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# METROPOLITAN HOSPITAL CENTRAL UTILITY PLANT ENERGY PLAN

PREPARED FOR:

Metropolitan Hospital

FEBRUARY 24, 2005

## TABLE OF CONTENTS

**Section** **Name** **Page No.**

# EXECUTIVE SUMMARY

## 1.0 EXECUTIVE SUMMARY

The new Metropolitan hospital is planning to employ state of the art medical and information technologies to continue its tradition and focus of improving the health and well being of its patients. To ensure the effectiveness of caregivers and supporting systems, there was a clear need to define an energy plan that ensured a high level of electric supply reliability and quality in a cost competitive fashion. To this end, Metropolitan Hospital contracted NOVI Energy to develop an energy strategy for the new Hospital Complex and the Center for Sustainability Energy and Education ('CSEE') being developed in Wyoming, Michigan.

Key elements of this strategy needed to bring a balance between energy performance and cost, consistent with the values of the hospital system. A risk management plan would also be put in place to help manage fuel costs. This strategy focused on the following key areas.

- Competitive energy supply
- Reliability and quality of electric supply
- Utilize proven, state-of-the-art energy technologies
- Environmentally responsive

To accomplish these objectives, a Central Utilities Plant ('CUP') within a LEED (Leadership in Energy and Environmental Design) certified building is planned. This facility would employ multiple units of efficient reciprocating engine generators with waste heat recovery. Industry terminology is Combined Heat and Power ('CHP') for such an application. The recovered heat would be used to produce hot water and steam that would support the hospital heating loads in winter months and to produce chilled water to help cool the hospital during summer months. Based on projected energy needs of the hospital, the efficiency of this system is expected to be about 75% as compared to fuel conversion efficiencies of about 33 to 38% observed at most utility owned central power stations. This gain in efficiency translates to the reduced amount of fuel used to produce electricity and will result in lower overall energy costs.

The CUP supply would be connected to the 46kV transmission line that traverses the Health Village on the South side. Market based supplementary power would augment supply from the CUP to support the peak electric needs. Based on availability of low cost off-peak power, the strategy focuses on procuring this market based supply to further reduce energy costs.

This study reviewed four available alternatives to meet the electrical energy needs. The Power Supply Alternatives ranged from total purchase of electrical energy from the local utility, to the construction of a CHP facility to generate all the electrical base load needs. The most favorable alternative combines the use of the CHP facility connected to the transmission grid and using a competitive Alternate Energy Supplier for remaining load.

Higher reliability of electric supply is achieved through a combination of CHP units, transmission level grid supply and diesel fueled emergency power with a power ride-through technology whereby switching and transfer between these electric supply sources are transparent to electric loads. In other words, the caregivers, patients and all supporting systems at the hospital will not be aware of any challenges being managed at the CUP. This technology also provides a high level of power conditioning that ensures good quality of supply. Clean burning natural gas is the fuel for the CHP units and all regulatory requirements for emission are met.

# OBJECTIVE

# INTRODUCTION

## 2.0 OBJECTIVE

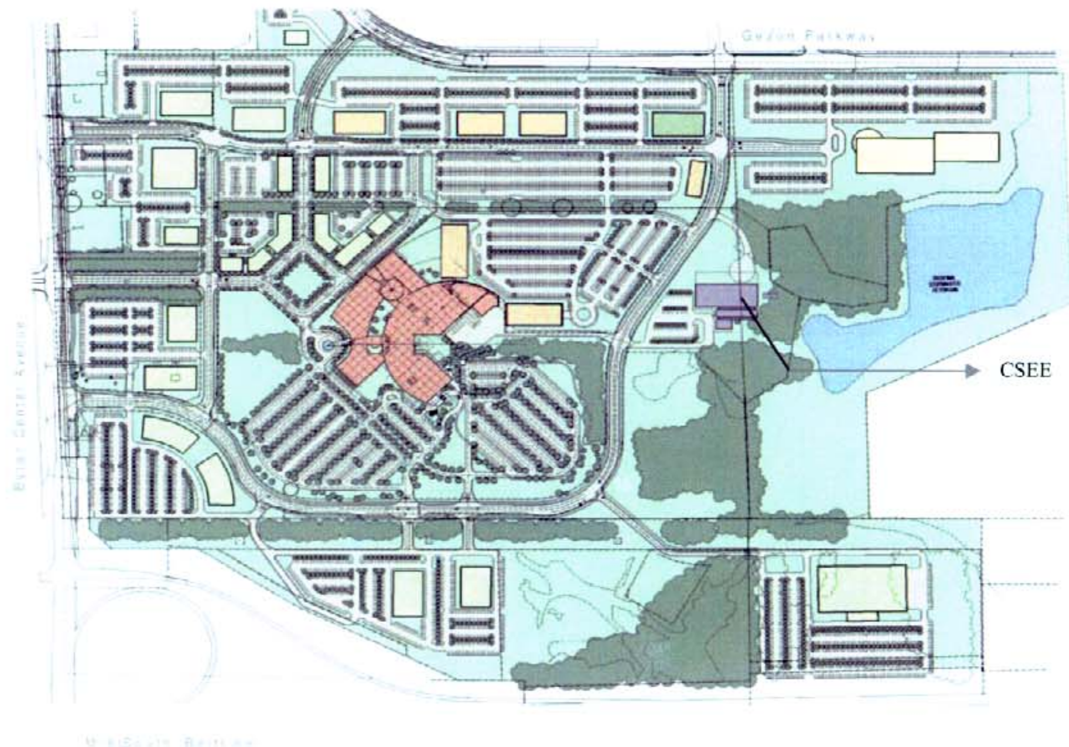
The objective of this report is to present Metropolitan Hospital ('Metro') with an energy supply strategy for the new Hospital in Wyoming, Michigan and operating strategies for the Center for Sustainability Energy and Education ('CSEE').

## 3.0 INTRODUCTION

Metropolitan Hospital has been providing quality, holistic, personal care to the Grand Rapids area for more than 60 years. Facing growing community demand and limited by its current facility and location, Metro broke ground for construction of a new state-of-the-art hospital that will incorporate their progressive total patient care philosophy, include the latest treatment technologies, and provide the ultimate environment for wellness, healing and recovery. Metro will also be developing a Health Care Village on this tract of land—an entire community of health care and related service providers who share a common location and a common goal of helping individuals lead healthier lives. With the development of this unique health care concept, Metro was presented with an opportunity to further its commitment to holistic and responsible service to the community by creating an environmentally responsive hospital and campus that offers a cleaner, healthier and greener environment that supports the healing process, reduces the cost of health care and respects our natural world.

Towards this end, Metro is actively seeking certification through the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) program for the hospital and the entire Village. It will be the first hospital and health care campus in the nation to attain this distinction. The LEED process is designed to ensure a high level of "sustainable design" and will entail dozens of innovations such as the use of vegetated roofs, re-use of recycled storm water, waterless urinals, recycled building materials, maximization of natural day lighting, improved indoor air quality, and year-around healing gardens for patient interaction.

Metropolitan Hospital complex is being developed with state of the art technologies that are environmentally sensitive and energy efficient. Strategic energy solutions have been developed through very careful planning and analysis which will provide Metropolitan Hospital with long term benefits with managed risks. Metro will also be an active and engaged "agent" for disseminating information about this development through the CSEE, co-located with the CUP. The CSEE will provide the Hospital with reliable and secure electric supply with several financial and strategic advantages.




Metropolitan Health Village Site Layout

The Central Utility Plant will provide the Hospital complex with base load clean power from a combined heat and power system, emergency power that includes a no break power system, and other utilities like hot water, steam, and chilled water. Electric supply from the CUP will be augmented with market based power through a direct feed from the transmission system. With on-site power generation supplemented by utility supply the reliability of the power supply to the hospital is largely improved. Various state of the art technologies and traditional equipment along with different methodologies were analyzed to optimize the infrastructure components for the CUP. The emergency power to the hospital will be from a rotary uninterruptible power system which will supply very clean uninterruptible power to the hospital during normal operation and emergency operation for majority if loads. The technology in this system will ensure that a 'blip-less' transfer occurs while switching between power supply sources and will be completely transparent to the electric loads and users.

# CENTER FOR SUSTAINABLE ENERGY AND EDUCATION

# CONCEPTUALIZATION OF CUP

## 4.0 CENTER FOR SUSTAINABLE ENERGY & EDUCATION

Located to the East end of the Metropolitan Health Village, the Center for Sustainable Energy and Education will house the CUP and the Education & Learning center (ELC). The surrounding areas of CSEE including the wetlands and tree line will be preserved or restored to its original state. The ELC serves as the front end of the CSEE and contains office spaces and exhibition and conference areas. The entire facility has been conceived in correlation with Metro's philosophy of environment friendly design. The use of waterless urinals and rooftop rain water collection are some of the concepts being considered to reduce the consumption of water. Creative engineering design also includes the use of green roofs providing cooling effect to the building interiors during summer months. This Center will showcase advanced energy efficiency and power generation technologies and be an on-going platform to educate hospitals, businesses, communities, and the public about advanced energy technologies. It serves as a medium to educate the community on the concepts of sustainability and efficient use of our natural resources. The entry level of the facility has observation decks overlooking the Central Utility Plant. Partnerships with associations, universities, the West Michigan Sustainable Business Forum, the West Michigan Chapter of the Green Building Council, and similar groups are envisaged as part of this initiative. Among various conference rooms and lecture halls, the ELC will also contain the central data center for the hospital.

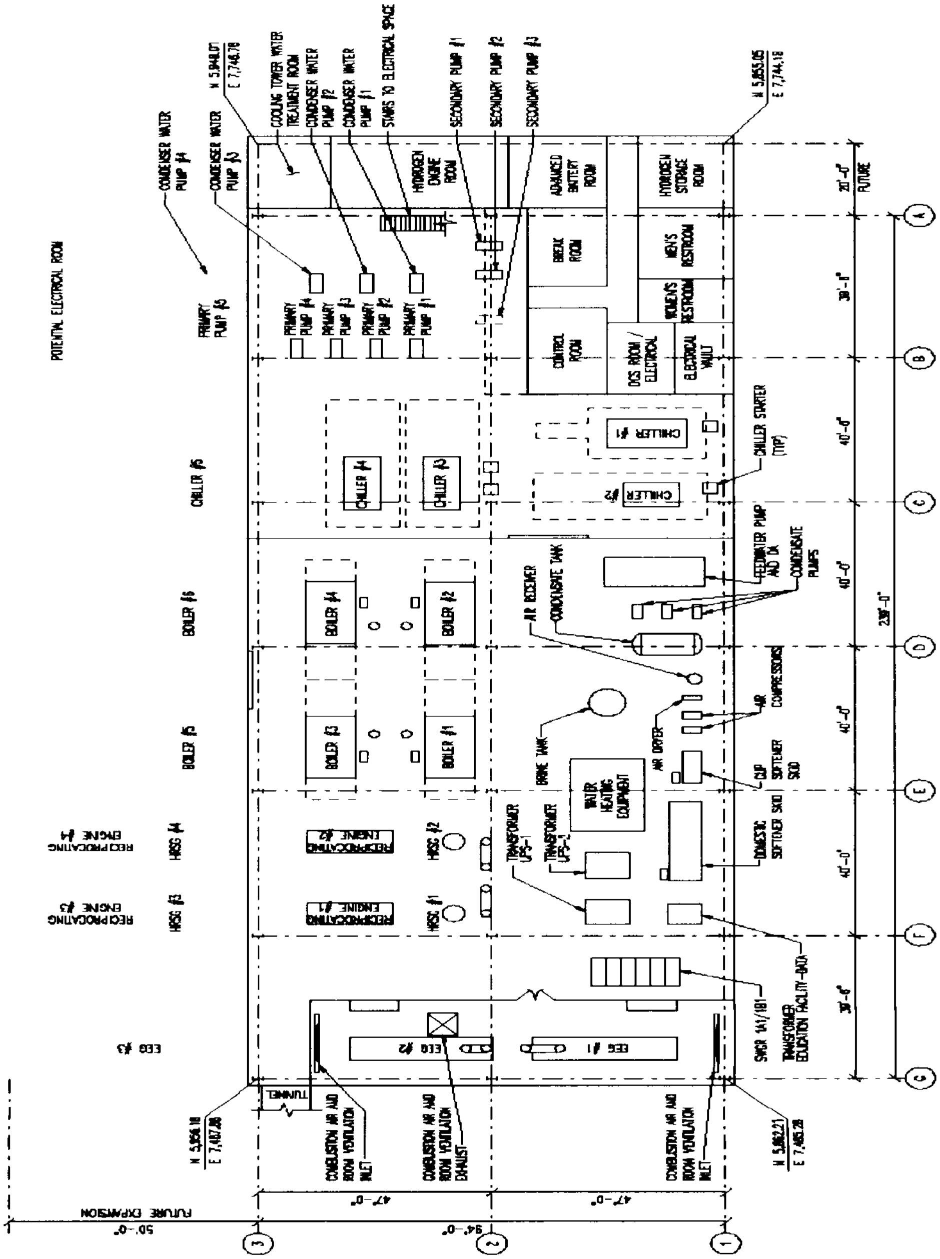

The Center for Sustainable Energy and Education

The CUP consists of Combined Heat and Power system that will provide 2MW of base load generation, uninterrupted emergency power, and supply steam, chilled water and hot water to the hospital. The CUP makes use of two ~ 1MW reciprocating engine generators to provide base electric load. Exhaust heat from the engine is recovered via a heat recovery steam generator to produce saturated steam and the heat recovered from the engine cooling system is used to produce hot water. The major CUP components are shown in the table below:

| Major Components | No# of units | Specifications |
|---|---|---|
| Reciprocating engine generator | 2 | 1MW natural gas fired engine. Generating voltage 480V and stepped up to 12.47 kV |
| Heat Recovery Steam Generator | 2 | Recovers engine exhaust to generate saturated steam at 80psig. |
| Auxiliary boilers | 4 | Boilers generate additional steam at 12000 lb/hr to meet hospital demands and to supply steam to the absorption chiller. |
| Chiller - Absorption | 1 | 350 ton |
| Chiller – Electric | 1 | 700 ton |
| Chiller – Electric | 1 | 350 ton |
| Emergency diesel generator | 2 | Rotary no-break UPS rated at 2250kW |

The CUP facility will also be connected to the 46 kV utility transmission system that provides supplemental electrical power to the hospital facility. The utility connection at transmission level will leverage the hospital load to access power from different retail energy providers as needed with long term contracts and retain necessary flexibility. The CUP will be connected to the transmission grid through a dedicated substation within the Metropolitan Hospital grounds which will have the capacity to accommodate the current hospital electrical demand and future expansions. This dedicated substation at the hospital site will improve the reliability of the Hospital power supply by providing a back-up to the on-site generation, and supply for the excess demand.

To provide reliable "no-break" power with high quality of supply to the hospital, the CUP will utilize two rotary Uninterruptible Power Supply ('UPS') systems. This cogeneration engineering design results in overall efficiency of approximately 75%. Other innovative and clean energy systems being considered for installation include a Hydrogen based power generation system and an advanced battery storage system. This plant is being described as the first LEED certified power generation facility in the US. The utilities are supplied to the Hospital via an underground tunnel. The tunnel spans a distance of 800ft and contains piping for all the utilities, electric cables for normal and emergency feeds to the hospital and communication cables linking the hospital to a central data center located in the CSEE. The tunnel has sufficient room for technicians to perform periodic inspections/walk through.




Central Utility Plant Layout

## 5.0 CONCEPTUALIZATION OF CUP

A cogeneration feasibility study was conducted to determine the economic viability of a combined heat and power facility. During the design phase of the Hospital (mid year 2003), the anticipated load profile for the hospital complex was provided by the hospital design engineers (HDR Inc.). A cogeneration study and economic analysis was completed for each one of the several different prime movers that were considered. The objective of that analysis was to determine the prime mover that will provide maximum economic advantage for the hospital with the anticipated load profile. The analysis indicated that for the estimated load profile, a reciprocating engine generator with heat recovery will provide efficient operation and maximum benefits.

Two engines of approximately 1 MW each will be used in the CSEE. The use of multiple engines to supply the load was proposed to reduce the supplemental power purchased from the utility and to minimize the impact of reducing generation capacity due to scheduled or unscheduled maintenance. The use of multiple engines also allows for efficient use of engines at reduced loads. Early focus was to operate the units at full load whenever possible so that maximum efficiency and economic benefits could be derived. Auxiliary boilers, waste heat recovered from the engines, and chillers will be used to supply the Hospital steam, hot water, and chilled water.

### 5.1 Importance of power conditioning:

Utilities are increasingly interfacing with customers who face issues with the quality of power at their facilities due to voltage sags, spikes and interruptions. Voltage sags are observed due to faults occurring on the transmission and distribution systems of the utility. The electrical supply system in many parts of the country is already facing capacity limits, and power quality and reliability issues are observed due to high demand on the transmission and distribution systems. These vulnerabilities coupled with power anomalies produced at the user level can cause disruption since commercial, residential and industrial customers have an increasing level of electronic and computing resources that are sensitive to supply quality. Interruptions and undesirable power characteristics can be detrimental to smooth operation of Metropolitan hospital.

A rotary based energy storage system utilizes a low speed flywheel or an induction coupling to convert stored kinetic energy to electric power. The system provides real time clean up of power with ride-through capability. When minor power interruptions or an unacceptable deviation in the supply power occurs, this system provides bridge-power for about 10 seconds, allowing time for a diesel engine generator to start and assume load. The system provides power quality benefits and improves the overall quality of utility power. Rotary based UPS systems offer a good, environment friendly alternative to battery powered UPS systems which require ongoing investment in battery replacements with maintenance and space requirements.

### 5.2 **Emergency Supply Strategy:**

As this report is being written, the design focus for the critical load supply requirements for the hospital is described as follows. Emergency power to the Hospital will be supplied through two rotary UPS system units of 2250 kW each. The capacity of the rotary UPS Units is large enough to provide backup power to the entire Hospital even without any utility supply or onsite generation. The rotary units will also be able to provide emergency power to the server and other ancillary loads located at the CSEE except the chiller loads. Rotary UPS system will supply full load power to the complex without interruption while the transfer of power supply is in progress from normal to emergency diesel generators are started to assume full load power.

### 5.3 **Strategic Alternatives to Supply Metro Loads:**

Four alternatives were considered and detailed evaluations were provided to the owner. The current approach is to operate the Cogeneration units based on a make versus buy scenario and to procure the supplemental power from the local utility or an alternate energy supplier. The resulting operating strategy will provide maximum economic benefit for the hospital.

# ECONOMIC ANALYSIS

## 6.0 ECONOMIC ANALYSIS

The energy strategy for Metropolitan Hospital is focused on achieving high quality and reliable supply of electrical power at a competitive price. The construction of a generating facility onsite and access to the transmission grid make it feasible for Metro to gain competitive supply from Alternate Energy Suppliers in Michigan or from the local utility. A fuel risk management strategy will be formalized prior to commercial operation of the facility.

The economic analysis detailed in this section considers various supply options available to Metro. The default option where Metro purchases all their electricity from the local utility was also examined. A comparison of all the different alternatives was performed to arrive at a conclusion that will balance the performance and economic needs of Metro. This analysis does not consider the remaining healthcare village loads.

Four alternatives were evaluated. Net Present Cost (NPC) is computed based on assumptions used for various alternatives. Supply of other utilities including steam, hot water and chilled water were also considered in developing the variables associated with consumption of electricity and gas for each alternative. NPC is derived from discounting an annual stream of operating expenses and fixed charges for the each of the alternatives. NPC is used to compare different alternatives available for Metro and defines a preferred alternative.

Through this evaluation, it was determined that Metropolitan Hospital will maximize the benefit of operating an onsite CHP facility if the facility is operated based on a make versus buy decision. The Hospital will still maintain the option of purchasing supplemental power from a local provider.

### 6.2 Sensitivity Analysis

Sensitivity analysis for Metro was performed for the most beneficial alternative to evaluate the impact of change in input variables and assumptions used to calculate the NPC. Key variables were selected to review their individual impact on project economics. This will enable the Hospital to take some mitigating steps early on in the project cycle so that the overall impact on the operation of the facility is less severe.

### 6.3 Metro Owned Substation.

A substation dedicated to the hospital is planned within the development at a location adjacent to the 46kV line. This option allows Metro flexibility with its energy procurement, providing a level of insulation to utility rate increases. Connected at primary voltage, it provides rate advantage, increased reliability and a better quality of supply. This was observed to provide better economic values when compared to connecting at a distribution voltage with a utility substation across the highway M6.

# OPERATIONAL STRATEGY

## 7.0 OPERATIONAL STRATEGY FOR THE COGENERATION UNITS

The plant is designed to provide base load while supplemental power is purchased from the local provider. The operational characteristics were determined by taking into account the period of the day when peak and off peak utility rates apply.

The cogeneration study performed in the preliminary phase of the project compared prime mover mechanical, electrical and operational characteristics. In this study it was determined that two GE Jenbacher J320 engines with heat recovery from exhaust gas, jacket water, intercooler and lube oil was an ideal fit to the project.

To develop an operational strategy, the GE Jenbacher J320 engines were evaluated for different operating profiles. At this time, the design of the hospital was near complete and a more accurate load profile was obtained from the design engineers (HDR, Inc.) for the hospital.

Updated load profiles and data were provided by HDR Inc. in Dec'03. (See attachment B) The data did not include seasonal variations in electric loads or the electric loads associated with the CSEE. The architects for the ELC (WorkStage) provided the electrical loads associated with the ELC (See attachment C). No chilling or heating loads for the ELC were available for this analysis. The seasonal electrical loads for the hospital were estimated from the chilling loads provided by HDR, Inc. The ancillary loads for the CUP is calculated as 3% of the load supplied to the hospital. To develop an operating strategy, it was assumed that the electric loads associated with CSEE will follow the daily load profile of the Hospital. It is also assumed that these load profiles utilized in this analysis are only estimated numbers and will be revised when the CUP is fully operational and the daily profiles are more defined.

HDR, Inc. has provided the monthly heating and cooling loads for the hospital. Since daily cooling and heating loads were not available, this monthly profile was extrapolated to daily profiles for this analysis. Two different chiller configurations were explored to define a more economically viable option for using an absorption chiller.

After examining the daily load profiles, different operational scenarios were considered for evaluation. For each operating scenario, two different chiller configurations were considered, one with a 200 ton single stage absorption chiller and another with a 350 ton double stage absorption chiller.

The heat balance and consequent efficiency calculations were performed solely on the basis of equipment performance, and more analysis was needed to define a more economically viable operating mode for the CUP taking into account the utility tariff, estimated budgets and other economic variables.

In the economic analysis in section 6.0, various alternatives for supplying power to the Hospital were analyzed to show that it is economically viable for Metropolitan Hospital to have onsite generation with supplemental power purchased from the local utility or

Alternate Energy Supplier (AES). To develop an operational strategy for the CUP, NPC for each operating scenario was also calculated with supplemental power purchase from local utility or AES. Through this evaluation, it was determined that Metropolitan Hospital will maximize the benefit of operating an onsite CHP facility if the facility is operated based on a make versus buy decision.

# INTEGRATED VALUE ANALYSIS

# ANALYSIS SUMMARY

# CONCLUSION

## 8.0 INTEGRATED VALUE ANALYSIS

The new Metropolitan Hospital calls for a balanced strategy for its energy supply. Energy reliability, quality of supply, economics and risk management are all key elements of the energy strategy with the additional requirements that this needs to be accomplished in a fashion consistent with the health, environmental and educational focus and values of Metropolitan Hospital. The following section briefly describes each of these key elements of the energy strategy.

8.1 **Electric Supply Reliability**: Ensuring continued electric supply under various single failure modes is essential to the smooth running of the hospital and effective care of patients. There are multiple layers of options that support a much higher level of reliability and are highlighted below:

- Multiple CHP or cogeneration units are planned for immediate and future planned additions.
- The CUP is connected to the transmission system located within the campus.
- A dedicated substation is planned to connect to the transmission system with a redundant underground feed to the CUP.
- Redundant primary and emergency feeders supply the hospital from the CUP. One set of feeders are supplied through a tunnel and the second set is concrete encased and directly buried outside the tunnel.
- Advanced energy technologies in the form of a 'No-Break' power system is planned and provides 'ride-through' power to allow transition power supply from one source to another in a fashion that is transparent to the patients, staff and all equipments that relies on this power.
- Diesel fuelled emergency supply is designed to support 100% load (critical and non critical) of the hospital under most circumstances.

8.2 **Quality of Supply**: The new hospital plans to use state of the art medical and information technology. These systems are sensitive to power quality and can be interrupted by voltage sags, swells or aberrations, short duration intermissions, harmonics and poor grounding. An active power conditioning system in the form of a rotary uninterruptible power system (UPS) is planned. Power output is designed for +/-2% of rated voltage and frequency. Active power conditioning in such systems will ensure adequate quality of supply and will offer significant improvement over that observed from grid based supply. It is important to note that early discussions with neighboring facilities showed the effect of grid instabilities at those locations.

Separately, the effect of cogeneneration units operating at the CUP also enhances the local quality of supply. VAR export, voltage and frequency stabilization are the some of the key locational values of such distributed generation systems.

8.3 **Retail Open Access ('ROA')** in the state of Michigan allows users to buy power from AES. This energy strategy is focused on achieving competitive energy costs for customers. Directly connecting to the transmission system allows Metro to pursue market based power into the future. This strategy additionally provides leverage while negotiating contracts with the local utility.

8.4 Since a large volume of Natural Gas needs to be procured, a risk management strategy is essential. This will be documented separately.

8.5 Clean burning advanced reciprocating engine technology is planned for the cogeneration units. With heat recovery, a combined efficiency of ~ 75% will be obtained. This is significantly better than a <40% efficiency obtained by utility managed central power facilities.

## 9.0 ANALYSIS SUMMARY

The integrated analysis measures each alternative by balancing supply reliability, quality and economics. The CUP will be operated in a manner that will ensure high efficiency, maximize the economics and minimize the impact on the environment.

## 10.0 CONCLUSION

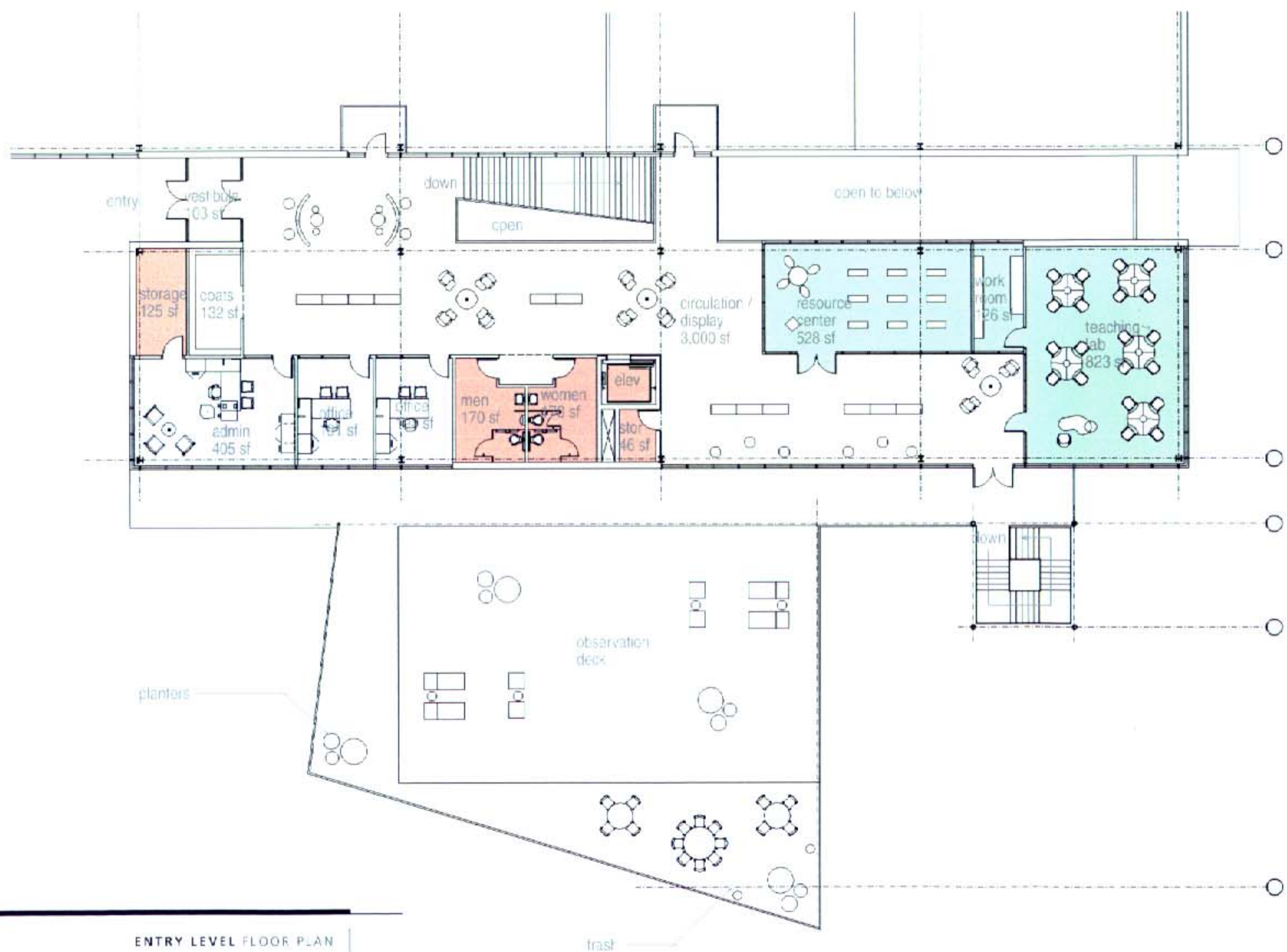
Various options were considered as a part of this evaluation to establish an energy strategy that brings a balance between reliability, power quality and economics. The best case utilized cogeneration units within the CUP with grid connected market power being the source of supplemental power. The selected alternative will be operated in a fashion that will ensure high efficiency. This will maximize the economics and minimize emissions of this clean power generating technology.

# ATTACHMENT A

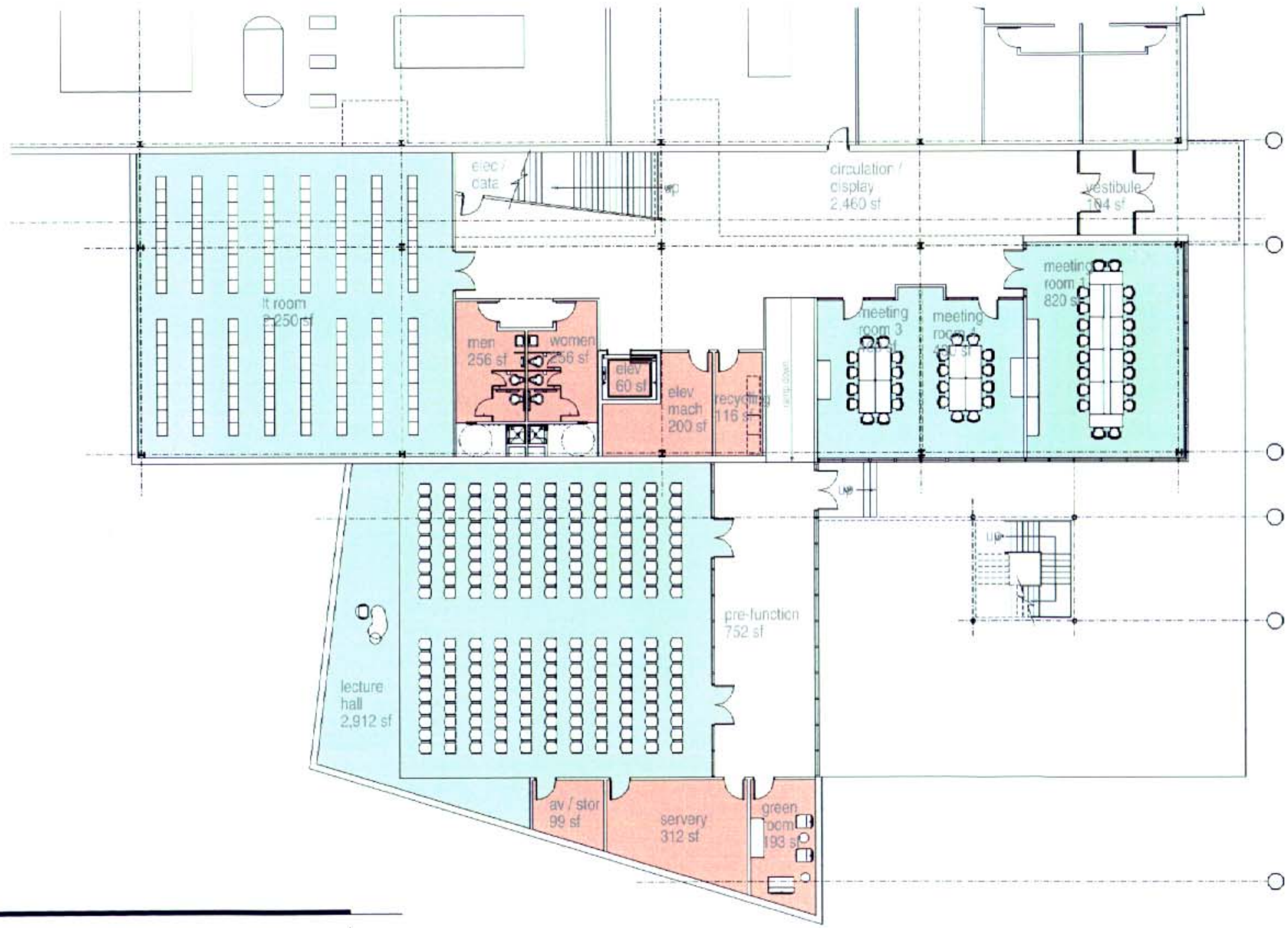
# CENTER FOR SUSTAINABLE ENERGY AND EDUCATION


service / staff
cooling towers
parking
e.l.c.
observation deck

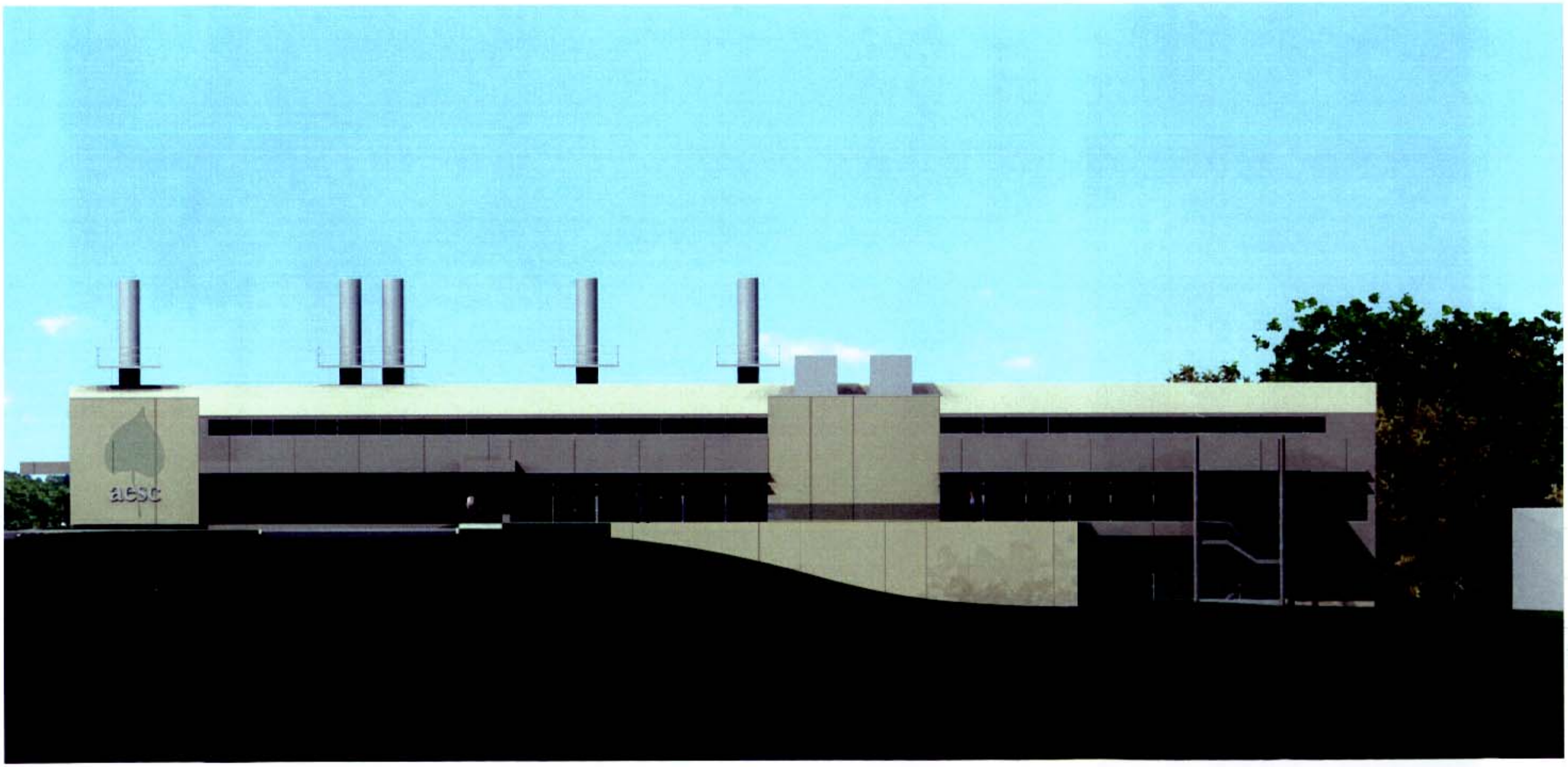
SITE PLAN



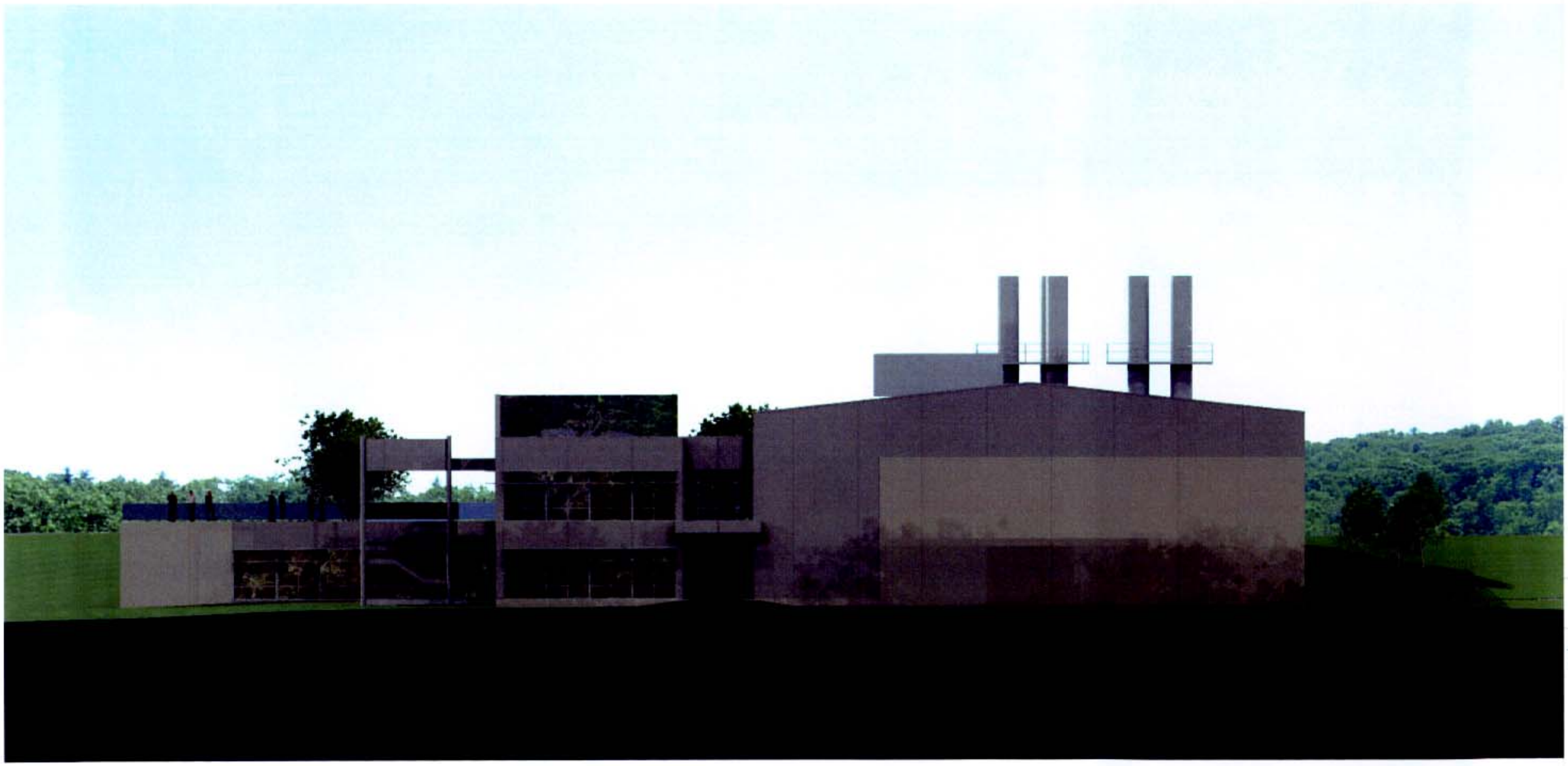

ENTRY LEVEL FLOOR PLAN




COURTYARD LEVEL FLOOR PLAN




SOUTH ELEVATION

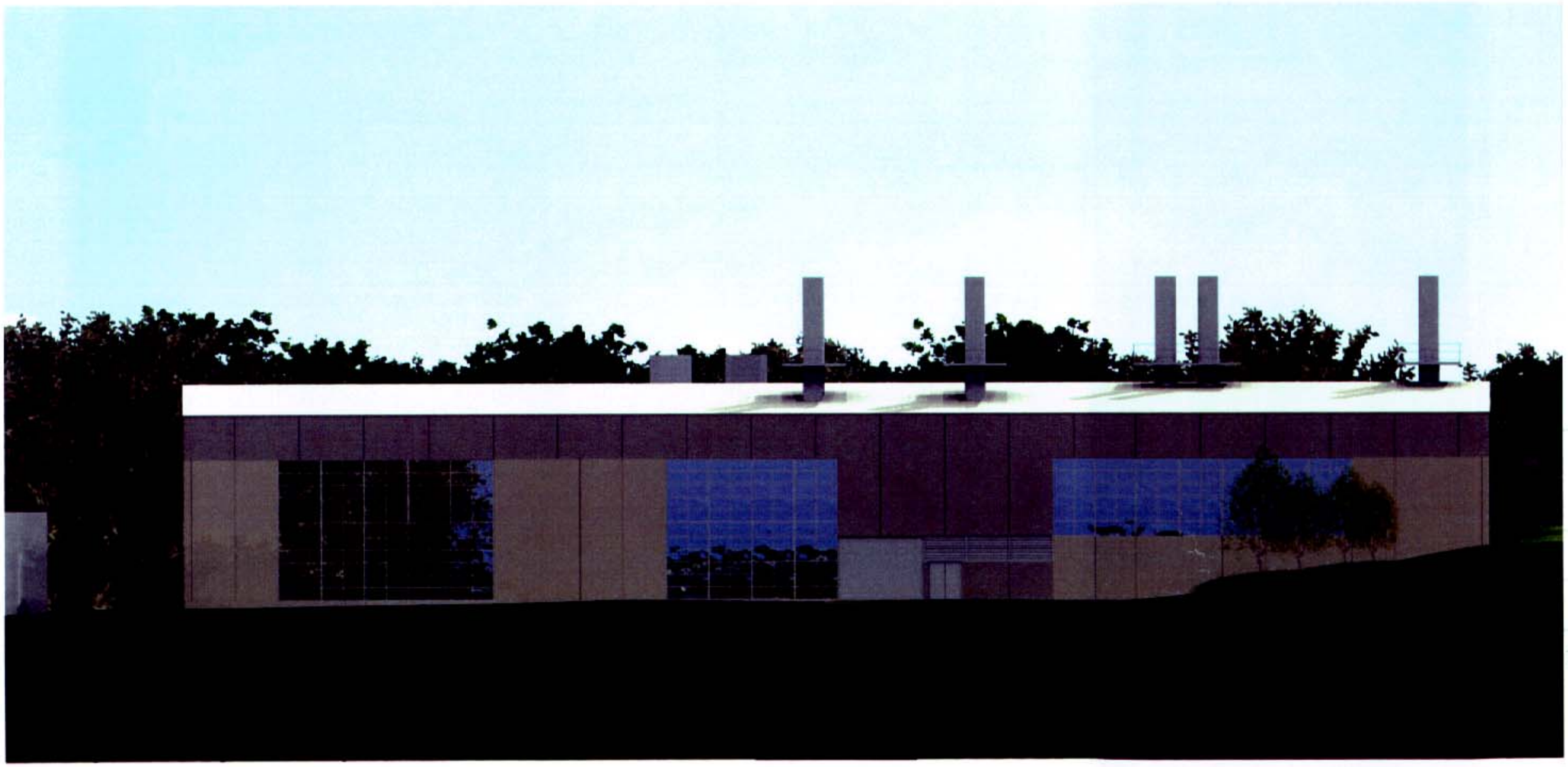


EAST ELEVATION

workstage™

Integrated Architecture

metro power | elc

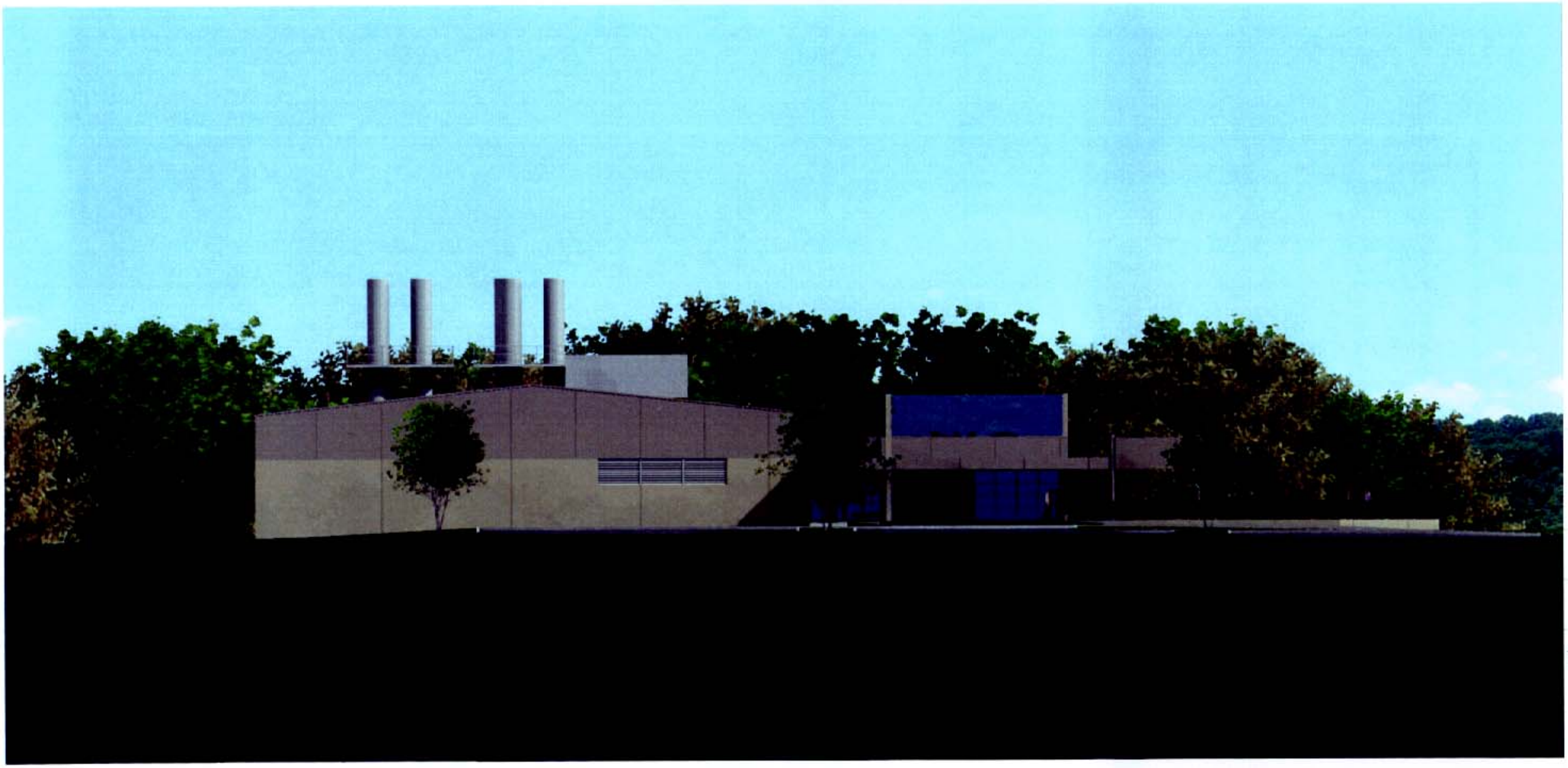


NORTH ELEVATION

workstage™

Integrated Architecture

metro power | elc

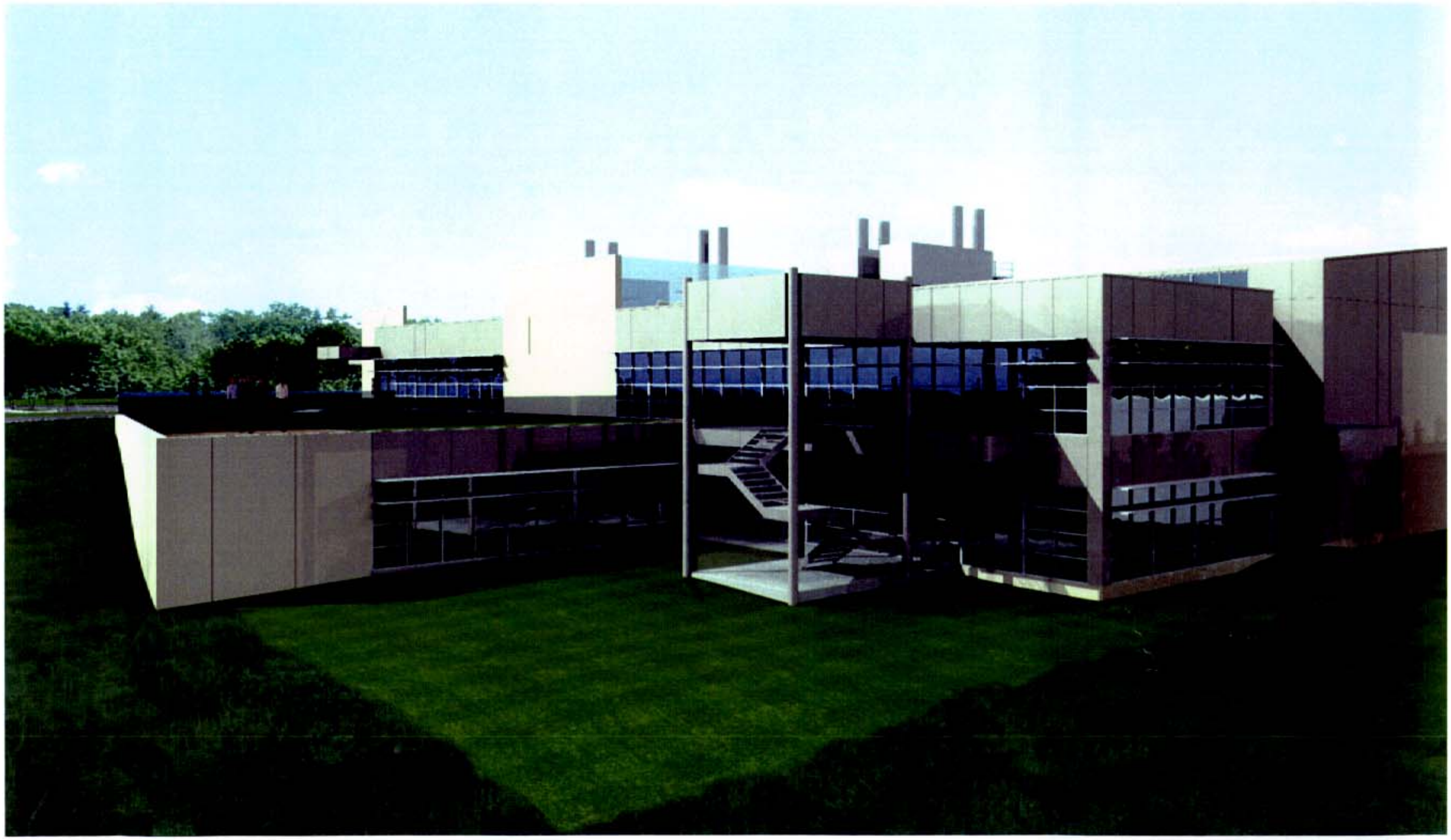


WEST ELEVATION

workstage™

Integrated Architecture

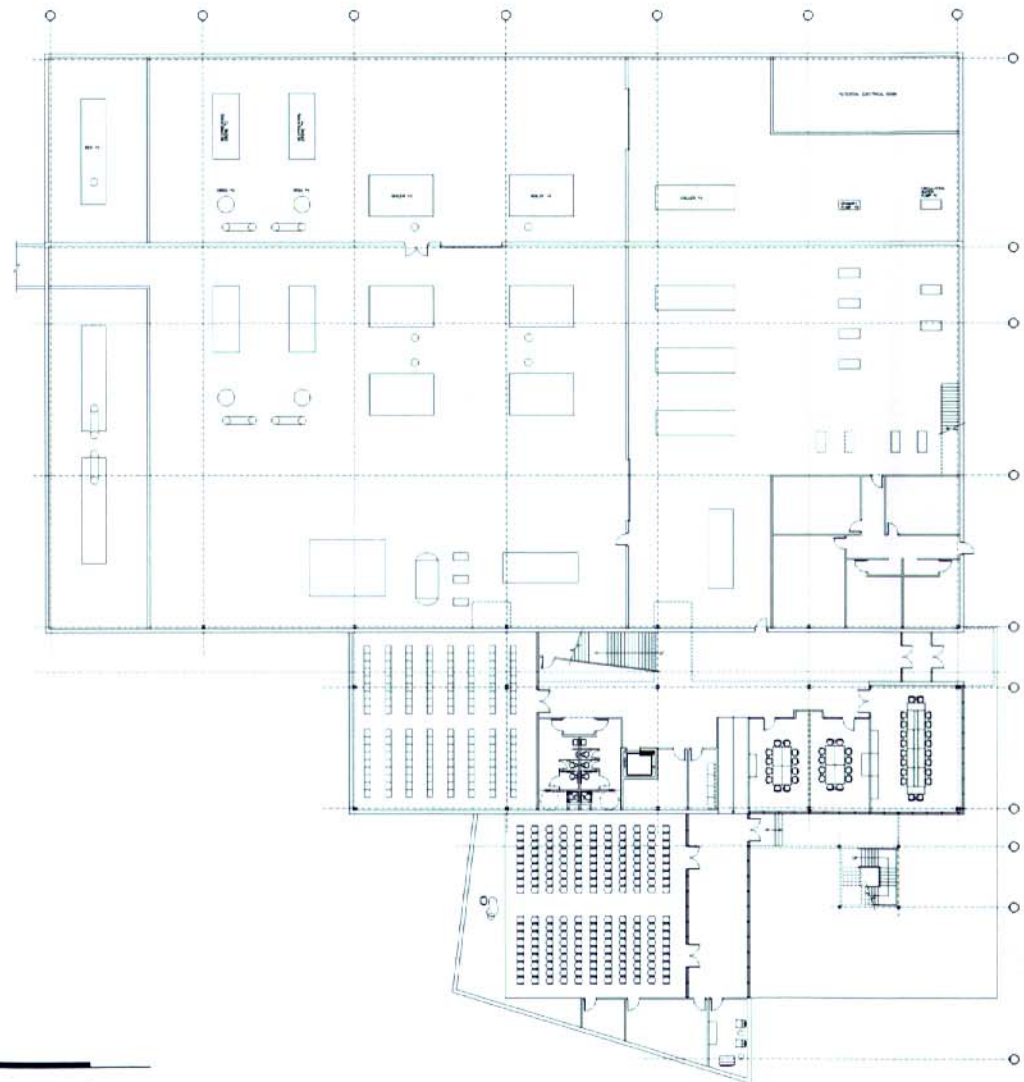

APPROACH VIEW



VIEW FROM **SOUTHEAST**

VIEW FROM **NORTHWEST**

metro power | elc



OVERALL LOWER LEVEL FLOOR PLAN

workstage™

Integrated Architecture

# ATTACHMENT B

# HOSPITAL LOAD LETTER

Stanley Consultants INC.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

January 30, 2004

Mr. Jeff Smitley
Director of Engineering & Real Estate
Metropolitan Hospital
Suite 201
1925 Breton SE
Grand Rapids, MI 49506

Dear Jeff:

Subject: Metropolitan Hospital Load Data

Stanley Consultants has previously sent to HDR a letter (attached) detailing the data required for the design of the CUP. Subsequently HDR has responded with a letter providing the required data (also attached). Stanley Consultants will proceed with the design of the CUP based on the data provided in the HDR data response letter.

If you have any questions regarding this issue please contact me ass soon as possible. The data is a key element in many equipment selection decisions.

Sincerely,

Stanley Consultants, Inc.

William Liegois
Senior Project Manager

Attachments(s): Stanley Data Request Letter
HDR Data Transmission Letter

cc: Anand Gangadharan, NOVI Energy
Judy Knight, NOVI Energy
Mark Bozo, NOVI Energy
Files 16931

wal:wal/mc:8:e:16931L01.doc

This document was sent electronically

Stanley Building • 225 Iowa Avenue • Muscatine, IA 52761-3764 • phone 563.264.6600 • fax 563.264.6658
internet: www.stanleyconsultants.com

31 December 2003 **(Revised 6 January 2004)**

Mr. William A. Liegois, Sr. Project Manager
Stanley Consultants, Inc.
225 Iowa Avenue
Muscatine, Iowa 52761

RE: Mechanical & Electrical Load profiles requested by Stanley Consultants.

Dear Bill,

The following items of response address and answer questions and requests for data included in the e-mail of the letter sent by you on November 21, 2003, the e-mails sent by Judy Knight on December 18, 2003 and on December 29, 2003 and are numbered to correspond with the numbering of the items included in your letter dated November 21, 2003.

These items include information previously transmitted in e-mails from David Hale dated November 17, 2003 December 4, 2003 and December 11, 2003; from Charles Hyman dated December 4, 2003 and December 24, 2003; and from me on December 8, 2003; however, this letter supercedes the referenced e-mails from HDR personnel.

**1. LOAD PROFILES**

**<u>Cooling</u>**

The cooling loads for the hospital as follows were calculated using Trane Trace 700 software:

| | Peak Chiller Load (MBH) | Avg. Chiller Load (MBH) |
|---|---|---|
| January | 0.0 | 0.0 |
| February | 0.0 | 0.0 |
| March | 2303.0 | 57.6 |
| April | 8013.7 | 392.3 |
| May | 13254.0 | 2322.9 |
| June | 14960.8 | 5449.0 |
| July | 16644.9 | 6812.9 |
| August | 14430.5 | 5681.2 |
| September | 15974.5 | 3895.4 |
| October | 6940.0 | 443.8 |
| November | 7720.8 | 177.6 |
| December | 388.3 | 3.8 |

**HDR Architecture, Inc.**
*Employee-owned*
8404 Indian Hills Drive
Omaha, NE
68114-4049
Telephone
402-399-1000
Architecture
Engineering
Planning

## Heating

The building **PEAK** heating loads are as follows:

| | Building Heat and Humidification Load (MBH) | Radiant Floor (MBH) | Snow Melt (MBH) | Kitchen (MBH) | KMUA (MBH) | Sterilizer Load (MBH) | Domestic Water (MBH) | Total (MBH) |
|---|---|---|---|---|---|---|---|---|
| January | 20794.1 | 480 | 1400 | 100 | 1400 | 321.5 | 10197.9 | 34693.5 |
| February | 21824.3 | 480 | 1400 | 100 | 1400 | 321.5 | 10197.9 | 35723.7 |
| March | 16908.5 | 480 | 1400 | 100 | 1400 | 321.5 | 10197.9 | 30807.9 |
| April | 8154.1 | 480 | 1400 | 100 | 1000 | 321.5 | 10197.9 | 21653.5 |
| May | 5925.8 | 240 | 1400 | 100 | 700 | 321.5 | 10197.9 | 18885.2 |
| June | 2394.5 | 0 | 0 | 100 | 700 | 321.5 | 10197.9 | 13713.9 |
| July | 1429.1 | 0 | 0 | 100 | 700 | 321.5 | 10197.9 | 12748.5 |
| August | 1209.1 | 0 | 0 | 100 | 700 | 321.5 | 10197.9 | 12528.5 |
| September | 4480 | 240 | 1400 | 100 | 700 | 321.5 | 10197.9 | 17439.4 |
| October | 11042.4 | 480 | 1400 | 100 | 1000 | 321.5 | 10197.9 | 24541.8 |
| November | 13597.2 | 480 | 1400 | 100 | 1400 | 321.5 | 10197.9 | 27496.6 |
| December | 20978.9 | 480 | 1400 | 100 | 1400 | 321.5 | 10197.9 | 34878.3 |

The building **AVERAGE** heating loads are as follows:

| | Building Heat and Humidification Load (MBH) | Radiant Floor (MBH) | Snow Melt (MBH) | Kitchen (MBH) | KMUA (MBH) | Sterilizer Load (MBH) | Domestic Water (MBH) | Total (MBH) |
|---|---|---|---|---|---|---|---|---|
| January | 9399.9 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 16861.4 |
| February | 9296.9 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 16758.4 |
| March | 7388.6 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 14850.1 |
| April | 3124.8 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 10586.3 |
| May | 1293.1 | 240 | 1400 | 100 | 700 | 257.2 | 3824.3 | 7814.6 |
| June | 643.7 | 0 | 0 | 100 | 0 | 257.2 | 3824.3 | 4825.2 |
| July | 643.3 | 0 | 0 | 100 | 0 | 257.2 | 3824.3 | 4824.8 |
| August | 623.2 | 0 | 0 | 100 | 0 | 257.2 | 3824.3 | 4804.7 |
| September | 916 | 240 | 1400 | 100 | 700 | 257.2 | 3824.3 | 7437.5 |
| October | 4698 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 12159.5 |
| November | 6034.5 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 13496.0 |
| December | 8240.8 | 480 | 1400 | 100 | 1400 | 257.2 | 3824.3 | 15702.3 |

**Sterilizer**

The sterilizer loads are as follows. Five sterilizers were changed to have their own steam generators and they will not require steam input.

Sterilizer Load

| Equip Name | Location | Equip Type | Peak Steam Load (lbs/min) | Load Time (min) | Total Steam per Load (lbs) | Pressure (psig) |
|---|---|---|---|---|---|---|
| Steri 51 | LLE 172 | Sterilizer | 5.0 | 50 | 29 | 65.0 |
| Steri 51 | LLE 173 | Sterilizer | 5.0 | 50 | 29 | 65.0 |
| Steri 51 | LLE 174 | Sterilizer | 5.0 | 50 | 29 | 65.0 |
| Steri 51 | LLE 174 | Sterilizer | 5.0 | 50 | 20 | 65.0 |
| Wash DAD | LLD182 | Disinfector | 2.9 | 30 | 12.65 | 65.0 |
| Wash 98 | LLD181 | Cart Wash | 12.0 | 11 | 19 | 65.0 |

**Water**

The water flow rates are as follows for the domestic water system:

| | Peak Flow Rate (gpm) | Average Flow Rate (gpm) | Pipe Size |
|---|---|---|---|
| Hard Cold Water | 70 | 35 | 2" |
| Soft Cold Water | 530 | 200 | 6" |
| Soft Hot Supply | 385 | 240 | 4" |
| Soft Hot Return | 170 | 170 | 3" |

The following notes address the Cooling, Heating,Sterilizer and Water Load calculations:

Due to uncertainties in operation of the snow melt system, radiant floor, sterilizer use, and domestic hot water demand; the following assumptions have been made in the above loads:

1. The snowmelt peak load and average load are the same.
2. Snowmelt has not been assumed from June-August.
3. The Radiant floor peak load and average load are the same.
4. During the summer months, there will be no radiant heat load.
5. The kitchen steam load and kitchen makeup air unit peak load and average load are the same.
6. We have assumed 4 "Steri 51" sterilizers in the hospital that will require building steam.
7. The boilers in the CUP will need to provide 65 psig steam at a point 5' from the hospital.
8. We have assumed one cart washer and one disinifector in the hospital that will require building steam.
9. All of the sterilizers are assumed to operate 80% of the time. The average load will be 80% of the peak load.
10. The domestic water load is based on the number of fixtures in the building per the GMP documents issued on September 12, 2003.
11. This load data does NOT include any provisions for future growth of the hospital beyond the current floor plan. The piping distribution system has been sized to accommodate any future growth. This information has been shown on the GMP documents.
12. The cold water flow rates are based upon a total of 6833 fixture units.

Because the final design and configuration of the "B" Building portion of the project has not been determined as yet, there are significant changes that could occur on the first floor of the hospital from the design reflected on GMP documents. We feel that these heating and cooling loads could decrease due to a smaller footprint of the hospital, but it is possible that the building load could increase due to factors unknown at this time. The above loads are based on the information provided in the GMP documents issued on September 13, 2003.

## Electrical

### Normal Power

Based on information in the IEEE White Book Std 602-1986 Table 4 and the hospital project as depicted in the GMP documents dated September 13, 2003, we estimate that the maximum demand for power for lighting, fans, hospital equipment, medical equipment and kitchen equipment will be 4.2 watts per square foot with an average power factor of .85. The building square footage as indicated in the GMP documents dated September 12, 2003 is 492,359 sq ft.

Based on normal operation the monthly demand for the above should not vary more than 10 per cent during the year (the seasonal loads will occur in the CUP).

On a daily basis the load will cycle on a weekday in the following estimated manner:

| | |
|---|---|
| 12 pm to 5 am | 40% of peak |
| 5 am to 7 am | 60% of peak |
| 7 am to 8 am | 70% of peak |
| 8 am to 4 pm | 100% of peak |
| 4 pm to 8 pm | 70% of peak |
| 8 pm to 10 pm | 60% of peak |
| 10 pm to 12 pm | 40% of peak |

On a weekend and holiday daily basis the load will cycle in the following estimated manner:

| | |
|---|---|
| 12 pm to 5 am | 40% of peak |
| 5 am to 7 am | 50% of peak |
| 7 am to 8 am | 50% of peak |
| 8 am to 4 pm | 60% of peak |
| 4 pm to 8 pm | 50% of peak |
| 8 pm to 10 pm | 40% of peak |
| 10 pm to 12 pm | 40% of peak |

### Emergency Power

The operating emergency electrical load is anticipated to be 1,200 KW at a .85 PF. (The connected load will be higher.) This emergency load is included in the normal operating electrical loads listed above and is not to be added for a total load.

Items served by emergency power include specific air handling units, critical lighting, life safety systems, critical equipment items—all items as required by the following codes: NFPA 70, NFPA 99, NFPA 101 and the AIA Guidelines for the Design and Construction of Hospital and Health Care Facilities.

There is no factor of safety or discretionary loads included.

The following notes apply to the Electrical Load Data

Normal power is supplied simultaneously to bus A & B.

The emergency unit substation transformers are always energized (utilizing minimal power for circulating currents).

Both emergency A & B are operational at the same time and full capacity should be available on either circuit at all times so that in the event of failure or service needs on one circuit, the other would be available to handle the entire load.

Sizing of normal and emergency power primary feeders will need to be determined by Stanley Consultants. We cannot determine cable sizes because we do not have information regarding exact feeder lengths and voltage drops.

Because the final design and configuration of the "B" Building portion of the project has not been determined as yet, there are significant changes that could occur on the first floor of the hospital from the design reflected on GMP documents. We feel that the electrical loads could decrease due to a smaller footprint of the hospital, but it is possible that the building load could increase due to factors unknown at this time. The above loads are based on the information provided in the GMP documents issued on September 13, 2003.

**2. HOT WATER STORAGE TANK/HEAT EXCHANGERS**

There will not be a hot water storage tank or hot water heat exchangers in the hospital. Tempered water can be used to preheat the makeup water in the CUP, or we can discuss areas where the hospital might be able to use the available heat.

**3. FIREWATER SYSTEM**

The firewater system for the hospital is fed directly from the City and will not come through the CUP.

**4. ELECTRICAL BUS STRUCTURE**

Load shedding is not anticipated or provided for in the current design. The generators are required for emergency operation per AIA Guidelines, State of Michigan Design Standard for Healthcare Facilities and NFPA 70, 99, and 101 Codes. The emergency unit substation will be energized at all times, while load transfer from the downstream automatic transfer switches will occur when loss of normal power is sensed by the automatic transfer switch. Please refer to the GMP documents dated September 13,2003 for one-line diagrams and schedules.

**5. DELIVERY PRESSURES AND TEMPERATURES**

The delivery pressures and temperatures for the hospital are as follows:

| | |
|---|---|
| A. Chilled Water Supply | 44F, 35 psig pressure drop* |
| B. Chilled Water Return | 56F, 25 psig pressure drop* |
| C. Overall Chilled water Pressure Loss for the hospital. | 60 psig |
| D. Steam | 65 psig, |
| E. Domestic Water | 80 psig |

*Absolute pressure in the supply and return headers has no been set as yet.

**GENERAL NOTES**

The information contained herein above can be used in the selection of equipment for the CUP. During the selection process you will need to consider the following information:

- Because the final design and configuration of the "B" Building portion of the project has not been determined as yet, there are significant changes that could occur on the first floor of the hospital from the design reflected on GMP documents. We feel that the loads indicated above could decrease due to a smaller footprint of the hospital, but it is possible that the building loads could increase due to factors unknown at this time. The above loads are based on the information provided in the GMP documents issued on September 13, 2003.

- The loads indicated above do NOT include future loads for the expansion of the current project reflected in the GMP documents dated September 13, 2003. It is our guess that the current hospital building might expand by 50% in the future. (Therefore, the peak demands in the future could increase by 50%.) The piping distribution system in the tunnel will be designed by Stanley Consultants and will be designed to accommodate some future expansion.

- The energy analysis conducted to calculate the loads listed above is a means to compare different architectural and engineering systems for the purpose of system selection. It also calculates energy consumption compared to a code mandated level based upon code defined parameters and actual system characteristics. Since it is intended as a comparison tool, the energy analysis is not intended to calculate actual building energy consumption or costs. Variables such as occupancy schedules, lighting schedules, weather conditions, utility rate structures, thermostat set points, equipment operating schedules, etc. can differ from values assumed in the energy analysis. Equipment reliability, quality of construction, and maintenance can also impact building energy consumption. In addition, the operating costs for special equipment such as medical and kitchen are neglected.

If you are in need of further information or clarification of the information contained within this letter, please don't hesitate to contact me.

Sincerely,

HDR Architecture, Inc.

James P. Ulrich, Vice President
Project Manager

**HDR Architecture, Inc.**
*Employee-owned*
8404 Indian Hills Drive
Omaha, NE
68114-4049
Telephone
402-399-1000
Architecture
Engineering
Planning

November 21, 2003

Mr. Jim Ulrich
Mechanical Engineer
HDR Architecture, Inc.
8404 Indian Hills Drive
Omaha, NE 68114-4098

Dear Chuck:

Subject: Metro Hospital
Data Request

This letter will document data required from HDR in order for Stanley Consultants to proceed with our design of the CUP facility for Metro Hospital. It is important that this information be received by Stanley Consultants no later than Monday December 1, 2003 in order for us to complete the information required for our January 15, 2004 submittal. This information is in support of HDR's submittal to state of Michigan agencies. HDR has indicated that they are still in the VE evaluation stage of the design. Until this is finalized, HDR will not be able to provide the design information required.

1. Load profiles for electricity, chilled water, steam, hard cold water, soft cold water, and hot soft water. This must include information on daily as well as seasonal fluctuations. Attached is information previously provided by HDR. Please confirm this information or provide current data.

2. Confirm the hot water heat exchangers are in the hospital. If so can we send you "Tempered" water for hot water make-up to your hot water storage tank. If not, I will not be able to recover any heat to the hot water system.

3. Confirm that the hospital firewater system does not come from the CUP but is directly fed from the city.

4. Provide information on the electrical bus structure in the hospital. How is load shedding to be performed? Is power only to be supplied to the emergency bus in the event of an electrical outage?

5. Confirm delivery pressures and temperatures required for each utility 5 feet from the hospital.

| | | |
|---|---|---|
| a. | Chiller water | 44 F supply ??? psig |
| b. | Chilled water return | 56 F ??? psig |
| c. | Steam | 60 psig saturated |
| d. | Water, Hard, soft, and hot soft. | ??? psig |

The load information is required for the current hospital design and peak load sizing for the first expansion of the hospital. The peak expansion information will be used for sizing the utility tunnel and tunnel piping. It has been assumed that the first expansion will double the utilities required from the CUP. A second expansion will further increase utility requirements. This expansion has not been considered in the current CUP design.

Sincerely,

Stanley Consultants, Inc.

William A. Liegois
Senior Project Manager

Attachments(s): Previous load information

cc: Chuck Sloup, HDR
Dave Hale, HDR
Jeff Smitley, Metro Hospital
Dave Brown, AMDC
Anand Gangadharan, NOVI Energy
Judy Knight, NOVI Energy
Files 16931

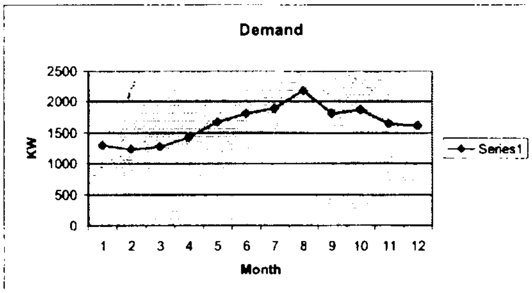
wal:wal/mc:8:169311.01.doc

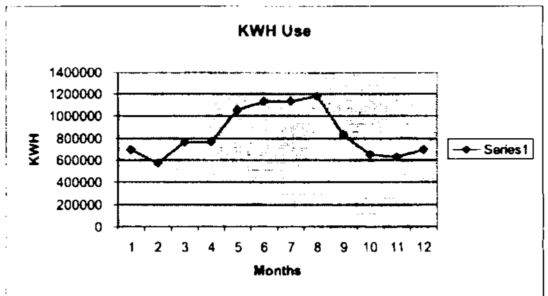
Test Hospital -260,000 SF

| | | | Centrifugal Chiller | | | | Adjusted for Absorption Chiller | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | KWH | KW | Monthly Utilization Factor based on PeakSummer KW | Monthly Utilization Factor based on Month Peak | KWH | KW | Monthly Utilization Factor based on PeakSummer KW | Monthly Utilization Factor based on Month Peak |
| Jan | 1 | 31 | 695900 | 1299 | 43% | 72.01% | 695900 | 1299 | 51% | 72.01% |
| Feb | 1 | 28 | 571700 | 1234 | 39% | 62.27% | 571700 | 1234 | 46% | 62.27% |
| Mar | 1 | 31 | 765200 | 1271 | 47% | 80.92% | 765200 | 1271 | 56% | 80.92% |
| April | 1 | 30 | 766700 | 1428 | 49% | 72.35% | 734270 | 1398 | 55% | 70.58% |
| May | 1 | 31 | 1055000 | 1668 | 65% | 85.01% | 906050 | 1542 | 66% | 78.96% |
| Jun | 1 | 30 | 1128400 | 1806 | 72% | 83.98% | 950090 | 1625 | 71% | 78.58% |
| July | 1 | 31 | 1134500 | 1880 | 70% | 81.11% | 953750 | 1670 | 69% | 76.78% |
| Aug | 1 | 31 | 1177500 | 2175 | 73% | 72.77% | 979550 | 1847 | 71% | 71.30% |
| Sept | 1 | 30 | 833000 | 1806 | 53% | 61.99% | 772850 | 1625 | 58% | 63.92% |
| Oct | 1 | 31 | 851100 | 1861 | 40% | 47.02% | 663710 | 1658 | 48% | 53.80% |
| Nov | 1 | 30 | 631500 | 1640 | 40% | 51.78% | 651950 | 1526 | 49% | 57.44% |
| Dec | 1 | 31 | 697700 | 1612 | 43% | 56.17% | 691670 | 1509 | 50% | 61.62% |
| | | | | | 53% | | | | 58% | |
| Adjust for outpatient Areas | | | | | 4% | | | | 4% | |
| | | | | | 49% | | | | 54% | |

| | |
|---|---|
| Test Hospital Demand | 2175 |
| Scaling Factor<br>475000 SF/260000sf | 1.8 |
| Metro Demand | 3915 |
| Safety factor @ schematic phase (5%)<br>& allow for mobile technology<br>trailer hookup. (5%) | 1.1 |
| Total | 4306.5 |

| | |
|---|---|
| Test Hospital Demand (adj for Absorption | 1847 |
| Scaling Factor<br>475000 SF/260000sf | 1.8 |
| Metro Demand | 3324 |
| Safety factor @ schematic phase (5%)<br>& allow for mobile technology<br>trailer hookup. (5%) | 1.1 |
| Total | 3656.268 |




682625 Avj KWH for Winter
1354 Avj KW for Winter

| | | Gas Boiler No Adjsutment Necessary MMBtu | **Monthly Utilization Factor based on Peak Winter Gas Flow** |
|---|---|---|---|---|
| Jan | 1 | 31 | 6700 | 39% |
| Feb | 1 | 28 | 7269 | 47% |
| Mar | 1 | 31 | 5803 | 34% |
| April | 1 | 30 | 4749 | 28% |
| May | 1 | 31 | 4148 | 24% |
| Jun | 1 | 30 | 2803 | 17% |
| July | 1 | 31 | 2637 | 15% |
| Aug | 1 | 31 | 2899 | 17% |
| Sept | 1 | 30 | 3365 | 20% |
| Oct | 1 | 31 | 4075 | 24% |
| Nov | 1 | 30 | 5338 | 32% |
| Dec | 1 | 31 | 7351 | 43% |

Waste Heat Recovery Scaled to Metro

| Traditional Boiler Component MMBTU/month | **Monthly Utilization Factor based on Peak Winter Gas Flow** | Absorption Chiller Comp MMBTU / Month | Monthly Utilization Factor based on Peak Absorber Flow | Total MMBTU/ Month | Total Average MMBTU/Hour/Month |
|---|---|---|---|---|---|
| 12060 | 39% | 17 | 0% | 12077 | 16 |
| 13084 | 47% | 9 | 0% | 13093 | 19 |
| 10445 | 34% | 157 | 1% | 10602 | 14 |
| 8548 | 28% | 1154 | 7% | 9703 | 13 |
| 7466 | 24% | 3494 | 22% | 10960 | 15 |
| 5045 | 17% | 6269 | 40% | 11314 | 16 |
| 4747 | 15% | 7610 | 47% | 12357 | 17 |
| 5218 | 17% | 6746 | 42% | 11964 | 16 |
| 6057 | 20% | 4470 | 29% | 10527 | 15 |
| 7335 | 24% | 2094 | 13% | 9429 | 13 |
| 9608 | 32% | 428 | 3% | 10036 | 14 |
| 13232 | 43% | 26 | 0% | 13258 | 18 |

Test Hospital Peak Gas Flow (Boiler Size/Boiler Efficienc 23.2 Therms

Scaling Factor
475000 SF/260000sf 1.8

Metro Demand 4176 Therms

**Needs to be validated**
**Waiting for**

| | | Hours | % LOAD | Steam Flow Adjusted for part load | | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 95 | 99 | 2 | 100 | 22 | **43.2** | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 22 | 0 | 0 | 0 | 0 |
| 90 | 94 | 27 | 90 | 19 | **524** | 0 | 0 | 0 | 0 | 0 | 155 | 175 | 116 | 78 | 0 | 0 | 0 |
| 85 | 89 | 115 | 80 | 17 | **1987** | 0 | 0 | 0 | 0 | 86 | 570 | 778 | 363 | 173 | 17 | 0 | 0 |
| 80 | 84 | 261 | 70 | 15 | **3941** | 0 | 0 | 0 | 60 | 257 | 846 | 1419 | 936 | 332 | 91 | 0 | 0 |
| 75 | 79 | 411 | 60 | 13 | **5302** | 0 | 0 | 0 | 116 | 503 | 1109 | 1509 | 1238 | 593 | 219 | 13 | 0 |
| 70 | 74 | 626 | 50 | 11 | **6761** | 0 | 0 | 22 | 162 | 659 | 1318 | 1663 | 1534 | 994 | 367 | 43 | 0 |
| 65 | 69 | 731 | 40 | 9 | **6316** | 0 | 0 | 26 | 251 | 778 | 1218 | 1149 | 1356 | 976 | 492 | 69 | 0 |
| 60 | 64 | 734 | 30 | 6 | **4698** | 0 | 0 | 45 | 294 | 704 | 691 | 672 | 858 | 813 | 512 | 109 | 0 |
| 55 | 59 | 675 | 20 | 4 | **2903** | 17 | 9 | 65 | 271 | 507 | 340 | 245 | 323 | 512 | 396 | 194 | 26 |
| | | **3562** | | | | | | | | | | | | | | | |
| | | **41%** | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 50 | 54 | 601 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45 | 49 | 578 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 44 | 574 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | 39 | 701 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 34 | 859 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 29 | 687 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 24 | 452 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 19 | 314 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 14 | 190 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 9 | 115 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 4 | 61 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -5 | -1 | 31 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -10 | -6 | 9 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | Therms Total for Cooling Per Month | | | | | | | | | | | |
| | | | | | | 17 | 9 | 157 | 1154 | 3494 | 6269 | 7610 | 6746 | 4470 | 2094 | 428 | 26 |
| | | | | | | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |
| | | | | | 32474 | Therms Per Hour for Cooling Per Month | | | | | | | | | | | |

| | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 95 | | | | | | 1 | | 1 | | | | |
| 90 | | | | | | 8 | 9 | 6 | 4 | | | |
| 85 | | | | | 5 | 33 | 45 | 21 | 10 | 1 | | |
| 80 | | | | 4 | 17 | 56 | 94 | 62 | 22 | 6 | | |
| 75 | | | | 9 | 39 | 86 | 117 | 96 | 46 | 17 | 1 | |
| 70 | | | 2 | 15 | 61 | 122 | 154 | 142 | 92 | 34 | 4 | |
| 65 | | | 3 | 29 | 90 | 141 | 133 | 157 | 113 | 57 | 8 | |
| 60 | | | 7 | 46 | 110 | 108 | 105 | 134 | 127 | 80 | 17 | |
| 55 | 4 | 2 | 15 | 63 | 118 | 79 | 57 | 75 | 119 | 92 | 45 | 6 |
| | | | | | | | | | | | | |
| 50 | 6 | 5 | 28 | **85** | **111** | 55 | 23 | 33 | 83 | 107 | **51** | 14 |
| 45 | 10 | 12 | 36 | **101** | **89** | 23 | 7 | 14 | 62 | 128 | 78 | 18 |
| 40 | 24 | 27 | 64 | **103** | **62** | 6 | | 3 | 26 | 97 | 127 | 35 |
| 35 | 70 | 65 | 126 | **120** | **28** | | | | 10 | 71 | **137** | 74 |
| 30 | 133 | 149 | 173 | **91** | **10** | | | | 4 | 36 | **118** | 145 |
| 25 | 145 | 139 | 124 | **37** | **2** | | | | | 14 | **78** | 148 |
| 20 | 108 | 99 | 79 | **12** | | | | | | 2 | **37** | 115 |
| 15 | 94 | 76 | 47 | **3** | | | | | | | **13** | 81 |
| 10 | 63 | 45 | 23 | | | | | | | | **3** | 56 |
| 5 | 45 | 28 | 12 | | | | | | | | **2** | 28 |
| 0 | 22 | 17 | 5 | | | | | | | | **2** | 15 |
| -5 | 11 | 9 | 2 | | | | | | | | | 9 |
| -10 | 6 | 2 | | | | | | | | | | [illegible] |
| | 741 | 675 | 746 | 718 | 742 | 718 | 744 | 744 | 718 | 742 | 721 | 745 |

Energy Profile - Hospital Only

Electric Usage

| Month | # of Hours | Peak Demand-hospital (kW) | Average Demand - hospital (kW) | % Utilization Factor Based on Monthly Peak Demand | % Utilization Factor Based on Peak Summer Demand in kW |
|---|---|---|---|---|---|
| January | 744 | 2,572 | 1,852 | 72% | 43% |
| Feburary | 672 | 2,443 | 1,522 | 62% | 35% |
| March | 744 | 2,517 | 2,036 | 81% | 47% |
| April | 720 | 2,827 | 2,047 | 72% | 48% |
| May | 744 | 3,303 | 2,808 | 85% | 65% |
| June | 720 | 3,576 | 3,004 | 84% | 70% |
| July | 744 | 3,722 | 3,019 | 81% | 70% |
| August | 744 | 4,307 | 3,135 | 73% | 73% |
| September | 720 | 3,576 | 2,217 | 62% | 51% |
| October | 744 | 3,685 | 1,732 | 47% | 40% |
| November | 720 | 3,247 | 1,682 | 52% | 39% |
| December | 744 | 3,192 | 1,858 | 58% | 43% |
| | | | | | |
| | 8,760 | 4,307 | 2,243 | 69% | 52% |

## Energy Profile - Hospital Only

Heating Loads

| Month | # of Hours | Average Monthly heating loads - Hospital (MMBtu / hr) | Total Monthly Heating Loads-Hospital (MMBtu) | Monthly Utilization Factor based on Peak Winter Gas Flow |
|---|---|---|---|---|
| January | 744 | 16.2 | 12,052.80 | 38.8% |
| Feburary | 672 | 19.5 | 13,104.00 | 46.6% |
| March | 744 | 14.0 | 10,416.00 | 33.6% |
| April | 720 | 11.9 | 8,568.00 | 28.4% |
| May | 744 | 10.0 | 7,440.00 | 24.0% |
| June | 720 | 7.0 | 5,040.00 | 16.8% |
| July | 744 | 6.4 | 4,761.60 | 15.3% |
| August | 744 | 7.0 | 5,208.00 | 16.8% |
| September | 720 | 8.4 | 6,048.00 | 20.1% |
| October | 744 | 9.9 | 7,365.60 | 23.6% |
| November | 720 | 13.3 | 9,576.00 | 32.0% |
| December | 744 | 17.8 | 13,243.20 | 42.6% |
| | | | | |
| | 8,760 | 11.8 | | 28.2% |

Cooling Loads

| Month | Average Metro Hospital Cooling Loads (Tons) | Utilization based on yearly peak |
|---|---|---|
| January | 1.93 | 0% |
| Feburary | 1.07 | 0% |
| March | 17.56 | 1% |
| April | 133.61 | 7% |
| May | 391.35 | 22% |
| June | 725.55 | 40% |
| July | 852.41 | 47% |
| August | 755.56 | 42% |
| September | 517.41 | 29% |
| October | 234.59 | 13% |
| November | 49.48 | 3% |
| December | 2.89 | 0% |

# ATTACHMENT C

# LEARNING CENTER LOADS

BUIST ELECTRIC, INC.
Commercial • Industrial • Institutional • Underground • Data/Communications

**Metropolitan Hospital**
**Electrical Usage Estimate**
**C.U.P./Learning Center Building**
**(Workstage Project)**

Learning Center
(total estimated = 418 kW)

318 kW = normal power
55 kW = life safety
45 kW = cooling of IT room
(Emergency power 1 minute transfer is acceptable)

IT Lab (servers/racks, etc.) 417 kW (all of which required to be uninterruptible)

The above load information is estimated with information available on 4/19/04; updated load information will be provided as project develops.

Steve Longstreet