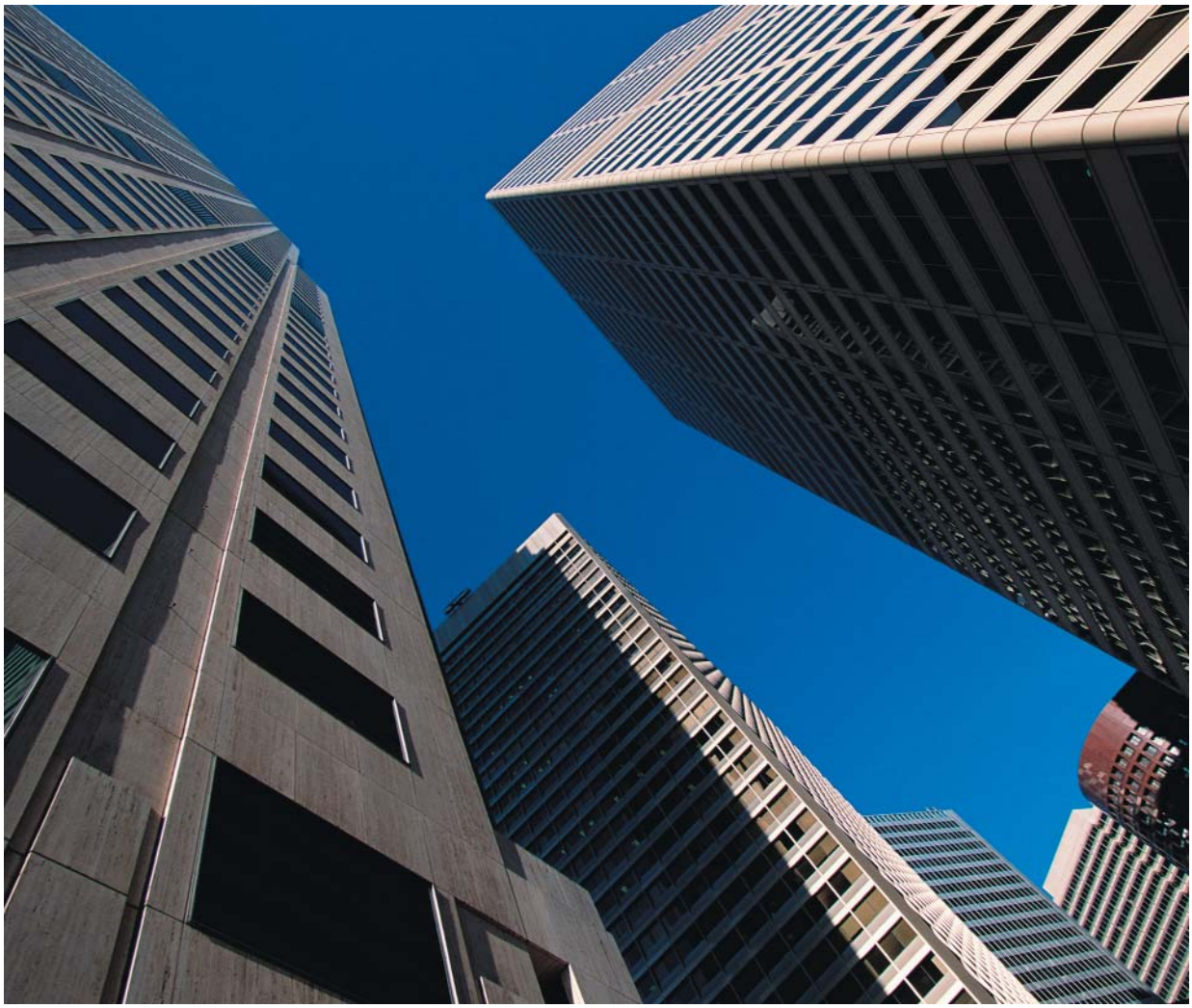
EPRI

Cooling Plant Optimization Guide

Technical Report



Cooling Plant Optimization Guide

TR-110404

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EPRI Project Manager
B. Lindsay

EPRI • 3412 Hillview Avenue, Palo Alto, California 94304 • PO Box 10412, Palo Alto, California 94303 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

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ORGANIZATION(S) THAT PREPARED THIS REPORT

Dorgan Associates, Inc.

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This report was prepared by

Dorgan Associates, Inc.
7601 Ganser Way
Madison, Wisconsin 53719-2074

Principal Investigators
C. B. Dorgan, P.E
R. J. Linder

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REPORT SUMMARY

Central cooling plants or district cooling systems account for 22% of energy costs for cooling commercial buildings. Improving the efficiency of central cooling plants will significantly impact peak demand and energy usage for both building owners and utilities. This guide identifies opportunities for optimizing a central cooling plant and provides a simplified optimization procedure. The guide focuses on plant optimization from the standpoint of minimizing energy costs and maximizing efficiencies. Two case studies demonstrate utility use of the procedure.

Background

Cooling plant optimization can take many forms, ranging from minimizing energy costs to decreasing maintenance and downtime. Among the primary reasons for cooling plant optimization are changes in chiller efficiency with age, unorganized expansion of the central cooling plant over a period of 15-20 years, and changes in energy costs or system cooling requirements. A cooling plant optimization study—such as the one described in this guide—offers many benefits, including the potential for reduced operating costs, documentation of system efficiencies, improved understanding of the system, and a prioritized list of necessary system enhancements.

Objectives

To identify typical opportunities for optimizing central cooling plants in commercial buildings and provide a simplified approach for implementing changes.

Approach

Investigators defined four main opportunities for optimizing a central cooling plant. They next developed a simple optimization procedure intended to provide the framework for implementing plant optimization studies. Finally, they applied the procedure to case studies of two central cooling plants. The first case study involved a state office building with an electric centrifugal and natural gas direct-fired absorption cooling plant. The second case study focused on a hospital with multiple electric chillers of different ages.

Results

Most cooling plants present opportunities to improve plant efficiency and reduce utility costs. These opportunities often exist due to the lack of original system operating

information, piecemeal addition of chillers, or a change in operations and maintenance strategy. Key opportunities include optimizing chiller staging, modifying pumping strategies, better matching of the operation of cooling tower and chiller, and upgrading equipment—particularly, inefficient chillers.

This report offers a simplified procedure for determining the optimum operating strategy for a central cooling plant. The entire procedure is iterative in nature. Results achieved the first time a customer completes the process will help identify other opportunities or more economical approaches for achieving even lower costs.

EPRI Perspective

In a deregulated environment, utilities are striving to provide new products and services as well as higher levels of service to their chiller customers. With customers asking more sophisticated questions, issues such as how to meet optimization challenges have become increasingly significant. This guide provides a simplified approach for working with customers to optimize central cooling plants. EPRI's Electric Chiller Handbook (TR-105951, Rev. 1) provides further information on chiller selection issues.

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Interest Category

HVAC

Keywords

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Space conditioning

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ABSTRACT

Cooling plant optimization can take many forms, ranging from minimizing energy costs to decreasing maintenance and downtime. The reasons for cooling plant optimization are similarly varied—including changes in chiller efficiency with age, unorganized expansion of the central cooling plant over a period of 15-20 years, and changes in energy costs or system cooling requirements. Because central cooling plants or district cooling systems account for 22% of energy costs for cooling commercial buildings, improving plant efficiency can significantly impact peak demand and energy usage for both building owners and utilities. This guide identifies opportunities for optimizing a central cooling plant and provides a simplified optimization procedure. The guide focuses on plant optimization from the standpoint of minimizing energy costs and maximizing efficiencies. Two case studies demonstrate utility use of the procedure.

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INTRODUCTION

The purpose of this guide is to provide information required to identify, access, collect and optimize the operation of a central cooling plant with more than one chiller. This includes both cooling plants with single (i.e., electric) and multiple (i.e., some electric and some gas chillers) energy sources.

The primary audience of this guide is utility marketing and technical representatives. However, building owners and operating personnel, and engineers will also find the information useful.

The need for cooling plant optimization and an overview of the guide structure is contained in this section.

Need For Cooling Plant Optimization

Cooling plant optimization can take many forms depending upon the intent of optimization, ranging from energy costs to maintenance time. In this guide cooling plant optimization focuses on minimizing the energy costs and maximizing efficiencies of the central cooling plant. One reason for this focus is that high energy costs are often a primary concern of building owners. The analysis and optimization has been simplified to require relatively few measurements.

The primary reasons for cooling plant optimization include:

- Chiller efficiency changes with age
- Central cooling plant expansion in an unorganized manner over a period of 15-20 years
- Change in energy costs
- Change in system cooling requirements

There are several characteristics of a central cooling plant which make it an ideal candidate for optimization:

- Multiple cooling plants of different:
  - Age
  - Size
  - Type
  - Part-load characteristics
- Cooling plants with different fuel sources and energy source availability
- High fuel costs
- High fuel cost differential (i.e., between gas and electric or between on-peak and off-peak)

Even if a central cooling plant is composed of several identical chillers, there usually are opportunities available related to slight efficiency differences between the chillers or by changing the system operating strategy.

A cooling plant optimization study produces many benefits to the plant's owner and operations and maintenance personnel, including:

- Reduced operating costs
- Documented system efficiencies (limited operating range)
- Improved understanding of the system (simplified schematics and control sequences)
- Prioritized list of system improvements

While approximately 6% of the buildings in the United States have either a central cooling plant or district cooling system, these systems cool approximately 19% of the air-conditioned floor space and expend 22% of energy costs for cooling commercial buildings.[1] Therefore, improving the efficiency of central cooling plants can have significant effect on building owner's and utility's peak demand and energy usage.

[1] EIA. 1995. "Commercial Building Energy Consumption and Expenditures 1992" Energy Information Agency, Washington, D.C., April 1995, #DOE/EIA - 0318(92), p. 39.

Guide Structure

This guide is structured towards readers with some knowledge of central cooling plants and the general layout and equipment contained in a central cooling plant. The guide is composed of six sections and three appendices.

Chapter 2: Cooling Plant Optimization Opportunities. The typical opportunities for optimizing a central cooling plant are presented in this section. This information provides the foundation required to implement the procedures described in Section 3.

Chapter 3: Cooling Plant Optimization Procedure. A simple procedure is presented in this section to optimize a central cooling plant. This information is intended to provide the framework to implement cooling plant optimization studies. However, due to the unique nature of each central cooling plant, modification of the procedure is often required to account for local space conditioning.

Chapter 4: Case Study 1 - State Office Building. The procedure presented in Section 3 was applied to two central cooling plants. The results of the first case study, a State Office building with an electrical centrifugal and a natural gas direct-fired absorption cooling plant, are presented in this section.

Chapter 5: Case Study 2 - Hospital. The results of the second case study, a hospital with multiple electric chillers of different ages, are presented in this section.

Appendix A: Case Study 1 Data. A summary of the key data collected for the first case study is contained in this appendix.

Appendix B: Case Study 2 Data. A summary of the key data collected for the second case study is contained in this appendix.

Appendix C: Utility Rata Data. The gas and electric utility data for the case studies in Appendices A and B are detailed in this appendix.

2

COOLING PLANT OPTIMIZATION OPPORTUNITIES

There are opportunities in most cooling plants to improve the plant's efficiency and to reduce utility costs. These opportunities often exist due to the lack of original system operating information, piecemeal addition of chillers, or a change in operations and maintenance (O&M). Some common opportunities are:

- Improve staging of chillers
- Modify pumping strategies
- Integrate cooling tower and chiller
- Upgrade equipment

Ideally, the central cooling plant should be analyzed in conjunction with the distribution system and loads. For this guide it was assumed that the system cooling supply temperature was fixed. This was assumed in order to avoid problems with space comfort (i.e., raising the cooling supply temperature to reduce chiller energy can result in loss of humidity control).

Improve Staging of Chillers

In central cooling plants with multiple chillers, the sequencing of the chillers is often based on an outdated original control sequence, a degradation of the original control sequence, or O&M personnel matching load with partial or peak chiller capacities. The efficiency and cost effectiveness of a chiller is based on the type, load operating characteristics and age of the chiller (expected remaining life), and not strictly on chiller size. The optimum staging of chillers is based on actual performance and must include:

- Peak load performance
- Part load performance
- Rate structure (i.e., on-peak/off-peak)
- Auxiliary power (pumps and heat rejection equipment)
- System degradation due to age and level of maintenance

Through the measurement of system performance, energy usage, and cooling loads, over a limited period, an optimum staging strategy can be developed. With this data, system performance can be continuously improved using periodic monitoring and re-evaluation of chiller staging.

Modify Pumping Strategies

As chillers are added to central cooling systems to handle an increased cooling load (i.e., an addition or renovation), the piping distribution system is sometimes modified in an inappropriate manner. To further complicate matters, piping system schematics may not be accurately updated or configured for efficient system operation.

This can lead to confusion on system operation and result in system inefficiencies. The first step in improving pumping strategies is to develop a simplified system schematic. Figure 2-1 shows an original system schematic and Figure 2-2 the corresponding "simplified" system schematic.

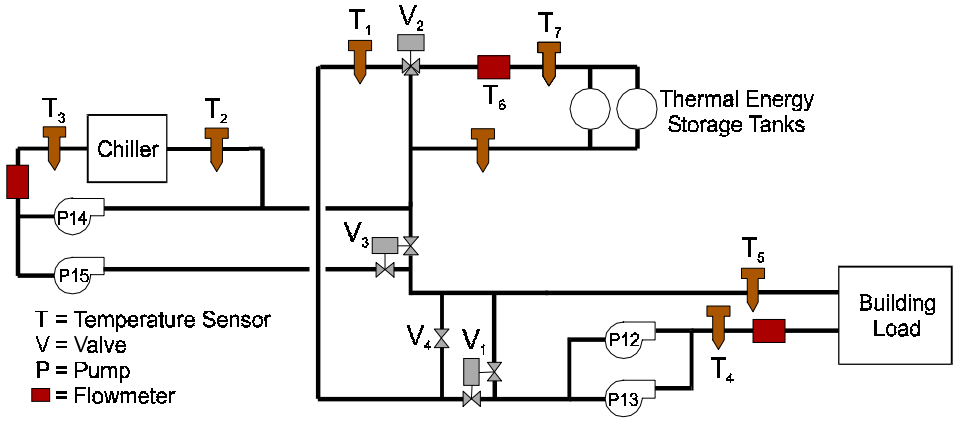

Figure 2-1
Original System Schematic

By reviewing the simplified system schematic, flow needs and opportunities between primary and secondary flow can be identified. Further savings can be obtained by improving the efficiencies of the pump motors and the addition of variable speed drives on secondary pumps.

While not included in the scope of this guide, significant savings on secondary pumping energy can be achieved by increasing the temperature differential across the secondary system. This can be accomplished through a review of cooling coil control strategies and the proper use of two-way valves on all cooling coils.

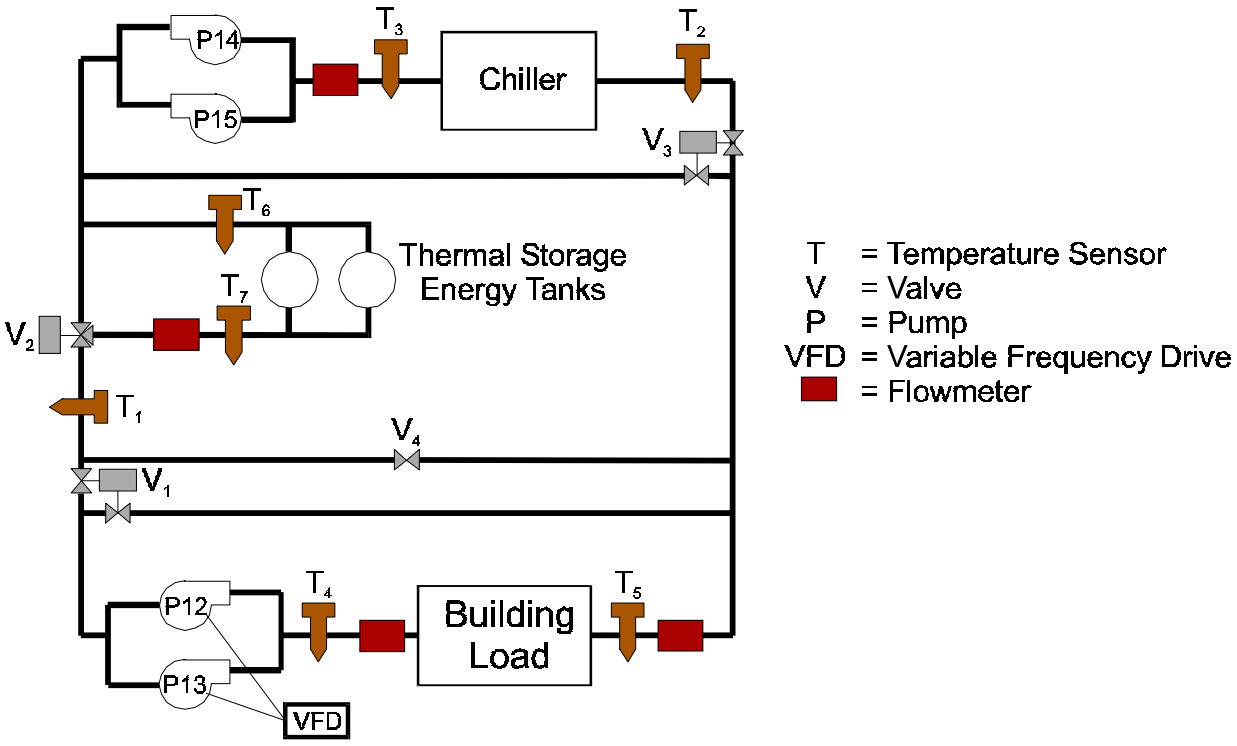

Figure 2-2
Simplified System Schematic

Integrate Cooling Tower and Chiller

For a fixed cooling load, there is a direct relationship between chiller energy use and entering condenser water temperature; as the condenser water temperature decreases, the chiller energy usage decreases. Conversely, there is an inverse relationship between cooling tower energy usage and leaving water temperature. Therefore, a tradeoff between chiller energy use and cooling tower energy use exists. The question becomes, does the chiller use less energy at a lower condenser water temperature than the cooling tower to lower the condenser water temperature? The aforementioned trade-off leads to an optimization (minimization) problem that requires determining chiller and cooling tower operating balance points that minimize the total power of the chiller central plant (chiller and heat rejection).

This optimum operating balance point continually changes with varying outdoor air conditions (cooling tower performance and system cooling loads). For example, the cooling tower fan may not operate to maintain a leaving water temperature of 80°F (27°C) when the outdoor air wetbulb temperature is 68°F (20°C) or lower, but will operate continuously when the outdoor air wetbulb temperature is 74°F (23°C).

Typically, this opportunity is only viable in systems with oversized cooling towers or during the swing seasons (spring and fall). A simplified analysis at one or two key operating points can usually determine if this is a viable opportunity.

Upgrade Equipment

In any central cooling system with chillers ten years of age, or older, there may be an opportunity to replace old inefficient chillers with a new energy efficient models. The replacement may be based on one of many factors:

- Maintenance costs and history
- Energy usage and costs
- Predicted life expectancy
- Refrigerant regulations/availability/cost
- Type of compressor (reciprocal/centrifugal/screw)
- Space constraints
- Structural constraints
- Equipment capital costs
- Energy source availability

The final decision for upgrading the system should be based on the lowest life cycle cost alternative, which includes costs for:

- Equipment
- Energy
- Maintenance
- Replacement
- Financing

Similar to plant optimization, modifications to the central cooling plant must be evaluated on how the new chiller will integrate into the existing plant. For example, replacing a small inefficient chiller with a larger efficient chiller could completely change the staging of the chillers. The new chiller may not only improve efficiency by offsetting the chiller it is replacing, but also by offsetting other less-efficient remaining chillers.

3

COOLING PLANT OPTIMIZATION OPPORTUNITIES

A simplified procedure for determining an optimum operating strategy for a central cooling plant is presented in this section. This presentation is an optimization overview and is not intended to provide detailed step-by-step procedures on the optimization process. To actually implement this procedure, the investigator will need to have experience in and knowledge of:

- Monitoring system performance
- Primary/secondary pumping strategies
- Chiller types and differences between them
- Life cycle cost estimating

The five steps to determine which opportunities provide the greatest benefits are:

1. Collect equipment information (name plate performance)
2. Collect limited performance data
3. Develop as-built piping schematic
4. Evaluate opportunities
5. Perform economic analysis

Step 1 - Collect Equipment Information (Name Plate Performance)

The first step is to collect manufacturer ratings on the various system components (chillers, primary/secondary pumps, heat rejection equipment). The specific information of interest includes:

- Model number
- Serial Number

- Rated performance at full load
  - — chiller: power, capacity, temperatures, flows and barrel pressure drops [kW, tons (kW_T), °F (°C), gpm (L/s), and psig (Pa)]
  - — pumps: head, power, flow rate, efficiency [ft (m), hp (kW), gpm (L/s) and %]
  - — cooling towers: entering and leaving air and water temperatures, water flow rate motor power and capacity as a function of outdoor air wet bulb (OAWB) full load, [°F(°C), gpm (L/s) and hp (kW)]
- Part load performance - system information at part-load and off-design conditions obtained from O&M manuals or from manufacturer.

The intent of collecting this information is assessment of the "as-new" expected system performance. Any values obtained in Step 2 which do not match the manufacturer's information indicate system degradation and potential opportunity for improvement.

Frequently, the desired information is not available due to the age of the equipment (no longer in production) or due to limited part load performance data (for chillers over 200 tons, many manufacturers do not produce performance information unless requested at time of purchase). A common occurrence then is that the water pressure drop through the evaporator is given only for the rated condition. In this instance, the pressure drop across the evaporator is measured and the flow rate determined using pump laws and the rated conditions (see equation 3-1).

$$Q_1 = Q_2\sqrt{\frac{P_1}{P_2}} \qquad \text{(eq. 3-1)}$$

where:

Q_1 = Actual flowrate, gpm (L/s)
Q_2 = Rated flowrate, gpm (L/s)
P_1 = Actual pressure drop, psia (kPa)
P_2 = Rated pressure drop, psia (kPa)

To account for degradation, this flow measurement should be verified by measuring the power usage and head pressure of the chiller evaporator pump and determining the flow using the specific curve for the pump (from the pump manufacturer).

Step 2 - Collect Limited Performance Data

Historically, the actual performance of a chiller only had to be within approximately ± 5% of the published rated condition to meet rating standards (ARI Standard 550-1992). Therefore, collection of limited performance data is desirable to validate the manufacturer's standard ratings and the current level of degradation. The length of data collection can vary from minutes to several weeks. The level of effort depends on several factors:

- Time of year: if not at design conditions, measurements may not accurately determine level of degradation
- Size of plant: in larger plants, not all chillers may be operated simultaneously
- Intent of study: a quick snapshot to verify current operating strategy or full/part load performance to determine upgrades
- Funding available: increased funding required for longer monitoring
- Variability between chillers: higher variability (i.e., one gas and one electric) typically requires additional monitoring

The required measurements to determine system performance are:

- Chiller power (electric or gas usage)
- Evaporator entering and leaving temperatures and flow
- Condenser entering and leaving temperatures and flow
- Evaporator and condenser pump power and pressure
- Heat rejection fan power
- Outdoor air temperature and humidity

When available, the direct digital control (DDC) system/energy management system (EMS) can typically record the majority of required information. Any auxiliary information not available from the DDC system can be collected during the site visit using portable instrumentation.

Regardless of the data recorder type, the sensors must be calibrated prior to collecting performance data. This can be done on or off-site. For existing sensors (DDC), the validation can be accomplished by comparing sensor values, in series, when the chiller

will track differential temperatures accurately. The absolute temperature being measured can be validated using a hand held temperature sensor which has been calibrated in the past six months.

Step 3 - Develop As-built Piping Schematic

As detailed in Section 2, the as-built schematics of a central cooling plant hydronic system are often incomplete and confusing. In this step the as-built hydronic system drawings are simplified to eliminate any crossing lines and verified with the installed piping and system components for accuracy.

An example transformation of an as-built drawing is shown in Figures 2-1 and 2-2 (Section 2, pages 2-2 and 2-3).

A simple and accurate system ladder diagram is critical to easily identify system flow problems and opportunities for improvements. The operation of a hydronic system may be misunderstood for 5, 10 and even 20 years. It is not until the tools are made available to the O&M personnel that problems become apparent and are properly addressed.

Remember that the goal of this step is to produce a ladder diagram with minimal (none preferable) lines crossing. See EPRI's *Cool Storage Open Hydronic System Design Guide*[2] for details on creating ladder diagrams.

Step 4 - Evaluate Opportunities

With data collected, the information for each chiller is evaluated against the four opportunities detailed in Section 2:

- Improve staging of chillers
- Modify pumping strategies
- Integrate cooling tower and chiller
- Upgrade equipment

For each opportunity, the energy savings and any associated implementation costs are estimated to enable an educated decision making process

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[2] EPRI, Gatley & Associates and Mackie & Associates, September 1995, *Cool Storage Open Hydronic System Design Guide*, TR-104906, Palo Alto, CA

Staging of Chillers

For a central cooling plant using a single energy source (electricity or gas), the optimization of chiller staging is simply calculating the coefficient of performance (COP) or system efficiency for each chiller at various load levels (30, 40, 50, etc.) and prioritizing chillers for all load ranges. While pump energy can be ignored in this analysis, heat rejection equipment (cooling tower) energy use must be included if it is not a single cooling tower system. With a single source of energy the rate structure is typically the same for all system components, thus it is strictly an efficiency comparison.

For central cooling plants with multiple energy/fuel sources, optimal staging is more difficult to determine. In order to normalize the system performance, the energy usage and demand is converted to "cost per cooling unit" ($/ton-hr, $/kWh$_T$).

Pumping Strategies

The modification of pumping strategies is based on a review of the pumping schematic to ensure proper primary/secondary circuits and the evaluation of the pumps for high efficiency and variable speed drive retrofits. The following provides guidance on improving pumping strategies:

- Use two-way valves
- Specify a motor efficiency >92%
- Ensure triple-duty valves (balancing) >90% open
- Verify secondary pumps are meeting cooling coil pressure requirements
- Verify primary pumps are only meeting chiller pressure requirements
- Ensure variable speed drive input (pressure sensor) provides accurate measurement of system requirements (location is critical)

Cooling Tower Integration

This opportunity is evaluated by comparing the system (chiller and cooling tower) energy use at various entering condenser water temperatures (nearly the same as cooling tower leaving water temperature), outdoor air wetbulb temperatures and system loads to determine the optimum system balance point. Table 3-1 can be used as a guide in these calculations.

Table 3-1
Chiller/cooling tower integration

Entering Condenser Temperature, °F (°C)	Outdoor Air Wetbulb Temperature, °F (°C)	System Cooling Load, %	Chiller Power, kW	Cooling Tower Fan Usage %	Cooling Tower Power, kW	System Power, kW
95 (35)	85 (29)	100	58.4	80	12	**70.4**
		75	37.9	60	9	**46.9**
		50	21.6	40	6	**27.6**
	65 (18)	100	58.4	50	7.5	65.9
		75	37.9	38	5.6	43.5
		50	21.6	25	3.8	25.4
90 (32)	85 (29)	100	55.6	100	15	70.6
		75	36.1	75	11.3	47.4
		50	20.6	50	7.5	28.1
	65 (18)	100	55.6	60	9	**64.6**
		75	36.1	45	6.8	**42.9**
		50	20.6	30	4.5	**25.1**

Note: Based on a 60 ton (210 kW_T) scroll liquid chiller package consisting of three scroll compressors and a 15 hp (11kW) cooling tower.

As is shown in Table 3-1, when the outdoor air wetbulb temperature is 85°F(29°C), it is more economical to use an entering condenser water temperature of 95°F(35°C). Whereas, when the outdoor air wetbulb temperature is 65°F(18°C), an entering condenser water temperature of 90°F(32°C) should be used. Calculating the optimum setpoint can easily be estimated using the DDC/EMS system.

If gas cooling is used, then the energy usage would be converted to monetary values for comparison purposes. In gas cooling, heat rejection is a large percentage of the energy use.

Upgrade Equipment

The final option is to upgrade/replace the current system. This decision must be based on the current state of the equipment (life expectancy) and the expected improved efficiency of the new equipment. The life expectancy of the equipment is determined through discussions with the O&M personnel and manufacturers. The key components which affect the life expectancy are:

- Run time hours
- Level of maintenance (i.e., quality of water, lubricants, etc.)
- Quality of equipment
- Part load runtime percentage (less wear and tear at full load)
- Chiller/Compressor type (centrifugal, screw, reciprocal, hermetic, operative, engine driven, etc.)

For most optimization studies, only the chillers are evaluated for this opportunity. The primary reason is that chillers provide the largest benefits. Discussions with O&M personnel will usually identify other opportunities in addition to the chillers.

Step 5 - Perform Economic Analysis

The final step in the optimization procedure is to evaluate the economics of each opportunity. While many building owners evaluate the viability of a project based on its payback (years), for central cooling plants that operate for 20-30 years, a simple payback does not accurately represent the true benefits of most opportunities. To properly evaluate and provide guidance to an owner, a life cycle cost estimate must be completed for each opportunity.

Life cycle cost estimating evaluates a project over a fixed time period, typically 30 years, and includes all expenses to be encountered during this period. The costs are compared to a common present value. When there are future operating uncertainties, an evaluation period of 8-12 years may be acceptable. The following are the primary components which comprise a life cycle cost estimate:

- Capital costs
- Operating costs
- Maintenance costs
- Replacement/salvage costs
- Financing costs

Some items, such as maintenance, will increase as chiller runtime increases, due to system degradation. This should not be a constant yearly cost. The typical base case for a life cycle cost comparison is to make no modifications to the current system.

Therefore, any life cycle cost estimates lower than the base case will provide economic benefit to the owner.

Since the base case establishes limits on economic feasibility, accurate estimation is essential. For example, if little preventative maintenance is being performed on a central cooling plant, significant degradation of the system can result. Then the life expectancy for the system must be reduced with increased "emergency fix" costs added near the end of its life. Unfortunately, many life cycle cost estimates for this scenario assume fixed maintenance costs and a standard life expectancy. These assumptions result in an artificially low life cycle cost with effective and economically attractive opportunities being rejected.

Iteration

The procedure presented in this Section is iterative in nature. As the opportunities are developed and life cycle cost estimates completed, the results will help identify other opportunities or more cost effective ways to achieve a better life cycle cost estimate.

An example is converting air handling units from 3-way to 2-way valves (from a primary only to a primary/secondary pumping strategy). The original opportunity may have been to install secondary pumps with variable speed drives. However, the life cycle cost benefits for the variable speed drive may not be positive after 3-way valves are converted to 2-way valves, leading to a modification of the opportunity to reject variable speed drives. While the energy savings may be reduced 15-20%, the cost of the drives are eliminated and have a higher present value than the pumping energy.

4

CASE STUDY 1 - STATE OFFICE BUILDING

Site Description

This office building consists of approximately 200,000 ft^2 (18,580 m^2) of open and private office space, with a cafeteria and mail room, of which 142,000 ft^2 (13,190 m^2) is cooled. There are three primary sections to the building. The original section of the building, built in 1952, consists of two floors and is served by multiple central station air handling units and wall units (window areas). The second section of the building, built in 1972, consists of three floors and is also served by multiple central station air handling units and wall units (perimeter zones). The third area, built in 1979, consists of five floors and has a single large multi-zone system.

The piping system is two-pipe, so these areas can only be heated or cooled, not both. The central cooling plant system consists of two chillers. Table 4-1 details the characteristics of the two chillers and Figure 4-1 is a schematic of the piping system (see Appendix C for the utility rate structure for this building).

Table 4-1
Cooling Plant Characteristics - State Office Building

Description	Chiller 1	Chiller 2
Location	New Section	Original Section
Type	Centrifugal	Direct-fired gas absorption (double effect)
Make	York	Trane
Model	HT C1B2-BAC	ABDL240
Capacity, tons (kW_T)	200 (700)	210 (740)
CHW ST, °F (°C)	46 (8)	44 (7)
CHW RT, °F (°C)	55 (13)	55 (13)
CHW Flowrate, gpm (L/s)	365 (23)	504 (32)
CWRT, °F(°C)	95 (35)	95 (35)
CWST, °F(°C)	85 (29)	85 (29)
CdW flowrate, gpm (L/s)	420 (26)	936 (59)
Primary Energy Input	164kW_T	2468 MBH (723 kW_T)
Chiller Efficiency	0.82kW/ton (4.3 COP)	1.03 COP
V/A/Ø	460/60/3	460/60/3
Refrigerant	R-11	Lithium Bromide

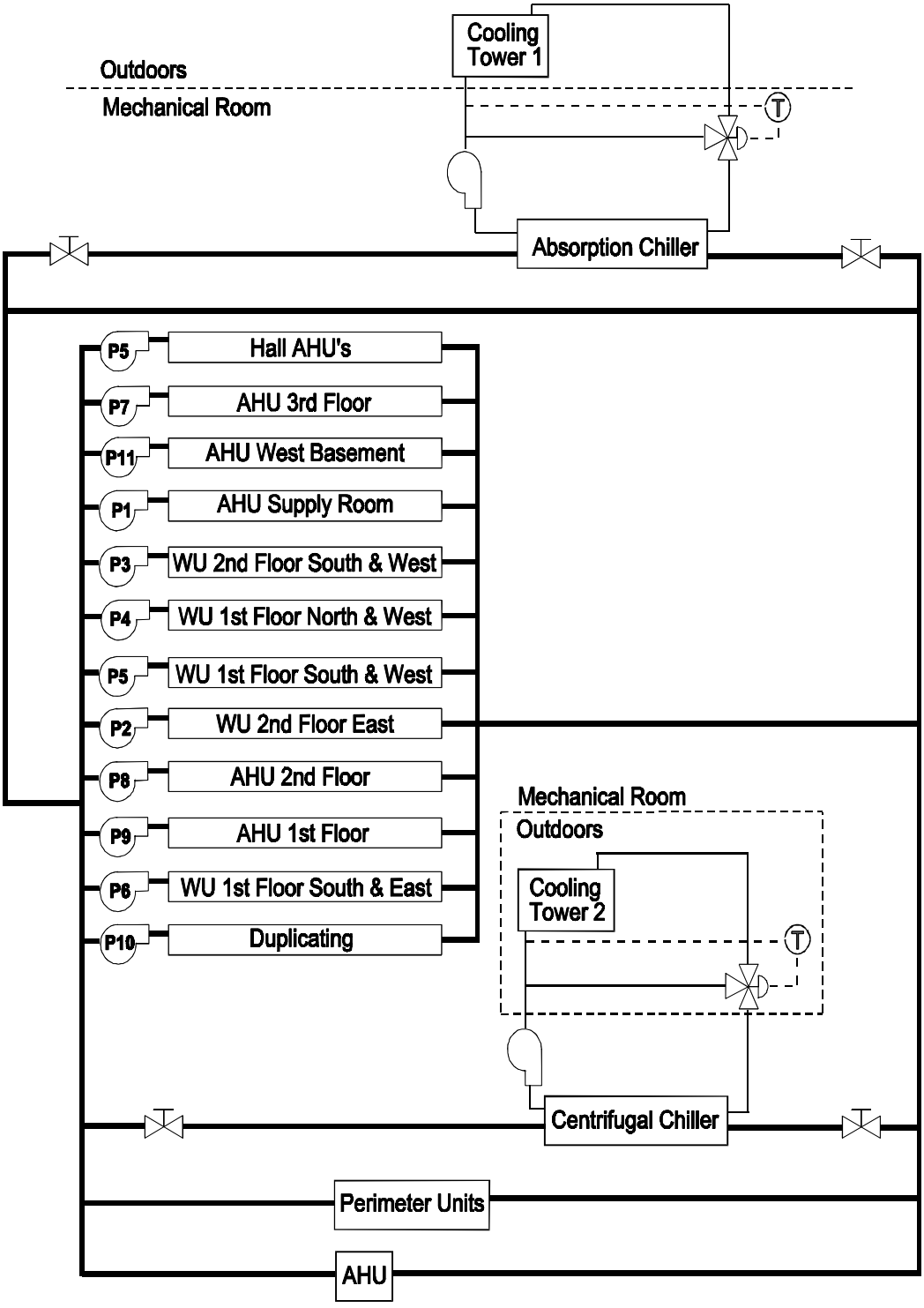

Figure 4-1
Building System Schematic

In addition to the two primary chillers, there are 10 individual computer room units, totaling 200 tons (700 kW_T).

The operation of the central plant system is manual. Currently, the absorption chiller is the lead chiller and is operated to handle the baseload cooling requirements. The centrifugal chiller is generally only operated when the building cooling load exceeds the capacity of the absorption unit. With both systems operating, the absorber typically handles 70-75% of the cooling load.

Cooling is provided continuously once the system is switched to the cooling mode, typically when the outdoor air temperature rises above 55°F(13°C). Once the chillers are manually enabled, their internal controls maintain leaving chilled water temperatures of 44°F (absorber) and 46°F (centrifugal), (7°C and 8°C respectively). Table 4-2 details the operation of the two chillers relative to outdoor air temperature.

Table 4-2
Chiller operating periods

Chiller	Outdoor Air Temperature, °F(°C)							
	55 (12)	60 (15)	65 (18)	70 (21)	75 (24)	80 (27)	85 (30)	90+ (33+)
Absorption	enabled							
Centrifugal	emergency					enabled		

The current electrical energy consumption for the building is shown in Figure 4-2, the current total energy consumption for the building is shown in Figure 4-3 and the corresponding costs for the electric and gas consumption is shown in Figure 4-4.

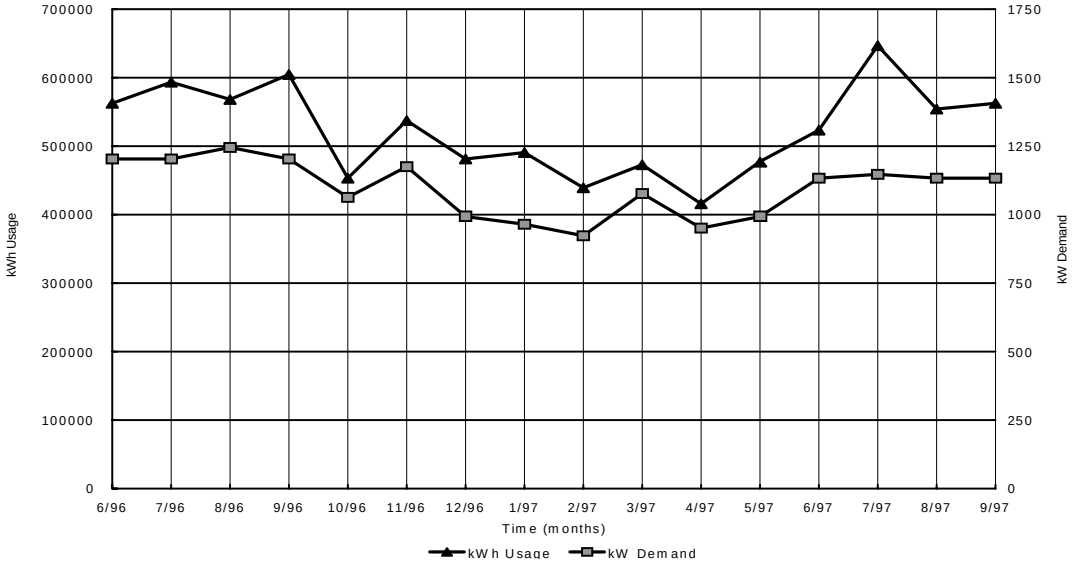

Figure 4-2
Building Current Electrical Energy Consumption

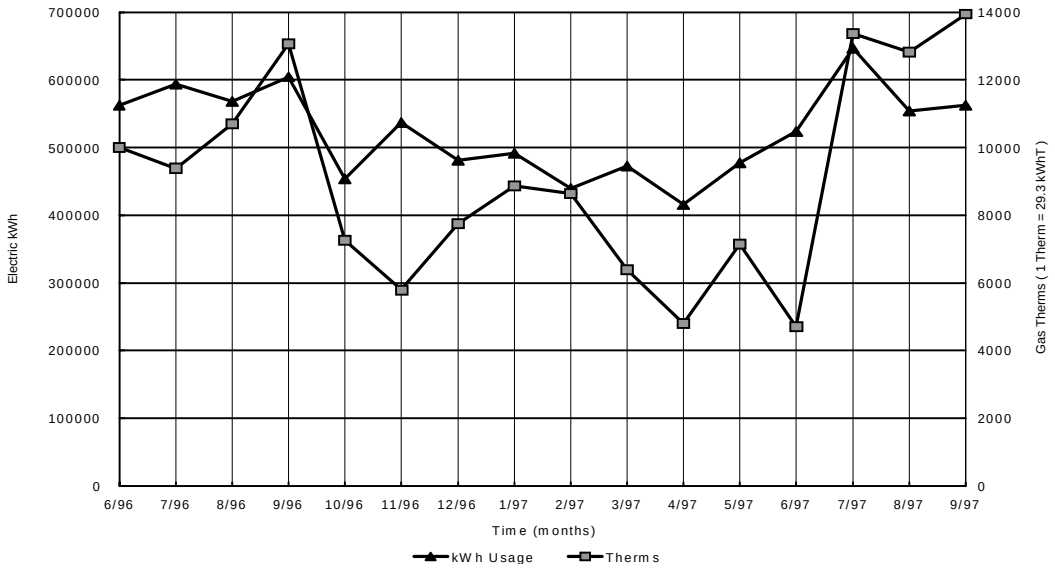

Figure 4-3
Building Current Total Energy Consumption

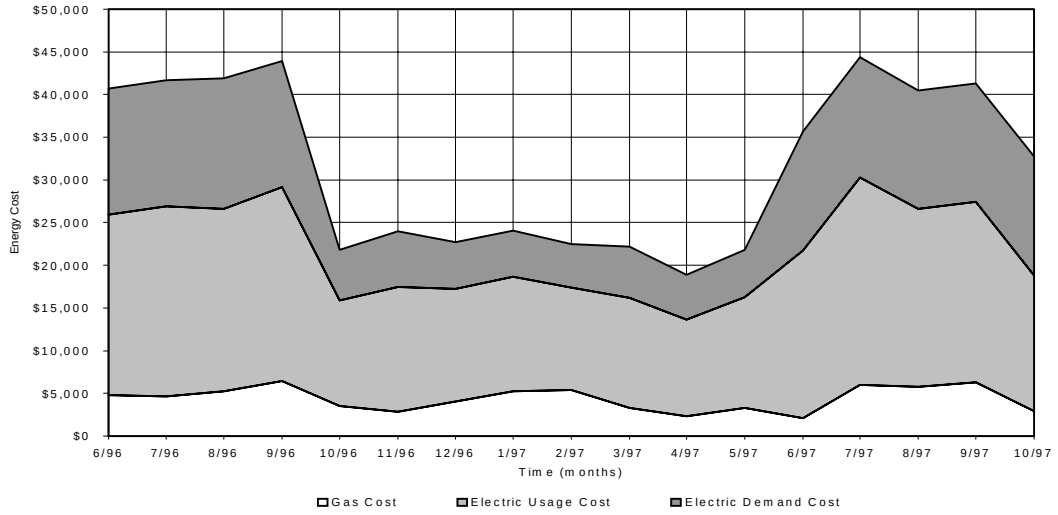

Figure 4-4
Building Current Energy Costs

Figure 4-5 shows the utility cost data by percent of total utility costs. The benefit of this information is that it can easily be seen that the primary utility cost is for electric energy, with electric demand second.

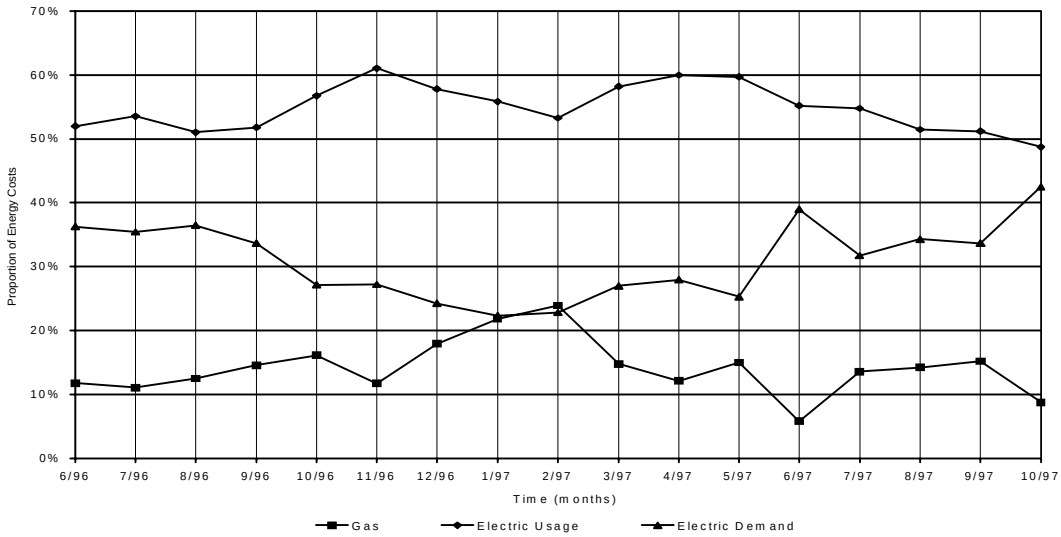

Figure 4-5
Utility Cost Data Distribution

From the utility data figures the following are obtained:

- The average energy use is 154,000 Btuh/ft^2 (485 kW_T/m^2).
- The electric baseload is 415,000 kWh/month (see April data in Figure 4-1).
- The gas baseload is 5,000 therms/month (146,500 kWh_T/month).
- The average gas cooling usage is approximately 9,000 therms/month (263,700 kWh_T/month), equating to $4,000/month.
- The average cooling electric demand is approximately 350 kW, equating to $4,300/month.
- The cooling electric usage (cooling towers, absorber pumps, primary pumps and centrifugal chiller) is approximately 185,000 kWh/month, equating to $7,000/month.
- The average winter (October-May) cost for energy is $0.040/kWh (including demand) and $0.52/therm ($0.018/kWh_T).
- The average summer (June-September) cost for energy is $0.062/kWh and $0.44/therm ($0.015/kWh_T).
- The marginal summer cost for electricity is $0.0376/kWh and $12.26/kW. These values are lower than the average due to the block billing structure in place. See Appendix C for actual rate structure. Since the electricity for cooling is an incremental load, the low marginal costs are used for analysis purposes.

Test Data

Figures 4-6 and 4-7 provide a summary of the data collected on the systems.

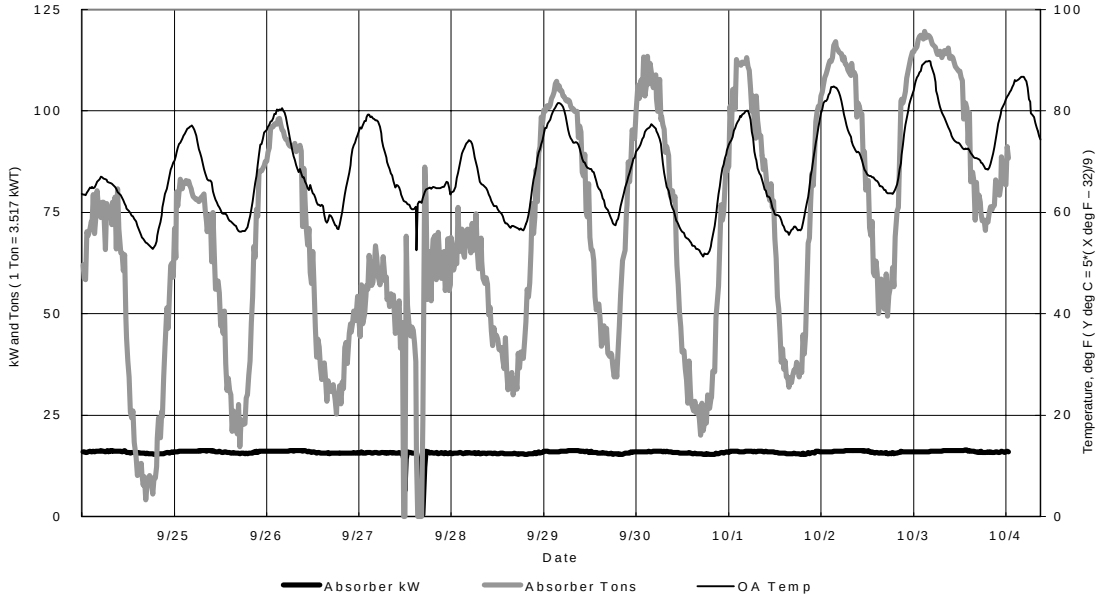

Figure 4-6
Absorption Chiller Performance

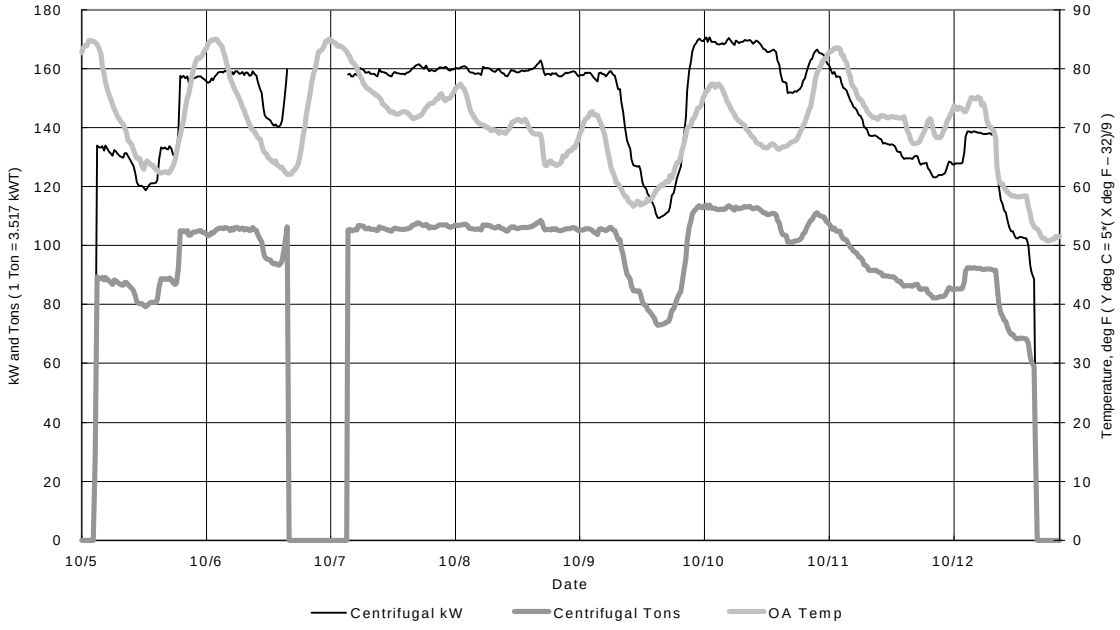

Figure 4-7
Centrifugal Chiller Performance

It should be noted that the information shown in Figure 4-7 is a best estimate of actual performance due to two sensors failing during the monitoring period. The estimate is based on information recorded using hand instruments during the test period and discussions with the chiller's manufacturer.

The following observations can be made based on the collected data (See Appendix B for actual data):

- For the absorption system, the average seasonal efficiency of the cooling tower is 0.40 kW/ton (8.8 COP). For the absorption chiller, the efficiency is 0.31 kW/ton (11.3 COP) for electricity and 0.13 therm/ton and (0.93 COP) for gas. This equates to a system coefficient of performance of 0.78 (1.3 kW/ton).

- For the centrifugal system, the efficiency of the cooling tower is 0.10 kW/ton (3.4 COP) and 0.90 kW/ton (3.79 COP) for the centrifugal chiller. This equates to a system efficiency of 1.00 kW/ton (3.41 COP).

- The average cost to operate the absorption system for the recorded period was approximately \$0.075/ton-hour (\$0.021/kWh_T) for electricity and \$0.058/ton-hour (\$0.017/kWh_T) for gas, equating to a total system cost of \$0.133/ton-hr (\$0.038/kWh_T). This value is representative of the summer (June-September) operating cost. The winter (October-May) operating costs would be approximately \$0.107/ton-hour (\$0.030/kWh_T) due to reductions in electric rates.

- The cost to operate the centrifugal system for the period recorded was approximately \$0.062/ton-hr (\$0.018/kWh_T). This value is representative of the summer (June-September) operating costs. The winter (October-May) operating costs will be approximate \$0.040/ton-hour (\$0.011/kWh_T) due to reductions in electric rates.

- Based on the recorded data (utility bill usage and system efficiencies) it is estimated that the absorption system is providing 60% of the cooling and the centrifugal 40%. The electric costs used for the previous estimates was based on the actual costs for the past year (see Appendix C for additional information on the electric and gas rate structure).

Table 4-3 provides information on the auxiliary system components (pumps).

Table 4-3
Auxiliary Energy Use

Pump	Notation	Head, ft (m)	Flowrate, gpm (L/s)
Condenser	200 ton centrifugal	81 (25)	420 (26)
Evaporator	200 ton centrifugal	55 (17)	365 (23)
Distribution	AHU West Basement	86 (26)	50 (3.2)
	AHU Supply Room	86 (26)	20 (1.3)
	WU 2nd Floor S & W	86 (26)	50 (3.2)
	WU 1st Floor N & W	86 (26)	27 (1.7)
	WU 1st Floor S & W	86 (26)	30 (1.9)
	WU 2nd Floor E	86 (26)	60 (3.8)
	AHU 2nd Floor	86 (26)	80 (5.0)
	AHU 1st Floor	86 (26)	193 (12.2)
	WU 1st Floor S & E	86 (26)	44 (2.8)
	Duplicating	86 (26)	22 (1.4)

Optimization Opportunities

Based on the collected data, four potential opportunities have been identified to optimize the operation of the chiller plant at the State Office Building. These are:

1. Staging of chillers
2. Pumping strategies
3. Cooling tower/Chiller integration
4. Upgrades

Staging of Chillers

It is estimated that the absorption chiller's performance has degraded approximately 10% and the centrifugal chiller's performance has degraded by approximately 10%. However, the cost to operate the absorption system is approximately twice that of the centrifugal system due to the high electrical use of the cooling tower (larger heat rejection required). Therefore, using the current system efficiencies, it would be advisable to operate the centrifugal chiller as the primary cooling source and the absorption machine as secondary . Basically, the centrifugal should be operated up to 80% of its capacity, then energize the absorber, and operate the absorber at 80-90% capacity. When absorber load reduces to 30% of its capacity, then cycle the centrifugal

to maintain load. The benefits of this modification would be a reduction in operating costs of approximately 20-30% ($10,000/year).

Pumping Strategies

The current pumping sequence does not obtain optimal performance. Based on discussions with operating personnel, the chillers are operating at part load a significant amount of the time due to a low system chilled water temperature differentiation and no primary/secondary pumping strategy. The schematic in Figure 4-8 details renovations to the pumping system to improve system efficiency and flexibility. Essentially, the two chillers are re-piped to form a primary system (a dedicated pump must be added to the absorption machine), reducing the required pumping energy. Further, a secondary system is created, which should increase the temperature differential of the system and chiller efficiency. A secondary benefit of these changes is increased flexibility of chiller use (primarily re-piping centrifugal chiller into primary system).

An option not pursued during this study due to high piping modification costs and control difficulties was the use of a variable speed pump to replace the current secondary pumps (P1-P10). The use of a secondary variable speed pump may be viable if the current pumps need to be replaced due to age or other problems.

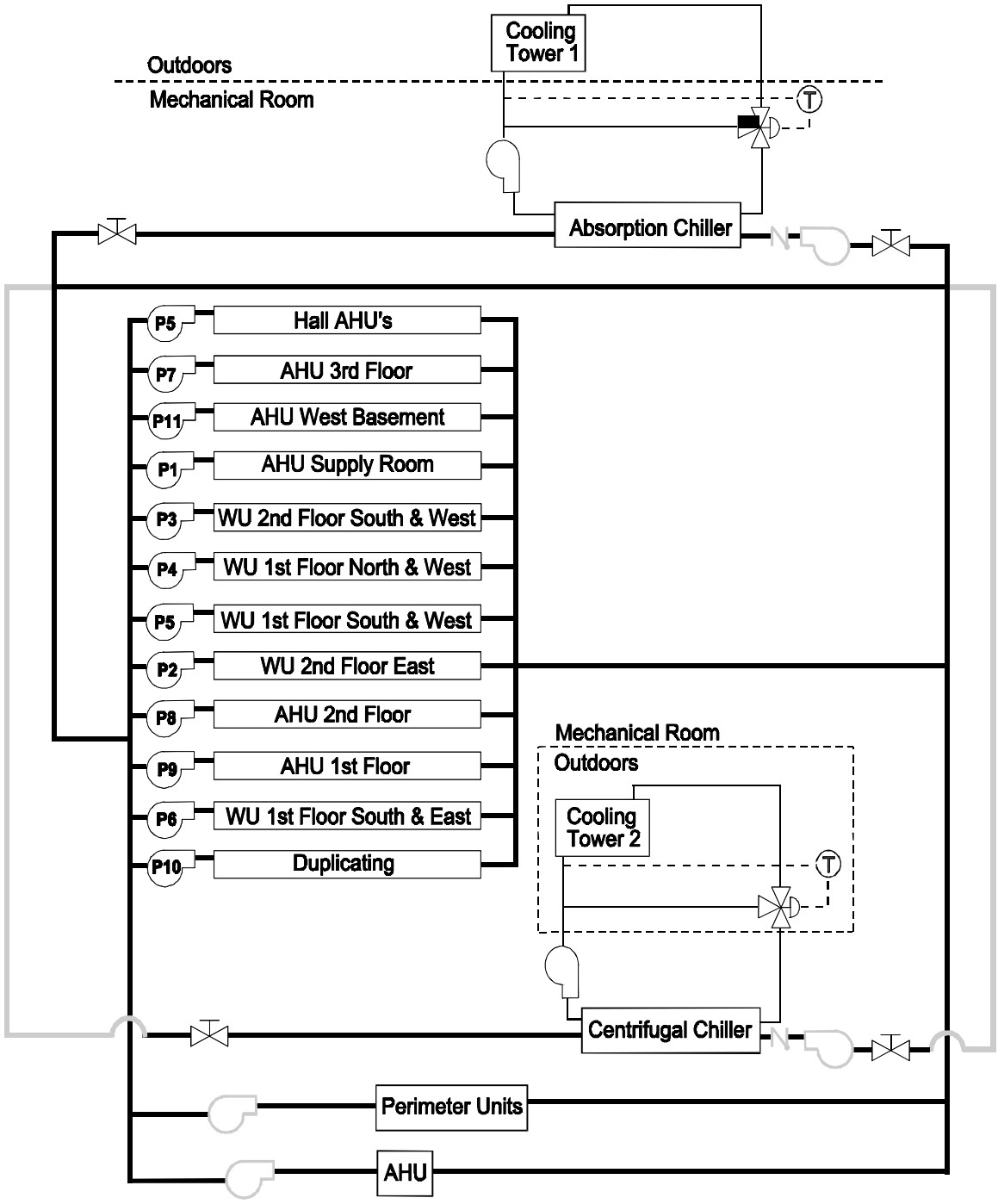

Figure 4-8
Schematic of Proposed Piping Modifications

The current distribution system should be reviewed to ensure two-way valves are not leaking. Any three-way valves should be replaced with two-way valves.

Cooling Tower/Chiller Integration

The current control of the bypass on the cooling towers and the bypass/fan staging, could be modified to improve system operation and minimize costs, especially for the absorption system. This modification would consist of automatically resetting the leaving cooling tower temperature to minimize system energy use.

It is recommended that the modifications to the centrifugal cooling tower be addressed when the centrifugal chiller is replaced (see next opportunity). Modifying the current strategy will have limited impact on the overall system energy use due to the inefficiency of the current centrifugal chiller.

Modifications to the absorption cooling tower should be accomplished as soon as possible. The opportunities include:

- Improve cooling tower part load efficiency with improved high efficiency fan
- Change fill to increase heat transfer and reduce fan usage

The benefits of these changes could be as high as a 30% reduction in cooling tower electric cost.

Upgrades

The centrifugal chiller is over 16 years old and is approaching its useful life. Also, with the phase out of R-11, the cost to maintain the system will continue to increase as leaks occur. Two options available to replace this chiller are:

- High efficiency electric chiller (HEEC)
- Gas chiller

The use of a HEEC should reduce the operating cost by $10,000 per year. This is achieved by using a chiller with a rated efficiency of 0.5 kW/ton (7.03 COP) and an integrated part load efficiency of approximately 0.7 kW/ton (5.02 COP).

The costs for the new chiller are detailed in Table 4-4.

Table 4-4
Life Cycle Cost Estimate

Chiller	First Cost	Operating	Maintenance	LCC*
New HEEC	150,000	50,000	2,125	641,380
New Absorption	260,000	52,000	4,300	762,450
No Change	75,700	60,000	2,125	661,346

*Note: Assumes a 4% inflation rate and a 6% interest rate. Based on information from R.S. Means 1997 Facilities Maintenance & Repair Cost Data. The "No Change" option does include an overhaul of the current chiller to improve its efficiency to rated conditions.

While a double-effect gas absorption system could be installed, the initial budgetary cost estimate in Table 4-3 indicates it is not economical.

Recommendations

The recommendations for the State Office Building, in priority order, are shown in Table 4-5.

Table 4-5
Recommendations

	Description	Cost, $	Savings, $/year
1	Staging of chillers	0	9,000-11,000
1	Modify pumping strategy	20,000	4,000 - 7,000
2	Upgrade absorption cooling tower	50,000	10,000 - 12,000
3	Replace centrifugal chiller w/ new HEEC	150,000	10,000 - 15,000
Total		220,000	33,000 - 45,000

The range of savings is due to unknown field conditions and the accuracy of the recorded data. For budgetary purposes, the average savings value is conservative and should be used.

5

CASE STUDY 2 - HOSPITAL

Site Description

This hospital contains diagnostic, surgery and recovery areas, a maternity ward and administrative area with an occupied space of approximately 237,000 ft^2 (21460 m^2). The building has been constructed in phases over the years, with the original building completed in 1962. While there are six chillers installed, two of these are on a separate cooling loop and were not part of the optimization study.

The four chillers analyzed vary in age with installation dates from 1962 to 1997. The characteristics of the chillers are detailed in Table 5-1. Figure 5-1 contains the schematic of the hospital cooling piping system (see Appendix C for utility rate data for this building).

Table 5-1
Chiller Characteristics - Hospital

Description	Chiller 1	Chiller 2	Chiller 3	Chiller 4
Name	90 ton	150 ton	225 ton	500 ton
Make	York	York	York	Trane
Model	LCH 100W-17PB	YCWJ56RSO/46PE	YTD1D3B2-CHATM	CVHF640
Type	Reciprocating	Reciprocating	Centrifugal	Centrifugal
Year Installed	1983	1993	1983	1997
Refrigerant	R-22	R-22	R-11	R-123
Capacity, ton (kW_T)	90 (315)	150 (530)	225 (790)	500 (1760)
CHWST, °F (°C)	40 (4)	40 (4)	40 (4)	40 (4)
CHWRT, °F (°C)	53 (12)	53 (12)	53 (12)	50 (10)
CHW Flowrate, gpm (L/S)	166 (11)	270 (17)	418 (26)	1200 (76)
CWST, °F (°C)	75 (24)	75 (24)	75 (24)	75 (24)
CWRT, °F (°C)	85 (29)	85 (29)	85 (29)	85 (29)
Power, kW	108	143	180	279
Efficiency*, kW/ton (COP)	1.2 (2.92)	0.95 (3.71)	0.80 (4.39)	0.558 (6.31)
V/A/Ø	280/275/3	460/397/3	460/425/3	460/389/3
Cooling Tower, #	1/2	1/2	1/2	3

*Rated efficiency at conditions shown

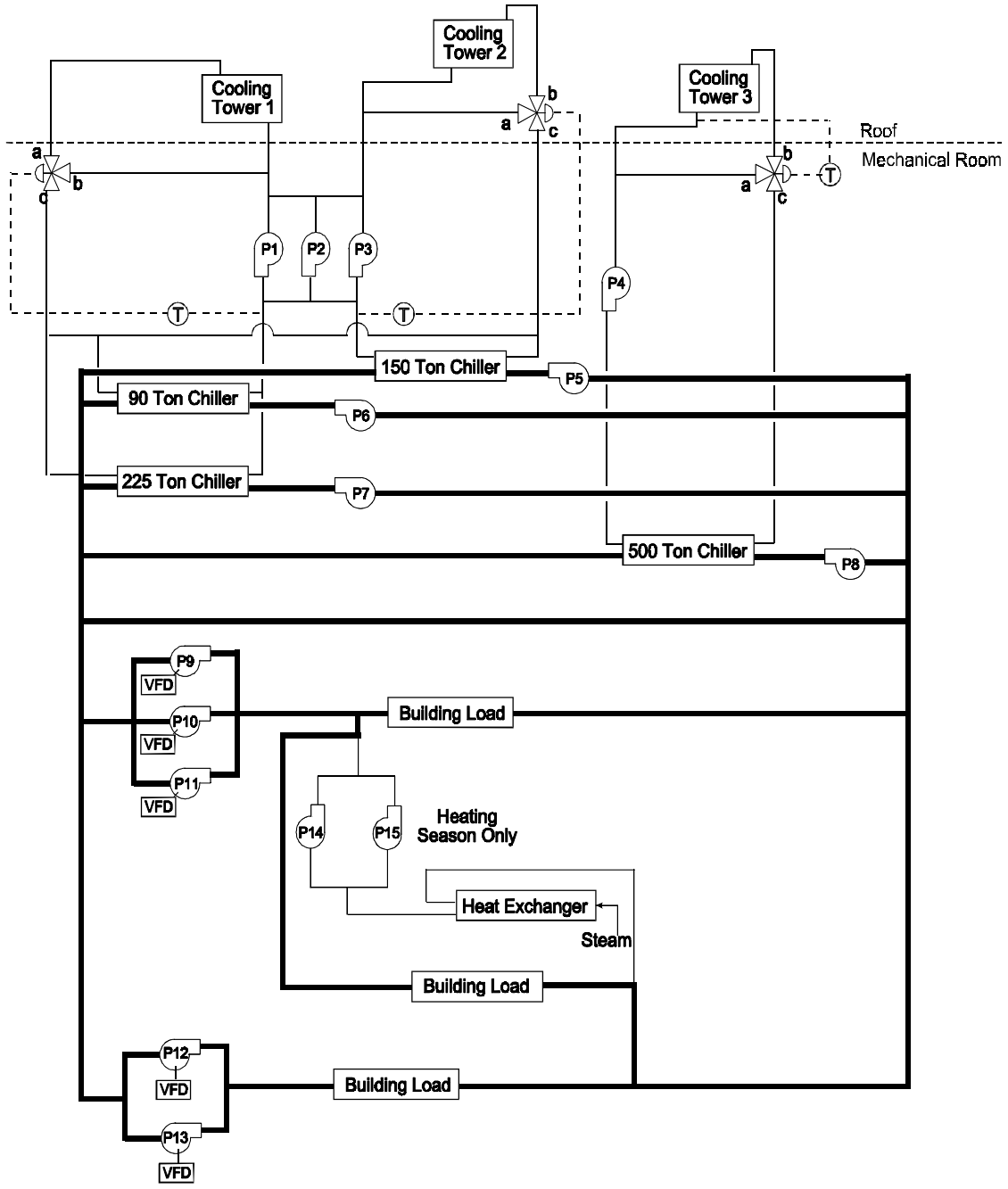

Figure 5-1
Building System Schematic

The operation of the central plant system is completely manual by the O&M staff. The building typically requires cooling when the outdoor air temperature exceeds 55°F (13°C). Currently, chiller logs are maintained on an hourly basis. When load exceeds chiller capacity (leaving chilled water temperature rises above setpoint) another chiller is energized. When the load decreases below the capacity of the chillers (all chillers are

approximately 60% load) the last chiller energized is shut down. The staging of chillers is based on operator experience and intuition as detailed in Table 5-2.

Once a chiller is energized, its internal controls maintain a discharge temperature of 40°F (4°C).

Table 5-2
Chiller operating periods

Chiller	Outdoor Air Temperature, °F(°C)							
	55 (12)	60 (15)	65 (18)	70 (21)	75 (24)	80 (27)	85 (30)	90+ (33+)
90 ton	operational						operational	
150 ton			operational					
225 ton							operational	
500 ton								operational

Note: Operator discretion allows for the 90+°F (33+°C) temperature range to be handled by the combination of the 90, 150 and 225 ton chillers (as done prior to installation of the 500 ton chiller).

The 90, 150 and 225 ton chillers utilize two cooling towers for heat rejection. The cooling towers are energized automatically as required by chiller operation to maintain the condenser water temperature at or below 85°F (29°C), down to 75°F (24°C). These two cooling towers each have a single fan (on-off) and a bypass. The 500-ton chiller utilizes a cooling tower with a similar control sequence, but has two fans and a bypass

While part of the HVAC system is two-pipe (same coil for heating and cooling), the majority of the building is served by a four-pipe system with separate heating and cooling coils. Mechanical cooling is typically provided from March through November, with air side economizers on air handlers, meeting the cooling needs the remaining months.

The current electrical usage and demand for the entire building is shown in Figure 5-2 and the current total usage and cost for the entire building in Figure 5-3. Figure 5-4 shows the distribution of the costs between the energy usage and demand.

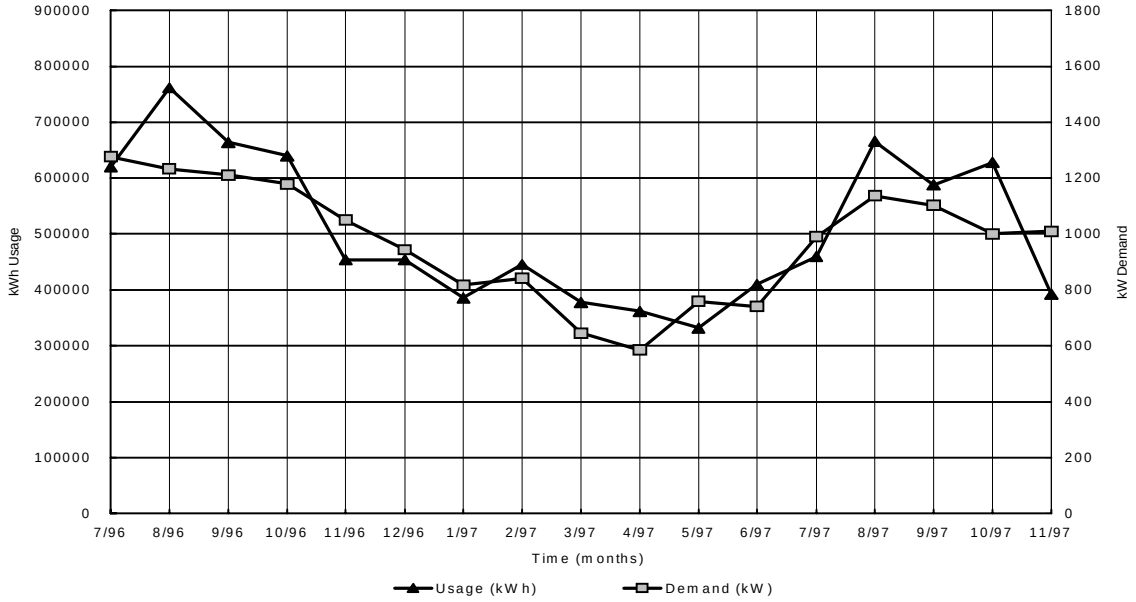

Figure 5-2
Building Current Total Energy Consumption

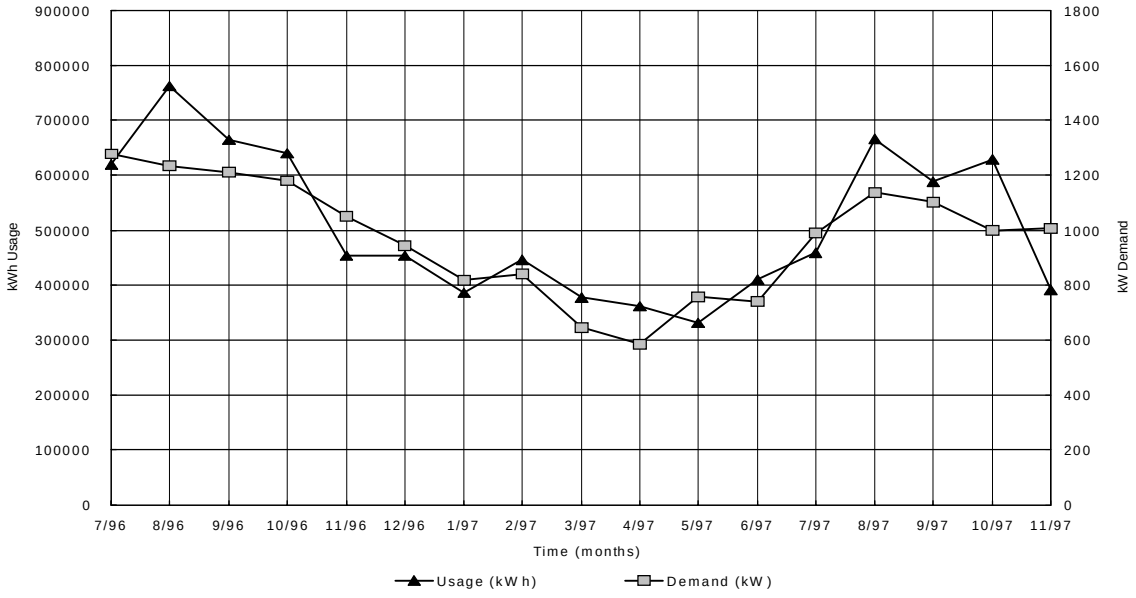

Figure 5-3
Building Current Energy Costs

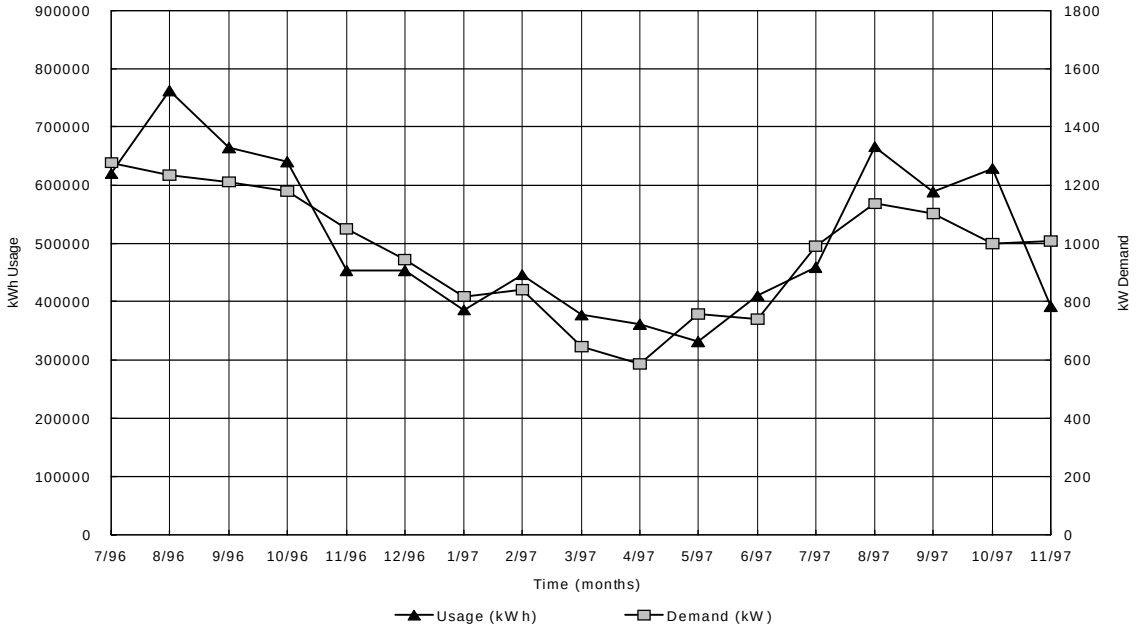

Figure 5-4
Building Current Energy Distribution

From this information, the following is obtained:

- The average energy use is 28.1 kWh/ft^2/month (310 kWh/m^2/month).
- The electric baseload is approximately 402,000 kWh/month, with a demand of 650kW (See November through March data in Figure 5-2).
- The peak cooling electric demand is approximately 600 kW prior to the 500-ton chiller addition and 470 kW after.

Test Data

Figures 5-5 and 5-6 provide a summary of the data collected on the system.

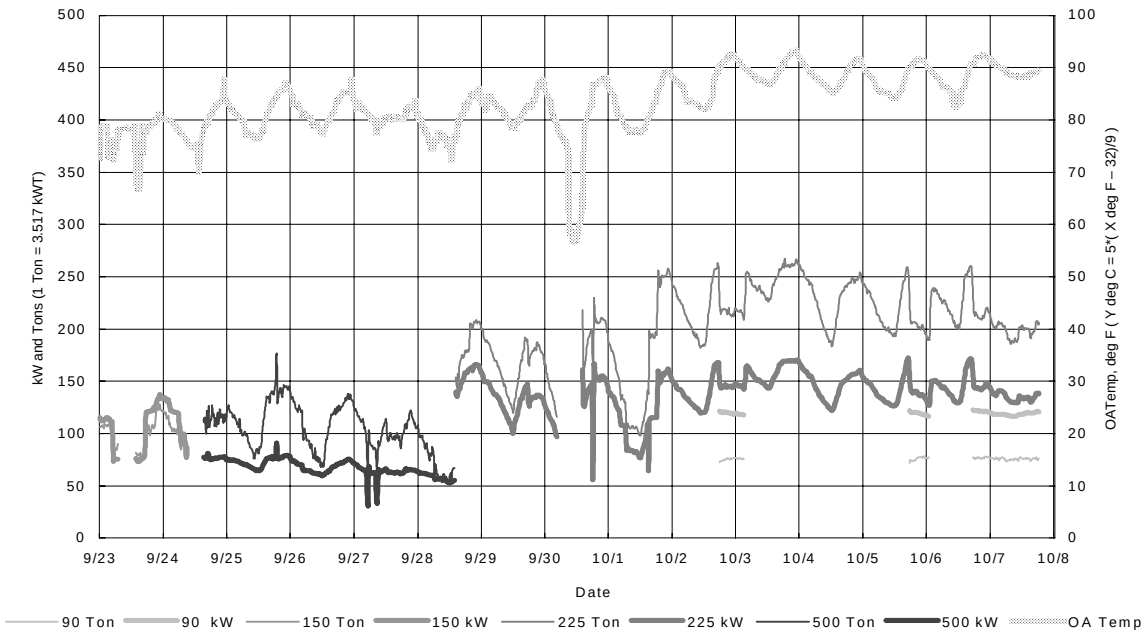

Figure 5-5
Chiller Performance

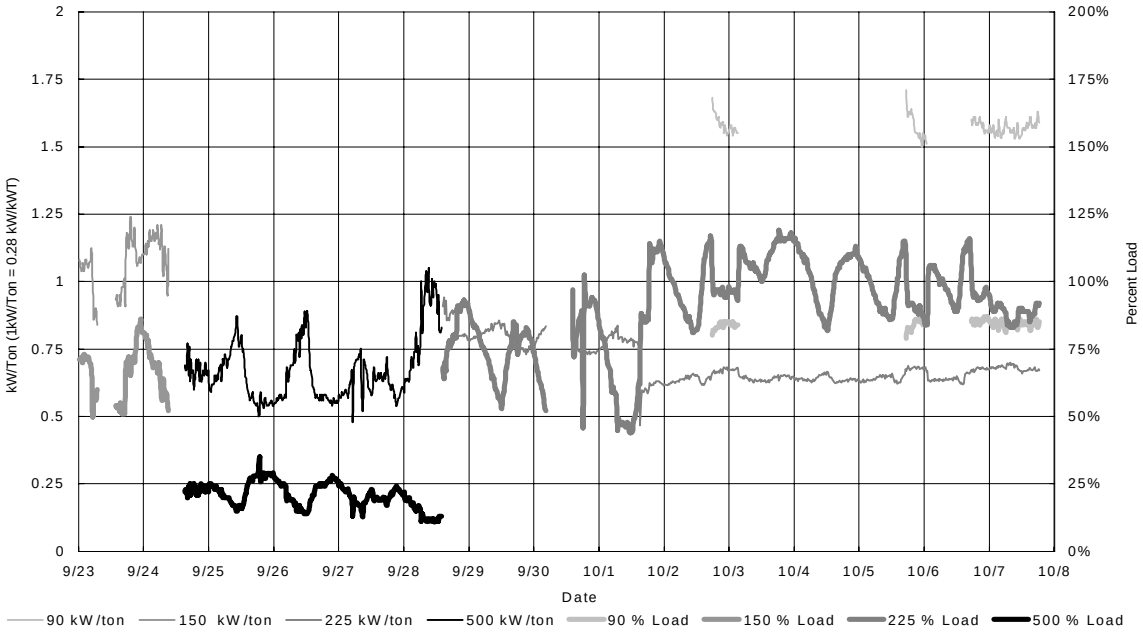

Figure 5-6
Chiller Efficiencies

Based on the data in Figure 5-5, the current operating characteristics of the chillers can be estimated. This information is shown in Table 5-3.

Table 5-3
Chiller Operating Information

Chiller	Rated efficiency kW/ton (COP)	Measured efficiency* kW/ton (COP)	Degradation Coefficient	Cost to operate $/ton hour ($/KWh$_T$)
500 ton	0.558 (6.31)	0.558 (6.31)	1.00	0.034 (0.010)
225 ton	0.80 (4.39)	0.88 (4.83)	1.10	0.054 (0.015)
150 ton	0.95 (3.71)	1.08 (4.23)	1.14	0.066 (0.020)
90 ton	1.2 (2.92)	1.58 (3.85)	1.32	0.096 (0.027)

*Values shown adjusted from part to full load using manufacturer's data

Table 5-4 provides information on the auxiliary loads for pumps.

Table 5-4
Auxiliary Energy Use

Pump	Notation	kW	Head, ft(m)	Flow Rate, gpm(L/S)
Condenser	P1	15.0	88 (27)	
Condenser	P2	14.9	75 (23)	700(44)
Condenser	P3	14.9	75 (23)	700(44)
Condenser	P4	29.8	60 (18)	1500(95)
Primary 1	P5			270(17)
Primary 2	P6		35 (11)	418(26)
Primary 3	P7		35 (11)	418(26)
Primary 4	P8	14.9	55 (17)	1200(76)
Secondary 1	P9	18.6	115 (35)	
Secondary 1	P10	10.8	120 (37)	
Secondary 1	P11	11.1	124 (38)	
Secondary 2	P12	29.8	65 (20)	1200(76)
Secondary 2	P13	29.8	65 (20)	1200(76)

Optimization Opportunities

There are four opportunities to optimize the operation of the chiller plant at the medical center. These are:

1. Staging of chillers

2. Pumping strategies

3. Cooling tower/chiller integration

4. Upgrades

Staging of Chillers

Due to the different efficiencies of the chillers at the various load levels, there is an optimum operating strategy to minimize the operating cost for providing cooling. A summary of the efficiency data for the various chillers is shown in Figure 5-5. This data was compared to the manufacturer rating data and degradation coefficients were estimated for equipment age. These coefficients are shown in Table 5-3.

Part load and full load performance curves were evaluated for the chiller using the manufacturers data and degradation coefficients. From this data, the optimization strategy shown in Table 5-5 was developed. The outdoor air operating temperatures and associated system loads are based on O&M personnel input and historical operating logs. The new staging of the chillers can be accomplished manually or through the use of an energy management system.

The benefits of this new operating strategy are reduced chiller operating costs (increase usage of 500-ton chiller) and reduced maintenance requirements (reduce use of older chillers).

Table 5-5
Chiller Optimization Sequencing Strategy

Chiller	Outdoor Air Temperature, °F(°C)							
	55(12)	60(15)	65(18)	70(21)	75(24)	80(27)	85(30)	90+(33+)
90 ton	Emergency							
150 ton	Emergency							
225 ton	operational							
500 ton				operational				

Pumping Strategies

The general pumping layout and operation is relatively good. The only opportunity for improvement is to open the triple duty valves on the variable speed secondary pumps to 100% open. Currently, the pumps are pushing against a false pressure drop across

the triple duty valves. By opening the valves up, the variable speed drives should decrease speed to compensate. This will reduce pumping energy use.

Cooling Tower/Chiller Integration

Currently, both cooling towers 1 and 2 operate whenever any of the 90, 150 or 225 ton chillers are operational. Therefore, when only one machine is operational, the cooling tower has excess capacity.

To optimize the condensers, they need to be sequenced as chillers are energized. This requires isolating condensers from the condenser water loop, which will allow the flowrate to match the requirement for the operating chillers. The benefit is reduced pumping energy (not pumping through all chiller condensers) and more efficient cooling towers (less flow, same surface area). This modification is accomplished simply by adding two-way automatic control valves to the condenser water input lines of the 90, 150 and 225 chillers.

A secondary opportunity is to allow the condenser temperature to fall below 85°F (29°C), down to 75°F (24°C), instead of bypassing water. This increases chiller efficiency with no energy penalty.

Upgrades

There are two upgrade opportunities available:

1. Single primary cooling loop

2. Chiller replacement

Single Primary Cooling Loop

By integrating the two oldest chillers, a 100 ton and a 120 ton (350 kW_T and 420 kW_T), into the primary cooling loop, the system energy use and demand can be reduced by maximizing the use of system diversity. Instead of the two chillers being at part load, in two separate loops, only one chiller would be required. The savings would be achievable whenever both current chiller loops are partially loaded (95% of the time). Further, due to the age of the two oldest chillers (in the second loop) their efficiencies are the worst of all chillers.

While the two oldest chillers were not part of the study, it is likely that due to their degradation, currently operating between 1.4kW/ton and 1.7kW/ton (2.5 to 2.1 COP), eliminating their operation would be economically feasible. Therefore, when integrated into the central cooling plant, these two chillers would be operated last.

Chiller Replacement

Several of the chillers will reach their projected life in approximately five to ten years and should be replaced within this timeframe. Based on their efficiencies, age and refrigerant, the 90-ton and the two older chillers, on the second loop, should be replaced first. Through proper sizing, replacement of these three chillers and using the new 500-ton chiller, the hospital load could be met 95-99% of the time. The 150-ton and 225-ton would be rarely used. Installing a new 125-ton ($440kW_T$) and a new 250-ton ($880kW_T$) machine to replace the three old chillers would provide for the widest operating range and best efficiencies.

Economics

The life cycle cost estimates for the potential opportunities are detailed in Table 5-6.

Table 5-6
Life cycle cost analysis

	Item	First cost	Operating savings/yr	Maintenance savings/yr	30 yr LCC, $
1	Staging of chillers	$0	$5-10,000	$2,000	($101,736) - ($174,405)
2	Pumping strategies	$0	$100-200	$0	($1,453) - ($2,907)
3	CT integration	$4,000	$500-700	$0	($3,267) - ($6,174)
4	Single cooling loop	$45,000	$2-2,600	$1,500	($5,868) - ($14,588)
5	Chiller replacement	$200,000	$5-12,000	$5-7,000	($54,663) - ($76,141)

Notes: Values in this table are shown as offsets from the base case. A negative life cycle cost (LCC) indicates a profitable option. Operating and maintenance savings are averages for the 30 year time period LCC estimate.

The Chiller replacement cost is the differential cost between replacing the chillers now or at time of failure.

Recommendations

It is recommended that opportunities 1 through 4 be implemented prior to the next cooling season. Opportunity 5 requires additional investigation. It is recommended that the hospital O&M staff review their load requirements and chiller usage after the first four opportunities are implemented to re-evaluate the need for new chillers beyond the current 500-ton ($1760kW_T$) chiller.

A

CASE STUDY 1 DATA

The following table contains portions of the data taken at the Office Building site. Data was taken at 2 minute intervals but hourly data is presented here for brevity. All temperatures are dry bulb (°F), pressure drops are in feet of water, and the abbreviations denote the following:

Temp:	temperature of outdoor air
RH:	percent relative humidity of outdoor air
CHW:	chilled water
CW:	condenser water
Sup:	temperature of supply water
Ret:	temperature of return water exiting the barrel
PD:	pressure drop across barrel
Chil kW:	electrical energy used by Chiller in kW
CoTo kW:	electrical energy used by cooling tower(s) in kW
Btuh 10^3:	natural gas energy used by absorption chiller in thousands of Btu-hours

Table A-1
Office Building Data

					Absorption Chiller								Centrifigal Chiller					
		Outdoor Air		CHW			CW		Chil	CoTo	Btuh		CHW			CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
9/24	13:00	63.47	75.40	48.92	46.11	11.37	85.12	95.45	16.00	35.55	747	52.41	52.41	10.28	75.56	73.54		
	14:00	63.86	75.37	49.29	46.14	11.54	82.60	93.42	15.86	54.85	747	52.51	52.47	10.18	75.56	73.66		
	15:00	64.80	74.51	49.43	46.16	11.51	84.06	95.17	15.98	38.51	515	52.56	52.46	10.20	75.63	73.76		
	16:00	64.97	73.91	49.73	46.61	11.56	84.73	96.61	16.00	36.08	687	52.84	52.74	10.06	75.63	73.83		
	17:00	66.30	72.77	49.60	46.16	11.47	84.94	96.51	16.15	38.79	602	52.89	52.75	9.99	75.70	73.97		
	18:00	66.90	71.36	49.41	45.93	11.50	83.05	94.01	16.11	59.77	602	52.80	52.70	9.83	75.78	74.05		
	19:00	66.35	74.43	49.74	46.29	11.59	81.61	93.52	16.07	65.95	602	53.00	53.00	9.67	75.78	74.12		
	20:00	65.78	76.58	50.32	46.92	11.53	85.64	98.07	16.19	33.39	602	53.33	53.36	9.75	75.85	74.19		
	21:00	65.31	78.44	49.61	46.36	11.50	85.01	95.68	16.17	41.80	602	52.66	52.70	9.74	75.85	74.19		
	22:00	64.06	79.43	49.36	45.74	11.53	81.60	93.44	16.16	65.63	602	52.64	52.67	9.61	75.92	74.25		
	23:00	62.91	77.09	49.23	46.29	11.38	82.31	92.39	15.99	53.32	602	52.22	52.27	9.78	75.92	74.19		
	00:00	61.22	78.51	48.60	46.43	11.69	84.56	93.65	15.94	30.51	602	51.25	51.28	9.74	75.91	74.19		
	01:00	60.24	75.84	47.27	45.73	11.62	83.45	90.77	15.86	30.81	602	50.40	50.42	9.75	75.85	74.12		
	02:00	59.19	76.30	46.65	45.49	11.61	82.72	89.16	15.76	36.43	602	49.93	49.96	9.71	75.84	73.98		
	03:00	57.37	81.45	46.52	46.06	11.72	83.88	89.92	15.68	17.42	602	49.13	49.19	9.77	75.63	73.74		

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	04:00	55.44	87.42	46.21	45.63	11.70	83.19	88.86	15.68	31.55	602	48.83	48.90	9.79	75.43	73.53		
	05:00	54.38	90.21	46.21	45.77	11.69	83.62	89.28	15.62	22.04	602	48.61	48.68	9.85	75.21	73.34		
	06:00	53.71	90.26	45.91	45.51	11.56	82.92	88.74	15.49	27.48	602	48.34	48.41	9.91	74.97	73.11		
	07:00	52.79	90.85	46.08	45.84	11.51	83.61	88.60	15.45	23.15	602	48.53	48.58	9.92	74.79	72.96		
	08:00	54.31	87.28	46.72	46.16	11.46	84.40	90.16	15.45	23.52	515	48.95	49.00	10.35	74.62	72.77		
	09:00	58.02	73.79	47.16	46.28	11.45	84.61	91.01	15.54	31.86	378	49.62	49.65	10.26	74.52	72.75		
	10:00	62.25	66.76	47.62	46.08	11.47	83.01	90.49	15.53	41.94	687	50.23	50.29	10.21	74.48	72.75		
	11:00	65.96	64.35	48.99	46.90	11.39	86.14	95.48	15.75	31.41	515	52.25	52.31	10.20	74.55	72.97		
	12:00	69.04	56.92	49.39	46.56	11.34	84.28	95.50	15.96	39.43	721	53.11	53.15	10.11	74.71	73.11		
	13:00	71.06	53.63	49.86	46.97	11.32	85.37	95.55	15.91	37.66	927	53.34	53.38	10.28	74.85	73.30		
	14:00	73.46	48.58	50.27	46.66	11.42	83.53	97.01	16.08	49.86	858	54.21	54.27	10.08	75.00	73.49		
	15:00	75.15	46.02	50.44	46.72	11.45	82.19	95.09	16.09	66.12	824	54.31	54.37	10.04	75.21	73.73		
	16:00	76.48	43.32	50.88	47.16	11.36	82.59	95.58	16.09	66.01	979	54.82	54.83	9.85	75.40	73.92		
	17:00	76.99	43.86	50.69	47.05	11.44	82.60	95.50	16.14	65.87	674	54.72	54.78	9.78	75.54	74.14		
	18:00	76.22	47.58	50.66	47.09	11.24	82.92	95.76	16.15	65.73	674	54.66	54.70	9.74	75.65	74.29		
	19:00	72.49	58.55	50.30	46.77	11.33	82.60	95.38	16.21	65.72	674	54.15	54.18	9.78	75.82	74.48		
	20:00	69.74	64.51	49.99	46.40	11.31	82.25	94.99	16.24	65.79	674	53.64	53.66	9.77	75.92	74.55		
	21:00	66.92	71.38	50.01	46.73	11.39	82.39	95.26	16.11	55.95	674	53.37	53.42	9.82	75.95	74.62		
	22:00	66.24	72.54	49.69	46.34	11.46	84.44	97.15	16.25	42.19	674	52.90	52.94	9.70	75.99	74.62		
	23:00	63.21	81.16	49.48	46.54	11.48	83.44	94.01	16.09	36.73	674	52.28	52.32	9.75	76.04	74.62		
9/26	00:00	61.36	85.26	48.79	46.18	11.51	83.87	93.59	16.01	45.08	674	51.71	51.74	9.72	76.06	74.55		
	01:00	59.84	86.64	48.27	46.15	11.56	82.47	90.66	15.83	42.56	674	50.81	50.86	9.82	75.99	74.48		
	02:00	59.79	86.61	47.60	45.92	11.57	84.30	92.22	15.88	26.53	674	50.52	50.54	9.67	75.99	74.38		
	03:00	58.31	89.82	47.48	46.08	11.54	84.18	90.88	15.80	39.36	674	50.11	50.13	9.85	75.91	74.14		
	04:00	57.74	90.05	47.27	46.10	11.65	83.68	91.12	15.83	23.50	674	49.93	49.97	9.86	75.71	73.95		
	05:00	56.75	89.61	46.83	45.92	11.49	83.46	89.44	15.58	31.48	674	49.57	49.62	9.83	75.51	73.77		
	06:00	56.21	91.17	46.92	45.85	11.54	83.49	90.71	15.65	19.61	674	49.61	49.65	10.00	75.31	73.56		
	07:00	56.32	90.00	46.62	45.59	11.47	83.80	89.51	15.53	35.91	674	49.47	49.50	10.10	75.15	73.44		
	08:00	58.20	89.07	47.80	46.23	11.45	83.52	91.67	15.61	27.38	481	50.30	50.33	10.26	74.98	73.37		
	09:00	62.12	85.63	48.70	46.28	11.54	83.80	93.11	15.69	51.68	464	51.35	51.40	10.23	74.91	73.35		
	10:00	67.13	76.17	49.65	46.21	11.28	85.52	97.91	16.16	40.19	790	52.90	52.93	10.28	74.98	73.47		
	11:00	73.34	62.87	50.48	46.62	11.36	83.66	96.49	16.09	66.30	721	54.11	54.13	10.06	75.12	73.54		
	12:00	75.78	50.94	51.11	47.20	11.38	83.24	96.21	16.07	66.10	1,030	54.64	54.68	9.97	75.21	73.69		
	13:00	76.88	46.45	51.62	47.56	11.39	83.10	96.16	16.05	66.06	824	55.35	55.36	10.03	75.36	73.86		
	14:00	78.09	43.85	52.24	47.88	11.31	82.86	96.10	16.05	66.13	996	55.80	55.84	10.03	75.50	74.08		
	15:00	79.40	43.41	52.46	48.09	11.43	82.82	96.09	16.05	65.93	798	56.11	56.12	9.86	75.63	74.26		
	16:00	80.31	42.38	52.78	48.31	11.25	82.87	96.19	16.08	65.96	798	56.28	56.30	9.89	75.81	74.47		
	17:00	80.04	44.85	52.57	48.26	11.29	83.07	96.26	16.10	65.62	641	56.16	56.16	9.70	75.92	74.62		
	18:00	77.46	50.65	52.35	48.14	11.35	82.82	95.96	16.11	65.25	641	55.86	55.88	9.80	76.06	74.78		
	19:00	73.40	58.85	51.88	47.73	11.25	82.47	95.58	16.23	65.07	641	55.25	55.26	9.82	76.16	74.91		
	20:00	70.27	64.32	51.04	46.86	11.28	81.77	94.93	16.26	65.27	641	54.40	54.41	9.77	76.23	74.98		
	21:00	67.92	69.19	50.43	46.29	11.23	81.04	94.17	16.25	65.36	641	53.68	53.71	9.73	76.28	74.98		
	22:00	66.87	68.91	50.61	47.36	11.26	83.23	93.74	16.07	38.64	641	53.37	53.38	9.77	76.34	74.98		
	23:00	65.53	71.69	50.01	46.82	11.43	81.91	92.54	16.05	53.87	641	52.57	52.58	9.70	76.35	74.94		
9/27	00:00	65.44	71.17	49.47	46.77	11.48	84.35	93.80	15.97	35.93	641	52.00	52.01	9.57	76.35	74.88		
	01:00	63.45	74.93	48.98	46.42	11.44	83.62	92.88	15.97	34.21	641	51.46	51.46	9.68	76.35	74.77		
	02:00	61.49	80.01	47.66	45.71	11.64	83.06	90.32	15.77	42.25	641	50.92	50.94	9.66	76.28	74.62		
	03:00	61.47	78.21	48.09	46.57	11.59	84.22	90.60	15.65	35.51	641	50.98	51.01	9.76	76.28	74.50		
	04:00	58.33	86.94	47.67	46.16	11.56	83.64	89.99	15.66	36.87	641	50.16	50.18	9.87	76.19	74.29		
	05:00	59.49	80.84	47.34	45.95	11.47	83.16	89.07	15.57	32.18	641	49.78	49.79	9.90	75.96	74.09		

				Absorption Chiller									Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW			CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	06:00	58.31	87.00	47.48	46.02	11.53	83.81	90.46	15.69	24.81	641	49.90	49.93	9.83	75.78	73.90		
	07:00	56.81	88.83	47.26	45.94	11.40	83.11	89.28	15.66	30.22	641	49.61	49.64	9.88	75.56	73.76		
	08:00	58.81	85.38	47.44	46.19	11.59	83.35	89.74	15.60	27.89	641	49.73	49.75	10.07	75.38	73.56		
	09:00	63.47	74.76	48.01	46.14	11.47	83.22	90.36	15.63	48.62	641	50.93	50.94	10.11	75.20	73.47		
	10:00	67.73	66.47	48.21	46.17	11.47	82.36	89.53	15.64	59.81	641	51.27	51.28	10.04	75.20	73.46		
	11:00	72.49	56.94	48.43	46.28	11.33	82.74	90.60	15.62	65.40	641	51.78	51.78	10.04	75.20	73.40		
	12:00	74.64	50.87	48.23	45.98	11.50	82.82	90.70	15.63	62.12	641	51.70	51.71	10.00	75.27	73.40		
	13:00	76.76	48.22	48.60	46.61	11.58	82.28	89.64	15.58	65.34	641	51.66	51.66	9.94	75.27	73.40		
	14:00	78.02	46.85	48.76	46.52	11.51	83.08	91.21	15.71	65.21	488	51.87	51.89	10.00	75.29	73.47		
	15:00	79.25	47.64	48.99	46.46	11.40	82.53	90.91	15.85	64.97	488	52.04	52.05	9.88	75.40	73.50		
	16:00	78.93	49.50	49.19	46.62	11.43	82.63	91.52	15.70	64.94	488	52.15	52.16	9.85	75.42	73.54		
	17:00	78.20	51.89	49.11	46.10	11.47	82.95	92.31	15.87	64.88	488	52.45	52.45	9.85	75.49	73.69		
	18:00	76.94	52.37	49.29	46.71	11.40	82.00	90.55	15.70	64.88	488	52.21	52.22	9.97	75.53	73.76		
	19:00	72.97	59.76	48.84	45.95	11.45	83.93	93.53	15.83	41.31	488	51.95	51.97	9.86	75.56	73.80		
	20:00	69.97	65.59	48.88	46.48	11.53	82.18	90.42	15.65	60.53	488	51.62	51.64	9.84	75.56	73.83		
	21:00	67.62	69.45	48.83	46.35	11.46	82.89	91.15	15.77	57.55	488	51.46	51.46	9.71	75.63	73.83		
	22:00	64.88	74.85	48.50	46.47	11.54	82.54	90.28	15.62	38.51	488	51.00	51.01	9.66	75.63	73.83		
	23:00	64.86	72.56	48.34	45.94	11.45	83.99	92.87	15.85	29.39	488	50.96	50.97	9.72	75.63	73.76		
9/28	00:00	62.85	76.36	47.98	45.82	11.40	82.56	90.39	15.69	42.59	488	50.63	50.63	9.74	75.63	73.69		
	01:00	61.96	77.81	52.48	49.35	11.32	83.39	94.78	14.32	32.79	488	55.76	55.77	9.76	75.63	73.69		
	02:00	60.87	80.62	48.04	46.03	11.43	81.46	89.00	15.79	27.49	488	50.55	50.56	9.85	75.56	73.54		
	03:00	60.67	79.69	48.02	46.11	11.61	83.09	90.45	15.65	37.68	488	50.17	50.17	9.85	75.56	73.47		
	04:00	61.59	76.19	54.65	56.35	11.28	80.40	93.91	14.25	0.21	488	54.06	54.05	9.60	75.49	73.40		
	05:00	61.84	76.21	65.25	66.56	11.15	81.95	97.11	0.45	0.00	488	64.58	64.58	9.61	75.49	73.33		
	06:00	64.46	77.24	49.54	45.97	11.30	83.27	93.98	16.08	59.65	488	53.25	53.27	9.70	75.56	73.40		
	07:00	64.81	80.51	49.08	46.14	11.48	84.09	93.12	15.69	51.56	488	51.84	51.85	9.93	75.56	73.40		
	08:00	65.10	65.07	48.92	45.81	11.27	82.28	90.13	15.66	35.88	488	50.86	50.87	10.02	75.56	73.40		
	09:00	64.74	70.37	48.86	46.00	11.38	81.45	88.86	15.74	25.03	488	50.54	50.54	10.07	75.49	73.33		
	10:00	64.97	64.69	48.86	46.20	11.33	81.59	88.77	15.76	26.27	488	50.44	50.45	10.08	75.49	73.33		
	11:00	65.56	63.42	48.91	46.40	11.46	82.87	89.76	15.74	36.61	488	50.35	50.37	10.07	75.49	73.20		
	12:00	64.86	66.31	49.04	46.50	11.23	83.37	90.95	15.69	48.80	488	50.39	50.41	10.05	75.42	73.17		
	13:00	64.00	63.92	49.16	46.12	11.32	83.12	90.98	15.51	47.30	488	50.47	50.48	10.00	75.42	73.11		
	14:00	66.82	55.84	49.29	46.45	11.25	81.93	89.31	15.66	31.12	428	50.44	50.45	9.96	75.34	73.04		
	15:00	70.32	48.99	49.11	46.12	11.41	81.19	88.24	15.76	27.67	428	50.16	50.17	9.97	75.27	72.97		
	16:00	72.71	41.16	49.54	46.63	11.26	84.23	91.72	15.64	35.31	428	50.70	50.70	10.01	75.27	72.90		
	17:00	73.84	40.70	49.52	46.33	11.44	83.57	91.98	15.64	55.70	428	50.79	50.79	9.96	75.27	72.89		
	18:00	73.48	43.54	49.52	46.28	11.54	83.44	91.93	15.71	45.97	428	51.03	51.03	9.92	75.27	72.89		
	19:00	69.86	48.67	49.18	45.81	11.42	83.45	91.54	15.52	38.58	428	50.57	50.58	9.94	75.20	72.90		
	20:00	65.98	59.98	48.88	45.97	11.18	81.73	89.03	15.56	27.51	428	49.94	49.94	9.90	75.20	72.86		
	21:00	65.43	60.61	49.07	46.40	11.34	82.54	89.03	15.67	27.93	428	49.87	49.87	9.85	75.13	72.82		
	22:00	64.29	58.45	49.18	46.59	11.43	83.44	90.72	15.60	43.66	428	50.04	50.05	9.68	75.13	72.76		
	23:00	62.29	60.38	48.53	46.47	11.56	82.48	88.02	15.64	18.92	428	49.52	49.52	9.69	75.06	72.72		
9/29	00:00	61.29	62.65	48.26	46.27	11.59	82.50	88.20	15.66	21.47	428	49.24	49.26	9.67	74.98	72.66		
	01:00	60.18	66.72	48.32	46.47	11.56	82.82	88.32	15.54	30.54	428	49.18	49.18	9.69	74.98	72.56		
	02:00	59.21	69.49	48.11	46.39	11.62	81.87	87.06	15.57	16.47	428	48.89	48.89	9.81	74.91	72.44		
	03:00	57.76	72.43	47.86	46.24	11.37	83.63	88.71	15.57	27.37	428	48.37	48.37	9.79	74.73	72.25		
	04:00	57.01	72.26	47.85	46.31	11.52	82.37	87.46	15.49	15.21	428	48.28	48.29	9.66	74.48	72.06		
	05:00	57.23	70.10	47.59	46.15	11.54	83.31	87.99	15.63	25.02	428	47.96	47.96	9.77	74.24	71.91		
	06:00	56.78	70.32	47.97	46.16	11.48	83.35	89.09	15.34	24.87	428	48.41	48.41	9.78	74.05	71.73		
	07:00	56.62	69.32	48.36	46.57	11.49	83.40	88.95	15.46	23.72	428	48.62	48.62	10.07	73.84	71.60		

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	08:00	57.67	67.41	48.56	46.40	11.48	83.34	89.33	15.38	29.07	481	49.01	49.01	10.23	73.69	71.53		
	09:00	61.00	64.04	49.04	46.44	11.46	82.11	89.31	15.54	22.90	515	49.17	49.17	10.28	73.61	71.52		
	10:00	66.48	53.91	50.41	47.24	11.29	85.97	95.09	15.53	48.76	549	51.30	51.30	10.35	73.63	71.61		
	11:00	70.65	47.33	51.20	47.70	11.45	86.48	96.03	15.62	57.51	652	52.51	52.51	10.26	73.76	71.80		
	12:00	73.42	44.04	51.70	47.24	11.36	81.65	93.54	15.74	38.89	901	53.27	53.27	10.16	73.89	72.04		
	13:00	76.60	40.74	51.47	46.93	11.26	84.31	96.93	16.06	66.30	567	53.15	53.15	10.26	74.07	72.34		
	14:00	77.92	39.16	52.26	47.69	11.34	84.14	96.86	15.99	65.99	961	54.02	54.02	10.23	74.19	72.60		
	15:00	79.77	35.64	53.15	48.43	11.24	84.17	97.05	15.95	65.96	858	55.13	55.12	9.95	74.40	72.85		
	16:00	81.13	34.21	53.52	48.66	11.33	84.04	97.14	15.98	65.92	1,133	55.62	55.63	9.98	74.55	73.10		
	17:00	81.48	36.19	53.37	48.59	11.25	84.04	97.10	16.08	65.67	681	55.51	55.51	9.80	74.74	73.37		
	18:00	79.99	38.77	52.83	48.13	11.30	83.76	96.75	16.08	65.18	681	54.87	54.87	9.87	74.87	73.56		
	19:00	76.29	43.74	52.12	47.45	11.25	83.18	96.10	16.21	65.15	681	54.02	54.03	9.82	74.98	73.76		
	20:00	74.21	47.92	51.58	47.00	11.22	82.84	95.67	16.20	65.35	681	53.43	53.43	9.86	75.13	73.89		
	21:00	73.85	47.07	51.37	46.84	11.31	82.43	95.28	16.25	65.34	681	53.17	53.17	9.88	75.20	73.98		
	22:00	72.64	49.60	51.32	46.96	11.34	81.62	93.39	16.04	41.16	681	52.84	52.84	9.75	75.27	74.05		
	23:00	69.98	55.19	51.14	47.32	11.28	82.77	93.52	16.15	37.68	681	52.43	52.43	9.58	75.34	74.05		
9/30	00:00	68.79	55.27	50.49	47.13	11.28	81.50	91.03	16.15	37.06	681	51.62	51.61	9.88	75.42	74.02		
	01:00	68.54	51.31	49.83	46.82	11.21	82.09	90.08	16.10	31.42	681	51.35	51.35	9.86	75.34	73.90		
	02:00	67.02	52.27	49.37	46.95	11.56	83.48	91.18	15.84	39.13	681	50.80	50.79	9.79	75.34	73.83		
	03:00	64.64	55.95	49.19	46.83	11.42	83.39	90.39	15.68	43.11	681	50.73	50.72	9.73	75.34	73.76		
	04:00	62.78	57.30	48.89	46.84	11.45	81.43	88.54	15.73	25.00	681	50.22	50.19	9.72	75.34	73.69		
	05:00	60.73	61.60	48.59	46.51	11.50	82.13	88.72	15.63	32.62	681	50.03	50.02	9.90	75.27	73.52		
	06:00	58.82	64.71	48.22	46.40	11.38	82.24	88.53	15.65	18.52	681	49.34	49.33	10.00	75.22	73.36		
	07:00	57.62	66.50	48.31	46.75	11.40	83.00	89.01	15.46	27.65	681	49.31	49.27	10.14	75.00	73.14		
	08:00	58.73	63.20	48.72	46.87	11.41	83.65	89.66	15.32	25.75	502	49.46	49.45	10.22	74.84	73.04		
	09:00	62.70	53.32	49.36	46.48	11.23	82.55	91.11	15.41	40.78	502	50.66	50.64	10.38	74.71	72.97		
	10:00	65.68	47.23	50.27	46.86	11.23	81.97	91.24	15.67	31.08	502	51.94	51.93	10.37	74.70	73.03		
	11:00	67.89	44.20	51.25	47.49	11.26	84.94	95.87	15.72	52.95	793	52.74	52.74	10.27	74.77	73.04		
	12:00	70.49	42.25	51.41	47.16	11.37	83.98	95.66	15.92	49.65	793	53.05	53.03	10.13	74.88	73.17		
	13:00	72.41	38.72	52.22	47.37	11.21	82.38	96.02	15.92	49.65	793	54.47	54.44	10.24	74.98	73.37		
	14:00	73.73	36.29	52.24	47.37	11.37	82.12	96.07	15.92	49.65	755	54.49	54.48	10.36	75.14	73.56		
	15:00	75.82	30.77	52.58	47.84	11.15	83.65	96.69	15.92	49.65	755	54.74	54.72	10.12	75.27	73.77		
	16:00	76.71	28.52	52.74	47.89	11.25	82.76	96.26	16.05	43.20	886	54.92	54.91	9.97	75.43	73.98		
	17:00	76.98	26.43	52.50	47.70	11.29	83.06	96.35	16.08	41.88	886	54.71	54.70	9.92	75.56	74.15		
	18:00	76.03	29.27	52.05	47.38	11.30	83.27	96.38	16.13	42.57	539	54.23	54.23	9.81	75.64	74.28		
	19:00	73.41	35.40	51.78	47.29	11.12	82.81	95.12	16.08	40.06	539	53.88	53.87	10.02	75.78	74.41		
	20:00	67.85	47.23	51.32	46.97	11.24	82.45	94.55	16.09	49.72	539	53.32	53.29	9.85	75.85	74.48		
	21:00	64.22	58.36	50.94	46.87	11.14	82.88	93.93	16.03	37.60	539	52.66	52.64	9.78	75.85	74.48		
	22:00	60.79	66.47	50.81	47.21	11.51	81.88	91.50	15.86	42.96	539	52.10	52.09	9.69	75.92	74.48		
	23:00	58.41	70.20	49.94	46.93	11.34	82.84	91.70	15.82	37.09	539	50.79	50.77	9.80	75.85	74.38		
10/1	00:00	57.13	72.77	48.99	46.72	11.47	83.52	90.41	15.71	20.08	539	49.67	49.65	9.83	75.67	74.16		
	01:00	55.89	75.63	48.66	46.81	11.40	81.93	88.39	15.68	23.37	539	49.55	49.53	9.70	75.49	73.96		
	02:00	54.80	78.06	48.09	46.83	11.34	83.05	88.43	15.62	22.26	539	48.94	48.91	9.82	75.27	73.74		
	03:00	54.04	78.45	47.59	46.32	11.44	82.92	88.13	15.60	10.50	539	48.52	48.51	9.91	75.07	73.48		
	04:00	53.22	83.76	47.54	46.26	11.48	82.42	87.74	15.59	21.74	539	48.43	48.42	9.84	74.85	73.22		
	05:00	52.53	82.04	47.59	46.50	11.48	82.06	87.04	15.50	17.34	539	48.07	48.05	9.81	74.62	73.01		
	06:00	51.21	83.72	47.39	46.44	11.53	82.96	87.57	15.35	19.08	539	47.67	47.67	9.91	74.45	72.74		
	07:00	51.75	85.48	47.44	46.40	11.31	82.38	87.15	15.28	14.89	539	48.01	48.01	10.03	74.25	72.51		
	08:00	53.31	84.59	47.80	46.49	11.31	82.89	88.00	15.31	23.43	433	48.60	48.58	10.30	74.12	72.36		
	09:00	57.36	76.00	48.28	46.66	11.33	84.35	89.86	15.38	25.67	433	49.39	49.36	10.27	74.05	72.27		

				Absorption Chiller									Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW			CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	10:00	63.57	63.44	49.22	46.64	11.34	82.38	89.73	15.43	37.07	515	50.76	50.75	10.30	73.98	72.32		
	11:00	68.75	43.53	50.50	47.17	11.29	83.73	93.99	15.84	36.39	556	52.35	52.34	10.33	74.11	72.47		
	12:00	71.36	38.08	51.07	47.09	11.32	84.78	95.85	15.91	34.99	556	53.10	53.08	10.12	74.25	72.68		
	13:00	73.88	36.56	52.02	47.41	11.23	83.19	96.36	16.05	48.85	670	54.23	54.23	10.08	74.42	72.85		
	14:00	76.15	35.02	51.66	46.85	11.23	81.96	94.99	16.08	66.62	1,099	54.15	54.13	10.02	74.58	73.10		
	15:00	77.96	32.15	52.03	46.92	11.12	79.40	92.99	16.09	66.30	1,099	54.56	54.55	10.05	74.77	73.35		
	16:00	78.82	31.06	52.31	47.24	11.21	79.49	93.07	15.99	66.41	803	54.90	54.90	9.84	74.91	73.56		
	17:00	79.91	30.16	52.20	47.10	11.21	79.49	93.11	16.06	66.38	803	54.83	54.81	9.81	75.12	73.80		
	18:00	79.29	32.26	51.66	46.64	11.18	79.31	92.86	16.09	66.26	611	54.26	54.25	9.86	75.27	74.02		
	19:00	74.64	39.12	51.36	46.64	11.21	80.04	92.27	16.03	66.40	611	53.88	53.88	9.83	75.41	74.17		
	20:00	70.25	48.41	51.30	46.58	11.23	81.09	93.46	16.00	62.84	611	53.58	53.56	9.90	75.49	74.26		
	21:00	67.23	56.46	51.11	46.84	11.26	84.00	96.08	16.15	42.54	611	53.23	53.21	9.92	75.56	74.40		
	22:00	64.48	67.39	51.11	47.10	11.21	82.76	93.66	16.02	49.38	611	53.01	52.98	9.61	75.63	74.41		
	23:00	63.10	66.08	50.83	47.22	11.28	82.95	92.74	15.90	33.67	611	52.37	52.35	9.65	75.63	74.41		
10/2	00:00	60.92	71.81	50.32	46.86	11.34	83.31	92.82	15.89	44.04	611	51.91	51.89	9.81	75.67	74.34		
	01:00	59.51	74.27	49.57	46.67	11.32	82.57	91.05	15.80	29.49	611	50.75	50.73	9.80	75.63	74.23		
	02:00	59.11	75.14	48.70	46.66	11.46	82.77	89.08	15.60	34.11	611	49.93	49.92	9.85	75.51	74.04		
	03:00	57.19	80.42	48.28	46.64	11.33	82.52	88.54	15.57	28.13	611	49.40	49.38	9.68	75.31	73.83		
	04:00	56.14	83.21	48.18	46.62	11.34	83.11	88.92	15.55	16.18	611	49.09	49.07	9.79	75.14	73.66		
	05:00	56.63	80.21	48.09	46.60	11.29	83.35	88.87	15.54	32.88	611	49.01	49.00	9.87	74.92	73.44		
	06:00	57.23	77.55	48.12	46.50	11.26	83.23	88.65	15.41	14.25	611	49.07	49.04	9.93	74.77	73.21		
	07:00	56.53	78.78	47.99	46.43	11.39	83.24	88.57	15.44	26.01	611	49.16	49.14	10.02	74.62	73.09		
	08:00	57.97	75.80	48.46	46.42	11.28	82.86	90.34	15.58	18.68	371	49.74	49.72	10.25	74.49	72.98		
	09:00	61.84	69.58	49.15	46.59	11.30	82.91	90.80	15.51	42.40	536	50.44	50.42	10.34	74.42	72.97		
	10:00	67.12	57.74	50.41	46.84	11.11	82.39	92.13	15.69	64.08	536	52.65	52.64	10.19	74.48	73.04		
	11:00	72.05	48.61	51.09	47.04	11.25	81.69	92.23	15.68	66.58	824	53.41	53.39	10.15	74.58	73.11		
	12:00	76.74	41.67	51.90	47.28	11.18	84.55	97.36	16.08	66.32	948	54.06	54.04	10.02	74.74	73.30		
	13:00	80.32	38.06	53.45	48.64	11.07	84.35	97.47	15.96	66.12	948	55.76	55.75	10.10	74.88	73.47		
	14:00	81.92	37.58	54.31	49.30	11.09	84.22	97.61	15.95	66.03	858	56.67	56.66	9.91	75.06	73.73		
	15:00	83.65	38.45	54.79	49.60	10.97	83.73	97.33	16.01	65.68	858	57.20	57.18	10.01	75.26	73.93		
	16:00	84.84	39.51	54.89	49.55	11.05	81.71	95.90	16.06	65.63	753	57.48	57.46	9.93	75.43	74.19		
	17:00	84.26	40.60	54.52	49.21	11.02	81.69	95.77	16.08	65.56	753	57.01	57.00	9.82	75.60	74.46		
	18:00	81.93	42.64	53.94	48.70	11.06	81.24	95.25	16.13	65.12	753	56.47	56.45	9.71	75.78	74.66		
	19:00	78.25	47.17	53.16	48.01	10.98	80.48	94.46	16.22	65.00	753	55.61	55.59	9.84	75.92	74.88		
	20:00	75.60	52.86	52.50	47.47	11.09	79.82	93.68	16.22	65.18	753	54.92	54.90	9.94	76.06	74.98		
	21:00	73.20	57.70	51.84	46.82	11.04	79.34	93.16	16.25	65.12	753	54.24	54.22	9.85	76.15	75.13		
	22:00	71.90	59.95	51.56	47.06	11.21	81.81	94.13	16.19	65.18	753	53.58	53.56	9.70	76.21	75.13		
	23:00	71.10	60.37	51.33	46.80	11.17	82.47	95.37	16.23	65.05	753	53.47	53.43	9.74	76.28	75.13		
10/3	00:00	68.41	65.95	51.42	47.29	11.10	83.69	95.89	16.25	43.11	753	53.26	53.24	9.84	76.28	75.13		
	01:00	67.29	67.29	50.45	46.67	11.14	84.24	95.10	16.23	37.87	753	52.24	52.23	9.86	76.35	75.03		
	02:00	66.91	65.82	49.44	46.11	11.14	83.99	93.37	15.96	36.03	753	51.86	51.82	9.77	76.35	74.91		
	03:00	66.30	65.87	48.82	45.97	11.35	82.77	90.95	15.76	44.77	753	51.23	51.22	9.78	76.28	74.83		
	04:00	65.19	67.61	48.71	46.29	11.28	81.98	89.41	15.61	51.42	753	50.96	50.93	9.83	76.28	74.64		
	05:00	64.41	69.35	49.12	46.80	11.30	82.82	89.67	15.63	38.81	753	51.05	51.04	9.89	76.28	74.53		
	06:00	63.78	70.83	49.03	46.80	11.32	83.52	91.03	15.55	23.07	753	50.83	50.80	9.97	76.21	74.40		
	07:00	63.76	71.50	49.32	46.72	11.23	82.36	90.02	15.56	36.55	753	51.62	51.59	9.99	76.21	74.23		
	08:00	64.55	72.16	49.82	46.67	11.20	81.55	90.37	15.58	52.82	592	52.35	52.34	10.33	76.14	74.16		
	09:00	68.54	69.05	51.16	47.06	11.02	80.38	91.05	15.73	66.25	853	53.56	53.53	10.26	76.14	74.12		
	10:00	73.19	65.03	52.39	47.70	11.04	84.46	97.31	16.03	66.00	853	54.51	54.49	10.19	76.21	74.18		
	11:00	78.58	57.00	54.62	49.62	10.93	84.61	98.12	15.92	65.53	853	56.87	56.86	10.07	76.21	74.26		

					Absorption Chiller								Centrifigal Chiller					
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	12:00	82.15	49.16	55.41	50.22	11.04	84.37	98.20	15.98	65.43	979	57.74	57.73	10.00	76.28	74.45		
	13:00	85.26	45.03	56.09	50.74	10.91	84.04	98.12	15.92	65.28	979	58.51	58.50	10.16	76.43	74.65		
	14:00	87.04	41.67	56.55	51.09	10.86	83.80	98.15	15.93	65.26	901	59.04	59.04	10.23	76.57	74.92		
	15:00	88.93	39.83	56.85	51.35	10.84	83.78	98.15	15.91	65.18	901	59.44	59.43	10.07	76.71	75.18		
	16:00	89.81	38.80	56.93	51.40	10.71	83.54	97.96	15.95	64.99	795	59.62	59.61	9.97	76.86	75.45		
	17:00	89.71	38.47	56.54	51.05	10.83	83.05	97.41	16.04	64.93	795	59.29	59.27	9.62	77.00	75.65		
	18:00	87.16	42.22	56.18	50.79	10.87	83.03	97.33	16.05	64.51	795	58.87	58.85	9.81	77.14	75.89		
	19:00	83.04	52.43	55.99	50.68	10.81	83.20	97.43	16.06	64.31	795	58.49	58.48	9.75	77.24	76.07		
	20:00	79.70	59.95	55.70	50.41	10.73	82.91	97.13	16.12	64.23	795	58.18	58.16	9.81	77.36	76.21		
	21:00	78.05	64.68	55.60	50.33	10.97	82.79	96.96	16.23	64.27	795	58.05	57.99	9.81	77.43	76.28		
	22:00	76.24	67.39	55.18	49.94	10.87	82.29	96.43	16.25	64.33	795	57.62	57.60	9.65	77.50	76.42		
	23:00	74.65	68.44	54.48	49.28	11.06	81.46	95.58	16.30	64.33	795	56.94	56.92	9.59	77.55	76.42		
10/4	00:00	73.69	68.17	53.18	48.08	10.98	80.67	94.68	16.33	64.23	795	55.93	55.90	9.68	77.58	76.42		
	01:00	73.13	66.70	51.82	46.83	11.01	79.82	93.71	16.33	64.45	795	54.75	54.73	9.71	77.58	76.34		
	02:00	72.45	66.02	51.72	47.07	11.06	81.05	93.91	16.41	64.60	795	54.54	54.53	9.72	77.56	76.21		
	03:00	72.65	63.87	51.13	46.90	11.03	79.91	91.14	16.10	64.75	795	53.94	53.90	9.66	77.50	76.09		
	04:00	71.28	66.20	50.55	46.66	11.12	82.80	93.26	16.09	64.84	795	53.65	53.64	9.80	77.47	75.92		
	05:00	70.65	67.19	50.41	46.65	11.18	80.72	90.71	15.89	64.87	795	53.13	53.10	9.78	77.43	75.76		
	06:00	70.21	67.95	50.27	46.71	11.06	81.13	90.62	15.85	65.05	795	52.76	52.73	9.90	77.36	75.56		
	07:00	69.04	69.74	50.29	46.94	11.13	82.05	91.27	15.81	38.79	795	43.59	52.59	31.40	77.29	75.42		
	08:00	68.42	71.90	50.26	46.92	11.06	82.98	92.52	15.90	41.51	795	43.50	52.50	31.37	77.22	75.27		
	09:00	70.57	68.42	50.38	46.91	11.12	82.58	92.05	15.74	65.45	795	43.85	52.85	31.48	77.22	75.12		
	10:00	74.31	62.01	50.39	46.59	11.11	83.24	93.47	15.89	65.47	795	44.02	53.02	31.54	77.14	74.97		
	11:00	78.34	51.93	50.58	46.96	11.14	82.32	92.06	15.82	65.29	795	44.04	53.04	31.55	77.07	74.87		
	12:00	81.00	46.14	50.82	47.00	11.12	83.24	94.17	15.98	65.20	795	44.55	53.55	31.72	77.00	74.84		
	13:00	82.81	44.32	50.76	46.56	11.02	83.50	94.92	16.07	64.61	795	44.77	53.77	31.79	77.00	74.77		
	14:00	84.08	41.66	50.96	46.87	11.06	82.73	94.44				44.79	53.79	31.80	77.00	74.77		
	15:00	86.04	41.47	50.79	46.53	11.14	84.06	96.26				44.71	53.71	31.77	77.00	74.77		
	16:00	86.29	39.78	51.02	46.90	11.12	82.59	93.70				44.96	53.96	31.86	77.00	74.77		
	17:00	86.79	40.31	50.70	46.37	11.03	84.17	97.06				44.87	53.87	31.83	77.00	74.77		
	18:00	85.79	40.65	50.48	46.20	11.23	83.64	96.44				44.58	53.58	31.73	77.00	74.84		
	19:00	81.76	44.33	50.88	46.85	11.00	81.44	92.63				44.98	53.98	31.87	77.00	74.84		
	20:00	78.74	52.72	50.94	46.96	10.95	81.79	93.37				45.00	54.00	31.88	77.00	74.84		
	21:00	76.01	58.63	50.69	46.79	11.16	80.77	91.29				44.84	53.85	31.82	77.00	74.84		
	22:00	73.82	62.54	50.56	46.88	11.14	81.46	91.66				44.45	53.45	31.69	77.00	74.84		
	23:00	72.19	65.20	50.28	46.76	11.03	82.01	91.72				44.25	53.25	31.62	76.96	74.77		
10/5	00:00	71.21	65.18	49.97	46.73	11.06	80.69	89.75				43.47	52.47	31.35	76.93	74.72		
	01:00	70.60	63.05	65.47	64.52	10.77	81.87	92.07				56.67	65.67	35.84	76.93	74.62		
	02:00	69.63	62.12	50.92	47.11	11.17	84.92	95.88				43.97	52.97	31.53	76.93	74.64		
	03:00	68.40	62.55	50.15	46.75	11.15	83.64	94.34				42.91	51.92	31.16	76.89	74.62		
	04:00	66.66	65.35	66.91	67.71	10.84	81.37	104.32				56.57	65.57	35.80	76.86	74.59		
	05:00	65.57	66.47	72.51	72.87	10.65	81.25	95.60				62.36	71.36	37.76	76.86	74.60		
	06:00	64.20	68.67	68.56	64.67	10.82	83.06	90.67				60.63	69.63	37.18	76.92	74.68		
	07:00	63.12	70.13	53.48	53.34	10.90	79.56	88.74				44.21	53.21	31.60	76.93	74.77		
	08:00	63.26	70.65	63.52	59.71	10.79	83.08	92.27				55.52	64.52	35.45	76.86	74.77		
	09:00	66.67	65.38	61.12	62.03	10.89	82.52	92.71				50.64	59.64	33.79	76.86	74.77		2.41
	10:00	70.89	57.67	61.90	56.89	10.76	82.48	94.19				55.04	64.04	35.28	76.86	74.74		2.41
	11:00	75.88	46.98	50.89	46.74	11.03	83.80	94.82				43.79	52.79	31.45	76.86	74.70		2.40
	12:00	78.73	41.09	63.99	59.24	10.90	83.08	93.57				56.54	65.54	35.79	76.86	74.70		2.41
	13:00	81.04	37.59	55.59	55.50	10.90	82.52	94.98				46.28	55.29	32.30	76.86	74.77		2.40

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	14:00	82.53	36.74	75.24	76.01	10.60	84.24	86.30				64.67	73.67	38.54	76.86	74.84		2.40
	15:00	83.90	35.75	58.49	52.94	10.91	83.75	97.31				52.74	61.74	34.50	76.94	74.98		2.41
	16:00	84.74	36.18	52.48	47.35	11.06	83.62	97.02				46.29	55.29	32.31	77.00	75.13		2.40
	17:00	84.45	37.30	52.08	47.06	11.01	83.22	96.43				45.82	54.82	32.15	77.00	75.20	41.96	0.74
	18:00	82.42	40.06	51.20	46.35	10.94	83.13	96.16				45.04	54.04	31.88	77.00	75.20	133.20	2.46
	19:00	77.69	49.10	67.59	68.39	10.68	82.87	101.80				57.20	66.20	36.01	77.00	75.20	133.88	2.41
	20:00	74.65	56.64	74.18	75.46	1.10	84.55	105.75				58.59	67.59	34.24	78.49	86.21	131.14	2.41
	21:00	72.36	61.22	74.40	80.10	0.90	86.75	104.83				48.13	57.13	30.77	78.96	86.47	131.72	2.41
	22:00	70.87	63.15	74.06	81.41	0.88	87.24	103.16				46.26	55.26	30.15	78.20	85.66	129.85	2.41
	23:00	69.10	65.81	74.10	82.10	0.92	87.55	101.39				45.01	54.01	29.75	77.20	84.57	131.36	2.41
10/6	00:00	67.02	70.45	73.80	82.50	1.01	87.73	100.03				43.82	52.82	29.34	76.53	83.94	128.10	2.41
	01:00	64.86	74.93	73.54	82.54	1.03	87.87	98.68				42.84	51.84	29.03	75.96	83.26	121.43	2.41
	02:00	63.49	78.12	73.12	82.47	1.02	87.81	97.59				41.47	50.47	28.57	75.63	82.93	120.35	2.41
	03:00	64.34	75.93	72.56	82.40	1.04	87.73	96.62				41.06	50.06	28.49	75.21	82.33	119.40	2.41
	04:00	63.58	77.91	72.00	82.54	1.05	87.55	95.76				40.57	49.57	28.43	74.34	81.15	121.02	2.41
	05:00	62.82	80.07	71.59	82.37	0.96	87.41	95.01				40.41	49.41	28.36	74.04	80.77	122.16	2.41
	06:00	62.42	81.87	71.31	82.10	1.17	87.20	94.32				40.75	49.75	28.49	73.82	80.55	132.84	2.41
	07:00	62.23	82.87	71.06	81.97	1.25	87.00	93.72				40.93	49.93	28.54	73.82	80.59	132.56	2.41
	08:00	63.55	80.59	71.23	81.79	1.39	86.79	93.17				41.78	50.78	28.73	74.89	82.01	130.58	2.41
	09:00	67.35	74.10	71.41	81.57	1.34	86.72	92.73				45.04	54.04	29.75	77.27	84.65	138.39	2.39
	10:00	71.16	67.47	71.84	81.43	1.39	86.65	92.43				47.52	56.52	30.57	78.51	86.00	157.60	2.39
	11:00	75.60	62.98	72.29	81.39	1.24	86.72	92.25				50.16	59.16	31.48	80.18	87.61	155.32	2.36
	12:00	79.99	55.25	72.79	81.42	1.17	86.81	92.19				51.57	60.57	31.61	83.24	91.89	156.77	2.37
	13:00	81.71	51.03	63.23	64.78	7.37	83.31	86.15				50.40	59.40	31.16	83.45	92.03	157.38	2.34
	14:00	82.88	46.40	63.97	65.85	1.09	84.43	85.67				51.71	60.71	31.67	83.19	91.84	156.56	2.37
	15:00	84.53	44.59	65.45	67.81	1.08	85.24	87.15				52.42	61.42	31.88	83.62	92.36	155.40	2.39
	16:00	84.99	42.41	66.57	69.35	1.05	85.84	88.13				52.57	61.57	31.92	83.23	92.02	157.23	2.30
	17:00	84.20	42.30	67.40	70.60	1.11	86.28	88.66				52.05	61.05	31.75	82.74	91.47	158.76	2.36
	18:00	81.93	44.30	67.82	71.73	0.87	86.57	89.18				51.25	60.25	31.47	82.41	91.18	159.17	2.32
	19:00	78.26	51.97	68.11	72.70	0.97	86.77	89.61				50.24	59.24	31.14	81.74	90.48	157.46	2.37
	20:00	76.27	56.04	68.06	73.31	1.14	86.90	89.93				49.58	58.58	30.94	81.15	89.82	159.08	2.29
	21:00	74.15	60.29	68.11	74.09	1.15	86.94	90.10				49.05	58.05	30.75	80.76	89.48	158.34	2.28
	22:00	72.14	64.25	68.13	74.99	0.79	87.01	90.21				48.34	57.34	30.49	80.31	89.08	158.53	2.27
	23:00	69.91	68.28	68.14	75.64	1.00	86.95	90.25				47.34	56.34	30.15	79.84	88.62	157.90	2.28
10/7	00:00	68.63	70.66	68.00	76.22	0.91	86.92	90.18				46.03	55.03	29.72	79.22	87.94	157.60	2.30
	01:00	67.08	75.40	67.60	76.72	0.90	86.79	90.17				44.97	53.97	29.38	79.06	87.75	151.85	2.31
	02:00	65.46	79.44	67.21	77.03	0.96	86.64	90.10				43.97	52.97	29.05	78.49	87.11	143.12	2.29
	03:00	64.34	82.63	66.96	77.29	0.98	86.49	89.96				43.06	52.06	28.78	78.01	86.49	141.37	2.33
	04:00	63.70	83.99	66.80	77.44	0.89	86.27	89.89				42.37	51.37	28.65	77.31	85.43	140.31	2.32
	05:00	63.21	85.57	66.43	77.58	0.96	86.04	89.75				42.08	51.08	28.60	76.72	84.68	142.31	2.35
	06:00	62.09	87.17	66.28	77.58	1.25	85.81	89.66				41.79	50.79	28.55	75.92	83.71	159.65	2.37
	07:00	62.59	86.30	66.52	77.58	1.23	85.58	89.52				41.85	50.85	28.57	75.93	83.70		
	08:00	63.74	84.35	66.67	77.58	1.27	85.37	89.34				42.99	51.99	28.86	76.62	84.70		
	09:00	68.64	75.74	66.85	77.50	1.37	85.21	89.24				44.60	53.60	29.29	79.75	88.32		
	10:00	74.16	68.01	67.17	77.50	1.37	85.14	89.21				47.06	56.06	30.13	82.06	90.65		
	11:00	79.10	62.67	67.68	77.81	1.21	85.21	89.24				50.25	59.25	31.18	84.11	92.77		
	12:00	82.84	55.31	68.39	78.09	1.21	85.28	89.26				51.88	60.88	31.70	84.91	93.72		
	13:00	83.90	48.88	69.00	78.28	1.17	85.35	89.31				52.30	61.30	31.82	84.14	92.96		
	14:00	84.96	47.05	69.50	78.51	1.09	85.50	89.38				52.94	61.94	32.05	84.32	93.11		
	15:00	84.40	50.06	69.91	78.70	1.15	85.57	89.46				53.14	62.14	32.15	84.43	93.13		

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	16:00	83.86	50.40	70.22	78.84	1.01	85.72	89.53				53.22	62.22	32.16	84.20	92.93		
	17:00	83.35	53.35	70.46	79.02	0.91	85.85	89.60				53.06	62.06	32.08	84.73	93.59		
	18:00	81.97	57.36	70.59	79.15	0.96	85.99	89.71				52.71	61.71	31.97	84.71	93.53	158.07	21.24
	19:00	80.57	57.91	70.66	79.23	1.01	86.08	89.82				52.13	61.13	31.79	83.92	92.66	158.08	21.26
	20:00	78.69	58.42	70.66	79.36	0.97	86.22	89.89				51.27	60.27	31.45	83.03	91.90	160.17	21.48
	21:00	77.01	61.94	70.55	79.38	0.85	86.29	89.96				50.77	59.77	31.30	82.66	91.45	158.67	21.26
	22:00	76.23	66.85	70.51	79.45	0.80	86.29	89.96				50.73	59.73	31.29	83.34	92.17	158.18	21.12
	23:00	75.58	69.00	70.52	79.45	0.79	86.36	89.96				50.64	59.64	31.27	83.36	92.18	157.70	21.04
10/8	00:00	74.58	70.98	70.48	79.45	0.71	86.36	89.96				50.06	59.06	31.05	83.26	92.14	158.81	21.14
	01:00	73.45	74.16	70.41	79.45	0.83	86.36	89.94				49.55	58.55	30.90	83.00	91.81	158.31	20.98
	02:00	72.60	75.18	70.25	79.45	0.75	86.29	89.89				49.01	58.01	30.73	82.48	91.24	157.28	20.91
	03:00	72.29	75.48	70.10	79.38	0.87	86.22	89.74				48.45	57.45	30.53	82.40	91.23	158.36	21.11
	04:00	72.58	74.64	69.90	79.36	0.79	86.07	89.67				48.06	57.06	30.41	82.32	91.05	158.16	21.05
	05:00	72.51	74.58	69.68	79.23	0.87	86.00	89.59				47.88	56.88	30.37	82.31	91.02	158.50	21.10
	06:00	71.57	79.67	69.52	79.16	1.01	85.87	89.47				47.83	56.83	30.34	82.30	90.99	159.91	21.32
	07:00	71.75	76.78	69.44	79.09	1.06	85.78	89.40				48.10	57.10	30.41	82.05	90.81	161.35	21.54
	08:00	72.48	74.31	69.44	79.02	1.31	85.78	89.38				48.73	57.73	30.63	81.98	90.72	160.16	21.56
	09:00	73.59	69.44	69.51	78.94	1.13	85.78	89.38				49.46	58.46	30.86	82.03	90.85	160.07	21.64
	10:00	74.13	68.67	69.72	78.94	1.15	85.78	89.44				49.98	58.98	31.04	82.21	91.01	159.20	21.56
	11:00	74.91	68.17	69.88	79.00	1.14	85.86	89.46				50.36	59.36	31.16	82.43	91.29	159.92	21.64
	12:00	75.02	70.23	70.09	79.02	1.04	85.94	89.50				50.69	59.69	31.26	82.83	91.73	160.20	21.70
	13:00	74.82	73.88	70.22	79.09	1.22	86.00	89.53				51.31	60.31	31.48	83.44	92.27	159.51	21.62
	14:00	75.95	69.73	70.38	79.13	1.25	86.07	89.57				51.66	60.66	31.59	83.59	92.46	159.81	21.61
	15:00	77.01	66.97	70.58	79.16	1.09	86.14	89.67				51.94	60.94	31.67	83.81	92.71	160.04	21.65
	16:00	76.53	73.10	70.78	79.25	1.09	86.23	89.74				52.35	61.35	31.81	84.51	93.46	160.81	21.77
	17:00	73.74	84.37	70.94	79.38	0.73	86.29	89.79				52.08	61.08	31.73	84.26	93.20	158.99	21.46
	18:00	71.60	90.12	70.96	79.45	0.93	86.36	89.88				51.60	60.61	31.57	83.70	92.56	158.11	21.31
	19:00	70.62	92.76	70.95	79.52	0.91	86.36	89.81				51.31	60.31	31.48	83.57	92.43	158.14	21.30
	20:00	70.26	92.50	70.95	79.52	0.76	86.32	89.76				50.95	59.95	31.33	83.45	92.42	160.14	21.48
	21:00	69.62	93.57	70.88	79.52	0.85	86.29	89.74				50.65	59.65	31.24	83.13	92.04	159.93	21.42
	22:00	69.53	90.82	70.85	79.59	0.79	86.29	89.73				50.33	59.33	31.14	82.89	91.80	158.88	21.21
	23:00	69.26	87.34	70.72	79.59	0.71	86.22	89.67				49.58	58.58	30.86	82.11	91.08	158.94	21.20
10/9	00:00	69.07	84.59	70.58	79.52	0.62	86.08	89.53				48.84	57.84	30.63	81.63	90.51	157.56	20.99
	01:00	70.48	80.01	70.41	79.52	0.65	86.00	89.46				48.43	57.43	30.48	81.83	90.79	159.41	21.20
	02:00	71.13	78.23	70.23	79.45	0.65	85.86	89.32				48.15	57.15	30.40	82.03	90.92	158.77	21.13
	03:00	70.93	82.61	70.04	79.38	0.67	85.76	89.25				48.13	57.13	30.40	82.32	91.18	159.16	21.18
	04:00	71.29	83.94	69.93	79.30	0.78	85.58	89.16				48.20	57.20	30.45	82.68	91.57	159.30	21.19
	05:00	69.23	93.05	69.81	79.23	0.71	85.50	89.04				47.85	56.85	30.33	82.66	91.46	159.63	21.27
	06:00	68.95	94.82	69.73	79.16	0.95	85.35	88.94				47.98	56.98	30.37	82.87	91.68	161.37	21.50
	07:00	67.65	94.37	69.71	79.09	0.86	85.28	88.88				48.31	57.31	30.46	82.44	91.30	161.57	21.60
	08:00	63.58	84.16	69.61	79.02	0.95	85.21	88.81				46.26	55.26	29.76	78.19	87.07	158.20	21.34
	09:00	63.88	80.29	69.36	78.92	1.00	85.07	88.75				46.12	55.12	29.71	78.02	86.88	158.42	21.49
	10:00	63.54	77.18	69.30	78.84	1.03	85.02	88.66				45.88	54.88	29.63	77.58	86.44	157.88	21.43
	11:00	65.20	72.39	69.07	78.74	1.08	84.89	88.58				45.89	54.89	29.63	77.58	86.42	157.85	21.47
	12:00	65.80	67.97	69.01	78.58	1.12	84.70	88.40				46.26	55.26	29.74	77.63	86.54	158.47	21.57
	13:00	66.60	62.87	68.96	78.51	1.07	84.57	88.38				46.20	55.20	29.72	77.30	86.21	159.08	21.60
	14:00	67.96	59.19	68.87	78.44	0.96	84.56	88.30				46.52	55.52	29.83	77.54	86.44	157.39	21.38
	15:00	70.78	50.82	68.94	78.37	1.06	84.56	88.30				47.10	56.10	30.00	77.84	86.85	157.90	21.43
	16:00	71.80	48.27	68.95	78.30	1.04	84.56	88.36				47.40	56.40	30.09	78.01	87.03	158.64	21.51
	17:00	72.13	44.60	68.99	78.30	1.01	84.63	88.38				47.11	56.11	30.00	77.61	86.64	156.97	21.23

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	18:00	71.35	45.59	68.94	78.30	0.95	84.63	88.38				46.47	55.47	29.77	77.53	86.58	158.30	21.31
	19:00	68.75	53.54	68.76	78.22	0.84	84.62	88.38				45.46	54.46	29.46	76.75	85.73	157.95	21.25
	20:00	64.37	66.58	68.58	78.18	0.85	84.56	88.31				44.18	53.18	29.02	76.24	85.23	159.08	21.37
	21:00	61.53	74.02	68.33	78.09	0.83	84.45	88.23				43.33	52.33	28.76	75.50	84.40	157.55	21.15
	22:00	59.82	81.10	67.96	77.94	0.95	84.26	88.03				42.78	51.78	28.62	75.19	83.85	152.96	20.53
	23:00	58.27	82.49	67.78	77.79	0.77	84.06	87.87				41.78	50.78	28.51	76.20	84.16	139.61	18.70
10/10	00:00	57.29	86.42	67.57	77.61	0.89	83.83	87.68				41.31	50.31	28.45	75.88	83.47	132.75	17.85
	01:00	57.10	89.88	67.19	77.43	0.75	83.57	87.41				41.06	50.06	28.45	76.12	83.42	126.91	16.97
	02:00	56.92	89.38	66.88	77.20	0.69	83.24	87.11				40.73	49.73	28.40	76.68	83.71	125.46	16.79
	03:00	57.22	86.29	66.46	76.95	0.77	82.92	86.85				40.25	49.25	28.33	75.91	82.74	119.08	15.96
	04:00	57.85	81.99	66.03	76.70	0.89	82.63	86.58				39.94	48.94	28.30	75.83	82.44	115.27	15.47
	05:00	59.23	76.32	65.71	76.44	0.86	82.34	86.33				39.55	48.55	28.26	75.55	81.86	110.78	14.98
	06:00	60.32	72.21	65.38	76.18	1.02	82.06	86.08				39.56	48.56	28.29	75.29	81.41	109.74	14.94
	07:00	60.86	71.28	65.14	75.92	1.04	81.79	85.84				40.10	49.10	28.46	75.46	81.67	110.82	15.06
	08:00	61.43	72.05	65.04	75.72	1.14	81.62	85.71				40.73	49.73	28.53	75.40	82.05	116.81	15.94
	09:00	63.98	68.07	64.90	75.53	1.06	81.46	85.60				41.35	50.35	28.62	75.12	82.13	122.89	16.78
	10:00	66.15	64.52	64.83	75.38	1.11	81.38	85.55				42.05	51.05	28.70	74.43	82.01	130.61	17.94
	11:00	69.89	56.80	64.91	75.27	1.09	81.38	85.57				43.40	52.40	28.88	77.10	85.66	152.43	20.67
	12:00	71.34	58.07	65.19	75.27	1.09	81.48	85.70				44.36	53.36	29.09	79.17	88.20	165.84	22.34
	13:00	73.21	57.81	65.53	75.27	1.13	81.72	85.84				45.55	54.55	29.46	80.43	89.60	169.48	22.81
	14:00	75.08	57.66	65.88	75.35	0.94	81.98	86.04				46.64	55.64	29.81	81.55	90.78	169.16	22.71
	15:00	76.25	61.44	66.26	75.49	0.96	82.27	86.26				48.31	57.31	30.37	82.98	92.23	169.12	22.74
	16:00	77.33	60.82	66.67	75.63	0.86	82.57	86.48				49.20	58.20	30.65	83.28	92.59	169.13	22.76
	17:00	77.42	62.74	67.05	75.81	0.82	82.87	86.71				49.27	58.27	30.68	83.75	93.05	168.16	22.55
	18:00	75.93	64.81	67.34	75.94	0.73	83.14	86.87				49.09	58.09	30.62	83.37	92.65	168.23	22.42
	19:00	73.95	68.23	67.50	76.14	0.95	83.35	86.98				48.62	57.62	30.49	82.88	92.13	170.30	22.65
	20:00	72.15	72.21	67.57	76.23	0.84	83.48	87.05				48.23	57.24	30.36	82.40	91.60	167.97	22.37
	21:00	71.06	75.57	67.64	76.33	0.79	83.62	87.08				47.91	56.91	30.23	82.39	91.65	168.52	22.41
	22:00	70.26	79.13	67.64	76.42	0.70	83.76	87.14				47.72	56.72	30.16	82.48	91.77	169.81	22.61
	23:00	68.99	82.20	67.64	76.50	0.64	83.81	87.20				47.11	56.11	29.95	81.97	91.25	169.75	22.51
10/11	00:00	67.95	84.57	67.56	76.55	0.63	83.84	87.15				45.48	54.49	29.45	81.54	90.69	169.07	22.38
	01:00	67.17	87.52	67.15	76.57	0.68	83.84	87.08				44.33	53.33	29.09	81.22	90.29	168.28	22.31
	02:00	66.62	88.74	66.77	76.50	0.61	83.77	87.08				43.75	52.75	28.91	80.89	89.90	166.51	22.07
	03:00	67.02	89.32	66.57	76.42	0.49	83.77	87.01				43.55	52.55	28.86	81.16	90.09	165.87	21.99
	04:00	66.74	91.34	66.35	76.28	0.69	83.70	86.98				43.38	52.38	28.83	81.36	90.23	165.48	22.00
	05:00	66.45	93.38	66.10	76.21	0.69	83.62	86.89				42.79	51.79	28.71	80.94	89.46	158.12	21.04
	06:00	66.82	93.21	65.92	76.14	0.86	83.48	86.79				42.52	51.52	28.66	80.86	89.23	155.13	20.71
	07:00	67.46	91.81	65.71	75.99	0.81	83.41	86.72				42.48	51.48	28.68	80.96	89.23	151.75	20.31
	08:00	67.93	92.36	65.59	75.92	0.75	83.34	86.72				42.57	51.57	28.72	81.24	89.49	152.11	20.35
	09:00	69.69	90.31	65.51	75.84	0.71	83.26	86.72				43.12	52.12	28.90	82.05	90.34	154.02	20.65
	10:00	71.47	85.68	65.49	75.78	0.85	83.26	86.65				43.41	52.41	28.96	82.87	91.28	158.38	21.22
	11:00	74.91	76.48	65.48	75.70	0.89	83.26	86.72				43.74	52.75	29.04	83.81	92.40	163.19	21.80
	12:00	79.26	61.22	65.52	75.63	0.69	83.34	86.72				44.03	53.03	29.09	84.26	93.04	166.56	22.22
	13:00	81.16	52.12	65.49	75.63	0.60	83.41	86.79				43.55	52.55	28.93	83.49	92.27	164.90	22.02
	14:00	82.34	47.31	65.47	75.63	0.70	83.48	86.86				43.21	52.21	28.83	82.80	91.49	161.60	21.56
	15:00	83.08	43.00	65.38	75.63	0.59	83.59	86.94				42.96	51.96	28.77	82.21	90.80	158.12	21.11
	16:00	83.58	41.49	65.34	75.63	0.83	83.70	87.01				42.75	51.75	28.72	81.56	90.05	157.19	21.01
	17:00	82.23	42.77	65.29	75.63	0.77	83.77	87.08				42.45	51.45	28.66	81.26	89.59	153.45	20.55
	18:00	79.45	46.97	65.26	75.63	0.63	83.77	87.15				42.30	51.30	28.63	81.11	89.38	150.64	20.19
	19:00	76.82	52.30	65.19	75.56	0.81	83.84	87.22				42.00	51.00	28.58	80.11	88.17	146.98	19.77

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	20:00	74.84	57.66	65.13	75.56	0.82	83.86	87.22				41.79	50.79	28.54	79.75	87.69	144.24	19.39
	21:00	73.70	61.76	65.06	75.50	0.80	83.85	87.22				41.52	50.52	28.51	79.49	87.27	140.30	18.91
	22:00	72.40	66.31	64.99	75.49	0.71	83.84	87.22				41.43	50.43	28.51	79.47	87.13	137.27	18.54
	23:00	71.77	68.53	64.90	75.43	0.76	83.81	87.21				41.43	50.43	28.51	79.44	87.07	137.35	18.52
10/12	00:00	71.73	68.07	64.82	75.42	0.56	83.77	87.15				41.33	50.33	28.46	79.23	86.89	136.24	18.37
	01:00	71.92	67.17	64.75	75.34	0.58	83.77	87.09				41.50	50.50	28.57	79.00	86.56	134.68	18.15
	02:00	71.78	65.97	64.70	75.27	0.58	83.76	87.08				41.43	50.43	28.52	78.82	86.38	134.16	18.07
	03:00	71.76	65.70	64.69	75.27	0.54	83.70	87.08				41.13	50.13	28.44	78.69	86.20	133.52	18.03
	04:00	71.59	65.16	64.56	75.27	0.61	83.70	87.08				41.04	50.04	28.43	78.30	85.75	131.79	17.77
	05:00	70.85	68.90	64.53	75.20	0.58	83.62	87.08				41.07	50.07	28.46	77.98	85.31	129.47	17.51
	06:00	67.93	79.89	64.47	75.20	0.65	83.62	87.01				41.06	50.06	28.45	77.91	85.27	129.48	17.55
	07:00	67.28	81.83	64.46	75.13	0.65	83.56	86.96				41.29	50.29	28.52	77.94	85.31	130.34	17.65
	08:00	68.16	76.78	64.40	75.06	0.59	83.48	86.90				40.86	49.86	28.43	77.56	84.77	127.34	17.32
	09:00	70.36	68.96	64.39	74.98	0.70	83.41	86.79				40.80	49.80	28.41	77.68	84.91	127.97	17.41
	10:00	71.21	65.41	64.33	74.98	0.74	83.34	86.76				40.48	49.48	28.36	77.01	84.05	124.49	16.97
	11:00	68.21	80.96	64.20	74.91	0.76	83.23	86.69				40.48	49.48	28.37	77.52	84.50	123.22	16.84
	12:00	68.69	81.97	64.18	74.90	0.68	83.18	86.58				40.81	49.81	28.49	78.06	85.02	123.93	16.87
	13:00	71.04	79.62	64.18	74.84	0.73	83.12	86.56				41.40	50.40	28.65	79.21	86.29	126.56	17.13
	14:00	72.76	67.59	64.22	74.84	0.75	83.12	86.50				41.03	50.04	28.51	78.63	85.82	127.49	17.29
	15:00	73.00	69.23	64.18	74.80	0.60	83.03	86.47				41.07	50.07	28.53	78.93	86.09	127.86	17.27
	16:00	73.09	69.90	64.18	74.77	0.66	82.98	86.39				41.21	50.21	28.58	79.41	86.58	128.04	17.33
	17:00	73.30	72.25	64.18	74.77	0.62	82.98	86.36				42.21	51.21	28.77	80.94	88.60	138.57	18.66
	18:00	74.96	65.26	64.26	74.77	0.69	82.97	86.36				42.02	51.02	28.72	80.72	88.39	138.52	18.67
	19:00	75.24	63.94	64.27	74.77	0.77	82.90	86.29				41.68	50.68	28.60	80.41	88.02	138.37	18.71
	20:00	74.11	67.75	64.19	74.75	0.67	82.90	86.29				41.64	50.64	28.60	80.47	88.06	137.74	18.61
	21:00	70.29	84.71	64.19	74.70	0.64	82.90	86.29				41.76	50.76	28.64	80.60	88.20	138.04	18.61
	22:00	69.38	88.75	64.19	74.70	0.70	82.90	86.27				41.89	50.89	28.67	80.74	88.37	137.27	18.54
	23:00	61.11	91.93	64.19	74.62	0.54	82.83	86.26				40.30	49.30	28.32	74.84	81.77	120.02	16.25
10/13	00:00	59.76	91.43	64.07	74.62	0.54	82.76	86.22				39.68	48.68	28.27	75.13	81.56	111.98	15.10
	01:00	58.78	94.04	63.94	74.55	0.59	82.66	86.11				39.14	48.14	28.21	75.51	81.48	106.34	14.43
	02:00	58.35	94.70	63.76	74.48	0.46	82.53	86.00				39.00	48.00	28.23	75.62	81.37	103.16	13.93
	03:00	58.26	93.31	63.63	74.41	0.52	82.33	85.81				39.40	48.40	28.36	75.70	81.43	102.83	13.85
	04:00	58.36	91.48	63.59	74.28	0.42	82.13	85.68				39.28	48.28	28.32	75.14	80.94	102.44	13.86
	05:00	55.30	80.21	63.49	74.19	0.48	81.97	85.53				37.95	46.95	28.12	75.47	80.41	93.37	12.51
	06:00	52.92	72.71	63.27	74.12	0.59	81.75	85.36				38.07	47.07	29.01	75.89	80.22	49.51	6.61
	07:00	51.85	71.10	63.38	74.05	0.72	81.58	85.28				48.52	57.52	33.06	76.25	79.65		
	08:00	51.00	74.96	64.21	74.03	0.64	81.52	85.28				52.25	61.25	34.34	76.04	78.60		
	09:00	50.92	70.42	65.25	74.09	0.71	81.46	85.21				53.45	62.45	34.73	75.91	77.30		
	10:00	51.53	68.55	66.27	74.25	0.84	81.40	85.21				54.18	63.18	34.98	75.77	76.15		
	11:00	51.63	67.67	67.14	74.49	0.70	81.39	85.16				54.56	63.56	35.11	75.57	75.28		
	12:00	52.35	61.82	67.86	74.76	0.78	81.39	85.14				55.00	64.01	35.26	75.48	74.59		
	13:00	53.47	60.06	68.47	75.00	0.70	81.39	85.07				55.42	64.42	35.40	75.33	74.09		
	14:00	54.18	58.75	68.96	75.27	0.75	81.39	85.06				55.76	64.76	35.53	75.24	73.72		
	15:00	55.05	57.05	69.36	75.50	0.70	81.39	85.06				56.13	65.13	35.65	75.13	73.41		
	16:00	56.85	50.55	69.75	75.72	0.80	81.39	85.06				56.88	65.88	35.90	75.05	73.18		
	17:00	58.23	46.52	70.15	75.92	0.71	81.39	85.06				57.49	66.49	36.11	74.98	73.04		
	18:00	57.71	45.92	70.54	76.14	0.73	81.39	85.13				57.55	66.55	36.13	74.93	73.04		
	19:00	55.90	44.75	70.84	76.29	0.83	81.45	85.14				56.76	65.76	35.86	74.91	72.97		
	20:00	53.35	50.81	70.88	76.50	0.71	81.39	85.06				55.80	64.80	35.54	74.84	72.96		
	21:00	51.89	53.57	70.81	76.58	0.80	81.39	85.06				55.10	64.10	35.31	74.77	72.82		

				Absorption Chiller								Centrifigal Chiller						
		Outdoor Air			CHW		CW		Chil	CoTo	Btuh		CHW		CW		Chil	CoTo
Date	Time	Temp	RH	Sup	Ret	PD	Ret	Sup	kW	kW	10^3	Sup	Ret	PD	Ret	Sup	kW	kW
	22:00	50.66	52.88	70.66	76.68	0.66	81.39	85.00				54.60	63.60	35.13	74.70	72.71		
	23:00	48.74	56.13	70.60	76.78	0.71	81.31	84.99				53.83	62.83	34.87	74.57	72.58		
10/14	00:00	47.19	60.46	70.53	76.79	0.62	81.24	84.85				53.69	62.69	34.82	74.48	72.39		
	01:00	45.90	67.08	70.51	76.86	0.65	81.13	84.78				53.82	62.82	34.87	74.47	72.31		
	02:00	45.68	73.19	70.45	76.86	0.68	81.02	84.70				53.67	62.67	34.82	74.41	72.14		
	03:00	46.70	68.62	70.45	76.86	0.66	80.93	84.60				53.76	62.76	34.84	74.41	72.03		
	04:00	47.15	63.47	70.45	76.86	0.73	80.83	84.56				53.89	62.89	34.90	74.34	71.96		
	05:00	45.10	69.72	70.45	76.86	0.67	80.73	84.49				53.61	62.61	34.80	74.27	71.89		
	06:00	45.33	67.34	70.44	76.87	0.96	80.60	84.39				53.54	62.54	34.77	74.26	71.75		
	07:00	45.06	65.46	70.21	77.60	1.27	80.36	84.05				53.11	62.11	34.62	74.19	71.64		
	08:00	44.86	65.52	70.00	77.17	1.43	80.08	83.81				53.57	62.57	34.70	74.06	71.53		
	09:00	47.76	56.79	69.89	76.90	1.51	79.87	83.64				54.05	63.05	34.69	73.94	71.38		
	10:00	50.54	50.31	69.58	76.70	1.51	79.74	83.48				54.56	63.56	34.74	73.83	71.38		
	11:00	53.49	38.16	69.32	76.57	1.45	79.65	83.41				54.99	63.99	34.80	73.76	71.53		
	12:00	55.88	31.58	69.12	76.42	1.43	79.52	83.41				55.40	64.40	34.90	73.69	71.68		
	13:00	58.09	26.41	69.08	76.35	1.54	79.52	83.47				55.80	64.80	35.02	73.62	71.93		
	14:00	60.22	25.42	39.56	76.32	0.62	66.49	186.38				56.17	65.17	35.16	73.69	72.15		

B

CASE STUDY 2 DATA

The following two tables contain portions of the data taken at the Hospital site. Data was taken at 20 minute intervals but hourly data is presented here for brevity. All temperatures are dry bulb degrees F, pressure drops are in feet of water, and the abbreviations denote the following:

Temp:	temperature of outdoor air
RH:	percent relative humidity of outdoor air
CHW:	chilled water
CW:	condenser water
Sup:	temperature of supply water
Ret:	temperature of return water
PD:	pressure drop across barrel
kW:	electrical energy used by Chiller in kW
CoTo kW:	electrical energy used by cooling tower(s) in kW

Table B-1
Hospital Data for 90 and 150 Ton Chillers

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
9/23	19:00	78.28	51.35	78.32	72.09	80.76	83.74	4.8		59.18	47.33	70.05	78.18	5.84	112.24
	20:00	78.48	52.06	78.3	72.09	80.44	83.8	4.85		59.5	47.45	70.33	78.98	5.89	113.10
	21:00	78.93	52.06	78.27	72.06	80.47	83.74	4.84		59.61	47.81	70.6	79.22	5.87	115.16
	22:00	74.52	68.62	78.34	72.07	80.11	83.45	4.92		59.51	47.67	70.2	78.91	5.85	114.15
	23:00	75.52	63.1	78.22	71.94	79.98	83.32	4.93		59.43	48.24	69.99	78.48	5.81	111.76
9/24	00:00	75.22	64.63	78.06	71.98	79.69	83.38	5.03		60.65	51	68.79	76.4	5.84	75.64
	01:00	76.18	60.87	77.89	71.84	79.58	83.17	5		60.81	50.81	68.85	76.49	5.85	75.60
	02:00	78.35	53.65	77.9	71.84	79.22	82.02	5.04		67.44	66.73	67.55	71.25	5.75	
	03:00	78.31	53.66	77.96	72.14	78.7	80.27	5.04		68.87	68.6	67.18	70.91	5.67	
	04:00	78.38	52.51	78.03	72.61	78.71	79.52	5.08		69.19	68.88	67.13	71.24	5.62	
	05:00	78.55	51.78	77.77	72.6	78.57	79.12	5.12		69.58	69.04	67.47	71.23	5.61	
	06:00	78.29	53.02	77.72	72.76	78.59	79.02	5.12		69.62	69.07	67.48	71.26	5.62	
	07:00	78.58	51.9	77.53	72.84	78.84	79.12	5.13		69.88	68.5	67.62	71.73	5.66	
	08:00	67.95	71.84	77.53	72.85	78.49	78.92	5.13		61.78	52.49	68.62	75.45	5.72	76.09
	09:00	66.64	73.87	77.73	72.71	78.85	79.62	5.14		61.12	52.05	68.35	75.59	5.71	73.30
	10:00	77.28	55.06	77.91	72.48	79.51	80.71	5.16		61.67	52.8	68.48	75.8	5.69	76.18
	11:00	77.95	49.3	77.74	72.17	79.25	80.83	5.19		61.91	53.04	68.39	76	5.62	77.29

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
	12:00	78.35	49.13	77.77	72.3	79.07	80.79	5.21		60.61	48.78	71.1	80.01	5.64	120.74
	13:00	78.77	48.84	77.71	72.14	79.83	81.47	5.23		60.7	48.73	71.62	80.66	5.65	121.29
	14:00	79.27	48.59	77.62	71.86	80.22	82.2	5.23		61.67	49.4	72.54	81.35	5.66	121.96
	15:00	79.51	48.8	77.67	71.92	80.65	82.78	5.24		61.99	49.58	72.83	81.85	5.63	122.73
	16:00	80	49.02	77.55	71.75	81.21	83.42	5.24		62.09	47.78	74.86	84.42	5.64	132.74
	17:00	81.19	47.09	77.61	71.81	81.87	83.76	5.25		61.99	47.23	75.94	85.94	5.65	137.45
	18:00	80.23	50.34	77.94	72.09	82.08	83.85	5.27		61.96	48.03	75.24	84.87	5.64	133.18
	19:00	80.1	51.49	77.95	71.88	82.25	83.85	5.29		61.67	48.05	75.3	85.23	5.65	134.45
	20:00	79.95	51.68	77.84	71.8	82.5	84.08	5.27		61.81	48.36	75.03	84.48	5.66	131.98
	21:00	79.74	50.81	77.91	71.79	82.48	84.18	5.31		61.94	49.58	73.68	82.37	5.57	122.28
	22:00	79.28	49.2	78.19	72.05	82.16	84.23	5.29		60.96	49	72.22	81.01	5.6	120.94
	23:00	78.54	48.86	77.98	72	81.78	84.25	5.32		60.21	48.2	71.4	80.15	5.62	120.00
9/25	00:00	78.06	46.6	77.93	71.91	81.26	83.65	5.34		59.27	47.33	70.1	78.92	5.65	118.86
	01:00	77.37	46.3	78.15	72.07	80.38	82.7	5.33		59.28	49.45	68.26	76.6	5.6	91.97
	02:00	76.98	45.72	78	71.75	79.68	81.96	5.37		59.3	49.14	68.32	76.46	5.62	99.14
	03:00	75.96	48.26	77.89	71.57	79.42	81.52	5.37		59.51	50.18	68.22	76.01	5.65	76.94
	04:00	75.28	49.04	77.85	71.58	79.06	80.99	5.35		62.02	61.15	69.25	73.94	2.68	
	05:00	74.93	48.4	77.71	71.57	79.35	80.16	5.36		67.32	66.84	70.66	74.12	2.74	
	06:00	74.67	47.71	77.36	71.34	79.42	80.22	5.4		68.16	67.46	72.18	73.5	2.75	
	07:00	75.17	46.68	77.38	71.74	79.25	80.11	5.4		68.29	68.05	72.96	72.93	2.89	
	08:00	73.02	55.38	77.58	72	78.94	79.82	5.39		68.85	68.95	73.54	72.23	2.84	
	09:00	76.93	44.69	77.27	71.88	79.27	80.2	5.41		70.63	70.17	74.65	72.18	2.88	
	10:00	79.03	43.71	77.28	71.85	79.51	80.38	5.37		70.66	58.65	75.39	72.66	2.82	
	11:00	79.48	43.35	77.59	71.78	80.16	81	5.37		70.65	51.56	75.85	73.33	2.78	
	12:00	80.95	41.88	77.39	71.49	80.61	81.55	5.4		69.7	49.21	76.75	73.96	2.82	
	13:00	81.54	41.09	77.19	71.28	81.28	82.1	5.39		68.01	49.75	77.49	74.65	2.81	
	14:00	82.46	39.9	77.42	71.39	81.85	82.65	5.4		66.37	50.3	77.95	75.38	2.83	
	15:00	83.16	39.37	77.46	71.52	82.18	83.05	5.41		65.41	50.63	78.37	75.87	2.92	
	16:00	83.65	39.14	77.63	71.51	82.83	83.45	5.37		64.54	50.68	78.73	76.72	2.82	
	17:00	85.57	38.2	77.76	71.7	83.31	84.02	5.4		64.1	50.56	79.16	77.48	2.82	
	18:00	83.57	41.67	77.75	71.62	83.58	84.14	5.38		63.63	50.82	79.35	77.62	2.81	
	19:00	82.84	42.85	77.73	71.86	83.92	84.62	5.36		63.4	50.86	79.92	77.74	2.86	
	20:00	82.12	43.78	77.85	71.9	84.19	84.87	5.37		63.31	51	79.97	77.88	2.93	
	21:00	81.33	44.56	77.45	71.57	84.35	85.02	5.36		63.13	50.88	80.26	77.87	2.94	
	22:00	81.02	44.67	77.69	71.72	84.18	84.83	5.34		62.54	51.05	80.12	77.66	2.93	
	23:00	80.36	45.33	77.51	71.46	83.96	84.76	5.35		62.24	50.94	80.2	77.39	2.96	
9/26	00:00	79.72	45.79	77.8	71.79	83.7	84.47	5.34		61.49	50.82	80.01	76.99	2.96	
	01:00	78.24	47.09	77.48	71.46	83.62	84.12	5.33		61.2	50.41	80.34	76.65	2.92	
	02:00	77.65	48.3	77.74	71.67	81.83	82.59	5.35		60.14	50.42	79.49	75.63	2.96	
	03:00	77.15	48.07	77.47	71.33	82.45	83.24	5.39		60.58	50.59	79.65	76	3.01	
	04:00	77	47.78	77.45	71.28	82.06	82.97	5.38		60.52	50.67	79.33	75.38	2.98	
	05:00	76.43	47.92	77.29	71.11	82.01	82.82	5.42		60.6	50.93	79	75	2.96	
	06:00	76.22	47.62	77.27	71.08	81.5	82.37	5.31		60.14	50.66	78.66	74.38	3	
	07:00	77.03	47.13	77.25	71.08	80.75	81.92	5.33		59.87	50.62	78.63	73.76	2.9	
	08:00	78.46	49.78	77.14	71.04	80.11	81.5	5.33		59.39	50.21	78.7	73.47	2.95	
	09:00	80.14	46.87	77.43	71.09	79.87	81.26	5.34		59.1	50.31	78.19	73.51	2.94	
	10:00	81.65	45.11	77.09	70.63	80.41	81.78	5.33		59.29	50.18	78.73	74.29	2.97	
	11:00	82.88	41.4	77.08	70.46	80.96	82.35	5.41		59.44	50	79.26	75.09	2.92	
	12:00	83.79	39.39	77.12	70.8	81.26	82.68	5.46		59.34	49.98	79.57	75.48	2.97	
	13:00	84.71	37.7	77.32	70.78	82.16	83.47	5.43		59.67	50.29	80.04	76.49	2.93	

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
	14:00	85.24	36.68	77.3	70.79	83	84.38	5.44		60.06	49.48	80.61	77.45	2.95	
	15:00	85.65	36.38	77.58	71.01	83.8	85.03	5.46		60.41	50.37	80.95	78.27	2.94	
	16:00	87.03	35.65	77.74	71.08	84.37	85.57	5.42		60.55	50.74	81.36	78.89	3	
	17:00	86.75	36.12	77.98	71.33	84.5	85.85	5.43		60.68	51.18	81.5	79.31	2.88	
	18:00	85.69	38.97	78.02	71.41	84.75	86.1	5.45		60.92	51.43	81.45	79.75	2.92	
	19:00	84.28	40.63	78.11	71.47	84.89	86.19	5.45		61.32	51.36	81.61	79.94	2.98	
	20:00	82.91	41.57	78.11	71.45	84.54	85.89	5.45		61.12	51.25	81.69	79.77	2.91	
	21:00	82.97	40.97	78.23	71.74	84.2	85.56	5.47		61.11	51.22	81.52	79.27	2.94	
	22:00	82.12	41.71	78.08	71.42	84.53	85.85	5.45		61.39	51.09	81.75	79.3	2.99	
	23:00	81.43	42.9	78.15	71.44	84.35	85.51	5.49		61.29	51.08	81.57	78.97	2.94	
9/27	00:00	80.92	43.56	78.09	71.42	84.37	85.51	5.48		61.39	51.7	81.68	78.77	2.98	
	01:00	80.59	43.44	78.04	71.4	84.17	85.34	5.49		61.32	53.49	81.53	78.49	3.03	
	02:00	79.99	43.52	78.1	71.63	83.86	85.03	5.51		61.34	53.82	81.2	77.96	2.97	
	03:00	79.32	43.93	78.11	71.64	83.55	84.84	5.4		61.57	53.93	81.12	77.53	3.01	
	04:00	79.17	43.83	77.94	71.59	83.28	84.56	5.37		61.75	53.9	80.99	77.06	3.04	
	05:00	78.28	44.62	77.89	71.65	83.01	84.29	5.4		61.93	53.94	80.71	76.9	3.03	
	06:00	77.44	44.65	77.8	71.48	82.66	84.13	5.39		62.28	54.13	80.45	76.32	3	
	07:00	77.93	45.43	77.77	71.36	82.18	83.68	5.42		62.07	53.94	80.22	75.79	2.97	
	08:00	79.34	44.21	77.92	71.53	81.97	83.33	5.39		61.78	53.59	80.15	75.43	2.95	
	09:00	79.71	44.01	77.62	71.24	82.02	83.42	5.43		61.79	53.32	80.4	75.41	2.96	
	10:00	81.43	42.03	77.78	71.41	81.79	83.23	5.41		61.57	53.47	80.22	75.64	2.92	
	11:00	82.26	40.46	77.63	71.08	82.46	83.82	5.43		61.94	53.2	80.85	76.45	2.93	
	12:00	83.9	39.17	78.09	71.48	82.64	84.05	5.38		61.89	53.7	80.6	76.8	2.87	
	13:00	84.39	38.82	78.19	71.59	83.14	84.46	5.36		61.95	54.02	80.77	77.51	2.93	
	14:00	85.08	38.55	78.3	71.72	83.6	84.9	5.35		62.31	53.85	81.07	78.09	2.91	
	15:00	85.23	40	78.1	71.75	84.41	85.6	5.34		62.66	53.88	81.66	78.89	2.95	
	16:00	85.11	40.85	78.34	71.82	84.81	85.94	5.35		62.76	53.93	81.9	79.35	2.94	
	17:00	85.68	40.2	78.24	71.79	85.26	86.35	5.36		63.06	54.05	82.26	79.95	2.92	
	18:00	84.36	42.03	78.4	71.9	85.47	86.61	5.37		63.13	53.96	82.4	80.09	2.94	
	19:00	82.43	44.08	78.5	72.04	85.57	86.58	5.33		63.06	53.94	82.46	80.21	2.99	
	20:00	83.22	42.5	78.31	71.84	85.68	86.66	5.4		63.46	53.71	82.77	80.11	2.98	
	21:00	82.36	42.64	78.6	72	85.29	86.28	5.34		63.27	54.04	82.44	79.59	2.96	
	22:00	81.69	42.52	78.61	72.3	84.67	85.69	5.32		63.03	54.23	82.08	78.99	2.98	
	23:00	81.47	42.22	78.57	72.08	84.65	85.61	5.38		62.95	54	82.25	78.81	2.99	
9/28	00:00	80.77	42.93	78.43	72.08	84.52	85.52	5.41		63.27	54.61	71.82	75.23	3.01	
	01:00	80.15	43.44	78.45	72.03	82.45	83.46	5.35		63.36	55.09	69.87	73.52	3.03	
	02:00	79.72	43.36	78.37	71.95	81.45	81.95	5.32		63.58	54.42	69.06	72.65	2.99	
	03:00	78.3	43.75	78.51	72.24	79.82	79.89	5.35		63.35	56.11	68.1	71.21	1.9	
	04:00	80	42.95	78.26	71.75	79.74	79.69	5.32		64.01	55.3	67.36	71.01	2.21	
	05:00	79.3	46.58	78.23	71.57	79.62	79.71	5.33		64.18	54.91	67.35	71.13	2.19	
	06:00	80.47	47.1	78.26	71.96	79.11	79.73	5.34		64.03	54.5	67.52	71.34	2.2	
	07:00	80.42	42.68	78.34	72.11	79.27	79.9	5.29		63.85	54.47	67.56	71.21	2.16	
	08:00	80.13	43.87	78.11	71.84	79.25	79.92	5.34		63.63	54.21	67.55	71.16	2.22	
	09:00	80.18	41.65	78.29	72.02	79.16	79.78	5.33		63.48	54.31	67.25	70.92	2.2	
	10:00	80.29	41.25	78.4	72.11	78.96	79.43	5.33		63.1	54.13	67.05	70.87	2.18	
	11:00	80.22	41.42	78	71.51	79.27	79.73	5.37		63.24	54.41	67.3	70.92	2.21	
	12:00	79.96	41.31	78.36	72.07	78.76	79.38	5.32		62.82	54.1	67.54	71.28	2.2	
	13:00	80.43	38.3	78.29	71.94	78.96	79.38	5.33		62.73	54.05	67	70.54	2.14	
	14:00	81.83	37.18	78.38	71.94	78.69	79.21	5.35		62.36	53.73	67.07	71.01	2.15	
	15:00	82.44	34.33	78.11	71.86	78.87	79.49	5.39		62.55	53.97	67.22	70.5	2.18	

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
	16:00	82.86	33.82	78.17	71.87	79.14	79.64	5.39		62.66	54.06	67.04	70.71	2.17	
	17:00	82.77	35.4	78.07	71.82	79.39	79.85	5.37		62.82	54.22	67.28	70.9	2.18	
	18:00	80.62	37.86	78.06	71.78	79.62	80.04	5.39		63.08	54.32	67.05	70.65	2.16	
	19:00	79.92	39.97	78.14	71.87	79.73	80.38	5.37		63.23	54.6	66.95	70.97	2.2	
	20:00	79.27	41.05	78.16	71.94	79.63	80.1	5.36		63.13	54.51	67.02	70.9	2.2	
	21:00	78.44	40.13	78.16	71.83	79.75	80.17	5.37		63.3	54.6	66.93	71.07	2.25	
	22:00	76.85	40.56	78.06	71.92	79.39	79.92	5.37		63.33	54.55	67.18	71.07	2.25	
	23:00	75.31	41.96	78.21	71.91	79.09	79.57	5.36		63.13	54.31	66.59	70.47	2.21	
9/29	00:00	74.19	43.51	78.03	71.82	79.11	79.57	5.36		63.19	54.36	66.25	70.12	2.21	
	01:00	76.02	42.04	78.1	71.86	78.82	79.25	5.36		63.06	54.43	66.3	70.27	2.21	
	02:00	77.53	40.49	78.18	71.75	78.64	79.05	5.37		63.05	55.67	66.49	70.46	2.23	
	03:00	76.47	40.84	77.86	71.75	78.75	79.38	5.37		63.04	56.91	67.05	70.71	2.19	
	04:00	76.94	39.5	77.97	71.69	78.25	78.9	5.39		62.6	56.84	66.81	70.6	2.23	
	05:00	75.06	40.76	77.91	71.73	78.18	78.91	5.43		62.79	57.04	66.44	70.39	2.21	
	06:00	75.45	39.91	77.72	71.52	78.24	78.87	5.41		63.09	57.05	66.02	69.84	2.24	
	07:00	72.31	42.91	77.57	71.6	77.95	78.47	5.41		63.18	56.9	65.65	69.12	2.2	
	08:00	75.88	40.52	77.87	71.65	77.23	77.96	5.41		62.93	56.61	65.43	69.01	2.24	
	09:00	77.45	39.71	77.63	71.32	77.74	78.06	5.41		54.22	53.96	69.33	72.42	2.23	
	10:00	79.45	38.83	77.57	71.46	78.33	79.39	5.41		54.83	54.49	68.4	71.88	2.25	
	11:00	81.03	37.74	77.69	71.54	78.6	80.58	5.36		55.39	55.07	68.97	72.47	2.26	
	12:00	82.92	35.88	77.87	71.91	78.99	81.76	5.36		55.64	55.42	70.01	73.31	2.17	
	13:00	83.31	35.32	77.74	71.91	79.93	82.93	5.33		55.97	55.75	70.25	73.55	2.22	
	14:00	83.98	33.3	77.94	72.26	80.14	83.64	5.3		56	55.69	70.2	73.64	2.22	
	15:00	84.71	32.47	78.12	72.27	81.11	84.57	5.31		55.94	55.64	70.34	73.9	2.24	
	16:00	84.91	33.86	78.32	72.41	81.33	84.98	5.32		56.48	56.18	71.1	74.59	2.11	
	17:00	84.68	35.14	78.42	72.62	81.95	85.9	5.31		56.54	56.38	70.91	74.64	2.2	
	18:00	84.74	36	78.64	72.91	82.16	86.43	5.37		56.16	55.96	70.25	74.24	2.15	
	19:00	83	38.78	78.65	72.96	82.39	86.99	5.36		55.76	55.6	69.51	73.57	2.22	
	20:00	81.81	38.92	78.58	72.89	82.14	87.32	5.37		55.81	55.38	69.01	72.8	2.21	
	21:00	84.59	36.39	78.62	72.93	81.93	87.21	5.35		55.74	55.47	68.77	72.6	2.2	
	22:00	84.01	36.93	78.86	73.12	81.47	86.71	5.33		55.17	54.89	67.67	71.77	2.23	
	23:00	83.35	37.01	78.8	73.02	81.29	86.24	5.33		54.76	54.53	68.39	72.25	2.23	
9/30	00:00	82.57	36.25	79.01	73.36	80.77	85.47	5.31		54.38	54.14	68.33	72.21	2.27	
	01:00	82.17	34.87	78.94	73.22	80.91	85.41	5.33		54.13	53.87	68.45	72.46	2.16	
	02:00	81.99	33.68	78.89	73.07	80.65	85.12	5.34		53.53	53.29	68.57	72.59	2.26	
	03:00	81.07	33.99	78.94	73.15	80.23	84.43	5.32		52.72	52.53	68.38	72.31	2.24	
	04:00	80.19	34.52	78.81	73.1	80.44	84.36	5.4		52.45	52.26	68.57	72.56	2.25	
	05:00	79.3	34.98	78.99	73.14	79.85	83.61	5.37		51.89	51.72	68.65	72.54	2.23	
	06:00	78.56	35.42	78.81	72.88	79.93	83.41	5.39		51.43	51.27	67.78	71.86	2.25	
	07:00	79.02	34.77	78.59	72.38	79.29	83.07	5.39		52.25	51.9	69.07	72.84	2.21	
	08:00	79.99	33.91	78.66	72.71	79.03	82.82	5.36		53.17	52.8	68.49	72.21	2.23	
	09:00	80.08	32.95	78.57	72.31	78.61	82.71	5.44		53.92	53.54	68.91	72.13	2.2	
	10:00	81.26	32.52	78.66	72.45	78.95	83.15	5.41		54.3	54.02	68.51	72.1	2.16	
	11:00	82.32	31.79	78.84	72.53	78.99	83.41	5.41		54.85	54.69	68.13	71.43	2.2	
	12:00	82.58	30.93	78.57	72.51	79.45	84.25	5.44		55.97	55.31	68.63	71.73	2.2	
	13:00	82.84	29.44	78.72	72.6	79.32	83.97	5.42		58.27	58.06	68.13	71.59	2.1	
	14:00	83.82	25.59	78.72	72.8	79.67	84.35	5.48		58.68	58.52	68.28	71.78	1.96	
	15:00	85.2	23.71	78.72	72.9	79.97	84.73	5.49		58.79	58.67	68.13	71.6	2.03	
	16:00	87.11	19.78	78.86	73.03	80.51	85.31	5.49		59.03	59.05	68.01	71.96	1.98	
	17:00	86.9	20.47	78.9	73.13	80.72	85.63	5.48		59.16	59.12	68.19	72.2	2	

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
	18:00	86.07	23.35	78.98	73.3	80.83	85.66	5.47		58.58	58.61	68.67	72.76	1.99	
	19:00	84.83	26.61	78.87	73.19	81.03	85.75	5.5		58.21	58.17	68.96	73.3	1.98	
	20:00	83.72	28.98	79.12	73.51	80.83	85.23	5.51		57.77	57.74	68.6	73.35	2.01	
	21:00	81.11	33.85	79.09	73.42	80.03	84.2	5.45		56.72	56.76	68.58	72.77	2.11	
	22:00	79.89	35.52	78.89	73.32	79.99	83.92	5.51		55.98	56.07	68.64	72.87	2.08	
	23:00	78.76	37.27	78.94	73.2	79.8	83.4	5.47		55.4	55.42	68.38	73.24	1.99	
10/1	00:00	77.11	38.24	78.7	73.03	79.33	82.76	5.46		56.26	56.02	69.38	73.2	1.75	
	01:00	76.38	38.73	78.55	72.86	79.02	82.05	5.47		56.89	57.09	70.86	72.89	1.79	
	02:00	75.91	39.11	78.44	72.69	79.29	81.9	5.51		57.57	58.1	71.92	72.71	1.8	
	03:00	71.36	45.22	78.24	72.49	79.14	81.5	5.53		58.18	59.07	73.05	72.4	1.8	
	04:00	58.99	66.29	77.74	72.29	79.13	81.5	5.51		59.09	60.32	74	72.56	1.88	
	05:00	56.75	70.25	77.96	72.49	79.09	81.05	5.46		59.51	60.75	74.25	72.39	1.84	
	06:00	56.92	72.73	77.73	72.54	79.19	80.89	5.52		60.28	61.77	74.93	72.66	1.88	
	07:00	58.61	71.21	77.45	72.51	79.09	80.7	5.52		60.67	62.6	75.62	72.63	1.78	
	08:00	62.53	66.43	77.64	72.84	79.15	80.44	5.52		65.82	64.82	70.76	72.53	2.01	
	09:00	77.29	40.88	77.49	72.87	79	80.57	5.5		53.27	53.42	68.73	72.03	2.1	
	10:00	80.05	35.39	77.44	72.66	78.54	81.24	5.52		54.58	54.28	68.99	72.06	2.07	
	11:00	82.03	30.01	77.51	72.53	78.98	81.95	5.51		55.25	55.24	68.7	72.16	2.14	
	12:00	83.63	29.1	77.88	72.58	79.27	82.55	5.47		55.63	55.61	68.13	72.04	2.09	
	13:00	86.63	25.4	77.83	72.54	79.44	82.31	5.52		57.46	59.47	68.42	71.95	2.05	
	14:00	86.98	24.52	77.96	72.79	79.95	83.06	5.53		56.12	56.2	68.15	72.05	2.1	
	15:00	87.46	24.34	77.96	72.87	80.23	83.81	5.53		56.15	56.39	68.41	72.2	2.1	
	16:00	87.6	23.97	78.36	73	80.43	84.32	5.52		56.46	56.56	68.31	72.36	2.04	
	17:00	87.96	23.42	78.43	73.23	80.56	84.64	5.5		56.45	56.63	68.47	72.18	2.06	
	18:00	86.39	29.94	78.48	73.19	80.84	85.13	5.44		56.39	56.59	68.33	72.76	2	
	19:00	85.43	31.41	78.48	73.2	80.85	85.18	5.48		55.85	55.94	68.7	73.2	2.07	
	20:00	84.87	30.85	78.34	73.07	80.7	84.78	5.5		55.42	55.35	68.88	73.14	2.09	
	21:00	82.83	35.55	78.4	73.06	80.66	84.68	5.48		54.96	55.16	68.99	73.54	2.19	
	22:00	81.22	38.1	78.4	73.2	80.47	84.07	5.45		54.17	54.22	68.88	73.2	2.13	
	23:00	80.28	39.16	78.44	73.27	80.11	83.6	5.45		54.35	53.91	69.05	73.3	2.09	
10/2	00:00	79.27	40.26	78.33	72.96	80.37	83.55	5.51		54.67	54.68	69.49	73.75	2.13	
	01:00	78.57	40.98	78.28	72.9	80.11	83.02	5.5		54.9	54.47	68.41	73.42	2.15	
	02:00	77.77	41.83	78.52	72.91	79.47	82.05	5.5		56.07	56.14	67.14	71.57	2.1	
	03:00	77.63	41.77	78.19	72.78	78.89	81.34	5.5		55.94	56	66.94	71.29	2.13	
	04:00	78.04	41.21	78	72.5	78.35	80.91	5.5		56	55.95	66.94	71	2.13	
	05:00	77.89	41.01	78	72.33	78.14	80.57	5.55		56.08	55.98	66.7	71.16	2.12	
	06:00	77.4	41.34	77.9	72.33	77.96	80.36	5.54		55.7	55.58	65.99	70.22	2.16	
	07:00	77.8	41.7	77.99	72.37	77.31	79.76	5.52		55.88	55.76	67.2	70.56	2.14	
	08:00	78.78	41.52	77.9	72.34	77.64	79.88	5.52		56.7	56.42	68.68	71.99	2.17	
	09:00	80.08	39.34	77.99	72.43	77.75	79.99	5.49		57.57	57.04	69.22	72.62	2.41	
	10:00	81.01	38.51	77.86	72.26	78.63	80.75	5.5		59.97	59.63	69.12	70.36	3.01	
	11:00	82.85	36.96	77.96	72.42	78.94	81.15	5.5		60.08	59.74	68.61	72.73	2.13	
	12:00	83.33	35.2	58.28	58.64	79.24	81.74	9.53		61.23	60.41	68.52	72.13	2.15	
	13:00	85.63	34.18	57.87	57.71	79.75	82.33	5.61		59	58.91	71.02	73.51	2.3	
	14:00	86.83	35.11	58.94	58.71	80.77	83.45	5.49		58.46	57.66	71.43	75.02	2.27	
	15:00	88.82	34.34	60.17	59.96	81.47	84.55	5.42		58.66	57.96	72.47	76.43	2.3	
	16:00	88.85	34.54	60.98	60.7	82.32	85.58	5.52		59.11	58.38	72.56	76.82	2.3	
	17:00	89.27	34.95	62.03	61.67	82.76	86.07	5.38		59.13	58.37	72.23	76.71	2.24	
	18:00	88.62	35.42	63.02	62.68	82.92	86.68	5.46		58.85	58.18	71.04	75.59	2.23	
	19:00	87.89	36.54	63.8	63.4	82.62	86.83	5.69		58.49	57.82	70.26	74.88	2.26	

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	20:00	87.29	37.14	64.44	63.93	82.28	86.83	5.59		58.13	57.41	69.51	74.26	2.27	
	21:00	86.82	37.26	65.34	64.67	81.63	86.27	5.52		58.01	57.32	68.8	73.46	2.28	
	22:00	86.5	37.3	65.68	64.98	81.42	85.48	5.69		57.77	57.25	68.37	73.29	2.33	
	23:00	84.8	39.28	66.59	65.24	80.77	84.8	5.74		57.43	56.75	67.85	72.48	2.28	
10/3	00:00	83.27	40.95	67.01	65.46	80.66	84.46	5.47		57.04	56.25	68.42	72.85	2.34	
	01:00	83.63	39.55	67.07	65.79	80.52	84.29	5.58		56.65	55.94	68.34	72.98	2.35	
	02:00	83.46	39.03	67.61	66.3	80.28	83.95	5.35		55.96	55.35	68.63	72.9	2.31	
	03:00	82.95	39.24	67.92	66.16	80.48	84.05	5.63		55.96	55.23	68.99	73.25	2.31	
	04:00	82.62	39.15	68.44	66.66	80.4	83.39	5.77		55.27	54.67	68.84	72.99	2.28	
	05:00	82.29	39.97	68.9	66.81	79.97	83.28	5.67		55.13	54.43	68.81	72.91	2.31	
	06:00	82.23	40.36	69.41	67.34	80.04	83.22	5.51		55.2	54.51	68.66	73.07	2.34	
	07:00	82	41.34	69.65	67.35	80.4	83.52	5.54		55.88	55.1	68.91	73.29	2.31	
	08:00	82.39	43.01	70.12	67.79	79.91	83.1	5.62		56.9	56.14	68.67	72.42	2.29	
	09:00	83.56	44.17	70.7	68.18	79.69	83.01	5.48		57.99	57.44	71.49	73.99	2.27	
	10:00	87.77	41.18	71.11	68.51	80.78	83.79	5.53		58.75	58.09	73.63	77.02	2.24	
	11:00	88.83	39.98	71.46	68.76	82.21	85.12	5.64		59.57	58.88	74.66	78.1	2.23	
	12:00	90.21	38.94	52.47	41.78	81.46	93.02	10.87	121.27	57.49	58.3	77.55	78.55	2.2	
	13:00	90.69	37.08	51.88	41.11	80.83	92.39	10.99	120.35	56.79	56.37	76.87	78.89	2.2	
	14:00	91.25	35.82	52	41.18	80.86	92.55	11.19	120.29	56.88	56.41	76.76	79.05	2.19	
	15:00	91.77	35.12	51.63	40.74	81.03	92.69	11.25	120.05	56.99	56.59	77.01	79.1	2.18	
	16:00	92.44	33.92	51.55	40.73	81	92.62	11.14	119.43	57.14	56.75	76.82	79.36	2.18	
	17:00	92.51	34.86	51.58	40.72	81	92.61	11.35	118.77	56.8	56.49	76.93	79.19	2.16	
	18:00	91.95	37.99	51.89	40.97	81.41	93.04	11.28	119.31	57.21	56.76	77.25	79.24	2.15	
	19:00	91.29	39.69	51.52	40.68	81.16	92.83	11.17	118.80	57.42	57.1	76.79	79.59	2.17	
	20:00	90.77	40.88	51.71	40.85	81.12	92.83	11.23	118.40	57.28	56.88	76.7	79.24	2.16	
	21:00	90.18	41.56	51.51	40.62	80.46	92.19	11.12	117.53	57.23	56.91	75.81	78.85	2.2	
	22:00	89.59	41.37	51.83	51.51	80.87	81.47	8.68		59.61	58.74	73.63	78.2	2.22	
	23:00	89.46	40.63	52.83	52.16	82.38	83.31	5.04		59.7	59	72.87	77.58	2.21	
10/4	00:00	88.96	40.01	53.81	53.1	83.05	84.57	0.3		59.12	58.51	72.05	76.83	2.26	
	01:00	88.41	39.62	54.88	54.07	83.16	85.59	-4.12		58.96	58.23	71.07	75.91	2.3	
	02:00	87.68	39.5	55.84	55.07	82.83	85.99	-9.71		58.54	57.95	70.71	75.37	2.24	
	03:00	87.63	39.31	56.91	56.12	82.57	86.24	-15.94		58.6	57.87	70.28	74.66	2.25	
	04:00	87.6	39.2	57.74	56.96	82.49	86.14	-22.22		58.59	57.86	70.02	74.72	2.32	
	05:00	87.36	39.27	58.58	57.93	82.23	86.09	-29.04		58.5	57.71	69.76	74.48	2.3	
	06:00	87.02	39.48	59.6	59	82.05	85.9	-35.77		58.37	57.75	69.28	74.18	2.24	
	07:00	86.67	40	60.32	59.75	81.62	85.44	-42.63		58.27	57.52	69.08	73.76	2.24	
	08:00	87.11	39.83	61.1	60.65	81.32	85.06	-49.41		58.56	57.86	70.39	74.36	2.27	
	09:00	87.74	39.66	62.15	61.78	81.3	84.95	-56.22		58.68	58.09	71.52	75.37	2.24	
	10:00	88.82	38.03	62.82	62.49	82.1	85.52	-62.94		58.98	58.37	72.46	76.5	2.27	
	11:00	89.81	36.95	63.78	63.59	82.73	86.03	-69.33		59.21	58.6	73.09	77.24	2.26	
	12:00	90.63	36.45	64.55	64.39	83.5	86.92	-74.48		59.52	58.77	73.93	77.69	2.24	
	13:00	91.24	35.01	65.34	65.06	84.36	87.8	-75.04		59.88	59.19	73.94	78.2	2.24	
	14:00	92.13	34.73	66.08	65.44	84.58	88.38	-74.96		60.13	59.56	74.61	78.49	2.17	
	15:00	92.63	33.52	66.91	66.43	84.96	88.92	-74.93		60.02	59.39	74.49	78.52	2.21	
	16:00	93.14	33.03	67.14	67.17	85.35	89.33	-74.87		60.08	59.38	74.57	78.81	2.12	
	17:00	93.32	31.81	67.9	67.96	85.37	89.65	-74.87		59.79	59.06	73.95	78.19	2.17	
	18:00	92.09	35.18	68.25	68.16	86.37	90.7	-74.95		60.84	60.05	73.83	78.81	2.22	
	19:00	91.5	35.44	69.06	68.92	85.89	90.39	-75.02		60.49	59.78	73.22	78.16	2.25	
	20:00	90.6	36.42	69.88	69.75	85.16	89.69	-75.03		59.83	59.24	72.32	77.3	2.18	
	21:00	90.01	37.08	70.47	70.28	84.75	89.14	-75.04		59.5	58.88	71.97	76.88	2.22	

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	22:00	89.25	37.73	70.95	70.6	84.18	88.76	-75.07		59.19	58.46	70.84	75.92	2.23	
	23:00	88.78	37.25	71.72	71.32	83.51	87.83	-75.1		58.86	58.27	69.85	75.15	2.33	
10/5	00:00	88.31	36.4	71.97	71.61	83	87.32	-75.13		58.51	57.85	68.94	74.08	2.35	
	01:00	87.83	35.46	72.52	72.14	82.2	86.51	-75.14		57.73	57.06	67.88	72.83	2.28	
	02:00	87.38	35.03	72.88	72.32	81.72	85.91	-75.17		57.4	56.68	68.21	72.53	2.32	
	03:00	86.86	35.02	73.14	72.61	81.69	85.45	-75.17		56.88	56.25	68.64	73.18	2.31	
	04:00	86.41	34.9	73.71	72.84	81.44	85.09	-75.19		56.5	55.84	68.65	73.27	2.37	
	05:00	85.97	35.06	74.01	73.84	81.18	84.76	-75.21		56.08	55.45	68.73	73.47	2.33	
	06:00	85.41	35.23	74.27	74.04	80.91	84.51	-75.22		55.75	55.05	68.71	73.42	2.41	
	07:00	85.12	35.51	74.28	74.01	81	84.37	-75.3		56.06	55.36	68.99	73.61	2.33	
	08:00	85.53	35.66	74.76	74.04	80.34	83.86	-75.31		56.75	55.94	68.86	73.18	2.25	
	09:00	86.2	35.44	75.03	74.36	80.19	83.77	-75.26		57.45	56.74	68.41	72.52	2.29	
	10:00	87.29	34.37	75.34	74.68	80.3	83.92	-75.21		58.01	57.35	69.63	73.14	2.31	
	11:00	87.89	32.74	75.63	74.99	80.79	84.37	-75.13		58.13	57.47	69.86	73.85	2.25	
	12:00	89.01	30.37	76.03	75.5	81.62	85.12	-75.08		58.29	57.71	69.96	74.1	2.2	
	13:00	89.91	29.58	76.3	75.5	82.15	85.76	-75.03		58.62	58.03	70.9	74.95	2.26	
	14:00	90.55	28.95	76.62	75.76	82.94	86.45	-74.99		58.91	58.19	71.21	75.72	2.21	
	15:00	91.07	29.25	76.85	75.95	83.42	87.07	-74.97		59.01	58.34	71.72	76.09	2.21	
	16:00	91.59	29.03	77.04	76.01	83.86	87.75	-74.96		59.4	58.65	72.1	76.25	2.26	
	17:00	91.63	29.62	77.82	76.72	83.91	87.85	-74.93		59.2	58.61	71.54	76.51	2.19	
	18:00	90.59	32.77	77.87	76.76	84.48	88.51	-75		59.52	58.85	71.33	76.48	2.26	
	19:00	89.51	34.74	78.19	76.99	83.87	88.22	-75.06		59.12	58.49	70.46	75.67	2.21	
	20:00	88.82	35.81	78.3	77.01	83.55	87.75	-75.11		58.77	58.07	69.69	75.13	2.25	
	21:00	88.28	36.15	78.62	77.19	82.87	87.07	-75.12		58.55	58	69.29	74.38	2.29	
	22:00	87.58	36.66	78.58	76.98	82.84	86.97	-75.2		58.61	57.99	68.7	74.02	2.26	
	23:00	86.39	37.78	78.81	77.09	82.34	86.08	-75.23		58.11	57.49	68.21	73.47	2.28	
10/6	00:00	85.72	38.28	78.69	76.89	81.32	85.26	-75.27		57.59	56.96	67.95	73.05	2.35	
	01:00	85.25	38.66	78.68	76.79	80.94	84.61	-75.31		57.19	56.59	68.54	73.55	2.26	
	02:00	85.4	38.5	78.8	76.33	80.67	84.18	-75.29		56.73	56.08	68.59	73.24	2.37	
	03:00	85.26	38.72	78.79	76.34	80.61	84	-75.29		56.41	55.73	68.21	73.17	2.35	
	04:00	84.75	39.31	78.79	76.1	80.7	84.08	-75.33		56.64	55.96	68.75	73.46	2.39	
	05:00	84.35	39.81	78.88	76.08	80.64	83.79	-75.35		56.51	55.91	68.91	73.6	2.36	
	06:00	84.19	39.95	78.91	75.92	80.11	83.33	-75.38		56.21	55.64	68.75	73.41	2.46	
	07:00	84.37	40.67	78.7	75.63	80.08	83.31	-75.39		56.7	56	68.65	73.28	2.38	
	08:00	85.11	40.87	78.69	75.54	79.69	83.11	-75.36		57.51	56.84	69.01	72.68	2.35	
	09:00	85.89	40.93	78.84	75.75	79.92	83.14	-75.29		58.2	57.49	70.46	73.82	2.41	
	10:00	87.83	40.64	78.98	75.71	80.61	83.83	-75.21		58.72	58.06	72.72	76.18	2.32	
	11:00	89.4	39.81	79.15	75.99	81.69	84.7	-75.12		59.38	58.71	74.62	78.03	2.29	
	12:00	90.08	38.99	51.77	40.97	79.71	91.3	11.25	120.91	56.7	56.89	75.71	78.59	2.21	
	13:00	90.47	37.52	51.07	40.38	79.18	90.9	11.43	119.93	56.34	55.93	75.33	77.71	2.23	
	14:00	91.25	36.45	50.96	40.23	80.38	91.95	11.36	120.44	56.63	56.33	76.38	78.45	2.26	
	15:00	91.57	34.57	50.92	40	79.13	90.76	11.33	119.58	56.14	55.82	75	78.02	2.23	
	16:00	91.41	34.09	50.86	39.95	78.98	90.66	11.43	119.03	56.27	55.95	74.85	77.64	2.22	
	17:00	91.35	34.03	50.85	39.91	78.5	90.12	11.41	118.06	56.44	56.11	74.21	77.35	2.27	
	18:00	90.51	35.54	50.4	39.53	78.24	89.79	11.52	117.47	56.35	56.04	73.8	76.96	2.21	
	19:00	89.88	36.47	50.09	39.17	77.33	88.84	11.41	116.86	56.05	55.7	72.81	76.22	2.26	
	20:00	89.24	37.53	50.95	50.5	78.83	80.22	6.27		58.85	58.11	70.84	75.55	2.36	
	21:00	88.76	37.96	52.2	51.36	80.8	82.42	6.08		58.78	58.19	70.53	75.35	2.3	
	22:00	88.19	38.14	53.66	52.61	81.3	83.55	6.14		58.57	57.96	69.89	74.61	2.3	
	23:00	87.63	38.64	54.45	53.4	81.67	84.56	5.89		58.67	57.9	69.46	74.51	2.31	

				90 Ton Chiller						150 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
10/7	00:00	86.5	39.74	55.32	54.19	81.64	85.18	6.07		58.47	57.89	69.02	74.19	2.44	
	01:00	86.32	40	56.47	55.29	81.02	84.69	6.13		58.21	57.62	68.75	73.8	2.41	
	02:00	86.13	40.22	57.18	56.05	80.91	84.58	5.88		57.95	57.34	68.47	73.52	2.39	
	03:00	85.52	40.66	58.21	57.08	80.64	84.41	6.23		57.7	57.01	68.31	73.21	2.42	
	04:00	84.04	41.92	59.2	58.03	80.12	83.87	6.01		57.33	56.67	67.85	72.88	2.45	
	05:00	84.31	41.19	60.11	58.98	80.06	83.74	6.11		56.75	56.13	68.48	73.27	2.43	
	06:00	83.38	42.64	60.93	59.81	79.88	83.63	6.17		56.63	55.98	68.81	73.08	2.54	
	07:00	83.34	43.39	61.77	60.6	79.94	83.52	6.02		56.77	56.1	68.11	72.88	2.55	
	08:00	85.81	42.12	62.77	61.5	79.72	83.53	6.03		58.03	57.25	69.82	73.45	2.43	
	09:00	87.53	42.26	63.66	62.33	80.01	83.62	6.06		58.76	58.07	73.25	75.95	2.42	
	10:00	89.24	42.68	64.28	63.07	81.26	84.47	5.93		59.36	58.64	75.52	78.6	2.49	
	11:00	90.72	41.71	65.26	64.04	82.55	85.47	5.81		60.32	59.48	76.66	79.94	2.37	
	12:00	90.53	39.54	51.76	40.81	80.9	92.58	11.3	121.84	56.8	56.73	77.07	79.21	2.25	
	13:00	91.78	38.13	51.53	40.69	81.11	92.69	11.33	121.99	56.67	56.38	77.07	79.39	2.3	
	14:00	91.93	38.21	51.38	40.43	81.28	92.81	11.23	121.75	56.72	56.38	77.28	79.47	2.35	
	15:00	92.25	37.91	51.21	40.34	81.32	92.64	11.36	121.27	56.47	56.19	77.31	79.16	2.39	
	16:00	92.31	38.92	51.32	40.42	81.79	93.2	11.17	120.97	56.73	56.41	77.77	79.75	2.39	
	17:00	91.89	39.75	51.88	40.93	81.88	93.41	11.35	121.04	57.4	57.01	77.61	80.08	2.31	
	18:00	91.66	39.41	51.38	40.42	81.4	92.95	11.3	120.43	57.32	57.12	77.13	79.85	2.31	
	19:00	91.14	38.72	50.92	40.04	79.91	91.45	11.41	118.89	56.73	56.43	75.63	78.49	2.31	
	20:00	90.62	39.48	50.77	39.97	79.43	90.96	11.32	118.25	56.64	56.33	75.01	78.02	2.3	
	21:00	90.13	41.18	50.9	40.03	79.81	91.47	11.13	118.26	56.79	56.39	75.48	78.06	2.33	
	22:00	90.05	41.91	50.73	39.92	80.3	91.86	11.26	118.55	56.87	56.58	75.85	78.71	2.34	
	23:00	89.88	42.63	50.86	39.97	79.85	91.48	11.25	117.90	56.52	56.3	75.41	78.3	2.31	
10/8	00:00	89.29	43.08	50.31	39.61	79.99	91.46	11.35	117.63	56.42	56.25	75.41	78.51	2.41	
	01:00	88.84	43.17	50.11	39.34	79.05	90.6	11.18	117.09	56	55.72	74.45	77.75	2.4	
	02:00	88.65	43.02	49.99	39.19	78.65	90.11	11.34	116.88	55.74	55.38	74.08	77.28	2.39	
	03:00	88.49	43.36	49.97	39.18	78.57	90.05	11.35	116.77	55.59	55.18	74.2	77.14	2.38	
	04:00	88.37	43.32	50.01	39.2	78.68	90.17	11.42	116.87	55.49	55.14	74.26	77.13	2.37	
	05:00	88.14	43.64	50.61	39.74	79.04	90.6	11.23	118.00	56.44	55.8	74.75	77.42	2.43	
	06:00	88.21	43.22	50.88	39.95	78.58	90.2	11.26	118.06	56.51	56.14	74.07	77.06	2.38	
	07:00	88.36	43.09	50.63	39.75	78.44	89.96	11.27	119.15	56.3	55.95	74.17	76.91	2.44	
	08:00	88.52	42	50.97	40.12	78.31	89.91	11.12	119.70	56.17	55.76	74.06	76.6	2.38	
	09:00	88.25	42.85	50.89	39.98	78.59	90.14	11.08	119.76	56.13	55.64	74.39	76.98	2.46	
	10:00	88.93	42.11	50.66	39.79	78.63	90.03	11.24	119.37	55.74	55.32	74.42	76.96	2.45	
	11:00	89.02	42.65	50.71	39.82	79.32	90.72	11.22	119.91	56.33	55.92	75.03	77.62	2.43	
	12:00	89.18	44.23	51.19	40.4	80.27	91.9	11.13	121.09	56.68	56.24	76.04	78.48	2.42	

Table B-2
Hospital Data for 225 and 500 Ton Chillers

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
9/23	19:00	78.28	51.35	92.12	86.55	70.05	72.67	4.1		75.13	70.64	74.99	76.29	2.7	
	20:00	78.48	52.06	93.22	88.06	70.33	72.82	3.97		75.44	70.8	75.7	77.12	2.64	
	21:00	78.93	52.06	93.17	88.88	70.6	72.61	4.08		75.54	70.95	75.99	77.63	2.59	
	22:00	74.52	68.62	93.2	89.54	70.2	72.51	4.07		75.5	71.15	76.19	78.12	2.92	

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	23:00	75.52	63.1	93.64	89.52	69.99	72.54	4.2		75.73	71.16	76.42	78.44	3.01	
9/24	00:00	75.22	64.63	94.47	89.82	68.79	72.65	4.08		75.72	71.31	76.55	78.66	2.91	
	01:00	76.18	60.87	95.07	90.23	68.85	72.74	3.98		75.86	71.48	76.81	79.15	2.87	
	02:00	78.35	53.65	95.82	90.44	67.55	72.42	4.02		75.81	71.79	76.78	79.39	2.89	
	03:00	78.31	53.66	95.97	90.8	67.18	72.19	3.79		75.68	72.23	76.77	79.37	2.85	
	04:00	78.38	52.51	96.25	90.62	67.13	71.93	3.9		75.59	72.71	76.98	79.75	3.01	
	05:00	78.55	51.78	96.66	90.55	67.47	72.3	4.1		75.82	72.93	77.02	79.9	2.83	
	06:00	78.29	53.02	96.94	90.8	67.48	72.21	4.15		75.8	73.16	77.09	80.1	2.82	
	07:00	78.58	51.9	97.12	90.67	67.62	72.33	4.15		76.1	73.69	77.53	80.55	2.89	
	08:00	67.95	71.84	96.61	90.08	68.62	72.85	4.19		75.94	72.54	77.21	78.97	3.18	
	09:00	66.64	73.87	97.15	89.96	68.35	72.52	4.32		75.7	72.07	77.39	78.4	3.4	
	10:00	77.28	55.06	97.52	89.4	68.48	72.5	4.21		76.19	72.46	78.01	78.28	3.37	
	11:00	77.95	49.3	97.48	89.78	68.39	72.46			76.21	72.28	78.11	78.27	3.08	
	12:00	78.35	49.13	97.41	89.21	71.1	72.49			76.16	71.92	77.94	78.37	2.99	
	13:00	78.77	48.84	96.54	87.86	71.62	72.3			76.29	71.85	78.24	78.87	3.04	
	14:00	79.27	48.59	95.43	85.29	72.54	72.89			76.33	71.44	78.27	79.24	3.02	
	15:00	79.51	48.8	94.71	83.06	72.83	73.38			76.43	71.53	78.61	79.73	3.43	
	16:00	80	49.02	94.03	81.62	74.86	74.84			76.62	71.48	78.82	80.1	3.53	
	17:00	81.19	47.09	93.53	80.16	75.94	75.91			76.67	71.45	79.11	80.52	3.47	
	18:00	80.23	50.34	92.5	78.33	75.24	75.6			76.76	71.35	79.11	80.6	3.47	
	19:00	80.1	51.49	92.28	77.64	75.3	75.48			76.55	71.02	79.12	80.91	3.54	
	20:00	79.95	51.68	91.71	76.94	75.03	75.35			76.73	70.69	79.08	81.1	3.53	
	21:00	79.74	50.81	91.12	76.13	73.68	74.36			76.94	70.98	79.23	81.29	3.46	
	22:00	79.28	49.2	90.49	75.43	72.22	72.75			76.91	70.8	79.11	81.26	3.42	
	23:00	78.54	48.86	90.26	74.99	71.4	72.06			77.09	70.88	79.14	81.38	3.19	
9/25	00:00	78.06	46.6	91.71	79.05	70.1	72.25			77.04	70.47	79.06	81.54	3.08	
	01:00	77.37	46.3	93.74	82.97	68.26	72.07			76.92	70.55	78.85	81.42	3	
	02:00	76.98	45.72	95	86.23	68.32	72.35			77	70.41	78.48	81.21	3	
	03:00	75.96	48.26	95.6	88.07	68.22	72.42			77.16	70.37	78.37	81.18	2.92	
	04:00	75.28	49.04	95.58	88.26	69.25	72.52			76.99	70.39	77.88	80.92	2.89	
	05:00	74.93	48.4	94.71	86.73	70.66	73.21			77.02	70.71	77.75	81.13	2.83	
	06:00	74.67	47.71	94	85.86	72.18	74.06			76.88	70.86	77.2	80.71	2.76	
	07:00	75.17	46.68	92.61	84.03	72.96	74.28			76.39	70.51	76.62	80.25	2.76	
	08:00	73.02	55.38	91.72	82.53	73.54	74.54			75.93	70.26	76	79.67	2.82	
	09:00	76.93	44.69	91.02	81.9	74.65	75.06			55.16	48.93	82.06	90.07	9.52	
	10:00	79.03	43.71	90.54	80.31	75.39	75.72			49.78	46.16	81.21	86.31	9.4	75.88
	11:00	79.48	43.35	89.94	78.98	75.85	75.75			50.12	46.77	81.9	87.3	9.42	80.52
	12:00	80.95	41.88	89.45	78.04	76.75	76.45			52.19	48.6	80.91	86.3	9.46	74.71
	13:00	81.54	41.09	89.32	77.42	77.49	76.95			52.24	48.53	81.75	87.04	9.43	75.63
	14:00	82.46	39.9	89.03	76.79	77.95	77.28			52.19	48.58	81.08	86.47	9.63	76.46
	15:00	83.16	39.37	88.15	76.16	78.37	77.65			52.3	48.88	81.78	87.48	9.67	76.51
	16:00	83.65	39.14	88.06	75.79	78.73	77.94			52.57	48.94	81.6	87	9.66	77.35
	17:00	85.57	38.2	87.58	75.32	79.16	78.23			52.46	49	81.16	87.08	9.67	77.34
	18:00	83.57	41.67	87.25	75.02	79.35	78.6			52.97	49.46	81.84	86.75	9.75	74.79
	19:00	82.84	42.85	87.17	74.86	79.92	78.83			53.26	49.27	81.25	86.48	9.6	74.60
	20:00	82.12	43.78	86.62	74.57	79.97	78.79			53.15	49.4	81.69	86.67	9.63	74.42
	21:00	81.33	44.56	86.55	74.82	80.26	79.14			53.02	49.3	82.09	87.15	9.52	74.40

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
	22:00	81.02	44.67	86.18	74.22	80.12	78.97			52.91	49.46	81.56	86.48	9.5	74.05
	23:00	80.36	45.33	85.75	74.38	80.2	79.02			52.9	49.28	81.55	86.23	9.46	72.31
9/26	00:00	79.72	45.79	85.38	73.98	80.01	78.67			52.54	49.42	81.46	85.72	9.45	71.29
	01:00	78.24	47.09	85.4	74.1	80.34	78.93			52.37	49.16	81.32	85.29	9.55	69.61
	02:00	77.65	48.3	84.58	73.31	79.49	78.06			51.57	48.52	79.97	84.39	9.49	69.52
	03:00	77.15	48.07	84.83	73.57	79.65	78.12			51.55	48.74	81.2	84.88	9.22	68.19
	04:00	77	47.78	83.98	73.12	79.33	77.81			51.77	49.15	81.16	84.79	9.29	66.69
	05:00	76.43	47.92	83.82	73.18	79	77.52			51.87	49.25	80.42	84.09	9.25	65.11
	06:00	76.22	47.62	83.3	73.01	78.66	77.12			51.84	49.18	80.4	84.46	9.2	65.12
	07:00	77.03	47.13	83.08	72.54	78.63	76.93			52.01	49.23	80.96	84.99	9.28	65.25
	08:00	78.46	49.78	82.85	72.45	78.7	76.92			51.94	48.43	81.52	86.06	9.39	70.66
	09:00	80.14	46.87	82.4	72.06	78.19	76.58			52.81	48.77	81	86.28	9.49	74.38
	10:00	81.65	45.11	82.39	72.29	78.73	77			52.68	48.42	81.66	87.18	9.6	76.67
	11:00	82.88	41.4	82.53	72.46	79.26	77.49			52.43	48.1	82.04	87.52	9.84	76.04
	12:00	83.79	39.39	82.12	72.14	79.57	77.84			52.14	47.87	80.42	86.02	9.89	76.38
	13:00	84.71	37.7	82.05	72.2	80.04	78.38			50	44.6	81.04	88.04	10.11	90.40
	14:00	85.24	36.68	82.08	72.35	80.61	78.95			52.76	48.46	81.94	87.63	9.91	76.33
	15:00	85.65	36.38	82.12	72.27	80.95	79.24			52.7	48.5	82.51	88.16	9.83	76.32
	16:00	87.03	35.65	81.99	72.34	81.36	79.63			52.97	48.47	81.97	87.85	9.76	78.35
	17:00	86.75	36.12	81.6	72.06	81.5	79.9			53.19	48.68	82.51	88.37	9.86	79.19
	18:00	85.69	38.97	81.61	71.76	81.45	80.04			53.49	49.1	82.07	87.67	10.07	77.73
	19:00	84.28	40.63	81.65	72.38	81.61	80.03			53.54	49.34	80.86	86	9.83	74.21
	20:00	82.91	41.57	81.57	72.35	81.69	80.14			53.21	49.25	79.69	84.71	9.9	72.81
	21:00	82.97	40.97	81.26	71.97	81.52	80.11			53.41	49.66	78.15	82.89	9.83	70.48
	22:00	82.12	41.71	81.4	72.31	81.75	80.23			52.98	49.14	78.13	82.68	9.77	69.91
	23:00	81.43	42.9	81.27	71.9	81.57	80.04			54.42	51.47	78.24	81.67	9.66	64.30
9/27	00:00	80.92	43.56	81.37	72.36	81.68	80.04			55.13	52.04	77.89	81.72	9.62	64.67
	01:00	80.59	43.44	81.38	72.41	81.53	79.73			55.04	52.1	77.84	81.64	9.63	64.45
	02:00	79.99	43.52	80.99	72.3	81.2	79.55			55.23	52.4	78.61	82.07	9.61	63.17
	03:00	79.32	43.93	80.79	72.16	81.12	79.33			54.94	52.43	77.2	80.77	9.6	62.02
	04:00	79.17	43.83	80.61	72.08	80.99	79.1			54.77	52.39	78.34	81.64	9.43	61.58
	05:00	78.28	44.62	80.71	72.08	80.71	78.89			54.82	52.41	77.48	80.73	9.46	60.94
	06:00	77.44	44.65	80.32	72	80.45	78.68			54.74	52.44	77.18	80.38	9.45	60.38
	07:00	77.93	45.43	80.27	71.6	80.22	78.28			54.92	52.53	77.17	80.64	9.46	60.79
	08:00	79.34	44.21	80.25	71.89	80.15	78.06			54.95	51.98	77.64	81.56	9.62	62.79
	09:00	79.71	44.01	80.39	71.89	80.4	78.43			55.16	51.8	76.97	81.13	9.66	64.08
	10:00	81.43	42.03	79.99	71.51	80.22	78.38			55.31	51.65	79.05	83.67	9.82	67.70
	11:00	82.26	40.46	80.25	71.91	80.85	78.83			55.2	51.42	79.64	84.36	10.1	68.71
	12:00	83.9	39.17	79.95	71.53	80.6	78.75			55.3	51.61	79.97	84.95	10.12	70.26
	13:00	84.39	38.82	79.76	71.44	80.77	78.9			55.63	51.92	80.75	85.8	10.35	71.05
	14:00	85.08	38.55	79.74	71.38	81.07	79.52			55.57	51.7	81.18	86.28	10.36	72.41
	15:00	85.23	40	79.8	71.59	81.66	79.84			55.7	51.63	82.22	87.49	10.33	73.61
	16:00	85.11	40.85	80	71.71	81.9	80.14			55.78	51.68	82.74	88.21	10.76	75.35
	17:00	85.68	40.2	80.02	71.67	82.26	80.49			55.7	51.62	82.58	87.95	10.7	74.66
	18:00	84.36	42.03	80.1	71.87	82.4	80.6			55.55	51.7	81.02	86.17	10.56	72.10
	19:00	82.43	44.08	80.29	71.79	82.46	80.6			55.71	52.02	80.27	85.02	10.5	70.31
	20:00	83.22	42.5	80.35	71.93	82.77	80.98			55.55	52.01	78.5	82.89	10.38	67.61

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	21:00	82.36	42.64	79.98	71.73	82.44	80.74			55.66	52.28	77.11	81.22	10.31	66.06
	22:00	81.69	42.52	79.74	71.2	82.08	80.47			55.77	52.58	77.53	81.47	10.33	65.06
	23:00	81.47	42.22	79.93	71.51	82.25	80.37			55.17	52.28	77.93	81.62	10.35	64.02
9/28	00:00	80.77	42.93	80.07	71.62	71.82	72.47			55.04	52.23	78.13	81.88	10.23	63.32
	01:00	80.15	43.44	84.06	77.98	69.87	72			55.04	52.34	78.2	81.72	10.22	62.72
	02:00	79.72	43.36	87.3	82.59	69.06	72.13			54.92	52.28	77.07	80.64	10.24	62.03
	03:00	78.3	43.75	89.07	85.63	68.07	72.42			55.74	53.78	76.08	78.36	10.42	33.62
	04:00	80	42.95	90.29	86.89	67.38	71.31			54.69	51.99	78.05	81.75	10.48	62.23
	05:00	79.3	46.58	91.03	88.82	67.29	71.28			55.06	51.88	76.56	80.71	10.49	64.58
	06:00	80.47	47.1	91.56	89.31	67.66	71.69			55.4	52	77.43	81.71	10.33	66.14
	07:00	80.42	42.68	92.17	89.91	67.52	71.82			54.76	51.95	77.71	81.48	10.36	63.39
	08:00	80.13	43.87	92.81	89.23	67.58	71.8			54.74	51.68	76.97	80.94	10.32	63.38
	09:00	80.18	41.65	93.12	88.6	67.11	71.37			54.64	51.77	77.3	81.11	10.35	62.59
	10:00	80.29	41.25	93.48	88.1	66.98	71.23			54.59	51.69	77.22	81	10.36	62.61
	11:00	80.22	41.42	94.04	88.39	67.41	71.56			54.8	51.97	78.01	81.87	10.54	62.39
	12:00	79.96	41.31	94.06	87.62	67.44	71.43			54.43	51.82	77.56	80.98	10.33	61.85
	13:00	80.43	38.3	94.53	87.86	66.91	71.26			54.77	51.7	77.07	81.11	10.37	63.19
	14:00	81.83	37.18	95.03	87.57	67.2	71.32			54.74	51.58	75.87	80.23	10.48	64.67
	15:00	82.44	34.33	95.26	87.96	67.13	71.42			54.94	51.54	77.49	82	10.63	65.54
	16:00	82.86	33.82	95.81	87.91	67.11	71.5			55.01	51.5	76.09	80.54	10.57	65.25
	17:00	82.77	35.4	96.3	88.02	67.38	71.56			54.84	51.57	76.29	80.49	10.61	64.82
	18:00	80.62	37.86	96.29	87.97	67.04	71.39			54.96	51.78	77.55	81.54	10.59	63.58
	19:00	79.92	39.97	96.51	87.92	67.06	71.34			55.04	52.1	78.01	81.7	10.63	62.31
	20:00	79.27	41.05	97.02	87.78	66.92	71.3			54.95	52	77.29	80.96	10.47	62.10
	21:00	78.44	40.13	97.16	87.89	66.96	71.24			54.72	52.15	78.16	81.58	10.42	61.35
	22:00	76.85	40.56	97.45	87.82	67.13	71.4			54.57	52.08	77.17	80.23	10.4	60.69
	23:00	75.31	41.96	97.52	87.77	66.59	71.15			54.54	52.08	77.12	80.26	10.34	60.12
9/29	00:00	74.19	43.51	97.91	87.87	66.33	70.73			54.53	52.07	77.8	80.66	10.3	59.48
	01:00	76.02	42.04	97.73	87.33	66.31	70.67			57.08	54.93	77.69	80.05	10.31	56.98
	02:00	77.53	40.49	97.96	87.37	66.53	70.73			56.87	55.1	76.41	78.9	10.25	56.56
	03:00	76.47	40.84	98.45	88.08	67.1	71.28			56.8	55.01	77.34	79.63	10.25	56.30
	04:00	76.94	39.5	98.14	87.57	66.83	71.08			56.73	54.87	76.15	78.64	10.23	55.62
	05:00	75.06	40.76	98.63	87.82	66.5	70.8			56.7	54.92	76.13	78.64	10.34	55.01
	06:00	75.45	39.91	98.58	87.32	66.08	70.36			56.49	54.83	76.8	79.02	10.27	53.74
	07:00	72.31	42.91	98.31	86.45	65.59	69.95			56.81	55.09	76.72	78.95	10.21	53.27
	08:00	75.88	40.52	98.19	85.8	65.46	69.52			56.73	54.68	76.18	78.78	10.12	55.46
	09:00	77.45	39.71	49.12	40.85	69.14	79.44		270.88	57	56.86	79.56	80.74	3.79	
	10:00	79.45	38.83	50.02	40.44	68.46	79.67		285.16	57.49	57.31	79.39	80.61	3.9	
	11:00	81.03	37.74	50.52	40.46	68.95	80.97		299.80	57.73	57.74	79.25	80.68	4.04	
	12:00	82.92	35.88	50.67	40.57	70.04	82.51		314.41	58.25	58.25	79.07	80.73	4.12	
	13:00	83.31	35.32	50.99	40.64	70.2	82.8		319.21	58.81	58.84	79.3	81.06	4.21	
	14:00	83.98	33.3	52.34	40.54	70.25	83.02		323.41	59.33	59.41	79.42	81.3	4.22	
	15:00	84.71	32.47	52.28	40.79	70.22	82.87		319.55	59.4	59.54	79.39	81.7	4.41	
	16:00	84.91	33.86	52.78	40.93	71.11	84.15		331.73	59.94	60.23	79.8	81.84	4.22	
	17:00	84.68	35.14	52.71	40.85	70.91	83.94		330.57	60.72	61.05	80.11	82.37	4.2	
	18:00	84.74	36	52.18	40.5	70.24	82.83		319.11	61.35	61.96	80.51	82.74	4.17	
	19:00	83	38.78	51.72	40.63	69.45	81.44		303.66	61.93	62.27	80.64	82.99	4.18	

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	20:00	81.81	38.92	51.45	40.67	68.98	80.67		298.55	62.49	62.68	80.74	83.1	4.43	
	21:00	84.59	36.39	51.1	40.41	68.8	80.29		296.16	63.11	63.26	80.92	83.39	4.37	
	22:00	84.01	36.93	51.09	40.76	67.65	78.7		285.23	63.39	63.43	80.72	83.31	4.33	
	23:00	83.35	37.01	50.58	40.8	68.33	78.78		275.76	63.79	63.71	80.52	83.33	4.33	
9/30	00:00	82.57	36.25	50.45	40.76	68.17	78.37		272.85	63.87	63.77	80.19	83.12	4.22	
	01:00	82.17	34.87	49.99	40.7	68.27	78.08		265.57	64.38	64.09	80.09	83.3	4.2	
	02:00	81.99	33.68	49.55	40.71	68.26	77.67		253.27	64.73	64.15	79.8	83.26	4.2	
	03:00	81.07	33.99	48.94	40.49	68.48	77.16		241.20	64.78	64.38	79.52	82.85	4.14	
	04:00	80.19	34.52	48.46	40.65	68.51	76.54		229.54	64.99	64.36	79.24	82.81	4.14	
	05:00	79.3	34.98	48.2	40.8	68.68	76.25		218.47	65.4	64.66	78.9	82.41	4.02	
	06:00	78.56	35.42	47.37	40.4	67.83	74.72		200.14	65.6	64.9	78.71	82.41	4.02	
	07:00	79.02	34.77	47.97	40.33	69.24	77.13		222.69	65.82	64.73	78.33	82.2	4.08	
	08:00	79.99	33.91	49.3	40.56	68.28	77.34		243.78	65.64	64.54	77.93	81.9	4.1	
	09:00	80.08	32.95	50.26	40.73	68.88	79.07		265.66	65.85	64.57	77.39	81.32	4.16	
	10:00	81.26	32.52	50.87	40.62	68.54	79.33		275.82	65.81	64.67	77.46	81.41	4.29	
	11:00	82.32	31.79	51.57	40.68	67.87	79.29		289.20	65.96	64.74	77.44	81.37	4.35	
	12:00	82.58	30.93	51.98	42.28	68.48	78.69		266.50	66.37	65.22	77.66	81.55	4.43	
	13:00	82.84	29.44	54.8	44.67	68.12	78.63		264.64	66.38	65.16	77.63	81.45	4.5	
	14:00	83.82	25.59	54.97	44.69	68.42	79.17		269.63	66.7	65.48	77.88	81.63	4.69	
	15:00	85.2	23.71	54.98	44.66	68.06	79		269.71	67.07	65.99	78.42	81.91	4.72	
	16:00	87.11	19.78	55.31	44.73	68.04	78.95		272.73	67.35	66.57	78.82	82.4	4.76	
	17:00	86.9	20.47	54.77	44.54	68.19	78.96		268.88	67.91	67	79.2	82.83	4.78	
	18:00	86.07	23.35	54.23	44.7	68.61	78.68		256.59	68.36	67.43	79.32	83.09	4.75	
	19:00	84.83	26.61	53.53	44.57	69.02	78.21		242.98	69.11	67.99	79.92	83.57	4.7	
	20:00	83.72	28.98	53.2	44.89	68.62	77.32		232.34	69.15	68.27	79.65	83.56	4.57	
	21:00	81.11	33.85	52.5	44.66	68.56	76.7		222.39	69.18	68.09	79.33	82.94	4.48	
	22:00	79.89	35.52	51.88	44.73	68.68	75.89		205.08	69.34	68.17	79.05	82.83	4.37	
	23:00	78.76	37.27	51.22	47.53	68.52	72.61			69.5	68.07	78.8	82.78	4.46	
10/1	00:00	77.11	38.24	51.69	51.26	69.36	70.81			69.55	68.16	78.57	82.38	4.74	
	01:00	76.38	38.73	52.51	52.44	70.84	71.76			69.49	67.94	77.95	81.97	4.61	
	02:00	75.91	39.11	53.28	53.45	71.87	72.19			69.35	67.76	77.68	81.72	4.61	
	03:00	71.36	45.22	53.77	54.28	72.98	72.9			69.43	67.74	77.17	81.32	4.57	
	04:00	58.99	66.29	54.2	54.9	74.07	73.76			69.72	68.17	77.05	81.14	4.63	
	05:00	56.75	70.25	55.18	55.96	74.28	73.74			69.53	67.98	76.5	80.81	4.54	
	06:00	56.92	72.73	55.83	56.79	74.92	74.16			69.58	67.96	76.04	80.65	4.64	
	07:00	58.61	71.21	56.15	57.37	75.62	74.81			69.8	68.39	75.91	80.41	4.66	
	08:00	62.53	66.43	60.54	56.52	71.5	74.33			69.54	68.2	75.74	80.09	4.42	
	09:00	77.29	40.88	50.01	40.65	68.89	75.36		250.92	69.36	67.86	75.54	79.87	4.33	
	10:00	80.05	35.39	50.8	40.44	68.73	76.19		272.49	69.66	67.74	75.76	79.96	4.45	
	11:00	82.03	30.01	51.69	40.61	68.58	76.56		286.57	69.81	67.53	76.03	80.37	4.53	
	12:00	83.63	29.1	52.19	40.72	68.07	76.36		293.54	69.91	67.64	76.27	80.74	4.63	
	13:00	86.63	25.4	53.64	41.04	68.44	77.9		327.27	70.28	67.74	76.61	80.97	4.74	
	14:00	86.98	24.52	52.61	40.72	68.14	76.81		302.84	70.46	68.16	77.15	81.39	4.76	
	15:00	87.46	24.34	52.4	40.55	68.33	76.95		301.60	70.75	68.08	77.35	81.73	4.92	
	16:00	87.6	23.97	52.74	40.69	68.33	77.15		309.70	70.91	68.13	77.86	82.07	4.7	
	17:00	87.96	23.42	52.59	40.66	68.41	77.12		304.68	71.33	68.54	78.27	82.31	4.95	
	18:00	86.39	29.94	51.86	40.72	68.29	76.51		287.86	71.75	69.08	78.95	82.84	4.88	

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	19:00	85.43	31.41	51.23	40.72	68.72	76.23		275.85	72.2	69.39	79.16	83.16	4.7	
	20:00	84.87	30.85	50.86	40.71	68.94	76.34		270.33	72.24	69.31	79.03	82.99	4.53	
	21:00	82.83	35.55	50.05	40.58	69.13	75.86		257.11	72.54	69.49	79.2	83.28	4.41	
	22:00	81.22	38.1	49.58	40.8	69	75.27		244.85	72.58	69.56	79.07	83.08	4.28	
	23:00	80.28	39.16	50.25	42.65	68.98	74.3		215.55	72.64	69.27	78.92	82.87	4.21	
10/2	00:00	79.27	40.26	50.06	42.47	69.56	74.82		214.67	72.88	69.41	78.73	82.82	4.13	
	01:00	78.57	40.98	50.62	44.86	68.6	72.75		168.14	72.95	69.53	78.4	82.55	4.12	
	02:00	77.77	41.83	52.02	45.92	67.11	71.21		168.56	72.73	69.21	77.96	82.32	4.04	
	03:00	77.63	41.77	52.05	45.88	66.95	71.02		166.60	72.72	69.06	77.63	82.06	4.02	
	04:00	78.04	41.21	51.75	45.75	66.89	70.88		164.04	72.85	69.22	77.19	81.71	3.96	
	05:00	77.89	41.01	51.78	45.73	66.79	70.86		164.11	72.74	69.07	76.93	81.59	4.03	
	06:00	77.4	41.34	51.33	45.71	66.05	69.71		154.46	72.83	69.26	76.76	81.37	4.05	
	07:00	77.8	41.7	51.94	45.6	67.18	71.36		167.41	72.74	69.12	76.6	80.99	4.05	
	08:00	78.78	41.52	52.82	45.94	68.57	73.21		185.79	72.65	68.84	76.32	78.2	4.1	
	09:00	80.08	39.34	53.91	45.77	69.15	74.85		216.78	72.54	68.51	75.86	77.67	4.45	
	10:00	81.01	38.51	56.35	45.36	69.11	74.96		228.79	68.8	65.83	74.17	75.34	6.07	
	11:00	82.85	36.96	56.53	45.48	68.86	74.99		230.23	59.82	59.75	71.03	71.13	4.61	
	12:00	83.33	35.2	57.65	46.35	68.55	74.74		230.16	60.33	60.34	71.71	72.27	4.67	
	13:00	85.63	34.18	55.36	40.68	70.99	79.91		318.62	60.82	60.86	72.71	73.55	4.59	
	14:00	86.83	35.11	54.83	40.74	71.43	79.68		302.41	61.58	61.7	73.74	74.84	4.68	
	15:00	88.82	34.34	54.96	40.63	72.49	81.03		310.92	61.86	62.06	74.53	75.95	4.69	
	16:00	88.85	34.54	55.12	40.65	72.63	81.39		317.56	62.63	62.89	75.67	77.19	4.72	
	17:00	89.27	34.95	55.29	40.63	72.28	81.07		319.31	62.88	63.15	76.24	78.11	4.77	
	18:00	88.62	35.42	54.83	40.58	70.98	79.42		304.47	63.39	63.69	76.96	78.96	4.91	
	19:00	87.89	36.54	54.4	40.61	70.32	78.54		296.61	63.92	64.24	77.51	79.79	4.9	
	20:00	87.29	37.14	53.68	40.42	69.55	77.45		287.19	64.44	64.64	78.1	80.53	4.87	
	21:00	86.82	37.26	53.9	40.8	68.89	76.6		284.27	64.96	65.05	78.49	80.99	4.86	
	22:00	86.5	37.3	53.49	40.66	68.47	76.08		279.04	65.55	65.53	79.17	81.64	4.84	
	23:00	84.8	39.28	53.14	40.82	67.86	75.08		270.24	65.84	65.63	79.12	81.76	4.75	
10/3	00:00	83.27	40.95	52.68	40.69	68.63	75.63		266.59	66.13	65.97	79.31	82.02	4.66	
	01:00	83.63	39.55	52.39	40.66	68.53	75.36		260.12	66.69	66.33	79.4	82.1	4.66	
	02:00	83.46	39.03	52.02	40.7	68.83	75.32		254.47	66.38	66.1	79.17	82.1	4.59	
	03:00	82.95	39.24	51.53	40.53	69.04	75.36		249.36	66.76	66.19	79.38	82.47	4.65	
	04:00	82.62	39.15	51.56	40.6	68.86	75		246.67	66.73	66.16	79.3	82.48	4.8	
	05:00	82.29	39.97	51.01	40.57	68.8	74.97		239.39	66.97	66.35	79.18	82.38	4.63	
	06:00	82.23	40.36	51.23	40.61	68.62	74.88		240.17	67.41	66.62	79.34	82.55	4.57	
	07:00	82	41.34	51.54	40.66	68.91	75.32		244.99	67.82	66.73	79.44	82.97	4.56	
	08:00	82.39	43.01	53.08	40.71	68.54	75.77		267.94	67.87	66.81	79.31	80.08	4.65	
	09:00	83.56	44.17	54.46	40.57	71.31	79.56		298.39	67.97	67.1	79.2	79.83	4.69	
	10:00	87.77	41.18	55.25	40.63	73.54	82.38		325.43	67.78	66.77	79.22	79.91	4.78	
	11:00	88.83	39.98	55.7	40.89	74.54	83.54		334.07	68.52	67.52	79.78	80.44	4.97	
	12:00	90.21	38.94	53.58	40.46	77.64	85.9		302.00	68.8	67.82	80.34	81.07	4.88	
	13:00	90.69	37.08	53.07	40.52	76.79	84.68		288.08	69.13	67.84	80.53	81.65	4.97	
	14:00	91.25	35.82	53.21	40.67	76.81	84.68		289.93	69.33	68.27	81	82.34	4.91	
	15:00	91.77	35.12	53	40.72	76.91	84.7		289.05	69.84	68.89	81.86	83.3	5.12	
	16:00	92.44	33.92	53.03	40.75	76.86	84.64		290.10	70.14	69.09	82.32	83.9	5.3	
	17:00	92.51	34.86	52.82	40.52	76.92	84.58		289.21	70.24	69.15	82.31	84.11	5.25	

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	18:00	91.95	37.99	53.16	40.54	77.3	85.15		295.72	70.6	69.41	82.49	84.45	4.97	
	19:00	91.29	39.69	52.77	40.34	76.84	84.72		292.01	71.1	69.98	83.02	85.22	5.07	
	20:00	90.77	40.88	53.02	40.51	76.69	84.58		291.95	71.46	69.84	83.1	85.34	5.07	
	21:00	90.18	41.56	53.01	40.88	75.82	83.53		287.17	71.97	70.32	83.54	85.64	4.95	
	22:00	89.59	41.37	55.14	40.7	73.55	82.2		326.37	72.22	70.61	83.65	85.99	5.04	
	23:00	89.46	40.63	55.24	40.73	72.96	81.66		326.08	72.51	70.92	83.74	86.03	4.99	
10/4	00:00	88.96	40.01	54.86	40.66	72.07	80.56		316.92	72.71	71.1	83.88	86.17	4.92	
	01:00	88.41	39.62	54.53	40.75	71.15	79.4		308.23	73.03	71.34	83.86	86.18	4.9	
	02:00	87.68	39.5	54.17	40.57	70.67	78.85		303.05	72.98	71.17	83.84	86.29	4.9	
	03:00	87.63	39.31	54.33	40.48	70.27	78.4		302.39	73.16	71.25	83.64	86.12	4.86	
	04:00	87.6	39.2	54	40.58	70.08	78		297.76	73.49	71.62	83.82	86.42	4.85	
	05:00	87.36	39.27	53.91	40.54	69.81	77.75		294.63	73.69	71.51	83.78	86.39	4.87	
	06:00	87.02	39.48	53.89	40.7	69.24	76.87		288.38	74.05	71.96	83.81	86.51	4.82	
	07:00	86.67	40	53.65	40.53	69.02	76.97		287.42	74.15	71.88	83.73	86.43	4.78	
	08:00	87.11	39.83	54.33	40.59	70.35	78.52		299.48	74.02	71.99	83.38	86.12	4.81	
	09:00	87.74	39.66	54.92	40.73	71.49	79.92		309.59	73.86	71.7	83.14	85.73	4.85	
	10:00	88.82	38.03	55.01	40.62	72.42	81.15		318.31	73.94	71.63	83.25	85.81	4.89	
	11:00	89.81	36.95	55.43	40.72	73.12	82.01		332.41	74	71.64	83.28	85.72	4.99	
	12:00	90.63	36.45	55.72	40.68	73.98	83.12		338.15	74.27	71.92	83.51	86	5.06	
	13:00	91.24	35.01	55.72	40.66	73.93	83.06		337.96	74.73	72.44	83.97	86.44	5.03	
	14:00	92.13	34.73	55.82	40.81	74.61	83.78		339.42	74.79	72.34	84.16	86.45	5.12	
	15:00	92.63	33.52	55.69	40.76	74.39	83.5		338.12	75	72.51	84.34	86.83	5.19	
	16:00	93.14	33.03	55.87	40.87	74.5	83.68		339.65	74.92	72.53	84.47	86.97	5.22	
	17:00	93.32	31.81	55.97	40.67	73.91	83		339.26	75.18	72.71	84.69	87.19	5.26	
	18:00	92.09	35.18	55.27	40.36	73.88	83		337.41	76.35	73.68	85.57	88.23	5.23	
	19:00	91.5	35.44	54.96	40.23	73.24	82.31		329.63	76.71	74.1	85.76	88.41	5.17	
	20:00	90.6	36.42	54.92	40.52	72.33	81.17		320.87	76.66	74.03	85.67	88.29	5.11	
	21:00	90.01	37.08	54.76	40.56	71.93	80.49		317.21	76.7	74.01	85.67	88.41	5.11	
	22:00	89.25	37.73	54.37	40.49	70.94	79.21		308.11	77.06	74.26	85.66	88.23	5.17	
	23:00	88.78	37.25	54.66	40.75	69.86	78.12		305.20	76.9	74.14	85.44	88.06	5.18	
10/5	00:00	88.31	36.4	54.13	40.78	68.93	76.71		292.52	77.04	74.1	85.2	87.93	5.12	
	01:00	87.83	35.46	53.44	40.7	67.89	75.37		280.58	76.98	73.98	84.9	87.58	5.13	
	02:00	87.38	35.03	52.84	40.55	68.2	75.33		272.19	77.34	74.17	85.08	87.61	5.12	
	03:00	86.86	35.02	52.51	40.73	68.54	75.32		264.23	77.41	74.14	84.79	87.42	5.02	
	04:00	86.41	34.9	52.14	40.72	68.68	75.3		258.64	77.45	74.03	84.59	87.14	4.91	
	05:00	85.97	35.06	51.64	40.59	68.81	75.24		251.49	77.62	74.32	84.34	86.88	4.88	
	06:00	85.41	35.23	51.35	40.53	68.49	74.78		246.12	77.68	74.27	84.11	86.71	4.83	
	07:00	85.12	35.51	51.71	40.77	68.83	75.16		248.00	77.95	74.18	83.87	86.6	4.85	
	08:00	85.53	35.66	52.3	40.62	68.79	75.69		262.62	77.68	73.93	83.41	86.01	4.93	
	09:00	86.2	35.44	53.35	40.59	68.34	75.92		279.28	77.38	73.48	83.04	85.7	5.09	
	10:00	87.29	34.37	53.89	40.48	69.58	77.56		293.64	77.34	73.26	82.81	85.39	5.15	
	11:00	87.89	32.74	54.05	40.46	69.87	78.04		299.73	77.35	73.36	82.83	85.39	5.25	
	12:00	89.01	30.37	54.57	40.78	69.92	78.23		303.29	77.36	73.24	82.96	85.53	5.32	
	13:00	89.91	29.58	54.57	40.56	70.88	79.28		309.05	77.88	73.75	83.44	85.78	5.26	
	14:00	90.55	28.95	54.84	40.57	71.19	79.72		312.22	77.92	73.89	83.64	86.11	5.31	
	15:00	91.07	29.25	54.52	40.5	71.7	80.15		313.28	78.2	74.06	83.96	86.44	5.42	
	16:00	91.59	29.03	54.57	40.4	72.06	80.73		316.04	78.52	74.25	84.37	86.67	5.47	

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	Time	Temp	RH	Ret	Sup	Sup	Ret	PD	kW	Ret	Sup	Sup	Ret	PD	kW
	17:00	91.63	29.62	55.22	40.63	71.59	80.41		320.30	78.38	74.15	84.44	86.92	5.43	
	18:00	90.59	32.77	54.63	40.57	71.32	79.8		309.36	79.18	74.83	85.06	87.56	5.46	
	19:00	89.51	34.74	54.46	40.58	70.43	78.7		302.22	79.42	74.94	85.19	87.68	5.39	
	20:00	88.82	35.81	54.42	40.81	69.67	77.68		296.90	79.36	74.85	85.03	87.74	5.37	
	21:00	88.28	36.15	54.03	40.64	69.32	77.26		295.48	79.45	74.93	84.94	87.43	5.4	
	22:00	87.58	36.66	53.74	40.72	68.75	76.34		286.60	79.99	75.31	85.29	87.87	5.39	
	23:00	86.39	37.78	53.48	40.79	68.13	75.42		279.28	80.03	75.32	85.05	87.7	5.34	
10/6	00:00	85.72	38.28	52.7	40.46	67.81	75.11		270.98	80.17	75.16	84.85	87.32	5.22	
	01:00	85.25	38.66	52.5	40.62	68.57	75.55		266.93	80.13	75.26	84.55	87.15	5.17	
	02:00	85.4	38.5	52.31	40.75	68.61	75.48		263.74	79.78	74.72	83.92	86.53	5.21	
	03:00	85.26	38.72	51.96	40.55	68.2	75.05		259.71	79.68	74.7	83.65	86.21	5.14	
	04:00	84.75	39.31	52.03	40.7	68.72	75.31		257.78	79.95	74.77	83.65	86.23	5.15	
	05:00	84.35	39.81	51.81	40.59	68.75	75.36		253.58	80.16	74.71	83.45	86.1	5.1	
	06:00	84.19	39.95	51.95	40.71	68.57	75.13		252.76	79.93	74.4	83.02	85.61	5.16	
	07:00	84.37	40.67	52.33	40.8	68.86	75.61		258.46	79.87	74.27	82.75	85.36	5.17	
	08:00	85.11	40.87	53.19	40.63	68.92	76.41		276.55	79.69	74.1	82.32	82.02	5.23	
	09:00	85.89	40.93	54.49	40.78	70.42	78.64		299.15	79.15	73.52	81.93	81.38	5.32	
	10:00	87.83	40.64	54.87	40.62	72.65	81.32		317.52	79.21	73.48	82.06	81.4	5.4	
	11:00	89.4	39.81	55.52	40.65	74.57	83.68		340.21	79.24	73.49	82.2	81.79	5.47	
	12:00	90.08	38.99	52.8	40.64	75.74	83.55		287.60	79.49	73.67	82.46	82.37	5.51	
	13:00	90.47	37.52	52.63	40.77	75.26	82.73		277.65	79.75	73.79	82.82	83	5.61	
	14:00	91.25	36.45	52.33	40.47	76.33	83.79		280.83	80.16	74.26	83.42	83.75	5.7	
	15:00	91.57	34.57	52	40.46	75.09	82.38		273.68	79.97	73.86	83.35	84.02	5.73	
	16:00	91.41	34.09	51.9	40.48	74.83	82.11		272.51	80.24	74	83.65	84.6	5.69	
	17:00	91.35	34.03	51.93	40.39	74.28	81.64		272.58	80.47	74.14	83.96	85.02	5.66	
	18:00	90.51	35.54	51.57	40.33	73.79	80.86		263.95	80.89	74.54	84.33	85.56	5.65	
	19:00	89.88	36.47	51.51	40.53	72.82	79.67		255.11	80.93	74.7	84.45	85.71	5.57	
	20:00	89.24	37.53	54.15	40.57	70.93	79.17		299.93	81.17	74.86	84.69	85.96	5.53	
	21:00	88.76	37.96	54.12	40.56	70.55	78.61		300.31	81.27	74.91	84.67	86.03	5.41	
	22:00	88.19	38.14	54.27	40.62	69.94	78.06		299.56	81.18	74.74	84.33	85.78	5.29	
	23:00	87.63	38.64	53.87	40.57	69.48	77.57		294.67	81.5	75.23	84.59	86.18	5.3	
10/7	00:00	86.5	39.74	53.49	40.64	69.03	76.81		286.34	81.78	75.52	84.77	86.46	5.23	
	01:00	86.32	40	53.79	40.74	68.9	76.65		286.44	81.52	75.08	84.22	85.98	5.21	
	02:00	86.13	40.22	53.22	40.55	68.49	76.08		280.69	81.58	75.22	84.33	86.13	5.19	
	03:00	85.52	40.66	53.02	40.59	68.27	75.64		275.22	81.74	75.15	84.08	86.06	5.2	
	04:00	84.04	41.92	52.83	40.72	67.85	74.99		268.79	81.62	75.12	83.77	85.66	5.26	
	05:00	84.31	41.19	52.23	40.61	68.56	75.48		260.77	81.47	74.76	83.35	85.49	5.27	
	06:00	83.38	42.64	52.5	40.8	68.62	75.36		259.35	81.41	74.6	82.88	85.11	5.23	
	07:00	83.34	43.39	52.58	40.67	68.36	75.39		262.84	81.19	74.38	82.49	84.78	5.25	
	08:00	85.81	42.12	54.01	40.85	69.73	77.62		287.35	81.11	74.26	82.27	84.58	5.32	
	09:00	87.53	42.26	55.17	40.67	73.22	82		324.49	80.49	73.48	81.75	84.1	5.43	
	10:00	89.24	42.68	55.61	40.97	75.49	84.47		338.34	80.68	73.75	82.03	84.2	5.53	
	11:00	90.72	41.71	56.78	41.82	76.68	85.81		342.63	80.42	73.5	81.87	84.17	5.55	
	12:00	90.53	39.54	53.02	40.51	77.2	85.07		290.63	80.86	73.94	82.39	84.62	5.43	
	13:00	91.78	38.13	52.96	40.67	77.12	84.96		286.98	81.04	73.99	82.96	85.09	5.45	
	14:00	91.93	38.21	52.45	40.39	77.37	85.13		286.62	81.12	73.99	83.28	85.43	5.5	
	15:00	92.25	37.91	52.43	40.44	77.28	84.81		283.91	81.25	74.02	83.53	85.62	5.86	

				225 ton Chiller						500 ton Chiller					
		Outdoor Air		CHW		CW				CHW		CW			
Date	**Time**	**Temp**	**RH**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**	**Ret**	**Sup**	**Sup**	**Ret**	**PD**	**kW**
	16:00	92.31	38.92	52.49	40.34	77.68	85.49		288.01	81.44	74.31	83.9	86.14	5.82	
	17:00	91.89	39.75	53.07	40.42	77.64	85.73		296.85	81.74	74.38	84.16	86.34	5.61	
	18:00	91.66	39.41	52.57	40.24	77.21	85.07		288.84	82.19	74.95	84.71	86.83	5.78	
	19:00	91.14	38.72	52.18	40.41	75.62	83.1		277.92	82.15	74.77	84.51	86.83	5.65	
	20:00	90.62	39.48	52.15	40.57	74.95	82.25		273.52	82.41	74.96	84.74	86.99	5.49	
	21:00	90.13	41.18	52.27	40.57	75.46	82.88		279.40	82.31	74.86	84.8	87.08	5.43	
	22:00	90.05	41.91	52.18	40.43	75.91	83.4		281.71	82.52	74.98	84.95	87.39	5.38	
	23:00	89.88	42.63	52.26	40.64	75.42	82.78		279.55	82.33	74.85	84.72	87.25	5.32	
10/8	00:00	89.29	43.08	51.91	40.46	75.41	82.51		271.53	82.74	75.4	85.06	87.58	5.3	
	01:00	88.84	43.17	51.57	40.66	74.41	81.36		264.45	82.65	75.32	84.77	87.43	5.25	
	02:00	88.65	43.02	51.24	40.56	74.18	81.01		259.80	82.5	75.03	84.5	87.2	5.2	
	03:00	88.49	43.36	51.22	40.47	74.12	80.93		259.47	82.49	74.91	84.32	86.96	5.2	
	04:00	88.37	43.32	51.35	40.56	74.26	81.14		258.95	82.48	74.85	84.21	86.87	5.18	
	05:00	88.14	43.64	51.95	40.43	74.74	82.02		270.49	82.77	75.18	84.3	86.87	5.19	
	06:00	88.21	43.22	52.09	40.56	74.04	81.34		268.97	82.7	74.98	84.03	86.76	5.19	
	07:00	88.36	43.09	51.79	40.35	74.15	81.4		266.37	82.62	74.96	84	86.64	5.22	
	08:00	88.52	42	52.31	40.8	74.05	81.37		267.71	82.39	74.38	83.68	84.12	5.32	
	09:00	88.25	42.85	52.17	40.77	74.38	81.71		268.50	82.21	74.39	83.75	83.76	5.41	
	10:00	88.93	42.11	51.89	40.69	74.4	81.48		262.05	82.29	74.47	83.56	83.78	5.37	
	11:00	89.02	42.65	52.15	40.83	75.04	82.37		269.09	82.56	74.68	84.05	84.27	5.45	
	12:00	89.18	44.23	52.47	40.56	76	83.61		277.72	82.57	74.74	83.91	84.46	5.38	

C

UTILITY RATE DATA

The gas and electric utility rate data for the case studies in this report are contained in this appendix.

Gas Rate Data

The gas rate schedule, for the State Office Building, uses Ameren Rate 836: Large General Service Rate. Table C-1 provides the details of this rate schedule.

Table C-1
Ameren 836 Natural Gas Rate Schedule

Item	Cost
Customer charge	$54.50
Commodity charge	10.28 ¢/ccf
Purchased gas adjustment	37.18 ¢/ccf

Electric Rate Data

The electric rate schedule used for both buildings in the case studies was Ameren Rate 211: Small Primary Service Rate. Table C-2 provides the details of this rate schedule.

Table C-2
Ameren 211 Electric Rate Schedule

kWh Range	Summer (June - Sept)	Winter (Oct - May)
0 - 150Y	0.0745X + 3.01 Y + 0.24W + 210.00	0.0469X + 1.10 Y + 0.24W + 210.00
150Y - 350Y	0.562X + 5.755Y + 0.24W + 210.00	0.0349X + 2.90Y + 0.24W + 210.00
Over 350Y	0.0376X + 12.265Y + 0.24W + 210.00	0.0273X + 5.56Y + 0.24W + 210.00

Where: X = Energy use, kWh
Y = Demand, kW
W = Reactive, kVar
Off-peak hours are 10 p.m. to 10 a.m.

Target:
Commercial Building Chillers

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EPRI • 3412 Hillview Avenue, Palo Alto, California 94304 • PO Box 10412, Palo Alto, California 94303 • USA
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