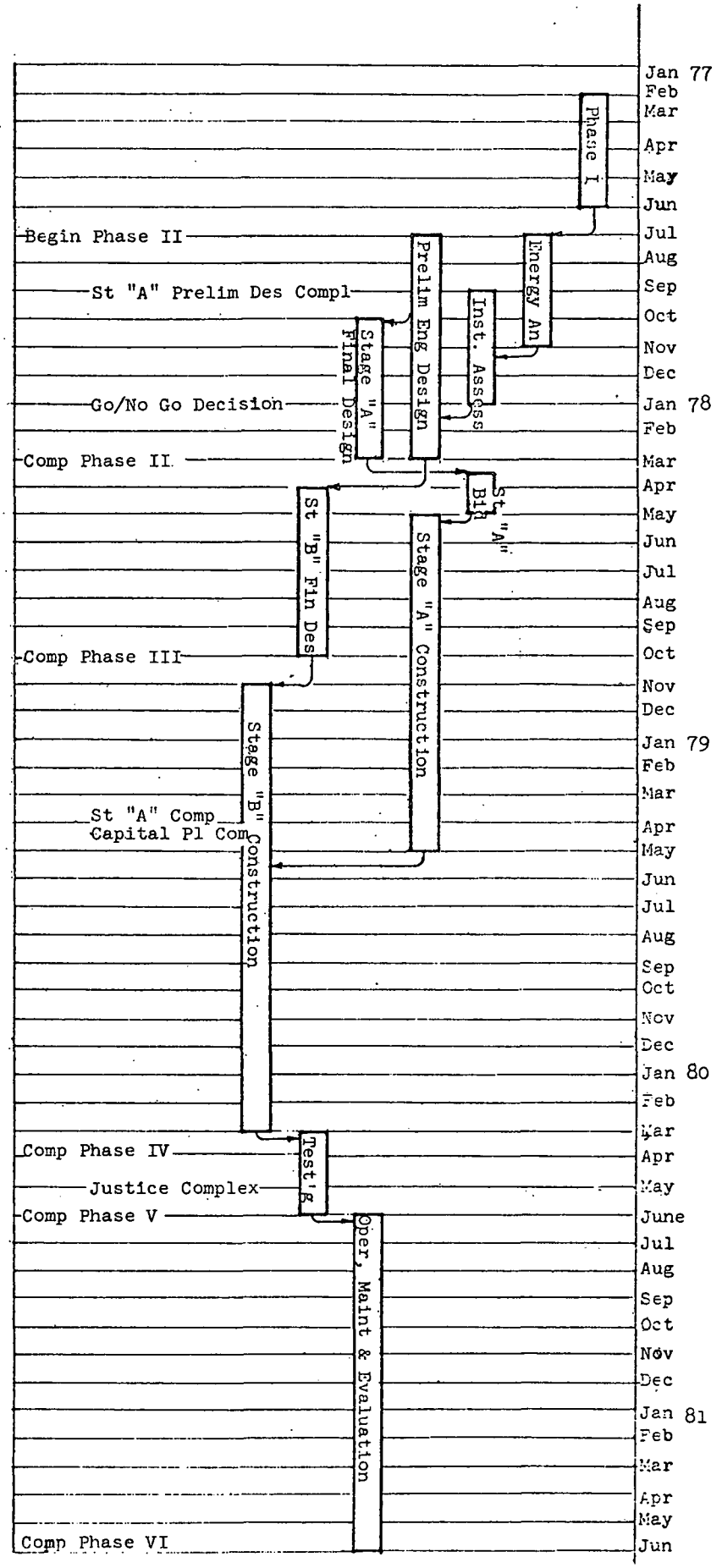
DEMONSTRATION TEAM ORGANIZATIONAL CHARTS: PHASE II AND PHASES III - VI



PHASE II DETAILED FEASIBILITY AND PRELIMINARY DESIGN



PHASE III THROUGH VI



Trenton ICES PERT Chart Phases II through VI

appendix A

central ICES plant

ICES CENTRAL PLANT

The proposed ICES generating plant is based on four conbustion/ turbine generator sets with heat recovery units having an electric capacity of 2.5 megawatts and a steam capacity of 14,200 pounds each. In addition, there is an auxiliary stand-by water tube boiler, having a capacity of 32,000 pounds per hour, giving a total steam generating capacity of 88,800 pounds per hour. It is anticipated that the ICES-based thermal requirement will be satisfied by the basic turbine/heat recovery units with the support of the thermal storage. The auxiliary boiler will serve as stand-by reserve in case of failure of up to two turbine modules. In addition, the auxiliary boiler will also provide steam to meet extraordinary peak thermal loads (estimated to occur less than 1 percent per year).

The base equipment (i.e. turbine-generators/heat recovery units with its ancillary air system) is arranged in modules for operational and expansion flexibility.

The basic thermal/electric cycle for the turbine/heat recovery unit is shown on page A - 3.

In order to capture lower temperature exhaust gas heat, an additional section is added to the heat recovery boiler in order to produce hot water at 230° F. For a description of this equipment, see Appendix E. The thermal cycle of the revised ICES module is shown on page A - 4.

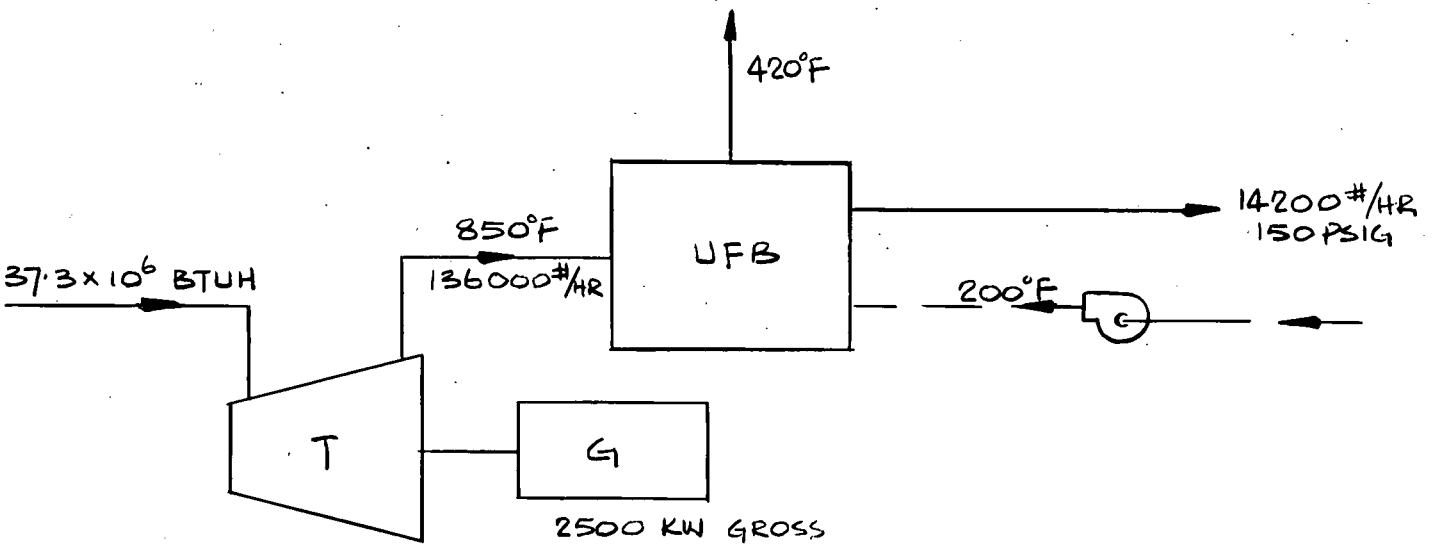
In order to verify the decision to utilize combustion turbine engines rather than diesel, a schematic comparison was made between the two technologies. The cycles used for the comparative evaluation of the diesel engines are shown on pages A - 5 and A - 6. A description of the inclusion of these findings begins on page A - 10.

Pages A - 7 and A - 8 show the data justifying the preheating of inlet air to the turbine to maintain overall thermal efficiency. These calculations are detailed in Section 1.5 of Task I.

Page A - 9 shows a one-line electrical diagram for the ICES plant and its connection to the PSE & G grid. The generators produce 13.8 KV which is stepped up to 26 KV by the 15 MVA transformer. This transformer size was selected to allow for future expansion.

Some of the protective relaying required by the grid connection is shown. A complete protective-relaying scheme for the plant and grid connection will be developed in Phase II.

PERFORMANCE : BASIC CYCLE HEAT BALANCE
FULL LOAD AT 80°F AMBIENT.



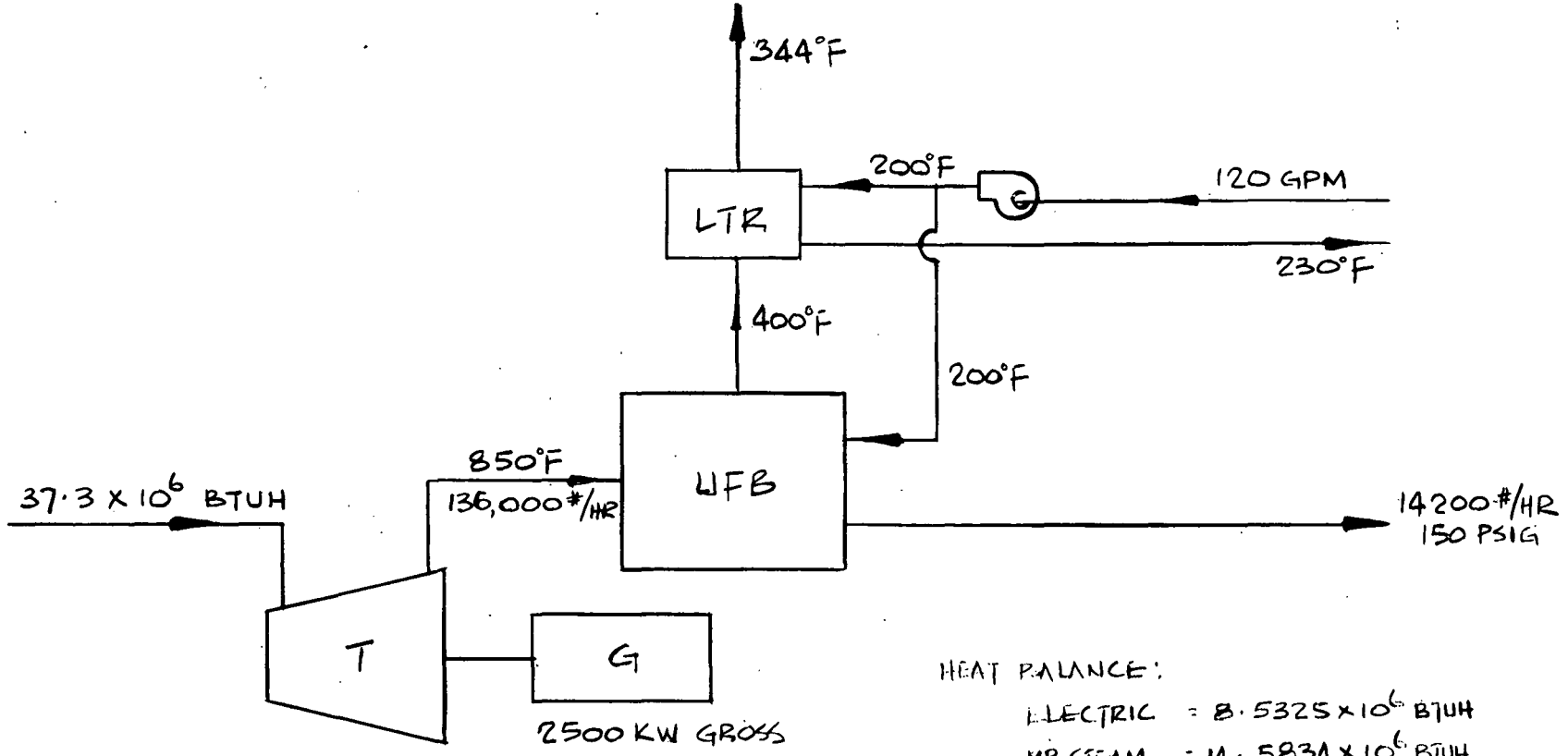
T = TURBINE
G = GENERATOR
UFB = UNFIRED HEAT RECOVERY BOILER

HEAT BALANCE:

ELECTRIC	=	8.5325×10^6 BTUH
MP STEAM	=	14.5834×10^6 BTUH
LOSSES	=	14.1841×10^6 BTUH

GROSS THERMAL EFFICIENCY = 61.97%.

PERFORMANCE: PROPOSED ICES CYCLE HEAT BALANCE
FULL LOAD AT 80°F AMBIENT.

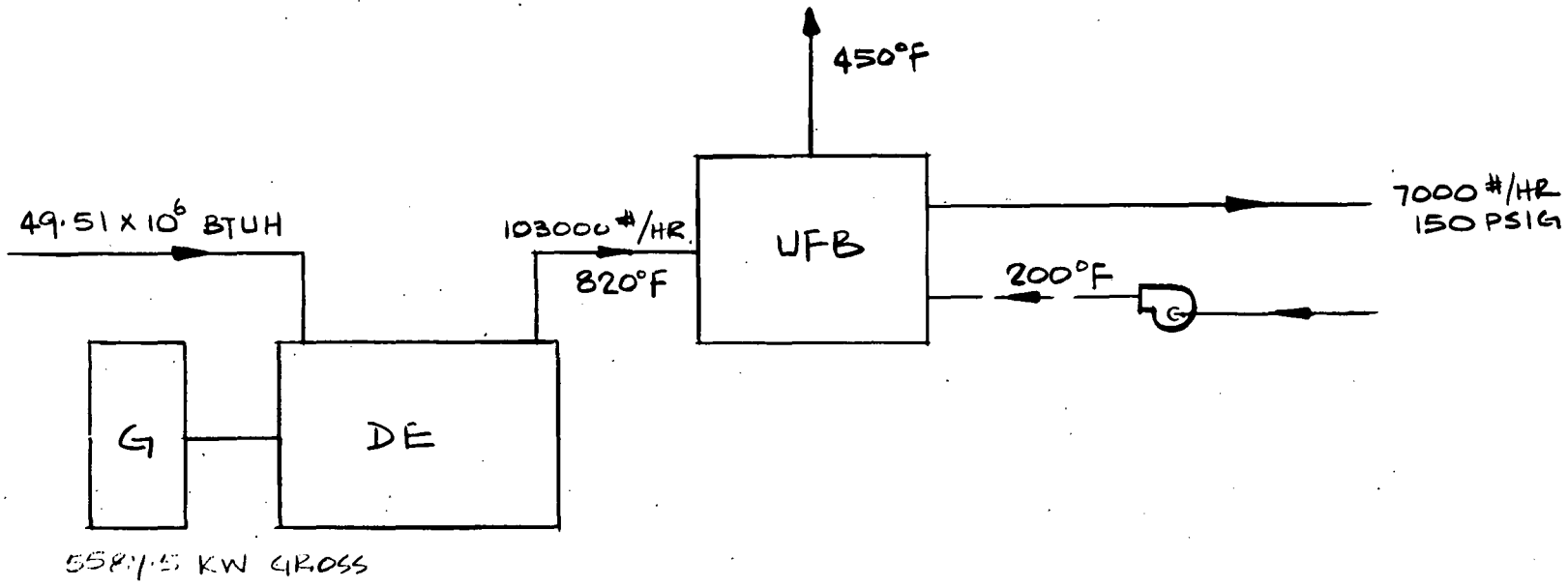


T = TURBINE
G = GENERATOR
UFB = UNFIRED HEAR RECOVERY BOILER
LTR = LOW TEMPERATURE RECOVERY.

HEAT BALANCE:
ELECTRIC = 8.5325×10^6 BTUH
MP STEAM = 14.5834×10^6 BTUH
LT RECOVERY = 2.7440×10^6 BTUH *
LOSSES = 11.4401×10^6 BTUH.
GROSS THERMAL EFF. = 69.33% *

*NOTE: THIS INCLUDES APPROX. 2.0×10^6 BTUH USED WITHIN THE PLANT.

PERFORMANCE: BASIC CYCLE HEAT BALANCE
FULL LOAD AT 90°F AMBIENT.



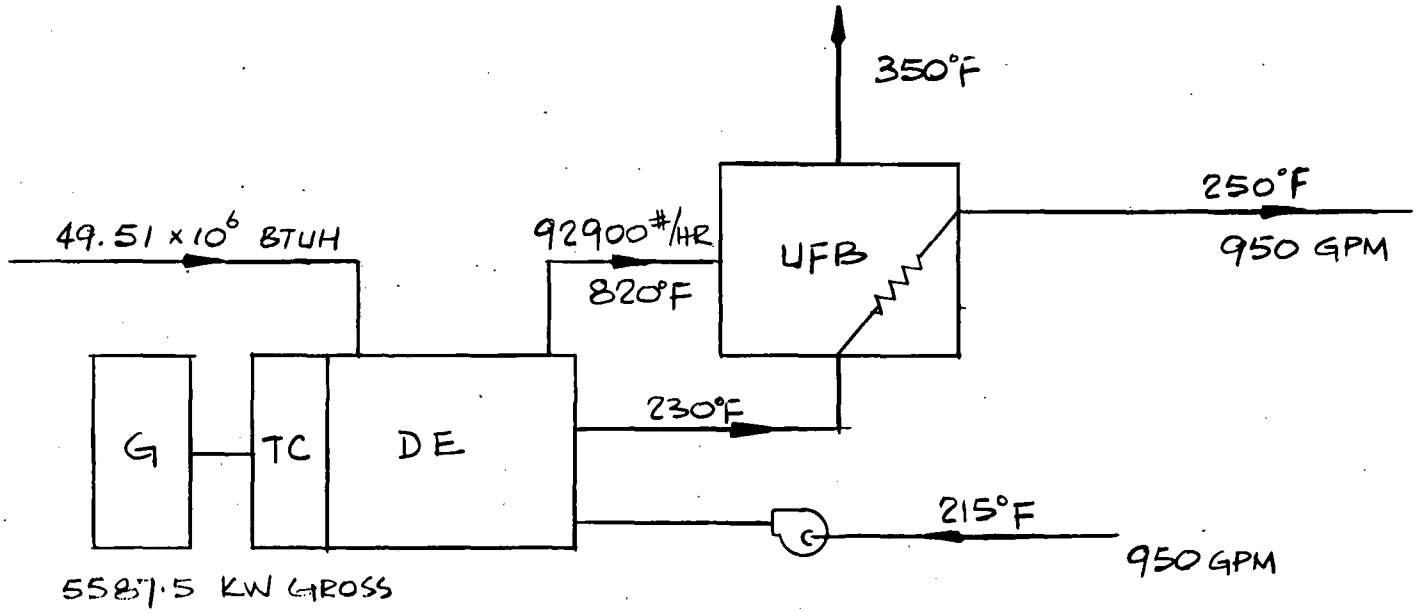
DE = DIESEL ENGINE
G = GENERATOR
UFB = UNFIRED HEAT RECOVERY BOILER

HEAT BALANCE:

ELECTRIC	=	19.0701×10^6 BTUH
MP STEAM	=	7.1890×10^6 BTUH
LOSSES	=	23.2509×10^6 BTUH

GROSS THERMAL EFFICIENCY = 53.03%

PERFORMANCE: PROPOSED ICES CYCLE HEAT BALANCE.
FULL LOAD AT 90°F AMBIENT.

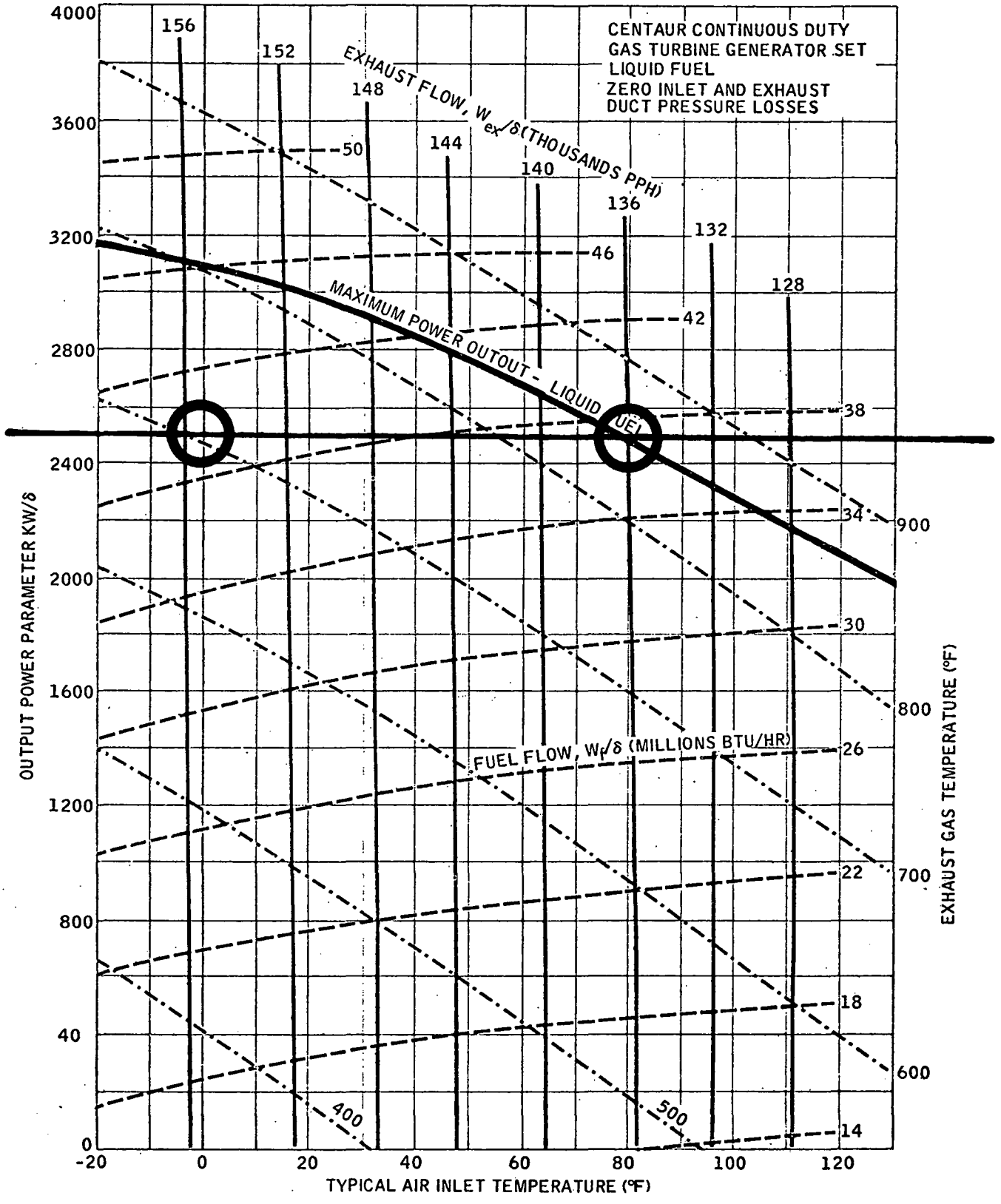


DE = DIESEL ENGINE
G = GENERATOR
TC = TURBO-CHARGER
UFB = UNFIRED HEAT RECOVERY BOILER

HEAT BALANCE:

ELECTRIC	= 19.0701×10^6 BTUH
L.T. WATER	= 15.6129×10^6 BTUH
LOSSES	= 14.8270×10^6 BTUH

GROSS THERMAL EFF. = 70.05%

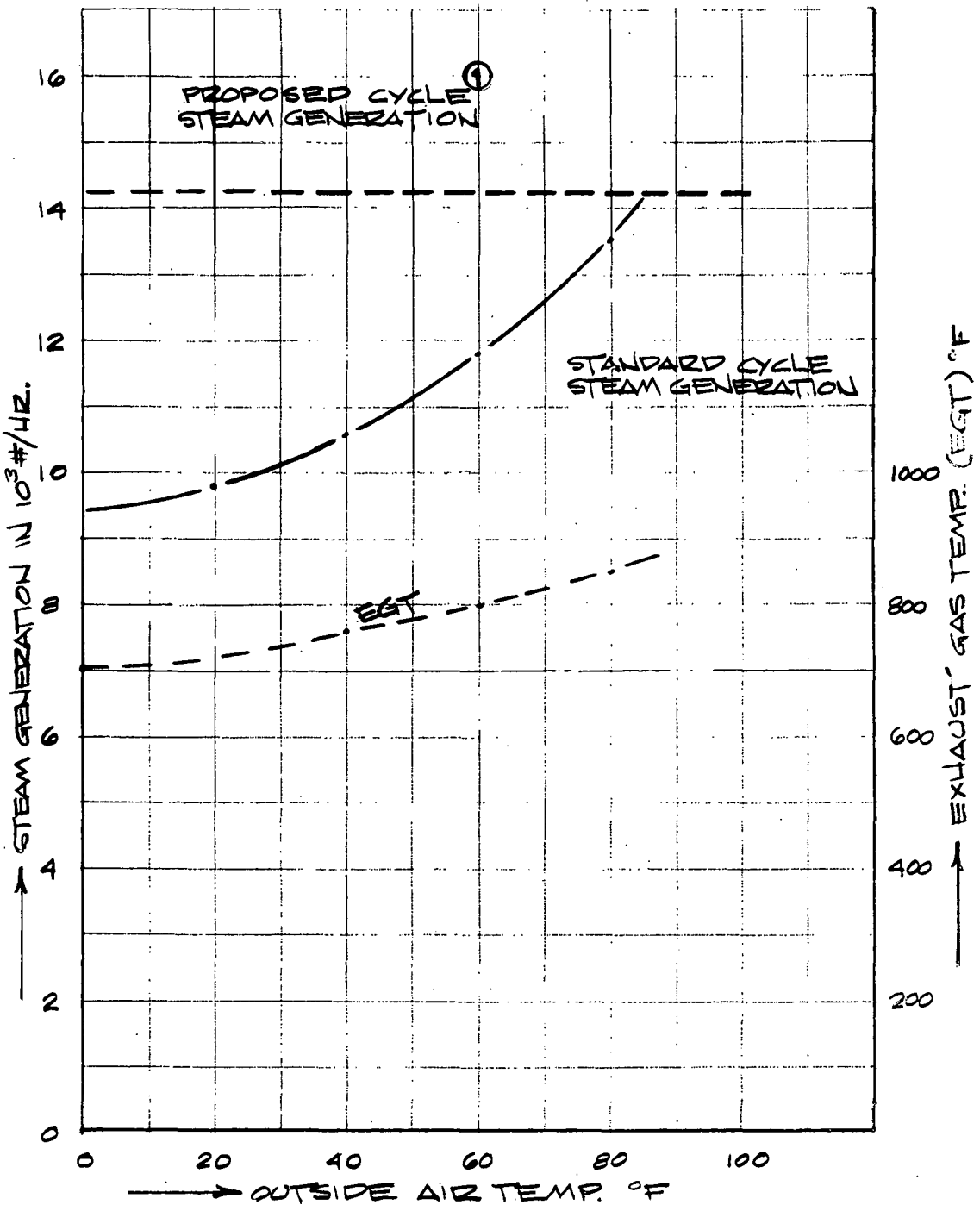


NOTE: Available power output at low ambient temperatures is dependent on the generator supplied for each individual application.

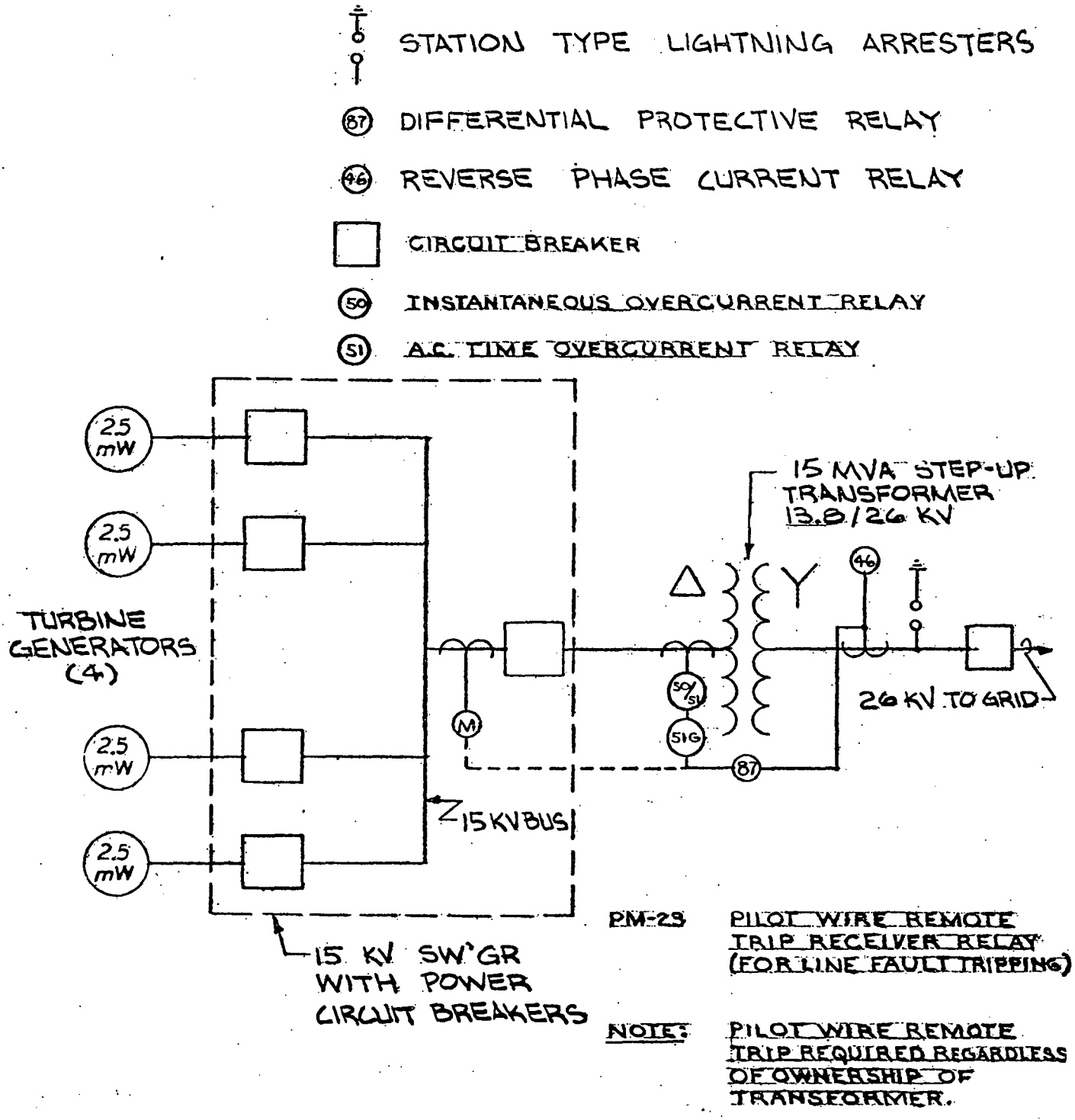
Typical Output Power Available - Liquid Fuel

STEAM GENERATION VS INLET AIR TEMP.

TURBINE REFERENCE: · FULL LOAD
80° INLET AIR TEMP



① PREHEAT COMBUSTION AIR TO 80°F
USING WASTE HEAT & LT RECOVERY


STATION TYPE LIGHTNING ARRESTERS
87 DIFFERENTIAL PROTECTIVE RELAY
46 REVERSE PHASE CURRENT RELAY
CIRCUIT BREAKER
50 INSTANTANEOUS OVERCURRENT RELAY
51 A.C. TIME OVERCURRENT RELAY
2.5 mW
2.5 mW
2.5 mW
2.5 mW
TURBINE GENERATORS (4)
15 MVA STEP-UP TRANSFORMER 13.8/26 KV
46
50/51
51G
M
87
26 KV TO GRID
15 KV BUS
15 KV SW'GR WITH POWER CIRCUIT BREAKERS
PM-23 PILOT WIRE REMOTE TRIP RECEIVER RELAY (FOR LINE FAULT TRIPPING)
NOTE: PILOT WIRE REMOTE TRIP REQUIRED REGARDLESS OF OWNERSHIP OF TRANSFORMER.

TABLE

EQUIPMENT SIZING - ICES VS. CONVENTIONAL

	Building	Cooling (Tons) Calculated Load	Cooling (Tons) Installed Cap	Heating (MBH) Calculated Load	Heating (MBH) Installed Cap
Conv.	Group 1:				
	Luther Arms	150 (1)	200 (1)	1,300	1,734
	Detention	-	-	Existing	Existing
	Fire House	13	15	125	150
	Justice	858	1,140	5,900	7,866
	J. D. Comm.	117 (2)	155 (2)	700	934
	M.C.C.	-	-	Existing	Existing
	Kings II	517	690	5,000	6,668
		1,655	2,200	13,025	17,352
ICES	Group I Total	1,960 (3)	2,600 (3)	13,500 (4)	18,000 (4)
Conv.	Group 2:				
	Capitol I	325	400	1,600	2,134
	Capitol I P.O.	117	160	700	934
	Civic Center	667	890	5,000 (5)	6,668 (5)
	W. M. Aud.	400	534	-	-
		1,509	1,984	7,300	9,736
ICES	Group 2 Total	1,050	1,400	5,500	7,340
Conv.	Group 3:				
	DEP	534	712	2,700	3,600
ICES	DEP	416	560	2,000	2,670
Conv.	Group 4:				
	Kings I	825	- (6)	7,500	- (6)
ICES	Kings I	542	- (6)	6,000	8,000
Conv.	Group 5:				
	L & I	- (6)	- (6)	- (6)	- (6)
	H & A	- (6)	- (6)	- (6)	- (6)
ICES	L & I/H & A	- (7)	- (7)	10,500	14,000
Conv.	Group 6:				
	Statehouse Complex	- (6)	- (6)	- (6)	- (6)
ICES	Statehouse Complex	- (7)	- (7)	1,8000	24,000

Notes:

(1) Existing electric chiller.
(2) Existing absorption chiller
(3) Includes Mercer County Courthouse
(4) Includes Mercer County Courthouse and Detention
(5) Included in State House Complex
(6) Existing Cooling and Heating Systems
(7) Not Served by ICES

General Notes:

All buildings or building groups are served by two machines each sized at 2/3 calculated load.

APPENDIX

Comparison of Diesel and Gas-Turbine

The body of the report gives the reasons for initially selecting gas turbines over diesels. The selection was made on the basis of practical considerations and a preliminary economic analysis. This appendix shows that had a thorough analysis been performed, the same selection probably would have been made.

We have taken ICES gas-turbine economic analysis and have changed only those numbers which would be affected if disels had been selected. We have carried these cahnges to the "bottom line"; that is we have looked at the differential effect diesel selection would have on the economic analysis.

The gas-turbine information used in this comparison was taken from the thorough gas-turbine analysis described in the report. This analysis considered actual gas-turbine operation including partial-load inefficiency. For simplicity, we have not considered partial load performance of diesels. If we had considered diesel partial-load performance, diesels would look less attractive.

If diesels had been selected, the total annual steam production would have to be greater, since the absorption chillers would be single instead of two stage. The additional steam produced to satisfy the same thermal requirements would be approximately 30,000,000 lb/yr. Additional electricity produced would be 38,900 mWh; additional capacity would be 11.6 mW, and additional fuel burned would be $193{,}800 \times 10^6$ Btu. The plant would use an additional 2,600 mWh/year to power the distribution pumps.

Capital costs would increase by approximately $5,600,000 for the larger (electric) plant and distribution system.

Table 1 puts these figures in annual levelized format. The figures indicate a slight disadvantage for diesel even though our partial-load analysis was biased in its favor.

TABLE 1

Diesel Advantage Over Gas-Turbine
(Levelized Annual Advantage - 1982 Dollars)

Value of additional electricity	$1,982,500
Cost of additional fuel	-1,085,300
Additional capital cost	- 916,100
Pumping power	- 117,000
Total	$- 135,900

appendix B

ICES distribution

THERMAL DISTRIBUTION

The ICES system will generate 150 psig steam which is compatible with the two existing boiler plants heating the Statehouse and Health and Agriculture/Labor and Industry Complexes. The distribution system originating from the ICES supplies six central equipment centers (CEC). Each CEC will serve a group of buildings grouped together.

The primary distribution system consisting of MP steam is shown on page B - 2.

The six central equipment centers are shown on pages B - 3 through B - 8. Each CEC will consist of:

Two-stage absorption chillers;

Steam-hot water converters;

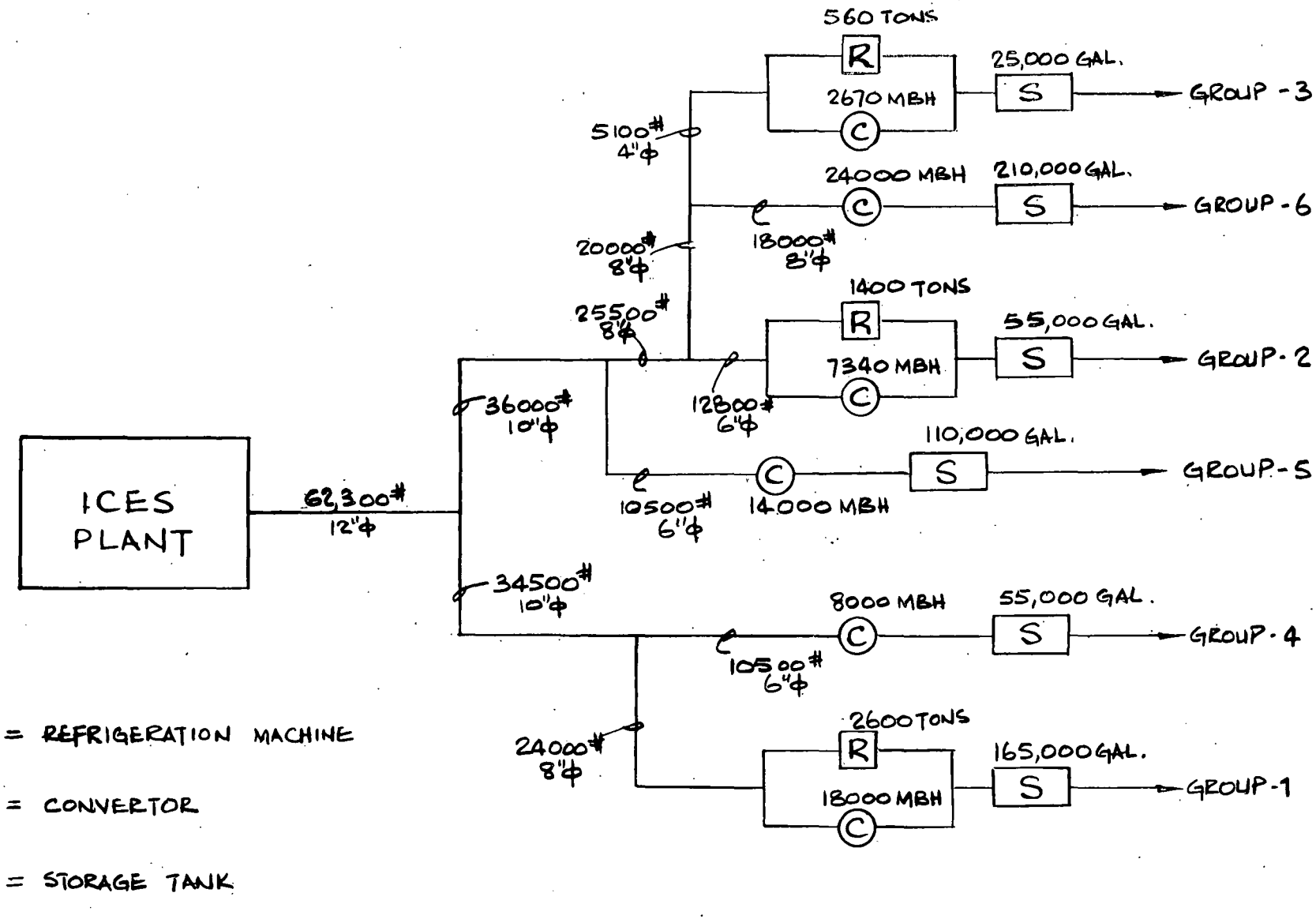
Thermal storage tanks;

Condensate receiver/pumps;

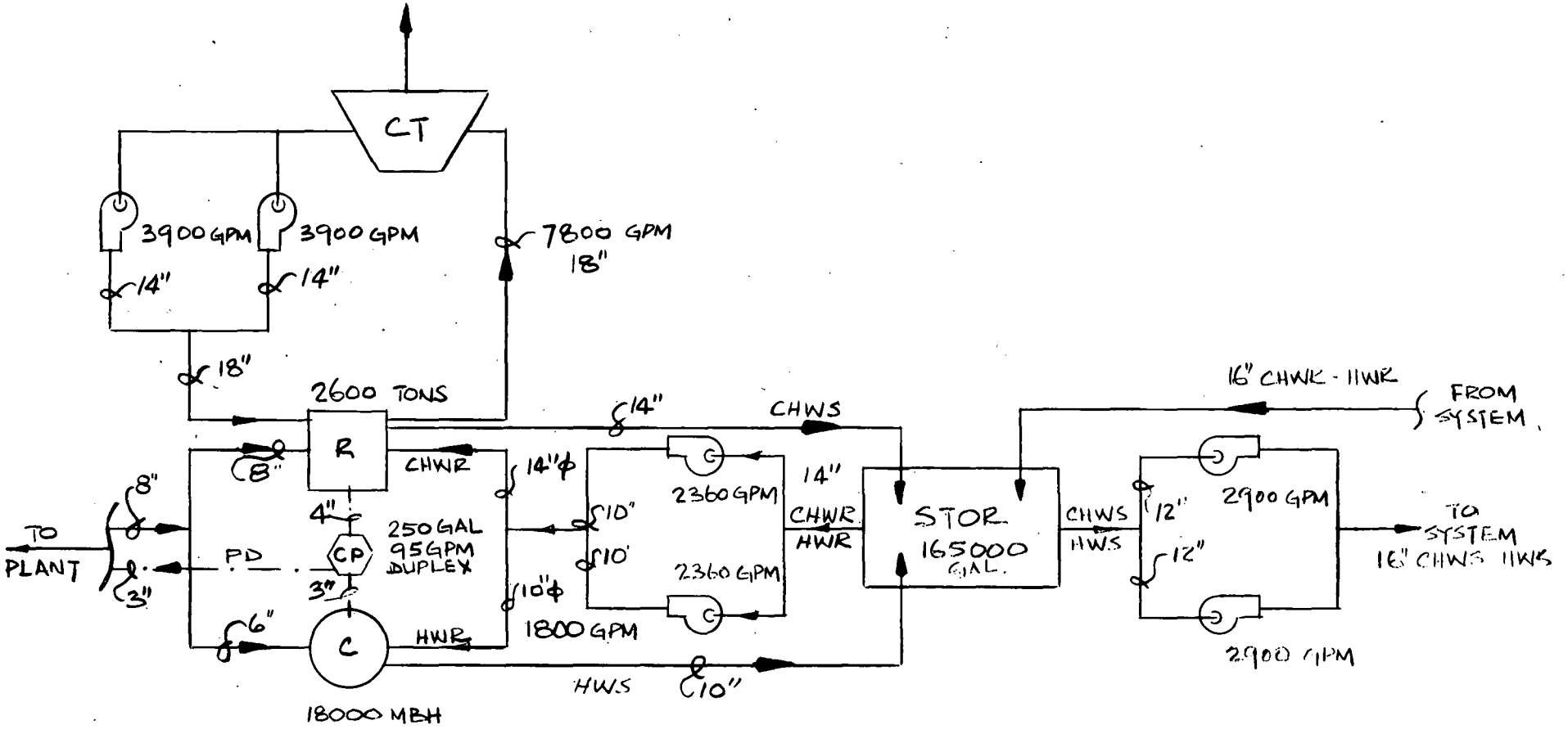
Cooling towers;

Associated pumps and auxiliary equipment such as chemical treatment system and controls.

ICES PLANT & DISTRIBUTION SCHEMATIC



GROUP-1 : CEC SCHEMATIC



CEC = CENTRAL EQUIPMENT CENTER

CT = COOLING TOWER

R = REFRIGERATION MACHINE

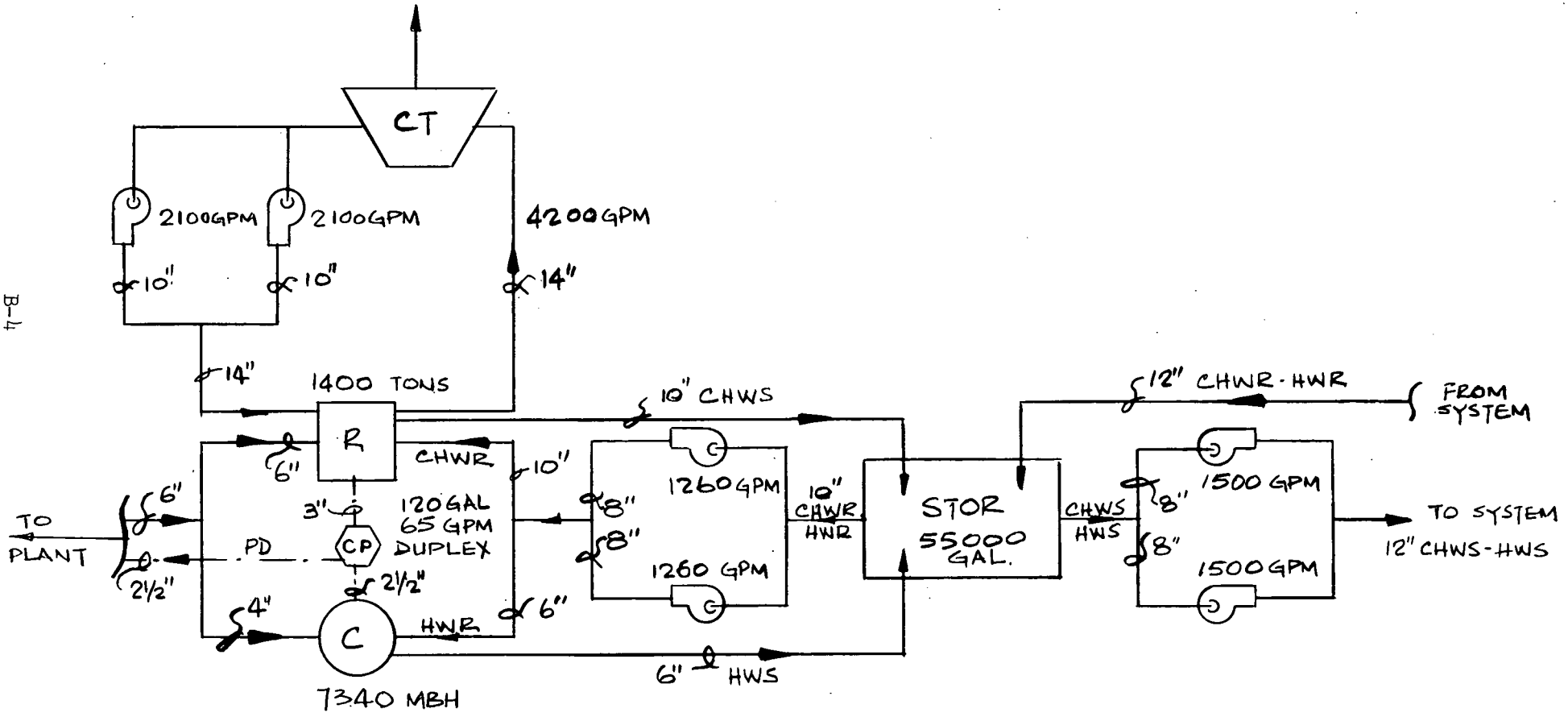
CP = CONDENSATE RECEIVER/PUMP

C = CONVERTOR

PD = PUMP DISCHARGE

STOR = STORAGE TANK

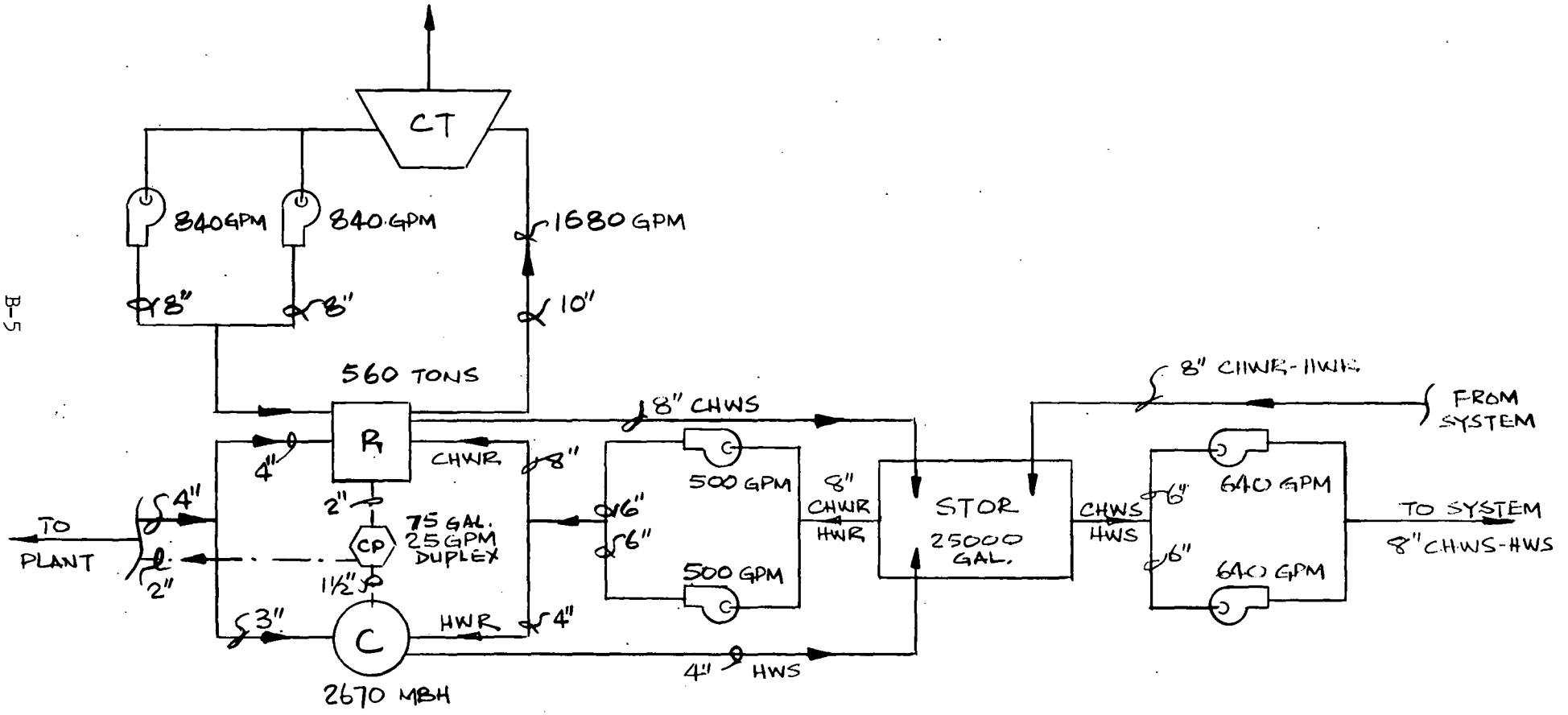
GROUP-2 : CEC SCHEMATIC



CEC = CENTRAL EQUIPMENT CENTER
CT = COOLING TOWER
R = REFRIGERATION MACHINE
STOR = STORAGE TANK

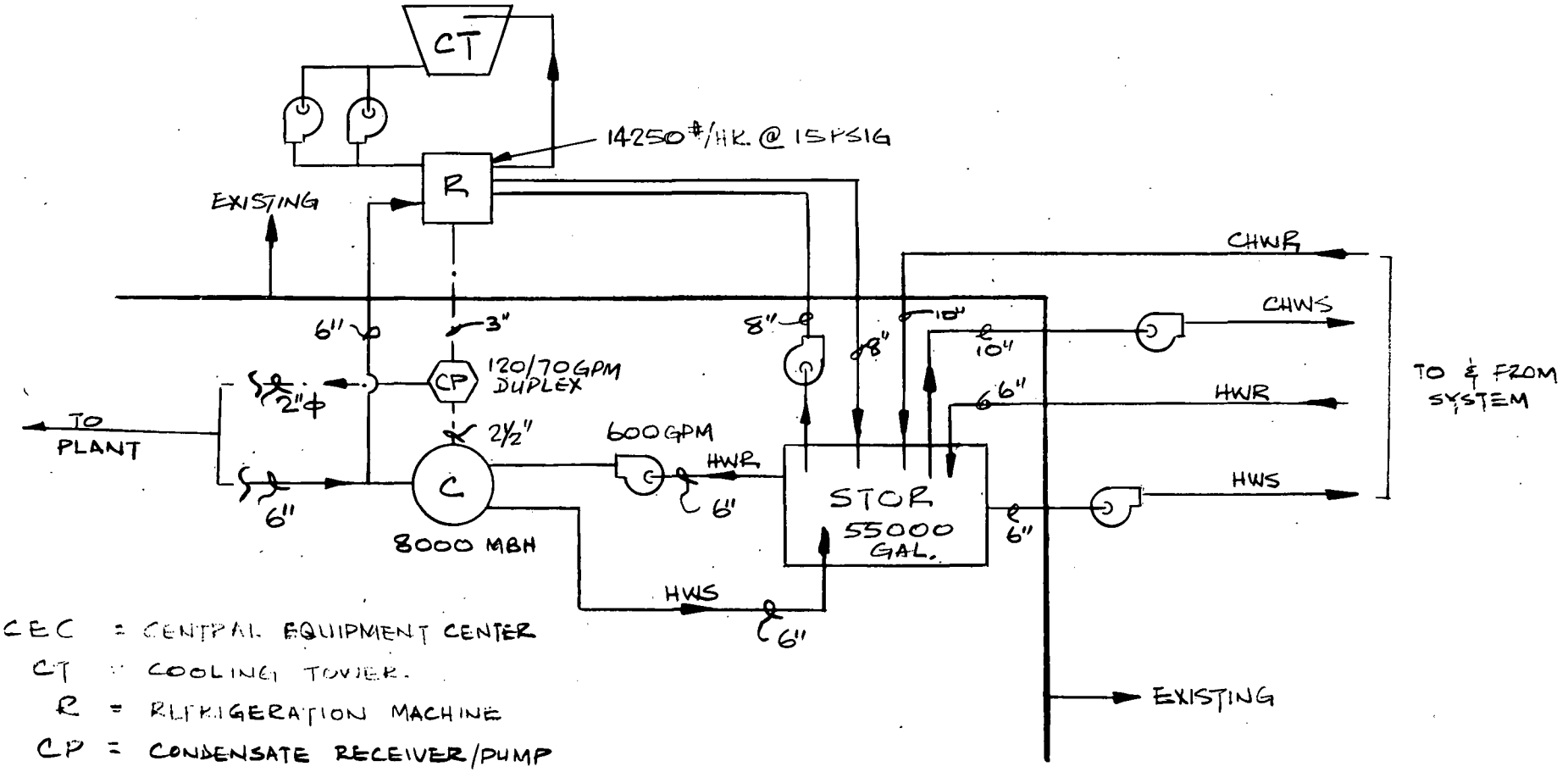
CP = CONDENSATE RECEIVER/PUMP
C = CONVERTOR
PD = PUMP DISCHARGE

GROUP-3 : CEC SCHEMATIC



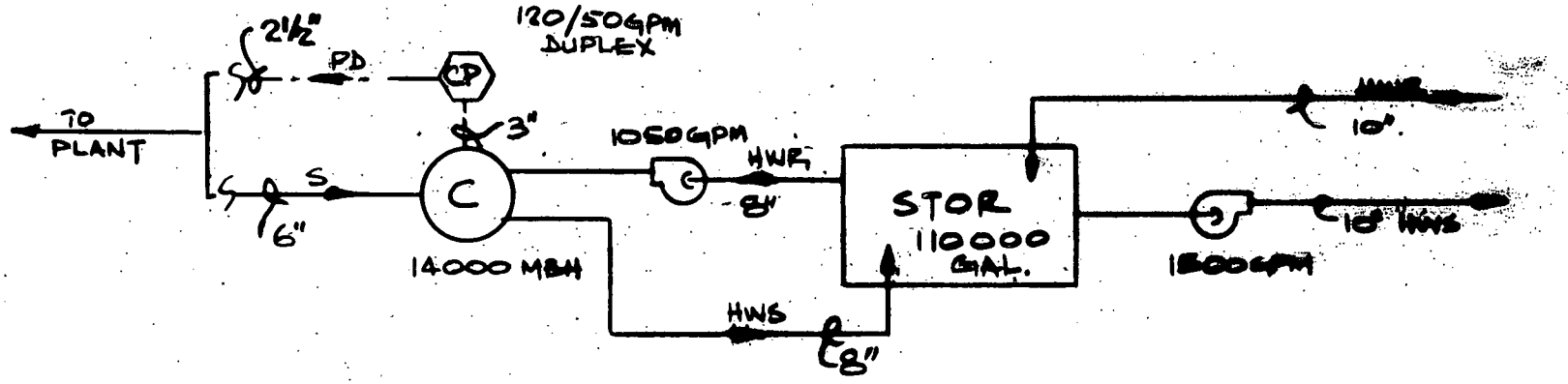
CEC = CENTRAL EQUIPMENT CENTER
CT = COOLING TOWER
R = REFRIGERATION MACHINE
CP = CONDENSATE RECEIVER/PUMP
C = CONVERTOR
PD = PUMP DISCHARGE
STOR = STORAGE TANK

GROUP-4 : CEC SCHEMATIC



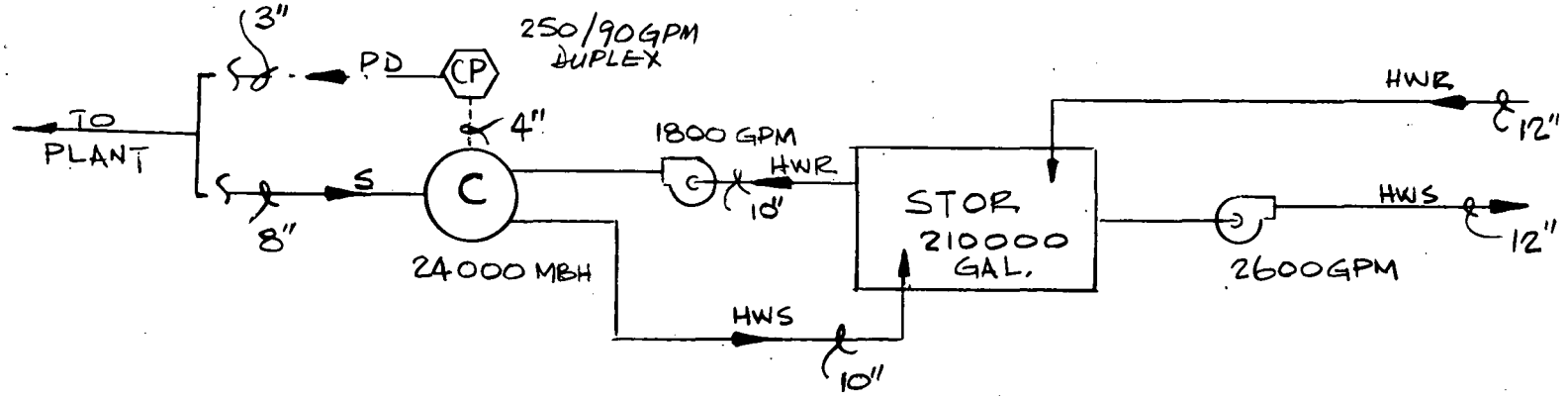
CEC = CENTRAL EQUIPMENT CENTER
CT = COOLING TOWER
R = REFRIGERATION MACHINE
CP = CONDENSATE RECEIVER/PUMP
C = CONVERTOR
STOR = STORAGE TANK

GROUP-5 : CEC SCHEMATIC



CEC = CENTRAL EQUIPMENT CENTER
S = MP STEAM
CP = CONDENSATE RECEIVER/PUMP
C = CONVERTOR
STOR = STORAGE TANK
PD = PUMP DISCHARGE

GROUP-6 : CEC SCHEMATIC



CEC = CENTRAL EQUIPMENT CENTER
S = MP STEAM
CP = CONDENSATE RECEIVER/PUMP
C = CONVERTOR
STOR = STORAGE TANK
PD = PUMP DISCHARGE

appendix C

empirically derived building energy use and demand

Electrical Load Profiles

Electric Load Profiles were developed for the existing community and Capitol Place I. These profiles consist of the following:

1) Maximum Demands
2) Daily Load Profile
3) Air Conditioning Demand
4) Heating Load Data

Maximum Demands were established from PSE&G records of connected electric loads within each of the buildings. These records were established when the electrical energy requirements of the buildings involved were last revised. For example, the original records of the Kingsbury I hi-rise apartment structure were on file and used to establish the demand profile. Other sources of information used were:

a) Interviews with building operators to discuss hours and modes of operation.

b) Guidelines on demand profiles obtained from the Edison Electric Institute and PSE&G experience.

These estimated demands were molded to fit the metered demand profile of the building.

Daily Load Profile(s) were established from PSE&G records of metered energy. By applying the data on hours and modes of operation, electric energy use profiles were established consisting of a Daily Load Profile for each major load (lighting, lease power, computer, etc.). The profiles were matched to billing records of kilowatthours consumed.

Air Conditioning Demand data reflects both the connected air conditioning needs and the estimated peak demands.

Heating Load Data were established on electric heating use in the same manner as described in the thermal section. In the electrical model, however, they were matched to actual energy use.

MAXIMUM DEMANDS
ELECTRIC LOAD PROFILE

Building Labor and Industry

	Summer Demand kW	Winter Demand kW
Lighting	1,490	1,490
Base Power	315	315
Air Conditioning	1,320	-
Space Heating	-	-
Kitchen/Laundry	-	-
Computer	245	245
	3,370	2,050

DAILY LOAD PROFILE

Building Labor and Industry Weekday [X] Weekend [ ]

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	20	320	
2	20	320	
3	20	320	
4	20	320	
5	20	320	
6	20	320	
7	20	320	
8	20	320	
9	90	1,410	
10	95	1,490	
11	95	1,490	
12 Noon	95	1,490	
13	80	1,255	
14	90	1,410	
15	90	1,410	
16	95	1,490	
17	95	1,490	
18	80	1,255	
19	70	1,100	
20	60	940	
21	40	630	
22	40	630	
23	40	630	
24 Midnight	40	630	

Total Kilowatthours this day 19,830.

DAILY LOAD PROFILE

Building Labor & Industry Weekday [ ] Weekend [X] Saturday

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		320	
2		320	
3		320	
4		320	
5		320	
6		320	
7		320	
8		320	
9		920	
10		920	
11		920	
12 Noon		920	
13		920	
14		920	
15		920	
16		920	
17		920	
18		320	
19		320	
20		320	
21		320	
22		320	
23		320	
24 Midnight		320	

Total Kilowatthours this day 13,080

DAILY LOAD PROFILE

Building Labor & Industry Weekday [ ] Weekend [X] Sunday

Month _____ Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		320	
2		320	
3		320	
4		320	
5		320	
6		320	
7		320	
8		320	
9		320	
10		320	
11		320	
12 Noon		320	
13		320	
14		320	
15		320	
16		320	
17		320	
18		320	
19		320	
20		320	
21		320	
22		320	
23		320	
24 Midnight		320	

Total Kilowatthours this day 7,680 .

DAILY LOAD PROFILE

Building Labor & Industry Weekday [X] Weekend [ ]

Month Any Type of Load Base Power

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		210	
2		210	
3		210	
4		210	
5		210	
6		210	
7		210	
8		315	
9		315	
10		300	
11		305	
12 Noon		305	
13		305	
14		300	
15		300	
16		300	
17		300	
18		210	
19		210	
20		210	
21		210	
22		210	
23		210	
24 Midnight		210	

Total Kilowatthours this day 5,985 .

DAILY LOAD PROFILE

Building Labor & Industry Weekday [X] Weekend [ ]

Month Any Type of Load Computer

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		210	
2		210	
3		210	
4		210	
5		210	
6		210	
7		210	
8		245	
9		245	
10		245	
11		245	
12 Noon		245	
13		245	
14		245	
15		245	
16		245	
17		245	
18		245	
19		245	
20		245	
21		245	
22		245	
23		210	
24 Midnight		210	

Total Kilowatthours this day 5,565.

DAILY LOAD PROFILE

Building Labor & Industry Weekday [ ] Weekend [X] Saturday

Month Any Type of Load Computer

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		210	
2		210	
3		210	
4		210	
5		210	
6		210	
7		210	
8		245	
9		245	
10		245	
11		245	
12 Noon		245	
13		245	
14		245	
15		245	
16		245	
17		210	
18		210	
19		210	
20		210	
21		210	
22		210	
23		210	
24 Midnight		210	

Total Kilowatthours this day 5,390 .

DAILY LOAD PROFILE

Building Labor & Industry Weekday [ ] Weekend [X] Sunday

Month Any Type of Load Computer

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		210	
2		210	
3		210	
4		210	
5		210	
6		210	
7		210	
8		210	
9		210	
10		210	
11		210	
12 Noon		210	
13		210	
14		210	
15		210	
16		210	
17		210	
18		210	
19		210	
20		210	
21		210	
22		210	
23		210	
24 Midnight		210	

Total Kilowatthours this day 5,040 .

AIR CONDITIONING DEMAND

Building Labor and Industry

Electric Vapor Compression [X] Absorption [ ]

Connected Load 1,320 kW (Max. Demand)

Assumed Peak Heat Gain 17,600 mBtuh

MAXIMUM DEMANDS
ELECTRIC LOAD PROFILE

Building Health & Agriculture

	Summer Demand kW	Winter Demand kW
Lighting	640	640
Base Power	360	360
Air Conditioning	800	-
Space Heating	-	-
Kitchen/Laundry	-	-
Computer	150	150
	1,950	1,150

DAILY LOAD PROFILE

Building H & A Weekday [X] Weekend [ ]

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	20	130	
2	20	130	
3	20	130	
4	20	130	
5	20	130	
6	20	130	
7	20	130	
8	20	130	
9	90	580	
10	95	610	
11	95	610	
12 Noon	95	610	
13	80	515	
14	90	580	
15	90	580	
16	95	610	
17	95	610	
18	80	515	
19	70	450	
20	60	385	
21	40	260	
22	40	260	
23	40	260	
24 Midnight	40	260	

Total Kilowatthours this day 8,735.

DAILY LOAD PROFILE

Building H & A Weekday [ ] Weekend [X] Saturday

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		130	
2		130	
3		130	
4		130	
5		130	
6		130	
7		130	
8		130	
9		385	
10		385	
11		385	
12 Noon		385	
13		385	
14		385	
15		385	
16		385	
17		385	
18		385	
19		130	
20		130	
21		130	
22		130	
23		130	
24 Midnight		130	

Total Kilowatthours this day 5,670 .

DAILY LOAD PROFILE

Building H & A Weekday [ ] Weekend [X] Sunday

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		130	
2		130	
3		130	
4		130	
5		130	
6		130	
7		130	
8		130	
9		130	
10		130	
11		130	
12 Noon		130	
13		130	
14		130	
15		130	
16		130	
17		130	
18		130	
19		130	
20		130	
21		130	
22		130	
23		130	
24 Midnight		130	

Total Kilowatthours this day 3,120.

DAILY LOAD PROFILE

Building H & A Weekday [X] & Weekend [X]

Month Any Type of Load Base Power

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		360	
2		360	
3		360	
4		360	
5		360	
6		360	
7		360	
8		360	
9		360	
10		360	
11		360	
12 Noon		360	
13		360	
14		360	
15		360	
16		360	
17		360	
18		360	
19		360	
20		360	
21		360	
22		360	
23		360	
24 Midnight		360	

Total Kilowatthours this day 8,640 .

DAILY LOAD PROFILE

Building H & A Weekday [X] & Weekend [X]

Month Any Type of Load Computer and Test Equip.

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		120	
2		120	
3		120	
4		120	
5		120	
6		120	
7		120	
8		150	
9		150	
10		150	
11		150	
12 Noon		150	
13		150	
14		150	
15		150	
16		150	
17		150	
18		120	
19		120	
20		120	
21		120	
22		120	
23		120	
24 Midnight		120	

Total Kilowatthours this day 3,180.

AIR CONDITIONING DEMAND

Building Health and Agriculture

Electric Vapor Compression [X] Absorption [ ]

Connected Load 360 kW (Max. Demand)

Assumed Peak Heat Gain 4,800 mBtuh

MAXIMUM DEMANDS
ELECTRIC LOAD PROFILE

Building Mercer County Court House and Detention Center

	Summer Demand kW	Winter Demand kW
Lighting	480	480
Base Power	460	460
Air Conditioning	280	-
Space Heating	10	10
Kitchen/Laundry	200	200
Computer	-	-
	1,430 /	1,150

DAILY LOAD PROFILE

Building Mercer Co. Court Detention Weekday [X] & Weekend [X]

Month Any Type of Load Lighting (Detention)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	30	150	
2	20	60	
3	20	60	
4	20	60	
5	20	60	
6	20	60	
7	50	150	
8	80	240	
9	80	240	
10	80	240	
11	80	240	
12 Noon	80	240	
13	80	240	
14	80	240	
15	80	240	
16	80	240	
17	80	240	
18	80	240	
19	80	240	
20	80	240	
21	80	240	
22	80	240	
23	50	150	
24 Midnight	50	150	

Total Kilowatthours this day 4,500.

DAILY LOAD PROFILE

Building Mercer Co. Court Office Weekday [X] Weekend [ ]

Month Any Type of Load Lighting (Office)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	6	10	
2	6	10	
3	6	10	
4	6	10	
5	6	10	
6	6	10	
7	10	20	
8	20	40	
9	90	170	
10	95	180	
11	95	180	
12 Noon	95	180	
13	80	150	
14	90	170	
15	90	170	
16	95	180	
17	95	180	
18	80	150	
19	70	130	
20	60	115	
21	40	80	
22	30	60	
23	20	40	
24 Midnight	20	40	

Total Kilowatthours this day 2,295

DAILY LOAD PROFILE

Building Mercer Co. Court Office Weekday [ ] Weekend [X]

Month Any Type of Load Lighting (Office)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		10	
2		10	
3		10	
4		10	
5		10	
6		10	
7		10	
8		10	
9		10	
10		10	
11		10	
12 Noon		10	
13		10	
14		10	
15		10	
16		10	
17		10	
18		10	
19		10	
20		10	
21		10	
22		10	
23		10	
24 Midnight		10	

Total Kilowatthours this day 240.

DAILY LOAD PROFILE

Building Mercer Co. Court Office Weekday [X] Weekend [ ]

Month Any Type of Load Base Power (Office)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		25	
2		25	
3		25	
4		25	
5		25	
6		25	
7		25	
8		30	
9		30	
10		30	
11		30	
12 Noon		30	
13		30	
14		30	
15		30	
16		30	
17		30	
18		25	
19		25	
20		25	
21		25	
22		25	
23		25	
24 Midnight		25	

Total Kilowatthours this day 650.

DAILY LOAD PROFILE

Building Mercer Co. Court Office Weekday [ ] Weekend [X]

Month Any Type of Load Base Power (Office)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		25	
2		25	
3		25	
4		25	
5		25	
6		25	
7		25	
8		25	
9		25	
10		25	
11		25	
12 Noon		25	
13		25	
14		25	
15		25	
16		25	
17		25	
18		25	
19		25	
20		25	
21		25	
22		25	
23		25	
24 Midnight		25	

Total Kilowatthours this day 600.

DAILY LOAD PROFILE

Building Mercer Co. Court Detention Weekday [X] & Weekend [X]

Month Any Type of Load Base Power (Detention)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		220	
2		220	
3		220	
4		220	
5		350	
6		400	
7		440	
8		440	
9		440	
10		440	
11		440	
12 Noon		440	
13		440	
14		440	
15		440	
16		440	
17		440	
18		440	
19		440	
20		440	
21		440	
22		440	
23		350	
24 Midnight		350	

Total Kilowatthours this day 9,150 .

DAILY LOAD PROFILE

Building Mercer Co. Court Detention Weekday [X] & Weekend [X]

Month Any Type of Load Elevator (Detention)

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			
2			
3			
4			
5			
6			
7			
8		10	
9		20	
10		25	
11		25	
12 Noon		25	
13		25	
14		25	
15		30	
16		55	
17		65	
18		65	
19		45	
20		10	
21			
22			
23			
24 Midnight			

Total Kilowatthours this day 400.

DAILY LOAD PROFILE

Building Mercer Co. Court Detention Center Weekday [X] & Weekend [X]

Month Any Type of Load Kitchen & Laund.

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		20	
2		20	
3		20	
4		20	
5		20	
6		150	
7		150	
8		200	
9		200	
10		200	
11		200	
12 Noon		200	
13		200	
14		200	
15		200	
16		200	
17		150	
18		150	
19		150	
20		150	
21		20	
22		20	
23		20	
24 Midnight		20	

Total Kilowatthours this day 2,880 .

AIR CONDITIONING DEMAND

Building Mercer Detention Center

Electric Vapor Compression [X] Absorption [ ]

Connected Load 140 kW (Est. Max. Demand)

Assumed Peak Heat Gain 1,867 mBtuh

AIR CONDITIONING DEMAND

Building Mercer Court House

Electric Vapor Compression [X] Also see Thermal Absorption [ ]

Connected Load 140 kW

Assumed Peak Heat Gain 1,493 mBtuh

MAXIMUM DEMANDS
ELECTRIC LOAD PROFILE

Building Kingsbury I

	Summer Demand kW	Winter Demand kW
Lighting	140	140
Base Power	250	250
Air Conditioning	60	-
Space Heating	-	-
Kitchen/Laundry	140	140
Computer	590	630

DAILY LOAD PROFILE

Building Kingsbury Weekday [X] & Weekend [X]

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	30	55	
2	20	35	
3	5	10	
4	5	10	
5	10	20	
6	21	40	
7	50	90	
8	50	90	
9	40	70	
10	30	55	
11	20	40	
12 Noon	30	55	
13	30	55	
14	20	40	
15	30	55	
16	40	70	
17	60	105	
18	80	140	
19	80	140	
20	80	140	
21	70	125	
22	70	125	
23	50	90	
24 Midnight	30	55	

Total Kilowatthours this day 1,710.

DAILY LOAD PROFILE

Building Kingsbury Weekday [X] & Weekend [X]

Month Any Type of Load Base Power

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		50	
2		50	
3		75	
4		75	
5		75	
6		75	
7		150	
8		150	
9		150	
10		150	
11		150	
12 Noon		150	
13		200	
14		200	
15		200	
16		200	
17		250	
18		250	
19		200	
20		150	
21		150	
22		150	
23		75	
24 Midnight		75	

Total Kilowatthours this day 3,400 .

DAILY LOAD PROFILE

Building Kingsbury Weekday [X] & Weekend [X]

Month Any Type of Load Refrigeration & Applianc

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		80	
2		80	
3		80	
4		80	
5		80	
6		80	
7		140	
8		140	
9		140	
10		110	
11		110	
12 Noon		110	
13		110	
14		110	
15		140	
16		140	
17		140	
18		140	
19		140	
20		140	
21		110	
22		110	
23		80	
24 Midnight		80	

Total Kilowatthours this day 2,670 .

HEATING LOAD DATA

Building Kingsbury I

Electric [X] Oil [ ]

Connected Load 165 kW

Gross Heat Loss 450 mBtuh

Occupied

Hours of Operation 7 A.M. - 11 P.M.

Net Heat Loss 254

Heating Energy Required Below 65 °F

Heat Loss/°F = 3.9 mBtuh/°F

Unoccupied - Assume no change in net.

Net Heat Loss _____ mBtuh

Heating Energy Required Below _____ °F

Heat Loss/°F = _____ mBtuh/°F

AIR CONDITIONING DEMAND

Building Kingsbury I

Electric Vapor Compression [X] Also see Thermal Absorption [ ]

Connected Load 60 kW (Max. Demand)

Assumed Peak Heat Gain 720 mBtuh

MAXIMUM DEMANDS
ELECTRIC LOAD PROFILE

Building Capital I

	Summer Demand kW	Winter Demand kW
Lighting	450	450
Base Power	180	180
Air Conditioning	600	-
Space Heating	-	-
Kitchen/Laundry	-	-
Computer	-	-
	1,230	630

DAILY LOAD PROFILE

Building Capital I Weekday [X] Weekend [ ]

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	20	95	
2	20	95	
3	20	95	
4	20	95	
5	20	95	
6	20	95	
7	20	95	
8	20	95	
9	90	430	
10	95	450	
11	95	450	
12 Noon	95	450	
13	80	380	
14	90	430	
15	90	430	
16	95	450	
17	95	450	
18	80	380	
19	70	330	
20	60	285	
21	40	190	
22	40	190	
23	40	190	
24 Midnight	40	190	

Total Kilowatthours this day 6,005.

DAILY LOAD PROFILE

Building Capital I Weekday [ ] Weekend [X] Saturday

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		95	
2		95	
3		95	
4		95	
5		95	
6		95	
7		95	
8		95	
9		280	
10		280	
11		280	
12 Noon		280	
13		280	
14		280	
15		280	
16		280	
17		280	
18		280	
19		95	
20		95	
21		95	
22		95	
23		95	
24 Midnight		95	

Total Kilowatthours this day 3,945 .

DAILY LOAD PROFILE

Building Capital I Weekday [ ] Weekend [X] Sunday

Month Any Type of Load Lighting

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		95	
2		95	
3		95	
4		95	
5		95	
6		95	
7		95	
8		95	
9		95	
10		95	
11		95	
12 Noon		95	
13		95	
14		95	
15		95	
16		95	
17		95	
18		95	
19		95	
20		95	
21		95	
22		95	
23		95	
24 Midnight		95	

Total Kilowatthours this day 2,280 .

DAILY LOAD PROFILE

Building Capital I Weekday [X] & Weekend [X]

Month Any Type of Load Base Power

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		150	
2		150	
3		150	
4		150	
5		150	
6		150	
7		150	
8		150	
9		150	
10		150	
11		150	
12 Noon		150	
13		150	
14		150	
15		150	
16		150	
17		150	
18		150	
19		150	
20		150	
21		150	
22		150	
23		150	
24 Midnight		150	

Total Kilowatthours this day 3,600.

DAILY LOAD PROFILE

Building Capital I Weekday [X] Weekend [X] Saturday

Month Any Type of Load Elevator

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			
2			
3			
4			
5			
6			
7			
8	50	50	
9	50	50	
10	10	10	
11	30	30	
12 Noon	30	30	
13	15	15	
14	5	5	
15	5	5	
16	5	5	
17	5	5	
18			
19			
20			
21			
22			
23			
24 Midnight			

Total Kilowatthours this day 205.

DAILY LOAD PROFILE

Building Capital I Weekday [ ] Weekend [X] Sunday

Month Any Type of Load Elevator

Electric [X] Oil [ ] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.		0	
2		0	
3		0	
4		0	
5		0	
6		0	
7		0	
8		0	
9		0	
10		0	
11		0	
12 Noon		0	
13		0	
14		0	
15		0	
16		0	
17		0	
18		0	
19		0	
20		0	
21		0	
22		0	
23		0	
24 Midnight		0	

Total Kilowatthours this day 0 .

AIR CONDITIONING DEMAND

Building Capital I

Electric Vapor Compression [X] Absorption [ ]

Connected Load 100 kW

Assumed Peak Heat Gain 12,000 mBtuh

Thermal Load Profiles

Thermal Load Profiles were developed for the existing community and Capitol Place I. These profiles consist of the following:

1) Daily Load Profiles for domestic hot water and process hot water, where applicable
2) Heating Load Data
3) Air Conditioning

Daily Load Profiles were established by use of one or more of the following sources of information:

a) Interviews with building operators to discuss hours and modes of operation.
b) Customer's records of oil consumption for heating.
c) Guidelines on thermal use profiles obtained from the Edison Electric Institute, The American Society of Heating, Refrigeration and Air Conditioning Engineers, and PSE&G experience.

Heating Load Data detail the heating profiles, reflecting internal heat gain and typical weather conditions. The above mentioned sources were also used to develop the Heating Load Data.

Air Conditioning Demand data was established for those buildings which use absorption air conditioning using the same sources mentioned above.

DAILY LOAD PROFILE

Building L&I/H&A & State House Weekday [X] Weekend [ ]

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu.
1 A.M.	5		486
2	5		486
3	5		486
4	5		486
5	5		486
6	5		486
7	5		486
8	55		5,347
9	55		5,347
10	55		5,347
11	55		5,347
12 Noon	90		8,749
13	90		8,749
14	80		7,777
15	80		7,777
16	75		7,291
17	75		7,291
18	30		2,916
19	50		4,861
20	50		4,861
21	5		486
22	5		486
23	5		486
24 Midnight	5		486

20,000 gal./mo. estimated for all Hot Water
Weekdays 87,004 MBTU/Day

Total Kilowatthours this day _____.

DAILY LOAD PROFILE

Building L&I/H&A & State House Weekday [ ] Weekend [X] Saturday

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			486
2			486
3			486
4			486
5			486
6			486
7			486
8			4,583
9			4,583
10			4,583
11			4,583
12 Noon			7,500
13			7,500
14			6,667
15			6,667
16			6,250
17			6,250
18			2,500
19			4,167
20			4,167
21			486
22			486
23			486
24 Midnight			486

Total Kilowatthours this day _____.

DAILY LOAD PROFILE

Building L&I/H&A & State House Weekday [ ] Weekend [X]

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			486
2			486
3			486
4			486
5			486
6			486
7			486
8			486
9			486
10			486
11			486
12 Noon			486
13			486
14			486
15			486
16			486
17			486
18			486
19			486
20			486
21			486
22			486
23			486
24 Midnight			486

11,664M

Total Kilowatthours this day _____.

HEATING LOAD DATA

Building L&I/H&A and State House

Electric [ ] Oil [X]

Connected Load _____

Gross Heat Loss 57,400 mBtuh

Occupied

Hours of Operation 8:00 A.M. - 11:00 P.M.

Net Heat Loss 41,200 mBtuh mBtuh

Heating Energy Required Below 50.2 °F

Heat Loss/°F = _____ mBtuh/°F

Unoccupied

Net Heat Loss 44,000 mBtuh

Heating Energy Required Below 53.7 °F

Heat Loss/°F = _____ mBtuh/°F

HEALTH AND AGRICULTURE
THERMAL PROFILES ARE
INCLUDED IN THE LABOR
AND INDUSTRY SECTION

DAILY LOAD PROFILE

Building Mercer Court House Weekday [X] Weekend [ ]

Month Any Type of Load Hot Water (Office)

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	5		41
2	5		41
3	5		41
4	5		41
5	5		41
6	5		41
7	5		41
8	55		446
9	55		446
10	55		446
11	55		446
12 Noon	90		729
13	90		729
14	80		648
15	80		648
16	75		608
17	75		608
18	30		243
19	50		405
20	50		405
21	5		41
22	5		41
23	5		41
24 Midnight	5		41

Approximately 2,000 gal./mo.

Total Kilowatthours this day _____.

DAILY LOAD PROFILE

Building Mercer Court House Weekday [ ] Weekend [X]

Month Any Type of Load Hot Water (Office)

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			41
2			41
3			41
4			41
5			41
6			41
7			41
8			41
9			41
10			41
11			41
12 Noon			41
13			41
14			41
15			41
16			41
17			41
18			41
19			41
20			41
21			41
22			41
23			41
24 Midnight			41

Total Kilowatthours this day _____.

DAILY LOAD PROFILE

Building Mercer Court House Detention Center Weekday [X] & Weekend [X]

Month Any Type of Load Kitchen & Laundry

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			-
2			-
3			-
4			-
5			60
6			90
7			90
8			120
9			150
10			510
11			510
12 Noon			330
13			60
14			330
15			600
16			600
17			480
18			300
19			270
20			120
21			30
22			30
23			30
24 Midnight			

Total Kilowatthours this day _____.

DAILY LOAD PROFILE

Building Mercer Court House / Detention Center Weekday [X] & Weekend [X]

Month Any Type of Load NHot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			100
2			100
3			100
4			100
5			100
6			500
7			600
8			1,000
9			1,000
10			900
11			800
12 Noon			700
13			700
14			600
15			500
16			500
17			600
18			800
19			850
20			850
21			750
22			650
23			100
24 Midnight			100

Total Kilowatthours this day _____.

HEATING LOAD DATA

Building Mercer Court House (Also see Detention)

Electric [ ] Oil [X]

Connected Load _____

Gross Heat Loss 9,100 mBtuh

Occupied

Hours of Operation 8:00 A.M. - 5:00 P.M.

Net Heat Loss 8418 mBtuh

Heating Energy Required Below 65 °F

Heat Loss/°F = 130.0 mBtuh/°F

Unoccupied

Net Heat Loss 7,660 mBtuh

Heating Energy Required Below 58.9 °F

Heat Loss/°F = 130.0 mBtuh/°F

HEATING LOAD DATA

Building Mercer Detention (Also see Court House

Electric [ ] Oil [X]

Connected Load _____

Gross Heat Loss 5,400 mBtuh

Occupied

Hours of Operation 7:00 A.M. - 11:00 P.M.

Net Heat Loss 3,350 mBtuh

Heating Energy Required Below 43 °F

Heat Loss/°F = 77.0 mBtuh/°F

Unoccupied

Net Heat Loss 3,975 mBtuh

Heating Energy Required Below 52 °F

Heat Loss/°F = 76.9 mBtuh/°F

AIR CONDITIONING DEMAND

Building Mercer Court House (Also see Detention - Elec. and Mercer Court - Elec.)

Electric Vapor Compression [ ] Absorption [X]

Connected Load 125 tons

Assumed Peak Heat Gain 1,500 mBtuh

DAILY LOAD PROFILE

Building Kingsbury Weekday [X] & Weekend [X]

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	55		400
2	50		364
3	50		364
4	43		364
5	50		313
6	60		364
7	100		437
8	100		728
9	90		728
10	80		655
11	70		582
12 Noon	70		510
13	60		510
14	50		437
15	50		364
16	60		364
17	80		437
18	85		582
19	85		619
20	85		619
21	75		546
22	65		473
23	70		510
24 Midnight	70		510

Approximately 3,250 gal./mo.

Total Kilowatthours this day _____.

HEATING LOAD DATA

Building Kingsbury I

Electric [ ] Oil [X] See also electric

Connected Load _____

Gross Heat Loss 9,990 mBtuh

Occupied

Hours of Operation 7:00 A.M. - 11:00 P.M.

Net Heat Loss 9705

Heating Energy Required Below 68 °F

Heat Loss/°F = 142.7 mBtuh/°F

Unoccupied - Assume no change in net

Net Heat Loss _____ mBtuh

Heating Energy Required Below _____ °F

Heat Loss/°F = _____ mBtuh/°F

AIR CONDITIONING DEMAND

Building Kingsbury I

Electric Vapor Compression [ ] Absorption [X] Also see electric

Connected Load 700 tons

Assumed Peak Heat Gain 8,000 mBtuh

DAILY LOAD PROFILE

Building Capital I Weekday [X] Weekend [ ]

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.	5		17
2	5		17
3	5		17
4	5		17
5	5		17
6	5		17
7	5		188
8	55		188
9	55		188
10	55		188
11	55		188
12 Noon	90		307
13	90		307
14	80		273
15	80		273
16	75		256
17	75		256
18	30		102
19	50		171
20	50		171
21	5		17
22	5		17
23	5		17
24 Midnight	5		17

Total Kilowatthours this day _____.

DAILY LOAD PROFILE

Building Capital I Weekday [ ] Weekend [X] Saturday

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			17
2			17
3			17
4			17
5			17
6			17
7			17
8			161
9			161
10			161
11			161
12 Noon			263
13			263
14			234
15			234
16			219
17			219
18			87
19			147
20			147
21			17
22			17
23			17
24 Midnight			17

Total Kilowatthours this day. _____.

DAILY LOAD PROFILE

Building Capital I Weekday [ ] Weekend [X] Sunday

Month Any Type of Load Hot Water

Electric [ ] Oil [X] Natural Gas [ ]

Hour	% of Max. Demand	Demand Kilowatts	Demand MBtu
1 A.M.			17
2			17
3			17
4			17
5			17
6			17
7			17
8			17
9			17
10			17
11			17
12 Noon			17
13			17
14			17
15			17
16			17
17			17
18			17
19			17
20			17
21			17
22			17
23			17
24 Midnight			17

Total Kilowatthours this day _____.

HEATING LOAD DATA

Building Captial I

Electric [ ] Oil [X]

Connected Load _____

Gross Heat Loss 1,290 kW

Occupied

Hours of Operation 8:00 A.M. - 11:00 P.M.

Net Heat Loss 2,764

Heating Energy Required Below 44.0 °F

Heat Loss/°F = 62.9 mBtuh/°F

Unoccupied

Net Heat Loss 2,559 mBtuh

Heating Energy Required Below 50.0 °F

Heat Loss/°F = 51.2 mBtuh/°F

appendix D/1

hour by hour profiles (building thermal gain, steam demand, and electric generation)

COMPUTER SIMULATION

A. General

Thermal profiles were generated using a computer program developed by R. G. Vanderweil Engineers, Inc. The program was modified to meet the requirements of this project.

A "Test Reference Year" weather tape for Philadelphia was obtained from the National Oceanic and Atmospheric Administration. The test reference year is an actual year selected from among 28 years (1948-1975) using an ASHRAE-developed procedure. Philadelphia's Test Reference Year is 1969. Philadelphia was chosen since it is the closest city to Trenton for which a Test Reference Year tape was available.

The tape was read into the computer, and the following data were extracted and stored for every hour of the year.

1) Dry bulb temperature.
2) Wet bulb temperature.
3) Cloud cover modifier.

The cloud cover modifier was calculated using the procedure described in Computer Program for Analysis of Energy Utilization in Postal Facilities.*

In order to simplify generation of the thermal profile, it was assumed that the community could be modelled as consisting of several types of buildings and that thermal requirements for each type of building would be proportional to gross floor area.

A thermal profile would be developed for one square foot of floor area for each model building type. Composite profiles could then be developed by multiplying these profiles by the appropriate total floor areas.

Seven "typical" model buildings were orignally created using ASHRAE 90-75 as a guide and assuming users of the buildings would be energy-conscious. The existing buildings do not conform to these criteria. Therefore, we originally planned to apply factors to the profiles to make them fit the known thermal demands of the existing buildings. It soon became apparent that this procedure would not give realistic results for existing office buildings, since the profiles for our energy conscious office buildings were shaped much differently from profiles of most existing office

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*Computer Program for Analysis of Energy Utilization in Postal Facilities, U.S. Post Office Department, Bureau of Research and Engineering, Washington, D.C.

buildings. Therefore, another building type was created for existing office buildings. The factoring method was used for existing residential buildings.

The State House Complex was added to the community after work on the profiles had begun. It was modelled as one building and added as an additional building type.

The nine building types used were:

1) low rise apartment building;
2) high rise apartment building;
3) square-plan office building;
4) rectangular-plan office building;
5) court building;
6) civic center;
7) commercial building;
8) existing office building (based on rectangular plan office building); and
9) State House Complex.

Characteristics of the nine typical buildings are given in Tables 1 through 9. The electrical profiles shown do not represent the buildings' total electric demand, but only that portion of the demand which would contribute to the thermal load.

TABLE 1

BUILDING DATA
LOW RISE APT

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	0	0
NORTHEAST	0	0
EAST	0	0
SOUTHEAST	0	1020
SOUTH	0	0
SOUTHWEST	0	0
WEST	0	0
NORTHWEST	0	1020

TOTAL CRACK (FT)	3322
INFILTRATION PER FOOT OF CRACK (CFM)	0.30
VENTILATION AIR (CFM)	713
WALL AREA (SQ FT)	3779
WALL U (BTUH/SQ FT-DEG)	0.12
ROOF AREA (SQ FT)	3960
ROOF U (BTUH/SQ FT-DEG)	0.10
FLOOR AREA (SQ FT)	7920
CONSTRUCTION WEIGHT	LIGHT

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
72	60	70	65

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	2.95	2.95	2.95	16	8	8
2	2.51	2.51	2.51	16	8	8
3	1.97	1.97	1.97	16	8	8
4	1.97	1.97	1.97	16	8	8
5	2.19	2.19	2.19	16	8	8
6	2.62	2.62	2.62	16	8	8
7	5.03	5.03	5.03	16	8	8
8	5.03	5.03	5.03	16	8	8
9	4.59	4.59	4.59	16	8	8
10	3.61	3.61	3.61	16	8	8
11	3.28	3.28	3.28	16	8	8
12	3.61	3.61	3.61	16	8	8
13	3.61	3.61	3.61	16	8	8
14	3.28	3.28	3.28	15	8	8
15	4.27	4.27	4.27	15	8	8
16	4.59	4.59	4.59	16	8	8
17	5.36	5.36	5.36	16	8	8
18	6.13	6.13	6.13	16	8	8
19	6.13	6.13	6.13	16	8	8
20	6.13	6.13	6.13	16	8	8
21	5.14	5.14	5.14	16	8	8
22	5.14	5.14	5.14	16	8	8
23	3.72	3.72	3.72	16	8	8
24	2.95	2.95	2.95	16	8	8

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 2

BUILDING DATA
HIGH RISE APT

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	0	5000
NORTHEAST	0	0
EAST	0	5000
SOUTHEAST	0	0
SOUTH	0	5000
SOUTHWEST	0	0
WEST	0	5000
NORTHWEST	0	0

TOTAL CRACK (FT)	11210
INFILTRATION PER FOOT OF CRACK (CFM)	0.30
VENTILATION AIR (CFM)	12600
WALL AREA (SQ FT)	37216
WALL U (BTUH/SQ FT-DEG)	0.12
ROOF AREA (SQ FT)	7056
ROOF U (BTUH/SQ FT-DEG)	0.10
FLOOR AREA (SQ FT)	140000
CONSTRUCTION WEIGHT	MEDIUM

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
72	60	70	65

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	49.50	49.95	49.95	203	203	203
2	42.55	42.55	42.55	203	203	203
3	33.30	33.30	33.30	203	203	203
4	33.30	33.30	33.30	203	203	203
5	37.00	37.00	37.00	203	203	203
6	44.40	44.40	44.40	203	203	203
7	85.10	85.10	85.10	203	203	203
8	85.10	85.10	85.10	203	203	203
9	77.70	77.70	77.70	203	203	203
10	61.00	61.00	61.00	203	203	203
11	55.50	55.50	55.50	203	203	203
12	61.00	61.00	61.00	203	203	203
13	61.00	61.00	61.00	203	203	203
14	55.50	55.50	55.50	203	203	203
15	72.15	72.15	72.15	203	203	203
16	77.70	77.70	77.70	203	203	203
17	90.65	90.65	90.65	203	203	203
18	103.60	103.60	103.60	203	203	203
19	103.60	103.60	103.60	203	203	203
20	103.60	103.60	103.60	203	203	203
21	86.95	86.95	86.95	203	203	203
22	86.95	86.95	86.95	203	203	203
23	62.90	62.90	62.90	203	203	203
24	49.95	49.95	49.95	203	203	203

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 3

BUILDING DATA
SQUARE OFFICE

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	0	3859
NORTHEAST	0	0
EAST	0	4594
SOUTHEAST	0	0
SOUTH	0	3859
SOUTHWEST	0	0
WEST	0	4594
NORTHWEST	0	0

TOTAL CRACK (FT)	4440
INFILTRATION PER FOOT OF CRACK (CFM)	0.30
VENTILATION AIR (CFM)	9750
WALL AREA (SQ FT)	31395
WALL U (BTUH/SQ FT-DEG)	0.12
ROOF AREA (SQ FT)	25725
ROOF U (BTUH/SQ FT-DEG)	0.10
FLOOR AREA (SQ FT)	155000
CONSTRUCTION WEIGHT	MEDIUM

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
78	65	68	60

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	67.00	67.00	67.00	0	0	0
2	67.00	67.00	67.00	0	0	0
3	67.00	67.00	67.00	0	0	0
4	67.00	67.00	67.00	0	0	0
5	67.00	67.00	67.00	0	0	0
6	67.00	67.00	67.00	0	0	0
7	67.00	67.00	67.00	0	0	0
8	98.00	98.00	67.00	975	688	0
9	322.00	222.00	67.00	975	688	0
10	335.00	222.00	67.00	975	688	0
11	335.00	222.00	67.00	975	688	0
12	335.00	222.00	67.00	975	688	0
13	288.00	222.00	67.00	975	688	0
14	322.00	222.00	67.00	975	688	0
15	322.00	222.00	67.00	975	688	0
16	335.00	222.00	67.00	975	688	0
17	335.00	222.00	67.00	975	688	0
18	291.00	191.00	67.00	0	0	0
19	224.00	67.00	67.00	0	0	0
20	194.00	67.00	67.00	0	0	0
21	131.00	67.00	67.00	0	0	0
22	131.00	67.00	67.00	0	0	0
23	131.00	67.00	67.00	0	0	0
24	131.00	67.00	67.00	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 4

BUILDING DATA
RECTANGULAR OFFICE

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	0	6038
NORTHEAST	0	0
EAST	0	2940
SOUTHEAST	0	0
SOUTH	0	6038
SOUTHWEST	0	0
WEST	0	2940
NORTHWEST	0	0

TOTAL CRACK (FT)	4716
INFILTRATION PER FOOT OF CRACK (CFM)	0.30
VENTILATION AIR (CFM)	9750
WALL AREA (SQ FT)	33345
WALL U (BTUH/SQ FT-DEG)	0.12
ROOF AREA (SQ FT)	25760
ROOF U (BTUH/SQ FT-DEG)	0.10
FLOOR AREA (SQ FT)	155000
CONSTRUCTION WEIGHT	MEDIUM

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
78	65	68	60

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	67.00	67.00	67.00	0	0	0
2	67.00	67.00	67.00	0	0	0
3	67.00	67.00	67.00	0	0	0
4	67.00	67.00	67.00	0	0	0
5	67.00	67.00	67.00	0	0	0
6	67.00	67.00	67.00	0	0	0
7	67.00	67.00	67.00	0	0	0
8	98.00	98.00	67.00	975	688	0
9	322.00	222.00	67.00	975	688	0
10	335.00	222.00	67.00	975	688	0
11	335.00	222.00	67.00	975	688	0
12	335.00	222.00	67.00	975	688	0
13	288.00	222.00	67.00	975	688	0
14	322.00	222.00	67.00	975	688	0
15	322.00	222.00	67.00	975	688	0
16	335.00	222.00	67.00	975	688	0
17	335.00	222.00	67.00	975	688	0
18	291.00	191.00	67.00	0	0	0
19	224.00	67.00	67.00	0	0	0
20	194.00	67.00	67.00	0	0	0
21	131.00	67.00	67.00	0	0	0
22	131.00	67.00	67.00	0	0	0
23	131.00	67.00	67.00	0	0	0
24	131.00	67.00	67.00	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 5
BUILDING DATA
COURT

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	0	10800
NORTHEAST	0	0
EAST	0	4320
SOUTHEAST	0	0
SOUTH	0	10800
SOUTHWEST	0	0
WEST	0	4320
NORTHWEST	0	0

TOTAL CRACK (FT)	8160
INFILTRATION PER FT OF CRACK (CFM)	0.23
VENTILATION (CFM)	42850
WALL AREA (SQ FT)	70560
WALL U (BTUH/SQ FT-DEG)	0.15
ROOF AREA (SQ FT)	36000
ROOF U (BTUH/SQ FT-DEG)	0.12
FLOOR AREA (SQ FT)	350000
CONSTRUCTION WEIGHT	HEAVY

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
78	65	68	60

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	129.50	129.50	129.50	0	0	0
2	129.50	129.50	129.50	0	0	0
3	129.50	129.50	129.50	0	0	0
4	129.50	129.50	129.50	0	0	0
5	129.50	129.50	129.50	0	0	0
6	129.50	129.50	129.50	0	0	0
7	157.50	157.50	129.50	0	0	0
8	227.50	227.50	129.50	1080	1080	0
9	717.50	717.50	129.50	2160	2160	0
10	752.50	752.50	129.50	4285	4285	0
11	752.50	752.50	129.50	4285	4285	0
12	752.50	752.50	129.50	4285	4285	0
13	647.50	647.50	129.50	2160	2160	0
14	717.50	717.50	129.50	4285	4285	0
15	717.50	717.50	129.50	4285	4285	0
16	752.50	752.50	129.50	4285	4285	0
17	752.50	752.50	129.50	4285	4285	0
18	647.50	647.50	129.50	1080	1080	0
19	577.50	577.50	129.50	0	0	0
20	507.50	507.50	129.50	0	0	0
21	367.50	367.50	129.50	0	0	0
22	297.50	297.50	129.50	0	0	0
23	227.50	227.50	129.50	0	0	0
24	227.50	227.50	129.50	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 6

BUILDING DATA
CIVIC CENTER

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	0	437
NORTHEAST	0	0
EAST	0	0
SOUTHEAST	0	0
SOUTH	0	437
SOUTHWEST	0	0
WEST	0	0
NORTHWEST	0	0

TOTAL CRACK (FT)	0
INFILTRATION PER FOOT OF CRACK (CFM)	0.00
VENTILATION AIR (CFM)	56000
WALL AREA (SQ FT)	225000
WALL U (BTUH/SQ FT-DEG)	0.12
ROOF AREA (SQ FT)	62500
ROOF U (BTUH/SQ FT-DEG)	0.10
FLOOR AREA (SQ FT)	100000
CONSTRUCTION WEIGHT	MEDIUM

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
78	65	68	60

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	25.00	25.00	25.00	0	0	0
2	25.00	25.00	25.00	0	0	0
3	25.00	25.00	25.00	0	0	0
4	25.00	25.00	25.00	0	0	0
5	25.00	25.00	25.00	0	0	0
6	25.00	25.00	25.00	0	0	0
7	25.00	25.00	25.00	0	0	0
8	25.00	25.00	25.00	0	0	0
9	225.00	25.00	25.00	2240	0	0
10	225.00	225.00	225.00	2240	3920	2800
11	225.00	225.00	225.00	2240	3920	2800
12	225.00	225.00	225.00	2240	3920	2800
13	225.00	225.00	225.00	2240	3920	2800
14	225.00	225.00	225.00	2240	3920	2800
15	225.00	225.00	225.00	2240	3920	2800
16	225.00	225.00	225.00	2240	3920	2800
17	225.00	225.00	225.00	2240	3920	2800
18	225.00	225.00	225.00	2240	3920	2800
19	225.00	225.00	225.00	2240	3920	2800
20	225.00	225.00	225.00	2240	3920	2800
21	225.00	225.00	225.00	2240	3920	2800
22	225.00	225.00	25.00	2240	3920	0
23	25.00	25.00	25.00	0	0	0
24	25.00	25.00	25.00	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 7

BUILDING DATA
COMMERCIAL

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	780	0
NORTHEAST	0	0
EAST	780	0
SOUTHEAST	0	0
SOUTH	780	0
SOUTHWEST	0	0
WEST	780	0
NORTHWEST	0	0

TOTAL CRACK (FT)	2288
INFILTRATION PER FOOT OF CRACK (CFM)	0.30
VENTILATION AIR (CFM)	5000
WALL AREA (SQ FT)	12840
WALL U (BTUH/SQ FT-DEG)	0.15
ROOF AREA (SQ FT)	25600
ROOF U (BTUH/SQ FT-DEG)	0.12
FLOOR AREA (SQ FT)	50000
CONSTRUCTION WEIGHT	LIGHT

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
78	65	68	60

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	12.50	12.50	12.50	0	0	0
2	12.50	12.50	12.50	0	0	0
3	12.50	12.50	12.50	0	0	0
4	37.50	37.50	37.50	50	50	50
5	37.50	27.50	27.50	50	50	50
6	37.50	37.50	37.50	50	50	50
7	62.50	62.50	62.50	250	250	250
8	62.50	62.50	62.50	250	250	250
9	112.50	112.50	112.50	500	500	500
10	112.50	112.50	112.50	500	500	500
11	112.50	112.50	112.50	500	500	500
12	112.50	112.50	112.50	500	500	500
13	112.50	112.50	112.50	500	500	500
14	112.50	112.50	112.50	500	500	500
15	112.50	112.50	112.50	500	500	500
16	112.50	112.50	112.50	500	500	500
17	112.50	112.50	112.50	500	500	500
18	62.50	62.50	62.50	250	250	250
19	62.50	62.50	62.50	250	250	250
20	12.50	12.50	12.50	0	0	0
21	12.50	12.50	12.50	0	0	0
22	12.50	12.50	12.50	0	0	0
23	12.50	12.50	12.50	0	0	0
24	12.50	12.50	12.50	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 8

BUILDING DATA
EXISTING OFFICE

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	7245	0
NORTHEAST	0	0
EAST	3528	0
SOUTHEAST	0	0
SOUTH	7245	0
SOUTHWEST	0	0
WEST	3528	0
NORTHWEST	0	0

TOTAL CRACK (FT)	5328
INFILTRATION PER FOOT OF CRACK (CFM)	0.28
VENTILATION AIR (CFM)	57000
WALL AREA (SQ FT)	29754
WALL U (BTUH/SQ FT-DEG)	0.20
ROOF AREA (SQ FT)	25760
ROOF U (BTUH/SQ FT-DEG)	0.18
FLOOR AREA (SQ FT)	155000
CONSTRUCTION WEIGHT	MEDIUM

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
78	65	68	60

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	67.00	67.00	67.00	0	0	0
2	67.00	67.00	67.00	0	0	0
3	67.00	67.00	67.00	0	0	0
4	67.00	67.00	67.00	0	0	0
5	67.00	67.00	67.00	0	0	0
6	67.00	67.00	67.00	0	0	0
7	67.00	67.00	67.00	0	0	0
8	98.00	98.00	67.00	975	688	0
9	322.00	222.00	67.00	975	688	0
10	335.00	222.00	67.00	975	688	0
11	335.00	222.00	67.00	975	688	0
12	335.00	222.00	67.00	975	688	0
13	288.00	222.00	67.00	975	688	0
14	322.00	222.00	67.00	975	688	0
15	322.00	222.00	67.00	975	688	0
16	335.00	222.00	67.00	975	688	0
17	335.00	222.00	67.00	975	688	0
18	291.00	191.00	67.00	0	0	0
19	224.00	67.00	67.00	0	0	0
20	131.00	67.00	67.00	0	0	0
21	131.00	67.00	67.00	0	0	0
22	131.00	67.00	67.00	0	0	0
23	131.00	67.00	67.00	0	0	0
24	131.00	67.00	67.00	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

Table 9

BUILDING DATA
STATE HOUSE COMPLEX

GLASS AREAS (SQ FT)

	SINGLE	DOUBLE
NORTH	23013	0
NORTHEAST	0	0
EAST	29017	0
SOUTHEAST	0	0
SOUTH	23595	0
SOUTHWEST	0	0
WEST	28513	0
NORTHWEST	0	0

TOTAL CRACK (FT)	21312
INFILTRATION PER FOOT OF CRACK (CFM)	0.50
VENTILATION AIR (CFM)	159000
WALL AREA (SQ FT)	294286
WALL U (BTUH/SQ FT-DEG)	0.20
ROOF AREA (SQ FT)	381259
ROOF U (BTUH/SQ FT-DEG)	0.25
FLOOR AREA (SQ FT)	795525
CONSTRUCTION WEIGHT	HEAVY

INDOOR DESIGN CONDITIONS

SUMMER		WINTER	
DB	WB	DAY	NIGHT
75	62	72	72

PROFILES

	ELECTRIC (KW)*			PEOPLE		
HR	WKDY	SAT	SUN	WKDY	SAT	SUN
1	190.00	160.00	160.00	0	0	0
2	190.00	160.00	160.00	0	0	0
3	190.00	160.00	160.00	0	0	0
4	190.00	160.00	160.00	0	0	0
5	190.00	160.00	160.00	0	0	0
6	1260.00	310.00	160.00	0	0	0
7	1485.00	410.00	160.00	0	0	0
8	1710.00	460.00	160.00	3837	782	0
9	1710.00	510.00	160.00	3937	782	0
10	1710.00	560.00	160.00	4767	1497	415
11	1710.00	560.00	160.00	4767	1497	415
12	1710.00	560.00	160.00	4767	1497	415
13	1710.00	560.00	160.00	4767	1717	615
14	1710.00	560.00	160.00	4987	1717	2015
15	1710.00	560.00	160.00	4767	1717	2015
16	1610.00	560.00	160.00	4767	415	2015
17	1460.00	560.00	160.00	781	0	415
18	1310.00	460.00	160.00	1001	0	0
19	110.00	410.00	160.00	1400	2000	0
20	960.00	310.00	160.00	1400	2000	0
21	910.00	310.00	160.00	0	2000	0
22	885.00	210.00	160.00	0	0	0
23	190.00	160.00	160.00	0	0	0
24	190.00	160.00	160.00	0	0	0

*ELECTRIC PROFILE FOR HEAT GAIN ONLY

B. Development of Profiles for Model Buildings

The program was run once for each model building. For every hour of the year, the program calculated the following.

1) Solar gain.
2) Heat gain from lights and appliances.
3) Heat gain from occupants.
4) Transmission gain (or loss).
5) Ventilation and infiltration gain (or loss).

ASHRAE calculation procedures were used throughout. Thermal inertia was accounted for by averaging the radiant portion of each component over two hours for light construction, four hours for medium construction, and eight hours for heavy construction.* Latent gains and losses were considered only for the cooling season.

During the winter, only half of the electric heat gain was considered, since it was assumed that the other half of the gain would be interior and would not reduce the heat load; it would create an interior cooling load which could be handled by economizing.

For each model building the computer summed the load components, divided by the total floor area, and stored the result giving a thermal profile for one square foot of the building.

The cooling season was assumed to begin on May 1 and the heating season on October 15. Cooling requirements during the heating season were ignored as were heating requirements during the cooling season. The results showed these assumptions to be reasonable.

In addition to the building characteristics mentioned above, operational information is needed for each program run. The computer asks the following questions:

1) Is there an economizer cycle? If the answer to this question is "yes", the computer increases ventilation to reduce the cooling load whenever outdoor enthalpy is less than indoor enthalpy. All buildings to be air-conditioned from the ICES system except the low-rise apartments were assumed to have economizer cycles.

2) Are the windows shaded? If the answer to this question is "yes", the computer assumes two-thirds shading in the summer and one-third in the winter. All new buildings were given shading.

3) Is air conditioning off at night? If the answer to this question is "yes", the computer gives a zero air conditioning demand to all nighttime hours as determined by the next questions. All but residential buildings were assumed to have their air conditioning off at night.

*ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating, and Air Conditioning, 1972, p. 422.

4) Night start? and Day start? The answers to these questions tell the computer when to do the following:

During the summer:

a) Start and stop air conditioning if the answer to question 3 is "yes".

During the winter:

a) Start and stop ventilation,
b) Change between night and day temperatures.

Some of the buildings do not operate on Sundays as indicated by their occupancy profiles. In these cases the computer treats Sunday as night. Night start and day start were taken to be 1 p.m. and 8 p.m. respectively for office buildings and residential buildings; 11 p.m. and 9 a.m. for the civic center; and 7 p.m. and 7 a.m. for the commercial building.

5) Is air conditioning to be considered? If the answer to this question is "no", the computer ignores air conditioning loads. This question was answered "no" for the State House Complex and the Existing Office Building since all of the existing buildings based on these typical buildings already have electric air conditioning.

C. Development of Actual Composite Thermal Profile

Having developed the nine model profiles described in Section A, we were able to weight and combine them to obtain the composite profile for the entire community or any group of actual buildings within the community. Table 10 shows the actual buildings with the floor areas and weighting factors used. Figures 1 through 6 show the plotted composite thermal profile. Figure 7 shows two typical days expanded. These figures do not consider storage. Heating requirements are shown as negative.

TABLE 10

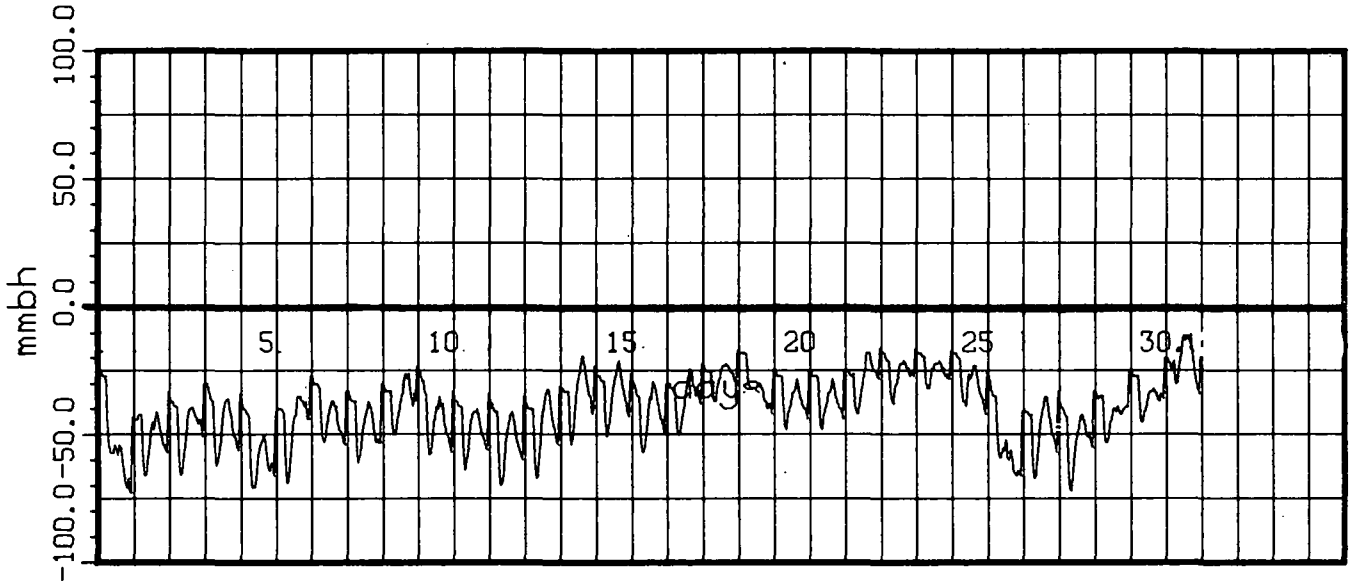
ICES COMMUNITY

	Floor Area (sq ft)	Factor	Model Building
Luther Arms	91,500	1.00	High Rise Apt.
Detention	160,000	1.00	High Rise Apt.
Mercer County Court	130,000	2.41	Court
Fire House	5,000	1.00	Low Rise Apt.
Justice	350,000	1.00	Court
Justice Commercial	50,000	1.00	Commercial
Kingsbury II	200,000	0.86	Low Rise Apt.
Capitol I	155,000	1.30	Square Office
Capitol I P.O.	50,000	1.00	Commercial
Civic Center	100,000	1.00	Civic Center
DEP	250,000	1.30	Rectangular Office
Kingsbury I L.R.	74,500	0.90	Low Rise Apt.
Kingsbury I H.R.	280,000	1.40	High Rise Apt.
Labor and Industry	300,000	1.00	Existing Office
Health and Agriculture	144,000	1.00	Existing Office
State House Complex	795,525	1.00	State House Complex

Figure 1

BUILDING THERMAL GAIN

jan



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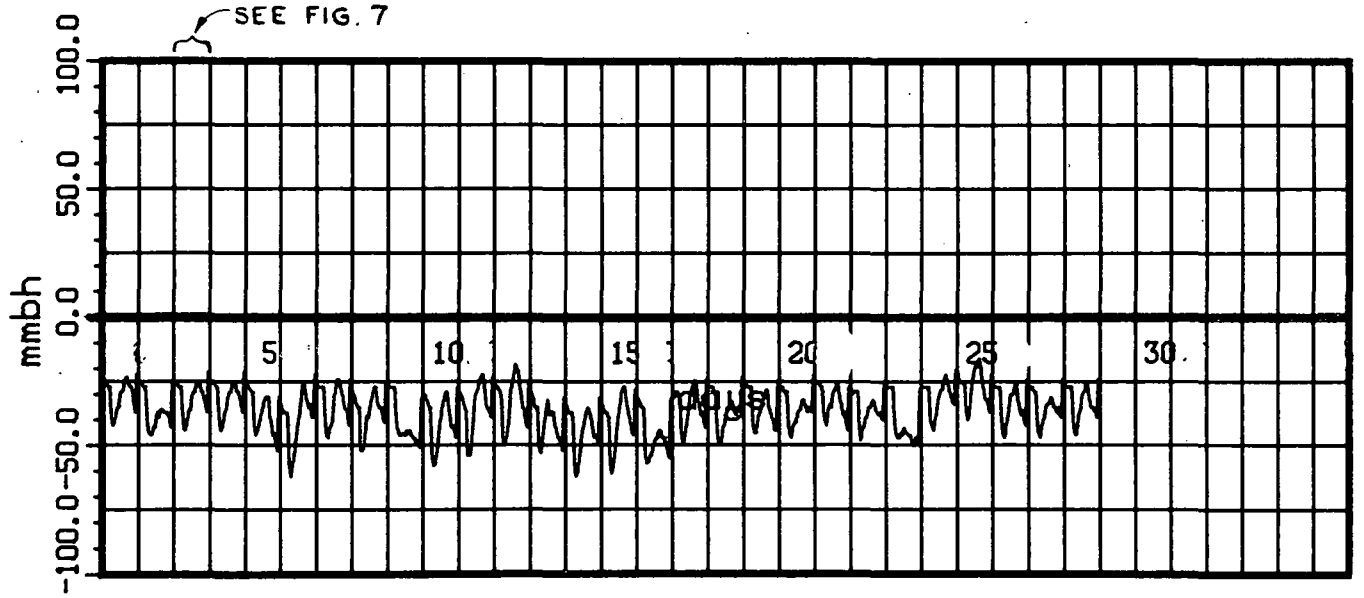
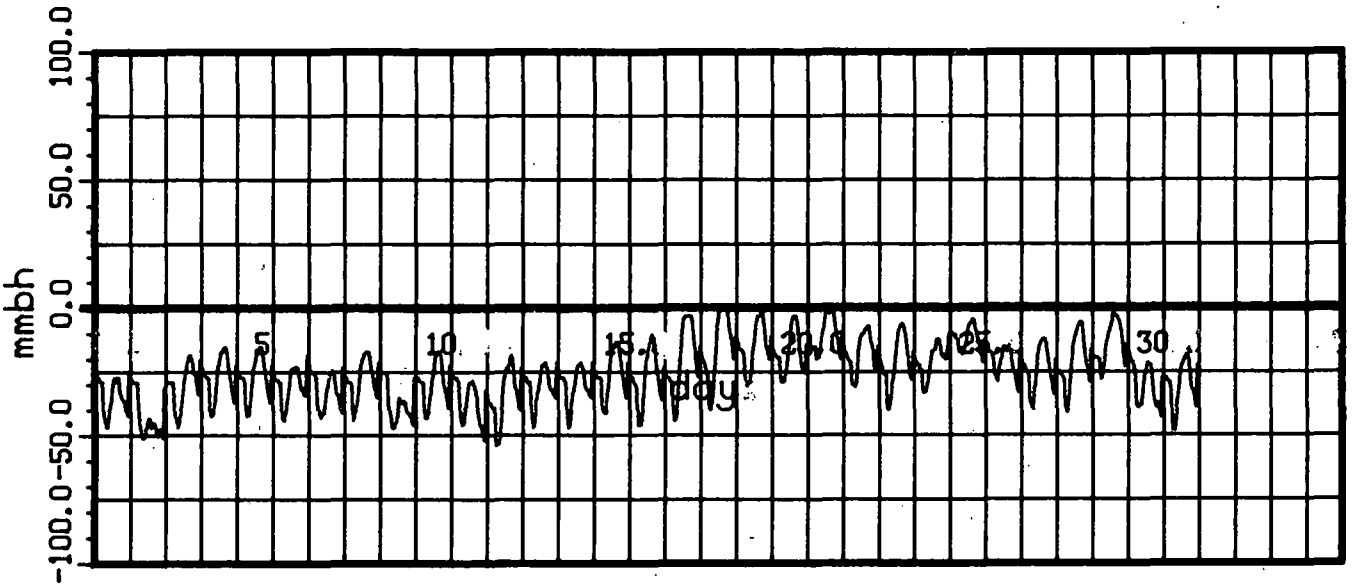


Figure 2

BUILDING THERMAL GAIN

mar



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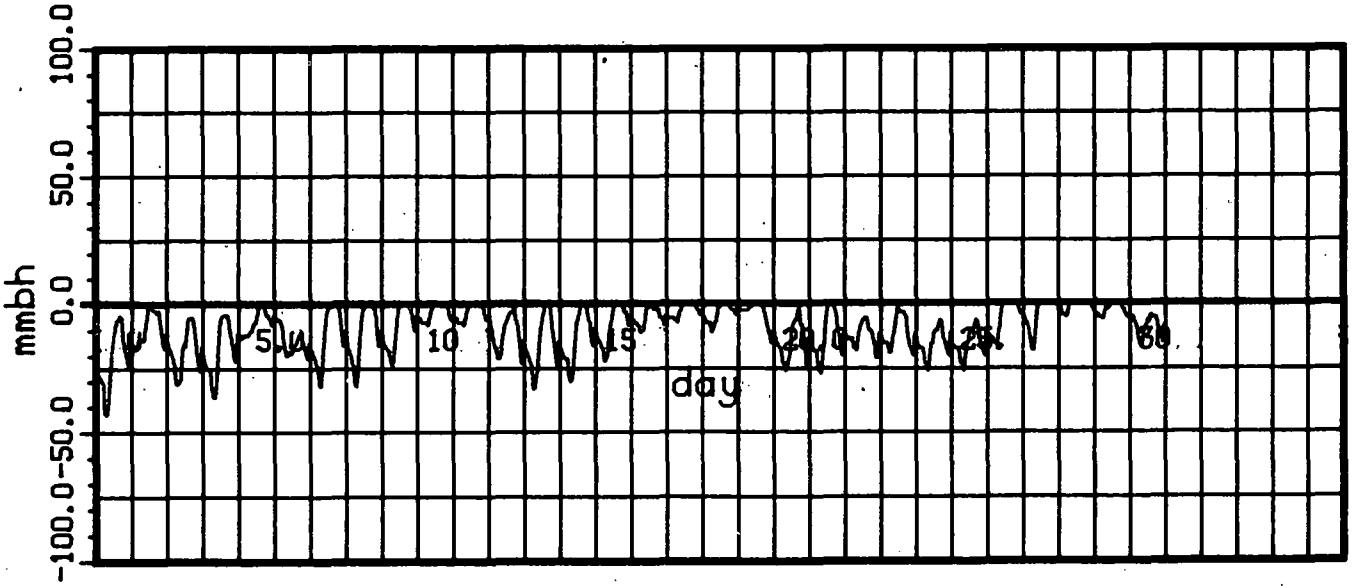
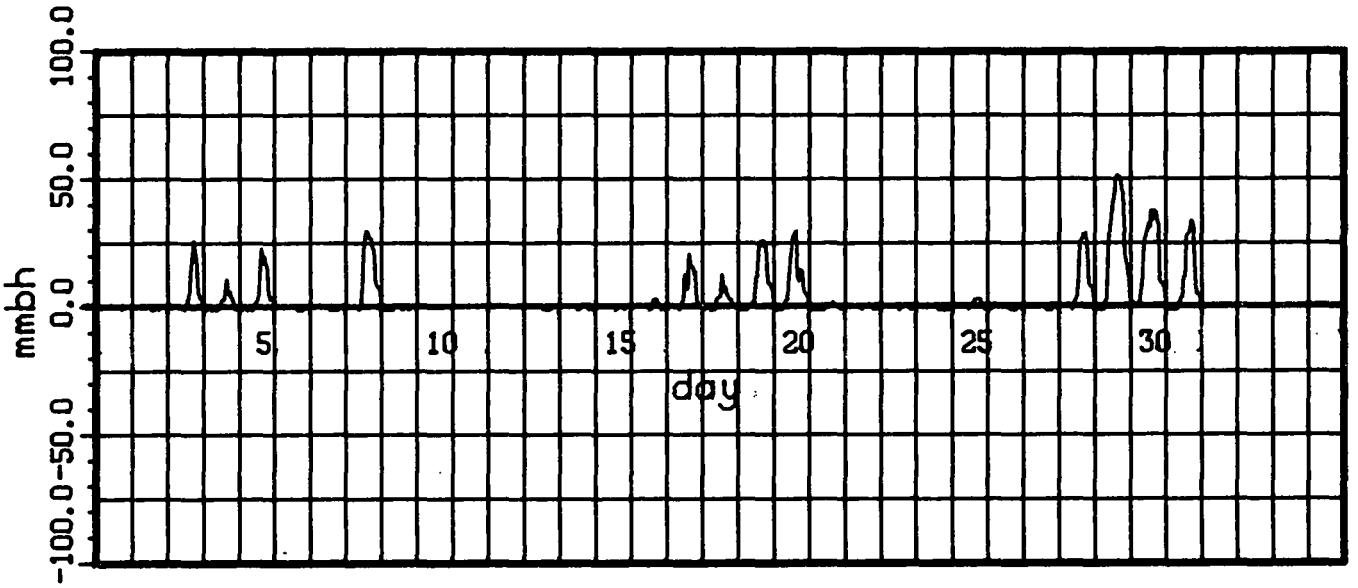


Figure 3

BUILDING THERMAL GAIN

may



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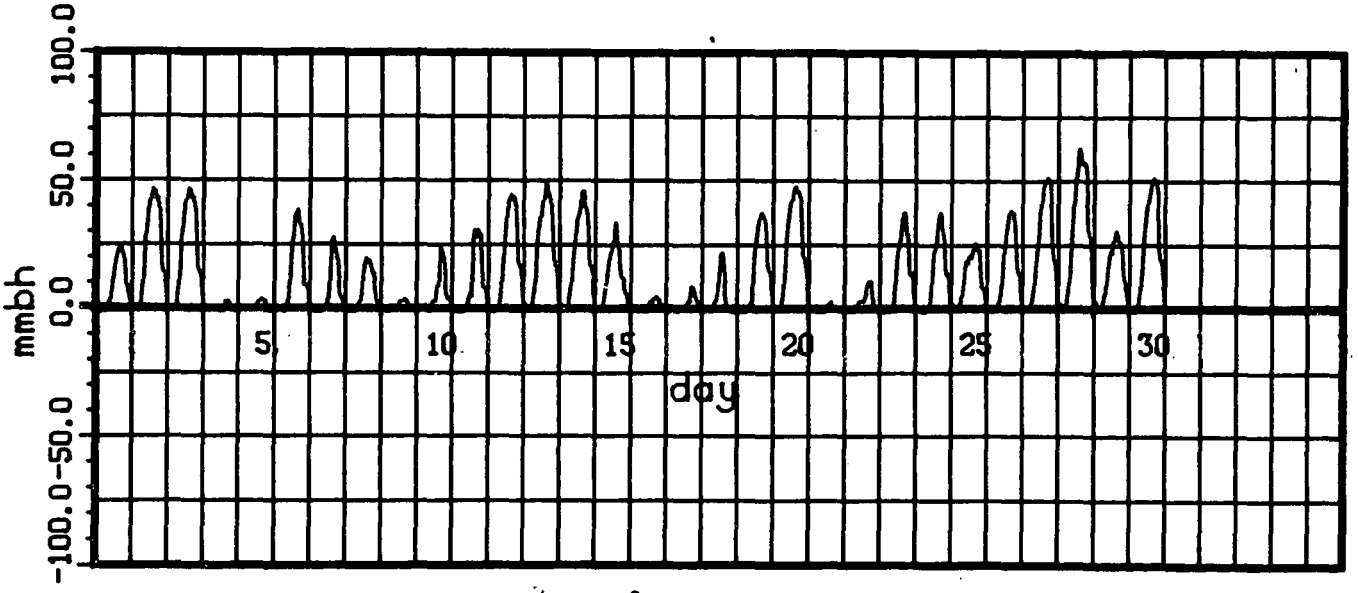
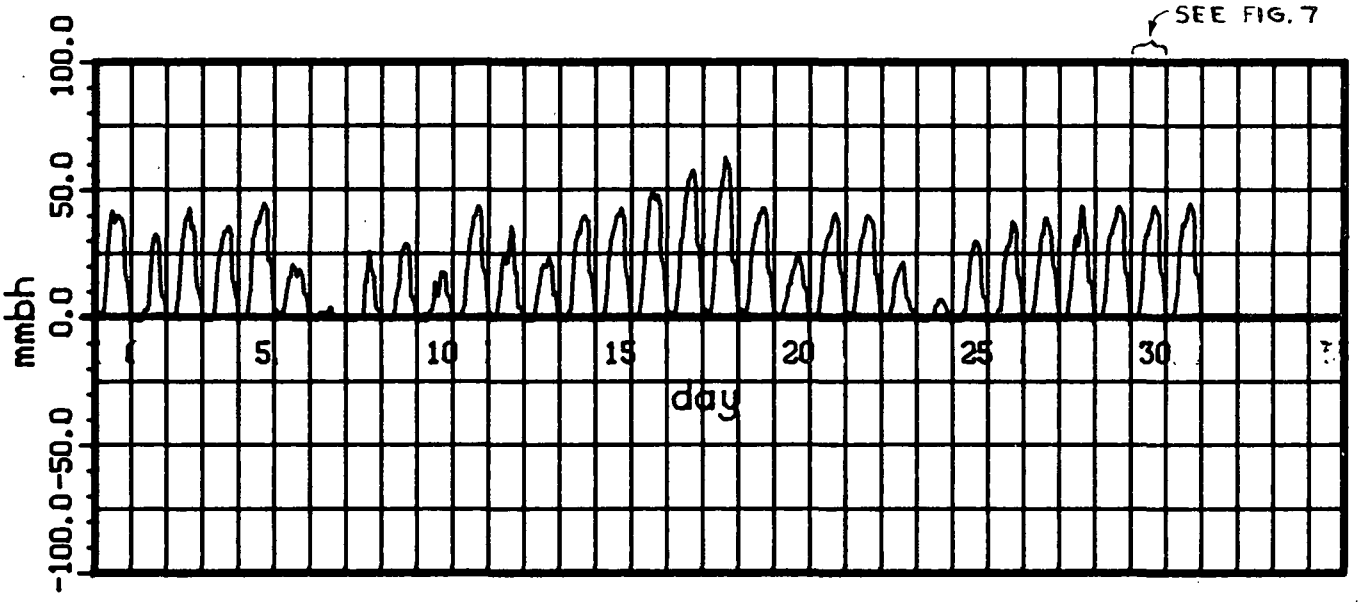


Figure 4

BUILDING THERMAL GAIN

jul



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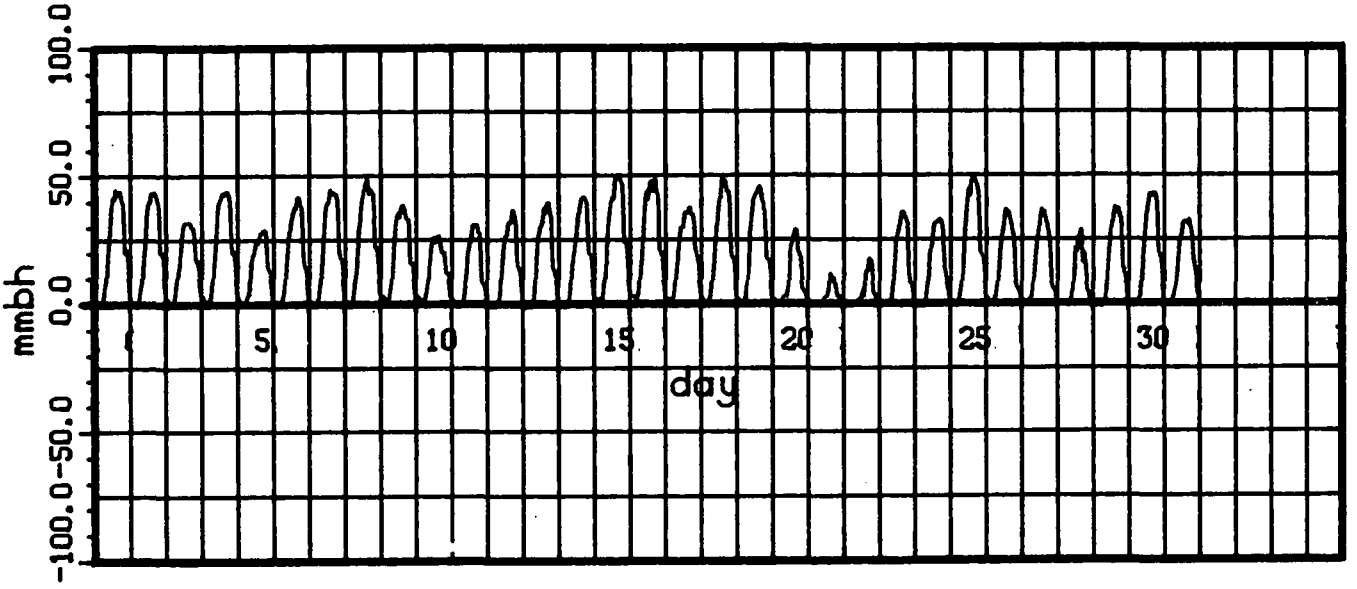
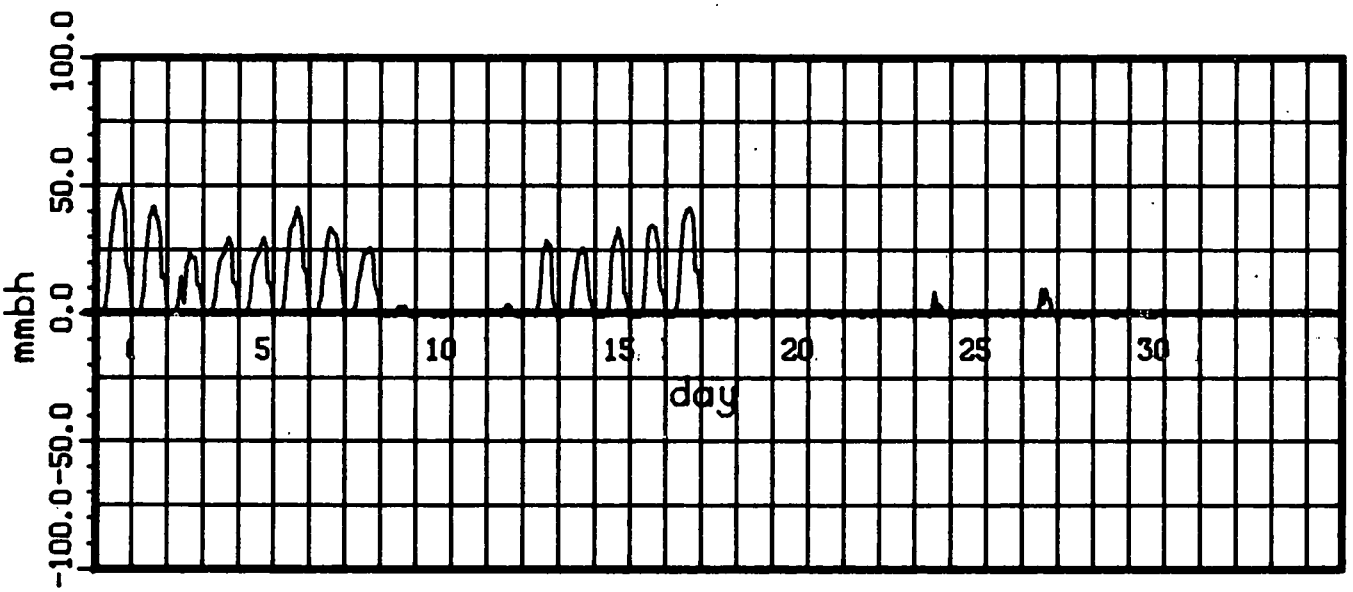


Figure 5

BUILDING THERMAL GAIN

sep



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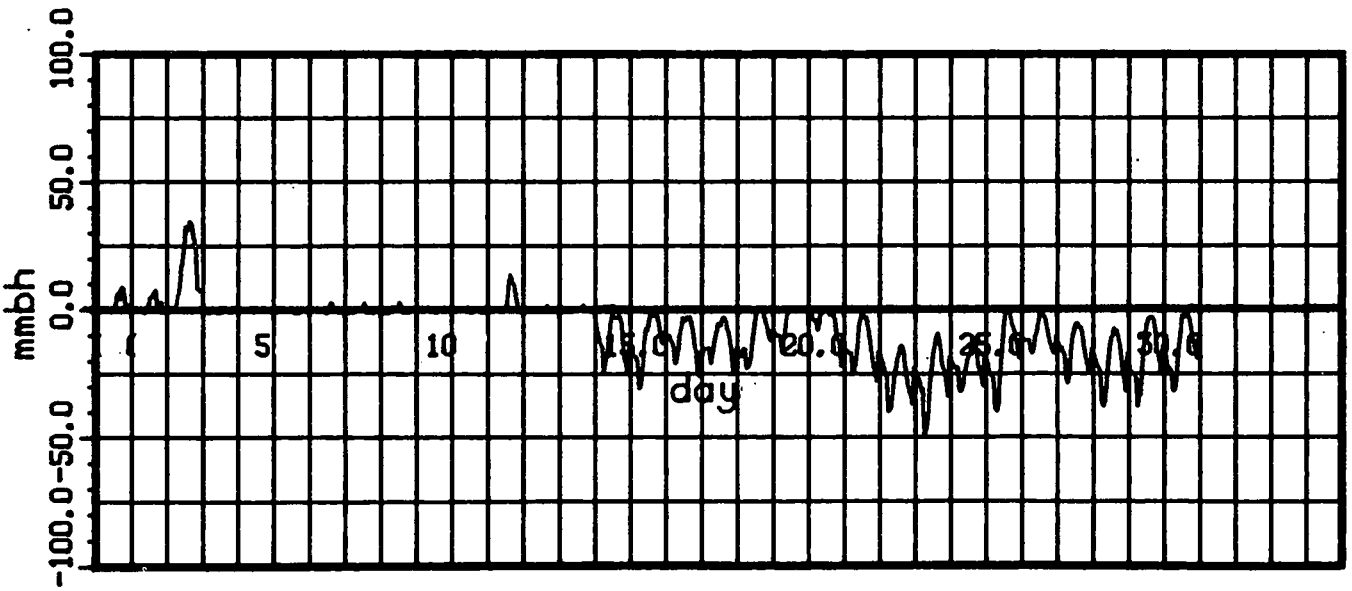
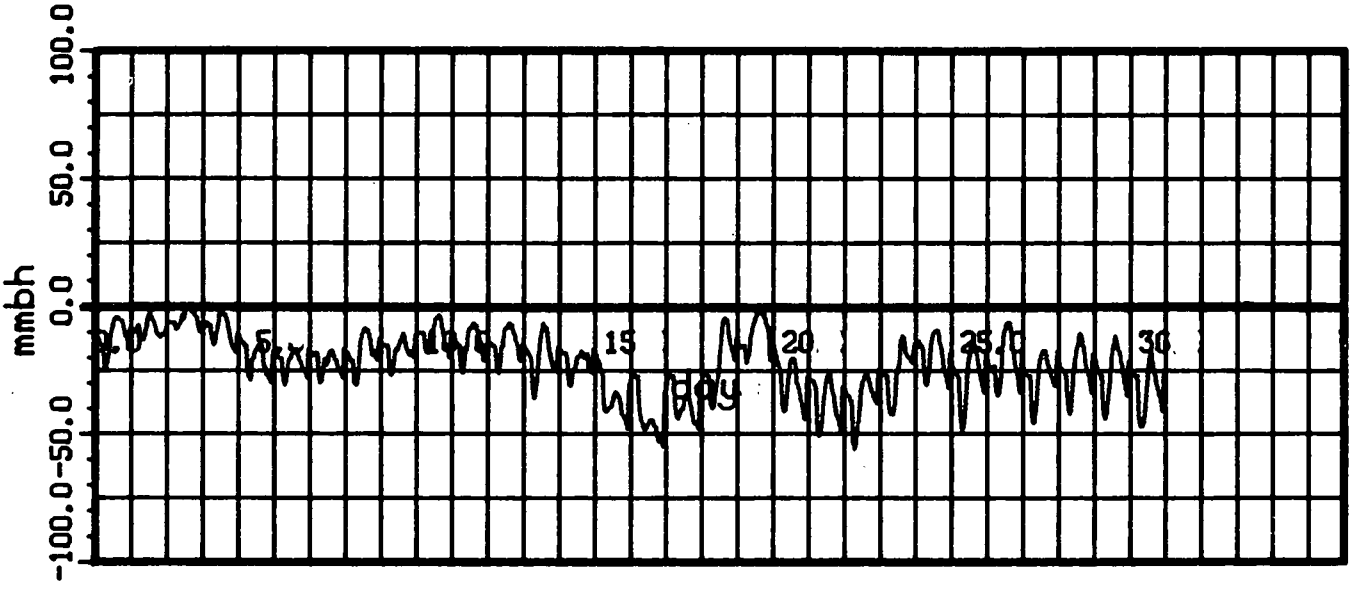


Figure 6

BUILDING THERMAL GAIN

nov



dec

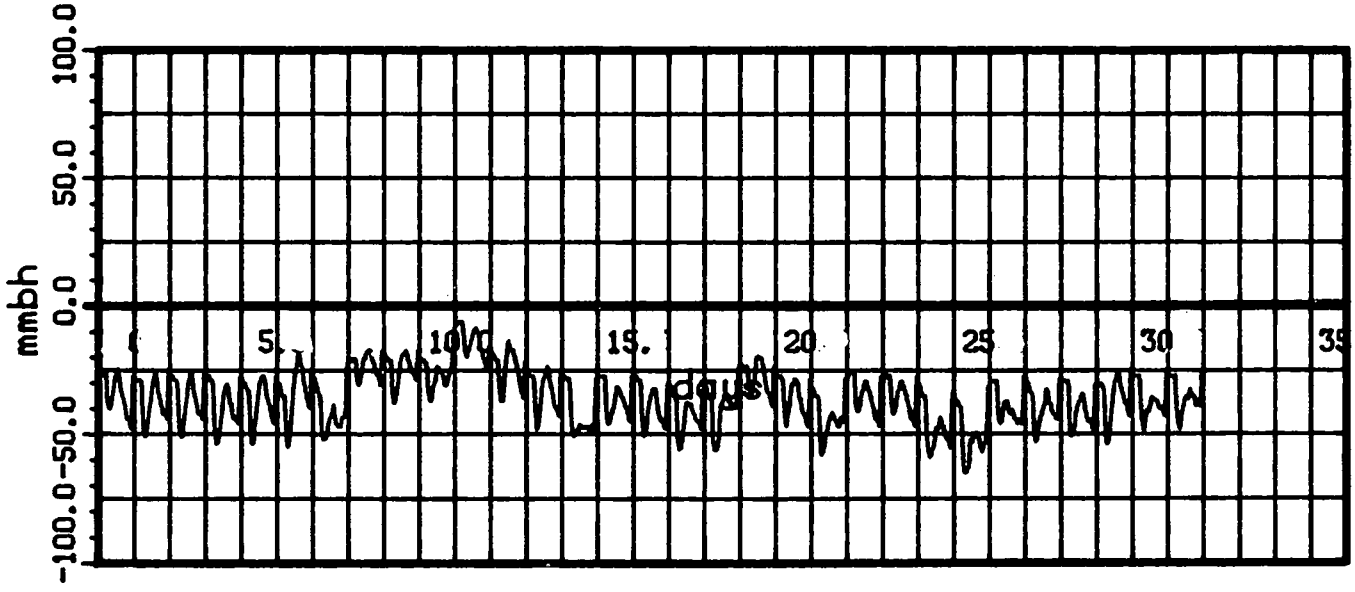
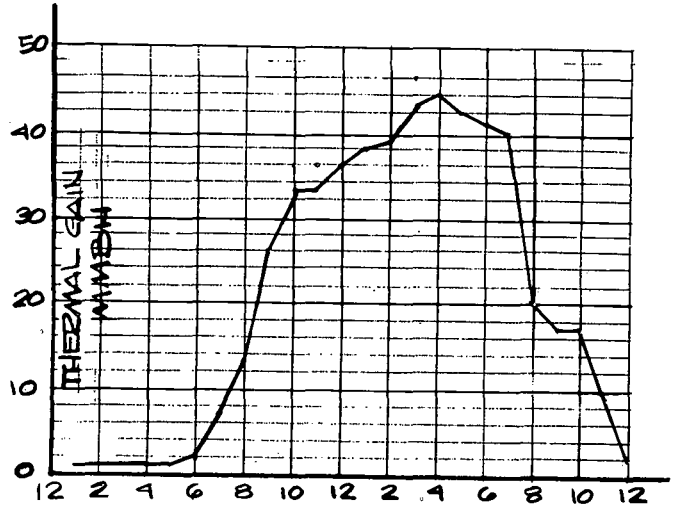


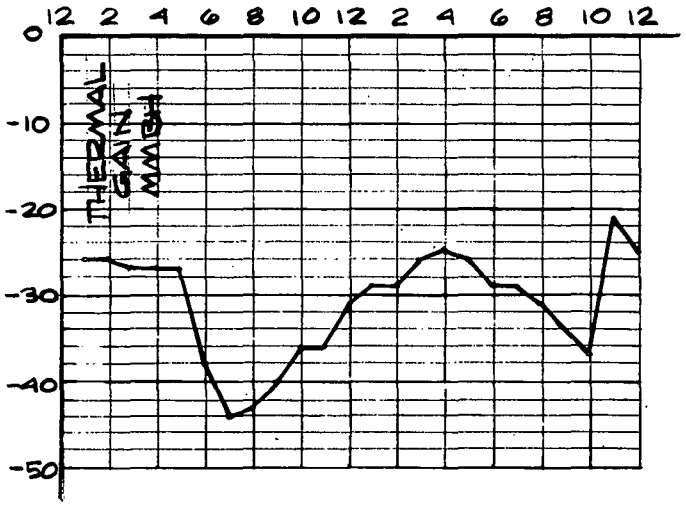
FIGURE 7

TYPICAL DAYS' THERMAL GAIN



JULY 30

FEB 3



D. Development of Steam Demand Profile Seen by ICES Plant

In order to simulate the effects of storage, the buildings were divided geographically into six groups as shown in Table 11. Each group consisting of new buildings was assumed to have a storage tank, a converter, and a two-stage absorption chiller. Groups of existing buildings, except the Kingsbury I group, were assumed to have only a storage tank and a converter. Kingsbury I was given a storage tank, a converter, and a single-stage absorption chiller (existing). Storage, converter, and chiller sizes are shown in Table 11.

A composite thermal profile was developed for each group as previously described. This profile represented the load seen by the storage-converter-chiller system. The storage simulation program then developed the profile of steam required at the input of the storage-converter-chiller system.

The following assumptions were used by the program.

1) Maximum hot water storage temperature = 205°F.*
2) Heating hot water is on an outdoor schedule. Temperature required at 0°F is 200°F dropping to 130°F at 65°F.
3) Minimum chilled water storage temperature = 40°F.
4) Maximum chilled water storage temperature = 48°F.
5) 1024 Btu available per pound of steam (125 psi in; 200°F out).
6) Part-load efficiencies of chillers as shown in Figures 8 and 9. (Straight lines used in simulation.)

For each hour, the program does the following:

Winter (summer is similar except that there is no schedule):

1) If storage is "full" (i.e., if storage temperature is 205°F), and demand is less than coverter capacity, run converter to satisfy demand. No change in storage temperature.

2) If storage is full and demand exceeds converter capacity run converter at capacity and take deficiency from storage. Calculate new storage temperature.

3) If storage is not full and not empty (i.e., storage temperature greater than required heating water temperature), run converter at capacity. Put excess capacity into storage or take deficiency from storage. Calculate new storage temperature.

4) If storage is empty (i.e., if storage temperature is less than required heating water temperature), run converter at capacity. Take deficiency from storage even though this will create an unrealistically low storage temperature. Calculate new storage temperature. Increment deficiency-hour counter.

*Actual temperature will be 199°F. The inaccuracy caused by using 205°F in the simulation is very slight.

The program keeps track of the number of hours for which the demand could not be satisfied. Equipment sizes shown in Table 11 were selected to keep this number less than 10. Most of these hours occur late at night.

After determining the demand on the chiller or converter, the program calculates the steam required and stores this number for every hour. In this way, a steam-demand profile was developed for each group.

A domestic hot water profile was developed using the information in Table 12. This profile was factored to match the total domestic hot water energy usage estimated for the existing and proposed buildings.

The six group profiles and the domestic hot water profile were summed to obtain the total steam demand on the ICES Plant. A plot of this profile is shown in Figures 10 through 15. Figure 16 shows two typical days expanded.

TABLE 11

STORAGE GROUPS

	Storage (gal)	Converter (mmBh)	Chiller (mmBh)
Group 1	165,000	13.5	23.5
Luther Arms Detention Fire House Justice Justice Commercial Kingsbury II Mercer County Court			
Group 2	55,000	5.5	12.5
Capitol I Capitol I P.O. Civic Center			
Group 3	25,000	2.0	5.0
DEP			
Group 4	55,000	6.0	6.5
Kingsbury I L.R. Kingsbury I H.R.			
Group 5	120,000	10.5	0
Labor and Industry Health and Agriculture			
Group 6	210,000	18	0
State House Complex			

TABLE 12

DOMESTIC HOT WATER PROFILES
(Btuh/sq ft)

	Non-residential			Residential
hr	Weekday	Saturday	Sunday	Any Day
1	0	0	0	0.92
2	0	0	0	0.83
3	0	0	0	0.75
4	0	0	0	0.83
5	0	0	0	0.75
6	0	0	0	0.75
7	0	0	0	0.83
8	0.55	0.28	0	1.0
9	0.55	0.28	0	1.67
10	0.5	0.25	0	1.5
11	0.55	0.28	0	1.3
12	0.9	0.45	0	1.2
13	0.6	0.3	0	1.2
14	0.8	0.4	0	1.83
15	0.7	0.35	0	0.83
16	0.75	0.38	0	0.83
17	0.3	0.15	0	1.83
18	0.3	0.15	0	1.0
19	0.5	0.75	0	1.3
20	0.05	0.03	0	1.5
21	0	0	0	1.3
22	0	0	0	1.1
23	0	0	0	0.92
24	0	0	0	1.2

From Edison Electric Institute AXCESS data.

FIGURE 8

SINGLE-STAGE ABSORPTION CHILLER

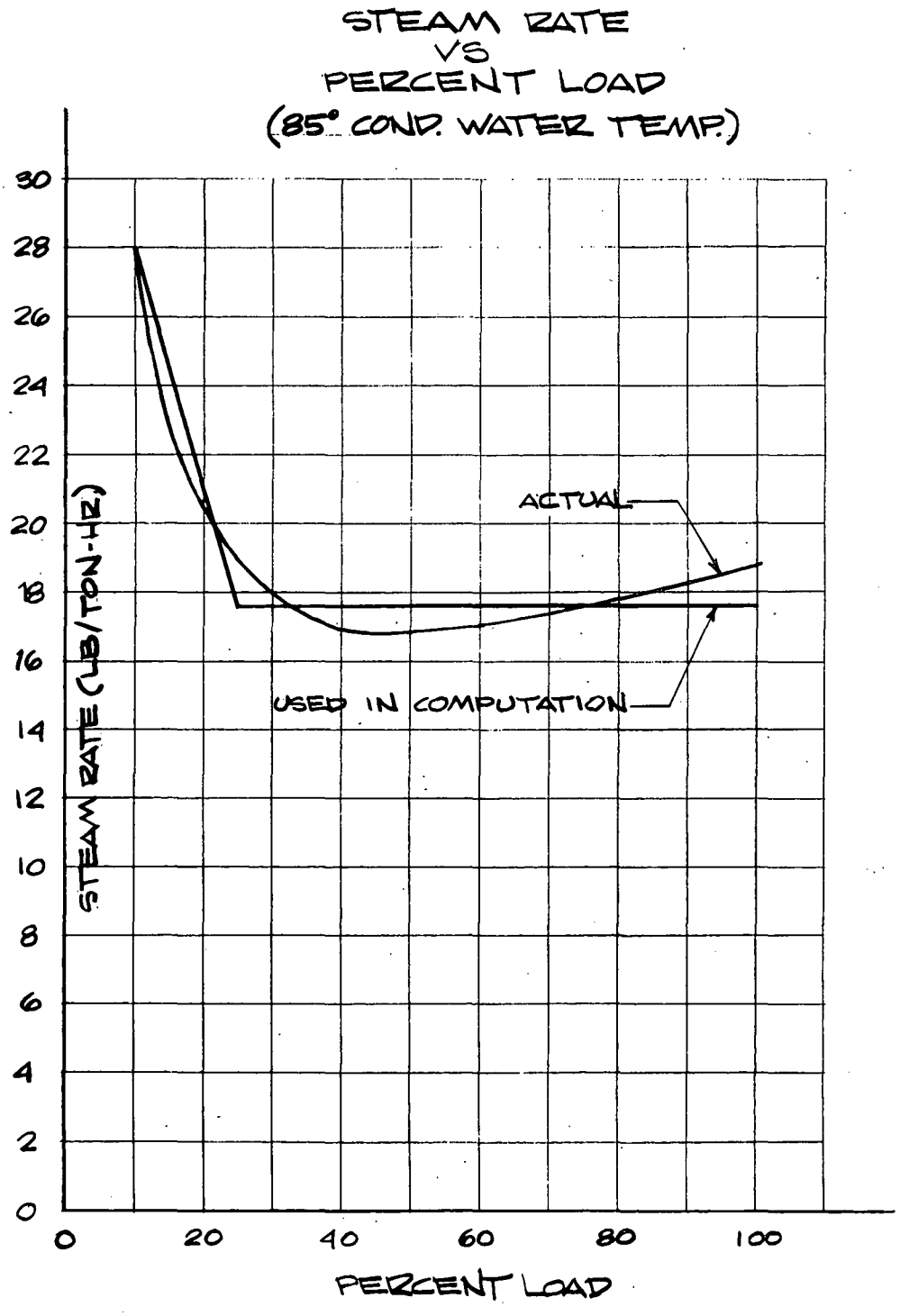


FIGURE 9

TWO-STAGE ABSORPTION CHILLERS

STEAM RATE VS PERCENT LOAD (85° COND. WATER TEMP.)

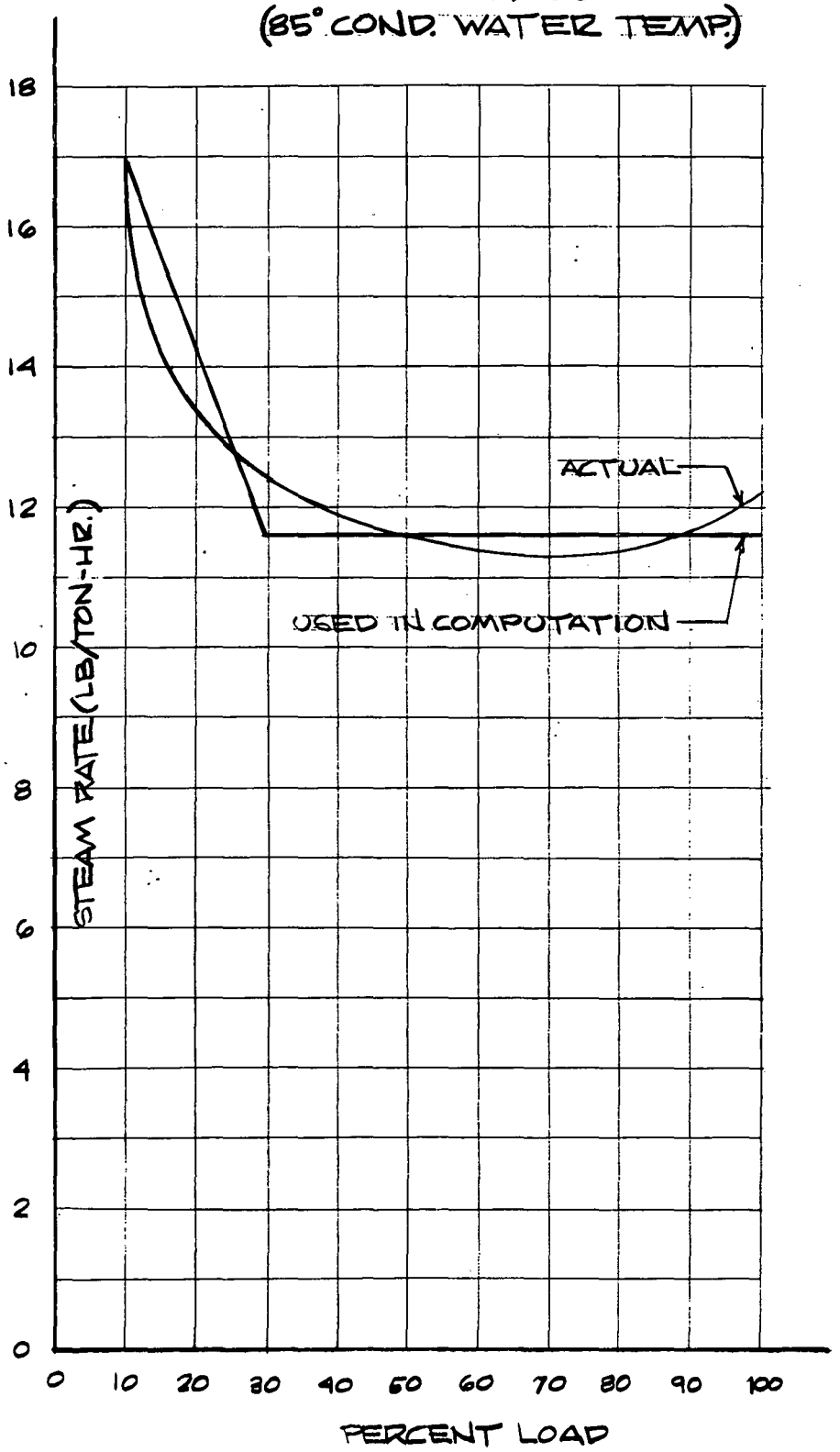


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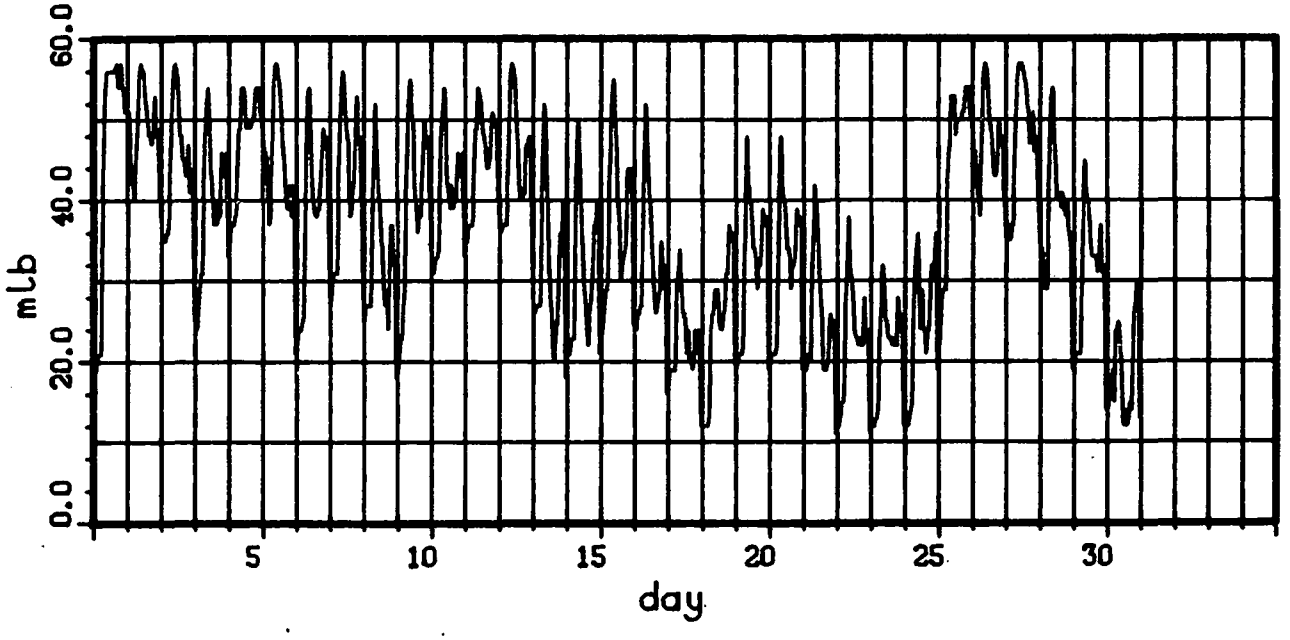
Figure 10

STEAM DEMAND

jan



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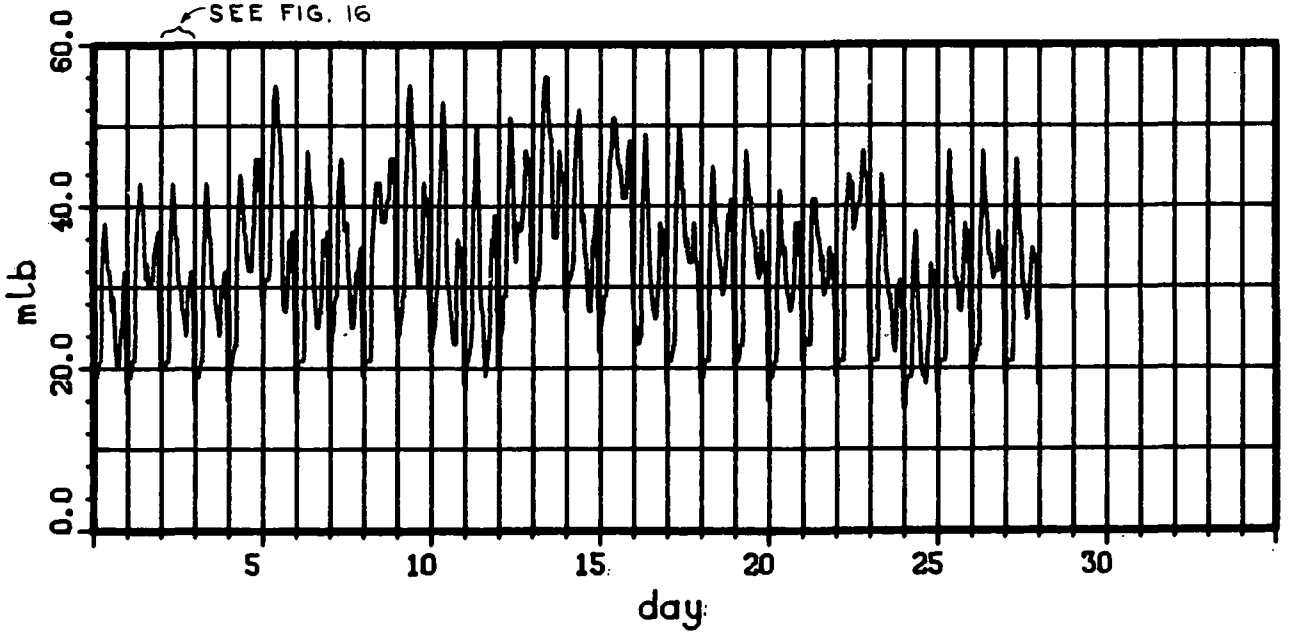
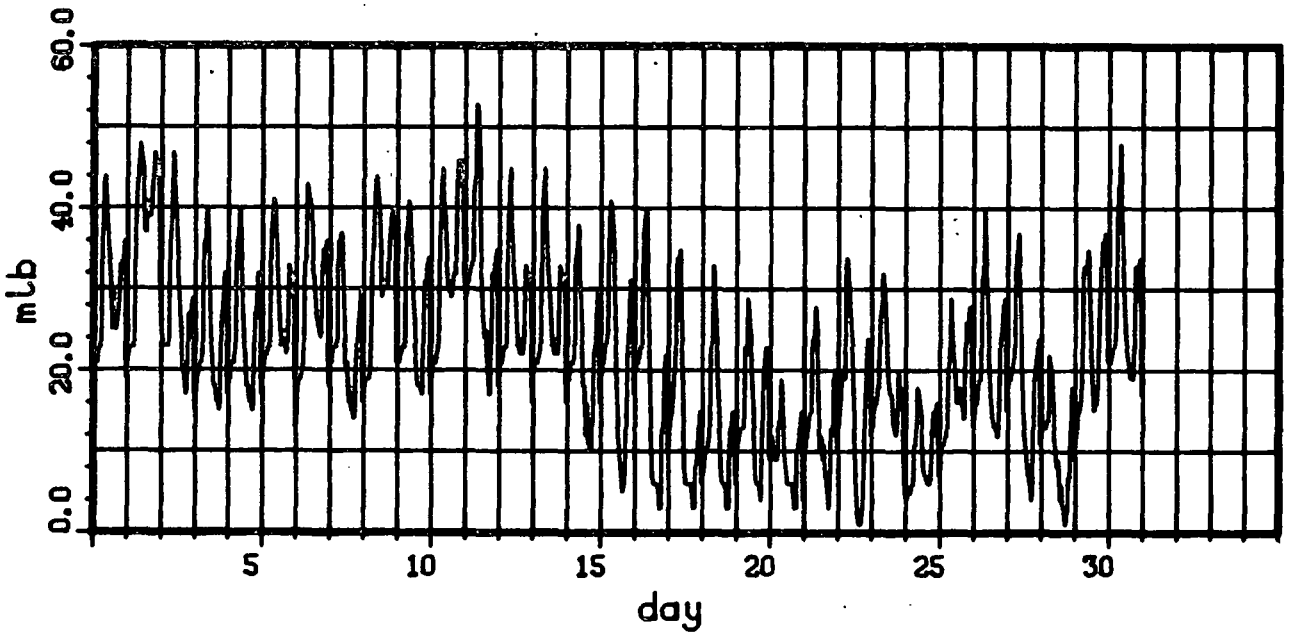


Figure 11

STEAM DEMAND

mar



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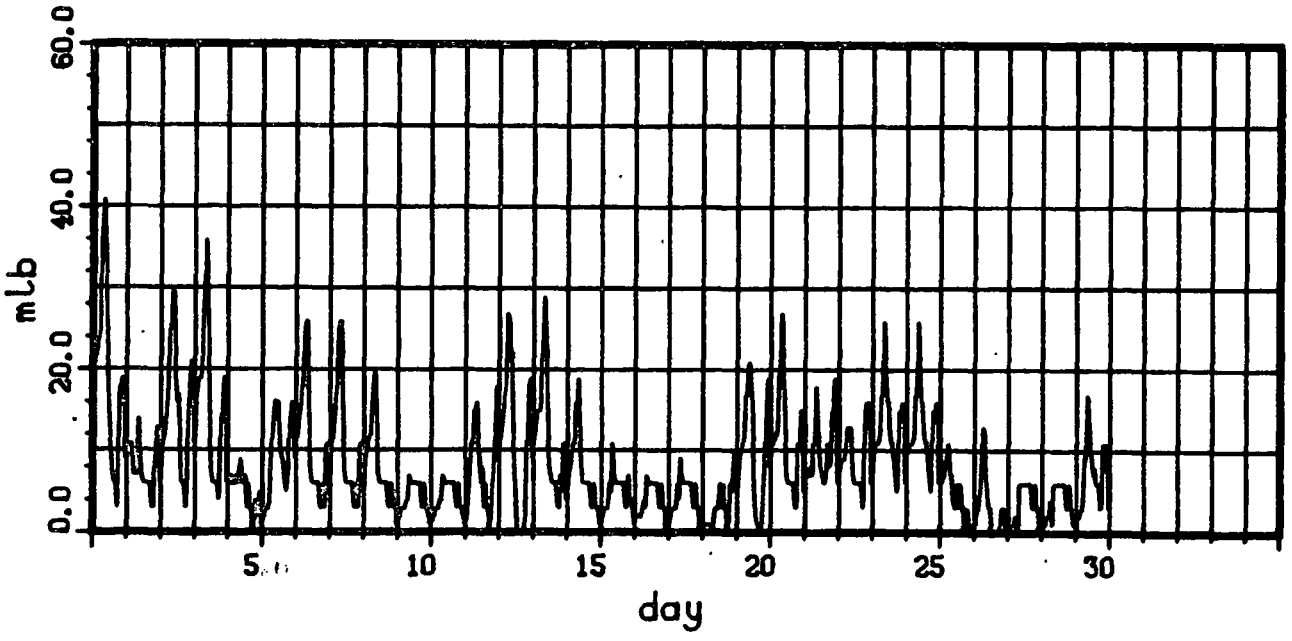
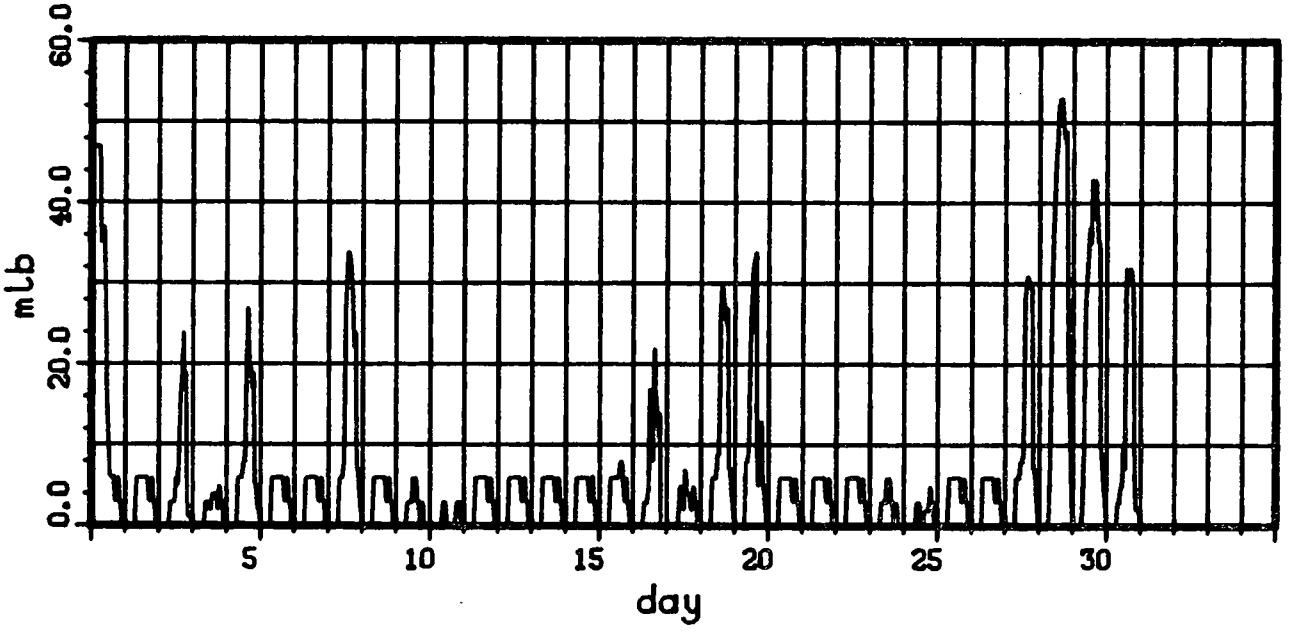


Figure 12

STEAM DEMAND

may



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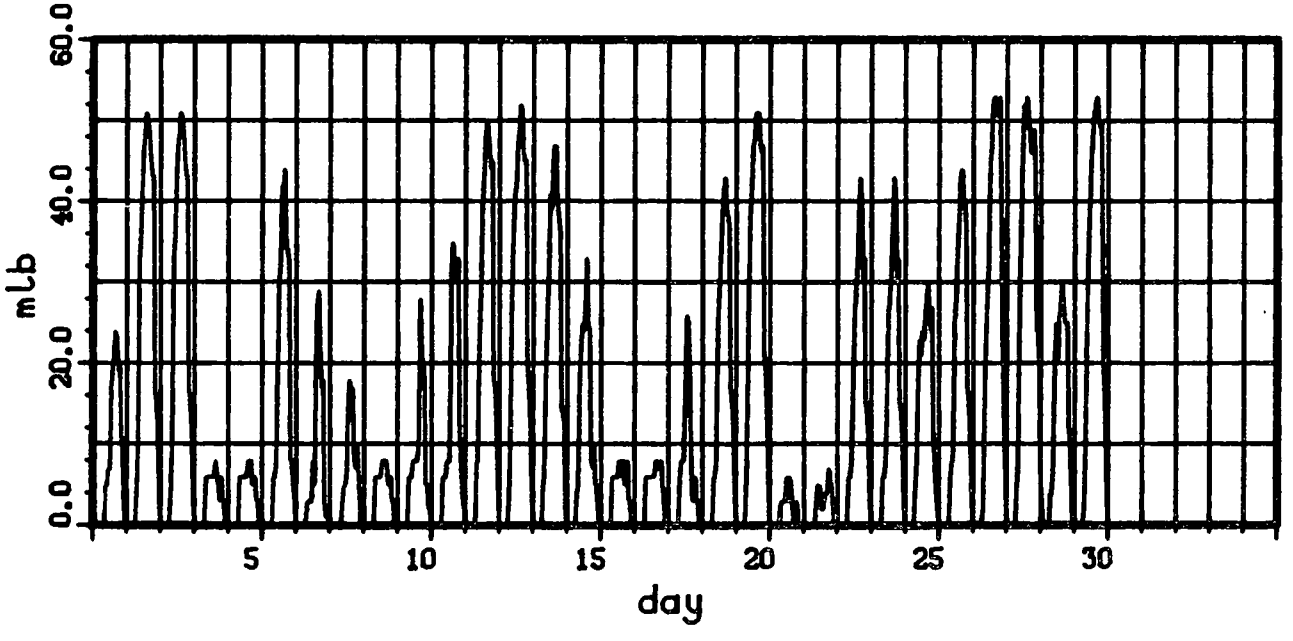
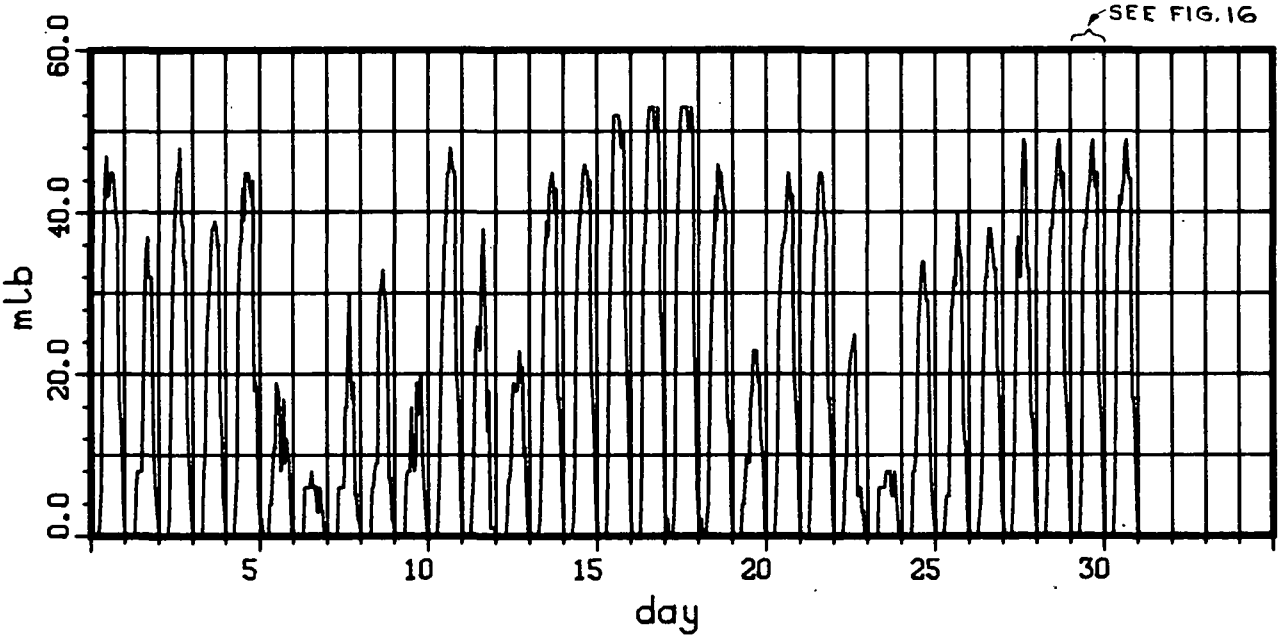


Figure 13

STEAM DEMAND

jul



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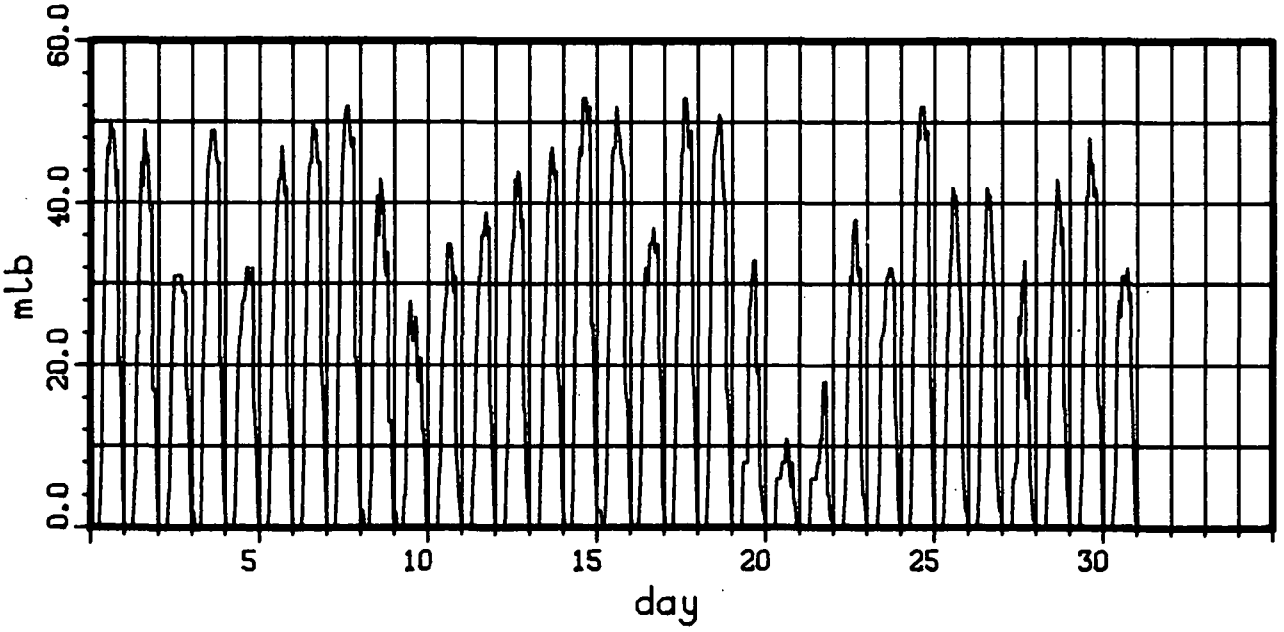
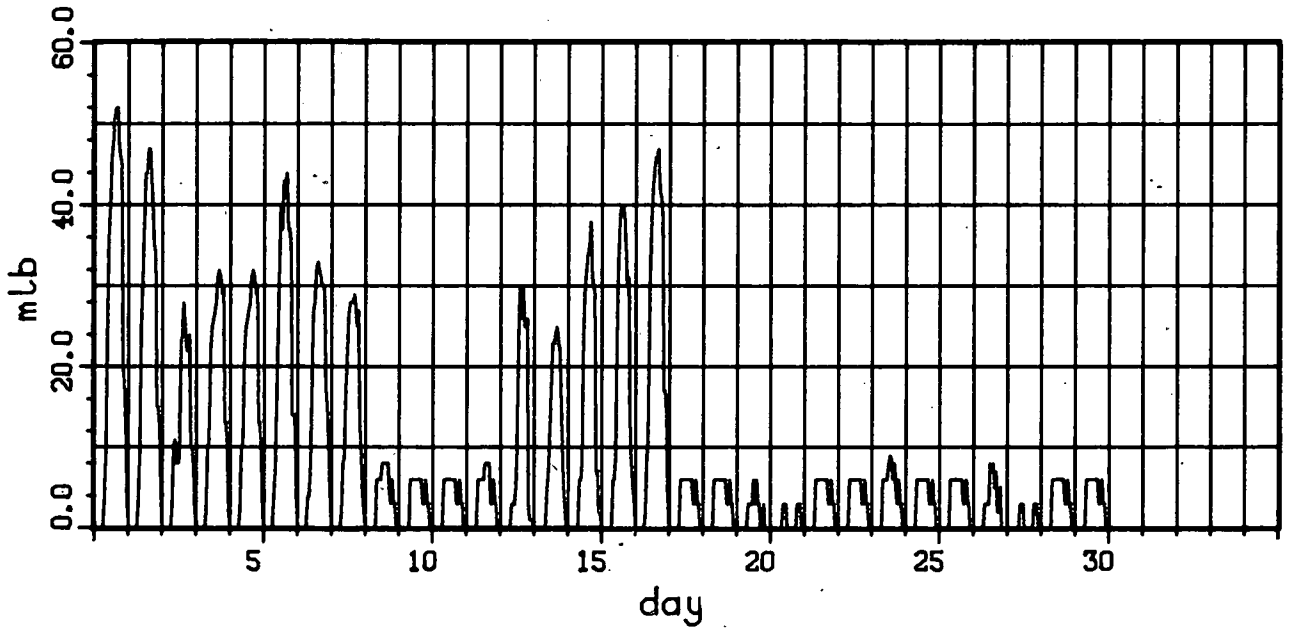


Figure 14

STEAM DEMAND

sep



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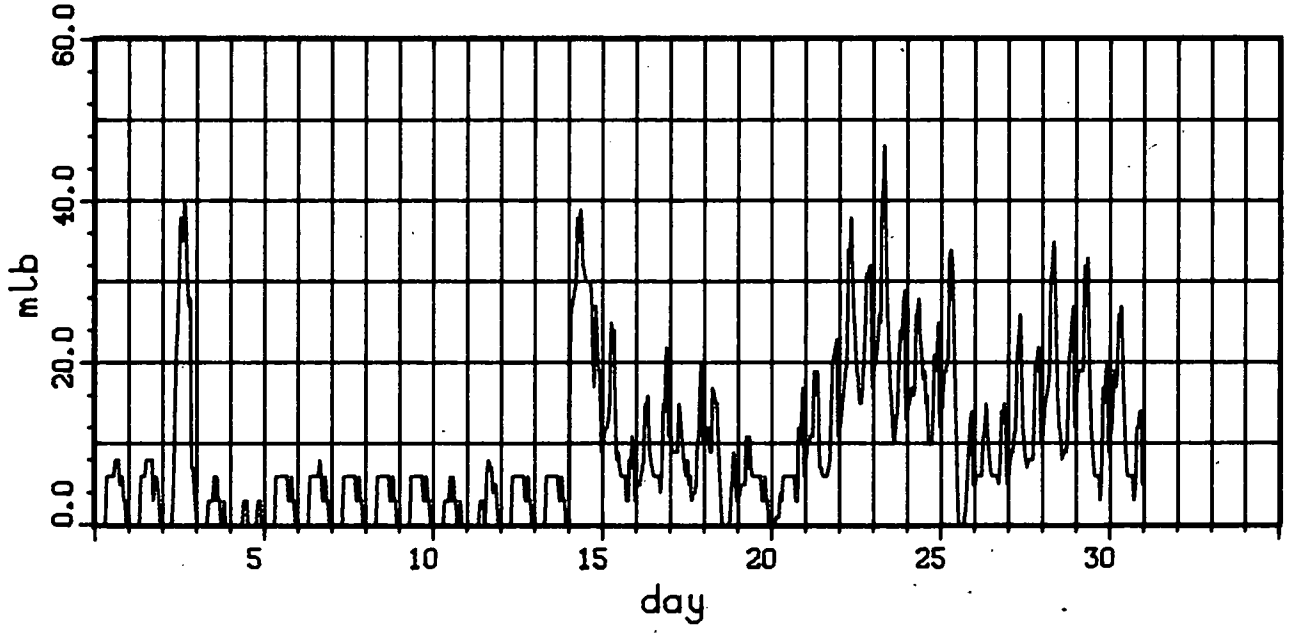
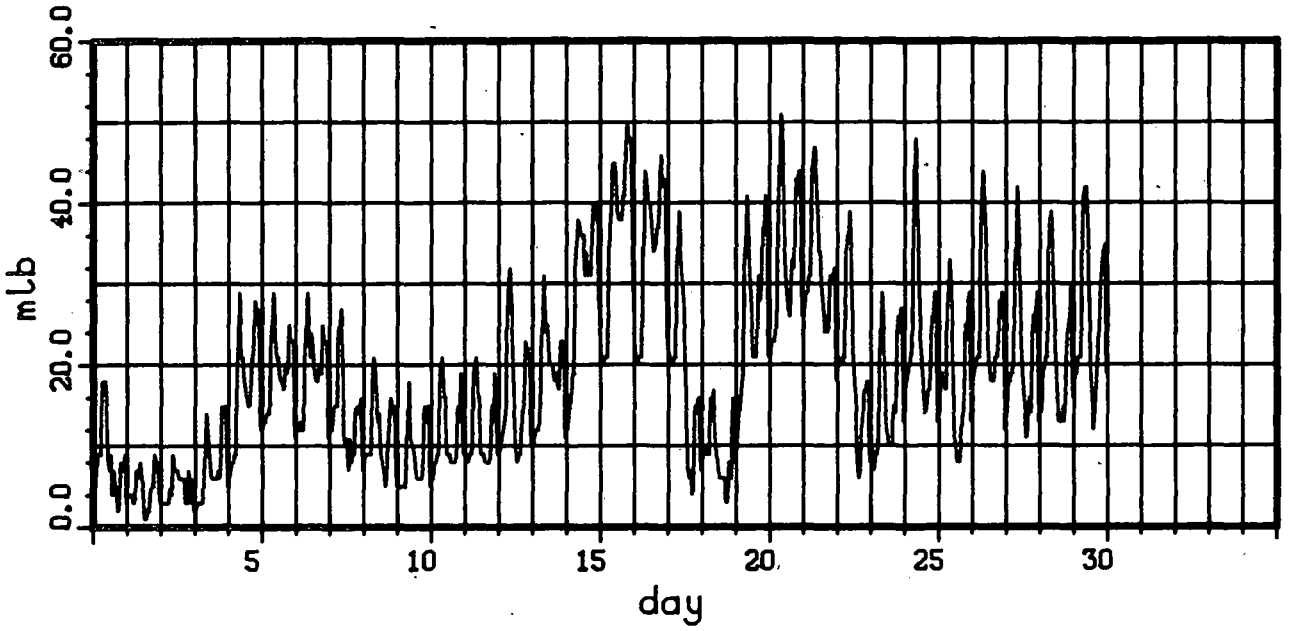


Figure 15

STEAM DEMAND

nov



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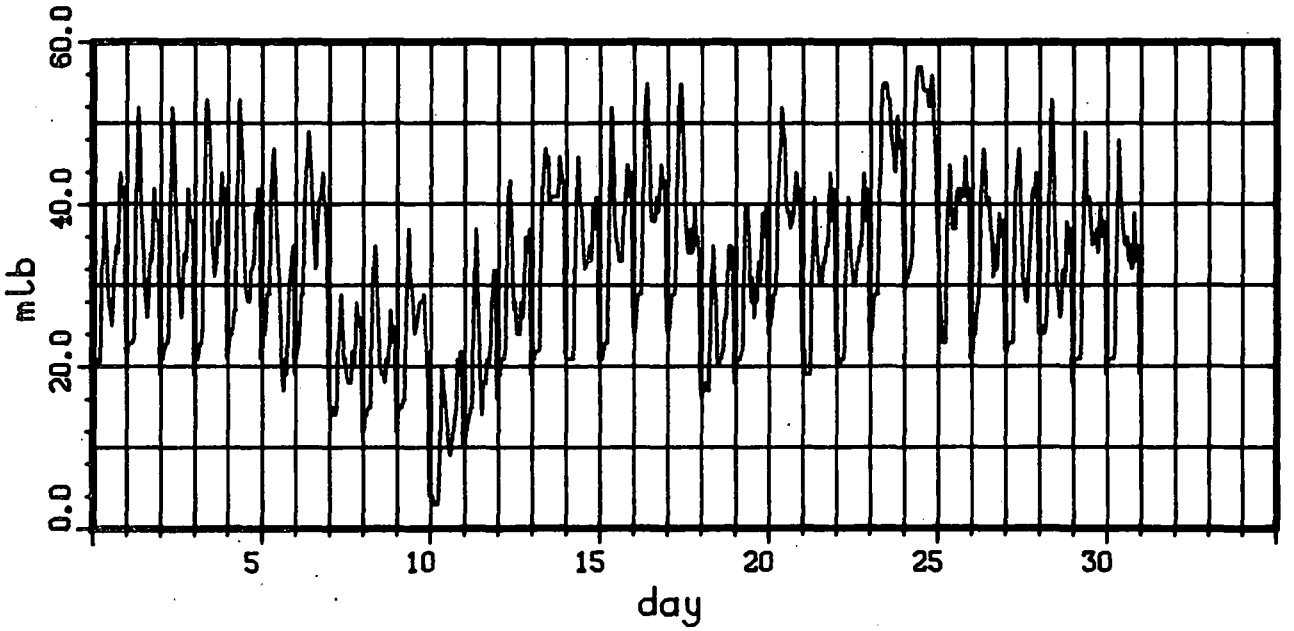
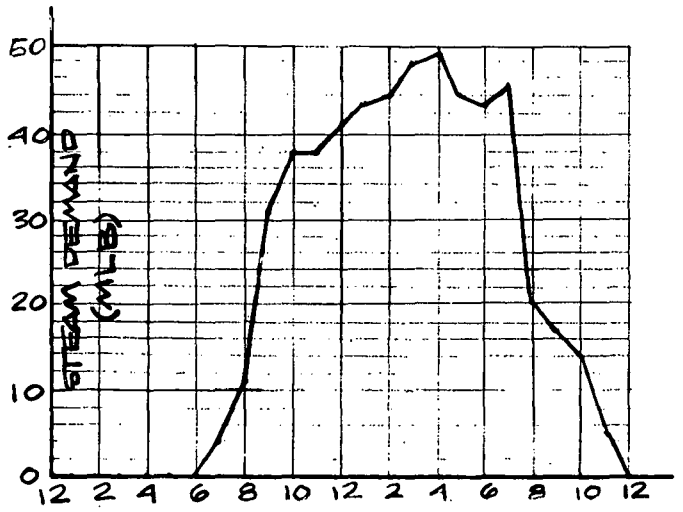
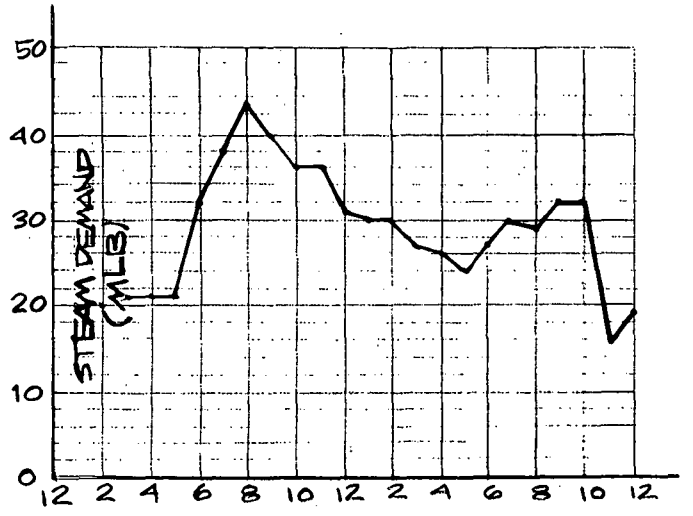


FIGURE 16

TYPICAL DAYS' STEAM DEMAND



JULY 30



FEB 3

E. Plant Simulation, Electric Generation Profile, and Fuel Consumption

Having developed the steam demand (Figures 10 through 15) we were able to calculate the oil burned and electricity generated. Steam distribution losses were taken to be 2,000 lb/hr all year.

The plant was assumed to operate with four 2.5 mW gas turbine units and one 32,000 lb/hr boiler. Assumed part-load turbine performance is shown in Figure 17. The overall boiler efficiency was taken to be 70 percent. For each hour of the year, the computer determined how many turbines would be running. This number was always the lowest possible. The demand was distributed evenly among the operating units. If the steam demand exceeded the capacity of the four turbines, the boiler would supply the deficiency. It was necessary to run the boiler only 52 hours. Electricity generated and oil burned were calculated from Figure 17, which was approximated in the program by straight lines. Figures 18 through 23 show the electric generation profile. Figure 24 shows two typical days expanded.

The results of this analysis, which assumed 100 percent availability of all equipment, are shown in Table 13. Figures used in the economic analysis were developed from the figures in this table using the following failure analysis technique.

An availability of 85 percent was used. That is, it was assumed that any gas-turbine module would be operational 85 percent of the time. With this assumption, the probability of one or more units' being available is 0.9995; two or more, 0.9880; three or more, 0.8786; and 4, 0.5101.

From the electric generation profile, the computer developed the following figures:

Amount generated by the first unit on line - 14,920,055 kWh
Amount generated by the second unit on line - 9,044,320 kWh
Amount generated by the third unit on line - 4,472,420 kWh
Amount generated by the fourth unit on line - 1,026,440 kWh

Applying the above availability factors to these generation figures gives a total generation of 28,079 mWh. Steam generation remains the same, since the boiler supplies the deficiency when necessary. However, there is an overall decrease in the amount of oil burned. Oil consumption drops to 73,364 barrels.

TABLE 13

SUMMARY OF RESULTS

Mo	8 am - 8 pm			8 pm - 10 pm			10 pm - 8 am		
	Wkdy	Sat	Sun	Wkdy	Sat	Sun	Wkdy	Sat	Sun
Electricity (mWh)									
1	1946	298	381	318	51	69	1250	202	250
2	1506	285	346	254	46	61	975	204	203
3	1012	204	286	192	40	61	821	193	223
4	465	48	66	79	8	18	402	51	80
5	594	107	30	49	4	6	106	11	8
6	1136	205	156	99	19	16	81	21	13
7	1504	265	158	132	18	20	110	21	16
8	1444	371	281	112	26	29	96	28	22
9	753	132	101	63	7	12	63	12	11
10	590	72	47	101	14	11	385	60	58
11	840	237	227	167	42	44	616	187	165
12	1734	278	348	301	51	59	1058	203	208
Total									29,465
Steam (1000 lb)									
1	11527	1758	2238	1877	300	402	7402	1197	1474
2	8912	1686	2044	1505	270	361	5779	1209	1202
3	6027	1217	1699	1146	238	359	4884	1150	1324
4	2836	306	415	485	51	108	2457	321	484
5	3595	664	211	313	32	40	811	106	80
6	6739	1220	935	605	115	94	652	153	118
7	8901	1571	938	796	112	121	833	157	126
8	8542	2195	1674	674	159	176	737	207	172
9	4516	796	620	398	48	75	561	104	99
10	3572	450	307	617	85	68	2397	379	363
11	5008	1413	1353	996	252	262	3679	1118	985
12	10257	1646	2056	1775	299	350	6279	1201	1232
Total									176,840
Oil (bbl)*									
1	5019	769	982	821	130	177	3223	520	645
2	3885	734	892	656	118	158	2513	526	523
3	2610	525	737	496	103	157	2117	499	576
4	1199	122	170	202	20	45	1037	132	205
5	1531	277	78	127	10	15	271	27	19
6	2930	528	401	256	48	40	208	53	32
7	3878	683	406	340	47	53	283	55	40
8	3723	956	726	288	67	76	247	73	58
9	1941	341	260	163	18	31	161	30	28
10	1522	187	120	261	35	28	992	156	148
11	2165	611	585	430	110	113	1587	482	425
12	4472	718	897	775	131	153	2728	524	537
Total									75,958

* Does not include 23 barrels used in boiler.

FIGURE 17

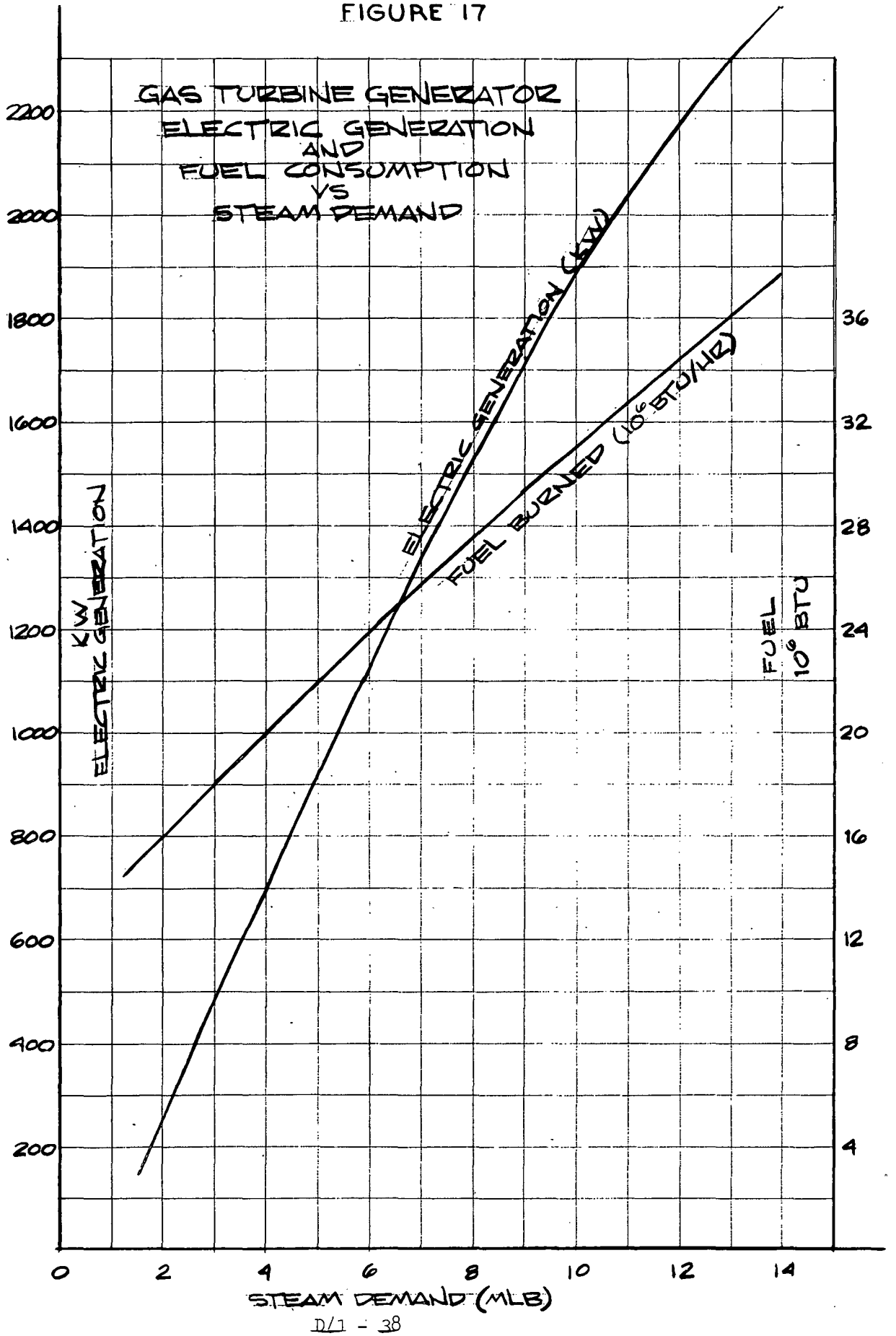
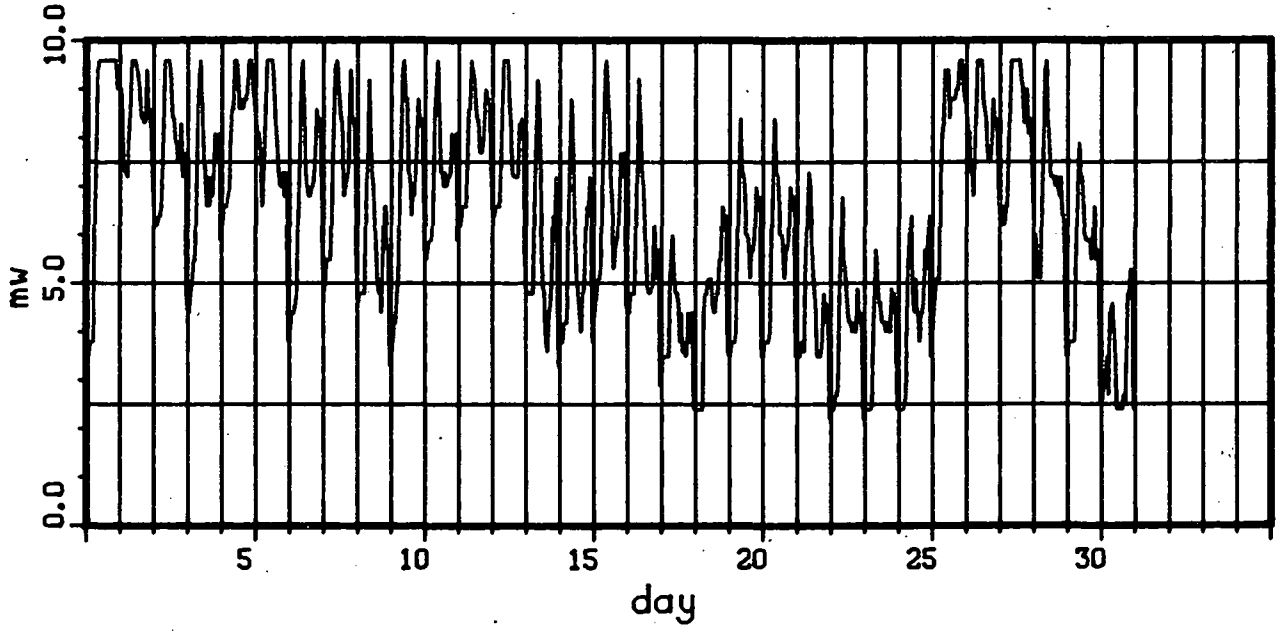

GAS TURBINE GENERATOR
ELECTRIC GENERATION
AND
FUEL CONSUMPTION
VS
STEAM DEMAND
ELECTRIC GENERATION (KW)
FUEL BURNED (10⁶ BTU/HR)
ELECTRIC GENERATION KW
FUEL 10⁶ BTU
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
36
32
28
24
20
16
12
8
4
0
2
4
6
8
10
12
14
STEAM DEMAND (MLB)

Figure 18

ELECTRIC GENERATION

jan



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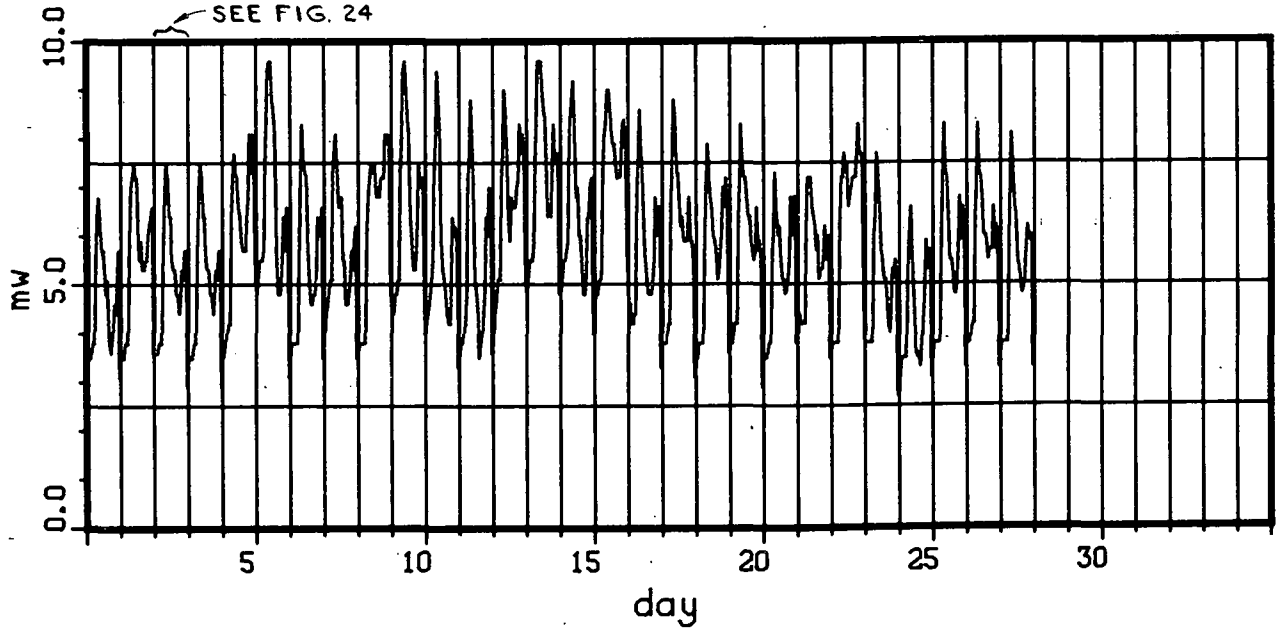
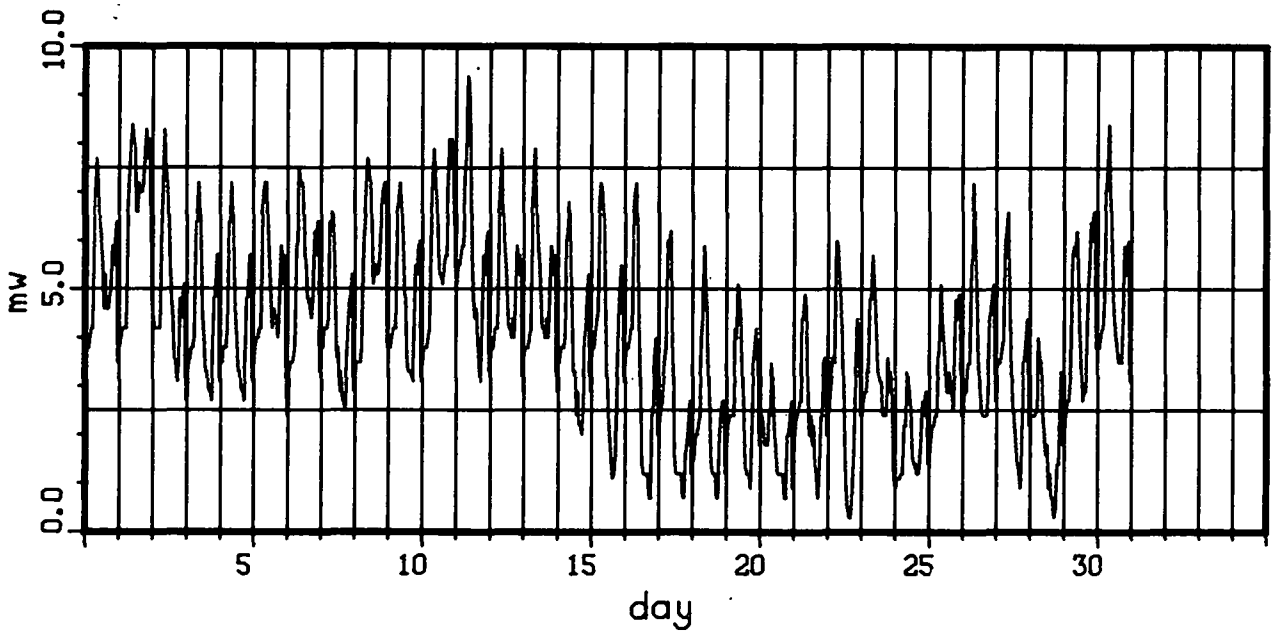


Figure 19

ELECTRIC GENERATION

mar



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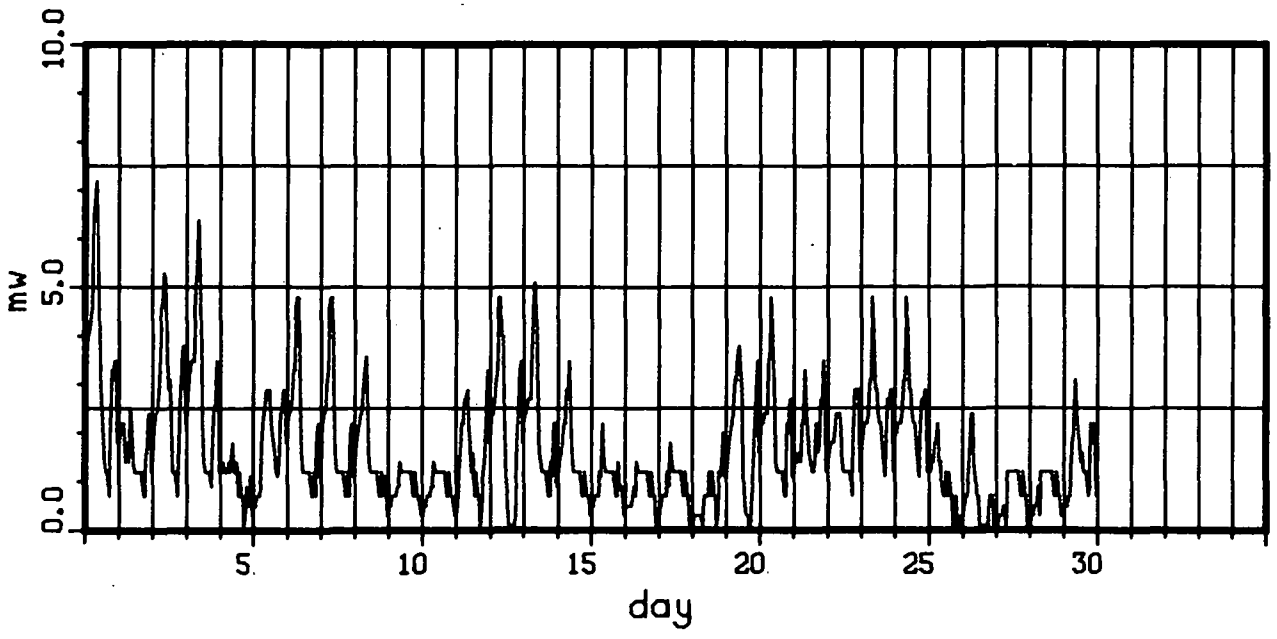
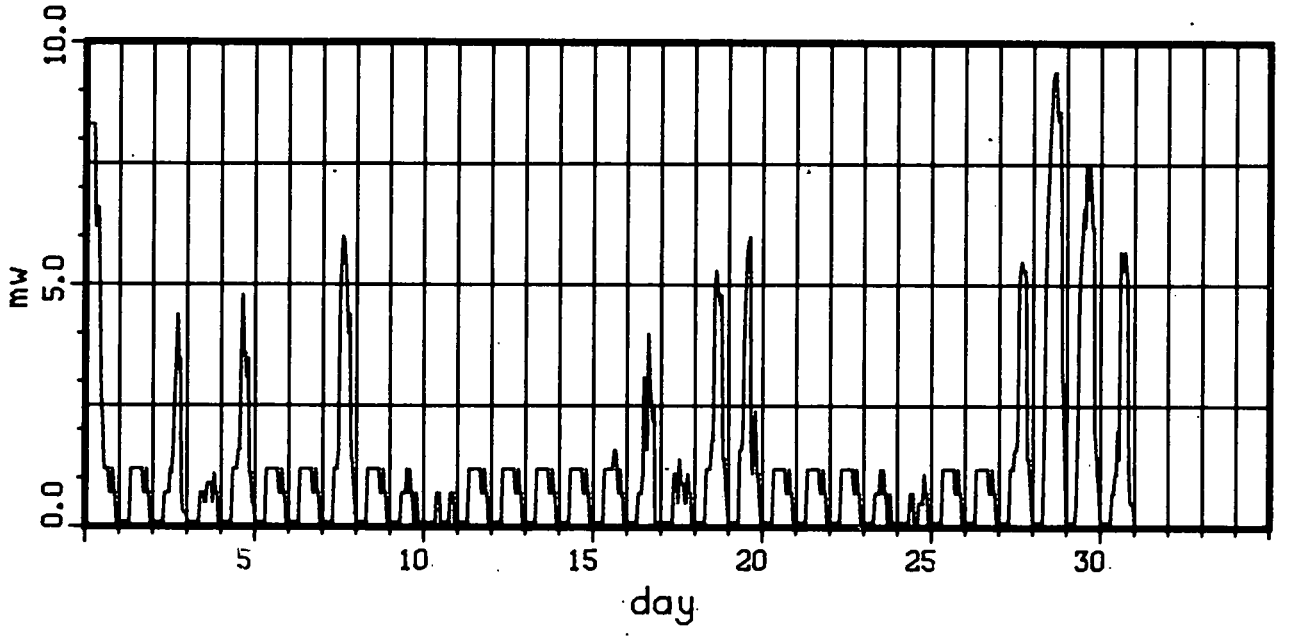


Figure 20

ELECTRIC GENERATION

may



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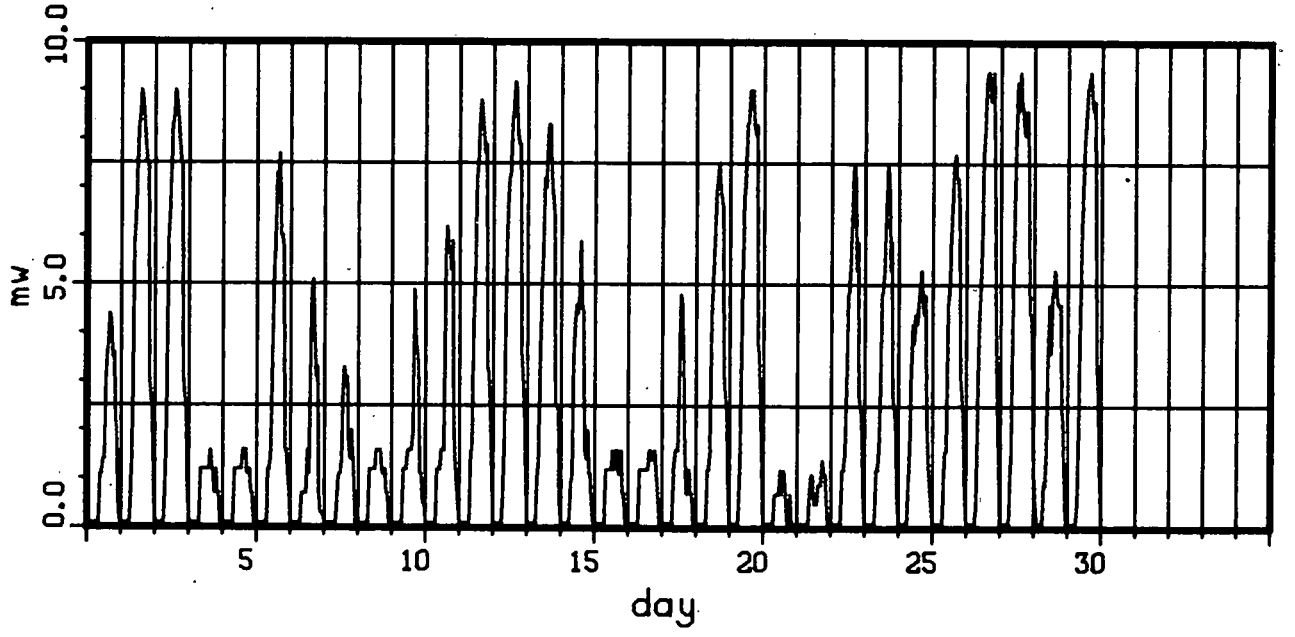
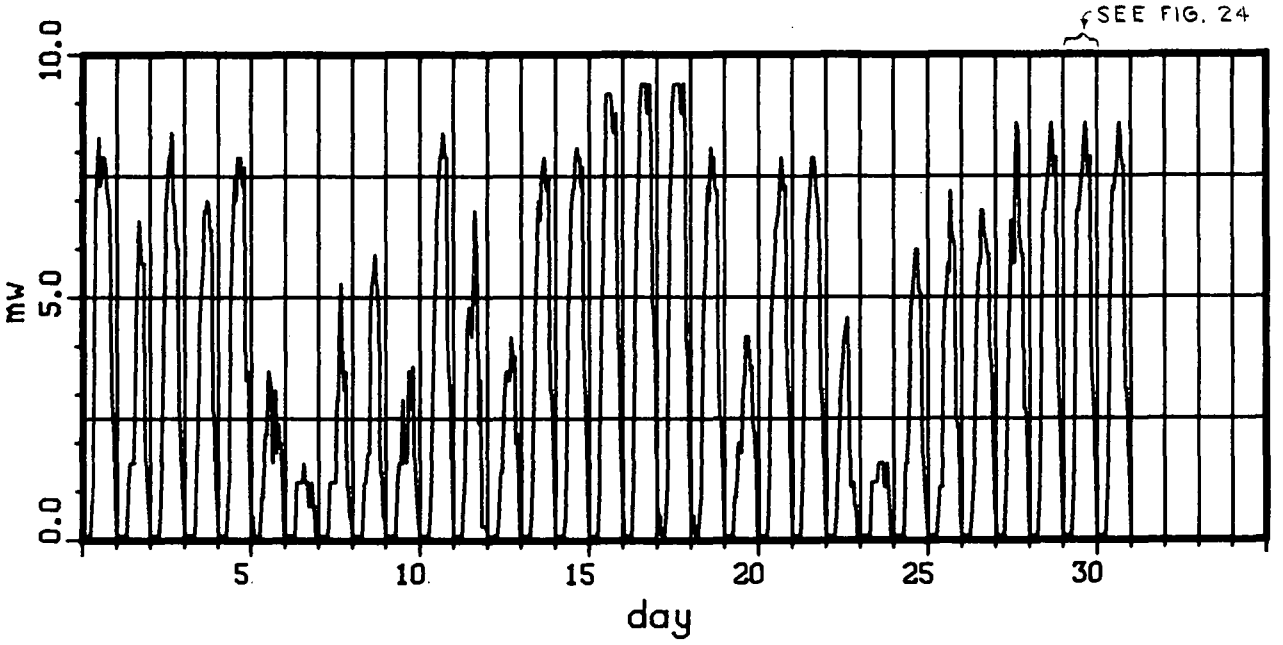


Figure 21

ELECTRIC GENERATION

jul



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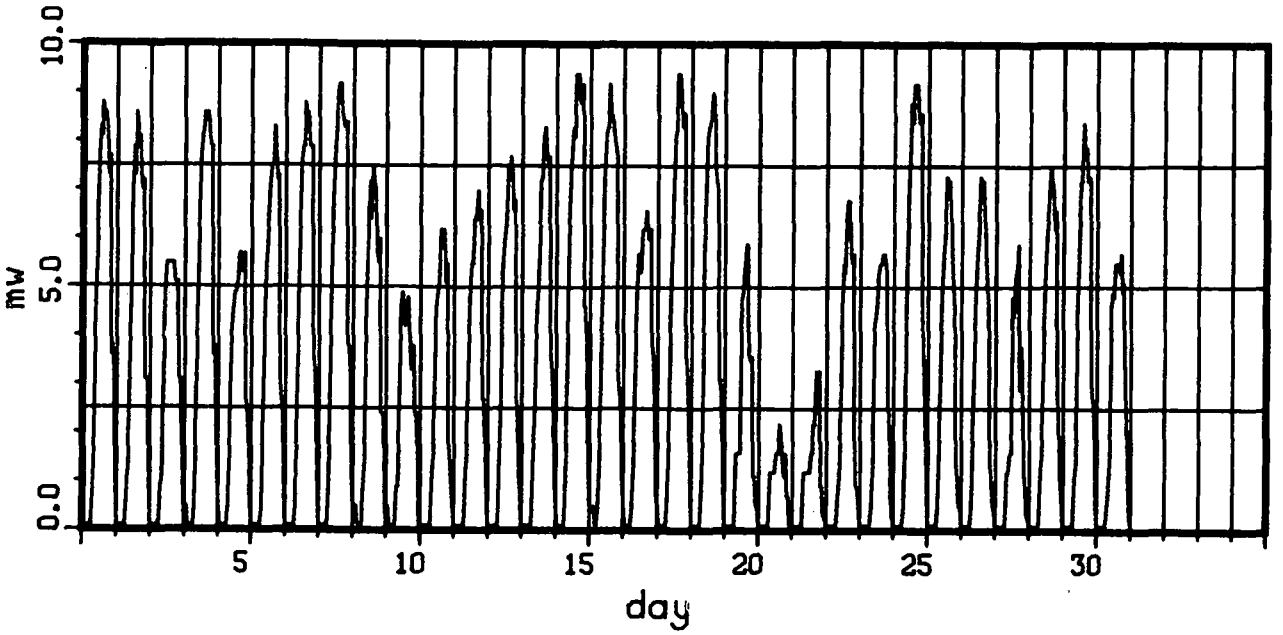
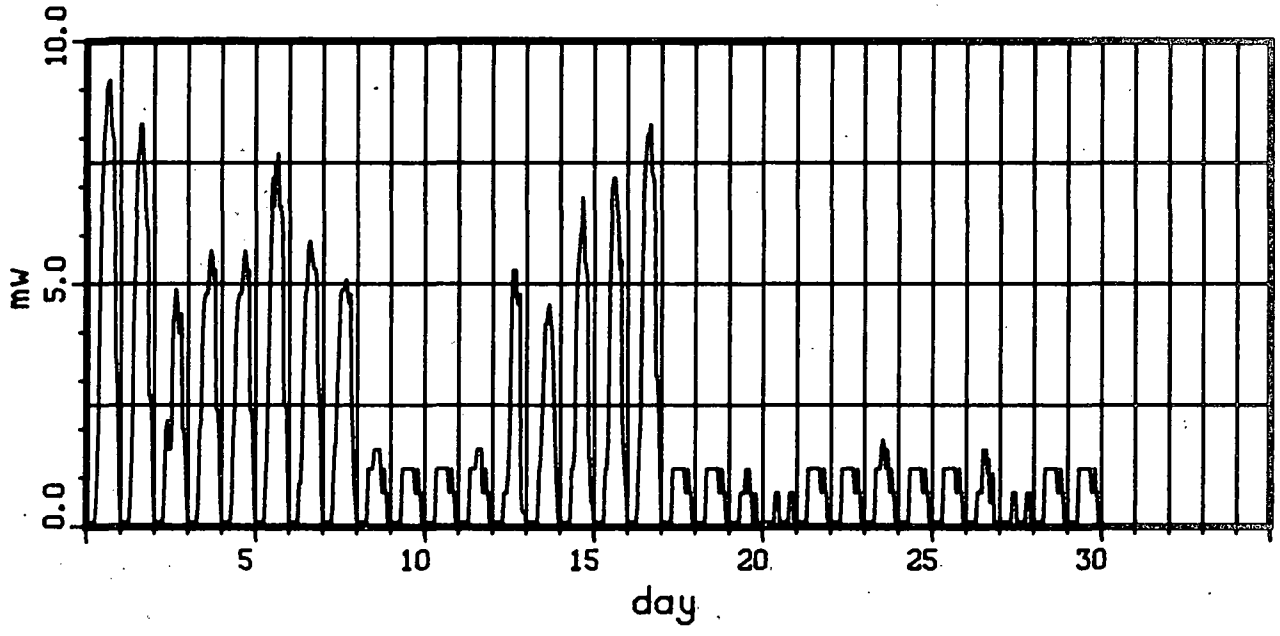


Figure 22

ELECTRIC GENERATION

sep



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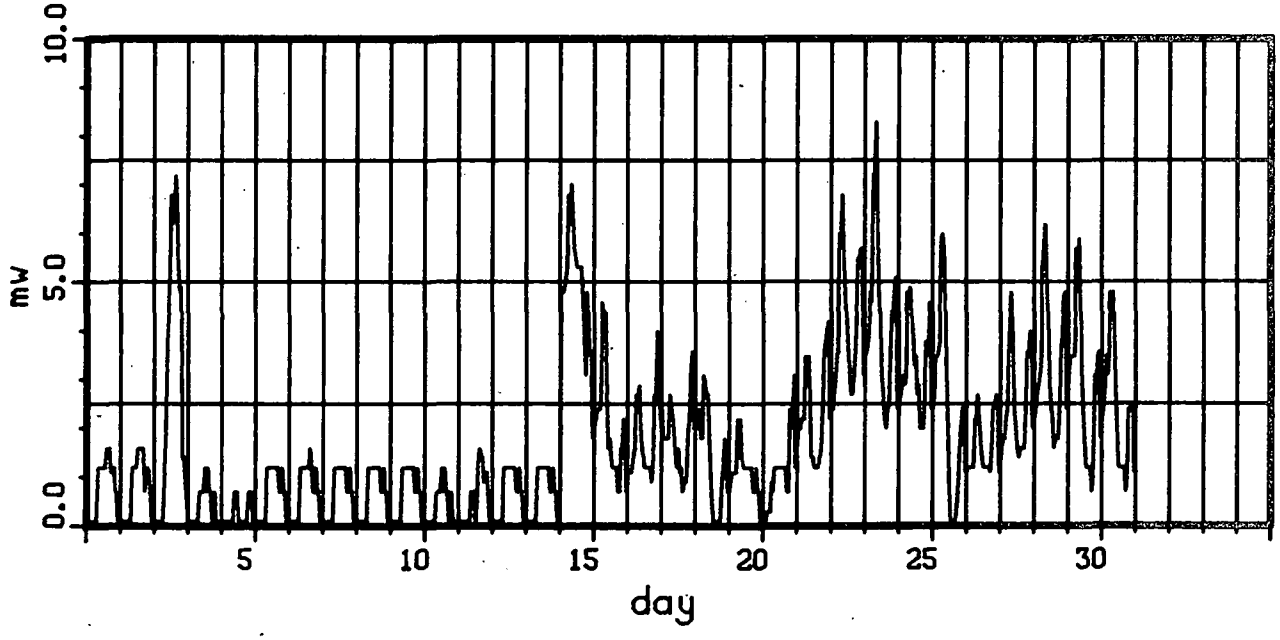
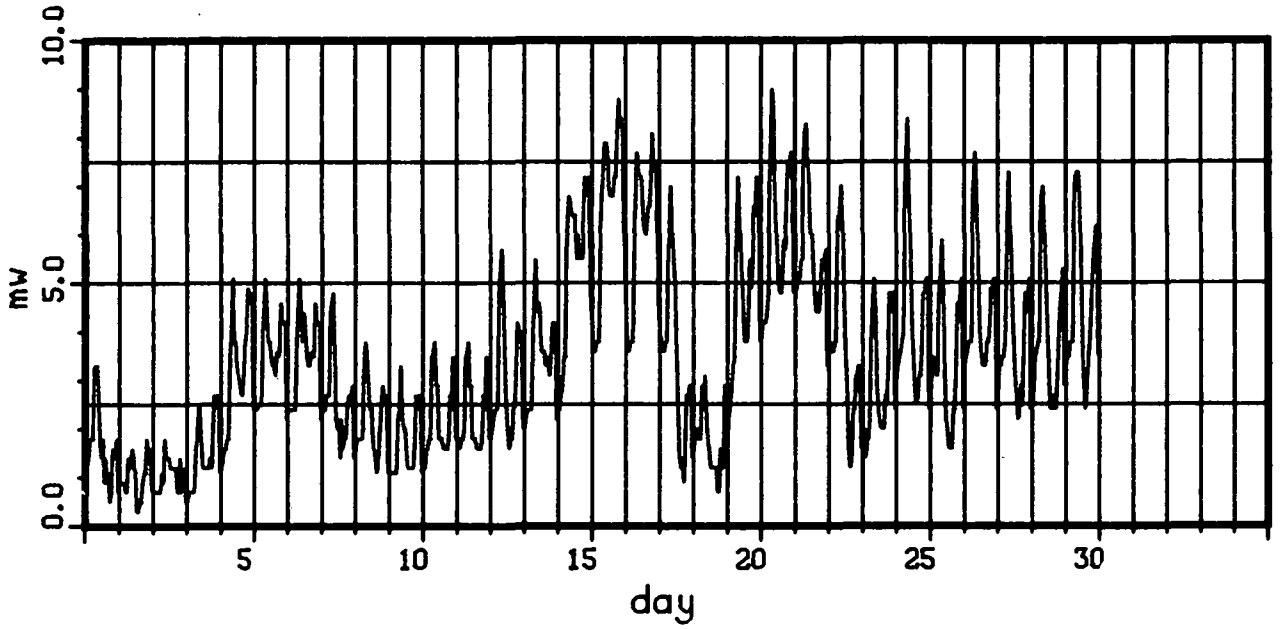


Figure 23

ELECTRIC GENERATION

nov



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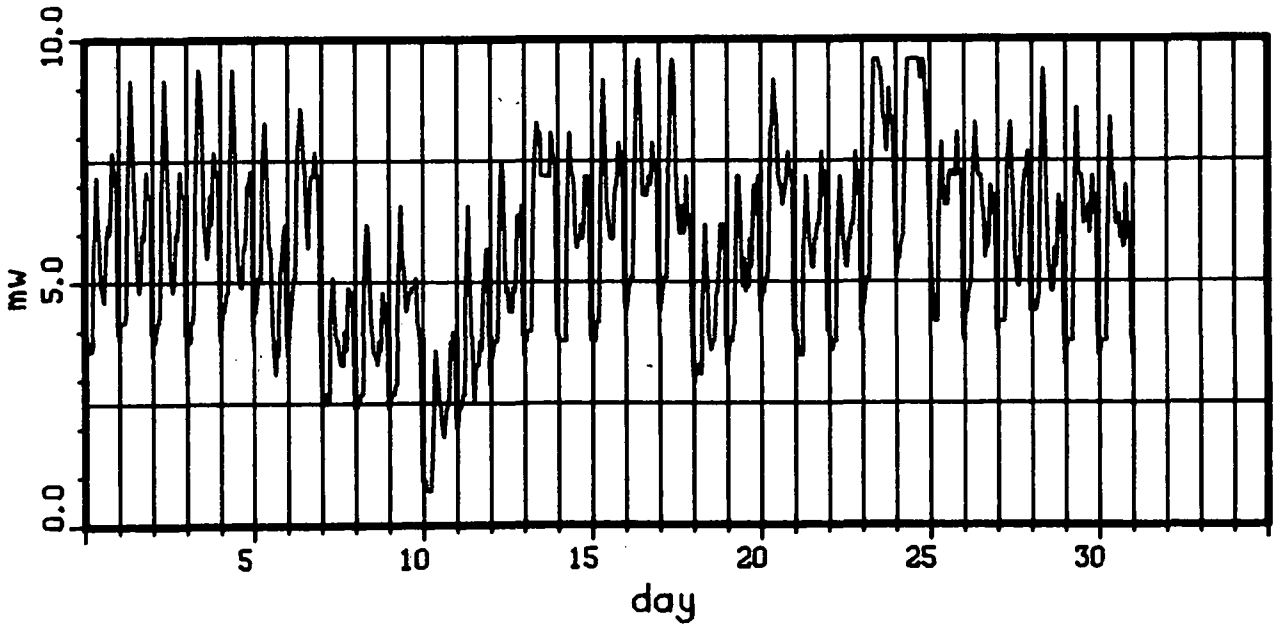
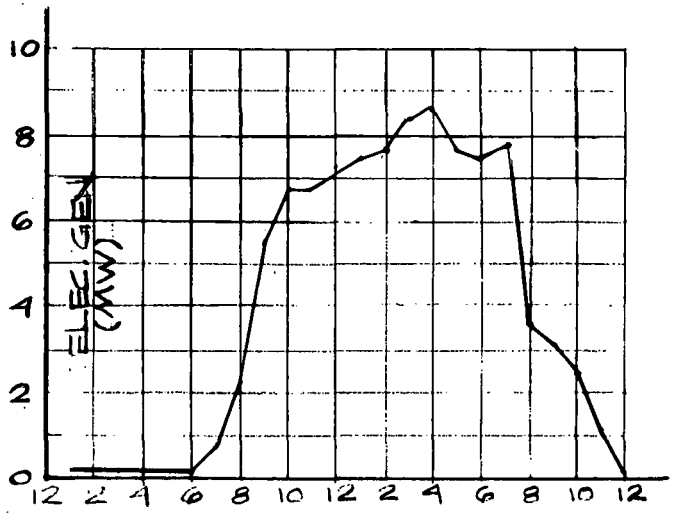
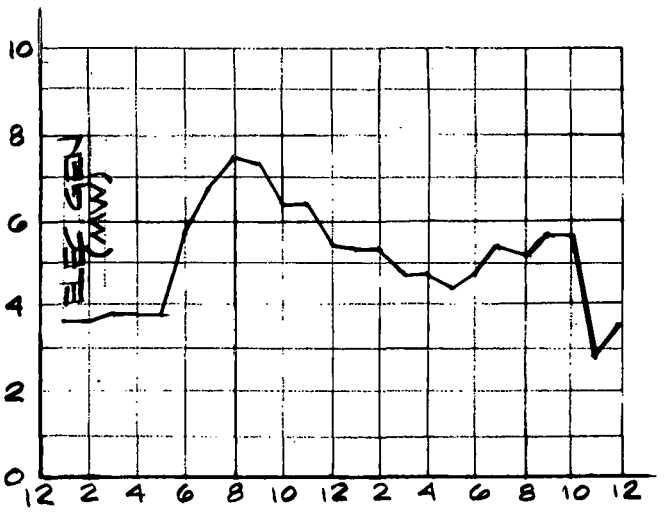


FIGURE 24

TYPICAL DAYS'
ELECTRIC GENERATION



JULY 30



FEB 3

IMPACT OF DIVERSITY ON PEAK DEMANDS

The simulation technique looks at each building on an hourly basis. Thus, the effect of diversity among the buildings in the Demonstration Community is accounted for in the process itself.

The sum of the individual building peak demands for thermal energy is approximately 87×10^9 Btu/hr.; however, the community as a whole shows a peak of 79×10^9 Btu/hr. due to the fact that these peaks do not all occur in the same hour. This ratio closely approximates rule of thumb factors for diversity factors applied to a community similar to the ICES Demonstration Community.

appendix D/2

miscellaneous profiles

MISCELLANEOUS PROFILES

ICES Plant Capacity

Pages F/2 - 1 through F/2 - 6 show the daily maximum and daily average thermal demand on the ICES plant. Superimposed on Page F/2 - 1 is the thermal generating capability of the ICES plant, including the standby/auxiliary boiler.

ICES Plant Electrical Capacity

Pages F/2 - 7 through F/2 - 12 show the actural daily maximum and daily average electricity generated by the ICES plant. The maximum ICES capacity is 10 MW.

ICES Community Thermal Load

Pages F/2 - 13 through F/2 - 18 show the daily maximum and daily average thermal load of the ICES community. Comparing these with pages F/2 - 1 through F/2 - 6 will show the significance of thermal storage.

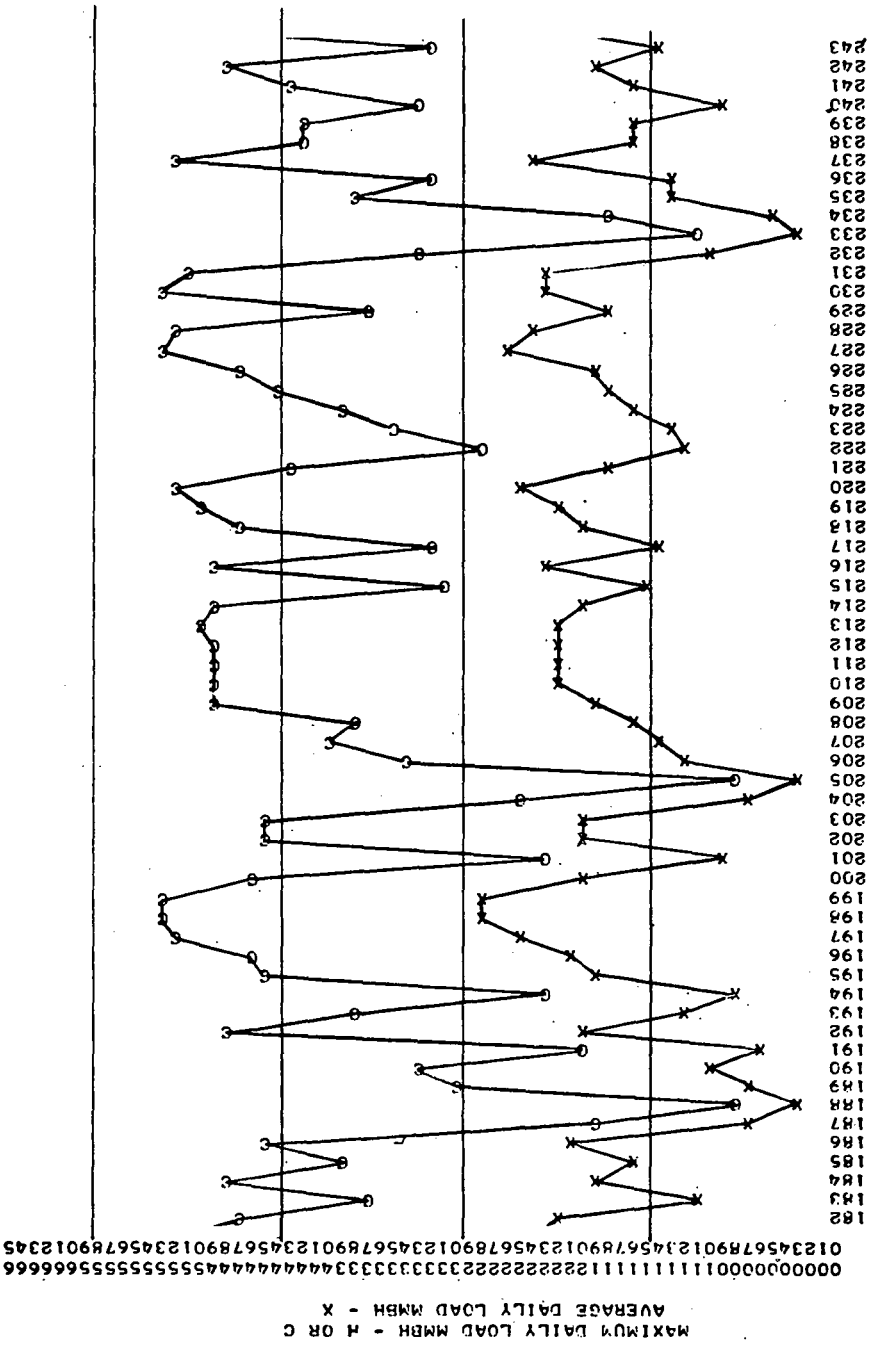
Note: For hourly profiles of the above, see Appendix F/1.

THERMAL DEMAND ON ICES PLANT AND PLANT CAPACITY

THERMAL DEMAND ON ICES PLANT AND PLANT CAPACITY

THERMAL DEMAND ON ICES PLANT AND PLANT CAPACITY

THERMAL DEMAND ON ICES PLANT AND PLANT CAPACITY



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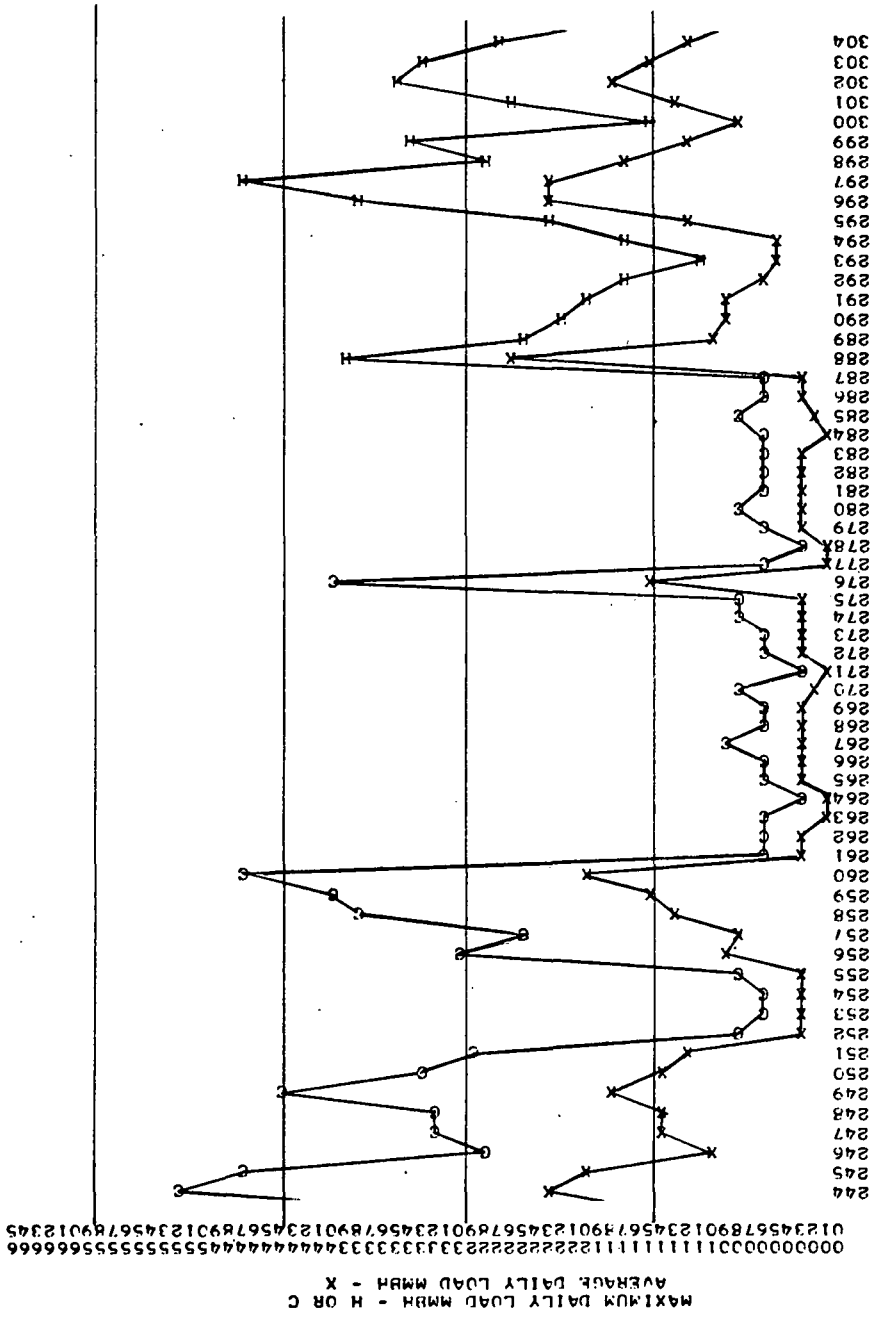
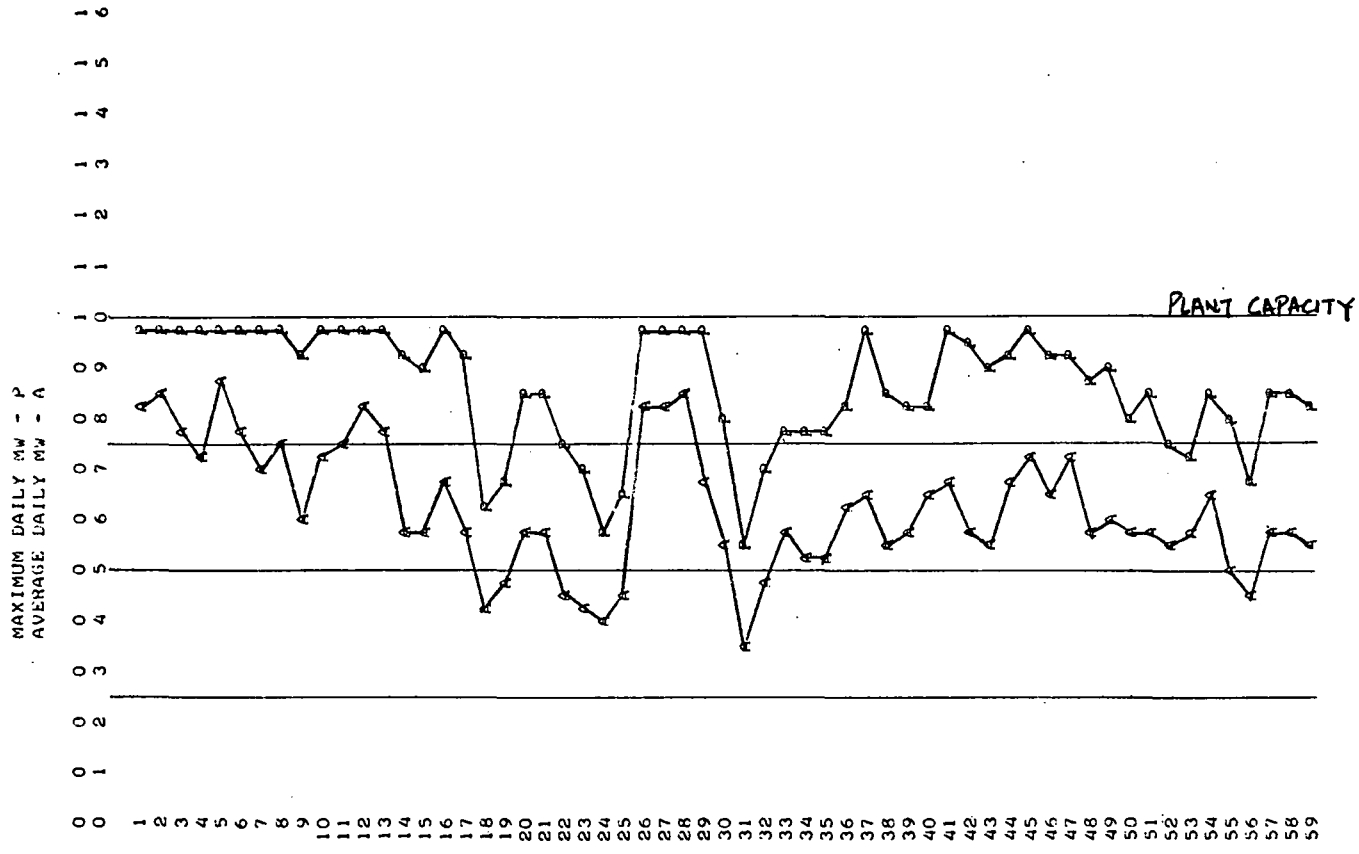


THERMAL DEMAND ON ICES PLANT AND PLANT CAPACITY

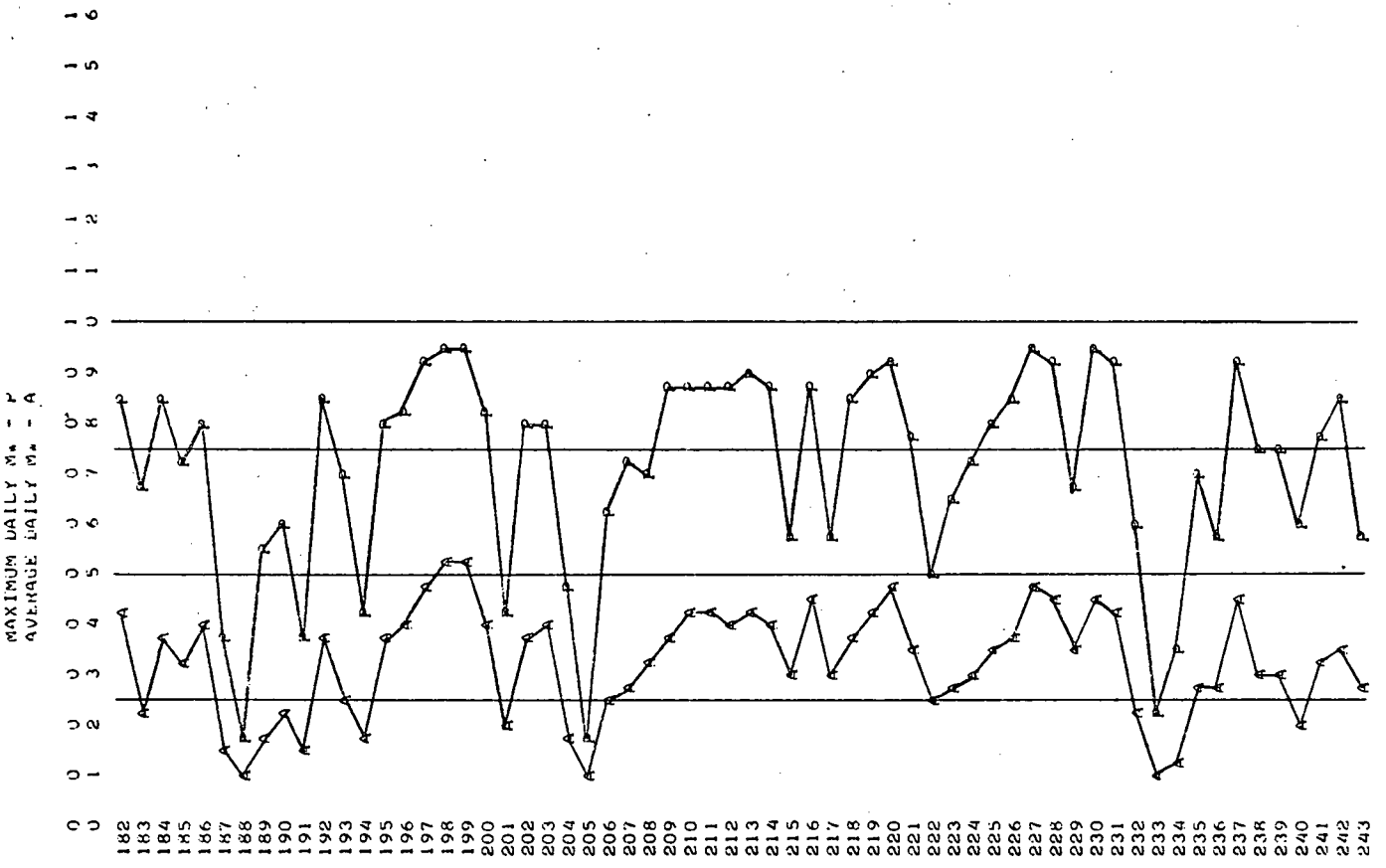
ELECTRICITY GENERATED BY ICES PLANT AND PLANT CAPACITY



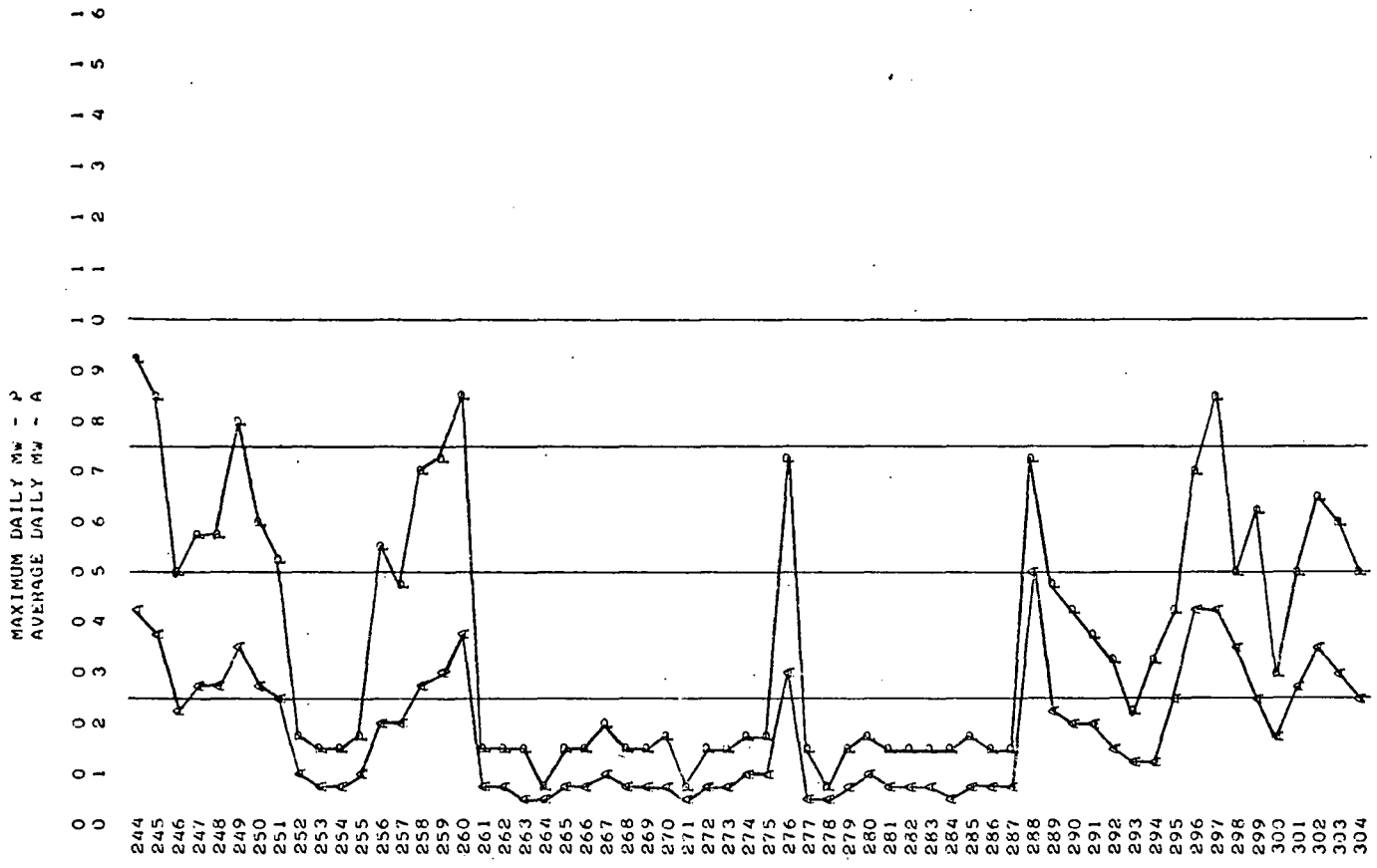
ELECTRICITY GENERATED BY ICES PLANT AND PLANT CAPACITY

ELECTRICITY GENERATED BY ICES PLANT AND PLANT CAPACITY

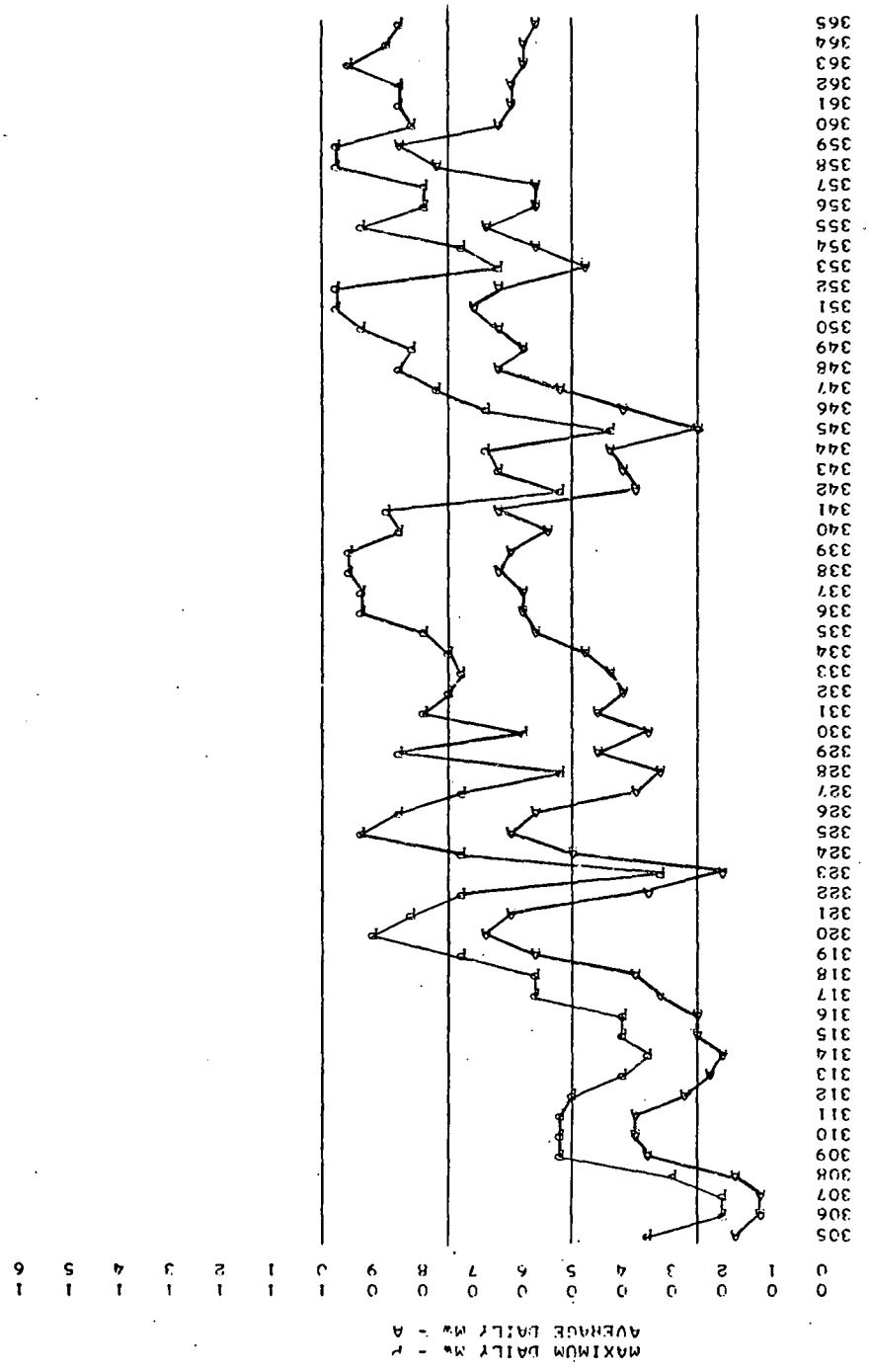
ELECTRICITY GENERATED BY ICES PLANT AND PLANT CAPACITY



ELECTRICITY GENERATED BY ICES PLANT AND PLANT CAPACITY


MAXIMUM DAILY MW - P
AVERAGE DAILY MW - A
0 0 0 0 0 0 0 0 0 1 1 1

ELECTRICITY GENERATED BY ICES PLANT AND PLANT CAPACITY



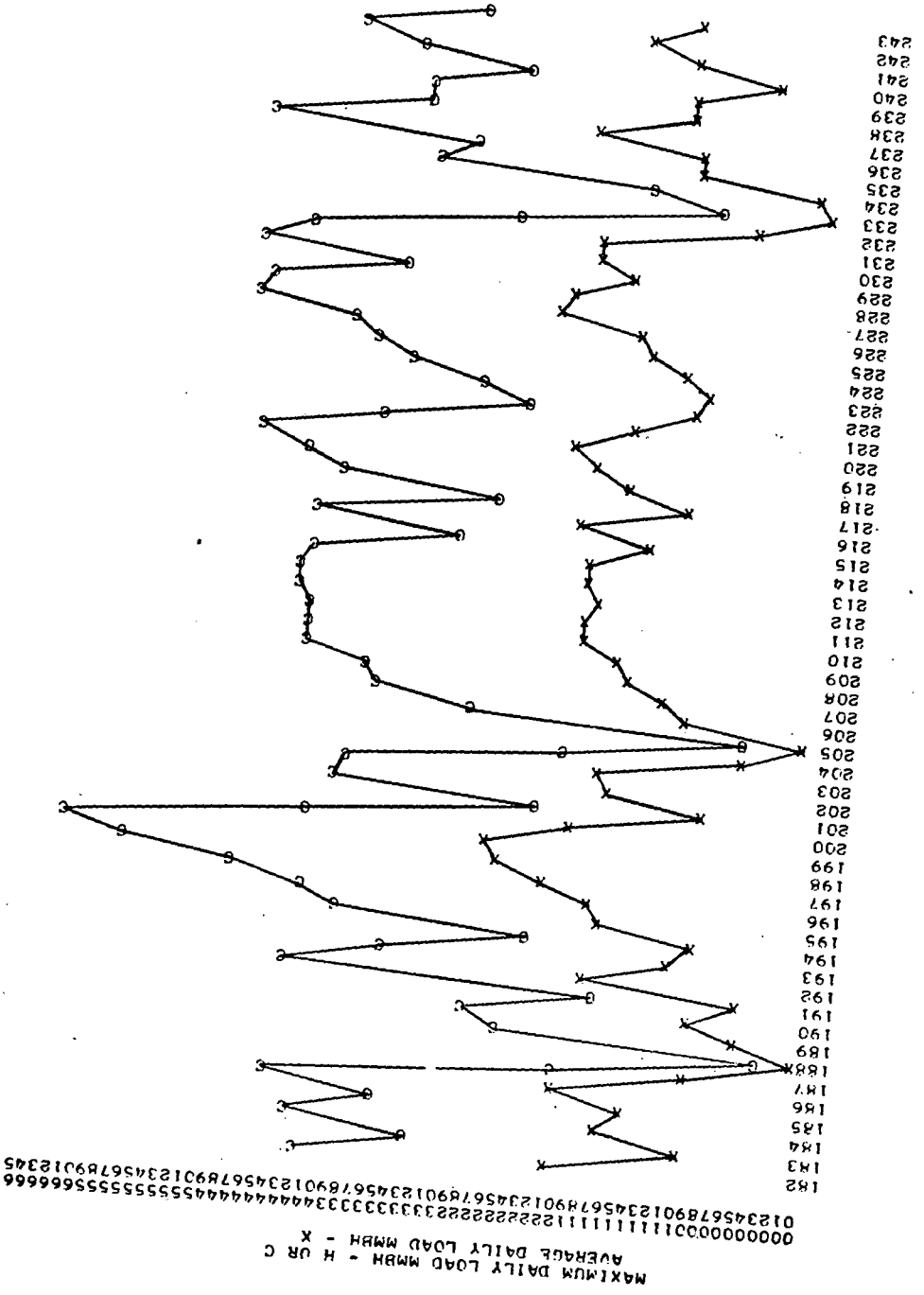
MAXIMUM DAILY LOAD MMBH - H OR C
AVERAGE DAILY LOAD MMBH - X

ICES COMMUNITY THERMAL LOAD

ICES COMMUNITY THERMAL LOAD

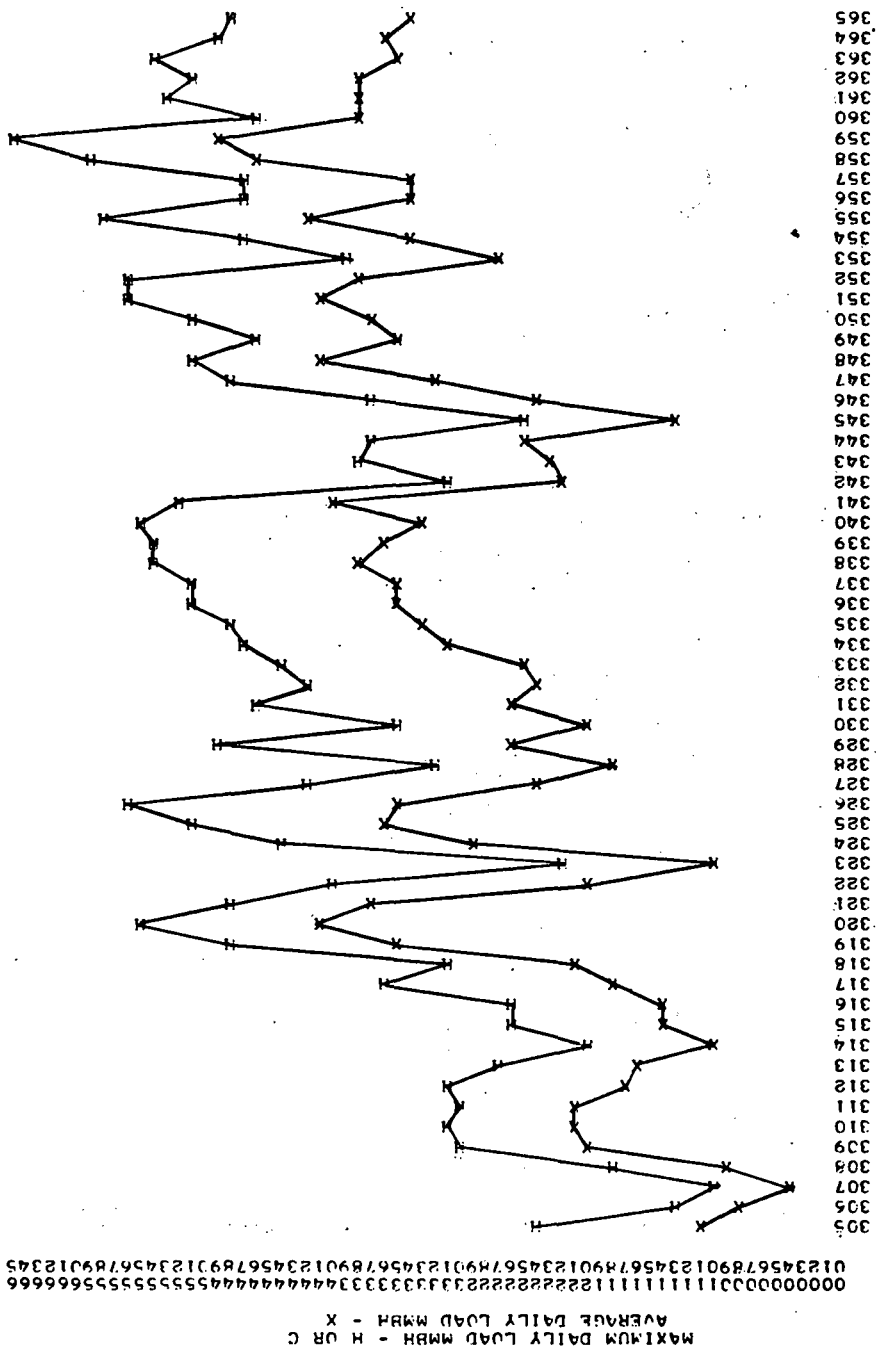
ICES COMMUNITY THERMAL LOAD

ICES COMMUNITY THERMAL LOAD



ICES COMMUNITY THERMAL LOAD

ICES COMMUNITY THERMAL LOAD



appendix E

description of major equipment

DESCRIPTION OF MAJOR EQUIPMENT

A. Turbine Generators

The Turbine:

Gas turbines will be of the constant speed, heavy-duty axial flow type with gear reduction drive, and a complete fuel system, designed to operate on diesel fuel and convertible to gas. The lubrication system for turbine and gearbox will be pressure fed with filters, cooler and oil tank for 1000 hours operation. The starting system will be of the hydraulic type and the turbine generator set will be completely enclosed in sound attenuating type enclosures.

The Governor System will be of the load sensing type with load sharing capabilities for multiple unit operation. A pressure and temperature switch will be used for malfunction indication and control.

The Generator:

Generators rated at 0.8 pf, three phase, 13,800 volts, 6 leads, Delta-connected, 1800 rpm and equipped with an exciter, voltage regulator with a 10 percent adjustment range, space heaters to keep the windings dry, and temperature detection and indication system to protect it from overheating, and with voltage control from more than one location. The generator insulation materials to conform to NEMA Class F requirements.

Turbine-Generator, Characteristics:

The turbine-generator set will have a continuous gross output of 2500 kW rated at 80°F ambient and 850°F exhaust gas temperature. Turbine-Generator controls to provide operation by manual start and stop by push buttons and automatic start upon receiving an appropriate signal. Automatic shutdown shall occur if any parameter exceeds limits considered harmful to the turbine set.

Turbine Control:

The turbine control panel will have such instruments as: Turbine temperature, percent speed and turbine vibration meter; Off/Local/Remote Auto Switch; Start/Stop/Reset buttons; Speed adjust and load transfer switches; Operation, warning and malfunction lights.

Electric Metering:

An electric metering panel will be supplied and designed for operation of each single generator-set in parallel with other turbine-generator and an Auto Start/Auto Restore System provided to start, load and stop the turbine generators as sequenced. The Automatic Synchronizing System, with logic to automatically operate four turbine generator sets, and a remote control panel will be supplied to monitor them.

Ancillary Equipment:

A complete, control nickel-cadmium battery system will be supplied; also an inlet air system with silencers for proper dynamic attenuation, and all exhaust systems between turbine and regain equipment with expansion bellows, etc.

B. Heat Recovery Unit

The unit will be a gas turbine heat recovery unit designed to comply fully with Section VIII of the ASME Pressure Vessel Codes and completely insulated. The unit will also function as a silencer capable of reducing turbine exhaust noise. The unit will include exhaust inlet transition, internal exhaust gas diverter, heat recovery section, steam separator, exhaust outlet transition.

The unit will be capable of producing 14,200 #/HR 150 psig steam and 120 gpm of 230^{o}F hot water with feed water temperatures of 200^{o}F and turbine exhaust gas flow of 136,000 #/HR at 850^{o} inlet gas temperature. The steam separator will serve two heat recovery units, will be insulated and have level controller, safety valves, gage glass, pressure gage, surface and bottom blowdown, high and low level alarm switches and air vent.

C. Standby Boiler-Burner Unit

Standby boiler-burner unit will be water tube type - designed for 175 psi working pressure. Output 32,000 lbs. of steam per hour, complete with structural steel, casing and insulation, forced draft fan, burner, combustion operating and safety controls and soot blower system. Burners shall be automatic air atomizing type for #2 fuel oil. Boiler convertible to future gas operation.

Deaerating System will be ASME, of the two compartment type, to operate at atmospheric pressure and shall be equipped with two boiler feed pumps, water level and emergency city water regulating valves, overflow valve, float switches, relief valve,

and vent. Accumulator tank shall be equipped with two condensate transfer pumps, water level control, water level emergency city water regulating valves, vent and drain.

D. Fuel Oil System

Fuel oil system will consist of three fuel oil storage tanks, each of a capacity of 40,000 gallons, oil pumping sets, piping, and controls, capable to feed either the turbine generator sets or the standby boiler. Storage tanks shall be designed for underground installation 1/2" thick, U.L. approved, complete with standby steam heater, manhole, cradles, fill pipe. Tanks will be continuous weld inside, sandblasted and brushed on the outside with #50 Bitumastic.

Fuel oil heating and pumping set will consist of 2 fuel oil transfer pumps each having a cpacity of 45 gpm rate and shall be automatically controlled.

E. Absorption Refrigeration Machines

Absorption refrigeration machines will be two stage, 150 psi construction, with capacity based on 123 psi steam, complete with operating and safety controls, demand limiter and flow switches. Motor shall be of the hermetic type with stainless steel shaft. Pump bearings and motor shall be cooled with refrigerant water.

Unit shall be equipped with a purge system, automatic recrystallization system and an electric control panel, indicating terminal blade, control transformers, water temperature, and including low temperature cut-outs, motor starter, time delays, fuses and external indicating light.

F. Cooling Tower

Cooling tower will be fire rated type, of capacity to cool the condenser water from 103°F to 85°F with a wet-bulb temperature of 78°F. Unit shall be complete with sump, basin, nozzles, eliminators, water makeup assembly, fans, motors, strainers, etc.

G. Converters

Converters will be ASME standard for 150 psi working pressure. They shall have a capacity to heat the water when supplied with 5 to 15 psi steam.

H. Pumps

Water Circulating Pumps will be single and double suction, centrifugal type. Pump and motor shall be direct connected on a common cast-iron bedplate.

Condensate Pumping Units will be duplex type with cast iron receiver, bronze fitted pumps, automatic controls, alternator, gages, etc. to make a complete unit.

I. Piping

Pressure reducing valves will be single-seat, pilot or diaphragm operated type, cast iron bodies, stainless steel seats.

Piping Distribution. Approximately 1/2 of the distribution system will be located in sidewalk, concrete trenches, with removable concrete covers. Balance of piping will be under pedestrian walkways.

Steam, chilled water, dual temperature and condensate pump discharge piping shall be steel, welded. Piping up to and including 10" shall be schedule 40, 12" - schedule 40S, 14" - schedule 30. Fittings shall be same weight as piping. Condensate piping and fitting shall be Schedule 80. Flanges and valves shall be 300 lbs construction for MP steam, 150 lbs construction for chilled water, dual temperature water service and LP steam.

J. Insulation

Piping in trenches will be insulated as specified. Piping under bridges shall obtain an additional weatherproof cover.

Insulation for steam and condensate piping will be 3" and 1 1/2" thick calcium silicate respectively, finished with an 8 oz. canvas jacket.

Insulation for chilled water and dual temperature water shall be fiberglass dual temperature type with vapor barriers. Thickness: up to 4" - 1 1/2"; 5" and up - 2".

FUTURE EXPANSION

A. General

The ICES plant has been planned to allow for an increase of 25% capacity, by means of adding a 2.5 mW module. The proposed ICES steam distribution and feedwater system is sized to handle a 25% increase. It is likely that the existing buildings will adopt some energy conservation measures. It is estimated that such measures could reduce the thermal load on the ICES plant by about 20%, consequently, increasing the expansion capability for the ICES community.

B. Replacement of Existing Chillers

1. Compression type electric chillers - There are about 4,000 tons of refrigeration by compression type electric machine. Future replacement of compression type shall be reviewed as to anticipated usage. If the operating hours have not changed from those used for modelling the ICES community, replacement shall be by same type (i.e., compression type). If the operating hours differ from those used for modelling the ICES community, replacement of compression type chillers by two-stage absorption chillers could be considered.

2. Absorption chillers - Existing chillers of the absorption cycle are single stage absorption chillers. In the future, the single stage machines should be replaced by two-stage absorption chillers. However, since the existing absorption chillers will be 3-10 years old by 1982, need for replacement is not immediate.

C. New Connections

The proposed 1982 ICES community thermal requirements and the ICES plant thermal capability is in balance. Consequently, any substantial new additions to the proposed ICES community would necessitate addition of the planned 25% plant expansion, preferably with identical modules, or if the existing building energy conservation measures precede community expansion, but additional turbine module could be delayed until a later date.

appendix F/1

economic analysis

ECONOMIC & ENERGY EVALUATION

SUMMARY

(1) The economic screening of the ICES shows a marginal penalty of about $100,000 per year when compared to the conventional oil heated system (see Table 1). Compared to a conventional electrically heated system, this penalty increases to $260,000 per year (see Table 2).

(2) From the standpoint of overall fuel consumption of PSE&G and ICES, the ICES plan would burn about 4600 barrels of oil more per year than the conventional system plan. However, ICES would reduce the PSE&G coal requirement by about 6440 tons which is the heat equivalent of 27,903 barrels of oil. On this basis, ICES compared to the conventional plan results in an equivalent oil saving of about 23,000 bbls. of oil (see Figure 1).

Comparing ICES to the conventional system with new buildings electrically heated, ICES would increase oil consumption by about 6200 barrels per year. PSE&G coal requirement would be reduced by about 7960 tons per year, which is the heat equivalent of 34,500 barrels of oil. There is a saving of 28,300 barrels of equivalent oil when ICES is compared to the conventional plan (see Figure 2).

(3) The installation of the ICES plant would not alter the PSE&G nuclear capacity expansion program. If the installation of such a plant is to be considered as an alternate to nuclear capacity, then an entire different economic evaluation would have to be made.

TABLE 1

COST COMPARISON OF ALTERNATE ENERGY SUPPLIES
TO TRENTON DOWNTOWN COMMUNITY

		Levelized Annual Costs ICES Installation 1982
A.	ICES (PSE&G Ownership)	
	1. ICES Energy Production	
	(a) Capital	$ 1,900,000
	(b) Fuel	2,380,000
	(c) Operating & Maintenance	1,410,000
	2. Reduced Electrical Energy (ICES vs. Conventional)	(300,000)
	3. Replacement Energy and Capacity Credit	(1,550,000)
	4. Transmission and Distribution Credit	
	(a) Energy Losses	(70,000)
	(b) Long Range Investment Savings •	(110,000)
	SUBTOTAL	$ 3,660,000
B.	CONVENTIONAL SYSTEM (New Buildings Oil Heated)	
	1. Steam Production	
	(a) Capital	$ 560,000
	(b) Fuel	1,440,000
	(c) Operating & Maintenance	1,560,000
	SUBTOTAL	$ 3,560,000
C.	ICES PENALTY	$ 100,000

TABLE 2

COST COMPARISON OF ALTERNATE ENERGY SUPPLIES
TO TRENTON DOWNTOWN COMMUNITY

		Levelized Annual Costs ICES Installation 1982
A.	ICES (PSE&G Ownership)	
	1. ICES Energy Production	
	(a) Capital	$ 1,900,000
	(b) Fuel	2,380,000
	(c) Operating & Maintenance	1,410,000
	2. Reduced Electrical Energy (ICES vs. Conventional)	(760,000)
	3. Replacement Energy and Capacity Credit	(1,550,000)
	4. Transmission and Distribution Credit	
	(a) Energy Losses	(70,000)
	(b) Long Range Investment Savings	(110,000)
	SUBTOTAL	$ 3,200,000
B.	CONVENTIONAL SYSTEM (New Buildings Electric Heat Pumps)	
	1. Steam Production	
	(a) Capital	$ 560,000
	(b) Fuel	1,160,000
	(c) Operating & Maintenance	1,220,000
	SUBTOTAL	$ 2,940,000
C.	ICES PENALTY	$ 260,000

FIGURE NO. 1

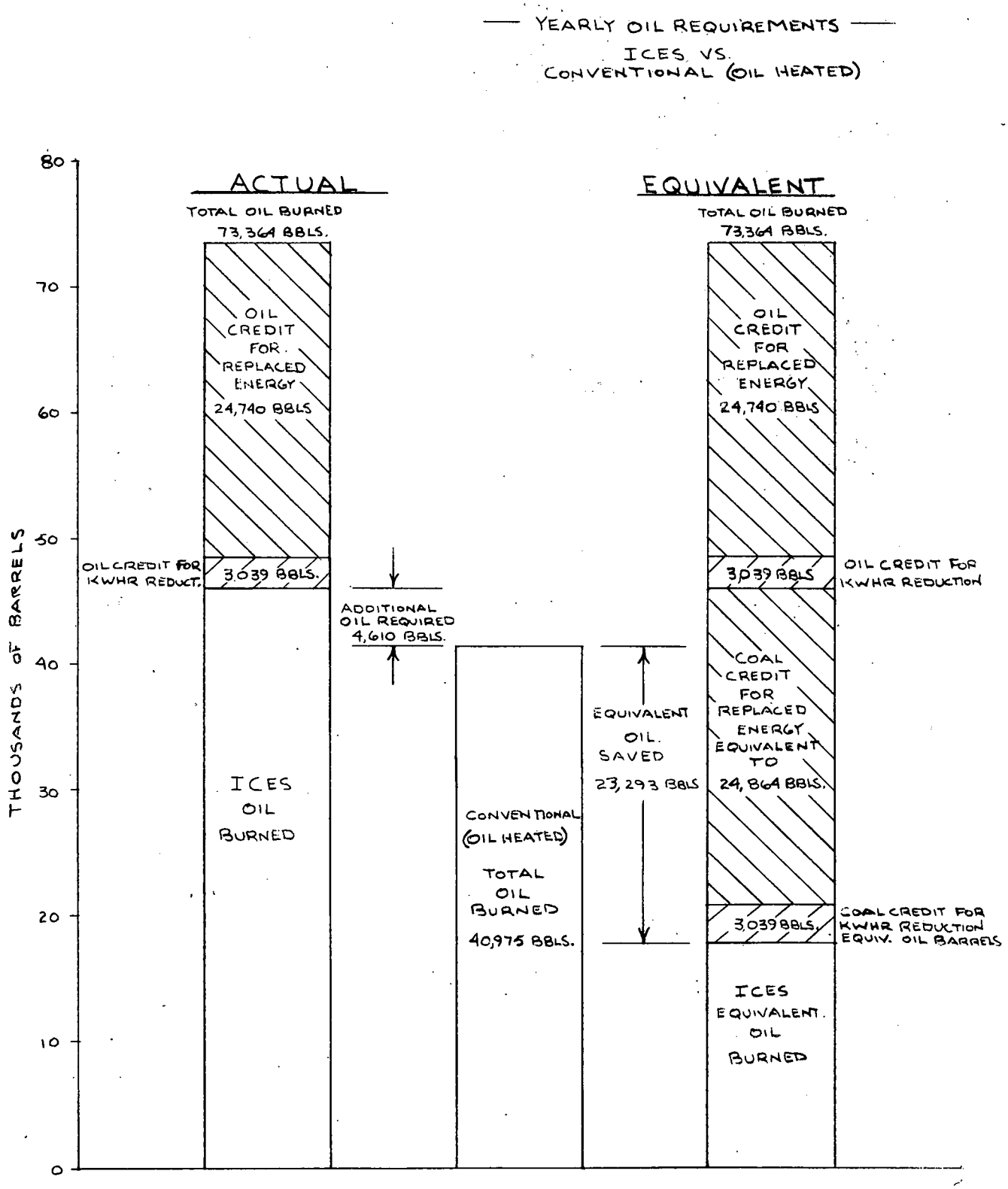
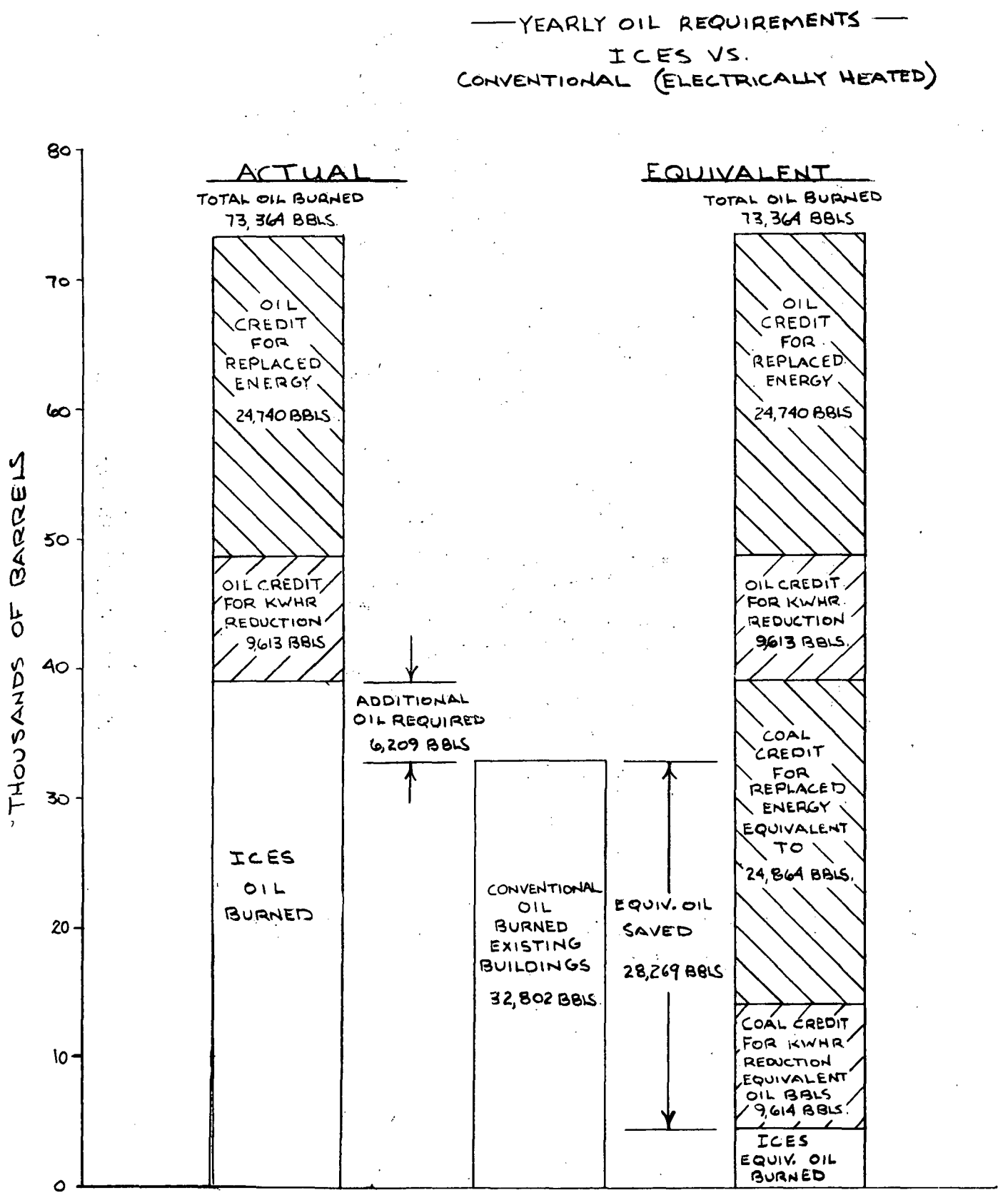

YEARLY OIL REQUIREMENTS
ICES VS.
CONVENTIONAL (OIL HEATED)
ACTUAL
TOTAL OIL BURNED
73,364 BBLS.
OIL CREDIT FOR REPLACED ENERGY
24,740 BBLS
OIL CREDIT FOR KWHR REDUCT.
3039 BBLS.
ICES OIL BURNED
ADDITIONAL OIL REQUIRED
4,610 BBLS.
CONVENTIONAL (OIL HEATED)
TOTAL OIL BURNED
40,975 BBLS.
EQUIVALENT OIL SAVED
23,293 BBLS
EQUIVALENT
TOTAL OIL BURNED
73,364 BBLS.
OIL CREDIT FOR REPLACED ENERGY
24,740 BBLS
3039 BBLS
OIL CREDIT FOR KWHR REDUCTION
COAL CREDIT FOR REPLACED ENERGY EQUIVALENT TO
24,864 BBLS.
3,039 BBLS.
COAL CREDIT FOR KWHR REDUCTION EQUIV. OIL BARRELS
ICES EQUIVALENT OIL BURNED
THOUSANDS OF BARRELS
0
10
20
30
40
50
60
70
80

FIGURE NO. 2


YEARLY OIL REQUIREMENTS
ICES VS.
CONVENTIONAL (ELECTRICALLY HEATED)
THOUSANDS OF BARRELS
80
70
60
50
40
30
20
10
0
ACTUAL
TOTAL OIL BURNED
73,364 BBLS.
OIL CREDIT FOR REPLACED ENERGY
24,740 BBLS
OIL CREDIT FOR KWHR REDUCTION
9,613 BBLS
ICES OIL BURNED
ADDITIONAL OIL REQUIRED
6,209 BBLS
CONVENTIONAL OIL BURNED EXISTING BUILDINGS
32,802 BBLS.
EQUIV. OIL SAVED
28,269 BBLS
EQUIVALENT
TOTAL OIL BURNED
73,364 BBLS
OIL CREDIT FOR REPLACED ENERGY
24,740 BBLS
OIL CREDIT FOR KWHR REDUCTION
9,613 BBLS.
COAL CREDIT FOR REPLACED ENERGY EQUIVALENT TO
24,864 BBLS.
COAL CREDIT FOR KWHR REDUCTION EQUIVALENT OIL BBLS
9,614 BBLS.
ICES EQUIV. OIL BURNED

1. GENERAL

A "total system" approach was applied in which the total costs of the ICES were compared to those of a conventional system. The costs for the ICES and conventional system follow:

ICES

1. Those costs associated with the total ICES energy production including capital, fuel, operating and maintenance.

2. The savings associated with supplying less electric energy required by the community, as compared to the conventional system, at the applicable rates.

3. A credit for the value to PSE&G of the energy and capacity provided by the ICES plant.

4. A credit for PSE&G transmission and distribution long term savings resulting from the operating of the ICES plant.

Conventional

1. The costs associated with the conventional heating facilities to provide steam output equivalent to that of ICES, including capital, fuel, operating and maintenance.

2. Basic Data and Assumptions

A. The basic cost data used in the analysis are shown on Table 3.

(1) The capital costs are identified in detail in the appendix.

(2) The fuel cost used in the ICES plant was determined by PSE&G. The fuel cost for the conventional system was developed using the 1977 cost obtained from the supervisor of N. J. State Buildings. PSE&G fuel escalation rate estimates were used in both cases.

(3) The operating and maintenance (O&M) costs for the ICES plant were determined by PSE&G. The O&M costs for the conventional system were jointly developed by PSE&G and the Planning Department of the City of Trenton.

B. PSE&G will build, own, and operate the ICES plant consisting of 4 oil-fired combustion turbines, generators, transformers, electrical connecting facilities, waste heat boilers and a steam distribution system to provide steam to the Demonstration Community.

C. All electricity produced by ICES will be delivered to the PSE&G 26-kV subtransmission system. The Community will take electrical power from the appropriate PSE&G supply points at the applicable tariff rates in both plans.

D. The combustion turbine - waste heat boiler unit will have an availability of 85%.

E. All economic results are expressed in 1982 dollars.

F. The capacity of the ICES system was sufficiently small that its installation did not affect PSE&G's planned generation capacity expansion program.

TABLE 3

BASIC DATA

1. ICES AND CONVENTIONAL SYSTEM DATA

A. Capital Costs (1982 Dollars)

(1)	ICES plant including land, building, 4-2.5 MW combustion turbines - waste heat boilers, fuel storage, fuel handling, standby boiler, water treatment, electrical connection.	$8,495,000
	Steam distribution.	1,870,000
	Terminal equipment, hot water storage, heat exchangers, absorption chillers	3,850,000
	ICES SYSTEM TOTAL	$14,215,000
(2)	Conventional system, new buildings oil heated. Includes boilers, fuel storage, load centers, electric chillers.	$ 4,162,000
(3)	Conventional system, new buildings electrically heated. Includes heat pumps, load centers.	$ 4,212,000

B. Carrying Charges (Return, Depreciation, Taxes)

ICES equipment (25 year recovery)	12.7%
Conventional system (25 year recovery)	12.7%

C. Fuel Costs (includes transportation, $/MBtu)

Representative Years	ICES Plant	Conventional Plant	
	#2 Oil	#2 Oil	#6 Oil
1981	3.40	4.00	3.35
1985	4.17	4.92	4.19
1990	5.41	6.38	5.55
2000	9.09	10.73	9.73
2005	11.79	13.90	12.87
Levelized Annual Cost 1982-2006 *	5.60	6.50	5.70

D. Operating & Maintenance Costs (O&M)

(1) ICES plant variable costs

Representative Years	Variable O&M Mills/kWhr
1981	6.15
1985	7.84
1990	10.62
1995	14.38
2000	19.48
2005	26.38
Levelized Annual Cost 1982-2006 *	11.00

(2) ICES Annual Fixed Costs (1982 $)

Plant	$153,000
Standby Boiler	7,000
Terminal maintenance	436,000
TOTAL	$596,000

(3) Conventional plant annual fixed costs (1982 $)

Oil heated	$842,000
Electrically heated	$656,000

2. UTILITY DATA

A. Energy and Capacity

Representative Years	Capacity Payment Rate Schedule ($/kW/yr)	Avg. Incremental Energy Cost (Mills/kWhr)	
		On-Peak	Off-Peak
1982	32	41.6	27.5
1985	39	47.0	29.4
1990	52	52.9	30.5
1995	70	75.6	44.9
2000	94	100.5	65.2
2005	126	125.2	87.2
Levelized Annual Cost 1982-2006 *	50	59.4	36.9
Levelized Study Cost **	20		

Notes:

* The annual levelized cost is the yearly average, weighted on a present worth basis, of a fluctuating series of expenses in 1982 dollars at a 10.4% cost of money.

** It is expected that PSE&G will receive no capacity payment credits until 1986, from then on, a 50/50 chance is expected. The study figure was therefore weighted accordingly and present worthed at 10.4%.

3. Methodology

A. The economic evaluation was based on the minimum revenue requirements approach, that is, the minimum amount of revenue that must be obtained to cover all expenses associated with each plan, including the minimum acceptable return on any capital required by a plan.

B. The PSE&G production cost program used in this project for the determination of incremental energy costs uses the incremental economic dispatch method. The program considers heat rate characteristics of units and fuel prices to minimize the production cost at each system load level. In addition, this program uses a chronological load model, considers spinning reserve requirements, and schedules week-by-week maintenance levelizing reserve levels. A detailed description of the program is included in the Appendix.

C. ICES generation and fuel requirements were obtained from a computer simulation program.

D. The cost comparisons were based on levelized costs with a 1982 installation date (see Tables 1,2).

E. The levelized annual capital related costs were obtained by applying a carrying charge to the 1982 capital dollars including a cost of money charge during construction.

F. The applicable PSE&G rate was applied to the reduction in electrical energy use of ICES compared to the conventional system.

G. The value to PSE&G of the electrical output of the ICES unit was based on what it would have cost if we purchased this energy from the Pennsylvania, New Jersey, Maryland Interconnection (PJM). On-peak, off-peak incremental energy costs were developed from the PSE&G production cost program. These costs were levelized and applied to the on-peak, off-peak energy developed from the computer simulation program.

The capacity value was determined from an estimated levelized capacity payment rate schedule. Because of the 10,000 kW of capacity, capacity deficiency payment credits to PSE&G would occur.

H. Transmission and Distribution credits to ICES would result from the following:

(1) A savings in losses estimated at 5%.

(2) A long term investment saving of about $50/kW based on work performed by PSE&G on an EPRI project No. 729-1, Economic Assessment of the Utilization of

Fuel Cells in Electric Utility Systems.

I. A total system approach was applied in which the total oil requirements of ICES were compared to the corresponding fuel requirements of PSE&G and the community in the conventional system plan. For ICES, this amounts to the oil burned for energy production and allowances for:

(1) Energy replaced by the utilities' oil and coal burning units (credit).

(2) A reduction in the oil and coal burning kWhr to the community (credit).

This net total was then compared to the oil burned for the community's conventional system (oil heat).

From the standpoint of overall fuel consumption of PSE&G and ICES, the ICES plan would burn about 4600 barrels of oil more per year than the conventional system plan. However, ICES would reduce the PSE&G coal requirement by about 6440 tons which is the heat equivalent of 27,903 barrels of oil. On this basis, ICES compared to the conventional plan results in an equivalent oil saving of about 23,000 bbls. of oil (see Figure 1).

Comparing ICES to the conventional system with new buildings electrically heated, ICES would increase oil consumption by about 6,200 barrels per year. PSE&G coal requirement would be reduced by about 7960 tons per year which is the heat equivalent of 34,500 barrels of oil. There is a saving of 28,300 barrels of equivalent oil when ICES is compared to the conventional plan (see Figure 2).

APPENDIX A

PSE&G Production Cost Program

This program simulates operation of the generating units in a system to meet the load considering incremental economic dispatch and calculates production costs (fuel, start-up, operation and maintenance) for each unit and for the system. This program was developed by PSE&G in 1970 and since then it has been extensively used for studies related to many planning and operating decisions. The program is also being used by some of the other member companies in the Pennsylvania-New Jersey-Maryland (PJM) pool. The following are the main features of the program.

1. Can simulate a single system or two interconnected systems considering the tie limits.

2. Can handle nuclear and fossil units, gas turbines, fuel cells, energy storage devices, and all types of hydro units.

3. Generating unit forced outages can be represented by derating units or as random outages by input. Higher

immature forced outage rates in the case of new units are recognized.

4. Generating unit maintenance is scheduled in weekly intervals levelizing capacity reserves at different weekly peak loads.

5. Loads are represented by a chronological load characteristic in bi-hourly intervals.

6. Generating units are dispatched in each bi-hourly interval using their incremental cost (fuel and variable O&M) curves adjusted for penalty factors. The minimum dispatch capacity is specified and incremental cost vs. output curve is represented by five points.

7. Separate dispatch scheduling. Routines also exist for run-of-river hydro, pondage hydro and energy storage type generating capacity.

8. Fuel escalation can be specified.

9. Spinning reserve requirement is checked in unit dispatch.

10. Weekly and annual production costs for each unit and for the system can be obtained. Fuel, startup, and fixed and variable operation and maintenance costs are identified separately.

11. The program can be used for long range studies of 20-30 year periods. Individual year and present worth of total costs can be obtained.

appendix F/2

economic analysis backup

TRENTON ICES
CAPITAL COST SUMMARY OF
ECONOMIC EVALUATION

ICES PLANT

		Cost (1977)
Fuel Conditioning		$ 48,000
Fuel Storage		110,000
Turbine Generators		2,300,000
Waste-Heat Boilers		240,000
Stand-By Boiler		100,000
Plant Power Distribution		250,000
Generator Controls		80,000
Premium for Automatic Controls		170,000
Steam Piping		75,000
Water Piping		75,000
By-Pass Dampers		80,000
Stack		72,000
Stack Insulation		15,600
Fuel Piping		7,200
Oil Cooling Piping		2,300
Steam Press. Valves		20,000
Water Valves		12,000
Pumps		12,000
Plumbing Mod. to Building		5,000
Water Treatment		148,000
Substation and PSE&G Connect.		320,000
Land and Building		500,000
		$4,642,100
	Overhead 28%	1,300,000
	Contingency 12%	713,000
	Total	$6,655,100

STEAM DISTRIBUTION

Steam Distribution		$1,109,600
		$1,109,600
	Overhead 20%	221,900
	Contingency 10%	133,200
	Total	$1,464,700

ICES TERMINAL

		Cost (1977)
Hot Water Storage		$ 590,000
Heat Exchangers		53,000
Pumps		144,000
Pressure Reducers		40,000
Electrical Load Centers		260,000
Absorption Chillers		1,160,000
Building Space		40,100
		$2,287,100
	Overhead 20%	457,400
	Contingency 10%	274,500
	Total	$3,019,000

CONVENTIONAL OIL HEATED

Boilers		$ 233,000
Fuel Storage		116,100
Stacks		46,600
Elec. Load Centers		520,000
Elec. Chillers		1,461,000
Building Space		93,600
		$2,470,300
	Overhead 20%	494,100
	Contingency 10%	296,400
	Total	$3,260,800

CONVENTIONAL ELECTRICALLY HEATED

Heat Pumps and Resistance		$ 1,906,500
Credit for Saving in Thermal Distribution and Controls		(300,000)
Electrical Load Centers		800,000
Building Space		93,600
		$ 2,500,100
	Overhead 20%	500,000
	Contingency 10%	300,000
	Total	$ 3,300,100

ELEMENTS INCLUDED IN
CAPITOL COST SUMMARY

ICES

1. ICES plant including tie-into PSE&G.

2. Steam distribution to major connection points on existing buildings and to new buildings by groups. Each group would have its own chillers, storage and pressure reduction stations.

3. Two-stage absorption chillers for all proposed buildings, thermal storage pumps, and pressure reducing stations for all buildings as well as associated piping.

4. Conversion of electric chillers in the existing buildings were not included. It should be noted that Kingsbury I and a portion of The Mercer County Court House presently use absorption chillers.

5. Electrical Load Centers for all proposed buildings reflecting the requirements for base electrical use in those buildings without electric HVAC.

6. Thermal space requirements.

CONVENTIONAL OIL HEATED

1. Oil-fired boilers, fuel storage and stacks for all proposed buildings.

2. Electrical chillers and associated equipment for all proposed buildings.

3. Electrical Load Centers for all proposed buildings reflecting the additional requirements for electric air conditioning.

4. Terminal space requirements.

CONVENTIONAL ELECTRICALLY HEATED

1. Heat pump system for all proposed buildings except the Firehouse and Civic Center - War Memorial Complex. Due to the unusual latent/sensible ratio in these structures, a resistance system with electric centrifugal chillers was used.

2. Credit was allowed for savings in thermal distribution and controls reflecting the fact that the heat pump system cost included distribution and controls while the alternate ICES or oil systems did not.

3. Electrical Load Centers for all proposed buildings reflecting the increased requirement for total electric HVAC systems.

4. Terminal space requirements.

TRENTON ICES
ELECTRIC ENERGY COSTS

Concentrating on the PSE&G ownership option or with PSE&G continuing to supply all electrical needs (ICES selling all electrical output to PSE&G), the electrical energy costs were computed based on individual metering to each proposed building and present metering arrangements with existing buildings. Electrical supply would consist of secondary service at 120/208Y or 265/460Y fed from a network or spot-network. PSE&G Rate Schedules GLP and LPL would therefore be applied.

All existing buildings were calculated on present energy use and Rate Schedules. It should be noted that Executive Order Number 13, issued by Brendan T. Byrne, Governor of New Jersey on December 12, 1974, calls for mandatory energy conservation measures in "all State-owned and State-leased buildings." Included were guidelines on temperature settings, HVAC operation and illumination. The energy figures used for electric and oil consumption in existing State buildings reflect the reduction in consumption effected by Executive Order Number 13.

Since conversion of electric air conditioning in the existing buildings is not contemplated at this time, the electric energy use was considered identical within existing buildings, for both conventional and ICES options. Electrical energy use within new buildings was considered with electrical air conditioning for the conventional system and with absorption air conditioning for the ICES system. Energy use data for air conditioning is low, reflecting conservation measures.

TRENTON ICES
PSE&G ENERGY ADJUSTMENT

Since PSE&G's most recent rate increase on October 21, 1976, the Energy Adjustment as applied to each kilowatthour billed on Rate Schedule GLP and LPL has been filed with the New Jersey Board of Public Utility Commissioners as follows:

Effective Month	$/kWh
November 1976	.005209
December 1976	.004857
January 1977	.007428
February 1977	.007315
March 1977	.012179

The increase in the Energy Adjustment for the billing month of March (which is calculated based on January costs) reflects the temporary outage for refueling of one of the Peach Bottom nuclear units and OPEC fuel price increases. The full impact of our share of Salem unit #1 has not yet been reflected in these adjustment figures, since commercial operation only began on December 25, 1976, on a reduced output level. For these reasons we have used an Energy Adjustment of $.0075 in our calculations.

TRENTON ICES
BUILDING ELECTRICAL ENERGY COST

PSE&G RATE SCHEDULES (October 21, 1976)

I. Proposed Buildings Using Oil Heat	
Existing Buildings	$1,532,054
Proposed Buildings Without ICES	834,067
Total Community Without ICES	$2,366,121
II. Proposed Buildings Using Electric Heat	
Proposed Buildings Without ICES	1,094,559
Total Community Without ICES	2,626,613
III. ICES	
Proposed Buildings With ICES	663,019
Total Community With ICES	$2,195,073

TRENTON ICES
BUILDING ELECTRICAL ENERGY USE

	kWh/Year
I. Proposed Buildings Using Oil Heat	
Existing Buildings	38,806,110
Proposed Buildings Without ICES	18,993,850
Total Community Without ICES	57,799,960
II. Proposed Buildings Using Electric Heat	
Proposed Buildings Without ICES	26,436,450
Total Community Without ICES	65,242,560
III. ICES	
Proposed Buildings With ICES	15,553,140
Total Community With ICES	54,359,250

EXISTING BUILDINGS
PSE&G ELECTRICAL SERVICE

Service Location	Rate Schedule	Yearly kWh	Maximum kW Demand	Cost (1977)
Mercer County Court House	LPL	1,545,910	472	$ 73,278
State House Complex	LPL	15,331,800	3,263	552,130
Kingsbury I	LPL	3,795,000	630	140,046
Health & Agriculture	LPL	7,736,400	1,953	321,556
Labor & Industry	LPL	10,188,000	3,372	426,212
War Memorial*	GLP-ED	209,000	250	18,832
Totals		38,806,110	9,940	$1,532,054

* Air Conditioning for the War Memorial is included in the Civic Center (See Proposed Buildings).

PROPOSED BUILDINGS
PSE&G ELECTRICAL SERVICE
WITHOUT ICES PLANT - OIL HEATING

Service Location	Rate Schedule	Yearly kWh	Maximum kW Demand	Cost (1977)
Kingsbury II	LPL	1,334,920	594	$ 60,704
Dept. Environmental Protection	LPL	4,853,710	1,248	197,187
Civic Center*	LPL	1,535,475	1,185	82,598
Justice Department	LPL	4,239,955	1,484	185,875
Capitol Post Office	GLP-MD	711,855	214	33,609
Justice Commercial	GLP-MD	711,855	214	33,609
Luther Arms	LPL	884,085	228	41,011
Capitol I	LPL	3,593,995	822	142,079
Firehouse	GLP-MD	48,000	35	4,363
Capitol Place Garage	GLP-MD	540,000	130	26,516
Justice Department Parking	GLP-MD	540,000	130	26,516
Totals		18,993,850	6,284	$834,067

* Includes Air Conditioning For War Memorial.

PROPOSED BUILDINGS
PSE&G ELECTRICAL SERVICE
WITH ICES PLANT

Service Location	Rate Schedule	Yearly kWh	Maximum kW Demand	Cost (1977)
Kingsbury II	LPL	877,080	154	$ 37,387
Dept. Environmental Protection	LPL	4,090,440	785	164,665
Civic Center	LPL	1,053,300	225	48,196
Justice Department	LPL	3,577,920	735	151,013
Capitol Post Office	GLP-MD	538,380	113	25,498
Justice Commercial	GLP-MD	538,380	113	25,498
Luther Arms	LPL	761,760	146	33,788
Capitol I	LPL	2,987,880	537	119,579
Firehouse	GLP-MD	48,000	35	4,363
Capitol Place Garage	GLP-MD	540,000	130	26,516
Justice Department Parking	GLP-MD	540,000	130	26,516
Totals		15,553,140	3,103	$663,019

TRENTON ICES
ELECTRIC HEATING

As an alternative to energy and cost studies with oil heating, we have estimated the cost and additional electric energy use, which would result, if all of the proposed buildings utilized electric heating. It should be noted that, from a rate viewpoint, the addition of heating kilowatthours will change the applicable Rate Schedule of the Capitol Post Office, Justice Commercial and Firehouse. This will result in a lower cost per kilowatthour for base use.

The electric heating system considered in most cases was an internal source heat pump. A seasonal performance of 1.5 : 1.0 was utilized as a conservative estimate of reduced heating energy use. The Civic Center and Firehouse were assumed to use straight resistance systems.

PROPOSED BUILDINGS
PSE&G ELECTRICAL SERVICE
WITHOUT ICES PLANT -
ELECTRIC HEATING AND ENERGY

Service Location	Rate Schedule	Additional Yearly kWh*	Winter Maximum kW Demand	Additional Cost (1977)
Kingsbury II	LPL	2,043,700	1,984	$ 71,530
Dept. Environmental Protection	LPL	590,400	1,232	20,664
Civic Center**	LPL	2,086,400	1,477	73,024
Justice Department	LPL	1,441,800	1,889	50,463
Capitol Post Office	LPL	170,400	266	5,964
Justice Commercial	LPL	170,400	266	5,964
Luther Arms	LPL	499,600	595	17,486
Capitol I	LPL	356,500	750	12,478
Firehouse**	LPL	83,400	85	2,919
Capitol Place Garage	GLP-MD	0	130	0
Justice Department Parking	GLP-MD	0	130	0
Totals		7,442,600	8,804	$260,492

*kWh = (Heating Required/.9) X (.67 for Heat Pump or 1.0 for Resistance)
**Resistance

ELECTRIC ENERGY COSTS
THIRD PARTY OWNERSHIP

Among several components which would most significantly impact on a third party ownership option when compared to the PSE&G ownership option is the difference in electric energy rates. As described earlier in the Appendix, PSE&G Rate Schedules GLP and LPL apply to the individual electric energy supply to buildings within the Demonstration Community. Under a third party ownership, if the electrical energy supply to the community were directly from the ICES plant supplemented and backed up by PSE&G, Rate Schedule HTS with Special Provision (d) would apply due to the capacity required.

Since the backup required would be in excess of 3,000 kW, the service would consist of a 26,400 volt feed. The customer would be required to construct the appropriate substation and may, depending on the anticipated revenue to PSE&G and the cost of PSE&G's subtransmission system modifications, be required to subsidize those expenses.

The ICES system would then be billed based on a required "Contract Capacity" applying Provision (d) and credited for any part of the capacity actually used. The net cost per kilowatt of demand used is somewhat higher than straight or non-backup service. For example, 3,000 kW of capacity with no use would be billed as follows for one month:

Capacity Charge

$2,808 for the first 1,400 kW	= $2,808
$2.29/kW for the next 18,600 kW	= $3,664

Demand Charge

Minimum Demand Charge	= $1,250
Total	$7,722

If 3,000 kW was coincidently used during that same month:

Capacity Charge	
As Above	$2,808
	$3,664
Demand Charge	
The first 250 kW	$1,250
$4.33/kW for the next 1,750 kW	$7,578
$3.98 for the next 3,000 kW	$3,980
Credit	
$1.86/kW for the first 5,000	($5,580)
	$13,700

Plus any energy use subject to Kilowatthour and Energy Adjustment.

On the other hand any energy flow out of the ICES system would be credited based on the PJM running rates (described earlier) less a 10% administrative fee.

It should also be noted that by owning and operating an electrical distribution facility, the owner must add 5% additional use for losses to the electric energy statistics listed in this report. An equivalent distribution system would consist of a "network" or completely redundant service to the individual buildings. The capital cost of this system is significantly higher than that of a single line radial feed originally contemplated for a third party ownership alternative. The true cost of this system must be used if a detailed third party ownership evaluation appears necessary in further Phases of this study.

RATE SCHEDULE GLP
GENERAL LIGHTING AND POWER SERVICE

APPLICABLE TO USE OF SERVICE FOR:

General purposes.

CHARACTER OF SERVICE:

Continuous.

RATE:

Kilowatt Charge—in the months of June through October:

First kilowatt of monthly maximum demand included in the Kilowatthour Charge

$6.07	per kilowatt for the next	9	kilowatts of monthly maximum demand	
5.54	" " " " "	90	" " " " "	
4.97	" " in excess of	100	" " " " "	

Kilowatt Charge—in the months of November through May:

First kilowatt of monthly maximum demand included in the Kilowatthour Charge

$5.66	per kilowatt for the next	9	kilowatts of monthly maximum demand	
5.13	" " " " "	90	" " " " "	
4.56	" " in excess of	100	" " " " "	

Kilowatthour Charge:

$3.64	for the first	20	kilowatthours or less used in each month	
6.044¢	per kilowatthour for the next	80	kilowatthours used in each month	
4.409¢	" " " " "	400	" " " " "	
3.500¢	" " " " "	7,500	" " " " "	
2.465¢	" " in excess of	8,000	" " " " "	

Energy Adjustment:

A charge or credit will be made when, in the second preceding month, the average cost per kilowatthour to Public Service of energy produced, purchased, and interchanged was 0.001 mills per kilowatthour above or below 10.000 mills per kilowatthour. The charge or credit will be the differential cost above or below 10.000 mills per kilowatthour multiplied by factors to reflect applicable losses and taxes related to revenue from sales of electricity.

Other Charges:

See SPECIAL PROVISIONS (b) Primary Distribution Service, (c) Auxiliary or Breakdown Service, (d) Building Heating Service and (e) Police Recall or Fire Alarm System Service.

MINIMUM CHARGE:

The monthly minimum charge shall be $3.64 where customer's monthly maximum demand is determined by estimate, and $11.20 where customer's monthly maximum demand is determined by measurement.

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in Docket No. 761-8

RATE SCHEDULE GLP
GENERAL LIGHTING AND POWER SERVICE
(Continued)

DETERMINATION OF DEMANDS:

The customer's monthly maximum demand shall be determined either by measurement or by estimate.

By Measurement: The customer's monthly maximum demand shall be the greatest kilowatt demand occurring during the month as recorded by a demand meter, furnished by Public Service, which measures the maximum kilowatt demand of a steady load in any thirty-minute interval.

By Estimate: Where no demand meter is installed, the customer's monthly maximum demand in any month shall be determined by dividing the kilowatthour use in such month by 100.

TERMS OF PAYMENT:

Bills are due on presentation.

TERM:

One year and thereafter until terminated by five days' notice.

SPECIAL PROVISIONS:

(a) **Limitations on Service:** Service under this Rate Schedule will not be supplied where the capacity required exceeds 400 kilowatts for any new installation, except that when Special Provision (d) is applied the capacity required may exceed 400 kilowatts in any of the months of November through May.

(b) **Primary Distribution Service:** Where special conditions such as location, size, or type of load require that customer take service at a primary distribution voltage, customer shall furnish, install, and maintain a service entrance interrupting device acceptable to Public Service and, where necessary, transformers and appurtenances. (See also Section 6.4. of the Standard Terms and Conditions) Customer's monthly bill, except Minimum Charge and any facilities charge, will be subject to a discount of 5%. Public Service will supply the metering equipment to measure service at the service entrance voltage either directly or by means of compensated metering on the secondary side of the transforming devices.

(c) **Auxiliary or Breakdown Service:** When Auxiliary or Breakdown Service, as defined in Section 10 of the Standard Terms and Conditions, is supplied, the following charges and provisions shall apply:

(c-1) Contract Capacity Charge:
$2.86 per kilowatt per month for the first 10 kilowatts of Contract Capacity
$1.72 per kilowatt per month in excess of 10 kilowatts of Contract Capacity

(c-2) Determination of Contract Capacity: The contract kilowatt capacity shall be equivalent to 85% of the customer's kilovolt-ampere requirement, as rated by Public Service; in no event shall the contract kilowatt capacity be less than the monthly maximum demand. The customer may be required to furnish and install, at his own expense, a load-limiting device, approved by Public Service, which shall be maintained by Public Service at customer's expense. The maximum kilovolt-ampere demand setting of the load-limiting device shall be under the sole control of and be

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RATE SCHEDULE GLP
GENERAL LIGHTING AND POWER SERVICE
(Continued)

adjusted only by Public Service, and shall not be tampered or interfered with in any way by the customer. At any time that there is an increase in the contract kilowatt capacity, a new Term shall commence; the contract kilowatt capacity may not be revised downward during any Term.

(c-3) **Determination of Demands:** The customer's monthly maximum demand shall be determined by measurement only and, for billing purposes, be not less than one kilowatt.

(c-4) **Minimum Charge:** In lieu of the Minimum Charge hereinbefore set forth, the Minimum Charge in any month shall be $2.86 per kilowatt of Contract Capacity, but not less than $11.20.

(c-5) **Parallel Operation:** Customer shall not, at any time, operate private plant service in parallel with the service furnished by Public Service except with the written consent of Public Service.

(d) **Building Heating Service:** Where a customer requires and has permanently installed comfort building heating equipment with a total rated capacity of not less than 25 kilowatts, the customer's monthly maximum measured demand shall be reduced for billing purposes during the months of November through May by an amount equal to one-half of the rated capacity in kilowatts of such building heating equipment, provided:

(d-1) The rated capacity used for determining such decrease in billing demand shall not exceed the kilowatt equivalent of the Btu heat loss, as determined by Public Service, of the area to be heated, which area shall not be heated in whole or in part by systems or equipment utilizing the process of combustion. Comfort building heating equipment shall also include lighting where the Btu equivalent of the connected lighting equipment is 60% or more of the heat loss as determined by Public Service of the area in which it is installed.

(d-2) The billing demand in the months of November through May shall be not less than the higher of (1) 25 kilowatts, or, (2) 50% of the monthly maximum demand.

(e) **Police Recall or Fire Alarm System Service:** Unmetered police recall or fire alarm system service will be furnished for signaling lamps, bells, or horns with an individual rating not greater than 100 watts or 1/8-horsepower, as rated by Public Service, at a charge of 14¢ per month for each signaling lamp, bell, or horn connected, but the total charge shall in no case be less than $1.40 per month. No other energy-using devices shall be connected to the police recall or fire alarm system. The customer shall provide, at his own expense, all necessary equipment and wiring, including the service connection.

STANDARD TERMS AND CONDITIONS:

This Rate Schedule is subject to the Standard Terms and Conditions on Sheets Nos. 6 to 19, inclusive, of this Tariff.

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RATE SCHEDULE LPL
LARGE POWER AND LIGHTING SERVICE

APPLICABLE TO USE OF SERVICE FOR:

General purposes at secondary and primary distribution voltages.

CHARACTER OF SERVICE:

Continuous.

RATE:

Kilowatt Charge—in the months of June through October:

$315.00 for the first 50 kilowatts or less of monthly maximum demand

$5.23	per	kilowatt	for	the	next	50	kilowatts	of	monthly	maximum	demand
4.85	"	"	"	"	"	500	"	"	"	"	"
4.59	"	"	"	"	"	500	"	"	"	"	"
4.32	"	"	"	"	"	900	"	"	"	"	"
4.15	"	"	in excess of			2,000	"	"	"	"	"

Kilowatt Charge—in the months of November through May:

$294.00 for the first 50 kilowatts or less of monthly maximum demand

$4.82	per	kilowatt	for	the	next	50	kilowatts	of	monthly	maximum	demand
4.44	"	"	"	"	"	500	"	"	"	"	"
4.18	"	"	"	"	"	500	"	"	"	"	"
3.91	"	"	"	"	"	900	"	"	"	"	"
3.74	"	"	in excess of			2,000	"	"	"	"	"

Kilowatthour Charge:

5.418¢	per	kilowatthour	for	the	first	5,000	kilowatthours	used	in	each	month
2.468¢	"	"	"	"	next	45,000	"	"	"	"	"
2.246¢	"	"	"	"	"	200,000	"	"	"	"	"
2.138¢	"	"	"	"	"	250,000	"	"	"	"	"
1.894¢	"	"	in excess of			500,000	"	"	"	"	"

Energy Adjustment:

A charge or credit will be made when, in the second preceding month, the average cost per kilowatthour to Public Service of energy produced, purchased, and interchanged was 0.001 mills per kilowatthour above or below 10.000 mills per kilowatthour. The charge or credit will be the differential cost above or below 10.000 mills per kilowatthour multiplied by factors to reflect applicable losses and taxes related to revenue from sales of electricity.

Other Charges:

See SPECIAL PROVISIONS (a) Night Use, (b) Primary Distribution Service, (c) Substation Service-Individual Customer, (d) Auxiliary or Breakdown Service, (e) Interruptible Service, (f) Seasonal Use and (g) Building Heating Service.

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RATE SCHEDULE LPL
LARGE POWER AND LIGHTING SERVICE
(Continued)

MINIMUM CHARGE:

In any month the Minimum Charge shall be the Kilowatt Charge in such month plus $1.10 per kilowatt of capacity required by customer, which capacity shall be not less than the higher of the monthly maximum demand in the current month or that in any of the months of June, July, August and September during the immediately preceding eleven months.

Waiver of Minimum Charge: When customer is temporarily prevented from receiving service during any month by reason of any act of God, accident, strike or work stoppage, legal process, governmental interference, or compliance with any governmental order, Public Service at its discretion may waive the Minimum Charge applicable in such month upon due receipt from customer of written request for such waiver.

DETERMINATION OF DEMANDS:

The customer's daily maximum 24-hour demand shall be the greatest average number of kilowatts supplied by Public Service during any fifteen-minute interval in each calendar day.

The customer's monthly maximum demand shall be the greatest average of the daily maximum 24-hour demands selected from four different days in the current month, or 75% of the highest daily maximum 24-hour demand, whichever is the higher.

The customer's daily maximum "day period" demand shall be the greatest average number of kilowatts supplied by Public Service during any fifteen-minute interval in each "day period."

The customer's monthly maximum "day period" demand shall be the greatest average of the daily maximum "day period" demands selected from four different days in the current month, or 75% of the highest daily maximum "day period" demand, whichever is the higher.

The daily maximum demands shall be determined by the registration of a recording demand meter furnished by Public Service. Where the use of electric service is intermittent or subject to violent fluctuations, Public Service may base the customer's maximum demands upon five-minute in lieu of fifteen-minute intervals. Where the customer's monthly maximum demand is less than 1000 kilowatts, or where the use of electric service is predominantly for lighting service, or where requested in writing by customer, in lieu of the determination of the customer's monthly maximum demand as hereinbefore provided, Public Service may base the customer's monthly maximum demand upon the greatest kilowatt demand occurring during the month as recorded by a demand meter, furnished by Public Service, which measures the maximum kilowatt demand of a steady load in any thirty-minute interval.

TERMS OF PAYMENT:

Bills are due on presentation.

TERM:

One year and thereafter until terminated by five days' notice.

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RATE SCHEDULE LPL
LARGE POWER AND LIGHTING SERVICE
(Continued)

SPECIAL PROVISIONS:

(a) **Night Use:** When the kilowatthours used by a customer during the "night periods" in any month, as determined by the registration of a meter furnished by Public Service, are not less than 30% of the total kilowatthours used in such month, or when the kilowatthours used during the "night periods" in the twelve months ended with such month are not less than 30% of the total kilowatthours used in such twelve months, customer shall have the option in such month of being billed for the kilowatthours used during the "night periods" at 1.894¢ per kilowatthour and for the kilowatthours used during the "day periods" at the Kilowatthour Charge hereinbefore set forth, in lieu of being billed for the total kilowatthours used at the Kilowatthour Charge hereinbefore set forth. If in any such month customer's monthly maximum "day period" demand is less than customer's monthly maximum demand, a deduction shall be made in the Kilowatt Charge equivalent to the amount of such difference in kilowatts of demand at one-half the charges per kilowatt as specified in the above Kilowatt Charge. The "day period" and the "night period" shall be designated by Public Service from time to time, but until further notice are hereby defined as being the periods from 8:00 A.M. to 8:00 P.M. and from 8:00 P.M. to 8:00 A.M., respectively.

(b) **Primary Distribution Service:** Where special conditions such as location, size, or type of load require that customer take service at a primary distribution voltage, customer shall furnish, install, and maintain a service entrance interrupting device acceptable to Public Service and, where necessary, transformers and appurtenances. (See also Section 6.4. of the Standard Terms and Conditions) Customer's monthly bill, except Minimum Charge and any facilities charge, will be subject to a discount of 5%. Public Service will supply the metering equipment to measure service at the service entrance voltage either directly or by means of compensated metering on the secondary side of the transforming devices.

(c) **Substation Service—Individual Customer:** Where special conditions such as location, size, or type of load require that customer be supplied at a subtransmission or transmission voltage, and customer and Public Service agree that Public Service will furnish, install, and maintain a substation solely to serve customer from the secondary side of the transformers at nominal voltages of 4,150 volts, 13,200 volts, or 26,400 volts, such service shall be considered as secondary distribution service and the charges in this Rate Schedule will not be subject to discount. Customer may be required to sell or lease a site for the location of the substation. Public Service may require a guaranteed annual payment and a termination agreement.

(d) **Auxiliary or Breakdown Service:** When Auxiliary or Breakdown Service, as defined in Section 10 of the Standard Terms and Conditions, is supplied, the following charges and provisions shall apply:

(d-1) Contract Capacity Charge:
$247.00 for the first 100 kilowatts or less of Contract Capacity
$ 1.97 per kilowatt per month in excess of 100 kilowatts of Contract Capacity

(d-2) Determination of Contract Capacity: The contract kilowatt capacity shall be equivalent to 85% of the customer's kilovolt-ampere requirement, as rated by Public Service; in no event shall the contract kilowatt capacity be less than the monthly maximum demand. The customer may be required to furnish and install, at his own expense, a load-limiting device, approved by Public Service, which shall be maintained by Public Service at customer's expense. The maximum kilovolt-ampere demand setting of the load-limiting device shall be under the sole control of and be adjusted only by Public Service, and shall not be tampered or interfered with in any way by the customer. At any time that there is an increase in the contract kilowatt capacity, a new Term shall commence; the contract kilowatt capacity may not be revised downward during any Term.

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Issued by W. E. SCOTT, Executive Vice President
80 Park Place, Newark, New Jersey 07101
Filed pursuant to Order of Board of Public Utility Commissioners, dated October 14, 1976
in Docket No. 761-8

RATE SCHEDULE LPL
LARGE POWER AND LIGHTING SERVICE
(Continued)

(d-3) Demand Credit: The Kilowatt Charge shall be subject to a credit of $1.87 per kilowatt of metered monthly maximum demand.

(d-4) Determination of Demands: In the Determination of Demands as hereinbefore set forth, the customer's monthly maximum "day period" demand shall be equivalent to customer's monthly maximum demand for billing purposes.

(d-5) Night Use: The Kilowatthours subject to the Night Use provision hereinbefore set forth shall be limited to 60% of the total kilowatthours used during such month, at $284.10 for the first 15,000 kilowatthours or less and at 1.894¢ per kilowatthour for the excess.

(d-6) Minimum Charge: In lieu of the Minimum Charge hereinbefore set forth, the Minimum Charge in any month shall be the Contract Capacity Charge. The Waiver of Minimum Charge is not applicable.

(d-7) Parallel Operation: Customer shall not, at any time, operate private plant service in parallel with the service furnished by Public Service except with the written consent of Public Service.

(e) Interruptible Service: Interruptible Service will be furnished when and where available under the following conditions:

(e-1) Where a customer agrees to take service under this Rate Schedule at a single service connection and agrees to reduce his maximum peak demand during times of interruption, a monthly deduction shall be made of $1.50 per kilowatt of interruptible capacity.

(e-2) Customer will be required to sign an Application for Interruptible Electric Service under this Rate Schedule, specifying the amount of firm capacity required during interruptions and the amount of interruptible capacity, which capacity shall not be less than 500 kilowatts.

(e-3) Upon advance notice of two hours, from any hour of any day given to customer by Public Service by telephone or otherwise, customer shall reduce his load to the amount of firm capacity specified in the Application for Interruptible Electric Service until further notice. Customer shall designate personnel who will accept notification of interruption at any hour of any day. Where necessary, Public Service will install and maintain suitable metering at its meter location for customer verification of compliance with the interruption notice.

(e-4) Firm capacity shall be reflected in the measurement by a magnetic tape meter of customer's maximum measured demand during the period of interruption called for. If it is determined by Public Service that customer did not reduce his load to the amount contracted for in (e-2) above, the excess over that amount shall be billed at a Kilowatt Charge of $36.00 per kilowatt.

(e-5) Public Service agrees to limit the total hours of interruption as described in this Rate Schedule to the customer during an annual period to a maximum of 150 hours, which hours of interruption can occur consecutively or at any time—the total occurrences not to exceed 15 times during the calendar year.

(e-6) Where customer signs an Application for Interruptible Electric Service and elects to be billed under this Special Provision, the Term of Service shall be three years in lieu of Term stated in this Rate Schedule. Public Service reserves the right to determine whether successive Terms may be negotiated and under what conditions interruptible capacity may be transferred to firm service.

(f) Seasonal Use: **This provision is in the process of elimination and is limited to those customers receiving service hereunder in the month of March 1964.**

When a customer has a seasonal load and guarantees a minimum payment of at least $1,690 in each annual period, if the monthly maximum demand in each of the four months, November to February, inclusive, is less than 50% of the highest monthly maximum demand in any of the immediately

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80 Park Place, Newark, New Jersey 07101
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in Docket No. 7612-1224

RATE SCHEDULE LPL
LARGE POWER AND LIGHTING SERVICE
(Continued)

preceding eight months, March to October, inclusive, such customer shall be billed for any electric service used at the regular charges hereinbefore set forth, except that in lieu of the Kilowatt and Minimum Charges hereinbefore set forth, the minimum charge shall be $25.95 per month and customer shall have the option, in any month, of being billed at $5.20 per kilowatt of demand based on the greatest average number of kilowatts used during any fifteen-minute interval in the month, as determined by the registration of a recording demand meter furnished by Public Service.

(g) Building Heating Service: Where a customer requires and has permanently installed comfort building heating equipment with a total rated capacity of not less than 50 kilowatts, the customer's monthly maximum measured demands shall be reduced for billing purposes during the months of November through May by an amount equal to one-half of the rated capacity in kilowatts of such building heating equipment, provided:

(g-1) The rated capacity used for determining such decrease in billing demand shall not exceed the kilowatt equivalent of the Btu heat loss, as determined by Public Service, of the area to be heated, which area shall not be heated in whole or in part by systems or equipment utilizing the process of combustion. Comfort building heating equipment shall also include lighting where the Btu equivalent of the connected lighting equipment is 60% or more of the heat loss as determined by Public Service of the area in which it is installed.

(g-2) The billing demand in the months of November through May shall be not less than the higher of (1) 50 kilowatts, or, (2) 50% of the monthly maximum demand.

(h) Resale: Service under this Rate Schedule is not available for resale.

STANDARD TERMS AND CONDITIONS:

This Rate Schedule is subject to the Standard Terms and Conditions on Sheets Nos. 6 to 19, inclusive, of this Tariff.

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80 Park Place, Newark, New Jersey 07101
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RATE SCHEDULE HTS
HIGH TENSION SERVICE

APPLICABLE TO USE OF SERVICE FOR:

General purposes at subtransmission and transmission voltages.

CHARACTER OF SERVICE:

Continuous.

RATE:

Kilowatt Charge:

$1250.00 for the first 250 kilowatts or less of monthly maximum demand
$4.33 per kilowatt for the next 1,750 kilowatts of monthly maximum demand
3.98 " " " " " 3,000 " " " " "
3.83 " " " " " 10,000 " " " " "
3.73 " " in excess of 15,000 " " " " "

Kilowatthour Charge:

4.725¢	per kilowatthour	for the first	5,000	kilowatthours used in each month
2.122¢	"	" next	45,000	" " " " "
2.012¢	"	" "	200,000	" " " " "
1.854¢	"	" "	250,000	" " " " "
1.639¢	"	" "	300,000	" " " " "
1.520¢	"	in excess of	800,000	" " " " "

Energy Adjustment:

A charge or credit will be made when, in the second preceding month, the average cost per kilowatthour to Public Service of energy produced, purchased, and interchanged was 0.001 mills per kilowatthour above or below 10.000 mills per kilowatthour. The charge or credit will be the differential cost above or below 10.000 mills per kilowatthour multiplied by factors to reflect applicable losses and taxes related to revenue from sales of electricity.

Other Charges:

See SPECIAL PROVISIONS (b) Night Use, (c) Service at Transmission Voltages, (d) Auxiliary or Breakdown Service and (e) Interruptible Service.

MINIMUM CHARGE:

In any month the Minimum Charge shall be the Kilowatt Charge in such month plus $1.00 per kilowatt of capacity required by customer, which capacity shall be not less than the monthly maximum demand in the current month or in any month during the immediately preceding eleven months, whichever is the higher.

Waiver of Minimum Charge: When customer is temporarily prevented from receiving service during any month by reason of any act of God, accident, strike or work stoppage, legal process, governmental interference, or compliance with any governmental order, Public Service at its discretion may waive the Minimum Charge applicable in such month upon due receipt from customer of written request for such waiver.

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80 Park Place, Newark, New Jersey 07101
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in Docket No. 7612-1224

RATE SCHEDULE HTS
HIGH TENSION SERVICE
(Continued)

DETERMINATION OF DEMANDS:

The customer's daily maximum 24-hour demand shall be the greatest average number of kilowatts supplied by Public Service during any fifteen-minute interval in each calendar day.

The customer's monthly maximum demand shall be the highest of (1) the greatest average of the daily maximum 24-hour demands selected from four different days in the current month, (2) 75% of the highest daily maximum 24-hour demand, or (3) 250 kilowatts, but not less than 15,000 kilowatts when service is furnished at 138,000 volts or higher for capacity requirements exceeding 30,000 kilovolt-amperes.

The customer's daily maximum "day period" demand shall be the greatest average number of kilowatts supplied by Public Service during any fifteen-minute interval in each "day period."

The customer's monthly maximum "day period" demand shall be the highest of (1) the greatest average of the daily maximum "day period" demands selected from four different days in the current month, (2) 75% of the highest daily maximum "day period" demand, or (3) 250 kilowatts, but not less than 15,000 kilowatts when service is furnished at 138,000 volts or higher for capacity requirements exceeding 30,000 kilovolt-amperes.

The daily maximum demands shall be determined by the registration of a recording demand meter furnished by Public Service. Where electric service is supplied for traction power to a rail rapid-transit system, Public Service shall base the customer's monthly maximum demand upon the greatest average number of kilowatts supplied by Public Service during any single coincident hour-ended sixty-minute interval, together with appropriate use, in lieu of fifteen-minute intervals. Where the use of electric service is intermittent or subject to violent fluctuations, Public Service may base the customer's maximum demands upon five-minute in lieu of fifteen-minute intervals. Where the use of electric service is predominantly for lighting service, or where requested in writing by customer, in lieu of the determination of the customer's monthly maximum demand as hereinbefore provided, Public Service may base the customer's monthly maximum demand upon the greatest kilowatt demand occurring during the month as recorded by a demand meter, furnished by Public Service, which measures the maximum kilowatt demand of a steady load in any thirty-minute interval.

TERMS OF PAYMENT:

Bills are due on presentation.

TERM:

One year and thereafter until terminated by five days' notice.

SPECIAL PROVISIONS:

(a) Service Entrance Installations: Customer shall furnish, install, and maintain a service entrance interrupting device acceptable to Public Service and, where necessary, transformers and appurtenances. Public Service will supply the metering equipment to measure service at the service entrance voltage either directly or by means of compensated metering on the secondary side of the transforming devices. (See also Section 6.4. of the Standard Terms and Conditions)

(b) Night Use: When the kilowatthours used by a customer during the "night periods" in any month, as determined by the registration of a meter furnished by Public Service, are not less than 30% of the total kilowatthours used in such month, or when the kilowatthours used during the "night periods" in the twelve months ended with such month are not less than 30% of the total kilowatthours used in such twelve months, customer shall have the option in such month of being billed for the kilowatthours

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RATE SCHEDULE HTS
HIGH TENSION SERVICE
(Continued)

used during the "night periods" at 1.639¢ per kilowatthour and for the kilowatthours used during the "day periods" at the Kilowatthour Charge hereinbefore set forth, in lieu of being billed for the total kilowatthours used at the Kilowatthour Charge hereinbefore set forth. If in any such month customer's monthly maximum "day period" demand is less than 90% of customer's monthly maximum demand, a deduction shall be made in the Kilowatt Charge equivalent to the amount of such difference in kilowatts of demand at one-half the charges per kilowatt as specified in the above Kilowatt Charge. The "day period" and the "night period" shall be designated by Public Service from time to time, but until further notice are hereby defined as being the periods from 8:00 A.M. to 8:00 P.M. and from 8:00 P.M. to 8:00 A.M., respectively.

(c) Service at Transmission Voltages: Where customer takes service at transmission voltage, customer's monthly bill, exclusive of facilities charge, will be subject to a discount of 2%.

(d) Auxiliary or Breakdown Service: When Auxiliary or Breakdown Service, as defined in Section 10 of the Standard Terms and Conditions, is supplied, the following charges and provisions shall apply:

(d-1) Contract Capacity Charge:

$2808.00 for the first 1,400 kilowatts or less of Contract Capacity
$2.29 per kilowatt per month for the next 18,600 kilowatts of Contract Capacity
$2.16 per kilowatt per month in excess of 20,000 kilowatts of Contract Capacity

(d-2) Determination of Contract Capacity: The contract kilowatt capacity shall be equivalent to 85% of the customer's kilovolt-ampere requirement, as rated by Public Service; in no event shall the contract kilowatt capacity be less than the monthly maximum demand. The customer may be required to furnish and install, at his own expense, a load-limiting device, approved by Public Service, which shall be maintained by Public Service at customer's expense. The maximum kilovolt-ampere demand setting of the load-limiting device shall be under the sole control of and be adjusted only by Public Service, and shall not be tampered or interfered with in any way by the customer. At any time that there is an increase in the contract kilowatt capacity, a new Term shall commence; the contract kilowatt capacity may not be revised downward during any Term.

(d-3) Demand Credit: The Kilowatt Charge shall be subject to a credit of $1.86 per kilowatt for the first 5,000 kilowatts of metered monthly maximum demand and $2.02 per kilowatt in excess of 5,000 kilowatts of metered monthly maximum demand.

(d-4) Determination of Demands: In the Determination of Demands, as hereinbefore set forth, the customer's monthly maximum "day period" demand shall be equivalent to customer's monthly maximum demand for billing purposes.

(d-5) Night Use: The kilowatthours subject to the Night Use provision hereinbefore set forth shall be limited to 60% of the total kilowatthours used during such month, at $245.85 for the first 15,000 kilowatthours or less and at 1.639¢ per kilowatthour for the excess.

(d-6) Minimum Charge: In lieu of the Minimum Charge hereinbefore set forth, the Minimum Charge in any month shall be the Kilowatt Charge plus the Contract Capacity Charge less the Demand Credit. The Waiver of Minimum Charge is not applicable.

(d-7) Parallel Operation: Customer shall not, at any time, operate private plant service in parallel with the service furnished by Public Service except with the written consent of Public Service.

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RATE SCHEDULE HTS
HIGH TENSION SERVICE
(Continued)

(e) **Interruptible Service:** Interruptible Service will be furnished when and where available under the following conditions:

(e-1) Where a customer agrees to take service under this Rate Schedule at a single service connection and agrees to reduce his maximum peak demand during times of interruption, a monthly deduction shall be made of $1.50 per kilowatt of interruptible capacity.

(e-2) Customer will be required to sign an Application for Interruptible Electric Service under this Rate Schedule, specifying the amount of firm capacity required during interruptions and the amount of interruptible capacity, which capacity shall not be less than 500 kilowatts.

(e-3) Upon advance notice of two hours, from any hour of any day given to customer by Public Service by telephone or otherwise, customer shall reduce his load to the amount of firm capacity specified in the Application for Interruptible Electric Service until further notice. Customer shall designate personnel who will accept notification of interruption at any hour of any day. Where necessary, Public Service will install and maintain suitable metering at its meter location for customer verification of compliance with the interruption notice.

(e-4) Firm capacity shall be reflected in the measurement by a magnetic tape meter of customer's maximum measured demand during the period of interruption called for. If it is determined by Public Service that customer did not reduce his load to the amount contracted for in (e-2) above, the excess over that amount shall be billed at a Kilowatt Charge of $36.00 per kilowatt.

(e-5) Public Service agrees to limit the total hours of interruption as described in this Rate Schedule to the customer during an annual period to a maximum of 150 hours, which hours of interruption can occur consecutively or at any time—the total occurrences not to exceed 15 times during the calendar year.

(e-6) Where customer signs an Application for Interruptible Electric Service and elects to be billed under this Special Provision, the Term of Service shall be three years in lieu of Term stated in this Rate Schedule. Public Service reserves the right to determine whether successive Terms may be negotiated and under what conditions interruptible capacity may be transferred to firm service.

(f) **Termination of Service by Customer:** Where a customer, served at 138,000 volts or higher, terminates service prior to fifteen years from the initial date of service, customer shall be obligated to pay Public Service that part of the total actual cost of any of the 138,000 volt or higher facilities, land, easements, interests, or rights of way used in rendering such service, under the following schedule:

(f-1) Actual cost of facilities through the first year; thence such actual cost reduced by 5% quarterly during the next succeeding year; thence reduced by 1¼% quarterly during the next succeeding six years; thence reduced by 1¾% quarterly during the next succeeding six years; and thence reduced by 2% quarterly during the remaining year.

(f-2) Actual cost of land, easements, interest, or rights of way through the first year; thence at 80% of actual cost during any of the next succeeding nine years; thence reduced by 4% quarterly during the remaining five years.

(f-3) In the event that Public Service determines to serve other loads from or otherwise use the aforesaid facilities, lands, easements, interests, or rights of way, then their cost shall be allocated on an equitable basis for the determination of the termination payment reflecting the difference between the actual cost and the allocated cost.

(g) **Limitations on Loads Served at 138,000 Volts or Higher:** Customer may be required to supply advance information as to conditions affecting his load as an aid to Public Service in load scheduling.

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Issued by W. E. SCOTT, Executive Vice President
80 Park Place, Newark, New Jersey 07101
Filed pursuant to Order of Board of Public Utility Commissioners, dated March 10, 1977
in Docket No. 7612-1224

RATE SCHEDULE HTS
HIGH TENSION SERVICE
(Continued)

Public Service shall not, without prior written acceptance, be obligated to deliver at a single service location an amount of power in excess of a maximum demand of 50,000 kilowatts at 85% power factor.

(h) Resale: Service under this Rate Schedule is not available for resale.

STANDARD TERMS AND CONDITIONS:

This Rate Schedule is subject to the Standard Terms and Conditions on Sheets Nos. 6 to 19, inclusive, of this Tariff.

Date of Issue: January 13, 1977 Effective: January 14, 1977
Issued by W. E. SCOTT, Executive Vice President
80 Park Place, Newark, New Jersey 07101
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in Docket No. 7612-1224

TRENTON ICES
BUILDING OIL CONSUMPTION

In order to evaluate the energy use of an oil heated, conventional community as compared to an ICES community - the use of oil, if all heating were done by on-site boilers, was considered. Actual consumption based on an average of several years was used. As mentioned under Electric Energy Costs, above, the impact of Executive Order 13 is included in the oil consumption figures.

TRENTON ICES
BUILDING OIL CONSUMPTION
WITH HEATING SUPPLIED FROM ON-SITE BOILERS

	Barrels/Year
Existing Buildings	32,802
Proposed Buildings	8,173
Total Community Without ICES	40,975
Total #2 and #4 Oil	11,741
Total #6 Oil	29,234

EXISTING BUILDINGS
YEARLY OIL HEATING ENERGY
PRESENT AVERAGE USE

Boiler Plant	Fuel	Heating 10^6 Btu	Oil* 10^6 Btu	Oil** Barrels
Mercer Court House	#4	13,048	20,711	3,571
Detention	#6	4,003	6,354	1,059
Detention Kitchen	#2	630	1,000	172
Health & Argriculture, Labor & Industry and State House Complex	#6	77,490	123,000	20,500
Kingsbury I	#2***	27,405	43,500	7,500
Totals		122,576	194,565	32,802

* Seasonal combustion efficiency of 70% and 10% distribution losses included.
**#6 Oil at 6 x 10^6 Btu/barrel, #2 and #4 at 5.8 x 10^6.
*** Assumed.

PROPOSED BUILDINGS
YEARLY OIL HEATING ENERGY
WITHOUT ICES PLANT

Boiler Plant	Fuel	Heating 10^6 Btu	Oil* 10^6 Btu	Oil** Barrels
Kingsbury II	#6	9,367	14,868	2,478
Dept. Environmental Protection	#6	2,706	4,296	716
Civic Center	#6	6,407	10,169	1,695
Justice Department	#6	6,608	10,489	1,748
Capitol Post Office	#2	781	1,240	214
Justice Commercial	#2	781	1,240	214
Luther Arms	#6	2,290	3,635	606
Capitol I	#6	1,634	2,594	432
Firehouse	#2	256	406	70
Capitol Place Garage	None	0	0	0
Justice Department Parking	None	0	0	0
Totals		30,830	48,937	8,173

* Seasonal combustion efficiency of 70% and 10% distribution losses included.
**#6 Oil at 6 x 10^6 Btu/Barrel, #2, and #4 at 5.8 x 10^6.

NOTE: Total Domestic Hot Water requirements for the community are assumed to be 28,000 x 10^6 Btu without losses.

TRENTON ICES
OPERATING AND MAINTENANCE
YEARLY COST OF STAND-BY

Operation of Oil Pumps	$ 500
Burner Operation	200
Steam Atomization	200
Maintenance	4,000
Total	$4,900

TRENTON ICES
SPACE SAVING IN
PROPOSED CONSTRUCTION
1977 COST

Building	Boiler Room @ $30/ft^2	Portion Used by ICES	Credit of Remainder @ $20/ft^2*
Capitol I	$ 14,400	$ 4,800	$ 6,400
Luther Arms	14,400	4,800	6,400
DEP	16,500	5,500	7,300
Civic Center	24,000	8,000	10,700
Kingsbury II	24,000	8,000	10,700
Justice	27,000	9,000	12,000
Totals	$120,300	$40,100	$53,500

Chargeable to Basic Building Structure	-	$26,700
Chargeable to Conventional System	-	$93,600
Chargeable to ICES	-	$40,100

Note: The above does not include consideration for fees in construction or general contingencies.

*The credit reflects a reduction in cost less the appropriate related factors of costs for building elements such as walls, footings, etc. required for other areas of the structure.

TRENTON ICES
OPERATING AND MAINTENANCE
YEARLY COST OF CONVENTIONAL SYSTEM

	All Buildings Oil Heat	Existing Buildings Using Oil Heat - Proposed Using Electric Heat
Operation of Oil Pumps	Included in Electrical	Included in Electrical
Burner Operation	Included in Electrical	Included in Electrical
Steam Atomization	$ 8,900	$ 7,120
Steam Heating and Tracing of #6 Oil	4,000	3,200
Maintenance	16,200	15,960**
Operating Engineers*	630,000	486,000
Water Treatment Additives	2,000	1,600
Total	$661,100	$513,880

*Assumes nine full-shift locations or 36 employees at $25,000 per year.

**Includes $3,000 additional maintenance for heat pumps. The majority of heat pump maintenance is included in that of the electric air conditioning.

TRENTON ICES
LICENSED BOILER OPERATORS
AND/OR MAINTENANCE PERSONNEL
REQUIRED AT BUILDING LOCATIONS

	Conventional Oil Heat	Conventional Electric Heat	ICES
State House Complex*	4	3	2
Health and Agriculture and Labor and Industry	5	5	2
Kingsbury I	4	4	2
Group I			
Luther Arms	4	2	2
Mercer Court and Detention	4	4	2
Firehouse	-	-	-
Justice	2	2	2
Kingsbury II	4	2	2
Group II			
Capitol I	3	2	2
Civic Center	2	1	1
Group III			
DEP	3	2	2
Total Personnel	35	27	19
Total Cost at $18,000**	$630,000	$486,000	$342,000

*During summer months the boilers are shutdown and the five operators used for other maintenance.

**Based on State of New Jersey salary rates of $14,000 per year plus fringe benefits.

PSE&G

Public Service Electric and Gas Company 80 Park Place Newark, N.J. 07101 Phone 201/622-7000

April 4, 1977

Mr. John Sullivan
Deputy - Director
Department of Boilers
Mechanical Inspection Bureau
John Fitch Plaza
P. O. Box 1503
Trenton, New Jersey 08625

Dear John:

As per our recent conversation regarding the Trenton ICES study, we would like specific written response to a number of questions regarding your Bureau's requirements.

Background Data

The Trenton ICES study encompasses the evaluation of the feasibility of locating a group of combustion turbine-electric generator sets with waste-heat boiler together in one building. The steam out put from the boilers (125 PSIG, 350°F) would be distributed to six groups of buildings at 125 PSIG. Heat exchanges would convert the steam to hot water (maximum one PSIG, 199°F). The hot water would be stored or used directly for heating. The steam would also be used in lithium bromide absorption chillers.

Option I

Assuming that ICES would be implemented:

1. Are licensed operators required in the generating plant?

2. Are licensed operators required at buildings were heat exchangers, storage devices or absorption machines are located?

3. If they are required at the buildings, does that requirement apply to unoccupied hours as well?

Option II

Assuming that ICES does not exist, and that the buildings are heated by oil-fired low pressure (under 15 PSIG) hot water boilers (over 499 square feet in area) located in the buildings:

1. Are licensed operators required during occupied hours?

2. Are licensed operators required during unoccupied hours?

We appreciate your assitance in evaluating our operating costs. If you need further detail, please call me.

C. W. Gellings, P.E.
Applications Engineer

CC Mr. James B. Greenberg

bcc Messrs. W. S. Ku
R. F. Dittrich

STATE OF NEW JERSEY
DEPARTMENT OF LABOR AND INDUSTRY
LABOR RELATIONS AND WORKPLACE STANDARDS
LABOR AND INDUSTRY BUILDING
TRENTON, NEW JERSEY 08625

JOHN J. HORN
Acting Commissioner

WILLIAM J. CLARK
Assistant Commissioner

Office of Boiler & Pressure Vessel Compliance
(Mechanical Inspection Bureau)
P. O. Box 1503
(609-292-2345)

April 15, 1977

Mr. C. W. Gellings, P.E.
Applications Engineer
Public Service Electric & Gas Co.
80 Park Place
Newark, N. J. 07101

Dear Clark:

Thank you for your letter of April 4, 1977 regarding the Trenton Inter Community Energy System and this Office's requirements.

Option I

1. Licensed operators must be in attendance at all times during the operation of the high pressure steam generating plant.

2. No. While Section 34:7-1 addresses "a steam or hot water heating plant ..... regardless of pressure or temperature conditions .....", in my opinion, it did not intend the coverage of unfired heat exchangers utilizing energy previously generated.

   Since the heat exchangers rely heavily upon controls and safety relief devices, these should be under the supervisory surveillance of the licensed generating crew. A good maintenance program and perhaps a central control and telemetering system could minimize physical attention to the heat exchangers.

3. Licensed operators are not required at the buildings served by the heat exchangers.

Option II

Where buildings are heated by oil or other fuel fired low pressure boilers, located in or serving the buildings:

1. Yes, licensed operators are required during occupied hours while any boiler in the system is operating or in an automatic condition to operate.

2. Licensed operators are not required while low pressure boilers serve unoccupied buildings.

I trust that this will assist your project. Should further be needed please let us know.

Sincerely yours,

John L. Sullivan
Assistant Director

JLS:CEB

cc: W. J. Clark
Assistant Commissioner

appendix G

public information material

APPENDIX G
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Trenton times

November 13, 1976 Trenton, N.J. 15 cents

City eyes steam heat plan

By MARK JAFFE
Staff Writer

A proposal for a generating plant that would provide electricity and low cost steam heat for downtown Trenton will be submitted to the federal government next week by the city and Public Service Electric & Gas Company.

Under the proposal, steam that turns electric generating turbines would afterward be piped into the downtown area to heat office buildings, stores and apartments, said City Planning Director John Clarke.

This recycling of steam is called "congeneration" and city officials say they hope the inexpensive heating will help attract development into downtown Trenton.

The city and PSE&G have requested about $100,000 from the federal Energy Research and Development Administration to determine the appropriate size of a cogeneration system, its cost and possible sites.

THE MERCER County Improvement Authority (MCIA) has expressed interest in financing the construction of the multi-million dollar system, according to Clarke.

Under the current "scenario," the MCIA would float bonds for construction of the system, build it as a public facility and repay the bonds with the revenues from selling steam. PSE&G would actually operate the generating station.

"Both the MCIA and PSE&G wanted us to submit the proposal," said Fred Travisano, assistant city planning director.

Travisano estimated that a cogenerating system would cost several million dollars and Clarke said that it would take roughly two years to build.

ERDA HAS been advocating cogeneration as a method of energy conservation and has said it will finance six metropolitan studies for cogeneration. The deadline for submitting proposals is Nov. 18.

However, Trenton officials are as interested in cogeneration's advantages in attracting development as its potential for saving energy.

"Buildings hooked-up to the system won't have to invest in boilers . . . and a developer could therefore reduce his capital costs (in constructing a building)," Clarke explained.

Clarke pointed out that as fuel costs continue to rise, downtown sites with access to less expensive steam heat become even more attractive to developers "from an energy standpoint."

COGENERATION ISN'T a new concept. Steam heat from generating plants has been used to heat buildings in New York City for decades and in countries such as West Germany, cogeneration is involved in making 29 per cent of the nation's electricity. There are about 26 electric generators which also supply heat in the PSE&G electric service area that includes Trenton.

Princeton University has its own generator which provides electricity and heat for university buildings and the Exxon Corporation complex in Hopewell Township has a similar facility.

However, "most steam heat created by electric generators in New Jersey is going up the stack," according to one city official.

Most generating stations are in out-of-the-way places and this presents a problem, Clarke says, because "steam heat is not easily transportable."

"THE ENERGY is thrown away because it can't be converted and it can't be transported.

"There has to be some facility close enough (to the generating plant) which can purchase the heat energy in the form of steam for use in heating or air conditioning," Clarke explained.

He said the proposed study would determine the maximum distance a generating facility could be from

(Continued on Page A2, Col. 5)

Steam Heat Plan — A Longshot

By JULIE CHARLIP

Trenton officials are taking a longshot by iswering a request from the federal govern-ent for plans to use recycled steam heat in)wntown buildings.

Trenton didn't make the proposal, stressed ty planner John Clarke.

And, the chance of getting it is a longshot.

The Trenton Times reported yesterday that renton is applying to the federal Energy Research and Development Administration (ERDA) for $100,000 to do a study on what is called congeneration, the recycling of steam that turns electric generating turbines by piping it into buildings for heating and cooling.

Clarke explained that Trenton didn't come up with the idea. ERDA did. ERDA asked for proposals from cities, and Clarke estimates that the federal agency will receive about 100 of them.

Of those 100, submitted from cities throughout the county, about six or eight will probably be chosen for a feasibility study, Clarke said.

And if it's feasible, and that's a big if, Clarke said, then it's likely only one city will be chosen for actual construction.

The Times also reported that funding to build the system would come from the Mercer County Improvement Authority (MCIA).

"That's complete conjecture on the part of the Times," Clarke said. "We don't know any of the financial terms on this and there's certainly no commitment on the part of the MCIA or anyone else."

Clarke explained that the work now being done by the city planning department is simply to answer ERDA's request for proposals.

Before responding, city officials felt they should talk to representatives of Public Service Electric and Gas Co. (PSE&G) and the MCIA, because if neither group was interested, there'd be no point in answering.

He said John Cantwell, MCIA chairman, and PSE&G representatives feel it's a good enough idea to warrant study.

But neither city council nor the MCIA has met to discuss it.

The only reason Trenton is interested, Clarke explained, is because of the possible potential of attracting downtown development.

"You use heat that is produced as a biproduct of producing energy," Clarke explained.

"It would mean that you could then build buildings in downtown Trenton and you would have some financial advantages. You wouldn't have to recreate a heating and cooling system in every building," he said.

"Theoretically, it would make developing in downtown Trenton more attractive, and that's our only interest."

Clarke said there are still a lot of questions to be answered.

"We need to know whether this thing is financially feasible, whether it's a good idea for Trenton, who would finance the development, who would operate it, how many buildings will be connected into it...many, many questions that there are no answers for," he said.

ERDA has been promoting cogeneration to conserve energy. The deadline for applying for ERDA funds for a study is Nov. 18.

Clarke said Trenton may prove to be a good area to study because of the expected state buildings to be constructed in a small downtown area.

"ERDA's looking for a test case to demonstrate the pros and cons of small scale cogeneration plants," Clarke said. "We expe-

region

Trenton Times, Trenton, N.J.
Wednesday, January 5, 1977

U.S. selects Trenton for heat-saving study

By DIANA HENRIQUES
Staff Writer

Trenton has been tapped by the federal government as one of six cities that will study ways to use the "waste heat" from power plants.

After the six cities complete their studies, the federal Energy Research and Development Administration (ERDA) will select one of them to build — with federal money — a system using heat that is normally lost when electricity is produced.

ERDA is going Trenton a $150,000 contract to evaluate a system using the process called co-generation. City officials anticipate using heat from a new power plant to heat office buildings.

According to City Planning Director John Clarke, who discussed the project at yesterday's city council meeting, most of the contract money will go to subcontractors who will actually perform the study. The subcontractors will include Public Service Electric & Gas, the power company serving Trenton.

"IN ALL PROBABILITY, Public Service would construct, own and operate a district plant to serve buildings owned by the state, the Mercer County Improvement Authority, the New Trenton Corporation, and the city," Clarke said.

The city planning department has proposed that the study involve new buildings proposed for the John Fitch Way and Center City South urban renewal areas.

In co-generation, electricity is produced with steam-driven turbines and then the steam is "recycled" to nearby office buildings.

CITY OFFICIALS have eyed the concept and the inexpensive heating service it would provide as a way of attracting downtown development.

The co-generation process is not new, however. There are about 26 electric generators which also supply heat in the Public Service customer area which includes Trenton. But because most generating stations are in remote areas — and because the steam heat can't be pumped for long distances — most of this thermal energy in New Jersey is being wasted.

The city is proposing a generating facility which would be close to buildings that can use the steam heat created.

The area outlined in the proposal will be the site of new state and county office buildings.

TRENTONIAN 5 JAN 1977

City Gets 150G's to Develop New Energy

By MARK STRADLING

The City of Trenton has been awarded a $150,000 contract from the federal government to do a feasibilty study for a revolutionary energy generation system.

The pilot project is one of only six in the entire country. The grant was made by the U.S. Energy Research and Development Adminstration.

John Clarke, director of planning and development for Trenton, explained that the study will explore the possibilty of a technique called co-generation.

Basically, what this system does, is to take waste heat produced in the generation of electricity and use it to power heating or cooling plants.

Clarke noted that the Public Service Electric & Gas Co. already operates such an installation in Linden, N.J., for the Exxon Corp.

The purpose of the new feasibility study is to see if such a scheme is economically viable on a large scale.

The first part of the study will begin early next month and is expected to take about four months to complete.

At the end of that time, the federal government will evaluate reports and make recommendations.

Mayor Arthur Holland congratulated Clarke and his staff for putting the application for the grant together. Holland noted that there were 21 applications for the funds.

Harry Sayen

TRENTON TIMES, TRENTON, N.J., THURSDAY, MARCH 31, 1977

Trenton studies ways and means to conserve

Energy is a hot issue everywhere in the United States. For New Jersey, however, the conservation of energy is of particular import because our state is so highly populated, so heavily industrialized and so completely dependent on outside sources for oil, gas and coal. Nuclear power has left far too many unanswered questions — not to speak of its rocketing lost and wastefulness. Wind has limitations. Solar energy, the hope of the future, does not have the broad acceptance needed. Thus, New Jersey is left with one immediate energy alternative: conservation.

Everyone talks of conservation, but precious few are doing something truly meaningful. However, Trenton is — through participation in a feasibility study for establishing an Integrated Community Energy System (ICES). Funded by the U.S. Energy Research and Development Administration (ERDA), an agency under the executive branch, the ICES study will be a joint effort of Trenton planners and the Public Service Electric & Gas Company (PSEG). This study will attempt to show that waste heat from an electrical plant can be recovered and utilized to heat and cool nearby buildings.

TRENTONIANS should be proud of receiving this $178,000 grant to study downtown Trenton energy requirements. Nationally, 22 regions answered ERDA's call for ICES participation. Five were then chosen for study grants. Shortly after a May 20 deadline, one award will be made to build the power unit. Naturally, John Clarke, Trenton's planner-in-chief, wants to win: "We are fairly confident that the economics will prove out."

Let's examine the ground rules. Present fossil-fueled electrical generating plants operate at 30 per cent efficiency while 70 per cent of the heat goes up the stacks or into adjacent waters. ICES would almost double the efficiency by recapturing and piping the wasted heat into nearby buildings in the form of super-heated steam.

The word "nearby" is important. This system can only be effective up to 2,500 feet from the central station. Over 2,500 feet, the steam cools, and that's the key to the wastefulness of stations such as the local Duck Island plant; they are too far from the areas of heavy usage.

CLARKE OUTLINED the ICES area of study, which includes the State House, the Cultural Center Complex, the proposed justice building, the envisioned Civic Center and various county and private structures in the immediate vicinity — or in Clarke's words, "with sympathetic owners such as state, county and New Trenton." Later, others on State Street and environs could hook into the steam lines.

The advantages of ICES were listed by Clarke. First, it is proven. Not 40 miles from here in Linden, a partnership between Exxon and PSEG in an ICES type facility has been successful for more than a decade. A clean environment is another benefit because less fuel is burned which, in turn, leads to tremendous dollar saving, as shown in the illustrative diagram. The million and a half gallons of oil saved (at 40 cents per gallon) would mean $600,000 per year if ICES were built in the downtown Trenton area.

Nor is that the end of the goodies. ICES will heat and cool any new downtown building. Therefore, boilers will not be needed — with resultant savings described by Clarke: "For the owner of a 350,000 square-foot facility, this means a saving of approximately $325,000 in capital costs." And, without the need for boilers, maintenance costs could be lowered and fire hazards reduced.

TO DO THE JOB in the downtown area outlined would mean the construction of a 10,000 kilowatt generating station. A landing at Chicago's O'Hare airport should convince most anyone that a generating station can be tastefully blended into the surroundings.

All of which leads to the final advantage of ICES — the creation of jobs. Obviously, there are the jobs for the building of ICES. Furthermore, the secondary impact of lower building costs should lead to more construction work. Finally, the saving of fuel would allow more for other purposes in the state, thereby tending to save jobs.

A nice picture, to be sure. But everyone, from building owner to state government, will have to cooperate. And Trenton must win the competition for ERDA funds.

Clarke and his cohorts are confident that the various problems of economics, the environment technical details and multiple ownerships and interests can be overcome.

As John Clarke will tell you: "ICES represents a very positive way of meeting the energy crisis."

N.J., FRIDAY, APRIL 8, 1977

City hopeful of federal funds for heat-recycling power plant

By CELESTINE BOHLEN
Staff Writer

Trenton's bid for federal funds for an energy recycling system in the downtown stands a good chance of success because it poses more problems than competing proposals, city officials said yesterday.

The city of Trenton, working with Public Service Electric and Gas, is in a five-way race for a grant from the U.S. Energy Research and Development Administration (ERDA). The multi-million dollar grant would construct a power plant that would recycle heat energy now wasted in the generation of electricity and use it to heat downtown office buildings.

The process — known as "cogeneration" on the Integrated Community Energy System (ICES) — would not only conserve energy but would also lessen the cost of new construction in downtown Trenton by eliminating the need for expensive boiler systems, which depend on expensive fossil fuels.

Because Trenton's plan involves complicated arrangements with several owners of downtown office buildings, it has at an advantage and a disadvantage in the sweepstakes for the ERDA grant, said John P. Clarke, Trenton planning and development director.

At a meeting yesterday with sponsors of the proposed ICES projet and officials from ERDA, Clarke said Trenton's proposal was "the most complicated institutionally" of the five finalists.

THE OTHER applicants for the RDA grant are a consortium of hospitals in New Orleans, La., the University of Minnesota and Clark University in Worcester, Mass.

Only Trenton has proposed to feed the steam heat produced at the congeneration plant into individually-owned buildings on separated sites, which will pose extra legal and bureaucratic problems, Clarke said.

The other proposals involve single institutions, owning a single complex of buildings, which would make the implementation of the energy system far simpler.

But, said Clarke, Trenton's situation, although a "very complicated puzzle," is more typical of the problems that cogenerating plants would face in most parts of the country. And since the ERDA grant is supposed to fund a demonstration project, the lessons learned in Trenton could prove more useful than those learned at the other, easier sites, Clarke said.

"Either we can demonstrate how we can do this or we will demonstrate how it can not be done," said Clarke.

YESTERDAY'S MEETING was held to release the initial findings of studies done by consultants hired on the city's preliminary $178,000 research grant.

A final report on Trenton's proposal will be ready for submission to ERDA on May 16. An award of the grant is due to be made later in May.

According to Clarke, the proposal will include major state office buildings, including the State House, the Mercer County Court House, the Kingsbury Towers, the Luther Arms Housing for the Elderly, the War Memorial Building and others.

The tentative site for the power plant itself is in the parking garage to be built near the proposed Capital Place office building at Lafayette and Warren Streets. The cost of the plant is estimated to be between $9 and $10 million.

Under the terms of the proposal, the 10,000 kilowatt plant would be built, owned and operated by PSE&G. The ERDA grant, if the city wins it, would pay for the initial engineering plans, not necessarily the cost of construction or maintenance.

State representatives attending yesterday's conference pledged the support of state to the city's proposal, noting the economic and environmental benefits of cogeneration.

TRENTON'S INTEGRATED COMMUNITY ENERGY SYSTEM

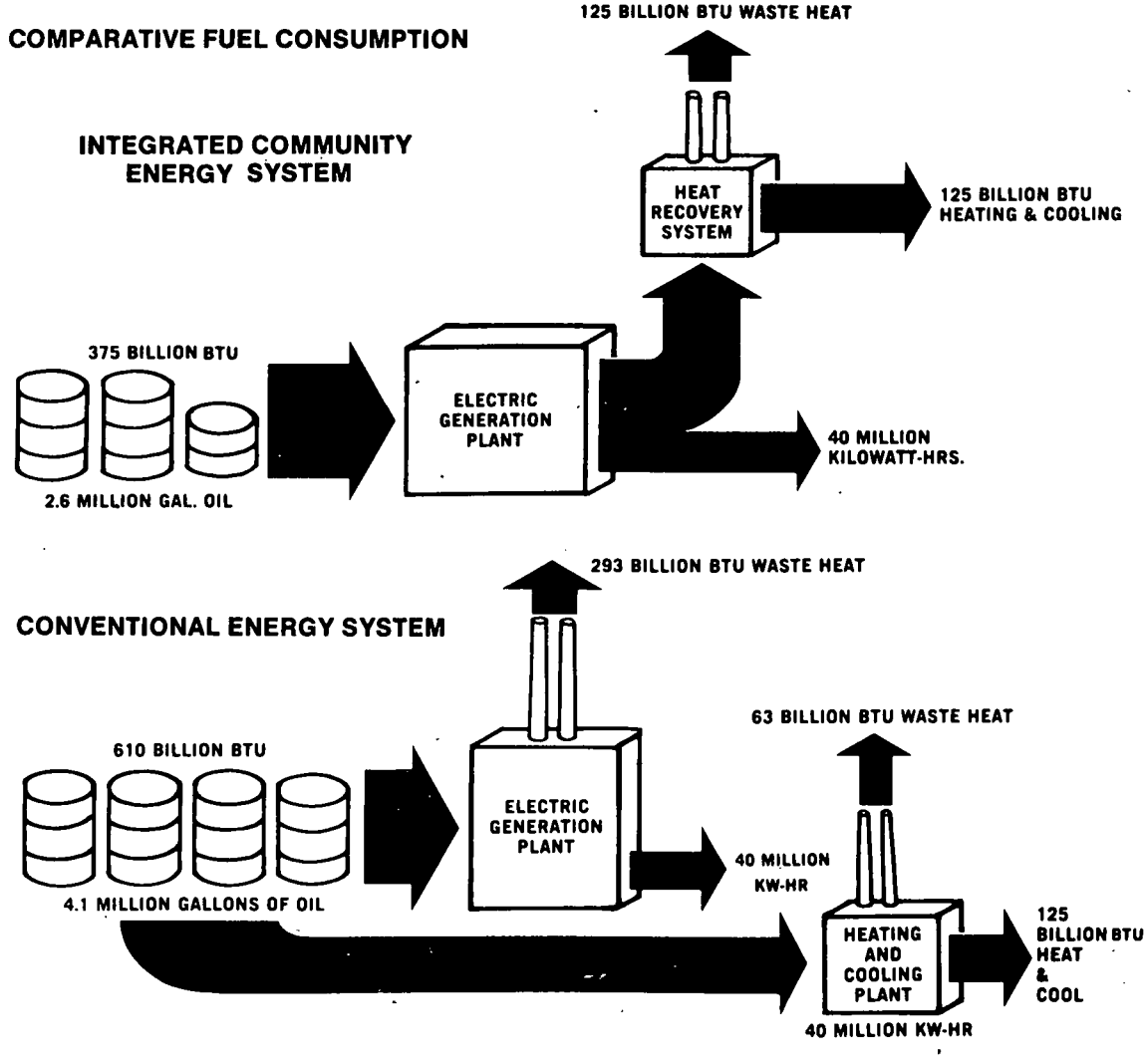
FEASIBILITY STUDY

The City of Trenton is currently studying the feasibility of establishing an Integrated Community Energy System (ICES) to serve the Central Business District. This study is being funded by the U.S. Energy Research and Development Administration (ERDA) and is being performed with the close cooperation of Public Service Electric and Gas Company.

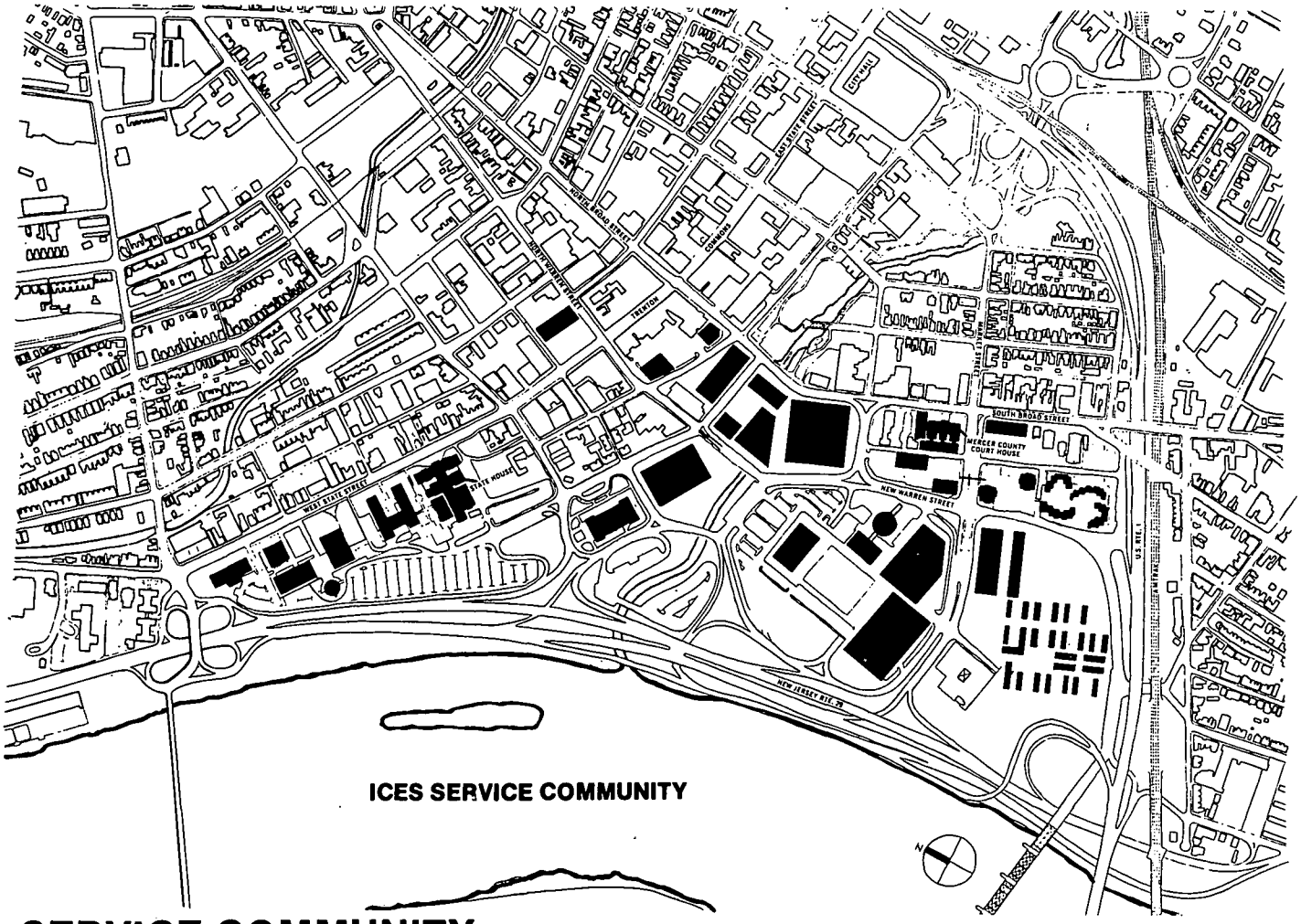
ERDA is concerned with the increasing drain on the nation's non-renewable energy resources. Accordingly, they have contracted with the City for this study directed at improving the efficiency of energy utilization in ways that protect the environment and provide energy to people at affordable prices. The City is one of only five agencies in the nation to undertake similar studies and the only one in the Middle Atlantic States. At the conclusion of this study in May, 1977 ERDA will choose one of these five for implementation.

ICES CONCEPT

ICES is a concept where waste heat from an electrical generation facility is recovered and utilized to heat and cool nearby buildings. A typical fossil fuel electrical generating station converts, on the average, 30% of the energy content of the fuel into electricity, with the other 70% lost as waste heat up the smoke stack or into an adjacent river or lake. The ICES system has the potential to nearly double the efficiency of the fuel by recapturing the waste heat and transporting it in the form of steam to nearby buildings.



NOTE: These figures are for illustrative purposes only and do not represent the findings of the ongoing feasibility study.



SERVICE COMMUNITY

Now is a propitious time for the implementation of the ICES in Trenton. The report of the Governor's Commission to evaluate the capital needs of New Jersey, published in April, 1975, identifies a significant need for additional office space for State workers. Further, Governor Brendan Byrne issued an Executive Order in September, 1976 which directs that all existing and new office space be centralized in urban areas, including Trenton. The Mercer County Improvement Authority and the New Trenton Corporation have responded by offering to finance and construct this office space. Furthermore, both agencies and Governor Byrne are on record as supporting the concept of the ICES in Trenton. The ICES could serve many of the existing State office buildings such as the State House, the State Museum and Library, the State Education Building, the State Departments of Labor and Industry, Agriculture and Health and the proposed Justice Complex, as well as the Mercer County Court House, Detention Center and proposed Administration Building, Kingsbury Housing, Luther Arms Housing for the Elderly, the War Memorial and the proposed Civic Center Auditorium, and the Capital Place Complex.

Implementation of such a system would require construction of a 10,000 kilowatt generating station.

CENTRAL ENERGY PLANT KENNEDY INTERNATIONAL AIRPORT

photo: Gottscho-Schleisner, Inc.

BENEFITS

FUEL CONSERVATION...

The ICES system for downtown Trenton would save a projected one and one-half million gallons of oil per year. This represents enough gasoline to fuel a fleet of 3,000 cars.

CLEANER ENVIRONMENT...

Because less fuel is burned, there is less resultant air pollution.

LOWER CAPITAL CONSTRUCTION COSTS...

Any new building which is constructed in downtown Trenton can be heated and cooled by energy recovered from the ICES power plant and therefore has no need of a boiler system. For the owner of a typical ten story building, this means a savings of $300,000 to $500,000 in capital costs.

LOWER MAINTENANCE COSTS...

Since this new construction has no boilers there are considerable maintenance savings.

JOBS...

The ICES will also create jobs. Directly, it will create construction jobs, not only for the ICES facility but also for other construction which may be attracted by the lower capital construction and operating costs in Trenton. Indirectly, it will increase, by conservation, the availability of scarce fuel resources which are the life blood of New Jersey's business and industry.

ICES PARTICIPANTS

- The City of Trenton, New Jersey
- Public Service Electric and Gas Company
- Mercer County Improvement Authority
- New Trenton Corporation
- Richard Stein and Partners, Architects
- R. G. Vanderweil Inc., Consulting Engineers
- Turner Construction Company
- Kingsbury Housing Corporation
- Lutheran Housing Corporation
- New Jersey Housing Finance Agency
- Capital Place Associates

ERDA is planning to implement only one of these five proposals being studied nationwide. The success of the Trenton proposal, the only one in the Middle Atlantic States, depends upon public awareness and support.

FOR MORE INFORMATION CONTACT:

John P. Clarke, Director
Department of Planning
and Development
10 Capital Street
Trenton, New Jersey 08618
Telephone (609) 989-3504

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letters from demonstration team

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OFFICE OF THE MAYOR

CITY OF TRENTON, NEW JERSEY 08608

ARTHUR J. HOLLAND
MAYOR

May 10, 1977

Mr. John A. Casazza
Vice President - Research and Planning
Public Service Electric and Gas Company
80 Park Place
Newark, New Jersey 07101

Dear Mr. Casazza:

I would like to thank you on behalf of the City and the Department of Planning and Development for the contribution and cooperation of Public Service in the City's performance of its contract with ERDA. I am very pleased that the results of the Phase I, Feasibility Study indicate that Public Service will consider actively the construction of a 10 megawatt generating station in downtown Trenton. I am very hopeful that the Trenton ICES Demonstration Team will be selected to continue its study into the preliminary engineering stage and, if it is, I am looking forward to continued close cooperation between our two organizations. I shall direct the various City departments to assist the ICES team wherever possible.

The Department of Planning and Development began work on a modification of the Urban Renewal Plan to accomodate the ICES plant and the Department of Public Works will assist PSE & G in the planning of the proposed steam distribution system through the City streets.

Please contact me if there is anything I can do to facilitate matters.

Sincerely yours,

Arthur J. Holland

City of Trenton Department of Planning

May 13, 1977

Mr. Steven A. Mallard
General Manager - Planning & Research
Public Service Electric & Gas Company
80 Park Place
Newark, New Jersey 07102

Dear Steve:

On behalf of the Department of Planning and Development which is Trenton's Urban Renewal Agency, I would like to pledge our continued participation and cooperation in the Trenton ICES project.

The Department is looking forward to our continued relationship with PSE&G on the Phase II study, detailed Feasibility and Preliminary Design.

Our agency is prepared to amend the Urban Renewal Plan for the John Fitchway Area to include the ICES, to expedite this plan change and to enter into a disposition agreement with PSE&G for the purchase of the Urban Renewal parcel.

I would also like to take this opportunity to commend the PSE&G team which facilitated the Phase I study and to thank them for their diligence and expertise.

Sincerely yours,

John P. Clarke, A.I.A., A.I.P.
Director, Dept. of Planning and Development

PSE&G

Public Service Electric and Gas Company 80 Park Place Newark, N.J. 07101 Phone 201/622-7000

May 5, 1977

Mr. John C. Rodousakis
Program Manager
Community Systems Branch
Division of Buildings and Industry
ERDA
Washington, D. C. 20545

Dear Mr. Roudousakis:

TRENTON ICES STUDY

The preliminary feasibility study (Phase I) of applying the grid-connected Integrated Community Energy System (ICES) concept to supply a portion of the downtown district in Trenton, N.J. is now completed. The purpose of this letter is to reaffirm the PSE&G position on this project and to include this statement of commitment in the Phase I final report as you requested.

Since the results of Phase I indicate that based on preliminary cost estimates and economic evaluation, the Trenton ICES plan and its alternative conventional system plan are about an economic stand-off, PSE&G is willing to proceed with Phase II work with the other study participants to provide detailed feasibility analysis and preliminary design of the demonstration system if ERDA chooses to provide further funding on this project.

In the event that Phase II study continues to demonstrate the economic viability of the Trenton ICES project, PSE&G will be ready to participate in implementing the subsequent phases of the project regarding its final design, construction and operation. In this respect, it is the PSE&G's preference to own and operate the ICES plant and the associated thermal energy distribution facilities, provided that the following conditions have been resolved:

1. Additional capital financing can be obtained.

2. All legal and regulatory requirements can be met.

3. Satisfactory agreements with customers can be reached.

Sincerely,

S. A. Mallard

S. A. Mallard
General Manager -
Planning and Research

Richard G. Stein and Partners Architects 588 Fifth Avenue, New York 10036 212 Plaza 7-0284

12 May 1977

Mr. John C. Rodousakis
Program Manager
Community Systems Branch
Division of Buildings and Industry
U.S. ERDA
Washington, D.C. 20545

Re: Trenton ICES

Dear Mr. Rodousakis:

The Phase I study of the Trenton ICES indicates that the implementation of this project is technically feasible using conventional technologies. Its operation would result in considerable reductions in fuel consumed and waste heat discharged to the environment.

We are convinced, based on the work to date, that this project can be readily implemented and will produce socially desireable results. We are actively in support of the Trenton ICES and are enthusiastic towards pursuing Phase II.

Sincerely,

Richard G. Stein, FAIA

RGS:rg

Richard G. Stein FAIA Cyril Beveridge AIA Carl Stein AIA Partners

Doris B. Nathan AIA Diane Serber AIA Paul F. Deibert AIA Associates

appendix H/2

letters from ICES customers

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Letter from John W. Cantwell, Chairman,
Mercer County Improvement Authority

Letter from the Mercer County Executive,
Arthur R. Sypek

Letter from Philip B. Caton, Executive Director and
Raymond L. Steen, Chairman, New Trenton Corporation

Letter from Richard E. Kobrin, Capital Place
Associates

Letter from John E. Curry, Chairman,
Trenton and Mercer County War Memorial Building
Commission

Letter from William F. Johnston, Executive Director
N.J. Housing Finance Agency

Letter from James Waldron, President
Kingsbury Housing Corporation

Letter from the Reverand Mr. F. Kenneth Shirk,
Secretary, Lutheran Housing Corporation

STATE OF NEW JERSEY
DEPARTMENT OF THE TREASURY
CLIFFORD A. GOLDMAN
STATE TREASURER

May 13, 1977

Mr. John P. Clarke, Director
Department of Planning & Development
City of Trenton
10 Capitol Street
Trenton, New Jersey 08608

Dear Mr. Clarke:

I understand that the City of Trenton, Department of Planning and Development, and Public Service Electric & Gas Company are now completing the first phase of the Integrated Community Energy System (ICES) Feasibility Study. I am gratified that in New Jersey, government and industry have been able to form an active partnership to seek solutions to our energy problems. The State Government is committed to the continued development of Trenton, energy conservation in general and the ICES project in particular.

I understand that the State Government will have to make some minor modifications to the two existing building complexes (the State House Building Complex and the Labor & Industry/Health and Agriculture Complex), in order to include them in the ICES system. You have estimated that these modifications would cost between $60,000 and $75,000. Upon a showing by the City of Trenton and Public Service Electric & Gas, that the cost savings will result in a return on the State's investment in approximately five years, I am prepared to request an appropriation at the appropriate time to fund the cost of construction.

If it is determined to be in the best economic interest of the State, I will require that any future State construction and any space to be leased by the State

within the Demonstration Community incorporate in its planning for connection to the ICES. These commitments are predicated upon the City of Trenton and Public Service Electric & Gas detailed Phase II study to provide the economic, institutional and environmental feasibility of the ICES program.

Sincerely,

Clifford A. Goldman
State Treasurer

THE MERCER COUNTY IMPROVEMENT AUTHORITY
COUNTY ADMINISTRATION BUILDING
640 SOUTH BROAD STREET
TRENTON, NEW JERSEY 08607

JOHN W. CANTWELL
CHAIRMAN

RICHARD F. ROCK
VICE-CHAIRMAN

May 11, 1977

Mr. John A. Casazza
Vice President-Planning and Research
Public Service Electric and Gas Co.
80 Park Place
Newark, N. J.

Dear Mr. Casazza:

The Mercer County Improvement Authority has been a supporter of the Trenton ICES project since its inception last November, and an observer participant in the study. Now that the initial feasibility study indicates that the Trenton ICES has the potential to satisfy its customers' energy requirements at a savings, I would like to reaffirm the MCIA's commitment to the connection of those new buildings which we will develop downtown to the ICES system beginning with the New Jersey State Justice Complex, assuming, of course, that further study proves that this system is warranted.

Sincerely,

John W. Cantwell
Chairman

OFFICE OF THE COUNTY EXECUTIVE
ARTHUR R. SYPEK, SR.

MERCER COUNTY ADMINISTRATION BUILDING
640 SOUTH BROAD STREET
TRENTON, NEW JERSEY 08607

May 13, 1977

John P. Clarke, AIA, AIP
Director, Department of Planning and Development
10 Capitol Street
Trenton, New Jersey 08618

Dear John:

I am very glad to hear that Trenton may be in the forefront of bringing "co-generation" from theory to reality. I would like to congratulate you and the Public Service Electric and Gas Company for your efforts in studying the feasibility of the "Integrated Community Energy System" concept in Trenton. I understand that the results of this study are promising and that the County of Mercer is a potential customer for the Energy System.

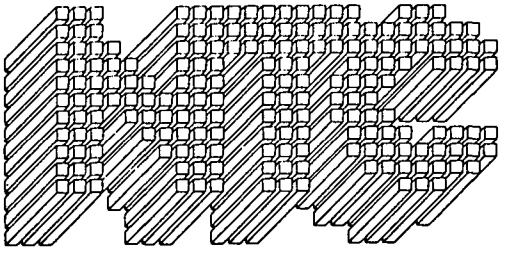
The County will be very interested in becoming a part of the Energy System if further study affirms that it is to the County's economic benefit to do so. We are enthusiastic about joining effors with other governments at all levels and with the utility company in an effort to find solutions to the Nation's and especially New Jersey's energy crisis.

Please keep me informed of your continued progress and contact me for any cooperation you may need involving County personnel.

Sincerely,

Arthur R. Sypek
County Executive

ARS:lc



New Trenton Corporation 88 E. State Street Trenton, New Jersey 08608

May 12, 1977

Mr. John A. Casazza
Vice President for Planning and Research
Public Service Electric and Gas Company
80 Park Place
Newark, New Jersey

Mr. John P. Clarke, AIA, AIP
Director, Department of Planning
and Development
10 Capitol Street
Trenton, New Jersey

Dear Messrs. Casazza and Clarke:

On behalf of the New Trenton Corporation we wish to express our continued support for the Integrated Community Energy System in downtown Trenton. We are pleased that your "Demonstration Team" has kept us informed at the various stages of the project.

If the continued study proves that the ICES is economically beneficial, as this initial study has indicated, and if the system should be built, the New Trenton Corporation would plan to have every building which we develop in Trenton connected to the ICES steam service if possible.

Sincerely yours,

Raymond L. Steen

Philip B. Caton

Raymond L. Steen, Chairman
Eugene V. Howard, Vice Chairman
Philip B. Caton, Executive Director

Capital Place Associates
200 Park Avenue
New York, N. Y. 10017
(212) 682-0480

May 12, 1977

Mr. John P. Clarke
Director, Department of
Planning & Development
City of Trenton
10 Capitol Street
Trenton, N. J. 08618

Dear Mr. Clarke:

As the developers of Capital Place, we wish to express our continued interest in the results of your energy study.

Since the initial feasibility study looks positive, we would like to learn more about how our building might become a part of the "community energy system," should it prove to be in our economic interest.

As you know, our flexibility is limited since our final working drawings have been completed and we expect to start construction shortly. However, we will do our best to cooperate in this worthwhile endeavor.

Yours very truly,

CAPITAL PLACE URBAN RENEWAL
ASSOCIATES, INC.

Richard E. Kobrin

REK:ab

Capital Place
TRENTON · NEW JERSEY

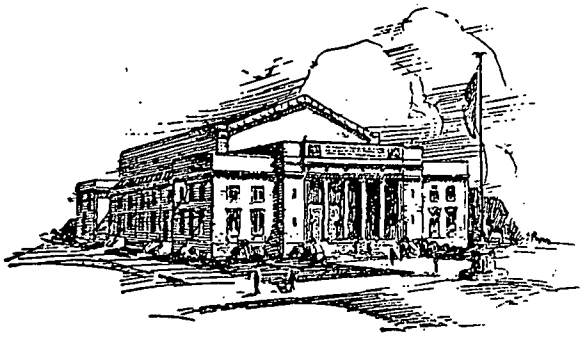
Trenton and Mercer County Memorial Building Commission

JOHN E. CURRY
President

JAMES KERNEY, JR.
Vice-Pres.

Henry B. Murphy
~~CHARLES R. PARKHURST~~
Treasurer

FRANK A. BOGDAN
Secretary



RICHARD J. COFFEE

GILBERT W. LUGOSSY

JOHN R. CIPRIANO

JOSEPH TRACTENBERG

Eugene V. Howard
~~HERBERT K. NEUMAN~~

EDWARD F. MEARA, III

SOLDIERS' AND SAILORS' WAR MEMORIAL BUILDING
W. LAFAYETTE STREET
TRENTON, NEW JERSEY 08608
TELEPHONES: 393-4866 — 393-0871

May 12, 1977

John P. Clarke, Director
Department of Planning & Development
10 Capitol St.
Trenton, N. J. 08618

Dear John:

On behalf of the War Memorial Commission, I would like to express our support for Trenton in your efforts to qualify for Federal funds to continue your Energy Study. We are most interested in the outcome of this study because, as you know, the War Memorial Commission is planning to refurbish the War Memorial and to install air conditioning. We understand that your Energy Project, should it reach fruition, may lower our operating costs. Naturally we are extremely interested in any opportunity for operating cost savings and for energy conservation.

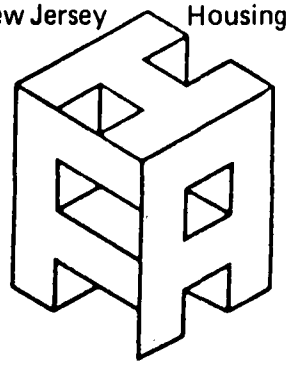
Sincerely,

John E. Curry

John E. Curry,
Chairman

JEC:dah

New Jersey Housing Finance Agency P.O. Box 417 Trenton, New Jersey 08603



May 13, 1977

Mr. John P. Clarke, Director
Department of Planning & Development
City of Trenton
10 Capitol Street
Trenton, New Jersey 08618

Dear Mr. Clarke:

We were pleased to learn that Trenton's ICES proposal was received favorably by the U.S. Energy Research and Development Administration.

We understand that the initial phase of study indicates that our mutual hopes for reduced energy costs to the demonstration area consumers may be well founded. In the event that further study proves this thesis and to the extent that it is technically feasible, we will direct that our future projects within the demonstration area be connected to the ICES system.

More specifically, we understand that in order for the Kingsbury II project to connect to the system, it may be necessary to make a small capital investment. If the Kingsbury Corporation decides to undertake this cost, we would be willing to include same in the mortgage loan, provided that the energy cost savings would pay back this additional amount in a reasonably short period of time.

Again, we are looking forward to hearing of your continued progress.

Sincerely yours,

WILLIAM L. JOHNSTON
Executive Director

WLJ:s

KINGSBURY CORPORATION
TRENTON, NEW JERSEY

Phone: (609) 599-1156

May 12, 1977

John P. Clarke, A.I.A., A.I.P.
Director of Planning and Development
10 Capitol Street
Trenton, New Jersey 08618

Dear Mr. Clarke:

I have been authorized by the Board of Directors of the Kingsbury Corporation to advise you of our continued interest in the ICES project. It is hoped that the Department of Planning and Development and the Public Service Electric and Gas Company will further its research in the hopes of reaching an implementation stage for the project.

As you know, we are in the stage of development of the second section of the Kingsbury project and are deeply interested in any method of energy saving which may be accomplished by being a part of the energy system. This concept has been discussed with our architects who are enthusiastic about its possible application to the Kingsbury II project.

In this connection, we would also like to include Kingsbury I into the system if it is at all feasible. We also recognize that there will be some capital investments required in order to connect the Kingsbury I project into the system. I am sure this capital expenditure will be approved by the Board of Directors if there can be demonstrated that the investment can more than pay for itself

in a reasonable amount of time by savings in utility costs.

With appreciation for your cooperation in involving the Kingsbury Corporation in this project, I remain

Very truly yours,

James A. Waldron

James A. Waldron
President

JAW:pjg
cc: Kathy Miano
John P. Scozzari
Louis J. Grimaldi
William Dinkins
Samuel J. Plumeri

LUTHER TOWERS
TRENTON LUTHERAN HOUSING CORPORATION
489 West State Street • Trenton, New Jersey 08618 • Telephone: (609) 695-7755

May 13, 1977

Mr. John Clarke, Director
Dept. of Planning - City of Trenton
10 Capitol St.
Trenton, New Jersey 08618

Dear John:

The Trenton Lutheran Housing Corporation in their design for Luther Arms at Broad and Market, have instructed their architect, Hassinger and Schwam, to take into account the possibility afforded by co-generation. We certainly hope the Department and Public Service will be able to move forward with this plan.

Sincerely,

Ken

F. Kenneth Shirk

appendix H/3

letters from regulatory agencies

APPENDIX H/3
TABLE OF CONTENTS

Letter to New Jersey Department of Environmental Protection

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Letter from Delaware Regional Planning Commission

Letter to Public Utilities Commission

Letter from Public Utilities Commission

Letter from New Jersey State Energy Office

Letter from the Trenton Planning Board

City of Trenton Department of Planning

February 15, 1977

Commissioner David J. Bardin
Department of Environmental Protection
P.O. Box 1390
Trenton, New Jersey 08625

Dear Mr. Bardin:

As you may be aware, the City of Trenton is conducting a study along with Public Service Electric and Gas, funded by the U.S. Energy Research and Development Administration, to determine the feasibility of an integrated Community Energy System (ICES) in downtown Trenton. The ICES is a concept which employs the waste heat from an electrical generating facility for space heating and cooling. The ICES plant, would, if it proves economically, environmentally and institutionally sound, provide electrical and thermal energy to existing and proposed new buildings in its service area.

The Department of Environmental Protection will have two major interests in the ICES. DEP will be one of the regulatory agencies who will sanction the operation of the ICES plant with regard to its emissions. Also, the proposed new building for the Department at State and Warren Streets might be connected to the ICES and would then receive thermal and electrical energy from our plant.

Since DEP does have a regulatory role in the construction and operation of the ICES, we would like to keep you informed of the progress of the study and to incorporate your suggestions and requirements into our analysis. I would, therefore, like to suggest that our project manager, Mr. James Greenberg, and I, meet with your representative to brief DEP on the ICES.

Sincerely yours,

John P. Clarke, A.I.A.
Director, Dept. of Planning & Development

cc: Travisano
Greenberg

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON

OFFICE OF THE COMMISSIONER

April 7, 1977

Mr. John P. Clarke
Director
Department of Planning
and Development
10 Capital Street
Trenton, New Jersey 08618

Dear Mr. Clarke:

I found the briefing on the Trenton Integrated Community Energy System to be extremely informative. The concept is as exciting as I had anticipated and you can count on our department's support and my personal interest in it. I suggest, to facilitate matters, that you direct any queries that may need to be put to our Department to Mr. Lawrence Schmidt, Chief of the Office of Environmental Review, who works directly with me on complex matters of this sort.

Sincerely,

Glenn Paulson

Glenn Paulson, Ph.D.
Assistant Commissioner for Science

GP:lcw

cc: Lawrence Schmidt
Chief
Office of Environmental Review

Linda Kirschner
Energy Specialist
Department of Labor & Industry

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
JOHN FITCH PLAZA P. O. BOX 2807 TRENTON, N. J. 08625

April 29, 1977

Mr. James Greenberg
Trenton Department of
Planning and Development
10 Capitol Street
Trenton, NJ 08618

Dear Mr. Greenberg:

As discussed in your office on April 25, 1977, the proposed installation of four 2.5 megawatt gas turbines by the City of Trenton must be examined in detail by the Permits and Certificates Section of the New Jersey Bureau of Air Pollution Control before construction can be undertaken. However, it has been possible, on the basis of tentative information you supplied, to make a rough appraisal which leads to the conclusion that the project is not large enough to be categorized by the U.S. Environmental Protection Agency (EPA) as a major air pollution source. If this projection is borne out by information on your permit application, it should not be difficult to obtain approval.

For the record, the USEPA publishes a booklet, AP-42, entitled "Compilation of Air Pollutant Emission Factors" which supplies information shown in the following table. The second column of figures applies to your installation based on the peak fuel oil usage rate you supplied by phone on April 28, 1977, namely, 680 gallons/hour, and an assumed 0.3% sulfur in the oil.

OIL FIRED TURBINES

Pollutants	lbs/1000 gal. oil	lbs/hr	tons/yr
Particulates	5.0	3.4	8.5
Sulfur Oxides	42.0	28.6	13.1
Carbon Monoxide	15.4	10.5	26.8
Hydrocarbons	5.57	3.8	9.7
Nitrogen Oxides	67.8	46.1	118.0

You stated that a more normal winter rate of fuel consumption would be 530 gallons/hour. The third column is calculated on an assumed average annual rate of 400 gallons/hour for 8700 on-line hours or a total of 3480 thousands of gallons per year.

You will note that the projected annual emission of nitrogen oxides exceeds 100 tons. This is an alarm figure to the USEPA; however, there is no current standard for NO_x. If such a standard is set later, you might be required to reduce the figure in some way.

The thought of later switching to coal is not one I can encourage. There are two reasons:

1. The particulates and sulfur emissions standards from coal could be raised on orders from President Carter, but the center of a city seems an unlikely spot for such relaxation.

2. The size of a furnace firebox is chosen to suit the fuel. Gas requires the smallest space, oil next and coal much larger. If a box built for oil were to be switched to coal, the rate of coal feed would have to be reduced to avoid pushing unburned fuel through the box and up the stack. This reduction would sacrifice capacity. On the other hand, if the box were built oversized at first to allow for a later changeover, it would waste fuel because the gases would cool before reaching the turbine.

If along the way in your planning you think I might be of help, please call me.

Sincerely,

Lee R. Ivey
Supervising Environmental Engineer

LRI:ap

cc: Mr. Arbesman
Mr. Tyler
Mr. Wortreich
Mr. Mancini
Dr. Dyba
Dr. Paulson

Office of Noise Control
380 Scotch Road
W. Trenton, N.J. 08628

Telephone: (609) 292-7695

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
JOHN FITCH PLAZA, P. O. BOX 2807, TRENTON, N. J. 08625

June 2, 1977

Mr. James Greenburg
Trenton Department of Planning & Development
10 Capital Street
Trenton, N.J. 08618

Dear Mr. Greenburg:

I have reviewed the data I received from R. G. Vanderweil concerning the noise levels of the Solar Centaur generating units Trenton is considering using in its ICES. Based on this review and the information I received at your Office, I would make the following comments and suggestions.

1. Since input air for the units will come from the building itself as a plenum and the building is a closed unit, no outside environmental problems will be created.

2. Since the exhaust outlet will be through boilers on the top of the structure, I would recommend that this exhaust be directed away from the residential areas.

The stated standard of 74 dBA measured at 50 feet for each unit would reduce approximately 4.5 to 6 dBA per doubling of distance in the direction of the exhaust. At 4.5 reduction, the level at 800 feet would be 56 dBA. This would be below the commercial nighttime level. Each additional unit would add approximately 3 dBA to the level, 59 dBA for 2 units, 62 dBA for 3. Since the sound radiation in the direction of the residential properties would be shielded, little spill-over sound would travel that path. Should problems be encountered, additional exhaust silencers can be introduced to further reduce the sound level. These units would not significantly increase the total cost of the ICES facility, (they cost several thousands of dollars depending on size and design).

I hope this information will assist you in preparing the proposal for the Trenton ICES. Should you require any additional noise control information, please don't hesitate to contact me. Good Luck.

Sincerely yours,

Edward J. DiPolvere, Chief
Office of Noise Control

EJD/jw
cc: Paul H. Arbesman, Director

City of Trenton Department of Planning

February 16, 1977

Walter K. Johnson, Executive Director
Delaware Valley Regional Planning Commission
Penn Towers Building
1819 J.F. Kennedy Blvd.
Philadelphia, Pa. 19103

Dear Walter:

The City of Trenton has entered into a contract with the U.S. Energy Research and Development Administration to study the feasibility of an Integrated Community Energy System (ICES) in downtown Trenton. ICES is a concept which employs the waste heat from an electrical generating facility for space heating and cooling. This technique raises the fuel efficiency from 33% to 70%. The City is working closely with Public Service Electric and Gas Company to evaluate the prospects for implementation of this concept in Trenton. The ICES plant, if it proves economically, environmentally, and institutionally sound, will provide electrical and thermal energy to existing and proposed new buildings in its service area.

The Delaware Valley Regional Planning Commission will be one of the regulatory agencies which must review and approve the construction of the ICES facility. We would like to keep the Commission informed of the progress and conclusions of the study and to incorporate your suggestions and requirements into our analysis. I would, therefore, like to suggest that Mr. James Greenberg from our staff meet with your representative to brief DVRPC on the ICES project and to outline your requirements and submittals necessary to receive DVRPC approval.

Sincerely yours,

John P. Clarke, A.I.A.,A.I.P.
Director, Dept. of Planning and Development

cc: Travisano
Greenberg

DELEWARE VALLEY REGIONAL PLANNING COMMISSION

Penn Towers Building, 1819 J.F. Kennedy Blvd., Philadelphia, Penna. 19103

February 22, 1977

John P. Clarke, Director
Department of Planning and Development
City of Trenton
10 Capitol Street
Trenton, N. J. 08618

Re: Integrated Community
Energy System (ICES)

Dear Mr. Clarke:

In response to your letter of February 16, 1977, the following information will be required for our review and comment under the provisions of the U.S. Office of Management and Budget Circular A-95:

1. One copy of Standard Form 424 (copy attached)
2. Expanded project description
3. Location Map

I am also enclosing a copy of Circular A-95 for your future reference.

We look forward to reviewing the ICES proposal and if you desire further assistance, please do not hesitate to contact me.

Sincerely yours,

Jerry A. Gray
Regional Review Coordinator

JAG/kd

cc: Jim Greenberg
Walter K. Johnson

City of Trenton Department of Planning

February 28, 1977

Commissioner Richard B. McGlynn
Public Utilities Commission
1100 Raymond Boulevard
Newark, N. J. 07102

Dear Commissioner McGlynn:

The City of Trenton has entered into a contract with the U.S. Energy Research and Development Administration to study the feasibility of an Integrated Community Energy System (ICES) in downtown Trenton. ICES is a concept which employs waste heat from an electrical generation facility for space heating and cooling of nearby buildings. This is somewhat similar to "co-generation" which uses waste heat for industrial process steam. In both cases the electricity produced is a by-product of the thermal energy processes. The City is working closely with Public Service Electric and Gas Company (PSE&G) to evaluate the prospects for implementation of this concept in Trenton. The ICES plant, if it proves economically, environmentally and institutionally sound, will provide electrical and thermal energy to existing and proposed new buildings within its service area.

The Public Utilities Commission will be one of the regulatory agencies which will review and approve the construction and operation of the ICES facility. We would like to keep the Commission informed of the progress and conclusions of the study and to incorporate your suggestions and requirements into our analysis. Our study must be complete in a four-month period ending in mid-May, and one of our major tasks is to perform an institutional assessment of all regulations--fire, safety, utility, environmental, etc.--which will impact upon the ICES.

We have not yet determined whether PSE&G will own and operate this facility, another entity will own the system

with an operation and maintenance contract with PSE&G, or some form of joint ownership established. Each of these ownership options has differing institutional and regulatory implications. We would like to meet with representatives of the PUC as soon as possible to ascertain its requirements with regard to the ICES. Also, I would appreciate any comments or suggestions you might have on how we should proceed with our project.

Sincerely yours,

John P. Clarke, A.I.A.
~~Director~~, Dept. of Planning and Development

cc: Travisano
Greenberg
W.S. Ku
Linda Kirschner

State of New Jersey

DEPARTMENT OF PUBLIC UTILITIES
BOARD OF PUBLIC UTILITY COMMISSIONERS
101 COMMERCE STREET
NEWARK, NEW JERSEY 07102

In Reply Refer To:
Eng. - A.R.

May 13, 1977

Re: Trenton's Integrated Community
Energy System (ICES)
M-50-77

John P. Clarke, A.I.A., Director
Department of Planning and Development
10 Capitol Street
Trenton, NJ 08668

Dear Mr. Clarke:

Pursuant to your request, the Board of Public Utility Commissioners has reviewed the concept, presented as part of the feasability study, of an ICES in downtown Trenton for the U.S. Energy Research and Development Administration (ERDA).

We support the study and endorse the concepts as presented at this stage of the effort. This endorsement is made with the understanding that the second phase of the investigation will result in a positive determination of the system design and configuration. It is further understood that commitments will be made by all parties, the City of Trenton and Public Service Electric and Gas Company so that regulatory requirements of the Board may be determined and evaluated.

Very truly yours,

Ralph C. Capriò
Secretary

State of New Jersey

STATE ENERGY OFFICE
DEPARTMENT OF PUBLIC UTILITIES
BOARD OF PUBLIC UTILITY COMMISSIONERS
101 COMMERCE STREET
NEWARK, NEW JERSEY 07102

May 12, 1977

Mr. John P. Clarke, Director
Department of Planning & Development
City of Trenton
10 Capitol Street
Trenton, New Jersey 08608

Dear Mr. Clarke:

As Administrator of the New Jersey State Energy Office I offer my complete support to the City of Trenton's Integrated Community Energy System Study. The "ICES" principle is one which many of us, who deal directly with energy conservation, believe to be both feasible and necessary as an integral part of any National Energy Conservation Program.

This office stands ready to assist at any time in the development of this program.

Very truly yours,

Charles A. Richman
Acting Administrator

CAR:eg

OFFICE OF THE MAYOR

CITY OF TRENTON, NEW JERSEY 08608

ARTHUR J. HOLLAND
MAYOR

TRENTON PLANNING BOARD

May 12, 1977

Mr. John P. Clarke, AIA, AIP
Director, Department of Planning
and Development
10 Capitol Street
Trenton, New Jersey 08618

Dear John:

Thank you for your briefing on the Trenton Integrated Community Energy System. We find the concept to be an exciting and innovative approach to urban redevelopment.

I believe that the Planning Board is favorably disposed toward the ICES project and will take the necessary actions for its authorization. First we would have to amend the Urban Renewal Plan to create a new parcel for sale to Public Service Electric and Gas in the John Fitch Way Urban Renewal Area. Secondly, the Planning Board will have to grant Site Plan Review approval prior to the construction of the project.

Providing that all the environmental regulations, including air and noise pollution, are met, I do not foresee any problem with granting expeditious approvals on the part of the Trenton Planning Board.

Sincerely,

Carl Shipper
Chairman

appendix J

resumes

APPENDIX J
TABLE OF CONTENTS

Resume: John P. Clarke, City of Trenton

Resume: James B. Greenberg, City of Trenton

Resume: W.S. Ku, PSE&G

Resume: H.B. Baranek, PSE&G

Resume: R.F. Dittrich, PSE&G

Resume: C.W. Gellings, PSE&G

Resume: Tarlock Shahansra, PSE&G

Resume: Richard G. Stein, Richard G. Stein & Partners

Resume: Carl Stein, Richard G. Stein & Partners

Resume: R.G. Vanderweil, R.G. Vanderweil, Inc.

Resume: Gary Vanderweil, R.G. Vanderweil, Inc.

Resume: J.L. Donahue, R.G. Vanderweil, Inc.

Resume: George Snyder, Turner Construction Co.

John P. Clarke, A.I.A.
Director
Department of Planning & Development
City of Trenton
10 Capitol Street
Trenton, New Jersey 08618
Phone: 609-393-9800

[redacted]

Education

Bachelor of Architecture	The Cooper Union 1961-'66
Master of Science in Urban Planning	Columbia University 1966-'68 School of Architecture

Professional Organizations

American Institute of Architects
American Institute of Planners
Board of Directors, N.J. Chapter, National Association of Housing and Redevelopment Officials
Certificate, National Council of Architectural Registration Boards
Architectual Registration; New Jersey, Virginia

Awards

New York Scoeity of Architects Medal for Excellence in Design, 1966

William Kinne Fellowship for Travel and Study in Urban Planning Abroad, 1967

Professional Experience

While in New York City, Mr. Clarke worked for several prominent architectural firms including Davis, Brody and Associates. Upon graduation from Columbia University, he took an appointment as an Assistant Professor at the School of Architecture, University of Virginia, where he acted as a architectural design critic and lecturer on urban planning.

In 1969, Mr. Clarke moved to Washington, D.C., to work for the President's Temporary Commission on Pennsylvania Avenue. His work for the Commission resulted in the formulation of the Pennsylvania Avenue Development Corporation which has been charged by Congress with the responsibility of overseeing the redevelopment of this area of the nation's capitol.

In addition to working on the Pennsylvania Avenue Development Corporation Legislation, Mr. Clarke continued as Visiting Lecturer at the University of Virginia and participated in several projects being carried out by the Washington Office of Skidmore, Owings and Merrill, Architects and Planners.

In 1971, Mr. Clarke moved to Trenton, New Jersey, to join the Department of Planning and Development, and was shortly appointed Director of that agency. This Department, which has a staff of some 180 employees, is unique because of its broad mandate and functions. It has responsibility for all physical planning, urban renewal, building inspections, traffic and transportation, housing and park development, home loan assistance and neighborhood preservation. In addition, the Department maintains its own staff of architects and landscape architects who are responsible for the design and construction of City buildings, parks and infrastructure improvements.

Mr. Clarke has been a Visiting Lecturer and Critic at City College, Rider College, University of Pennsylvania, Princeton University and the University of Virginia.

November 3, 1975

Curriculum Vitae

James B. Greenberg
301 West State Street
Trenton, New Jersey 08618
Telephone 609-393-5765

[redacted]
Married, no children

EDUCATION:

Sept. 1964-June 1968	Cornell University, College of Engineering, Ithaca, New York. Received Bachelor of Science degree in structural engineering, June 1968.
Sept. 1968-Aug. 1972	University of Pennsylvania, Grade School of Fine Arts, Philadelphia, Pennsylvania. Received Master of Architecture degree, August 1972. Special interest in architectural and programming methodology. Basic computer programming skills in FORTRAN and PL1.

EMPLOYMENT EXPERIENCE:

16 Sept. 74-present	Department of Planning & Development, City of Trenton, New Jersey, Senior Architect.
8 Oct. 1973-31 July 1974	Castren-Jauhiainen-Nuuttila, Takojantie 12, Tapiola Finland. Position: architectural designed. Worked on design development of new city hall for Lappeenranta and new bank building in Lahti.
4 Sept. 1972-3 Oct. 1973	Arkkitehtitoimisto Keijo Petäjä, Luoteisväylä 23C, Helsinki. Position: designed/draftsman. Designed details and prepared construction documentation for ship building yard in Helsinki.
1 April 1971-30 June 1971	Architehtitoimisto Kirsti ja Egil Nordin, Huvilakatu 4, Helsinki. Position: draftsman. Modified working plans for bank renovation and rehabilitation.
8 June 1970-31 March 1971	Arkkitehtitoimisto Kristian Gullichsen, Vuorimiehenkatu 5A, Helsinki. Position: draftsman. Prepared construction documentation of suburban office building.

Sept. 1969- May 1970	Young Great Society, Architecture and Planning Center, 3420 Brandywine Street, Philadelphia, Pennsylvania, 19104. Worked parttime while studying. Position: draftsman. Worked on community development planning and residential rehabilitation for this "community design workshop' similar to ARCH in Harlem.
May 1969- August 1969	Cope Linder Walmsley, Architects, Landscape Architects and Engineers, 1927 Sansom Street, Philadelphia. Position: draftsman. Worked on preparation of structureal working plans for the Columbia (Md.) Shopping Mall.
June 1968- August 1968	New Jersey State Department of Community Affairs, Bureau of State and Regional Planning, Trenton, New Jersey. Position: assistant planner. Worked on projection of demographic data for the development of a comprehensive state plan.
Additional experience	Worked independently on two architectural competions in Finland - May to August 1971 and March to May 1974. Assisted Fred Travisano with 2nd Prize scheme, Elderly Housing Competition, Trenton, New Jersey.
Professional Organizations	Association for Preservation Technology National Trust for Historic Preservation

W. S. Ku

Education

Tatung University, Shanghai, China, 1944, BSEE
Cornell University, MS in Eng., 1948
PSE&G Engineering Economics Course, 1958
Utility Engineering Seminar, Westinghouse Electric Co., 1961
Middle Management Course, Rutgers University, 1964
Long Range Corporate Planning Course, American Management Association, 1971
PSE&G Scientific Analysis of Ideas Course, 1976

Experience

Since 1948 he has been employed at PSE&G, working at various levels of responsibility in the development of bulk system plans. He is currently the Transmission Planning Engineer, responsible for supervising all aspects of transmission and interconnection plans for the PSE&G electric system.

Mr. Ku has participated in regional transmission planning through the Pennsylvania-New Jersey-Maryland Interconnection (PJM) and numerous ad hoc study committees. In the late 1960's, he participated in the development of a PJM Under-frequency Load Shedding Relay program designed to prevent system collapse caused by load generation mismatch during major system disturbances. He had a key role in the designation of these relays to achieve maximum effectiveness for the PJM Interconnection. He participated on the EEI Bulk Power System Security Research Program (RP90) Committee. This program was concerned with the development of techniques for the application of faster on-line stability analysis of a real electrical system. In March 1975, he participated in the EPRI System Security Seminar in Atlanta, Georgia, as follow up to the RP90 project where significant findings and applications were reported.

Mr. Ku served as an advisor to the Federal Power Commission in the preparation of transmission material of the Northeast region for the 1970 National Power Survey, and also served on the Electric Utility Industry Subcommittee advising Pratt & Whitney Aircraft on the development of fuel cells. He is also a member of the IEEE Power System Engineering Committee and its Computer and Analytical Methods Subcommittee and is a licensed professional engineer in New Jersey.

Currently Mr. Ku serves as a member of the EPRI System Planning, Security and Control Task Force.

Mr. Ku has been PSE&G's Planning witness concerning a new 345 kV transmission line in northern New Jersey and the 500 kV transmission development in Southern New Jersey.

PUBLICATIONS

1. Economic Comparison of Switched Capacitors and Voltage Regulators For System Voltage Control. W.S.Ku, AIEE Transactions, Dec. 1957.

2. System Voltage Control in a Large Utility. W.S.Ku, T&D Magazine, May 1958.

3. A Model For Transmission Planning By Logic. C. J. Baldwin, C.A.DeSalvo, C.H.Hoffman, and W.S.Ku, AIEE Transactions, Vol. 78, Pt. IV, 1959.

4. A New Technique For Transmission Planning. C.A.DeSalvo and W.S.Ku, Electric Light and Power, Nov. 1, 1959.

5. Determination of Pumped Storage Requirements and Limitations on a Long-Range System Basis. W.S.Ku and C.L.Sulzberger Paper No. 31PP66-496, IEEE 1966 Summer Power Meeting.

6. Current Planning For Nuclear Generators - Reliability, Siting and Associated Transmission. W.S.Ku, Pennsylvania Electric Association System Planning Committee Meeting, October 1966.

7. Security and Voltage Applications of the Public Service Dispatch Computer. W.S.Ku and P. Van Olinda, IEEE 1969 PICA Conference Proceedings.

8. Year 2000 Generation and Transmission Plan. W.S.Ku and V.T.Sulzberger, 1973 American Power Conference Proceedings.

9. Philosophies and Practices of Reactivie Capacity Planning For Public Service Electric and Gas System. W.S.Ku, EEI System Planning Committee Meeting, October 1973 and PEA System Planning Committee Meeting, May 1974.

H. B. Baranek

Education

Graduate of Seton Hall University, 1961, BS (Physics)

Practical Heat Cycle Analysis Workshop

IEEE Engineering Economics and Elements of Nuclear Engineering Courses

PSE&G Workshop and Courses in Computer Programming and Report Writing

Experience

Mr. Baranek was employed by Public Service Electric and Gas Company's Energy Laboratory in 1955. While being assigned to the Energy Laboratory, he engaged in performance testing of all types of large and small turbines, boilers, condensers, and various power plant equipment. He developed computer programs to calculate the results for all system turbine-generator acceptance or periodical performance testing.

In 1965 he was re-assigned to the Engineering and Construction Department and through a series of subsequent promotions is now a Principal Staff Engineer in the Mechanical Division.

During the last ten years he has been responsible for the economic studies relating to both fossil and nuclear multi-billion dollar projects. He has been actively engaged in all phases of plant design, ratings and other special studies involving thermodynamics and economics. This includes feasibility and economic studies of alternative power sources.

A typical major project presently being investigated for its feasibility and economics is a 1000 MW underground pumped storage plant. Mr. Baranek has been involved with plant layout, cooling water system designs, and plant start-up. He was responsible for the development of the logic for the performance calculations which are included in all our station on-line computers.

As a member of an environmental task force, he was directly involved in the writing of the environmental reports for several 1000 MW nuclear projects.

Mr. Baranek has developed computer programs that simulate the performance of the secondary portion of a nuclear power plant, the optimization of cooling tower-condenser cooling water systems, and for the economic selection of other plant components.

Mr. Baranek is presently a committee member of the Power Test Code for Air Compressors and Exhausters (ASNI PTC-10). This code is now being revised to reflect the latest in technology. He has assisted in updating other Power Test Codes for nuclear application.

Since 1970, Mr. Baranek has been a commissioner of the Board of Health in Roselle Park, New Jersey. He was instrumentive in revising the Town's Health Codes and is now the Vice President of the Board. He has also been the Roselle Park's delegate to the Inter-Municipal Group for Better Rail Service since 1971.

Mr. Baranek is a member of the American Society of Mechanical Engineers.

4/16/75

RICHARD F. DITTRICH

Education

United States Merchant Marine Academy, Kings Point, N. Y.,
1947 - B.S.

Stevens Institute of Technology, Hoboken, N.J.,
1951 - ME (Honors)

Short Courses

PSE&G Engineering Economics
ASME - Nuclear Reactors
Nuclear Fuel Management - N.U.S.

Experience

Mr. Dittrich has been with PSE&G for 25 years. He is currently assigned to the Power Supply Planning Division of the Electric Planning Department as Principal Engineer. He has been engaged in a number of assignments dealing with the economic evaluations of power generation alternates and production cost work.

Prior to his assignment in the Electric Planning Department, Mr. Dittrich was a member of the Electric Production Department having spent time in the generating stations and general office.

His generating station experience included supervisory responsibilities in all phases of power plant work; performance, operation and maintenance.

In the general office, he was responsible for the load scheduling of units in daily dispatch, the development and application of production cost programs for O&M studies, and replacement energy cost development. He also served as the PSE&G member of the following PJM Interconnection Task Forces: Capacity Rating, Production Cost.

Professional Activities

Mr. Dittrich is a member of the American Society of Mechanical Engineers.

Publications

"A Study of the Economic Shutdown of Generating Units in Daily Dispatch", C. J. Baldwin, K. M. Dale, R. F. Dittrich, AIEE Transactions, Vol. 78, PT III 1959, pg. 1272-84.

"Unit Shutdown in Light-Load Periods Cut Production Costs", C. J. Baldwin, R. F. Dittrich, Electrical World, Vol. 152, No. 10, Sept. 7, 1959, pg. 54-56.

BIOGRAPHY OF TECHNICAL QUALIFICATIONS - CLARK W. GELLINGS

Education

a. Don Bosco Technical High School, Paterson, New Jersey, 1963, Electronics.

b. New Jersey Institute of Technology (formerly Newark College of Engineering), Newark, New Jersey, 1968, Bachelor of Science Electrical Engineering.

c. Stevens Institute of Technology, Hoboken, New Jersey, 1975, Master of Management Science.

Professional Activities

a. Illuminating Engineering Society- President of the New Jersey Section. Instructor for numerous courses sponsored by this Society. Recipient of several awards in lighting design from this Society.

b. Licensed Professional Engineer in New Jersey.

c. New Jersey Society of Professional Engineers- member.

d. Chairman of the Electrification Council's Lighting Task Force.

e. New Jersey Gas Association- member.

f. New Jersey Producer's Council- member.

g. New Jersey Designers Lighting Forum- member.

Publications and Presentations

a. Co-author of "Energy Management in Lighting Design" course published by The Electrification Council.

b. Author of several articles on Lighting Design, Demand Control and Energy Utilization for Electrical World Magazine and Lighting Design and Applications Magazine.

c. Taught numerous courses in lighting design for the Illuminating Engineering Society, Designers Lighting Forum, the Union County Vocational Center and PSE & G.

d. Presented numerous technical presentations on energy cost, use and management to both National and New Jersey professional and technical groups.

Experience

The majority of Mr. Gellings' professional experience has been in the positions of Sales Engineer and currently Applications Engineer.

In the position of Sales Engineer (1968-72), Mr. Gellings was responsible for marketing related aspects of electric and gas energies to large industrial and commercial facilities in a specific geographical area. Engineering application and design of lighting, heating, air conditioning and process uses were conducted in coordination with customers' service requirements, PSE & G policies and the best energy management principles.

In the position of Applications Engineer (1972-present), Mr. Gellings functions as PSE & G's specialist in the application of energy in its end-use in industrial and commercial facilities. This function includes; playing a key role in organizing PSE & G's energy management efforts; providing technical assistance to field marketing representatives, architects, engineers and customers; designing Company lighting systems; designing lighting, HVAC and process systems for customer facilities; and training new and experienced Company personnel, customer representatives and trade allies in subjects allied to energy management.

Tarlock S. Sahansra

Education: Master of Engineering, 1973, Cooper Union for the Advancement of Science and Art, New York.

Bachelor of Mechanical Engineering 1962, Delhi University, New Delhi, India.

BWR Technology Self Study Course administered by General Electric.

Nuclear Technology Seminar 1976, Ebasco Services, New York.

Experience: Since 1962 Tarlock has been involved in the design, engineering and development of steam turbines; steam, water and oil piping systems; extraction feedwater heaters; equipment layout; equipment specification and purchase.

At present, he is working as a Lead Engineer in the Power Systems Group where his responsibilities involve trouble-shooting and rectification of various turbine systems.

Tarlock is a licensed professional engineer in the State of New York and is a member of the American Society of Mechanical Engineers.

Personal Resume

RICHARD G. STEIN, FAIA, ARCHITECT

[redacted]

EDUCATION:

Harvard University - M. Arch.	1937 - 1939
New York University - B. Arch., magna cum laude	1932 - 1937
Cooper Union Night School of Art Certificate in Painting	1933 - 1937

PROFESSIONAL PRACTICE:

Richard G. Stein and Partners, Architects — 1961 - present
successor to Richard G. Stein and Associates

Commissions Include:

Energy Use in Building Construction
ERDA-supported Research project
Grid-connected Integrated Community Energy System
Trenton, New Jersey (ERDA-supported)
Johnson Building, New York City Community College
Classrooms, offices, library, students' spaces
Namm Hall, New York City Community College
Alterations and Additions
Total Energy Plant, New York City Community College
Electric Generation and Heat Recovery for Campus
Allied Health Center Building, New York City Community College
Alterations, new mechanical facilities, laboratories, classrooms
Low Energy Utilization School Study, New York City
NSF-RANN supported study for New York City Board of Education
Energy Conservation Study, New York State Building, Albany
Analysis of Buildings 8 and 12, State Office Campus
Wiltwyck School for Boys, Yorktown Heights, New York
New Campus with 15 new buildings. Treatment Center
Manhattan Children's Treatment Center, Ward's Island, New York
New 5-building treatment center for 200 children
Intermediate School 183, Bronx, New York
Urban school for 1,800 children
Public School 55, Staten Island, New York
Semi-suburban school for 1,000 children
Memorial Plaza to Sebastiano Satta, Nuoro, Sardinia
Pavings, street furniture, sculpture to honor poet
Master Plan, New York City community college
Educational, economic and physical proposal
Master Plan, Cooper Union, New York City
Analysis for building expansion

CARL STEIN

Personal Resume

[redacted]

EDUCATION:

Croton-Harmon Public Schools	
Middlebury College - B.A. (physics)	1960 - 1963
The Cooper Union - B. Arch.	1963 - 1968
Harvard Graduate School of Design	1966 - 1967

REGISTRATION:

Licensed Architect, New York, New Jersey

PROFESSIONAL PRACTICE:

Richard G. Stein and Partners, Architects, Partner	1977

PROFESSIONAL EMPLOYMENT:

Davis, Brody, Wisniewski (part-time)	
Richard Meier (part-time)	1963 - 1968
Componoform (part-time)	
Marcel Breuer and Associates	1968 - 1971
Richard G. Stein and Associates	1971 - 1976

PROFESSIONAL ACTIVITIES:

Corporate Member, New York Chapter, AIA
Member, Committee on the Natural Environment
Chairman, Energy Subcommittee

New York State Association of Architects/AIA
Chairman, Energy Task Force

National AIA
Component Energy Coalition
ASHRAE 100-P Task Force

AWARDS:

New York Society of Architects Gold Medal	1968

R. G. VANDERWEIL

EDUCATION: Master of Science in Mechanical Engineering, University of Vienna.

REGISTRATION: Professional Engineer: Massachusetts, New York, Vermont, Connecticut, New Hampshire, Pennsylvania, Rhode Island, Maine, Kentucky, and others.

PROFESSIONAL: N.E. Council, Industrial Affairs Committee, Boston Chamber of Commerce.
U.S. Naval Ordinance, Naval Ordinance Development Award.

EXPERIENCE:

1947-Present: Principal Engineer, R. G. Vanderweil Engineers. Consulting Engineer. Also special studies on power plants, water supply, and industrial facilities.

1938-1947: Boiler design, utility and industrial power plant design with Combustion Engineering, Phelps Dodge Corp., and the Austin Company. Heat transfer R & D with Chase Brass and Copper Co.

GARY VANDERWEIL

EDUCATION:	A. B., 1961, Engineering and Applied Physics, Harvard University M.S., 1963, Mechanical Engineering, Massachusetts Institute of Technology
REGISTRATION:	Professional Engineer: Alabama, California District of Columbia, Florida, Louisiana, Maryland, Massachusetts, Michigan, New York, South Carolina, Virginia, Wisconsin
PROFESSIONAL:	Lecturer, Harvard University. Member, Governor's Task Force for Energy Conservation. President, Metropolitan Chapter, Massachusetts Society of Professional Engineers.

EXPERIENCE:

1972-Present	Engineer and President, R. G. Vanderweil Engineers.
1967-1971	Project Engineer, R. G. Vanderweil Engineers. Coordination of projects and systems analysis.
1966-1967	Engineer, General Electric Atomic Power Department. Design of nuclear steam supply systems - 600 MWe plants.
1963-1966	Engineer, Lockheed Missiles & Space Company. Liquid propulsion and rocket systems analysis. Direction of large scale test programs.
1961-1963	Full-time Research Assistant, Massachusetts Institute of Technology. Theoretical and experimental studies of the direct conversion of heat to electricity.

J. L. DONAHUE

EDUCATION: B.S.E.E., Massachusetts Institute of Technology

ORGANIZATIONS: I.E.E.E.

EXPERIENCE:

1973-Present: R. G. Vanderweil Engineers, Inc. Electrical design engineers, electric rate design, relaying, controls substation, and distribution engineering.

1968-1973: Westinghouse Electric Corporation, Engineering Services Division. Analysis, installation, and maintenance of Westinghouse capital and power distribution equipment, including such components as computers, motor-, circuit breaker-, and process-control circuitry, and power factor correction for such clients as paper mills, electric utilities, and the U.S. Navy.

George L. Snyder, Jr. - Project Manager

Following his long term involvement with the Lafayette College Building program, Mr. Snyder assumed the Engineering and Superintendence responsibilities for General Electric Company's Hi-Bay Research Building at the GE Technology Center in King of Prussia, Pennsylvania.

As Mechanical/Electrical Engineering Consultant for all of Turner's Philadelphia Territory projects, he has, since 1968, been actively concerned with the following projects:

Philadelphia Electric Company Office Bldg.
Philadelphia, PA

Fidelity Mutual/Girard Trust Bank & Office Bldg.
S. Penn Square, Philadelphia, PA

Brandywine Office Building for E. I. duPont deNemours, Wilmington, DE

Headquarters Bldg. for Pittsburgh National Bank
Pittsburgh, PA

Penn Mutual Life Insurance Co. Office Bldg. and Visitor's Center, Philadelphia, PA

American College of Life Underwriters Bldg.
Bryn Mawr, PA

The Chilton Co. Office Building
Radnor, PA

Sears, Roebuck & Co. Headquarters Bldg.
Radnor, PA

Mercy Hospital
Pittsburgh, PA

Johns Hopkins Medical Center
Baltimore, MD

TURNER CONSTRUCTION COMPANY

George L. Snyder, Jr. - Project Manager

[redacted]

Education: Lehigh University - BSCE 1937

Career Data:

Mr. Snyder was employed by Turner Construction Company in 1939. His first assignments were in the field of accounting and material purchasing. For the period January 1942 to April 1946, his employment was interrupted by his entrance in the Armed Forces where he served as a First Lieutenant and Platoon Commander in the Intelligence Reconnaisance, 114th Engineers.

Upon his return to civilian life, Mr. Snyder rejoined our organization, advancing through the various phases of field construction until 1955, when he was assigned as superintendent on the Turner project for St. Andrews School in Middletown, Delaware, after which he became Purchasing Agent in our Philadelphia office, with related engineering duties.

In 1962, Mr. Snyder was transferred to field operations as Superintendent for building programs at Lafayette College in Easton, Pennsylvania. During the next several years he supervised the building of Lafayette's Skillman Library, Pardee Hall Modernization, Dana Hall of Engineering, Freshman Dormitory and Alterations to Easton Hall, and Reconstruction of the John Milton Colton Chapel. As a result of this experience, he has in-depth knowledge of the Construction market in North-Eastern Pennsylvania.

George L. Snyder - Project Manager

Presently, Mr. Snyder is Project Manager for the following projects:

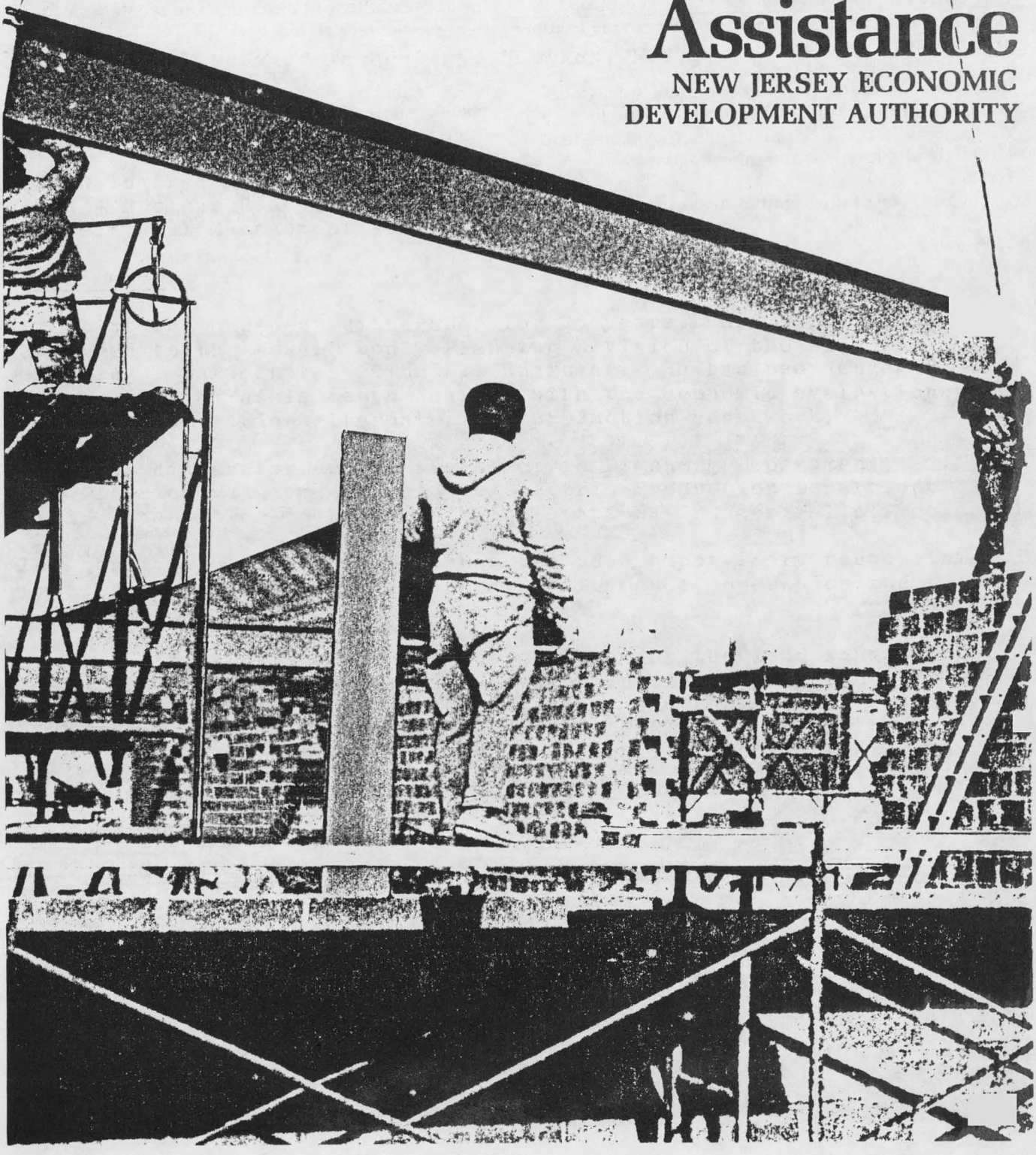
Lafayette College:	Alterations to existing natatorium to create new women's dormitory.
City of Trenton:	Neighborhood Health Center.
Nazareth Hospital:	Construction of new Intensive Care and Coronary Care Units.
Moses Taylor Hospital:	Additions and Alterations to existing hospital buildings.

appendix K

new jersey economic development authority brochure

Guidelines for Financial Assistance

NEW JERSEY ECONOMIC DEVELOPMENT AUTHORITY



INTRODUCTION

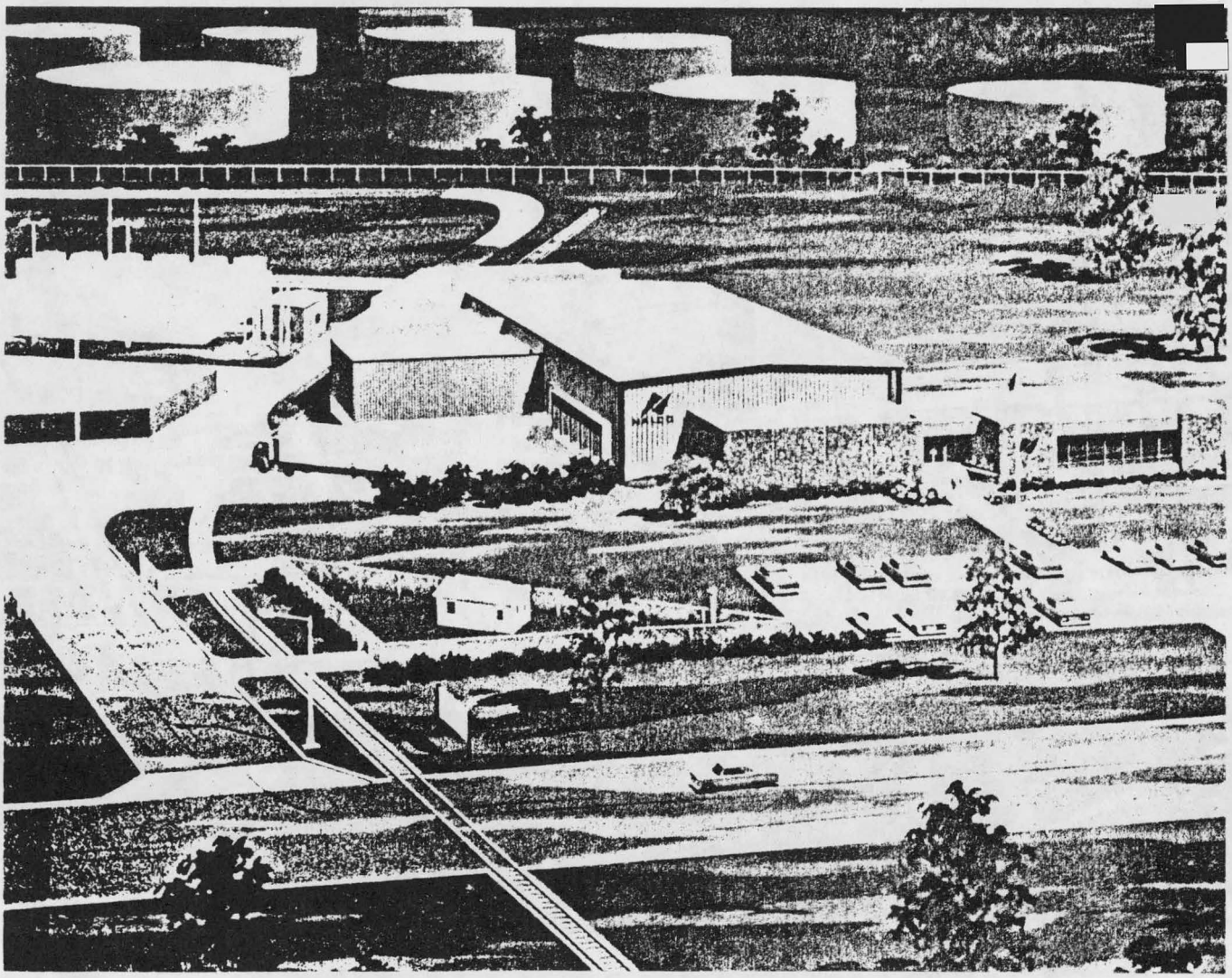
The New Jersey Economic Development Authority was established to provide long-term, low-interest financing to private companies for the purpose of constructing, acquiring, enlarging, and equipping industrial plants and certain other business facilities.* The overall objective of the Authority is to maintain and expand job opportunities, and to enlarge the tax base of state and local governments in New Jersey. To accomplish its objectives, the Authority is empowered to issue tax-exempt industrial development bonds, and to provide funds raised from its bond issue for financing eligible projects. The Authority is also authorized to guarantee loans, to enter into contracts, to buy and sell land, buildings, and other property, and to conduct studies related to its legislative mandate to stimulate employment and investment in New Jersey.

The purpose of these guidelines is to provide a general understanding of the Authority's work and eligibility standards. Please note that these guidelines of necessity are generalized and, therefore, do not represent a complete description of all applicable laws and regulations concerning industrial development bond financing. Persons interested in Authority assistance should arrange for a personal consultation with a member of the staff who can provide more detailed information on the applicability of these rules and regulations to their particular project.

**The Authority was established pursuant to Chapter 80, P.L. 1974, and the Authority's enabling statute has been amended and expanded pursuant to Chapter 32, P.L. 1975; Chapter 34, P.L. 1975; Chapter 253, P.L. 1975; and Chapter 50, P.L. 1977.*

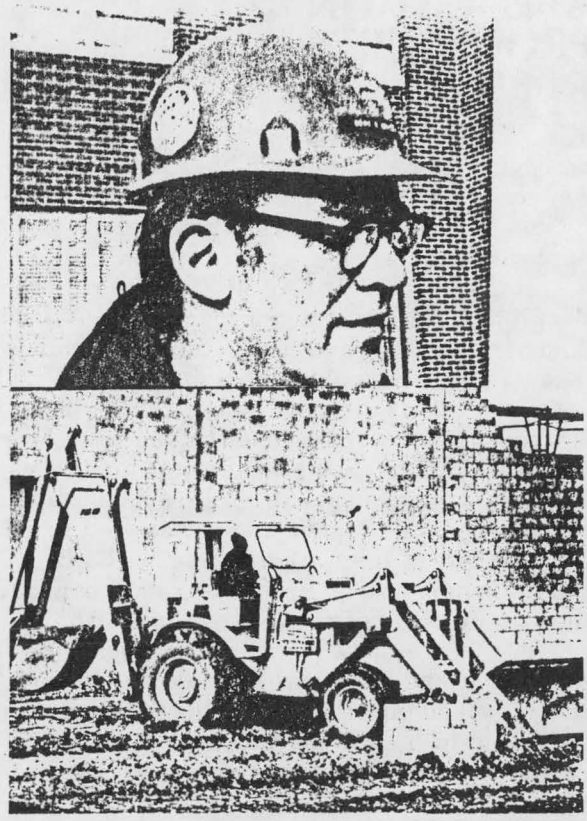
Cover Photo: Construction of facilities for B. Manischewitz Company, Jersey City, New Jersey.

Nalco Chemical Company, West Deptford, New Jersey



WHAT IS THE ECONOMIC DEVELOPMENT AUTHORITY?

The Authority is a governmental agency designed to arrange low-interest, long-term financing for industrial and business projects. The Authority is governed by a seven-member board consisting of the New Jersey Commissioner of Labor and Industry who serves as Chairman; the Commissioner of Community Affairs; the Commissioner of Environmental Protection; the State Treasurer; and three additional members appointed by the Governor and approved by the New Jersey Senate. The Authority is empowered to borrow and lend money, to enter into contracts, to buy and sell land, buildings, and other property, and to do a number of other things pursuant to its broad mandate to stimulate investment in New Jersey. The Authority cannot obligate the credit of the State of New Jersey, however. No contracts, loans, indebtedness, or other agreements may be executed by the Authority except pursuant to formal resolution of the members of the Authority.



HOW THE AUTHORITY WORKS

The Authority does not loan state funds. To raise funds for its assistance to companies, the Authority will issue industrial development bonds. Within the limitations imposed by the Internal Revenue Code on industrial development bonds, the interest income earned on such bonds is exempt from federal income taxation. Tax-exempt bonds usually carry a lower interest rate than taxable bonds, and this favorable interest rate is passed along to companies whose projects qualify under the Authority's assistance program. Thus, the primary advantage provided to companies by the Authority is the opportunity to borrow money at low rates of interest.

The funds necessary for payment of principal and interest on Authority bonds are provided by companies using the facilities financed by the Authority. In most cases, title to the land and buildings involved in a project are also pledged to bondholders in the event of default. The State of New Jersey makes no guarantee of payment on Authority bonds.

Top to Bottom: GAF Corporation, Linden, New Jersey.
Great Bear Spring Water Company, Teterboro, New Jersey.
Firmenich, Inc., Plainsboro, New Jersey.
Windsor Products, Inc., South Hackensack, New Jersey.

APPLICATION PROCEDURES IN BRIEF

The Authority will review applications for assistance to determine whether the proposed project is legally eligible for tax-exempt bond financing. Once eligibility has been determined, the applicant will have the primary responsibility for securing a purchaser of Authority bonds to finance the project. Authority bonds may be purchased by commercial banks, or other institutional lenders, or may be sold to the public through an underwriter.

Once a bond purchaser has been identified, the Authority, the company, and the bond purchaser will work out detailed terms for the financing. When such agreement has been reached, and after formal approval of the financing has been voted by the members of the Authority, the Authority will sell the lender one or more tax-exempt bonds for the amount of funds needed to accomplish the project, secure these bonds with pledges of repayment and collateral from the applicant company, and then arrange for the proceeds of the bond sale to be provided to the company to pay the cost of the project.

Surveying for new facilities for Univac Division of Sperry-Rand Corporation, Voohrees Township, New Jersey

Construction for B. Manischewitz Company, Jersey City, New Jersey

ELIGIBILITY FOR AUTHORITY ASSISTANCE

Projects must meet the following standards to be eligible for tax-exempt bond financing through the Authority.

Economic Benefit Projects must maintain or expand employment in New Jersey, aid and assist in the economic development or redevelopment of a municipality, maintain or increase the tax base of a municipality, and maintain or diversify business and industry in the state. Projects should not cause a substantial removal of jobs from one part of the state to another. Pollution control projects must be designed to abate or reduce environmental pollution.

Types of Projects The Authority may arrange financing for manufacturing, industrial, research, office, recreational, and warehousing facilities, hotels and motels, and combinations of the above, and may also arrange financing for certain types of commercial facilities. Projects may also consist entirely of the purchase of equipment and machinery used in such facilities including pollution control equipment.

Eligible Project Costs In connection with the above categories of projects, the Authority may finance the purchase of land and the cost of such other items which are of a character subject to the allowance for depreciation.
For example, the Authority may finance:

1. The construction of a new building, or the purchase, renovation or expansion of an existing building;
2. The purchase and improvement of land needed to accommodate the buildings;
3. Provision of access roads, utilities, or other appurtenant facilities related to the project;
4. The purchase of machinery and equipment, including pollution control equipment; and
5. Costs of issuing bonds, engineering and inspection costs, legal fees, architect fees, other professional fees associated with the project, and fees paid to the Authority.

The Authority may **not** arrange tax-exempt bond financing for the following project costs, because such costs are not of a character subject to the allowance for depreciation:

1. Working capital;
2. New materials, inventory, work in process, or stock in trade;
3. Debt or mortgage refinancing.

Finally, the Authority may not finance projects which are substantially underway at the time of application to the Authority for assistance.

Speculative Buildings In most cases, the Authority will not arrange financing for the acquisition or construction of facilities if none of the users or occupants of such facilities are known, since the Authority would be unable to determine whether such a project would expand employment opportunities. However, the Authority will consider providing financial assistance for the acquisition or construction of facilities where only some of the occupants or users are identified at the time of the financing. A condition

Technician at Nalco Chemical Company facilities, West Deptford, New Jersey

for Authority approval of such partially speculative projects is that the Authority retain the right to approve prospective tenants or users of such facility. The Authority insists on such oversight powers to insure that future tenants moving into the facility do not remove jobs from other parts of the state.

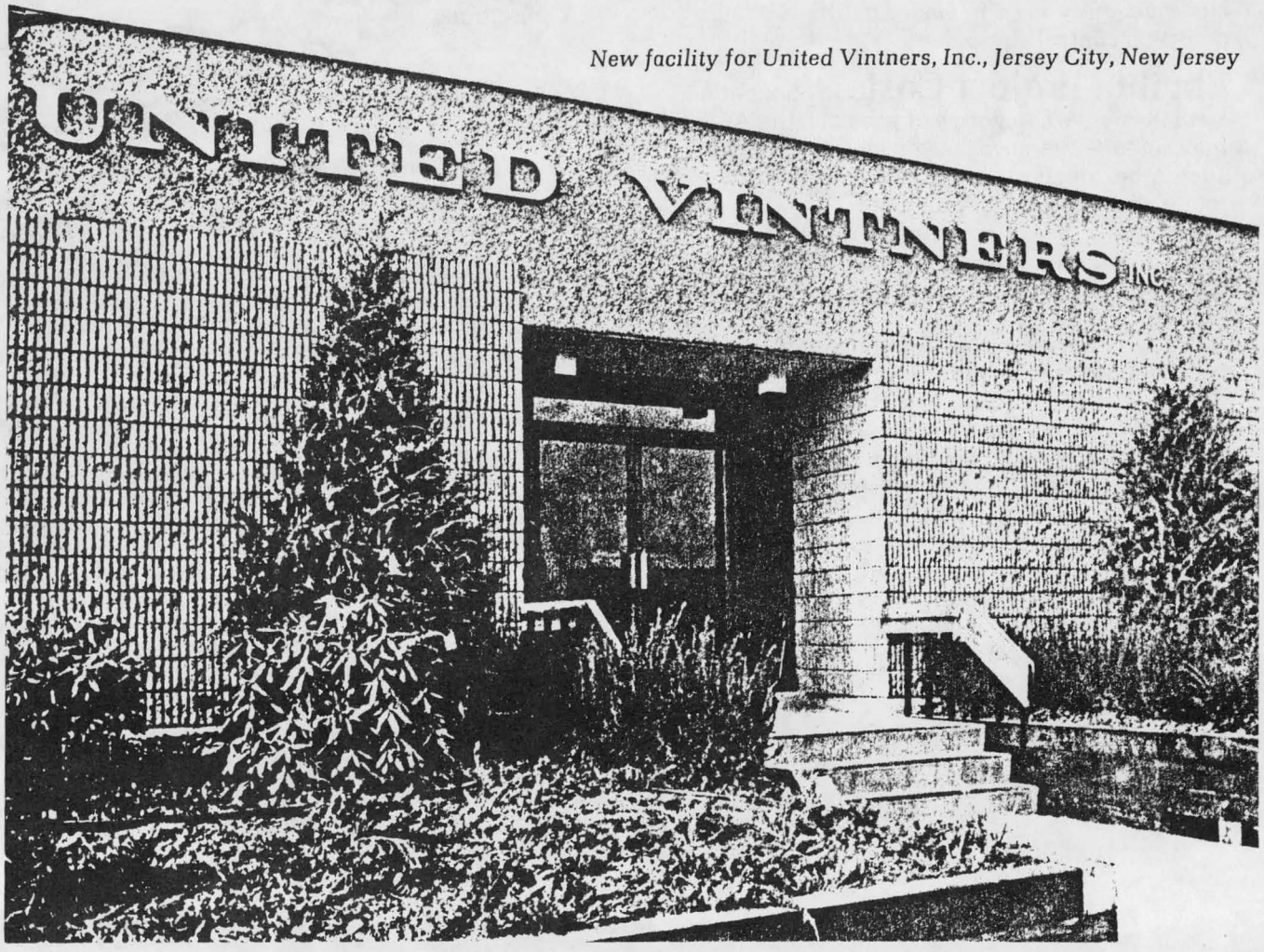
Dollar Limitation The Authority may not provide more than $1 million in tax-exempt bond financing to any single project, with the following exception. If the total project costs does not exceed $5 million, the Authority may provide up to $5 million in tax-exempt bond financing. "Total project cost" as used here must include all capital expenditures (land, buildings, machinery, equipment), whether related to the project or not, made by the owner of the project in the project municipality, during a six-year period, beginning three years before the financing from the Authority and ending three years after such financing.

These rules may be illustrated with the following examples:

Example 1: Company X wishes to arrange a $900,000 tax-exempt bond financing through the Authority for the purpose of expanding the company's existing manufacturing facility in Trenton, N.J. Since the proposed financing is under $1 million, the Authority need not concern itself with the total project cost. Therefore, assuming all other conditions for financing were satisfactory, the Authority could arrange the full $900,000 financing.

Example 2: Company Y constructed a $3 million plant in New Brunswick, N.J. in 1974, with conventional financing. In 1975 the Company approached the Authority seeking a $3 million tax-exempt bond financing to add a warehouse adjacent to the existing factory in New Brunswick. Since the amount of financing requested from the Authority is more than $1 million, the Authority must determine that the total project cost does not exceed $5 million. In this example, the total project cost must include the $3 million expenditure on the factory built in 1974, plus the proposed $3 million warehouse facility, for a total project cost of $6 million. Since the total project cost exceeds $5 million, the company is eligible only for a maximum of $1 million in tax-exempt bond financing.

New facility for United Vintners, Inc., Jersey City, New Jersey



Example 3: Company Z constructed a $2 million factory in Newark, N.J. in 1970. The company made no capital improvements to the facility until 1974, at which time the firm spent $500,000 to replace some equipment and machinery. In 1975, the firm approached the Authority to obtain a $3 million financing for the purpose of constructing an addition to the factory in Newark. To determine eligibility for more than $1 million in tax-exempt bond financing, the Authority must compute the firm's total capital expenditures in Newark during the three years prior to 1975. The original expenditure was made more than three years prior to the date the Authority bonds would be issued to finance the expansion. However, the $500,000 purchase of new equipment and machinery in 1974 fell within this period, and thus is considered a project cost. This expenditure together with the proposed $3 million expansion, means that the total project cost would be $3.5 million. In addition, the company would have to agree that during the period three years following the issuance of the Authority bonds for this project, the company would limit its capital expenditures to a maximum of $1.5 million, so that three years before and three years after the Authority bond issue, total capital expenditures by the firm in the municipality would not exceed $5 million. If the $5 million limitation were exceeded by the company during the three year period following the bond issue, the interest income on the Authority bonds to finance this project would become taxable, and the company would have to pay a substantial penalty to the bondholders.

No such expenditure limitations apply to certain types of projects. For example, there is no limitation on the cost of pollution control equipment that the Authority may finance with tax-exempt bonds, provided that such equipment is designed and will be used for no purpose other than the control of pollution. In addition, no dollar limitation applies to the construction or acquisition of certain business facilities which will be available for use by the public, such as airports, marine and port terminal facilities, convention and trade show facilities, and public industrial parks. You should consult with the Authority staff for further information about these exceptions.

Top: Firmenich, Inc., Plainsboro, New Jersey; bottom left, Windsor Products, Inc., South Hackensack, New Jersey; bottom right, Homa Company, Parsippany, New Jersey.

TAXES

Projects financed by the Authority will be subject to all applicable state and local taxes.

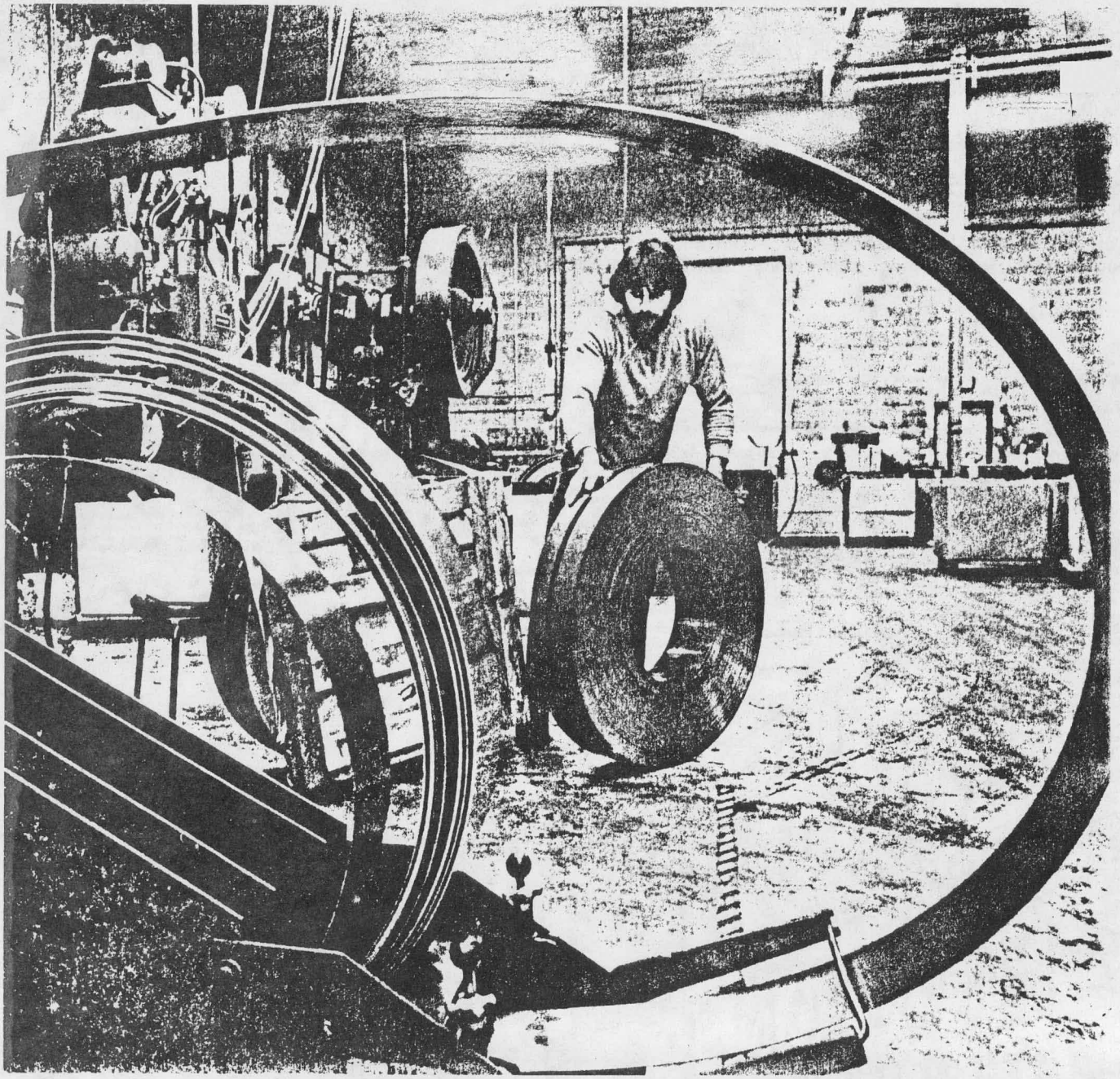
FEES

Companies arranging financing from the Authority will be responsible for paying an application fee to the Authority, and will also be responsible for bond counsel fees and other professional costs incidental to the approval of the financing.

Authority Application Fee A non-refundable fee of $250 must accompany the formal loan application to the Authority; this sum is credited to the full application fee if the loan is approved. The full application fee, to be paid by the company to the Authority at closing, is equal to ½ of 1% of the loan amount. (Note: The Authority will receive a larger fee if the Authority is guaranteeing a portion of the bond issue. See Page 9.)

Legal Fees and Other Fees The borrower is responsible for paying bond counsel fees and other fees associated with the financing and the project, including but not limited to printing fees, consulting fees, real estate fees, etc.

Windsor Products, Inc., South Hackensack, New Jersey



LOAN AND BOND GUARANTEE

In certain cases, the Authority may guarantee repayment of a portion of a loan or bond issue undertaken for a project. This partial guarantee is backed up by cash and securities held in the Authority's Economic Development Fund. The Authority may guarantee repayment of a maximum of 30% of a loan or bond issue or $1,000,000, whichever is less.

Eligibility for Loan Guarantee

The Authority will accept applications for loan guarantee for all projects deemed eligible under its enabling legislation. (P.L. 1974, Chapter 80, as amended.)

However, highest priority will be given to projects located in economically disadvantaged areas, and to projects which have a high ratio of employment to capital investment.

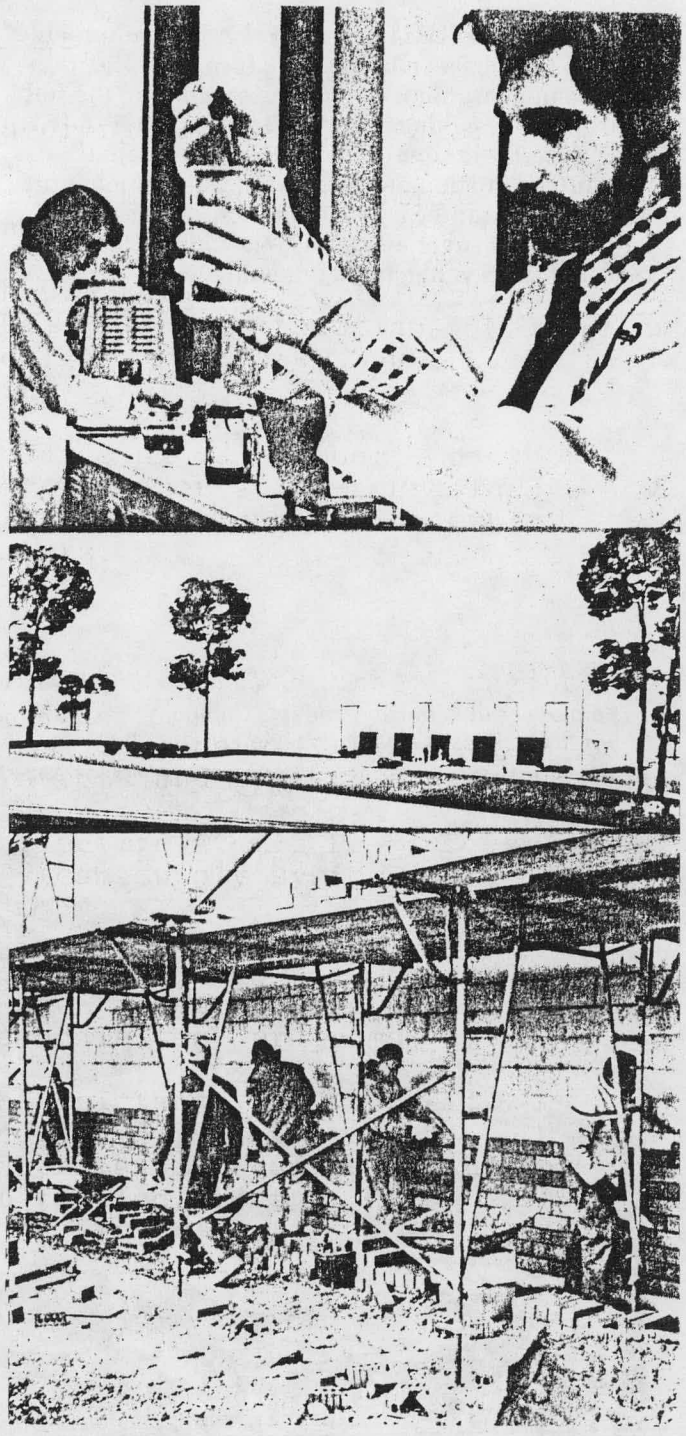
Type of Guarantee Available

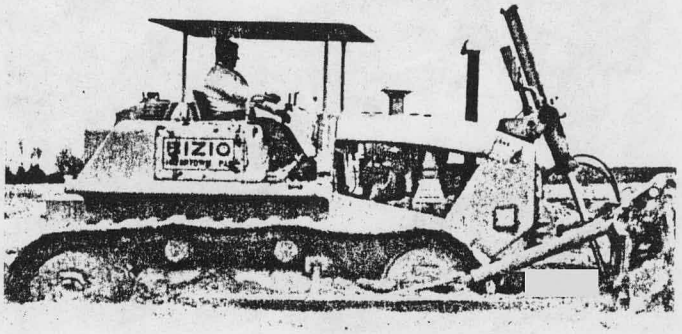
In event of default by the applicant, the guarantee program will provide:

1. Reimbursement for up to 30% of the principal amount of the loan outstanding at the time of default or,
2. Continuation of debt service for a period of time, so long as the aggregate amount paid does not exceed 30% of the loan outstanding or $1,000,000, whichever is less, or
3. Other coverage acceptable to the parties to the transaction, within the dollar limits stated above.

Term of Guarantee The Authority prefers to limit its exposure on loans on the early years of repayment. Maximum coverage of the guarantee will be ten years.

Security and Collateral The Authority usually will require a second security position on the project, and may also require a lien on other unencumbered properties owned by the applicant, personal guarantees, or other collateral. The Authority will permit the primary lender or bondholder to take the first mortgage on a project.





Top to Bottom: Firmenich, Inc., Plainsboro, New Jersey
Camden Enterprises Inc., Camden, New Jersey
Great Bear Spring Water Company, Teterboro, New Jersey
Univac Division of Sperry-Rand Corporation, Voohrees Township, New Jersey

Loan Guarantee Fee: A non-refundable fee of $250 must accompany the formal application for a loan guarantee; this sum is credited to the full guarantee fee, which is due at closing. The full guarantee fee is equal to ½ of 1% of the initial guaranteed portion of the loan times the number of years the guarantee is to be in effect. This is an additional fee, over and above, the closing fee required for revenue bond financing.

Additional Conditions for a Guarantee The applicant must provide at least 10% of the project cost in equity. This can take the form of cash or in-kind property contribution.

The applicant must provide to the Authority audited annual financial statements while the guarantee is in effect, and such other periodic financial information that the Authority may require in the guarantee agreement.

The Authority may require certain covenants to be added to the loan guarantee agreement, such as the maintenance of management and financial stability during the period of the Authority's guarantee; limitations on future long-term borrowings; and restriction on mergers and acquisitions.

The Authority may require that its representative be permitted to attend meetings of the Board of Directors of the applicant during the period of guarantee coverage.

Employees at Windsor Products Company, South Hackensack, New Jersey

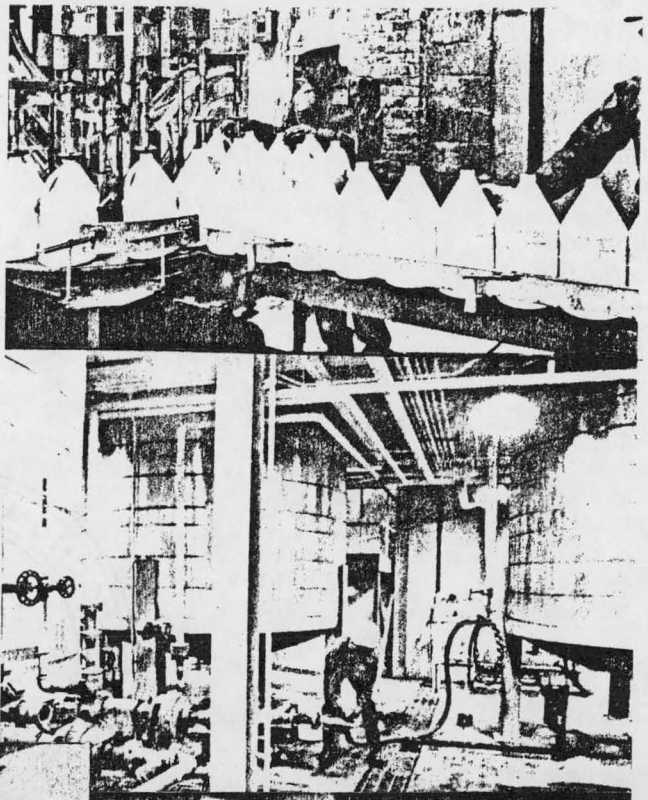
Wollen Chemical and Supply Company, Paterson, New Jersey

HOW LONG DOES IT TAKE, AND HOW DOES ONE GET STARTED?

Tax-exempt bond financings by the Authority can be closed no later than 60-90 days from the date of application, provided a lender can be found to purchase bonds to finance the project. Loan guarantee applications may take slightly longer, depending upon the completeness of financial information on the applicant and the project available to the Authority.

To get started, give the Authority a call or send a letter, outlining the basic features of your project and requesting a consultation.

We look forward to the opportunity of serving your firm's financial needs.



Below from Top: Philadelphia Insulated Wire Company, Moorestown, New Jersey
Homa Company, Parsippany, New Jersey
Intercon Company, Carteret, New Jersey

Top to Bottom:
Wollen Chemical and Supply Company, Paterson, New Jersey
Nalco Chemical Company, West Deptford
Homa Company, Parsippany, New Jersey

NEW JERSEY ECONOMIC DEVELOPMENT AUTHORITY
P.O. BOX 1446
LABOR AND INDUSTRY BUILDING—JOHN FITCH PLAZA
TRENTON, NEW JERSEY 08625
(609) 292-1800

BRENDAN T. BYRNE, GOVERNOR

JOHN J. HORN, CHAIRMAN

ROBERT S. POWELL, JR., EXECUTIVE DIRECTOR

appendix L

regulations and laws

SUBCHAPTER 8. PERMITS AND CERTIFICATES

Authority

N.J.S.A. 26:2C-8

As amended, R.1973 d.10, eff. March 5, 1973.
See: 4 N.J.R. 184(b) 5 N.J.R. 38(a).

FOREWORD

Chapter 9, Permits of the Air Pollution Control Code which became effective on January 15, 1968, is hereby repealed. This repeal shall not affect actions, proceedings or departmental orders pending or outstanding on the effective date of the new regulation; said actions, proceedings, or departmental orders may be prosecuted, defended and continued in the same manner and to the same effect as if the new regulation had not been adopted. The text of the regulation follows.

7:27–8.1 Definitions

The following words and terms, when used in this Subchapter, shall have the following meanings, unless the context clearly indicates otherwise.

"Air contaminant" means solid particles, liquid particles, vapors or gases which are discharged into the outdoor atmosphere.

"Commercial fuel" means solid, liquid or gaseous fuel normally produced, manufactured, used or sold for the purpose of creating useful heat.

"Control Apparatus" means any device which prevents or controls the emission of any air contaminant.

"Department" means the Department of Environmental Protection.

"Equipment" means any device capable of causing the emission of an air contaminant into the open air, and any stack, chimney, conduit, flue, duct, vent or similar device connected or attached to, or serving the equipment. This shall include equipment in which the preponderance of the air contaminants emitted is caused by the manufacturing process.

"Incinerator" means any device, apparatus, equipment or structure used for destroying, reducing or salvaging by fire any material or substance including but not limited to refuse, rubbish, garbage, trade waste, debris or scrap or a facility for cremating human or animal remains.

"Liquid particles" means particles which have volume but are not of rigid shape and which upon collection tend to coalesce and create uniform homogeneous films upon the surface of the collecting media.

"Manufacturing process" means any action, operation or treatment embracing chemical, industrial, manufacturing, or processing factors, methods or forms including, but not limited to, furnaces, kettles, ovens, converters,

cupolas, kilns, crucibles, stills, dryers, roasters, crushers, grinders, mixers, reactors, regenerators, separators, filters, reboilers, columns, classifiers, screens, quenchers, cookers, digesters, towers, washers, scrubbers, mills, condensers or absorbers.

"Non-commercial fuel" means solid, liquid or gaseous fuel not normally produced, manufactured, used or sold for the purpose of creating useful heat.

"Particles" means any material, except uncombined water, which exists in finely divided form as liquid particles or solid particles at standard conditions.

"Person" includes corporations, companies, associations, societies, firms, partnerships and joint stock companies as well as individuals, and shall also include all political subdivisions of this State or any agencies or instrumentalities thereof.

"Solid fuel" means a fuel which is fired as a solid, such as anthracite or semianthracite coal, bituminous or sub-bituminous coal, lignite, coke breeze, wood or any solid by-product of a manufacturing process that may be substituted for any of the above specifically mentioned fuels.

"Solid particles" means particles of rigid shape and definite volume.

"Source operation" means any manufacturing process or any identifiable part thereof emitting an air contaminant into the outdoor atmosphere through one or more stacks or chimneys.

"Stack or chimney" means a flue, conduit or opening designed and constructed for the purpose of emitting air contaminants into the outdoor air.

"Standard conditions" shall be 70 degrees Fahrenheit and one atmosphere pressure (14.7 psia or 760 mm Hg).

7:27–8.2 Permits and certificates required

(a) Control apparatus and equipment for which a permit to construct and a certificate to operate are required include:

1. All control apparatus;

2. Equipment used in a manufacturing process involving surface coating, including but not limited to spray and dip painting, roller coating, electrostatic depositing or spray cleaning, which emits air contaminants into the open air and in which the quantity of material used in any source operation is in excess of 10 pounds in any one hour;

3. Equipment used in a manufacturing process involving surface cleaning or preparation, including but not limited to degreasing, etching, pickling, or plating, which emits air contaminants into the open air from a tank or vessel, the capacity of which is in excess of one hundred gallons;

4. Equipment, used in a manufacturing process, other than as set forth in paragraphs 2. and 3. of this subsection, which emits air contaminants into the open air either directly or indirectly and in which the combined weight of all materials, excluding air and water, introduced into any one source operation is in excess of 50 pounds in any one hour;

5. Tanks, reservoirs, containers and bins used for the storage of:

i. Liquids except water, including, but not limited to, acids, solvents, diluents or thinners, inks, colorants, lacquers, enamels, varnishes, liquid resins, gasolines, crude oils, petrochemicals, commercial fuels, noncommercial fuels and petroleum derivatives; and having a capacity in excess of 10,000 gallons;

ii. Solid particles in finely divided or powdered form including, but not limited to, binders, fillers, foodstuffs, detergents, fluxes, catalysts, mineral wools, resins, plastics, pigments, construction materials and solid fuels; and having a capacity in excess of 2,000 cubic feet.

6. Stationary material handling equipment using pneumatic, bucket or belt conveying systems which emit air contaminants into the open air either directly or indirectly;

7. Commercial fuel burning equipment having a heat input rate of 1,000,000 BTU per hour or greater to the burning chamber;

8. Any equipment used for the burning of noncommercial fuel, crude oil or process by-products in any form;

9. Any incinerator, except incinerators constructed, installed or used in one or two-family dwellings or in multi-occupied containing six or less family units, one of which is owner occupied.

7:27–8.3 General provisions

(a) No person shall construct, install or alter any equipment or control apparatus without first having obtained a permit to construct, install or alter control apparatus or equipment from the Department. Such permits may be cancelled if construction, installation or alteration is not begun within one year from the date of issuance.

(b) No person shall use or cause to be used any new or altered equipment or control apparatus without first having obtained a certificate to operate control apparatus or equipment from the Department. Such certificates shall be valid for a period of five years unless sooner revoked by the Department, and such certificates may be renewed only after application to the Department not less than 90 days prior to their expiration date.

(c) Upon receipt of an application for the issuance of a certificate to operate control apparatus or equipment or any renewal thereof, the

Department may issue a temporary certificate valid for a period not to exceed 90 days.

(d) Any person in possession of a certificate to operate control apparatus or equipment shall maintain said certificate readily available on the operating premises.

(e) No person shall use or cause to be used any equipment or control apparatus unless all components connected or attached to, or serving the equipment and/or control apparatus are functioning properly and are in use in accordance with the permit to construct, install or alter control apparatus or equipment and certificate to operate control apparatus or equipment.

(f) A certificate to operate control apparatus or equipment shall not be transferable either from one location to another or from one piece of ccontrol apparatus or equipment to another. A transfer from one person to another is permissable provided such transfer is reported to the Department within 90 days of the occurrence..

(g) The possession of a certificate to operate control apparatus or equipment does not relieve any person from the obligation to comply with all other provisions of this Subchapter,

(h) Permits and certificates issued under this Subchapter are based on emissions of air contaminants only and do not in any way void the applicant's obligation to obtain necessary permits from other governmental agencies.

(i) The provisions of subsections (a) and (b) of this Section shall not apply to structural changes, repairs or maintenance, if such changes, or repairs or maintenance will not change the quality, nature or quantity of the air contaminant emitted.

7:27–8.4 Applications for permits and certificates

(a) Applications for a permit to construct, install or alter control apparatus or equipment or a certificate to operate control apparatus or equipment shall be made to the Department on forms provided by the Department.

(b) The Department may require such details regarding the equipment or control apparatus as it considers necessary to determine that the equipment or control apparatus is designed to operate without causing a violation of any provisions of the New Jersey Air Pollution Control Act or any provisions of codes, rules or regulations promulgated thereunder and that the equipment or control apparatus incorporates advances in the art of air pollution control developed for the kind and amount of air contaminant emitted by the applicant's equipment. Such information may include description of processes, raw materials used, operating procedures, physical and chemical nature of air

40:62–25.2 Duration of contract; ownership and control of facilities

Any such contract may be made by a municipality, notwithstanding any other provisions in this article contained, for a period not to exceed the anticipated useful life of said facilities for the financing which obligations of the municipality are issued as hereinafter provided, and the governing body of a municipality approving and executing such contract is hereby authorized to provide therein for the joint ownership, operation and maintenance of the facilities made the subject of such contract under such terms and conditions as it determines necessary, convenient or desirable to carry out and effectuate the purposes of this act and the acts to which this act is a supple-

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ment, provided that neither the money nor credit of any municipality shall be given or loaned in any manner, directly or indirectly, to any State-regulated public utility which is a party to such contract, nor shall any municipality be liable for more than its proportionate share of the cost, damages, expenses, liabilities or other obligations incurred in the acquisition, construction, operation or maintenance of said facilities as set forth in such contract or otherwise arising in connection with such facilities, and every municipality shall own and control an interest in such facilities and the electrical output thereof at least equal or proportionate to the money, property or other consideration furnished or supplied in or with respect to the planning, acquisition, construction, operation or maintenance thereof by said municipality.
L.1973, c. 280, § 2, eff. Nov. 29, 1973.

Library References
Electricity ⇦1½.
C.J.S. Electricity § 6 et seq.

peak demand, will reduce or defer the need for the expansion of utility generating and transmission capacity, with attendant public benefits in land use, environmental quality and public health and safety;

3. That installing adequate levels of ceiling insulation in residential structures is one readily available means which requires minimal investment to conserve energy resources;

4. That the utility will continue to develop and implement other conservation programs which will be promoted and advertised as provided for herein;

5. The information shall be distributed to the public by the following means:

i. Extensive advertising by public media, including newspapers, periodicals, television and radio;

ii. The use of outdoor signs and messages, including posting on utility vehicles and facilities, and common carriers;

iii. By direct mailing, at no direct charge to customers, informational booklets detailing methods for conserving energy resources and any other information pursuant to this Subchapter which the Board may from time to time require.

6. No utility may distribute to the public, advertise or otherwise disseminate information for the purpose or with the effect of encouraging or promoting the consumption of energy resources in a manner inconsistent with these regulations.

As amended, R.1975 d.305, eff. October 17, 1975.
See: 7 N.J.R. 277(b), 7 N.J.R. 510(b).

14:3-3.4 Permits

The utility, where necessary, will make application for any street opening permits for installing its service connections and shall not be required to furnish service until after such permits are granted. The municipal charge, if any, for permission to open the street shall be paid by the customer.

"Utility" has the same meaning as defined in N.J.S.A. 48:2–13 and includes pipeline utilities as defined in N.J.S.A. 48:10–3, and municipally-operated utilities, insofar as the Board's jurisdiction is extended to them under the appropriate statutes.

SUBCHAPTER 2. PLANT

14:3–2.1 Plant construction

(a) The construction and installation of plant and facilities of the utility must be in accordance with standard practice. Each utility shall make reasonable efforts to protect the public and its property from injury or damage and shall exercise due care to reduce hazards to which employees, customers, and the general public may be subjected by reason of its equipment and facilities.

(b) The various utilities should cooperate to the greatest extent practicable to reduce or eliminate interference among the different systems.

14:3–2.2 Inspection of work performed by contractors

To the extent necessary to assure compliance with safe practices, any construction work performed for a utility by contractors shall be inspected by a qualified representative of the utility before being placed in active service.

14:3–2.3 Foreign construction on utility poles

Each utility owning poles shall endeavor to prevent nonstandard foreign construction on poles owned by it. In other words, fire alarm and telephone, electric or trolley wires, or any other facilities, private or otherwise, should be located and attached in accordance with standard practice. When existing construction is replaced or changed, all nonstandard construction then in place shall be made to conform with this regulation. In the event of disagreement with any municipality or other utility as to the necessity of changes or removals under this rule, the matter shall be submitted to the Board for determination.

14:3–2.4 Identification of buildings and structures

Each group of buildings or structures shall be provided with a sign displaying the name of the operating utility. This regulation shall not apply to buildings or structures located on railroad rights-of-way.

14:3–2.5 Identification of poles or structures supporting wires; fire hydrants

(a) Each utility owning solely or jointly poles or structures supporting wires along or over public highways or fire hydrants shall properly mark each such pole, structure or fire hydrant with the initials of its name, abbreviation of its name, corporate symbol or other distinguishing mark or code by which ownership may be readily and definitely ascertained, and with number or symbol or both by which the location of each such pole, structure or fire hydrant may be determined on office records. Such markings may be made with paint, brand or with a soft metal plate and the characters of the mark shall be of such size and so spaced and hereafter maintained as to be easily read.

(b) In the case of two or more utilities jointly owning any structures, the distinguishing mark or number of each utility shall be placed on such structure but not necessarily more than one number shall be placed thereon. The numbering may be in accordance with a code which will indicate joint ownership.

(c) In the case of such structures carrying or supporting overhead trolley wires, where there is a double line of such structures, one on each side of the track, such mark need be affixed to but one line of such structures.

(d) In the case of such structures erected upon private rights-of-way or on public highways of such character that the construction may be deemed to be a through or trunk line, such mark need be affixed only to every fifth structure; provided, however, that each and every structure situated within the limits of any built-up community shall be marked, except as otherwise provided in subsection (c) of this Section. This subsection shall not be deemed to require the marking of railroad structures located on railroad rights-of-way.

(e) The requirements in this Section shall apply to all existing and future structures erected and to all changes in ownership and name.

(f) Each such utility shall have available a statement showing:

1. The initials, abbreviations of name, corporate symbol or distinguishing mark;

2. The means of marking employed;

3. The method followed in numbering structures within the limits of cities, towns or other built-up communities, and upon through or trunk lines.

(g) Each utility should make reasonable efforts to prevent the placing upon its poles of any marks, signs, placards, bulletins, notices, or any other foreign object other than as provided in N.J.S.A. 27:5–1 (Advertising on highways and private property prohibited; penalty) and as prescribed in these regulations.

14:3–2.6 Maintenance of plant, equipment and facilities

Every utility shall have and maintain its entire plant in such condition as will enable it to furnish safe, proper and adequate service.

14:3–2.7 Inspection of property

(a) Each utility shall inspect its equipment and facilities at sufficiently frequent intervals to disclose conditions, if existing, which would interfere with safe, adequate and proper service, and shall promptly take corrective action where conditions disclosed by such inspection so warrant.

(b) Whenever any equipment is removed from the system for any reason, it shall be inspected as to safety and serviceability before being reinstalled in the same or other location.

(c) Each pole, post, tower or other structure shall be inspected by the utility owning or using it with sufficient frequency and comprehensiveness to disclose the necessity for replacement or repair in order to maintain service in accordance with established practice.

14:3–2.8 Construction work near utility facilities

A utility shall endeavor, to the extent feasible and practicable, to obtain prompt notice and information concerning commencement and progress of construction work in close proximity to its facilities through its qualified employees, or through contractors, government agencies, or others who may be permitted to perform construction work within the confines of its territory. Nothing herein shall affect the duties and obligations of persons working in the vicinity of high voltage lines as set forth in N.J.S.A. 34:6–47.1 or working in the vicinity of gas facilities as set forth in N.J.S.A. 2A:170–69.4 *et seq.*

SUBCHAPTER 3. SERVICE

14:3-3.1 Duty

(a) It shall be the duty of every utility to furnish safe, adequate and proper service, including furnishing and performance of service in a manner that tends to conserve energy resources and preserve the quality of the environment.

(b) Accordingly, it is the proper function and continuing duty of utilities as defined in N.J.A.C. 14:3-11.1 to suggest and develop conservation proposals for presentation to the Board. The regulations which follow do not limit this continuing duty nor other duties now imposed upon the utilities, but merely serve to define such duties and to establish standards for their performance.

As amended, R.1975 d.305, eff. October 17, 1975.
See: 7 N.J.R.277(b), 7 N.J.R.510(b).

14:3-3.2 Applications

(a) Applications by a customer for the establishment of service may be made at the utility's office either in person, by mail or by telephone. If the utility requires a written application, the same may be subsequently submitted to the customer for signature.

(b) When a customer makes application for service to any utility and the service requested is supplied by another utility, the company shall advise the customer when possible of the appropriate utility to whom the application should be made.

14:3-3.3 Customer information

(a) Each utility shall, upon request, furnish its customers with such information as is reasonable in order that the customers may obtain safe, adequate and proper service.

(b) Each utility shall inform its customers, where peculiar or unusual circumstances prevail, as to the conditions under which sufficient and satisfactory service may be secured from its system.

(c) Each utility shall file with the Board, and keep open to public inspection, tariffs applicable to the service area or line, pursuant to the provisions of N.J.A.C. 14:11-1.18 and 1.19, as applicable.

(d) Each utility shall supply its customers with information on the furnishing and performance of service in a manner that tends to conserve energy resources and preserve the quality of the environment, which shall include but not be limited to the duty to inform customers:

1. That there is a critical national and local need for the conservation of all types of energy resources by industrial, commerical and residential customers;

2. That such conservation if widely practiced, particularly at periods of

the taking of such property is not imcompatible with the public interest, and would not unduly injure the owners of private property;

6. A statement of the reasons why the property cannot be purchased by negotiation;

7. Where the petitioner has after diligent search been unable to determine the name and address of the owner of the property to be condemned or of any interest therein, such facts must be stated in an affidavit of inquiry prepared in the manner provided for in the rules of the Superior Court.

(b) On receiving notice from the Board as to the time and place fixed for hearing, the petitioner shall give each respondent whose name and address is known not less than 20 days notice, either personally or by mail, of the time and place so fixed for hearing. The petitioner shall file with the Board proof of the giving of such notice pursuant to the provisions of Section 5.6 (Service and notice of proceedings) of this Chapter, at least five days prior to the date set for hearing.

(c) Where the petitioner has, after diligent search, been unable to determine the name and address of any respondent the petitioner shall publish notice of hearing, addressed to such respondent by name (or other appropriate designation if the name is unknown). Such publication shall be made twice in consecutive calendar weeks, once in each week, in a newspaper published in the county where the property is situated, of if none be published therein, then in a newspaper published in this State and circulating in said county, the second such publication to be made not less than 20 days prior to the hearing date. Said publication shall contain a description of the property to be condemned. Sworn proof of publication must be filed at least five days prior to the hearing date.

14:1–6.13 Petitions for authority to issue stocks, bonds, notes, other evidence of indebtedness or to execute mortgages

(a) Petitions for authority to issue any stocks, bonds, notes, or other evidence of indebtedness, payable in more than one year from the date thereof, and to execute mortgages shall conform to the provisions of N.J.S.A. 48:3-7 and 48:3-9 and Subchapter 5 (Pleadings Generally) and Section 6.1 through 6.5 of this Chapter to the extent applicable, and shall in the body thereof or in attached exhibits provide the following information:

1. A statement of the amount and terms of the proposed issue including the nature of the security therefor, if any; the purposes for which

the proceeds are to be used; and the nature of all rights and limitations applicable to the security;

2. Where one of the purposes is the acquisition of property, a general description of the property, the name of the transferrer, and a copy of the contract, if any, for such acquisition. In the case of property to be acquired for right-of-way purposes, a general description of the proposed route and a map or plot plan will be sufficient;

3. Where one of the purposes is the construction, completion, extension or improvement of facilities, a general description of the work proposed to be done, and an estimate of the cost thereof in reasonable detail. Where one of the purposes is the improvement or maintenance of service, there shall be included a description of the existing service as well as of the improvements, or betterments proposed;

4. Where one of the purposes is the refunding of securities, a description of the securities and obligations to be refunded, including the kind, amount, date of issue and date of maturity, together with the terms of refunding and all other material facts affecting the same must be set out;

5. Where one of the purposes is the issuance of capital stock based upon the investment of earnings in plant which might have been distributed in dividends, a complete and reasonably detailed enumeration of petitioner's property, priced at original cost (estimated if not known). The petitioner shall produce evidence at the hearing in support of such enumeration and pricing;

6. Where one of the purposes is to reimburse the treasury for expenditures not theretofore capitalized by the issuance of securities, the petitioner shall also show the exact period and amount for which reimbursement is desired; comparative financial statements which shall include, as a minimum, balance sheets and utility plant by accounts as at the beginning and end of the period, as well as changes in the period (in the case of utility plant, additions and retirements shall be stated separately for each year); a statement indicating the source and application of funds during the period; a statement indicating the manner in which petitioner proposes to use the proceeds from the security issue; and the necessity and reasonableness of the proposed transaction;

7. Where one of the purposes is for the issuance of common capital stock in connection with the organization of a new corporation to operate as a public utility, the petition must contain the following:

i. Copy of certificate of incorporation;

ii. Names and addresses of the elected or proposed officers, directors and stockholders of the company and the number of shares of capital stock to be held by each;

iii. The required number of stockholders and directors and the state in which they reside pursuant to the statute under which the corporation will be organized;

iv. Corporate resolution or proposed resolution of directors of the utility authorizing the issuance of the stock;

v. Copy of a *pro forma* balance sheet of the new corporation and copy of a *pro forma* income statement of estimated operating results anticipated for the first two years of its proposed operations, unless a different period is specified by the Board;

vi. The name of the municipality and the street and number therein:

(A) In which the principal office in this State is to be located, and the name of the agent in and in charge of such principal office upon whom process against the corporation may be served;

(B) In which the principal business office is to be located;

(C) At which the records, books, accounts, documents and other writings referred to in N.J.S.A. 48:3-7.8 are to be kept and the name, place of residence within this State, and place of business of the agent who shall have custody of said corporate records and upon whom process for the production of the same before the Board may be served. (The books of account must be kept in conformity with the appropriate Uniform System of Accounts rescribed by the Board. Books and records must be kept within this State unless authority to do otherwise is obtained from the Board.)

Authority

N.J.S.A. 48:2-16 and 48:3–7.8

vii. A detailed list of organization expenditures;

viii. A copy of a *pro forma* balance sheet giving effect to the issuance of the proposed securities;

ix. Copy of a *pro forma* income statement giving effect to the issuance of the proposed securities;

x. The effective rate of interest or of the cost of money to the petitioner and the reasonableness thereof, if authority is requested to issue stocks, bonds, notes or other evidence of indebtedness by means of private placement and not at a public offering, and the financial sources that the petitioner has contacted in this connection. Petitioner should submit

information as to the computation of the effective rate of interest or of the cost of money as distinguished from the nominal rates which may be indicated;

8. Where one of the purposes is the issuance of bonds to be secured by an existing mortgage a statement showing the amount and use made of the proceeds of the bonds, if any, already issued under such mortgage;

9. Information relating to the current financial condition of the petitioner setting forth:

i. As to each class of capital stock of the petitioner, the amount authorized and the amount issued and outstanding;

ii. As to each class of preferred stock of the petitioner, a summary statement of the terms of preference thereof;

iii. As to each issue or series of long-term indebtedness of the petitioner, the principal amount authorized to be issued, date of issue, date of maturity, rate of interest and principal amount outstanding; and as to each such issue secured by a mortgage upon any property of the petitioner, the date of said mortgage, name of trustee, principal amount authorized to be secured, and a brief description of the mortgaged property;

iv. Other indebtedness of all kinds, giving same by classes and describing security, if any;

v. Amount of interest charged to income during previous fiscal year upon each kind of indebtedness and rate thereof; and, if different rates were charged, amount charged at each rate;

vi. Amount of dividends paid upon each class of stock during previous fiscal year and rate thereof;

vii. Detailed income statement for previous fiscal year and balance sheet showing condition at the close of that year.

10. A statement whether any franchise or right is proposed to be capitalized directly or indirectly. In case it is proposed to capitalize any franchise as authorized by N.J.S.A. 48:3-5, a copy of such franchise and a statement, together with an affidavit showing the amount actually paid for said franchise shall be attached to the petition;

11. Where any contract, agreement or arrangement, verbal or written, has been made to sell the securities proposed to be issued, a description of such contract, agreement or arrangement and, if in writing, a copy thereof;

12. If no contract, agreement, or arrangement has been made for the sale or other disposition of the securities proposed to be issued, the proposed method of sale or other disposition must be set forth together with an

affidavit of a competent person showing the amount which can probably be realized from the sale and disposition thereof, and the reasons for the opinion of the affiant;

13. Petitions filed under this rule shall contain a certified copy of the resolution of the board of directors or other authority authorizing the proposed issuance of securities and shall be verified. The verification shall include a statement that it is the intention of the petitioner in good faith to use the proceeds of the securities proposed to be issued for the purposes set forth in the petition.

NOTE: Information which under this rule is required to be set forth in a petition or any exhibit attached thereto and which is contained in any report, document, pleading or other instrument previously filed with the Board pursuant to any requirement of any statute or any regulation of the Board, may be incorporated in such petition or exhibit by reference to the official filing thereof with the Board provided that said information is still correct in all respects.

14:1–6.14 Petitions for authority to transfer capital stock

(a) Petitions for authority to transfer upon the books and records of any public utility, pursuant to N.J.S.A. 48:3-10, any share or shares of its capital stock, shall conform to the provisions of Subchapter 5 (Pleadings Generally), Section 5.6 (Service and notice of proceedings) and Sections 6.1 through 6.5 of this Chapter to the extent applicable, and shall in the body thereof, or in attached exhibits, also provide the following information:

1. The name and address of the proposed transferrer and transferee;

2. A description of the proposed transferee including information as to whether the proposed transferee is a public utility, a holding company either separately or by affiliation in a utility holding company system, or a person or other domestic or foreign corporation;

3. A description of the capital stock proposed to be transferred including the class of shares, number of shares and the par or stated value thereof;

4. The per cent in interest of the outstanding voting capital stock of the public utility which the proposed transfer, either by itself or in connection with other previous sales or transfers, will vest in the transferee;

5. The reason for the proposed transfer;

6. Details and explanation of any changes expected to be made, if petition is approved, in:

appendix M

construction schedule

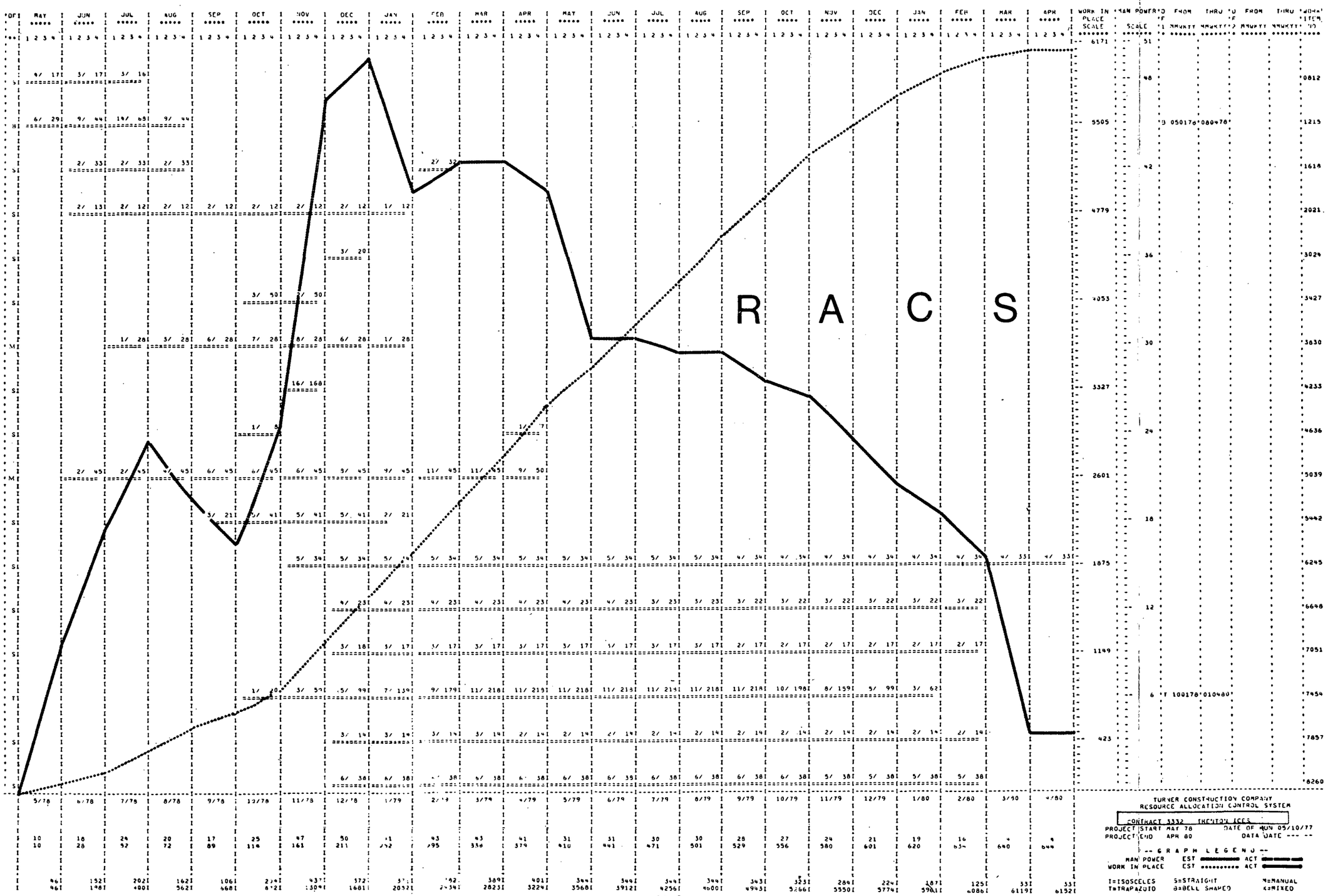
WORK ITEM NO.	WORK ITEM DESCRIPTION	EST. VALUE (000)	I.O.R. VALUE (000)	EST. PCT.	ACT. PCT.	LABOR VALUE (000)	LABOR RATE	TOTAL MAN HOURS	TOT. MAN HOURS	REM. MAN HOURS	MAN POWER TO DATE EST.	MAN POWER TO DATE ACT.	MAN POWER TO DATE REM.	WORK IN PLACE TO DATE EST.	WORK IN PLACE TO DATE ACT.	WORK IN PLACE TO DATE REM.
0812	STRUCTURE - UPGRADING	50	52	39		20	1945	10	3	3			10			50
1215	PARTITIONS&EXTERIOR WALLS	185	185	43		80	2085	38	4	4			38			185
1618	STRUCT STL &MISC METAL	131	131	13		17	2105	8	4	4			8			131
2021	FIRE PROTN. MECH.ELEC.	97	97	32		31	2080	15	8	8			15			97
3024	TURBINE GEN SETS - PADS	20	20	27		5	1820	3	1	1			3			20
3427	PEAK LOAD BOILER	100	100	10		10	2080	5	2	2			5			100
3830	INTERIOR PIPING	196	196	34		67	2070	32	7	7			32			196
4233	EXHAUST SYSTEM	168	168	20		34	2080	16	1	1			16			168
4636	WATER TREATMENT	15	15	28		4	2070	2	2	2			2			15
5039	CONTROL DIVICES	500	508	31		155	2105	74	11	11			74			500
5442	FUEL SUPPLY	165	165	25		41	2070	20	5	5			20			165
6245	TRENCHING & BACKFILL	610	610	24		146	1780	82	18	18			82			610
6648	STEAM DISTRIBUTION	339	339	32		108	2080	52	15	15			52			339
7051	CONDENSATE RETURN	256	256	32		82	2080	39	15	15			39			256
7454	TURBN GENS & W/H BOILERS	2540	2540	11		279	2185	128	16	16			128			2540
7857	WATER DISTRIBUTION	210	210	34		71	2070	34	15	15			34			210
8260	ELECTRICAL DISTRIBUTION	570	570	32		182	2105	86	15	15			86			570
	WORK ITEM TOTALS	6152	6152	22		1332	2068	649	24	24			649			6152

MONTHLY ACTUAL MAN-POWER
CUMULATIVE ACTUAL MAN-POWER

MONTHLY ESTIMATED MAN-POWER
CUMULATIVE ESTIMATED MAN-POWER

MONTHLY ACTUAL WORK IN PLACE
CUMULATIVE ACTUAL WORK IN PLACE

MONTHLY ESTIMATED WORK IN PLACE
CUMULATIVE ESTIMATED WORK IN PLAC



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