New York Presbyterian

The University Hospital of Cornell

Retro-Commissioning Report

Prepared by:

VANDERWEIL
274 Summer Street | Boston MA 02210

Horizon Engineering Associates LLP

Vanderweil Project No.:26607.00

October 24, 2012

DRAFT

New York Presbyterian Hospital Retro-Commissioning Plan

Appendix F - Site Inspection Functional Performance Test

<u>Greenberg Pavilion</u>

- HVAC including Hot Water Heating Systems and Operating Rooms (ORs)
- Lighting
- DHW
- DHW Heater Replacement
- BMS
- Plumbing Compressors

<u>Annex Campus Central Chiller Boiler Plant</u>

- Lighting
- BMS
- Chiller Plant
  - Cooling Towers
  - Cooling Tower CPIs
  - Chillers
  - Condenser and Chilled Water Pumps
  - Condenser Water Piping CPI
  - Chilled Water Pump CPIs
- Hydronic Free Cooling
- Boiler Plant
  - Boilers
  - Boiler and Forced Draft Fan CPIs
  - Deaerator and Receiver Tank CPI
  - Feedwater Pump CPI
  - Condensate Water Pump CPIs
  - Steam Piping CPI
- Combustion Air
- Reduced Steam and Make-up Water Pressure
- Boiler Turndown
- BMS

Appendix G - Data Logger Trend Data

Appendix H - Identified Facility Improvement Measures (FIMs)

Appendix I - Identified Energy Conservation Measures (ECM)

Appendix J - NYPH Implemented Facility Improvement Measures

Appendix K - NYSERDA - Implemented Facility Improvement Measures

Appendix L - NYPH Implemented Energy Conservation Measures

Appendix M - NYSERDA - Implemented Energy Conservation Measures

Appendix N - NYSERDA - Project Summary Sheets & Case Studies

Appendix O - Meeting Notes & Agendas

Appendix P - Energy Savings

Appendix Q - Implementation Phase

Appendix R - Follow-up Warranty Phase

Appendix S - Documents Reviewed

Appendix T - Horizon Engineering NYPH Cornell Campus Final Report

Horizon Appendix A – Greenberg Pavilion HVAC Checklists
Horizon Appendix B – Annex Building HVAC Checklists
Horizon Appendix C – Trending Data
Horizon Appendix D – Current Facility Requirements Sample
Horizon Appendix E – Calibration Reports

1. Executive Summary

Vanderweil Engineers and Horizon Engineers have been retained by New York Presbyterian Hospital (NYPH) to conduct a custom Retro-Commissioning Project for the following selected buildings at the Cornell Campus (Greenberg Pavilion, Annex Building, specifically the Central Boiler/Chiller Plant Buildings).

The Retro-Commissioning process was engineered to meet NYPH, City of New York Law No. 87 Article 38 (still in development) and New York NYSERDA requirements.

The Greenberg Pavilion spans a total of 1,057,337 sf and was renovated in 1997. The Annex building's total square footage was 392,573 sf. The private hospital is owned and operated by New York Presbyterian (NYP). The two hospital buildings are located at NYP's Weill Cornell campus at the Upper East Side of Manhattan at 525 East 68th.

The Annex building houses administration offices and student dorm rooms. Located on the 6th floor of the Annex building is the Building Management System (BMS) office where the entire campus can be centrally controlled. The focus of the Annex building study was lighting, boiler and chiller plant systems.

The Greenberg Pavilion is a hospital offering a variety of services. Below is a list of the services by floor:

- 1st Floor - Emergency Room
- 2nd Floor - Neurology
- 3rd Floor - Operating Rooms
- 4th Floor - Heart Center (Cardiology)
- 5th Floor - Pediatrics
- 6th Floor - NICU
- 7th Floor - Labor and Delivery
- 8th Floor - Burn Unit / Vascular Surgery
- 9th Floor - MER
- 10th Floor - ACE Unit
- 11th Floor - Psychiatry
- 14th Floor - VIP

The Project Goals were to identify energy reduction opportunities via the Retro-Commissioning Planning, Investigation, Analysis, Implementation and Hand-off / Warranty phases. These measures have been placed into two categories Facility Improvement Measures (FIMs - low cost measures) and Energy Conservation Measures (ECMs - Capital Projects).

The Project Cornell RetroCommissioning Team consisted of the following individuals:

NYPH	Role/Department
Glenn Grube	NYPH - Strategic Engineering
Kathia Benitez	NYPH - Energy Program Manager
Joe Lorino, PE	Cornell - Engineer
Dan Lilly	Cornell - Chief Engineer
Patrick Ford	Cornell Operating Engineer
Leo Matos	Cornell Operating Engineer
Timothy Smyth	Cornell Operating Engineer
Vern Jablowsky	Capital Projects - Project Manager

Vanderweil Engineers	
David Pinto, PE, LEED AP	New York - Project Principal in Charge (PIC)
Denis Silvia CEM, LEED AP BD+C, CBCP/EBCP	Commissioning Authority (CxA) Project Manager
John Saad, LEED AP, HFDP	Healthcare - Principal in Charge (PIC)
Jim Gikas CEM, LEED AP BD+C, CBCP/EBCP	Commissioning - Principal
Chris Hastings, PE	Chiller/Boiler Plant Principal

Elliot Miller, PE	Chiller/Boiler Commissioning Engineer
Charlie Kalasinsky, PE, LEED AP BD+C	Energy Engineer
David Lee, LEED AP	Energy Engineer
CJ Thouret	Commissioning Engineer
Michael Millerick	Commissioning Engineer
Martin Khallaf	Commissioning Engineer

Horizon Engineers	
Michael English, PE, LEED AP	Commissioning Authority (CxA)
Austin Azzaretto	Commissioning Engineer
Jessica Corriere	Commissioning Engineer
Zack Levnuk	Commissioning Engineer

Investigation, Analysis, Implementation and Hand-off / Warranty Phase will help insure energy savings are a successful energy program.

Vanderweil and Horizon Engineers would like to thank New York Presbyterian Hospital for the opportunity to undertake this study and all the above individuals that participated in this effort.

2. Retro-Commissioning Plan Overview

The Retro-Commissioning (RCx) is a systematic process for investigating, analyzing, and optimizing the performance of building systems through operational and maintenance improvement measures and help to confirm their continued performance over time. The process assists in making the building systems perform interactively to meet the Owner's Current Facility Requirements (CFR) and operating energy efficiently.

The project goal is to implement a Retro-Commissioning Project as per the City of New York Administrative Code, Law No. 87 Article 308. NYSERDA will be actively participating in the Project Funding.

Parties involved in the existing building commissioning process include the New York Presbyterian's maintenance and operations staff, building automation system contractor or current service contractor, testing adjusting and balancing contractor (TAB), contracted service personnel, and the Commissioning Authority (Vanderweil Engineers and Horizon Engineers).

The buildings within this study have not undergone any type of retro-commissioning. Additionally, over time the facility requirements change and the operational efficiencies of buildings tend to degrade. Because of these factors many buildings are performing well below their original design intent, use more energy than necessary and cost more to operate than they should. The RCx Team responds to NYPH desire to improve building performance, solve comfort and operational problems and reduce the amount of energy the building consumes which will lead to a reduction in operational cost.

The purpose of existing building commissioning may include any of the following:

- Reduce energy consumption.
- Improve building performance by saving energy and reducing operational costs.
- Identify and resolve building system operation, control and maintenance problems.
- Address occupant complaints and increase tenant satisfaction.
- Document current system operation to compare to the original design intent.
- Identify and provide Operations & Maintenance (O&M) personnel training needs and provide such training.
- Extend equipment life-cycle potential with improved O&M.
- Ensure the persistence of improvements over the building's life.

RCx promotes operations and maintenance and building performance excellence, but requires the involvement of all stakeholders, including senior management, engineering, O&M personnel, contractors, vendors and facility users/occupants. The commissioning process is not a one time event, but rather an ongoing activity that continues throughout the life-cycle of a facility.

This document identifies distinct and sequential phases to the Existing Building Commissioning process; however, it is important to recognize that the commissioning process is an iterative process that may repeat or loop back to previously completed phases over time.

3. Background

New York Presbyterian Hospital has engaged Vanderweil and Horizon Engineers to perform commissioning for their existing hospital buildings and the cooling and heating plants that serve them on their Cornell campus in efforts to develop initiatives to address comfort, operational improvements, indoor environmental quality, and energy reduction.

The buildings to be included in the retro commissioning (RCx) process include the Greenberg Pavilion Hospital building, the Annex building, (the Chiller Plant and the Boiler Plants for the campus).

The intent is to identify and recommend Facility Improvement Measures (FIMs) and Energy Conservation Measures (ECMs) to allow NYPH to implement the improvements to meet ASHRAE guidelines, NYPH, NYSERDA and City of New York Administrative Code, Law No. 87 Article 308 energy requirements.

4. Project Description

The retro commissioning (RCx) project for New York Presbyterian Hospital's Cornell Campus has multiple phases of work effort as follows:

Pre-Site Investigation Phase

- Review of existing available building and system documentation to familiarize the RCx team with the facilities.
- Utility usage evaluation.
- Interview facility management and building operators and technicians.
- Attendance at weekly project meetings including publishing of meeting notes and any project updates.

Site Investigation Phase

- Site investigative survey and Building facility surveys and equipment and systems testing.
- Gain an in depth understanding of existing equipment and system operation and maintenance.
- Document existing building equipment and system deficiencies.
- Develop an equipment and system test plan.
- Collect trend data to be provided by NYPH.
- Identify cost effective improvements.
- Provide equipment and system functional testing.
- Identify and recommend equipment and system non capital repairs, corrections and adjustments.

Analysis and Reporting Phase

- Analyze identified issues and make improvement recommendations.
- Reports including equipment and system data and test results.
- Identify estimated costs for improvements and energy savings calculations.
- Prepare CPIs post commissioning functional testing checklists (FPTs).
- Issue current deficiency logs.

Implementation / Corrective Action Phase

- Identify a corrective action plan.
- Operation and Maintenance (O&M) recommendations.
- Prioritize the most cost effective improvements.
- Document and train NYPH personnel to properly operate the equipment and systems.
- Provide improvement procedures and monitor same.

Hand off / Follow up Phase

- Validate facility performance post corrective actions.
- Retest and document change in maintenance, trouble calls, utility usage against prior data, and facility changes or rate structure changes.
- Conduct lessons learned workshops and issue reports.
- Determine if NYPH RCx improvement goals were achieved

The basic phases and the goals of each phase of the Existing Building Commissioning process are as follows:

- ***Planning Phase:*** Development of the Existing Building Commissioning goals, facility requirements, and a commissioning plan.

- ***Investigation Phase:*** Field inspections, data gathering, testing and analysis to accurately assess system performance and identify improvement opportunities.

- ***Implementation Phase:*** The desired facility improvements are completed and the results and performance are verified.

- ***Turnover Phase:*** The systematic transition from a commissioning activity and the Commissioning Team to standard operating practice and the O&M team.

- ***Persistence Phase:*** Implementation of systems and tools to support both the persistence of benefits and continuous performance improvement over time.

5. Abbreviations and Definitions

The following are common abbreviations used in this document and throughout the project.

Cx	Commissioning	**CTS**	Check/Test/Start Checklist
Cx Plan	Commissioning Plan	**PM**	Project Manager
FT	Functional Performance Test	**TAB**	Test, Adjust & Balance Contractor
FIM	Facility Improvement Measure		

Benchmarking: Benchmarking is the process of comparing a building's current energy usage to other similar buildings and to the building itself prior to the RCx process. Developing standards and goals for energy management is a good way to motivate people to improve towards the goal of optimal energy performance. ENERGY STAR Portfolio Manager is a frequently used and nationally recognized building energy benchmarking tool, among others.

Commissioning Team: The individuals who through coordinated actions are responsible for implementing the Commissioning Process.

Retro-Commissioning (RCx): RCx is a systematic process for investigating, analyzing, and optimizing the performance of building systems through the identification and implementation of low/no cost and capital intensive Facility Improvement Measures and provide a means to verify their continued performance. The RCx process assists in making the building systems perform interactively to meet the CFR and provides the tools to support the continuous improvement of system performance over time.

Retro-Commissioning Plan (RCx Plan): A document that outlines the organization, responsibilities, schedule, allocation of resources and documentation requirements of the RCx process.

Facility Improvement Measure (FIM): Alterations or revisions to systems or equipment planned to improve building and system performance, reduce Operations and Maintenance (O&M) costs and/or improve the indoor environmental quality as part of an RCx process.

Implementation Plan: A written document that details the prioritization and selection of FIMs for completion during the Implementation Phase.

Lessons Learned Meeting: A meeting held during the Turnover Phase to discuss what went right and what went wrong during the RCx process. Attendees include the Owner's building operating personnel and members of the Commissioning Team.

Master List of Findings: The Master List of Findings is a document assembled at the end of the investigation phase of an existing building commissioning project. It serves as a preliminary budgeting tool and identifies possible Facility Improvement Measures (FIMs) to be included in the implementation phase to follow.

Measurement and Verification (M&V) Plan: Measurement and Verification (M&V) Plan uses ongoing BAS trending, portable data loggers, spot measurements, and functional testing to measure the efficacy of each FIM and verify its proper implementation. It is intended to verify the performance of the measure/system and confirm that the predicted energy savings have been achieved upon the completion of implementation.

Monitoring Based Commissioning: A process variation of RCx, Monitoring Based Commissioning employs remote energy system metering with trend log capability to identify inefficiencies in energy system operations, facilitate diagnostics, document energy savings, and ensure persistence of savings through ongoing re-commissioning.

Return on Investment (ROI): The ratio of the money gained or lost on an investment relative to the cost of the investment. To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio.

ROI = (Gain from Investment - Cost of Investment) / Cost of Investment

Stakeholder, Commissioning Process: People or organizations that have a direct or indirect interest or stake in the commissioning process. Typical commissioning process stakeholders include: operations and maintenance personnel, facility users/occupants, senior management, maintenance or service contractors and related vendors.

Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Turnover Phase: The phase of Existing Commissioning where all necessary documentation and training are provided to the O&M personnel to ensure that they understand how to use the commissioning tools and make sure that positive results persist far into the future.

6. General New York Presbyterian Scope Information

Project Specific Information - Cornell University Medical Center

Greenberg Pavilion 541 East 68 Street New York, NY 10021	Year Built: 1997 HVAC Lighting Domestic Hot Water HVAC Controls	Floors: 15	Gross sf: 1,057,337
Annex Building 523 East 70 Street New York, NY 10065	Lighting Chilled Water Plant Boiler Plant Siemens DDC BMS System	Sub-Basement Sub-Basement	Gross sf: 392,573

7. Commissioning Team Members / Contact Data

Team Member	Affiliation	Contact Information
NYPH Project Executive	Glenn Grube NYP	Phone: 212-305-8988 Fax: Cell: Email: glg9013@nyp.org
NYPH Project Manager	Kathia Benitez NYP	Phone: 212-746-0204 Fax: Cell: Email: keb9039@nyp.org
Commissioning Authority (CxA), Principal	Denis Silvia Vanderweil	Phone: 617-423-7423 Fax: 617-423-7401 Cell: 401-714-7191 Email: dsilvia@vanderweil.com
CxA Project Manager Cornell Campus	Michael Millerick Vanderweil	Phone: 646-648-0791 Fax: Cell: Email: mmillerick@vanderweil.com
CxA Project Manager Columbia Campus	CJ Thouret Vanderweil	Phone: 609-786-2739 Fax: Cell: Email: cthouret@vanderweil.com
Commissioning Authority (CxA) Principal	Michael English Horizon	Phone: 646-442-1111 Fax: 646-442-1118 Cell: Email: Michael@horizon-engineering.com

Team Member	Affiliation	Contact Information
Vanderweil Commissioning Principal	Jim Gikas Vanderweil	Phone: 617-423-7423 Fax: 617-423-7401 Cell: 617-719-9862 Email: jgikas@vanderweil.com
Vanderweil Health Care Principal	John Saad Vanderweil	Phone: 617-423-7423 Fax: 617-423-7401 Cell: 617-462-5543 Email: jsaad@vanderweil.com
Vanderweil NY Principal	David Pinto Vanderweil	Phone: 315-558-5600 Fax: 315-558-5601 Cell: 646-872-4887 Email: dpinto@vanderweil.com

8. Commissioning Process

Commissioning Scope of Work

Existing Building Commissioning (RCx) during this project is intended to achieve the following specific objectives in accordance with the Commissioning Provider/Owner's – Scope of Work.

Commissioning Team Roles and Responsibilities, and Qualifications

- The Commissioning Authority (CxA) is the entity that leads, plans, schedules and coordinates the commissioning process and makes recommendations to the Owner regarding Facility Improvement Measures and assists in verifying their continued performance over time.

- The CxA is an objective, independent advocate of the Owner who leads, plans, and coordinates the Commissioning Team and commissioning process. Ideally, the CxA will be independent of the O&M team, without specific operational responsibilities, maintenance tasks or project responsibilities. The use of a 3rd party "outsider" can be beneficial in that a fresh perspective is brought to the commissioning process that can show ways to improve traditional O&M practices, infuse new enthusiasm, technical expertise and human resources into the process which will ultimately enhance the benefits achieved by the process. The CxA can be an independent consultant or a qualified employee of the Owner.

- If the CxA is an independent consultant and the CxA's firm is responsible for operational/maintenance duties, has other project responsibilities or is not under direct contract to the Owner, a conflict of interest may exist. Wherever this occurs, the CxA shall disclose, in writing, the nature of the conflict and the means by which the conflict shall be managed.

Systems to be Commissioned

- The RCx Scope of work includes HVAC system, Building Automation System, central boiler/chiller plants, domestic hot water and lighting audits.

- The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

Greenberg Pavilion Building
HVAC
o Building Automation System
o Exhaust Fans
o Fan Powered Boxes

o Hot Water System
o Air Handling Units
o Pumps
o VAV Terminal Unit / Boxes
o Variable Frequency / Speed Drives
o Air Handling Units
Plumbing
o Domestic Hot Water System
Electrical
o Lighting and Controls

Annex Building
HVAC
o Chiller Plant
o Boiler Plant
o Building Automation System
Electrical
o Lighting and Controls

Vanderweil / Horizon have commissioned these systems and have formatted this report and findings per ASHRAE Guideline 0 and Level 1 and Level 2 report format.

Standard Forms and Reports

The CxA will create equipment-specific forms prior to the start of testing, for team review, revision and acceptance. Forms will be submitted to the commissioning team for their input and/or comments, prior to implementation. The reports utilized on this project are listed below with a brief description:

- ***Miscellaneous Test Verification Forms****:* The CxA will document tests required by the specifications and conducted by the responsible contractor.
- ***Functional Performance Test (FPT):*** Functional performance test verifies the intended operation of individual components and associated controls under various conditions and modes of operation. The functional performance tests are prepared so that the complete sequence of operations is included in the test procedures.
- ***Field Observation Reports:*** Field observation reports are issued to document on-site events or activities that are not recognized in a Cx checklist or test verification form.
- ***Deficiency Reports:*** The CxA will periodically issue online deficiency reports containing a list of new and outstanding deficiencies. The reports are a compilation of deficiencies obtained from field observation reports, construction checklists, and functional performance testing. The report includes all details of the components found non-compliant, and details the recommendations needed to correct the system.

Existing Building Commissioning Log

The CxA will develop and maintain an existing building commissioning log of all equipment/systems and associated commissioning tasks throughout the commissioning process. This is a quick reference for the client and commissioning team to review the status of equipment/systems.

9. Planning Phase

The objectives of the Planning Phase are to develop/confirm the Owner's needs and requirements for the facility and set overall objectives of this process. These processes are documented to develop an RCx Plan to define the commissioning process for the facility.

Define Roles and Responsibilities

The roles and responsibilities of all RCx participants and the RCx Plan should be defined during this phase. Clear documentation of the Owner's operational needs and requirements, should be completed prior to concluding this phase of the process.

Define Scope of Work, Schedule and CFR

A clearly defined scope of work, schedule and operational needs to be understood, documented and agreed upon as part of the agreement and RCx Provider's contract. The roles of all the commissioning participants should be defined in the agreement. Based upon the size of the specific facility(s) and the scope of services, the duration of the RCx contract may vary from just a few weeks to several years.

Design RCx Goals

Clear goals and objectives for the commissioning process should be developed to focus the team and to provide guidance in the planning effort which culminates with the RCx Plan.

Preliminary Building Benchmarking

Perform preliminary building benchmarking of readily available data to quantitatively measure overall building performance. This preliminary benchmarking can help uncover potential opportunities and can be used as a baseline to measure future performance improvements during the RetroCommissioning process.

Review Existing Building Documentation

Review existing building documentation, such as building plans and specifications, O&M Manuals, maintenance documentation records, etc. This review helps to increase an understanding of the building, but the primary focus is to determine the availability of documentation for the RCx Investigation process.

Interview Key O&M Personnel

Interview key O&M personnel to learn from their extensive knowledge and experiences from working in the building on a daily basis.

Perform a Cursory Walk-Through

Perform a cursory walk-through of all major spaces to gain an understanding of the types of spaces, condition of spaces, occupancy levels, lighting and controls and prevalence of information technology related infrastructure and equipment.

Develop RCx Plan

Develop an RCx Plan that documents goals, roles, responsibilities, the RCx process, communication protocols, major activities and tasks and the overall RCx project schedule. It is important that the Plan give thoughtful consideration to the level of involvement of all Stakeholders and how communication with key Owner constituencies will be handled to ensure consensus and success. The Plan is a working document that evolves throughout the commissioning process.

10. Investigation Phase

The objective of the Investigation Phase is to conduct the site investigation to compare the actual building conditions and system performance with the Owner's current operational needs and requirements defined by the owner Commissioning Facility Requirements (CFR). This phase concludes with the completion and review of a Master List of Findings that identifies Facility Improvement Measures (FIMs) that upon implementation will improve building and system performance to meet the CFR, reduce energy and O&M costs and/or improve the indoor environmental quality.

Commissioning Coordination

During the Investigation Phase (and throughout the entire commissioning process) the RetroCommissioning Team should meet periodically to discuss Commissioning status, system performance, and issues identified. Stakeholder participation in these status meetings is critical to solicit additional input and build consensus, as well as to help address any simple repairs or adjustments that need to be made during this phase.

Documentation Review

Review building drawings and documentation to understand the building energy usage, initial basis of design and evaluate the system integration. The review process includes the evaluation of all old and new drawings, specifications, Test and Balance Reports, Operations & Maintenance Manuals (typically related to mechanical, electrical and controls), and any past Commissioning Reports.

Site Review/Survey

Conduct a thorough and detailed building walk through (maintenance staff participation is highly desirable) to evaluate the issues identified in the Planning Phase and observed during the drawing and documentation review. Important facility information not found during the Documentation Review may need to be recreated during the site survey (i.e. TAB analysis to determine current air/water flows, or if sequences of operation are unavailable, perform functional performance testing to determine how systems operate). During this step additional issues which are not captured through the Documentation Review should be noted.

Building Occupant Interviews

Interview the Owner's maintenance personnel, utility personnel, and other relevant parties to understand the current needs and issues related to system operations and maintenance. A formal interview process is recommended to systematically assist in understanding potential issues and problems, uncover potential improvement opportunities, confirm the Owner's operational needs and to develop consensus on the commissioning process goals.

Facility Performance Analysis and Performance Baseline Establishment

Collect and analyze available energy, non-energy and other system performance data to establish baseline benchmarks for facility performance. Available facility performance baseline data may include utility billing data, sub-metering data, work orders, comfort complaint logs, indoor air quality parameters, occupant satisfaction survey results, BAS trend data and/or stand alone data logger trend data.

Systems Diagnostic Monitoring

Develop a diagnostic monitoring plan and then perform comprehensive system diagnostic monitoring. Diagnostic monitoring methods can include BAS trending, portable data logger trending, and energy and weather data collection. The collected data is analyzed to identify issues and improvement opportunities and highlight particular problems that may require more rigorous and focused investigation. Analyzing the diagnostic monitoring data can assist in determining if the system is meeting the Owner's operational needs.

Test Development

Develop Functional Performance Test (FPTs) procedures for the systems identified in the project scope. Test plans typically focus on confirming that the system performance is meeting the performance requirements of the Owner's requirements.

System Testing

Perform system testing to evaluate the building systems performance. In addition, any anomalies or issues identified in earlier Investigation Phase steps should be considered for further evaluation during system testing to determine root causes and possible solutions. It is recommended that the testing process include the verification and calibration of critical sensors. Typically, critical sensors are those sensors which are essential to the effective and efficient operation of the building systems.

Repairs or Improvements

If appropriate and agreed upon by the Commissioning Team, perform simple repairs or improvements identified during the Investigation Phase monitoring and testing. The RCx process is intended to be an iterative and flexible process, therefore, some implementation may occur during the Investigation Phase and conversely further investigation may occur during the Implementation Phase.

Master List of Findings

Create a Master List of Findings that identifies possible FIMs based on the findings from the steps above. The following information on each FIM is desirable so that the Owner has sufficient information to make an informed decision when selecting the FIMs for implementation:

- Description of Finding
- The Recommended Solution/Measure Description
- Benefits
- Projected Implementation Cost
- Projected savings (details on the estimated electrical, fossil and demand energy savings may be desired)
- Payback and Return on Investment (ROI) analysis
- Commissioning Team recommendation for implementation.

Rough budgetary implementation cost estimates are included in the Master List of Findings during the Investigation Phase with firm contractor quotes being obtained during the Implementation Phase, once specific measures have been selected for implementation. The rigor of the energy saving calculation methodology utilized to estimate energy savings can vary significantly. Factors that impact calculation methodology rigor may include utility program requirements if applicable, owner expectations, and the level of investment required for measure implementation.

Performance Assurance

Evaluate methods of measuring system performance and verifying proper implementation to demonstrate the success of the FIMs and ECMs that were implemented. Each measure should have a verification methodology appropriate to the size and complexity of the measure. The identified verification methodology is then incorporated into a Measurement and Verification (M&V) Plan. The M&V plan is intended to provide a comprehensive protocol to verify the performance of the measure/system and confirm that the predicted energy savings have been achieved upon the completion of implementation. Ongoing BAS trending, portable data loggers, spot measurements, and functional testing may be utilized pre and/or post implementation as part of the M&V process. Clear direction and training needs to be provided for those responsible for the on-going operation and management of the building energy costs.

11. Implementation Phase

The intent of the Implementation Phase is to implement the Facility Improvement Measures (FIMs) that are selected from the Master List of Findings and to verify that the predicted results and system performance are achieved.

Analyze, Prioritize and Select Facility Improvement Measures and Energy Conservation Measures

The Implementation Phase begins with the analysis, prioritization and selection of FIMs for implementation. The Owner, with any necessary support from the Commissioning Team, evaluates and prioritizes the measures that have been recommended for implementation by the Commissioning Team. The final selection of measures for implementation and implementation timing is frequently influenced by many factors, including ROI and simple payback, budgetary constraints, anticipated facility impacts, future capital plans, available implementation resources, etc.

Prepare an Implementation Plan

Upon measure selection, the Commissioning Team prepares an Implementation Plan to guide the implementation process and provide details on steps to be followed to complete the implementation of the selected Facility Improvement Measures and Energy Conservation Measures. This plan typically indicates which improvements will be made during the Implementation Phase and which ones will be deferred with a timetable for planned implementation as capital improvement projects, with the ultimate goal of having the systems perform efficiently to meet the CFR.

Implement Selected FIMs and ECMs

As defined by the Implementation Plan, the selected improvements to the systems and operations are undertaken and completed.

Verify Successful FIM and ECMs Implementation

Testing or re-testing is performed on modified or upgraded systems to demonstrate that the improvements are successful. These steps are outlined above under the Existing Building Commissioning Process section. Plans are also made for the future testing of the deferred capital improvement projects identified. If testing does not show that the improvements were successful based upon the agreed benchmarks, further modifications or refinements to the upgrades should be made to achieve acceptable results based upon the recommendations of the RCx team and the Owner.

12. Suggested Big Picture Energy Reduction Strategies

Annex Building Main Chiller Plant

The existing Chiller Plant is a 12,600 ton plant made up of the following components:

Chiller #	Drive	Tons
Rm - 3	Steam	2,200
Rm - 4	Electric	4,400
Rm - 7	Steam	2,000
Rm - 8	Electric	2,000
Rm - 9	Steam	2,000

Cooling Towers

20 induced draft cells (7-BAC-13 Marley)

The existing condenser water system has rusting problems due to winter drain of the system exposing steel pipe to the atmosphere resulting in oxidation.

The Marley Cooling Tower Air intake is restricted due to Architectural/sound barrier and condenser water piping resulting in a reduction in cooling tower thermal performance.

The Cooling Tower supply/return piping and associated controls lack individual cell control.

The Cooling Towers should undergo a replacement project or a Cooling Tower/condenser water distribution upgrade.

The existing Chiller Plant lacks a plate/frame heat exchanger and associated components which could provide "hydronic free cooling" for campus.

The installation of this system at the central plant would allow the phased connection of the remote existing air and city water cooled systems (AC and compressors) to the campus chilled water system. This operational change would base load the chiller plant, allow for winter operation of the condenser water system and selected cooling tower cell operation resulting in electric and water savings.

Steam Boiler Plant

The existing Cornell Boiler Plant (500,000 PPH) consists of the following:

Boiler	Nameplate (PPH)
1	125,000
3	125,000
4	125,000
5	125,000
*HRSG	70,000

*Heat Recovery Steam Generator is limited to 35,000 PPH due to contract requirements (limits) with ConEd) of 5 MW.

Condensate Return

The existing boiler plant currently receives approximately 20% total condensate return. A target of 70% condensate return should be considered with following phased approached.

Conduct study/field survey of the condensate system. The study would provide specific piping and repair projects. Resulting savings would yield a reduction in natural gas (thermal heating of make-up water), make-up water and sewer costs.

Install condensate meters.

Steam Supply Pressure Reduction

Field investigation suggests that a reduction in steam supply pressure can be obtained. The specific reduction can be identified and implemented during the project's implementation phase.

The CxA Team with plant operations would develop a list of maximum pressure requirements of all equipment. Review findings, determine supply steam setpoint, identify safeties, reliefs and alarms to be recalibrated.

Findings would be implemented resulting in natural gas savings.

Operating Room - Unoccupied Setbacks

The existing Operating Rooms and associated support space (prep rooms, locker rooms, corridors, diagnostic treatment and recovery rooms) are currently operating 24/7.

The proposed measure suggests that an operational plan is developed by medical operating staff and facilities engineering that allows for selected unoccupied setbacks.

Greenberg Pavilion Building

Domestic Hot Water System

The existing domestic hot water system is the original building system and requires constant maintenance due to the age.

The system is due for replacement which will result in natural gas savings.

Air and Water Testing and Balancing

With the exception of selected isolated projects and operating room Testing and Balancing, the building has been Tested and Balanced completely. The full HVAC system should be rebalanced resulting in natural gas and electric savings.

Miscellaneous - HVAC

This report consists of approximately 400 Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM). The selected recommended measures have been placed out to bid and are in the process of bid negotiations. The individual items vary from setpoint adjustments to sensor replacement.

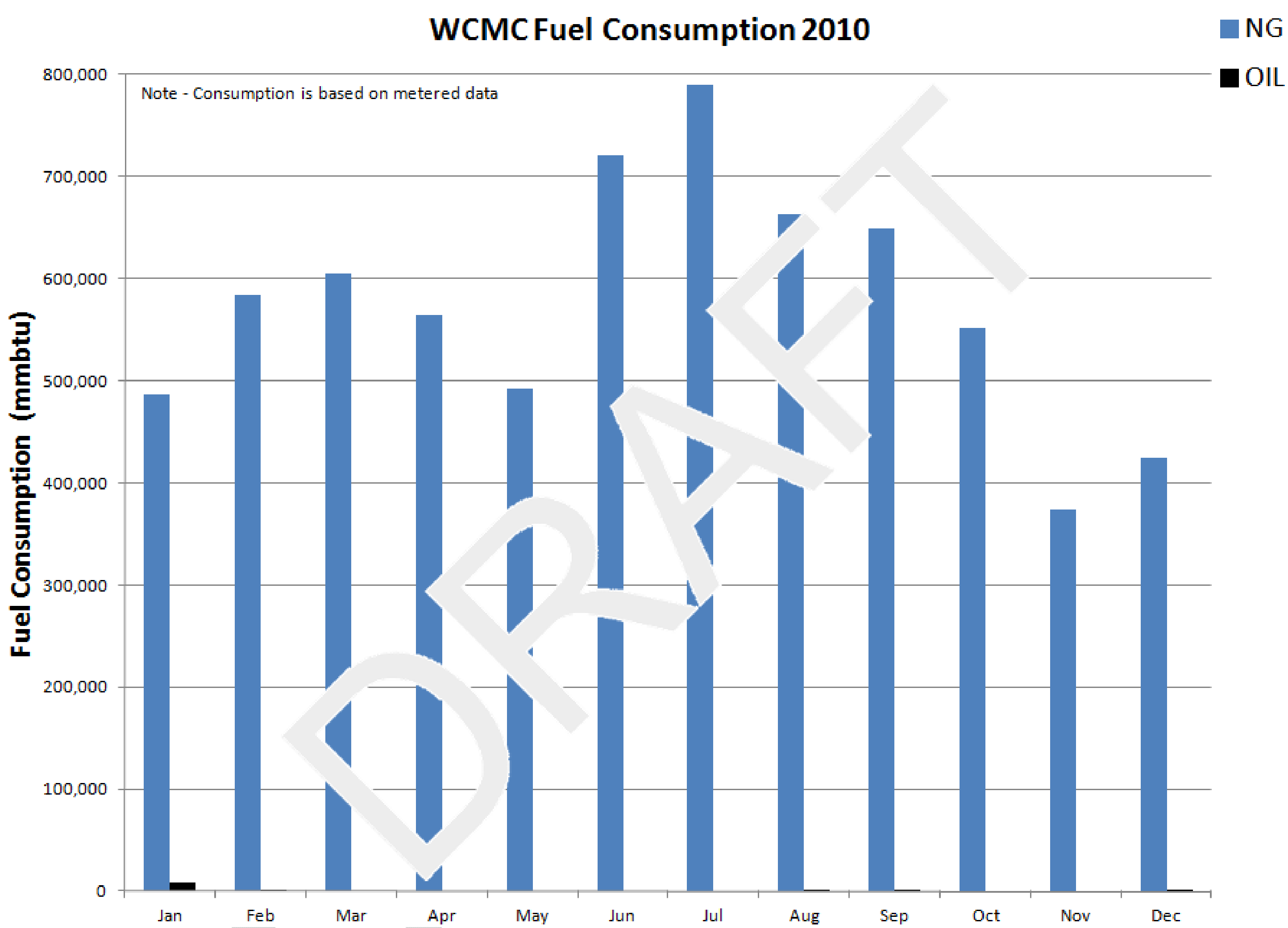
Lighting Audit

The lighting audits for Greenberg Pavilion and the Annex Buildings consist of over 600 FIMs and ECMs varying from lamp replacement to fixture replacements.

NYPH is currently evaluating and will develop a selected bid package with the RCx team.

13. Campus Wide Energy Data and FIMs/ECM Tables

Cornell Campus Blended Average Summary 2010			
Utilities			kbtu
Total Electricity Purchased (kwh)	62,657,200		213,786,366
Electricity Generated	53,658,161		183,081,645
Total Electricity Consumption (kwh)	116,315,361		396,868,012
Electricity Sold (kwh)	52,265,521		178,329,957
Net Electricity Consumption (kwh)	64,049,840		218,538,054
NG Consumption (mmbtu)	1,354,785		1,354,784,960
Oil Consumption (mmbtu)	12,087		12,087,148
Process Heating/Cooling			kbtu
Total Steam Production (lbs)	1,021,839,000		970,747,050
Steam Sold (lbs)	531,544,444		504,967,222
Net Steam Production (lbs)	490,294,556		465,779,828
% Sold		52%	
Total CHW Production (Ton-hours)	21,940,998		263,291,976
CHW Sold (Ton-hours)	14,544,614		174,535,370
Net CHW Production (Ton-hours)	7,396,384		88,756,606
% Sold		66%	
Campus Square Footage	2,662,715		
Metrics			
Gross kWh/SF (elec)	23.5		
Gross mmbtu/SF (fuel)	0.5		
Gross Steam kbtu/sf	364.6		
Gross CHW kbtu/sf	98.9		
Gross kbtu/SF (elec+fuel)	593.6		
Net WCMC kWh/SF (elec)	24.1		
Net WCMC mmbtu/SF (fuel)	0.3		
Net WCMC Steam kbtu/sf	174.9		
Net WCMC CHW kbtu/sf	33.3		
Net WCMC kbtu/SF (elec+fuel)	340.2		
Unit Costs			
$/kwh (elec)		0.184	
$/mmbtu (NG+oil)		12.397	



WCMC Fuel Consumption 2010
NG
OIL
Note - Consumption is based on metered data
Fuel Consumption (mmbtu)
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

VANDERWEIL

Executive Summary - Cornell Campus

New York Presbyterian WCMC Campus RetroCommissioning

WCMC Campus Baseline Gross $28,464,469
WCMC Campus Baseline Net $19,914,232

Package	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Recommended Implementation Annual Savings	Recommended Implementation Simple Payback	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Annex	$35,860	$28,811	0	156,511	$25,983	—	See		
Greenberg * ****	$1,916,452	$958,379	26,574	3,335,730	$675,415	—	Building		
Chiller Plant	$2,532,250	$1,293,706	10,404	6,712,800	$75,708	—	for		
Boiler Plant **	$1,005,596	$320,582	12,161	759,702	$98,502	—	Details		
Total Savings	$5,490,158	$2,601,478	49,139	10,964,743	$875,608	—			

Executive Summary - Annex

WCMC Campus Baseline Gross $2,070,039

Package	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Recommended Implementation Annual Savings	Recommended Implementation Simple Payback	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Annex Lighting	$35,860	$28,811	0	156,511	$25,983	0.55	See Building for Details		
Total Savings	$35,860	$28,811	0	156,511	$25,983				

Executive Summary - Cornell Boiler Plant

Package	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Recommended Implementation Annual Savings	Recommended Implementation Simple Payback	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Cornell Insulation	$50,596	$98,502	7,944	0	$98,502	0.51	In Construction		
Boilers**	$915,000	$149,781	-2,027	759,702	*	*			
Boiler plant pressure reduction*	$40,000	$72,299	6244	0	*	*			
Total Savings	1,005,596	$320,582	12,161	759,702	$98,502				

Executive Summary - Cornell Chiller Plant

Package	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Recommended Implementation Annual Savings	Recommended Implementation Simple Payback	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Cornell Chiller Plant	$1,307,450	$1,095,451	10,404	5,635,323	$75,708	3.40			
Cornell Hydronic Free Cooling*	$425,000	$70,020	0	380,545	*	*			
Cornell Chiller Plant CW cleaning*	$799,800	$128,235	0	696,932	*	*			
Total Savings	$2,532,250	$1,293,706	10,404	6,712,800	$75,708				

Executive Summary - Greenberg Pavilion

WCMC Campus Baseline Net*** $5,180,259

Package	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Recommended Implementation Annual Savings	Recommended Implementation Simple Payback	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Greenberg Lighting	$215,743	$133,724	0	726,786	$132,528	1.59			
Greenberg DHW	$91,818	$91,275	7,807	0	$45,952	1.77			
Greenberg HVAC	$494,190	$340,699	11,356	1,087,195	$337,519	1.10			
Greenberg HW heat	$10,750	$18,108	749	9,293	$18,108	0.59			
Greenberg OR	$320,400	$82,125	2,120	292,160	$82,125	3.90			
Greenberg compressors*	*	$40,126	0	155,100	*	*			
Greenberg DHW Replacement	$400,000	$30,758	2,481	0	$30,758	13.00			
Greenberg HWH Reset		-$2,081	30	-13,359					
Greenberg Fan Curtailment****	****	****	****	****	****	****			
Greenberg Testing and Balancing	$370,780	$193,139	2,061	910,714	$0	*			
Greenberg Air Filter Replacement	$12,771	$28,425	0	154,482	$28,425	0.45			
Total Savings	$1,916,452	$958,379	26,574	3,335,730	$675,415				

Notes:
* Savings evaluated but not yet identified for implementation
** Measures identified with savings currently being evaluated
*** Costs for buildings based on sq footage and campus net costs
**** Measures currently under evaluation

LEVEL 2 ENERGY AUDIT

Introduction

Vanderweil Engineers has conducted a Level 2 Energy Audit of Cornell Campus. The study was performed in accordance with the guidelines of the *ASHRAE Procedures for Commercial Building Energy Audit* standard.

This report provides detailed information for energy conservation opportunities. The information contained herein is to be used as the basis for either an investment grade, Level 3 Energy Audit, or directly as the basis for energy conservation projects within the building Implementation Stage.

The following table represents the Cornell Campus blended average summary after the implementation of recommended ECMs.

The Campus-wide EUI number after implementation of ECMs would be 328.4 kbtu/sf/yr.

Cornell Campus Blended Average Summary After ECM Implementation			
Utilities			kbtu
Total Electricity Purchased (kwh)	59,854,657		204,224,090
Electricity Generated*	53,658,161		183,081,645
Total Electricity Consumption (kwh)	113,512,818		387,305,735
Electricity Sold (kwh)*	51,006,217		174,033,213
Net Electricity Consumption (kwh)	62,506,601		213,272,522
NG Consumption (mmbtu)	1,326,485		1,326,484,960
Oil Consumption (mmbtu)*	12,087		12,087,148
Process Heating/Cooling			kbtu
Total Steam Production (lbs)	1,003,398,514		953,228,588
Steam Sold (lbs)*	531,544,444		504,967,222
Net Steam Production (lbs)	471,854,070		448,261,367
% Sold		53%	
Total CHW Production (Ton-hours)	21,694,061		260,328,732
CHW Sold (Ton-hours)*	14,380,920		172,571,046
Net CHW Production (Ton-hours)	7,313,141		87,757,686
% Sold		66%	
Campus Square Footage	2,662,715		
Metrics			
Gross kWh/SF (elec)	22.5		
Gross mmbtu/SF (fuel)	0.5		
Gross Steam kbtu/sf	358.0		
Gross CHW kbtu/sf	97.8		
Gross kbtu/SF (elec+fuel) - EUI	579.4		
Net WCMC kWh/SF (elec)	23.5		
Net WCMC mmbtu/SF (fuel)	0.2		
Net WCMC Steam kbtu/sf	168.3		
Net WCMC CHW kbtu/sf	33.0		
Net WCMC kbtu/SF (elec+fuel) - EUI	328.4		
Building Consumption			
Greenberg Square Footage	982,411		SF
Greenberg Steam Consumption	183,053,323		lbs
Greenberg CHW Consumption	2,482,329		ton hrs
Greenberg Electric Consumption	8,400,955		kwh
Greenberg EUI	237		
Annex Square Footage	392,573		SF
Annex Steam Consumption	78,448,725		lbs
Annex CHW Consumption	1,035,494		ton hrs
Annex Electric Consumption	4,040,876		kwh
Annex EUI	257		

Notes:
1) 1 mmbtu = 10 therms = 1,000,000 btu
2) Kbtu=1,000 btu
3) Fuel data includes cogen plant
4) Unit costs are based on Total purchased Consumption
5) Utilities and Process Heating/cooling section data are based on metered values
6) Building Consumption is estimated based on square footage

14. Summary of Projects' Master List of Findings for Greenberg Pavilion Building

Commissioning Summary

R.G.Vanderweil Engineer's, LLP (Vanderweil) and Horizon Engineering was commissioned to perform Retro-Commissioning Procedures at the New York Presbyterian Hospital, Cornell Campus.

The Greenberg Pavilion building, located at 541 East 68 Street on the Hospital's Cornell campus is 15 floors totaling 982,411 square feet and was built in 1997. The purpose of the retro-commissioning is to verify that the building's energy related systems are calibrated, functioning and performing optimize energy usage and to identity Facility Improvement Measures (FIM's) and Energy Conservation Measures (ECM's) The commissioning process was executed in accordance with Vanderweil submitted Retro-Commissioning Plan.

The New York Presbyterian Hospital provided a list of equipment and systems to be retro commissioned. A walk through of the facility was conducted by Vanderweil /Horizon and developed functional performance testing procedures based on this equipment list and reviewed the testing / inspectional procedures with the hospital engineering personnel prior to the actual testing. The functional testing took place during the spring and summer of 2012.

The building automation system (BMS) is by Siemens.

LEVEL 1 ENERGY AUDIT

Introduction

Vanderweil Engineers has conducted an energy audit of the Greenberg Pavilion Building at the New York Presbyterian University Hospital of Cornell. The study was performed in accordance with the guidelines of the *ASHRAE Procedures for Commercial Building Energy Audit* standard. For the purpose of this report, the documentation is limited to a Level 1 evaluation. A more comprehensive Level 2 analysis is in the next section of this report. The purpose of this report is to document field observations and energy analyses of the building, so the current energy performance of the building can be determined.

Executive Summary

The New York Presbyterian University Hospital requested an energy performance evaluation of the existing Greenberg Pavilion Building to identify opportunities for energy savings. This work was conducted by Vanderweil Engineers to observe existing system deficiencies and identify potential Facility Improvement Measures (FIMs) and Energy Conservation Measures (ECMs).

The activities performed for this study were conducted in accordance with the Level 1 guidelines of the *ASHRAE Procedures for Commercial Building Energy Audits* standard and included a site walkthrough, utility bill analysis FIM / ECM analysis, and energy benchmarking of the existing facility.

Key findings for the Greenberg Pavilion Building are as follows:

Our work identified many of FIMs (Facility Improvement Measures) and many ECMs (Energy Conservation Measures). The FIMs are generally maintenance items necessary to bring the buildings into correct operation sufficient to meet codes and occupants' requirements.

The ECMs are a mixture of capital and low/no cost items each of which offers energy savings. The low/no cost items should be implemented immediately. The capital items should be prioritized and implemented according to economic benefit. We have estimated their economic benefit and have recommended groups of ECMs to implement in each building, with estimated costs and payback periods.

This report includes sections related to building system descriptions, existing energy use summaries, and energy conservation measures. Level 1 calculations represented in this report are preliminary estimates only, and initial cost numbers and payback represent an opinion of cost only.

Energy Use Summary / Benchmark Data

The estimated site energy intensity value of the existing the Greenberg Pavilion Hospital Building is 260 kBtu/SF/yr. A typical hospital building type has an average site intensity value of 214 kBtu/SF/yr.

Level 2 Energy Audit

Introduction

Vanderweil Engineers has conducted a Level 2 Energy Audit of Greenberg Pavilion Building at the New York Presbyterian University Hospital of Cornell. The study was performed in accordance with the guidelines of the *ASHRAE Procedures for Commercial Building Energy Audit* standard.

This report provides detailed information for energy conservation opportunities. The information contained herein is to be used as the basis for either an investment grade, Level 3 Energy Audit, or directly as the basis for energy conservation projects within the building Implementation Stage.

Energy Conservation Measure Summary

The New York Presbyterian University Hospital requested an energy performance evaluation of the Greenberg Pavilion Building to identify opportunities for energy savings. This work was conducted by Vanderweil and Horizon Engineers to observe existing system deficiencies and identify potential Energy Conservation Measures (ECMs).

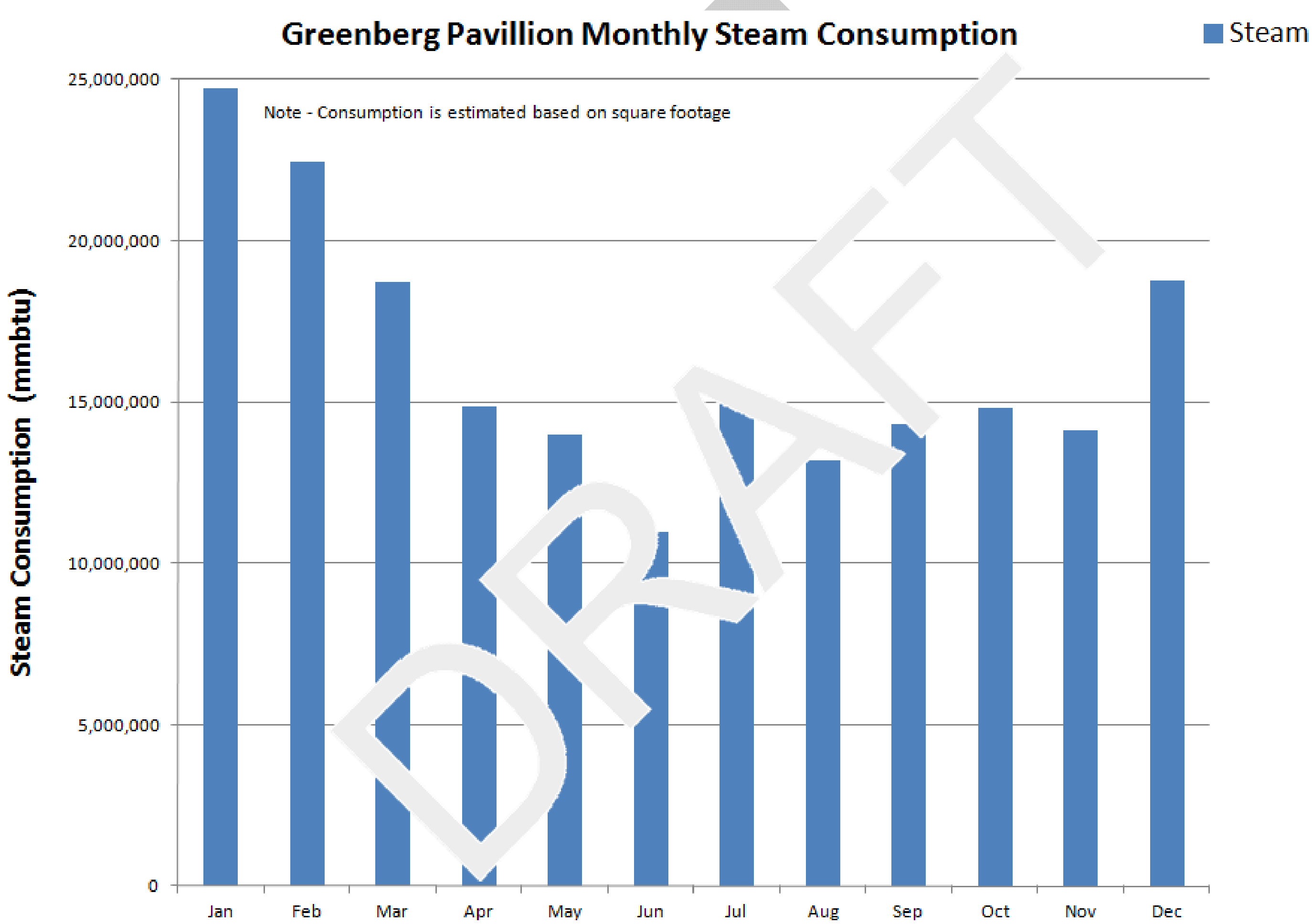
Overview

Each ECM is presented with an initial estimate of annual energy and dollar savings for electricity, steam and chilled water, capital costs for installation, and the simple payback with consideration of operation/ maintenance costs or utility incentives where applicable. Units of electric energy savings are presented in terms of end-use energy. Utility costs associated with the ECMs are priced at $ .184/kWh for electricity, $12.397/mmbtu (NG+oil). Initial judgments of capital costs are based on RS Means Mechanical Cost Data and previous experience on similar projects.

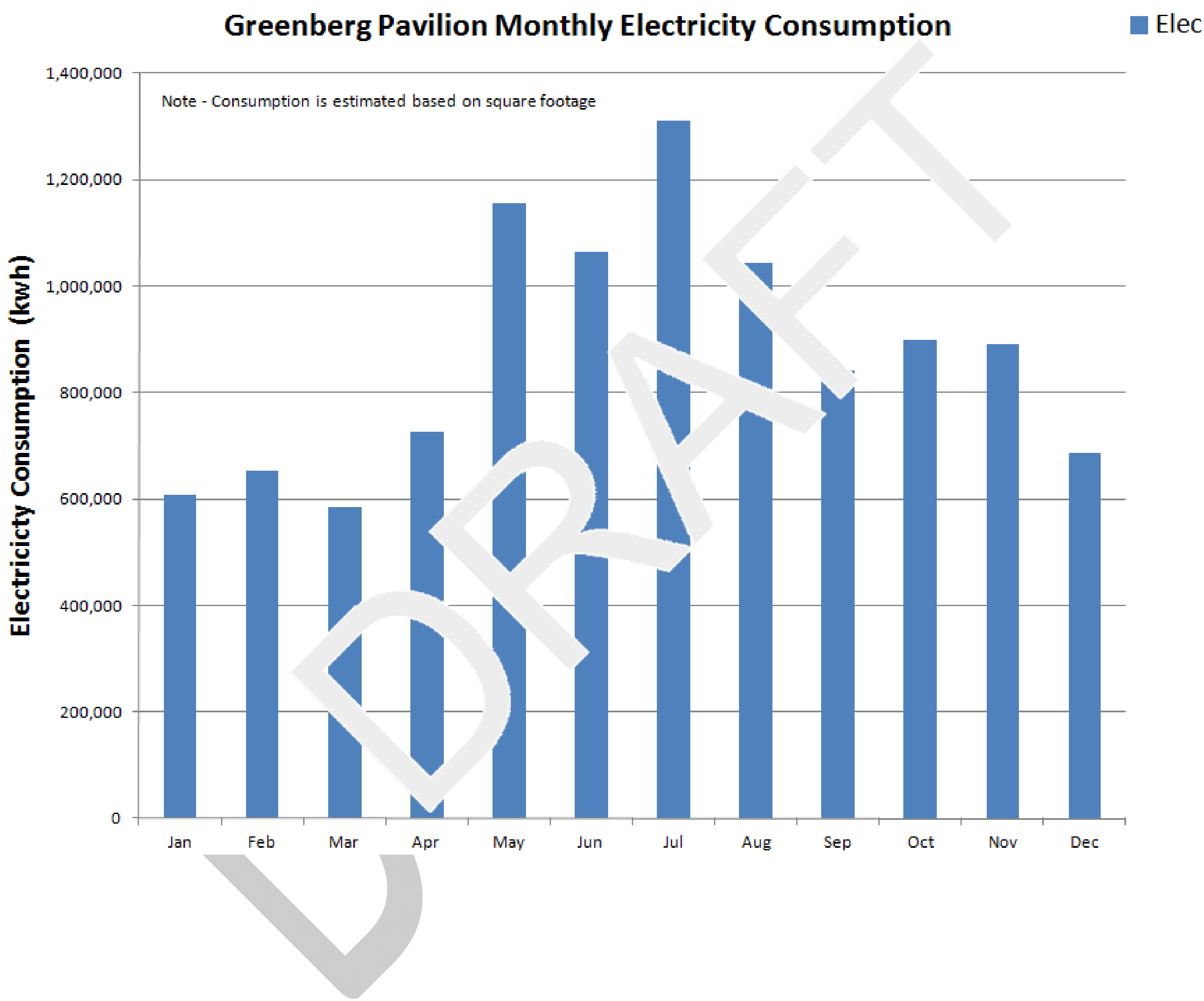
The estimated site energy intensity value of the existing Greenberg Pavilion Hospital building is 260 kBtu/sf/yr. A typical hospital building type has an average site intensity value of 214 kBtu/sf/yr.

The following table provides a summary of the measures that have been considered and their associated simple payback periods. For detailed information including supplemental calculations and equipment information, please refer to the corresponding section of the Appendix.

Greenberg Pavilion Building Estimated Energy Consumption		
Greenberg Square Footage	982,411	sf
Greenberg Steam Consumption	196,317,441	lbs
Greenberg CHW Consumption	2,729,266	ton hrs
Greenberg Electric Consumption	10,465,626	kwh
Greenberg EUI	260	



Utility Summary



Summary of FIM/ECM Tables

This section of the report provides Summary Tables for Facility Improvement Measures (FIMs) / Energy Conservation Measures (ECMs). Detailed FIM/ECM descriptions can be found in the Specific Building Appendices.

Greenberg Pavilion - *Energy Audit Level 1 FIM/ECM Summary*

FIM / ECM #	Description	Estimated Payback (years)	Low Cost/No Cost	Recommended for Level 2 Evaluation
ECM 1	Review Domestic Hot Water System Set-Back	2	Y	Y
ECM 2	Lighting Measures	3		Y
ECM 3	Heating Hot Water Set-Back	1	Y	Y
ECM 4	Increase Filter Replacement	2	Y	Y
ECM 5	Implement Operating Room (OR) Set-Backs	3		Y
ECM 6	Repair / Replace Various HVAC Control Devices		mixed	Y
ECM 7	Most AHUs were found to be operating at 100% fan speed. TAB Contractor should balance systems.		Y	Y
ECM 8	Program Summer/Winter mode to prevent simultaneous heating/cooling	>1	Y	N

Recommendations

The following Energy Conservation Measures (ECMs) have been determined using existing building drawings, functional test data, system inspection and the site walk-through information. The energy costs savings and simple payback rates shown for each ECM are preliminary estimates only. Further Level 2 analysis is recommended for selected ECMs prior to implementation.

Air Conditioning, Heating, and Ventilation Systems

The Greenberg Pavilions Heating, Ventilation, Air Conditioning and Humidification is provided by Air Handling Units in five locations throughout the Building as follows: Sub Sub Basement (SSB) Mechanical Equipment Room, Basement (MER), 9th floor (MER), 12th floor (MER), 14th floor Roof.

The majority of the Air Handlers are equipped with Variable Frequency Drives (VFD's) controlled by Static Pressure Sensor located in the ductwork. The (SPS) adjusts the Fan speed to maintain Static Pressure as demands changes to meet the Cooling Heating and Ventilation loads of the spaces served.

The Air Handlers are constructed from Galvanized Steel built-up casings with insulated panels and stainless steel drain pans. They consist of Cooling Coil, Heating Coil, Humidification, Vain Axial Supply fan, Pre, and Final Filter sections. They are designed for medium pressure operation, 2.5" - 6" of water column.

Chilled Water and Steam is provided by a Central Plant located in the Annex building.

The control for the units is accomplished by a Siemens DDC Control system with pneumatic actuators integrated into the campuses BMS system. The front end is located in the Annex building.

The following is a summary of the units that have been tested.

Greenberg Air Handling Unit Schedule					
BMS #	**Location**	**Area Served**	**CFM**	**Hours of Operation**	**Type**
A-01	SSB MER	SB and 1st fl	14,000	24/7	Built-up
A-01	SSB MER	2nd fl S.I.C.U.	22,600	24/7	Built-up
A-03	SSB MER	3rd fl Recovery	20,000	24/7	Built-up
A-04	SSB MER	4th fl M.I.C.U.	27,600	24/7	Built-up
A-05	SSB MER	6th fl M.I.C.U.	29,000	24/7	Built-up
A-06	SSB MER	5th fl step down	18,000	24/7	Built-up
A-07	Basement MER	3rd fl recovery	13,500	24/7	Built-up
A-08	Basement MER	1st fl BC atrium	16,000	24/7	Built-up
A-09	Basement MER	1st fl emergency	20,500	24/7	Built-up
A-10	Basement MER	2nd fl step down	18,000	24/7	Built-up
A-11	Basement MER	Standby w/AC-PWB-6	N/A	24/7	Built-up
A-12	Basement MER	Standby w/AC-PWB-5	N/A	24/7	Built-up
A-16	9th fl MER	Elevator lobby 4th - 9th floors	29,000	24/7	Built-up
A-17	9th fl MER	8th fl burn unit	23,200	24/7	Built-up
A-18	N/A	N/A	N/A	N/A	N/A
A-19	N/A	N/A	N/A	N/A	N/A
A-20	9th fl MER	3rd fl ORs	18,000	24/7	Built-up
A-21	9th fl MER	2nd fl M/S	18,000	24/7	Built-up
A-22	9th fl MER	8th fl M/S	18,000	24/7	Built-up
A-23	9th fl MER	2nd fl prep & pack	22,300	24/7	Built-up

Greenberg Air Handling Unit Schedule					
BMS #	Location	Area Served	CFM	Hours of Operation	Type
A-24	9th fl MER	4th,5th,6th,7th fl	29,900	24/7	Built-up
A-25	9th fl MER	4th,5th,6th,7th fl	29,900	24/7	Built-up
A-26	9th fl MER	4th,5th,6th,7th fl	29,900	24/7	Built-up
A-27	9th fl MER	8th fl M/S	15,000	24/7	Built-up
A-29	9th fl MER	3rd fl ORs	18,500	24/7	Built-up
A-31	9th fl MER	4th fl stich atrium	20,400	24/7	Built-up
A-33	9th fl MER	4th , 5th, 7th floors	20,400	24/7	Built-up
A-35	9th fl MER	4th , 5th, 7th floors	22,000	24/7	Built-up
A-36	9th fl MER	4th , 5th, 7th floors	22,000	24/7	Built-up
A-46	9th fl MER	OR South	30,000	24/7	Built-up
A-89	14 floor roof	14th floor	28,000	24/7	Built-up
A-90	14 floor roof	14th floor	26,000	24/7	Built-up
A-91	14 floor roof	14th floor	15,000	24/7	Built-up

➢ Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)

See Appendix F for functional Test Scripts, Results and all associated documents.

No Cost / Low Cost Facility Improvement Measures (FIMs)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #1 A-01	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #2 A-01	BMS supply & Return fan start /stop overrides locked out through BMS	Modify control sequence to unlock start/stop overrides	$1000	$0	0	0	FIM	___	___	0	
AH #3 A-01	Air flow monitoring station not calibrated	Calibrate / Replace Air Flow monitoring Station	$150/ $3000	$4,059	43	19138	0.78	I	___	0	
Ah #4 A-01	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH #5 A-01	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #6 A-01	Return Air damper actuator out of calibration. End switch requires manual toggle to restart fan	Adjust/ Replace end switch	$200	$320	9	1152	0.63	I	___	0	
AH #7 A-02	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #8 A-02	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH #9 A-02	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #10 A-03	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #11 A-03	BMS supply & Return fan start /stop overrides locked out through BMS	Modify control sequence to unlock start/stop overrides	$1000	$0	0	0	FIM	___	___	0	
AH #12 A-03	Air flow monitoring station not calibrated	Calibrate / Replace Air Flow monitoring Station	$150/ $3000	$5,798	62	27341	0.54	I	___	0	
AH-13 A-03	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH-14 A-03	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #15 A-03	Unusual noise coming from supply fan during operation.	Replace bearings or Lubricate	$50	$908	0	4935	0.06	I	___	0	
AH #16 A-03	Steam gauge not installed on Preheat Coil	Install steam pressure gauge on Preheat Coil	$800	$0	0	0	FIM	___	___	0	
AH-17 A-04	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #18 A-04	Control sequence calls for the discharge damper to enable the fan to start. No Discharge damper installed	Install Discharge damper and end switch. Interlock with BMS to start fan when end switch proved damper fully open.	$1200	$0	0	0	FIM	___	___	0	
AH #19 A-04	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #20 A-04	Steam gauge not installed on Preheat Coil	Install steam pressure gauge on Preheat Coil	$800	$0	0	0	FIM	___	___	0	
AH #21 A-05	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #22 A-05	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH #23 A-05	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #24 A-05	Steam gauge not installed on Preheat Coil	Install steam pressure gauge on Preheat Coil	$800	$0	0	0	FIM	___	___	0	
AH #25 A-05	Return fan belt tension requires adjustment	Adjust tension on return fan belt	$50	$475	0	2584	0.11	I	___	0	
Ah #26 A-06	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #27 A-06	BMS supply & Return fan start /stop overrides locked out through BMS	Modify control sequence to unlock start/stop overrides	$1000	$0	0	0	FIM	I	___	0	
AH #28 A-06	Air Flow monitoring station is not calibrated	Calibrate / Replace air flow monitoring station	$150/ $3000	$5,218	56	24607	0.60	I	___	0	
AH #29 A-06	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH #30 A-06	Discharge air, preheat temp,& mixed air temp sensors out of calibration	Recalibrate / Replace discharge air, preheat tem & mixed air sensor	$150/ $900	$1,160	56	2549	0.91	I	___	0	
AH #31 A-06	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #32 A-06	Supply fan start / stop feedback not functional	Modify control to show start / stop feedback	$1000	$0	0	0	FIM	___	___	0	
AH#33 A-06	Return Air damper actuator out of calibration. End switch requires manual toggle to restart fan	Adjust/ Replace end switch	$200	$411	11	1482	0.49	I	___	0	
AH #34 A-06	Unusual noise coming from supply fan during operation.	Replace bearings or Lubricate	$50	$817	0	4442	0.06	I	___	0	
AH #35 A-06	Steam gauge not installed on Preheat Coil	Install steam pressure gauge on Preheat Coil	$800	$0	0	0	FIM	___	___	0	
AH #36 A-06	Return fan belt tension requires adjustment	Adjust tension on return fan belt	$50	$295	0	1604	0.17	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #37 A-07	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #38 A-07	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH #39 A-07	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #40 A-07	A07 Min outside air damper does not close completely when unit is shut down	Adjust / replace min outside air damper actuator	$150/ $400	$0	0	0	FIM	___	___	0	
AH #41 A-07	Steam gauge not installed on Preheat Coil	Install steam pressure gauge on Preheat Coil	$800	$0	0	0	FIM	___	___	0	
AH #42 A-07	Return fan belt need adjustment	Adjust tension on return fan belt	$50	$221	0	1203	0.23	I	___	0	
AH #43 A-08	Humidification control sequence wasn't operational	Modify control sequence to include Humidification	$1000	$0	0	0	FIM	___	___	0	
AH #44 A-08	Discharge damper not installed	Install discharge damper and end switch	$2500	$0	0	0	FIM	___	___	0	
AH #45 A-08	Return Fan does not disable when supply fan is deenergized	Modify control sequence to disable return fan when supply is deenergized	$1000	$0	0	0	FIM	___	___	0	
AH #46 A-08	Steam gauge not installed on Preheat Coil	Install steam pressure gauge on Preheat Coil	$800	$0	0	0	FIM	___	___	0	
AH #47 A-02	Discharge temperature sensor is out of calibration. BMS off 1.5+ deg	Recalibrate / replace discharge air sensor	$150/ $300	$1,456	70	3200	0.31	I	___	0	
AhH#48 A-02	Discharge temperature sensor is out of calibration. BMS off 1.5+ deg	Recalibrate / replace discharge air sensor	$150/ $300	$1,456	70	3200	0.31	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #49 A-01	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$215	17	0	2.09	I	___	0	
AH #50 A-02	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$347	28	0	1.30	I	___	0	
AH #51 A-01	Return air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$107	9	0	4.19	I	___	0	
AH #52 A-02	Return air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$173	14	0	2.59	I	___	0	
AH #53 A-02	Outside air damper is out of calibration	Recalibrate outside air damper	$150	$1,161	70	1594	0.13	I	___	0	
AH #54 A-01	Outside air damper is out of calibration	Recalibrate outside air damper	$150	$719	43	987	0.21	I	___	0	
AH #55 A-04	Discharge temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace discharge air sensor	$150/ $300	$1,778	85	3908	0.25	I	___	0	
AH #56 A-03	Preheat temperature sensor is out of calibration. BMS more the 1.5 deg off	Recalibrate / replace Preheat sensor	$150/ $300	$768	62	0	0.59	I	___	0	
AH #57 A-03	Mixed air temperature sensor is out of calibration. BMS more the 1.5 deg off	Recalibrate / Replace mixed air sensor	$150/ $300	$515	25	1133	0.87	I	___	0	
AH #58 A-03	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$307	25	0	1.47	I	___	0	
AH #59 A-04	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$424	34	0	1.06	I	___	0	
AH #60 A-04	Return air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$212	17	0	2.12	I	___	0	
AH #61 A-03	Return air damper is out of calibration	Recalibrate / Replace Return air damper	$150/ $1200	$456	12	1646	2.96	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #62 A-06	Discharge temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge temp sensor	$150/ $300	$1,160	56	2549	0.39	I	___	0	
AH # 63 A-05	Preheat temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat temp sensor	$150/ $300	$1,113	90	0	0.40	I	___	0	
AH #64 A-06	Preheat temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat temp sensor	$150/ $300	$691	56	0	0.65	I	___	0	
AH #65	Mix air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mix air temp sensor	$150/ $300	$387	19	850	1.16	I	___	0	
AH #66 A-05	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$445	36	0	1.01	I	___	0	
AH #67 A-06	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$276	22	0	1.63	I	___	0	
AH #68 A-05	Return air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$223	18	0	2.02	I	___	0	
AH #69 A-06	Return air damper is out of calibration	Recalibrate / Replace Return air damper	$150/ $1200	$411	11	1482	3.29	I	___	0	
AH #70 A-05	Outside air damper is out of calibration	Recalibrate / Replace Outside air damper	$150/ $1200	$1,489	90	2045	0.91	I	___	0	
AH #71 A-06	Outside air damper is out of calibration	Recalibrate / Replace Outside air damper	$150/ $1200	$924	56	1269	1.46	I	___	0	
AH #72 A-08	Preheat temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat temp sensor	$150/ $300	$614	50	0	0.73	I	___	0	
AH #73 A-07	Mix air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mix air temp sensor	$150/ $300	$348	17	765	1.29	I	___	0	
AH #74 A-08	Mix air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mix air temp sensor	$150/ $300	$412	20	906	1.09	I	___	0	
AH #75 A-07	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$207	17	0	2.17	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #76 A-08	Supply air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$246	20	0	1.83	I	___	0	
AH #77 A-07	Return air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$104	8	0	4.34	I	___	0	
AH #78 A-08	Return air relative Humidity sensor out of calibration	Recalibrate / Replace relative humidity sensor	$150/ $300	$123	10	0	3.66	I	___	0	
AH #79 A-07	Return air damper is out of calibration	Recalibrate / Replace Return air damper	$150/ $1200	$308	8	1111	4.38	I	___	0	
AH #80 A-08	Return air damper is out of calibration	Recalibrate / Replace Return air damper	$150/ $1200	$365	10	1317	3.70	I	___	0	
AH #81 A-09	Only outside air damper modulated when commanded , Exhaust remained at 100%, return remained at 10%	Modify Control sequences / replace / Repair end switches, and actuators	$1000/ $1200	$0	0	0	FIM	___	___	0	
AH #82 A-09	Return, Exhaust and Enthalpy Economizer trip points are Overridden.	Remove override from @ BMS	$1000	$0	0	0	FIM	___	___	0	
AH #83 A-09	Enthalpy control program doesn't command open/closed OA damper, damper remains at min	Trouble shoot enthalpy controls	$1000	$748	0	4064	1.34	I	___	0	
AH #84 A-09	Relative Humidity resets, valve does not open	Trouble shoot Humidity controls	$1000/ $2900	$0	0	0	FIM	___	___	0	
AH #85 A-09	Temperature sensor is located to close to the heating coil. As the heating valve opens the mix air temp increases dramatically.	Relocate temp sensor to allow for accurate reading. Retest!	$150	$787	63	0	0.19	I	___	0	
AH #86 A-10	Relative Humidity resets, valve does not open	Trouble shoot Humidity controls	$1000/ $2900	$0	0	0	FIM	___	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH #87 A-10	2/3 static pressure control needs tuning. VFD never makes setpoint	Rework 2/3 static pressure control loop to make VFD modulate properly.	$200	$10,866	111	51545	0.02	I	___	0	
AH #88 A-10	Temperature sensor is located to close to the heating coil. As the heating valve opens the mix air temp increases dramatically.	Relocate temp sensor to allow for accurate reading. Retest!	$150	$691	56	0	0.22	I	___	0	
AH #89	Discharge temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace discharge air sensor	$150/ $300	$967	46	2124	0.47	I	___	0	
AH #90 A-09	Return air temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace return air sensor	$150/ $300	$264	13	581	1.70	I	___	0	
AH #91 A-10	Return air temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace return air sensor	$150/ $300	$232	11	510	1.94	I	___	0	
AH #92 A-09	Preheat temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace r Preheat sensor	$150/ $300	$787	63	0	0.57	I	___	0	
AH #93 A-10	Preheat temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace r Preheat sensor	$150/ $300	$691	56	0	0.65	I	___	0	
AH #94 A-10	Mixed air temperature sensors out of calibration. BMS more the 1.5 deg off	Recalibrate / replace r Mixed air sensor	$150/ $300	$464	22	1020	0.97	I	___	0	
AH#95 A-09	Humidifier control valve needs to be calibrated	Calibrate / replace Humidifier control valve	$150/ $2000	$315	25	0	6.83	I	___	0	
AH#96 A-10	Humidity valve need calibration	Calibrate / replace humidity valve	$150/ $2000	$276	22	0	7.78	I	___	0	
AH#97 A-09	Return Air damper needs calibration	Calibrate / replace return Air damper actuator	$150/ $400	$940	25	3397	0.59	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#98 A-10	Maximum outside air damper needs calibration	Calibrate / replace maximum outside air damper	$150/ $1200	$924	56	1269	1.46	I	___	0	
Ah#99 A-09	Exhaust air damper needs calibration	Calibrate / replace Exhaust air damper	$150/ $1200	$336	0	1827	4.02	I	___	0	
AH#100 A-10	Exhaust air damper needs calibration	Calibrate / replace Exhaust air damper	$150/ $1200	$295	0	1604	4.57	I	___	0	
AH#101 A-25	Return fan VFD only reads 35% when commanded to 50%	Calibrate VFD to read the same and command as per BMS	$1000	$0	0	0	FIM	___	___	0	
AH#102 A-11	RA, OA, & RA dampers modulate in sequence with heating and cooling valves based on OA temp. to maintain	Reset the supply air temp to maintain to maintain constant return air temp	$500	$2,201	133	3022	0.23	I	___	0	
AH#103 A-11	A-!! & A-12 are manifolded together when switching from A-11 to A-12 return fan remains energized with A-12 supply and return fan running	Correct BMS sequence to stop all fans prior to starting next set	$500	$0	0	0	FIM	___	___	0	
AH#104 A-12	RA, OA, & RA dampers modulate in sequence with heating and cooling valves based on OA temp. to maintain	Reset the supply air temp to maintain to maintain constant return air temp	$500	$2,201	133	3022	0.23	I	___	0	
AH#105 A-12	Return Air damper closed to 50% when commanded to 100%	Recalibrate / replace return air actuator to match BMS	$150	$11,916	265	46883	0.01	I	___	0	
AH#106 A-12	Pre-heat steam vale has leak at steam	Repair / replace steam valve	$500/ $800	$658	53	0	1.98	I	___	0	
AH#107 A-12	No access door at discharge control damper	Install access door at discharge control damper	$150	$0	0	0	FIM	___	___	0	
AH#108 A-12	Preheat temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat temp sensor	$150/ $300	$1,645	133	0	0.27	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#109 A-11	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace mixed air temp sensor	$150/ $300	$880	53	1209	0.51	I	___	0	
AH#110 A-09	Supply air relative humidity sensor out of calibration	Recalibrate / replace supply air relative humidity sensor	$150/ $300	$315	25	0	1.43	I	___	0	
AH#111 AH-10	Supply air relative humidity sensor out of calibration	Recalibrate / replace supply air relative humidity sensor	$150/ $300	$276	22	0	1.63	I	___	0	
AH#112 A-10	Return air relative humidity sensor out of calibration	Recalibrate / replace Return air relative humidity sensor	$150/ $300	$138	11	0	3.26	I	___	0	
AH#113 A-12	Return air damper Needs to be calibrated	Calibrate Return are damper	$150	$2,270	53	8761	0.07	I	___	0	
AH#114 A-11	Outside air damper need to be calibrated	Calibrate Outside air damper	$150	$2,201	133	3022	0.07	I	___	0	
AH#115 A-11	Exhaust air damper needs to be calibrated	Calibrate Exhaust air damper	$150	$1,135	0	6169	0.13	I	___	0	
AH#116 A-12	Exhaust air damper needs to be calibrated	Calibrate Exhaust air damper	$150	$1,135	0	6169	0.13	I	___	0	
AH#117 A-16	Return fan does not shut down when commanded. Requires manual shut down via BMS	Reconfigure BMS to shut down Return fan when commended	$1000	$0	0	0	FIM	___	___	0	
AH#118 A-16	Enthalpy control program not functioning Dampers modulate in sequence with heating valves to control discharge temps .when return air enthalpy simulated less then outside air enthalpy RA damper does not modulate.	Reconfigure BMS Enthalpy programming to modulate RA damper	$1000	$1,058	0	5749	0.95	___	___	0	
AH#119 A-16	No steam at humidifier valve modulates open	investigate why no steam is available	$1000	$0	0	0	FIM	___	___	0	
AH#120 A-17	Humidified valve has leak and rusty	Repair / replace valve	$500/ $2000	$1,018	82	0	2.46	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#121 A-17	Supply fan damper does not close when supply fan fails.	BMS should monitor damper status to protect against freezing coil	$1000	$0	0	0	FIM	___	___	0	
AH#122 A-17	No access to verify exhaust fan damper position	Install access door at exhaust air damper	$150	$0	0	0	FIM	___	___	0	
AH#123 A-17	BMS Supply and Return fans start/stop locked out at BMS	Modify BMS sequence	$1000	$0	0	0	FIM	___	___	0	
AH#124 A-16	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,869	90	4106	0.24	I	___	0	
AH#125 A-17	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$3,404	205	4675	0.13	I	___	0	
AH#126 A-16	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$1,113	90	0	0.40	I	___	0	
AH#127 A-17	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$2,544	205	0	0.18	I	___	0	
AH#128 A-16	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$747	36	1643	0.60	I	___	0	
AH#129 A-16	Supply air relative humidity sensor out of calibration	Recalibrate / replace supply air relative humidity sensor	$150/ $300	$445	36	0	1.01	I	___	0	
AH#130 A-17	Supply air relative humidity sensor out of calibration	Recalibrate / replace supply air relative humidity sensor	$150/ $300	$1,018	82	0	0.44	I	___	0	
AH#131 A-16	Return air relative humidity sensor out of calibration	Recalibrate / replace Return air relative humidity sensor	$150/ $300	$223	18	0	2.02	I	___	0	
AH#132 A-17	Humidified valve needs to be calibrated	Calibrate Humidifier Valve	$150	$1,018	82	0	0.15	I	___	0	
AH#133 A-16	Return air damper needs to be calibrated	Calibrate return air damper	$150	$662	18	2387	0.23	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#134 A-16	Exhaust air damper needs to be calibrated	Calibrate Exhaust air damper	$150	$475	0	2584	0.32	I	___	0	
AH#135 A-17	Exhaust air damper needs to be calibrated	Calibrate Exhaust air damper	$150	$1,756	0	9541	0.09	I	___	0	
AH#136 A-21	Minimum outside air damper remains open when unit is commanded to Unoccupied mode	Modify control sequence for Unoccupied mode	$150/ $1000	$1,849	111	2539	0.62	I	___	0	
AH#137 A-21	Humidifier is not operational	Check steam supply and control vale at Humidifier	$500/ $2900	$0	0	0	FIM	I	___	0	
AH#138 A-21	Enthalpy control programming not functioning	Modify programming for Enthalpy control	$1000	$657	0	3568	1.52	I	___	0	
AH#139 A-22	Humidifier is not operational	Check steam supply and control vale at Humidifier	$500/ $2900	$0	0	0	FIM	___	___	0	
AH#140 A-22	Return fan requires manually start from BMS. Does not automatically start after supply fan	Modify control sequence to start return fan	$1000	$0	0	0	FIM	___	___	0	
AH#141 A-22	Enthalpy control programming not functioning	Modify programming for Enthalpy control	$1000	$657	0	3568	1.52	I	___	0	
AH#142 A-21	Return air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Return air temp sensor	$150/ $300	$232	11	510	1.94	I	___	0	
AH#143 A-22	Return air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Return air temp sensor	$150/ $300	$232	11	510	1.94	I	___	0	
AH#144 A-22	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$691	56	0	0.65	I	___	0	
AH#145 A-21	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$464	22	1020	0.97	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#146 A-22	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$464	22	1020	0.97	I	___	0	
AH#147 A-21	Supply air relative humidity sensor out of calibration	Recalibrate / replace Supply air relative humidity sensor	$150/ $300	$276	22	0	1.63	I	___	0	
AH#148 A-22	Supply air relative humidity sensor out of calibration	Recalibrate / replace Supply air relative humidity sensor	$150/ $300	$276	22	0	1.63	I	___	0	
AH#149 A-21	Return air relative humidity sensor out of calibration	Recalibrate / replace Return air relative humidity sensor	$150/ $300	$138	11	0	3.26	I	___	0	
AH#150 A-22	Return air relative humidity sensor out of calibration	Recalibrate / replace Return air relative humidity sensor	$150/ $300	$138	11	0	3.26	I	___	0	
AH#151 AH-21	Heating valve needs to be calibrated	Calibrate / replace heating valve	$150/ $2900	$691	56	0	4.42	I	___	0	
AH#152 AH-21	Cooling valve needs to be calibrated	Calibrate / replace Cooling valve	$150/ $2900	$469	0	2549	6.50	I	___	0	
AH#153 A-21	Humidifier valve needs to be calibrated	Calibrate / replace Humidifier valve	$150/ $2000	$276	22	0	7.78	I	___	0	
AH#154 AH-21	Return air damper needs to be calibrated	Calibrate / replace Return air damper	$150/ $1200	$411	11	1482	3.29	I	___	0	
AH#155 A-22	Return air damper needs to be calibrated	Calibrate / replace Return air damper	$150/ $1200	$411	11	1482	3.29	I	___	0	
AH#156 A-21	Outside air damper needs to be calibrated	Calibrate / replace Outside air damper	$150/ $1200	$924	56	1269	1.46	I	___	0	
AH#157 A-21	Maximum air damper needs to be calibrated	Calibrate / replace Maximum air damper	$150/ $1200	$924	56	1269	1.46	I	___	0	
AH#158 A-21	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,160	56	2549	0.39	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#159 A-22	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,160	56	2549	0.39	I	___	0	
AH#160 A-20	Damper control end switch not set properly Switch must be manually toggled VFD start stop not verified	Adjust / replace end switch to prove damper is open - closed. To start stop VFD	$200	$0	0	0	FIM	___	___	0	
AH#161 A-20	BMS indicated supply and return fan are in Hand. VFD was in Auto. Unable to shut down supply and return fans.min outside air not verified	Correct BMS control problem to allow for shut down of fan and check min air damper position	$1000	$0	0	0	FIM	___	___	0	
AH#162 A-20	Exhaust air damper remained open when commanded to 0,50 &100%	Correct BMS control of exhaust air damper	$500	$0	0	0	FIM	___	___	0	
AH#163 A-20	Discharge air and mixed air set points not working properly in control program .both stroke the outside air dampers	Correct BMS control program to properly operate discharge and mixed air dampers	$500	$1,160	56	2549	0.43	I	___	0	
AH#164 A-20	Humidity control valve does not modulate when commanded by BMS	Repair / replace humidity control valve, / check point to point for Valve continuity	$500/ $2900	$0	0	0	FIM	___	___	0	
AH#165 A-20	Enthalpy control effected by having both mixed air and discharge set points	Correct set points for enthalpy control.	$1000	$657	0	3568	1.52	I	___	0	
AH#166 A-29	Min and outside and exhaust air dampers do not close when in unoccupied	Correct unoccupied sequence to close dampers in Unoccupied	$1000	$1,330	80	1827	0.75	I	___	0	
AH#167 A-29	Space temp sensor is out of calibration	Calibrate / replace space temp sensor	$150/ $300	$1,192	57	2620	0.38	I	___	0	
AH#168 A-29	OR # adjacent corridors have negative / positive pressure problem	Check DOH OR standards and correct pressure problem. rebalance	$7900	$0	0	0	FIM	___	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#169 AH-29	Damper end switch doesn't make and holds fan out of operation	Adjust / Replace end switch to bring fan on when made	$200	$0	0	0	FIM	___	___	0	
AH#170 A-29	Humidification not making set point . No reset	Check steam pressure and operation of humidifier control valve	$500	$284	23	0	1.76	I	___	0	
AH#171 A-29	Airflow sensor on the exhaust VAV failed		$700	$303	0	1648	2.31	I	___	0	
AH#172 A-29	VAV Failed		$150/ $2000	$0	0	0	FIM	___	___	0	
AH#173 A-29	Enthalpy control is nit operational	Identify problem with enthalpy controls & repair	$1000	$675	0	3667	1.48		___	0	
AH#174 A-20	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,160	56	2549	0.39	I	___	0	
AH#175 A-29	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,192	57	2620	0.38	I	___	0	
AH#176 A-20	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$691	56	0	0.65	I	___	0	
AH#177 A-29	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$710	57	0	0.63	I	___	0	
AH#178 A-20	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$464	22	1020	0.97	I	___	0	
AH#179 A-29	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$477	23	1048	0.94	I	___	0	
AH#180 A-20	Supply air relative humidity sensor out of calibration off 1.5+ deg	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$276	22	0	1.63	I	___	0	
AH#181 A-29	Supply air relative humidity sensor out of calibration off 1.5+ deg	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$284	23	0	1.58	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#182 A-20	Return air relative humidity sensor out of calibration off 1.5+ deg	Recalibrate / Replace Return air relative humidity temp sensor	$150/ $300	$138	11	0	3.26	I	___	0	
AH#183 A-29	Return air relative humidity sensor out of calibration off 1.5+ deg	Recalibrate / Replace Return air relative humidity temp sensor	$150/ $300	$142	11	0	3.17	I	___	0	
AH#184 A-20	Cooling valve needs to be calibrated	Calibrate / replace Cooling valve	$150/ $2900	$469	0	2549	6.50	I	___	0	
AH#185 A-20	Humidity valve needs to be calibrated	Calibrate / replace Humidity valve	$150/ $2000	$276	22	0	7.78	I	___	0	
AH#186 A-20	return air damper actuator needs to be calibrated	Calibrate / replace Return air damper actuator valve	$150/ $400	$411	11	1482	1.34	I	___	0	
AH#187 A-21	Maximum Outside air damper actuator needs to be calibrated	Calibrate / replace Maximum Outside air damper actuator valve	$150/ $400	$924	56	1269	0.59	I	___	0	
AH#188 A-20	Exhaust air damper actuator needs to be calibrated	Calibrate / replace Exhaust air damper actuator valve	$150/ $400	$295	0	1604	1.86	I	___	0	
AH#189 A-23	Enthalpy control not operational	Calibrate / Replace enthalpy control	$1000	$813	0	4421	1.23	I	___	0	
AH#190 A-24	When unit is shut down supply air leaks excessively at shared plenum	Repair leaks in ductwork	$2000	$5,117	56	24070	0.39	I	___	0	
AH#191 A-24	Heating valve hunting when commanded to fixed point and to maintain preheat coil temperature	Adjust control to stop valve from hunting for set point	$1000	$1,148	93	0	0.87	I	___	0	
AH#192 A-24	A24,25,&26 are headered together yet have different humidity and temperature set points	Adjust individual set points to match each other	$50	$1,156	56	2540	0.04	I	___	0	
AH#193 A-24	No humidity . steam valve isolated	Identify problem with humidity repair / replace valve. Adjust control s	$500/ $1200	$0	0	0	FIM	___	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#194 A-24	Enthalpy controls not operational	Identify problem with enthalpy controls and repair / replace defective equip adjust BMS	$1000/ $1500	$1,091	0	5927	2.29	I	___	0	
AH#195 A-25	A24,25,&26 are headered together yet have different humidity and temperature set points	Adjust individual set points to match each other	$50	$1,156	56	2540	0.04	I	___	0	
AH#196 A-25	Enthalpy controls not operational	Identify problem with enthalpy controls and repair / replace defective equip adjust BMS	$1000/ $1500	$1,091	0	5927	2.29	I	___	0	
AH#197 A-25	Min outside air damper remained 50% open with unit in occupied position	Modify control sequence for occupied mode	$1000	$2,150	130	2952	0.47	I	___	0	
AH#198 A-25	Only 1 exhaust damper for both A25,A26 damper does not modulate. with either unit in operation	Install additional exhaust damper modify controls to modulate existing and new	$3500	$905	0	4919	3.87	I	___	0	
AH#199 A-25	Steam supply is isolated	Determine why steam is isolated repair / replace equipment to allow for proper operation	$150/ $2900	$0	0	0	FIM	___	___	0	
AH#200 A-26	A24,25,&26 are headered together yet have different humidity and temperature set points	Adjust individual set points to match each other	$50	$1,156	56	2540	0.04	I	___	0	
AH#201 A-26	Enthalpy controls not operational	Identify problem with enthalpy controls and repair / replace defective equip adjust BMS	$1000/ $1500	$1,091	0	5927	2.29	I	___	0	
AH#202 A-26	Min outside air damper remained at 50% in occupied and un occupied mode	Adjust BMS to accommodate occupied and unoccupied modes	$1000	$2,150	130	2952	0.47	I	___	0	
AH#203 A-26	Only 1 exhaust damper for both A25,A26. Damper does not modulate. with either unit	Install additional exhaust damper modify controls to modulate existing and new	$3500	$905	0	4919	3.87	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#204 A-26	Steam supply is isolated	Determine why steam is isolated repair / replace equipment to allow for proper operation	$150/ $2900	$0	0	0	FIM	___	___	0	
AH#205 A-26	Enthalpy control not operational	Identify problem with enthalpy controls and repair / replace defective equip adjust BMS	$1000/ $1500	$1,091	0	5927	2.29	I	___	0	
AH#206 A-31	Enthalpy control not operational	Identify problem with enthalpy controls and repair / replace defective equip adjust BMS	$1000/ $1500	$744	0	4044	3.36	I	___	0	
AH#207 A-24	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,927	93	4234	0.23	I	___	0	
AH#208 A-24	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,927	93	4234	0.23	I	___	0	
AH#209 A-26	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,927	93	4234	0.23	I	___	0	
AH#210 A-26	Return air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Return air temp sensor	$150/ $300	$385	19	847	1.17	I	___	0	
AH#211 A-24	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$1,148	93	0	0.39	I	___	0	
AH#212 A-26	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$1,148	93	0	0.39	I	___	0	
AH#213 A-24	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$771	37	1694	0.58	I	___	0	
AH#214 A-26	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$771	37	1694	0.58	I	___	0	
AH#215 A-24	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$459	37	0	0.98	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#216 A-26	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$459	37	0	0.98	I	___	0	
AH#217 A-24	Return air relative humidity sensor out of calibration	Recalibrate / Replace Return air relative humidity temp sensor	$150/ $300	$230	19	0	1.96	I	___	0	
AH#218 A-25	Return air relative humidity sensor out of calibration	Recalibrate / Replace Return air relative humidity temp sensor	$150/ $300	$230	19	0	1.96	I	___	0	
AH#219 A-24	Heating valve needs calibration	Calibrate / replace heating valve	$150/ $2900	$1,148	93	0	2.66	I	___	0	
AH#220 A-25	Heating valve needs calibration	Calibrate / replace heating valve	$150/ $2900	$1,148	93	0	2.66	I	___	0	
AH#221 A-26	Heating valve needs calibration	Calibrate / replace heating valve	$150/ $2900	$1,148	93	0	2.66	I	___	0	
AH#222 A-24	Cooling valve needs calibration	Calibrate / replace Cooling valve	$150/ $2900	$779	0	4234	3.92	I	___	0	
AH#223 A-25	Cooling valve needs calibration	Calibrate / replace Cooling valve	$150/ $2900	$779	0	4234	3.92	I	___	0	
AH#224 A-26	Cooling valve needs calibration	Calibrate / replace Cooling valve	$150/ $2900	$779	0	4234	3.92	I	___	0	
AH#225 A-24	Humidifier valve needs calibration	Calibrate / replace Humidifier valve	$150/ $2000	$459	37	0	4.68	I	___	0	
AH#226 A-25	Humidifier valve needs calibration	Calibrate / replace Humidifier valve	$150/ $2000	$459	37	0	4.68	I	___	0	
AH#227 A-24	Return air damper valve needs calibration	Calibrate / replace return air damper valve	$150/ $400	$682	19	2461	0.81	I	___	0	
AH#228 A-35	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$2,412	195	0	0.19	I	___	0	
AH#229 A-25	Minimum outside air damper valve needs calibration	Calibrate / replace Minimum outside air damper valve	$150/ $400	$1,536	93	2109	0.36	I	___	0	
AH#230 A-24	Maximum outside air damper valve needs calibration	Calibrate / replace Maximum outside air damper valve	$150/ $400	$1,536	93	2109	0.36	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#231 A-25	Maximum outside air damper valve needs calibration	Calibrate / replace Maximum outside air damper valve	$150/ $400	$1,536	93	2109	0.36	I	___	0	
AH#232 AH-26	Maximum outside air damper valve needs calibration	Calibrate / replace Max outside air damper valve	$150/ $400	$1,536	93	2109	0.36	I	___	0	
AH#233 A-24	Exhaust air damper valve needs calibration	Calibrate / replace Exhaust air damper valve	$150/ $400	$490	0	2664	1.12	I	___	0	
AH#234 A-25	Exhaust air damper valve needs calibration	Calibrate / replace Exhaust air damper valve	$150/ $400	$490	0	2664	1.12	I	___	0	
AH#235 A-26	Exhaust air damper valve needs calibration	Calibrate / replace Exhaust air damper valve	$150/ $400	$490	0	2664	1.12	I	___	0	
AH#236 A-23	Max & Min dampers remained open as unit failed and supply spill opened 50%	Determine why problem exists correct within BMS	$1000	$0	0	0	FIM	I	___	0	
AH#237 A-23	No exhaust damper installed	Install exhaust damper w/ assoc controls	$3600	$0	0	0	FIM	___	___	0	
AH#238 A-23	Supply fan remote shutdown locked out.	Correct lockout at BMS	$1000	$0	0	0	FIM	___	___	0	
AH#239 A-23	Upstream heating valve leaking steam	Repair / Replace valve to stop steam leak	$500/ $2900	$342	28	0	9.93	I	___	0	
AH#240 A-23	Humidifier valve not operational	Investigate and repair / replace valve or turn on steam	$500/ $2900	$0	0	0	FIM	___	___	0	
AH#241 A-27	Humidifier valve not operational	Investigate and repair / replace valve or turn on steam	$500/ $2900	$0	0	0	FIM	___	___	0	
AH#242 A-31	Humidifier valve not operational	Investigate and repair / replace valve or turn on steam	$500/ $2900	$0	0	0	FIM	___	___	0	
AH#243 A-31	Min outside air damper does not close when commanded of or when unit failed	Repair / replace valve / modify BMS control sequence	$1000/ $1200	$0	0	0	FIM	___	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#244 A-23	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,437	69	3158	0.31	I	___	0	
AH#245 A-27	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$967	46	2124	0.47	I	___	0	
AH#246 A-27	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$576	46	0	0.78	I	___	0	
AH#247 A-31	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$783	63	0	0.57	I	___	0	
AH#248 A-23	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$575	28	1263	0.78	I	___	0	
AH#249 A-27	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$387	19	850	1.16	I	___	0	
AH#250 A-31	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$526	25	1155	0.86	I	___	0	
AH#251 A-23	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$342	28	0	1.31	I	___	0	
AH#252 A-27	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$230	19	0	1.95	I	___	0	
AH#253 A-31	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$313	25	0	1.44	I	___	0	
AH#254 A-23	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$342	28	0	1.31	I	___	0	
AH#255 A-27	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$230	19	0	1.95	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#256 A-31	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$313	25	0	1.44	I	___	0	
AH#257 A-31	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$313	25	0	1.44	I	___	0	
AH#258 A-31	Supply air relative humidity sensor out of calibration	Recalibrate / Replace Supply air relative humidity temp sensor	$150/ $300	$313	25	0	1.44	I	___	0	
AH#259 A-23	Supply air damper valve needs calibration	Calibrate / replace Supply air damper valve	$150/ $400	$1,145	69	1573	0.48	I	___	0	
AH#260 A-23	Minimum outside air damper valve needs calibration	Calibrate / replace Minimum air damper valve	$150/ $400	$1,145	69	1573	0.48	I	___	0	
AH#261 A-23	Maximum outside air damper valve needs calibration	Calibrate / replace Maximum air damper valve	$150/ $400	$1,145	69	1573	0.48	I	___	0	
AH#262 A-27	Maximum outside air damper valve needs calibration	Calibrate / replace Maximum air damper valve	$150/ $400	$770	46	1058	0.71	I	___	0	
AH#263 A-31	Exhaust air damper valve needs calibration	Calibrate / replace Exhaust air damper valve	$150/ $400	$334	0	1818	1.64	I	___	0	
AH#264 A-18	Supply and return start stop overrides are locked out on BMS	Modify BMS sequence	$1000	$0	0	0	FIM	I	___	0	
AH#265 A-18	Unit does not respond to any set point commands VFD does not modulate valves do not respond	Correct sequences in BMS / Overhaul commands check point to point	$3000	$1,135	0	6169	2.64	I	___	0	
AH#266 A-46	Unoccupied mode shown ret damper @100% actually closed	Modify BMS to show actual conditions and check all dampers	$1000	$0	0	0	FIM	I	___	0	
AH#267 A-46	Cooling coil control valve leaking	Repair / replace cooling coil control valve	$150/ $2900	$782	0	4248	3.90	I	___	0	
AH#268 A-46	Ret air damper remains closed with all commands Min OA damper does not modulate	Correct control sequence and check damper control valves	$1000	$7,122	186	26193	0.14	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#269 A-46	Steam leaks at preheat and bypass valves	Repair / replace valves correct leaks	$500/ $2900	$461	37	0	7.38	I	___	0	
AH#270 A-46	Supply fan trips on high static in Bypass	Check static pressure sensor and VFD correct problem	$1000	$0	0	0	FIM	___	___	0	
AH#271 A-46	Supply fan does not modulate	Check static pressure sensor and VFD correct problem	$150/ $200	$4,540	0	24676	0.08	I	___	0	
AH#272 A-46	Humidifier valve does not modulate	Repair / replace humidifier control valve check BMS sequence	$500/ $2000	$461	37	0	5.43	I	___	0	
AH#273 A-46	Access door not installed at exhaust air control valve	Install access door	$100	$0	0	0	FIM	___	___	0	
AH#274 OR Rm #9	System needs balancing OR is positive to hallway	Balance system	$6000	$0	0	0	FIM	___	___	0	
AH#275 A-18	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$967	46	2124	0.47	I	___	0	
AH#276 A-46	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,933	93	4248	0.23	I	___	0	
AH#277 A-18	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$576	46	0	0.78	I	___	0	
AH#278 A-46	Preheat air temp sensor out off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$1,151	93	0	0.39	I	___	0	
AH#279 A-12	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$880	53	1209	0.51	I	___	0	
AH#280 A-18	Mixed air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$387	19	850	1.16	I	___	0	
AH#281 A-18	Supply air relative humidity sensor out of calibration	Recalibrate / Replace supply air relative humidity sensor	$150/ $300	$230	19	0	1.95	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#282 A-46	Supply air relative humidity sensor out of calibration	Recalibrate / Replace supply air relative humidity sensor	$150/ $300	$461	37	0	0.98	I	___	0	
AH#283 A-18	Supply air relative humidity sensor out of calibration	Recalibrate / Replace supply air relative humidity sensor	$150/ $300	$230	19	0	1.95	I	___	0	
AH#284 A-46	Humidifier valve needs calibration	Calibrate humidifier control valve	$150/ $2000	$461	37	0	4.67	I	___	0	
AH#285 A-46	Return air damper valve needs calibration	Calibrate / Replace Return air damper valve	$150/ $400	$685	19	2470	0.80	I	___	0	
AH#286 A-46	Minimum outside air damper valve needs calibration	Calibrate / Replace Return air damper valve	$150/ $400	$1,541	93	2116	0.36	I	___	0	
AH#287 A-31	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$1,314	63	2889	0.34	I	___	0	
AH#288 A-33	Discharge air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Discharge air temp sensor	$150/ $300	$2,993	180	4111	0.15	I	___	0	
AH#289 A-35	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$2,412	195	0	0.19	I	___	0	
AH#290 A-36	Preheat air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Preheat air temp sensor	$150/ $300	$2,412	195	0	0.19	I	___	0	
AH#291 A-33	Mixed t air temp sensor out of calibration off 1.5+ deg	Recalibrate / Replace Mixed air temp sensor	$150/ $300	$1,197	72	1644	0.38	I	___	0	
AH#292 A-33	Supply air relative humidity sensor out of calibration	Recalibrate / Replace supply air relative humidity sensor	$150/ $300	$895	72	0	0.50	I	___	0	
AH#293 A-35	Supply air relative humidity sensor out of calibration	Recalibrate / Replace supply air relative humidity sensor	$150/ $300	$965	78	0	0.47	I	___	0	
AH#294 A-36	Supply air relative humidity sensor out of calibration	Recalibrate / Replace supply air relative humidity sensor	$150/ $300	$965	78	0	0.47	I	___	0	
AH#295 A-33	Return air relative humidity sensor out of calibration	Recalibrate / Replace Return air relative humidity sensor	$150/ $300	$447	36	0	1.01	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#296 A-35	Return air relative humidity sensor out of calibration	Recalibrate / Replace Return air relative humidity sensor	$150/ $300	$482	39	0	0.93	I	___	0	
AH#297 A-36	Return air relative humidity sensor out of calibration	Recalibrate / Replace Return air relative humidity sensor	$150/ $300	$482	39	0	0.93	I	___	0	
AH#298 A-33	Humidifier valve needs calibration	Calibrate / Replace humidifier valve	$150/ $2000	$895	72	0	2.40	I	___	0	
AH#299 A-35	Humidifier valve needs calibration	Calibrate / Replace humidifier valve	$150/ $2000	$965	78	0	2.23	I	___	0	
AH#300 A-35	Supply air damper valve needs calibration	Calibrate / Replace Supply air damper valve	$150/ $400	$3,228	195	4433	0.17	I	___	0	
AH#301 A-33	Return air damper valve needs calibration	Calibrate / Replace Return air damper valve	$150/ $400	$1,544	0	8390	0.36	I	___	0	
AH#302 A-35	Return air damper valve needs calibration	Calibrate / Replace Return air damper valve	$150/ $400	$1,665	0	9048	0.33	I	___	0	
AH#303 A-36	Return air damper valve needs calibration	Calibrate / Replace Return air damper valve	$150/ $400	$1,665	0	9048	0.33	I	___	0	
AH#304 A-36	Minimum outside air damper valve needs calibration	Calibrate / Replace Minimum outside air damper valve	$150/ $400	$3,228	195	4433	0.17	I	___	0	
AH#305 A-35	Maximum outside air damper valve needs calibration	Calibrate / Replace Maximum outside air damper valve	$150/ $400	$3,228	195	4433	0.17	I	___	0	
AH#306 A-36	Maximum outside air damper valve needs calibration	Calibrate / Replace Maximum outside air damper valve	$150/ $400	$3,228	195	4433	0.17	I	___	0	
AH#307 A-33	Exhaust air damper valve needs calibration	Calibrate / Replace Exhaust air damper valve	$150/ $400	$1,544	0	8390	0.36	I	___	0	
AH#308 A-35	Exhaust air damper valve needs calibration	Calibrate / Replace Exhaust air damper valve	$150/ $400	$1,665	0	9048	0.33	I	___	0	
AH#309 A-36	Exhaust air damper valve needs calibration	Calibrate / Replace Exhaust air damper valve	$150/ $400	$1,665	0	9048	0.33	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#310 A-01	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$5600	$1,059	0	5758	5.29	I	___	0	
AH#311 A-03	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$8000	$3,683	0	20015	2.17	I	___	0	
AH#312 A-06	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$7200	$3,314	0	18013	2.17	I	___	0	
AH#313 A-09	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$8200	$3,775	0	20515	2.17	I	___	0	
AH#314 A-10	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$7200	$3,314	0	18013	2.17	I	___	0	
AH#315 A-16	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$11600	$5,340	0	29021	2.17	I	___	0	
AH#316 A-18	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$6000	$2,762	0	15011	2.17	I	___	0	
AH#317 A-20	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$7200	$3,314	0	18013	2.17	I	___	0	
AH#318 A-21	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$7200	$3,314	0	18013	2.17	I	___	0	
AH#319 A-24	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$11960	$5,506	0	29922	2.17	I	___	0	
AH#320 A-25	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$11960	$5,506	0	29922	2.17	I	___	0	
AH#321 A-26	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$11960	$5,506	0	29922	2.17	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#322 A-27	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$6000	$2,762	0	15011	2.17	I	___	0	
AH#323 A-29	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$7400	$3,407	0	18514	2.17	I	___	0	
AH#324 A-33	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$8160	$3,087	0	16780	2.64	I	___	0	
AH#325 A-35	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$8800	$3,330	0	18096	2.64	I	___	0	
AH#326 A-36	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$8800	$3,330	0	18096	2.64	I	___	0	
AH#327 A-46	VAV supply and return fan operate at 100% throughout testing.	Rebalance system to correct inefficient operation	$12000	$5,524	0	30022	2.17	I	___	0	
AH#328 A-02	Balancing volume damper is not installed	Install balancing volume damper	$5000	$13,643	140	64717	0.37	I	___	0	
AH#329 A-04	Discharge balancing damper is not installed	Install discharge balancing damper	$2500	$0	0	0	FIM	___	___	0	
AH#330 A-22	Isolation valve before heating coil is leaking steam	Repair / Replace valve to stop steam leak	$150/ $2900	$691	56	0	4.42	___	___	0	
AH#331 A-38	Cooling valves are rusted and in poor condition	Repair / Replace valves	$150/ $2900	$756	0	4106	4.04	___	___	0	
AH#332 A-39	No access door at exhaust air damper	Install access door at exhaust air damper	$150	$0	0	0	FIM	___	___	0	
AH#333 A-39	Isolation valve before heating coil is leaking steam	Repair / Replace valve to stop steam leak	$150/ $1500	$959	77	0	1.72	I	___	0	
AH#334 A-41	Humidifier control valve is leaking steam when throttled	Repair / Replace valve to stop steam leak	$150/ $2000	$1,113	90	0	1.93	I	___	0	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
AH#335 A-41	No access door at exhaust air damper	Install access door at exhaust air damper	$150	$0	0	0	FIM	___	___	0	

Cornell Operating Rooms - HVAC Systems - Lack of HVAC Setback Strategies

The purpose of this investigation was to review the existing operating rooms/suites and lack of "night setback" or "unoccupied setback" energy saving strategies that can reduce the amount of air supplied (air-changes) to the operating rooms during unoccupied hours and maintaining required pressure differials relationship.

These findings and recommendations are based on review of operating rooms, schedule logs, HVAC Testing and Balancing readings and recent reports, field observations and operating engineering staff interviews.

The Commissioning Team findings are consistent with Joint Commission, ASHRAE and AIA recommendations.

The following systems and operating rooms were reviewed.

				Current Occupied Airflows, ACH & Room Pressurization				Desired Occupied Airflows, ACH & Room Pressurization (AIA)				Desired Occupied Airflows, ACH & Room Pressurization (ASHRAE)				Setback Airflows, ACH & Room Pressurization			
Location	AHU	OR Number	Volume	Supply (CFM)	Return (CFM)	ACH	Room Pressurization	Supply (CFM)	Return (CFM)	ACH	Room Pressurization	Supply (CFM)	Return (CFM)	ACH	Room Pressurization	Supply (CFM)	Return (CFM)	ACH	Room Pressurization
3rd Floor	A-20	OR #4	4341	1686	959	23.3	43%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-20	OR #5	4341	1554	1000	21.5	36%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-20	OR #6	4341	1653	874	22.8	47%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-20	OR #7	4341	1188	771	16.4	35%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-28	OR #2	4341	1645	1360	22.7	17%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-28	OR #3	4341	1771	883	24.5	50%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-28	OR #8	4341	1589	654	22	59%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-28	OR #9	4341	1775	150	24.5	92%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-28	OR #10	5022	1600	158	19.1	90%	1256	1067	15	15%	1674	1423	20	15%	502	427	6	15%
3rd Floor	A-29	OR #1	4341	1404	779	19.4	45%	1085	922	15	15%	1447	1230	20	15%	434	369	6	15%
3rd Floor	A-29	OR #11	4472	1793	1609	24.1	10%	1118	950	15	15%	1491	1267	20	15%	447	380	6	15%
3rd Floor	A-29	OR #12	4472	1374	884	18.4	36%	1118	950	15	15%	1491	1267	20	15%	447	380	6	15%
3rd Floor	A-29	OR #18	4774	1571	404	19.7	74%	1194	1014	15	15%	1591	1353	20	15%	477	406	6	15%
3rd Floor	A-29	OR #19	4774	1650	1972	20.7	-20%	1194	1014	15	15%	1591	1353	20	15%	477	406	6	15%
3rd Floor	A-46	OR #12A	4472	1668	818	22.4	51%	1118	950	15	15%	1491	1267	20	15%	447	380	6	15%
3rd Floor	A-46	OR #14	4472	1547	937	20.8	39%	1118	950	15	15%	1491	1267	20	15%	447	380	6	15%
3rd Floor	A-46	OR #15	4472	1661	1381	22.3	17%	1118	950	15	15%	1491	1267	20	15%	447	380	6	15%
3rd Floor	A-46	OR #16	5226	1946	1043	22.3	46%	1307	1111	15	15%	1742	1481	20	15%	523	444	6	15%
3rd Floor	A-46	OR #17	5226	1534	604	17.6	61%	1307	1111	15	15%	1742	1481	20	15%	523	444	6	15%
3rd Floor	A-93	OR #20	6911	1921	864	16.7	55%	1728	1469	15	15%	2304	1958	20	15%	691	587	6	15%
3rd Floor	A-93	OR #21	5946	2930	1622	29.6	45%	1487	1264	15	15%	1982	1685	20	15%	595	505	6	15%
3rd Floor	A-93	OR #22	7417	2067	434	16.7	79%	1854	1576	15	15%	2472	2101	20	15%	742	630	6	15%
3rd Floor	A-93	OR #23	6319	1872	648	17.8	65%	1580	1343	15	15%	2106	1790	20	15%	632	537	6	15%
7th Floor	A-18	OR #1	3469	1249	669	21.6	46%	867	737	15	15%	1156	983	20	15%	347	295	6	15%
7th Floor	A-18	OR #2	3469	1756	1265	30.4	28%	867	737	15	15%	1156	983	20	15%	347	295	6	15%
7th Floor	A-18	OR #3	3469	1447	1186	25	18%	867	737	15	15%	1156	983	20	15%	347	295	6	15%
7th Floor	A-18	OR #4	3469	1300	1129	22.5	13%	867	737	15	15%	1156	983	20	15%	347	295	6	15%
LDR (Labor, Delivery & Recovery Rooms)																			
7th Floor	A-18	LDR 1	3564	1168	790	19.7	32%	356	356	6	0%	356	356	6	0%	0	0	0	0%
7th Floor	A-18	LDR 2	3431	620	307	10.8	50%	343	343	6	0%	343	343	6	0%	0	0	0	0%
7th Floor	A-18	LDR 3	3754	849	302	13.6	64%	375	375	6	0%	375	375	6	0%	0	0	0	0%
7th Floor	A-18	LDR 4	3809	939	296	14.8	68%	381	381	6	0%	381	381	6	0%	0	0	0	0%
7th Floor	A-18	LDR 5	3846	958	389	14.9	59%	385	385	6	0%	385	385	6	0%	0	0	0	0%
7th Floor	A-18	LDR 6	3431	842	214	14.7	75%	343	343	6	0%	343	343	6	0%	0	0	0	0%
7th Floor	A-18	LDR 7	3535	915	702	15.5	23%	354	354	6	0%	354	354	6	0%	0	0	0	0%
7th Floor	A-18	LDR 8	5995	1064	493	10.6	54%	600	600	6	0%	600	600	6	0%	0	0	0	0%
7th Floor	A-18	LDR 9	3368	807	305	14.4	62%	337	337	6	0%	337	337	6	0%	0	0	0	0%
7th Floor	A-18	LDR 10	3337	901	293	16.2	67%	334	334	6	0%	334	334	6	0%	0	0	0	0%
7th Floor	A-18	ISO LDR	4449	506	752	6.82	-49%	445	445	6	0%	445	445	6	0%	0	0	0	0%
7th Floor	A-18	ISO LDR	1242	135	317	6.52	-135%	124	124	6	0%	124	124	6	0%	0	0	0	0%

Occupied Mode

During occupied mode the VAV box minimum speed should be set to the desired supply airflow to maintain the minimum total air change per hour. The room temperature set point should be set to 68-73°F; the VAV box damper should modulate to maintain the setpoint and minimum airflow.

A motorized damper should be installed in the return duct to keep the room pressurized by maintaining the difference between the supply and return airflow through BMS programming. A less expensive solution would be to install a two position damper that can switch between the maximum and minimum settings during occupied and unoccupied modes. In the case of using the two position damper, the damper must be calibrated regularly to make sure that it maintains the correct airflow and room pressure.

Setback (Unoccupied) Mode

During unoccupied mode the VAV box minimum speed should be set to the setback supply airflow to maintain the minimum total air change per hour. The room temperature set point should be set to 73-78°F; the VAV box damper should modulate to maintain the setpoint and minimum airflow.

A motorized damper should be installed in the return duct to keep the room pressurized by maintaining the difference between the supply and return airflow through BMS programming. A less expensive solution would be to install a two position damper that can switch between the maximum and minimum settings during occupied and non occupied modes. In the case of using the two position damper, the damper must be calibrated regularly to make sure that it maintains the correct airflow and room pressure.

The switch between the occupied and unoccupied mode can be managed by either a time schedule program for the ORs that are used regularly through certain days and weeks. Another method is to use occupancy sensors that can switch to the occupied mode when it senses movement in the room, a brief delay should be used in switching between modes. Manually activated method can be used also in activating the occupied mode. Two or more methods can be combined together to achieve the best control.

Cornell Operating Rooms - HVAC Systems OR Setback ECM Summary

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
OR-1 A-18	OR's operating 24/7 at full flow	Put OR's on reduced flow schedule for unoccupied times	$114,200	$22,408	**555**	**84388**	5.10	I	—	—	
OR-2 A-20	OR's operating 24/7 at full flow	Put OR's on reduced flow schedule for unoccupied times	$37,400	$8,882	**221**	**31624**	4.21	I	—	—	
OR-3 A-28	OR's operating 24/7 at full flow	Put OR's on reduced flow schedule for unoccupied times	$43,800	$13,458	**377**	**45299**	3.25	I	—	—	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
OR-4 A-29	OR's operating 24/7 at full flow	Put OR's on reduced flow schedule for unoccupied times	$43,800	$11,381	**284**	**40521**	3.85	I	—	—	
OR-5 A-46	OR's operating 24/7 at full flow	Put OR's on reduced flow schedule for unoccupied times	$43,800	$12,205	**304**	**43454**	3.59	I	—	—	
OR-6 A-93	OR's operating 24/7 at full flow	Put OR's on reduced flow schedule for unoccupied times	$37,400	$13,791	**379**	**46874**	2.71	I	—	—	

See Calculation Sheets for Cost Breakdown

NYPH WCMC Campus Quarterly Filter Replacement Program

Based on site observation, the existing filter replacement program at New York Presbyterian is not aggressive enough. Filter replacement should occur quarterly versus yearly (4x vs 1x/year) The increase in filter replacement will save energy and provide cleaner air to terminal devices.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measures (ECM)

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
F #1 Greenberg	Dirty air filters increase pressure drop	Replace filters quarterly instead of yearly	$12,771	$28,425		154482	0.45	I	—	—	
F #2 Annex	Dirty air filters increase pressure drop	Replace filters quarterly instead of yearly	$3,926	$8,737		47485	0.45	I	—	—	

NYPH Greenberg Pavilion Hot Water Heating Systems

The Reheat and Perimeter Heat system are located in the Sub-Basement and twelfth (12^{th}) floor MER's. They consist of two (2) circulating pumps and two (2) Heat exchangers in the Sub-Basement MER and Three (3) Circulating Pumps and two (2) Heat Exchangers in the twelfth floor MER.

The Basement Pumps are 20 HP and are designated to provide 435 gmp each with 80 feet of head. The system is fully redundant with one operating Pump and Heat Exchanger on Standby. The circulating pumps maintain a return temperature of 180 deg.F. The Heat Exchangers are designed to produce 435 gmp of 200 deg. F. hot water and use 4,235 pph of steam at 15 psig.

The twelfth (12^{th}) floor Pumps are 7.5 HP and are designed to provide 150 gpm at 80 feet of head. One Pump serves the VAV terminal reheat units and the second serves perimeter fin tube radiation. The third pump provides standby capacity for the VAV reheats and fin tube radiation during the heating season and the VAV reheat system during the cooling system.

The Heat exchangers are designed to be redundant so that one (1) will handle the load while the other is standby. The Heat Exchangers are designed to produce 300 gpm of 200 deg. F. Hot water and use 3,300 pph steam at 10 psig.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Facility Improvement Measures (FIM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
HWH #1 SSB	Heat exchanger missing approx. 3/4 of its insulation. Loss of heat	Insulate heat exchanger	$2200	$4090	329	0	0.5	I	___	___	
HWH #2 5^{th} fl. perimeter heat Visitor elevator	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
HWH #3 5th fl. perimeter heat Patient lounge	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	
HWH #4 7th fl. perimeter heat Patient elevator	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	
HWH #5 10th fl. perimeter heat South sitting room	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	
HWH #6 11th fl. perimeter heat Visitors elevator	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	
HWH #7 11th fl. perimeter heat South sitting room	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	
HWH #8 2th fl. perimeter heat Patient lounge	Danfoss valve no longer functioning Sensor and handle no longer attached	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	
HWH #9 4th fl. perimeter heat Patient lounge	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	___	___	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
HWH #10 5th fl. perimeter heat Patient lounge	Isolation valve to perimeter heating closed	Open valve	$50			0	FIM	I	—	—	
HWH #11 5th fl. perimeter heat Play room	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	$525	42	0	1.15	I	—	—	
HWH #12 1st fl. perimeter heat Atrium south	Danfoss valve no longer functioning Sensor and handle no longer attached loss of control	Replace Danfoss valve	$600	Ongoing	42	0	Ongoing	I	—	—	
HWH #13 SSB	HX is set to run all year round Recommend installation differential pressure reset based on demand	Install differential pressure reset and connection to BMS for monitoring	$2500	$9293		9293	0.27	I	—	—	
HWH #14 SSB	HX 1 &2 using a deadband to start/stop @ 54 & 56 deg.	?				0			—	—	
HWH #15 SSB	HX 5 & 6 using a deadband to start/stop @ 54 & 56 deg.	?				0			—	—	
HWH #16	HWS setpoint is overridden on BMSw/ setpoint of 160 deg F.	Put back to automatic Adjust setpoints	0	0		0	FIM		—	—	
HWH #17	HWS setpoint is overridden on BMS w/ setpoint of 160 deg F.	Put back to automatic Adjust setpoints	0	0		0	FIM		—	—	

Greenberg Pavilion Lighting Audit

The Greenberg Pavilion Lighting Audit consists of 14 floors and two floors below street level. This audit Team walked the facility viewed fixtures, lamp type and quantity, occupancy time of each space, and mode of operation for the fixtures.

With that information we were able to calculate an energy costs analysis, and give recommendations to lower energy usage.

The Comments and Recommendations are grouped by, space types, occupancy, size, and or method of operation for an easier understanding of the energy use breakdown.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

No Cost / Low Cost Facility Improvement Measures (FIMs)

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #1 Mech/Elect rooms lighting change	Reduce avg. fc/sg.ft High Tension, Elect. Sub Station, SSB MER ,fire protection Bsmt, MER Bsmt., 9th fl MER, Generator Rm, Control Rm, 12th fl MER, 12 fl Elect. Rm. (560 / 2'x4' F32T8 / 24/7)	Change double bulb fixtures to single bulb fixtures. Add interior reflectors.	$28,000	$28,884	0	156979	0.97	I	___	___	
LA#2 Sub Basement & basement Storage and corridors	Reduce avg. fc/sg.ft Linen South depot 102.A, Corridor near linen Depot, (72 / 2'x4' F32T8 / 24/7)	Change double bulb fixtures to single bulb fixtures. Add interior reflectors.	$3,600	$3,714	0	20183	0.97	I	___	___	
LA#3 Basement Corridors	Reduce avg. fc/sg.ft Corridor, Corridor near Elevator lobby (72 / 4'x4' F32T8 / 24/7)	Change four bulb fixtures to double bulb fixtures. Add interior reflectors.	$5,400	$7,427	0	40366	0.73	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#4 1st, 2nd, 3rd, 4th, 5th, & 6th floor Corridors	Reduce avg. fc/sg.ft Corridors and Elevator lobbies 1st, 2nd, 3rd, 4th & 5th Floors (193 / 4'x4' F32T8 / 24/7)	Change four bulb fixtures to double bulb fixtures. Add interior reflectors..	$14,475	$19,909	0	108204	0.73	I	___	___	
LA#5 7th floor corridors	Reduce avg. fc/sg.ft Corridor, passenger and staff elevator lobbies (159 / 3'x4' F32T8 / 24/7)	Change three bulb fixtures to double bulb fixtures. Add interior reflectors..	$11,925	$16,402	0	89142	0.73	I	___	___	

Energy Conservation Measure (ECM)

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#1 Patient Rooms 2nd floor 209- 216, 219, 220, 221, 222.224, 428, 429, 430, 431, 432, 433, 434, 435	Utilize daylight to supplement elect lighting during daytime when daylight is adequate ((3)-2'x26watt CFL & (2) - 2'x4'F32t8 / 24/7 **each room**	Install Day light harvesting system ((63) 2'x26W CFL (42) 2'x4' F32's)	$8,946	$3,409	0	18529	2.62	I	___	___	
LA#2 Patient Rooms West 2nd floor 426A, B, C, D,	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (3) -2'x26watt CFL& (2) - 2'x4' F32T8 & (2) - 2'x18watt CFL / 24/7 **each room**	Install Day light harvesting system ((12) 2'x26w CFL (8) 2'x4'F32's (8) 2'x18w CFL's)	$2,136	$814	0	4424	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#3 Patient Rooms West 2nd floor 414, 415, 416, 417, 418, 419, 420, 421, 422	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (4)- 2x26watt CFL's & (1)- 2'x4' F32t8 / 24/7 **each room**	Install Day light harvesting system ((36) 2x26w CFL (9) 2'x4' F32T8)	$3,672	$1,399	0	7605	2.62	I	___	___	
LA#4 South wing 2nd floor Patient Rooms 408, 409, 410, 411, 412, 413,	Utilize daylight to supplement elect lighting during daytime when daylight is adequate ((3)-2'x26watt CFL & (2) - 2'x4'F32T8 / 24/7 **each room**	Install Day light harvesting system ((18)- 2'x26w CFL (12)- 2'x4'F32T8)	$2,556	$974	0	5294	2.62	I	___	___	
LA#5 Patient Rooms 400, 401, 402 South 2nd floor	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26wayy CFL's (2) 2'x4' F32T8 & (1) 1'x3' F32T8/ 24/7 **each room**	Install Day light harvesting system ((6)- 2x26w CFL's (6)- 2'x4' F32T8 (3)- 1'x3' F32T8)	$1,188	$453	0	2461	2.62	I	___	___	
LA#6 Patient Rooms South 2nd floor 403, 404, 405, 406	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (3) 2'x26watt CFL's (2) 2'x4' F32T8/ 24/7 **each room**	Install Day light harvesting system (12)2'x26wCFL (8) 2'x4' F32T8	$1,704	$649	0	3529	2.62	I	___	___	
LA#7 Patient Rooms West 4th floor 423 - 440	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26watt CFL & (2) 2'x4' F32T8 (1) 2'x2' F17T8 / 24/7 **each room**	Install Day light harvesting system (36) 2'x26wCFL's (36) 2'x4' F32T8 (18) 2'x2' F17T8	$7,182	$2,737	0	14875	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#8 Patient Room West 4th floor 411	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (4) 2'x26watt CFL(2) (2) 2'x4'F32T8 (1) 2'x2'F17T8 / 24/7 **Each room**	Install Day light harvesting system (4)2'x26wCFL (2) 2'x4'F32T8 (1) 2'x2'F17T8	$555	$212	0	1150	2.62	I	___	___	
LA#9 Atrium	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (78) 40 w LED (65) Track light (41) theater lights (170 Stair and Ramp Lights 24/7	Install Day light harvesting system There is ample natural lighting	Ongoing	$0	0	0	Ongoing	—	—	___	
LA#10 Patient Room West 4th floor 132, 141, 142	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 3'x4' F32T8 / 24/7 **Each room**	Install Day light harvesting system (6) 3'x4' F32T8	$864	$329	0	1790	2.62	I	___	___	
LA#11 Patient Room West 4th floor 200-206, 213-222, 236-242	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26watt CFL (2) 2'x4' F32T8 / 24/7 **Each room**	Install Day light harvesting system (48) 2'x26w CFL (48) 2'x4' F32T8	$8,352	$3,183	0	17299	2.62	I	___	___	
La#12 Patient Rooms West 4th floor 207, 208, 209,210, 211, 212,	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (1) 2'x26watt CFL & (2) 2'x4'F32t8 / 24/7 **Each room**	Install Day light harvesting system (6) 2'x26w CFL (12) 2'x4'F32T8	$1,620	$617	0	3355	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#13 Patient Room West 4th floor 117	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 3'x4'F32T8 / 24/7	Install Day light harvesting system (2) 3'x4'F32T8	$288	$110	0	597	2.62	I	___	___	
LA#14 Patient Rooms West 4th floor 119,127	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (1) 3'x4'F32T8 / 24/7 **Each room**	Install Day light harvesting system (2) 3'x4' F32T8	$288	$110	0	597	2.62	I	___	___	
LA#15 Patient room West 4th floor 324	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (6) 2'x26watt CFL's (4) 4'x4' F32T8 (4) 1'x4' f32T8 24/7	Install Day light harvesting system	$1,428	$544	0	2958	2.62	I	___	___	
LA#16 Patient Room West 4th floor 322' 323	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (3) 3'x4'F32t8 /24/7 **Each room**	Install Day light harvesting system (6) 3'x4' F32T8	$864	$329	0	1790	2.62	I	___	___	
LA#147 Patient Room West wing 5th floor 425	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (6) 2'x26wattCFL & (4) 2'x4' F32T8 / 24/7	Install Day light harvesting system (6) 2'x26wattCFL & (4) 2'x4' F32T8	$852	$325	0	1765	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#18 Patient Room South 6th floor 400, 401, 402	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (9) 2'x26watt CFL & (3) 2'x4' F32T8 / 24/7 **Each room**	Install Day light harvesting system (27) 2'x26wCFL (9) 2'x4' F32T8	$2,970	$1,132	0	6151	2.62	I	___	___	
LA#19 Patient Room South 6th floor 403	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (11) 2'x26watt CFL & (3) 2'x4' F32T8 / 24/7	Install Day light harvesting system (11) 2'x26watt CFL & (3) 2'x4' F32T8	$1,146	$437	0	2374	2.62	I	___	___	
LA#20 Patient Room Cntrl. 6th floor 223, 232, 233	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (1) 2'x26watt CFL & (2) 2'x4' F32T8 / 24/7 **Each room**	Install Day light harvesting system (3) 2'x26wCFL (6) 2'x4' F32T8	$810	$309	0	1678	2.62	I	___	___	
LA#21 Patient Rooms Cntrl. 6th floor 231, 230	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26watt CFL & (2) 2'x4' F32T8 / 24/7 **Each room**	Install Day light harvesting system (4) 2'x26wCFL (4) 2'x4' F32T8	$696	$265	0	1442	2.62	I	___	___	
LA#22 Patient Rooms North 6th floor 235, 236, 237, 238	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26watt CFL's & (1) 3'x4' F32T8& (1) 2'x2'F17T8 **Each room**	Install Day light harvesting system (8) 2'x26wCFL (4) 2'x4' F32T8 (4) 2'x2'F17T8	$1,584	$604	0	3281	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#23 Patient Rooms North 6th floor 209, 210, 211, 212, 213, 214, 215, 216	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26watt CFL & (4) 2'x4' F32T8 & (1) 2'x2' F17T8 / 24/7 **Each room**	Install Day light harvesting system (16) 2'26wCFL (32) 2'x4'F32T8 (8) 2'x2' F17T8	$4,728	$1,802	0	9793	2.62	I	___	___	
LA#24 Patient Rooms South 7th floor 239, 240, 241, 242, 243, 244	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (4) 2'x26watt CFL & (1) 2'x2' F17T8 / 24/7 **Each room**	Install Day light harvesting system (12) 2'x4'F32T8 (24) 2'x26wCFL (6) 2'x2'F17T8	$3,330	$1,269	0	6897	2.62	I	___	___	
LA#25 Patient Rooms South 7th floor	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (1)3'x4'F32T8 24/ 7	Install Day light harvesting system (1)3'x4'F32T8	$144	$55	0	298	2.62	I	___	___	
LA#26 Patient Rooms Cntrl. Wing 7th floor 227, 228,229, 230,231	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (2) 2'x26wattCFL /24/7 **Each room**	Install Day light harvesting system (10) 2'x4'F32t8 (10) 2'x26wCFL	$1,740	$663	0	3604	2.62	I	___	___	
LA#27 Patient Rooms Cntrl. Wing 7th floor 218, 219, 220, 221, 222, 223, 224, 225, 226,245	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (4) 1'x13wattCFL & (1) 2'x2'F17T8 /24/7 **Each room**	Install Day light harvesting system (20) 2'x4'F32T8 (40) 1'x13wCFL (10)2'x2'F17t8	$3,210	$1,223	0	6649	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#28 Patient Rooms North wing 7th floor 201, 202, 203, 204, 205, 206, 207, 208	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26wCFL & (4) 2'x4'F32T8 & (1) 2'x2'F17T8 24/7 Each room	Install Day light harvesting system (16) 2'x26wCFL (32) 2'x4'F32T8 (8) 2'x2' F17T8	$4,728	$1,802	0	9793	2.62	I	___	___	
LA#29 Patient Rooms North wing 8th floor 441, 442	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4' F32t8 & (4) 2'x26watt CFL / 24/7 Each room	Install Day light harvesting system (4) 2'x4" F32T8 (8) 2'x26wCFL	$1,008	$384	0	2088	2.62	I	___	___	
LA#30 Patient Rooms North wing 8th floor 207-216, 218, 220, 221, 222	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26wattCFL & (4) 2'x4'F32T8 & (1) 2'x2'F17T8 24/7 Each room	Install Day light harvesting system (28) 2'x26wCFL (56) 2'x4'F32T8 (14) 2'x2' F17T8	$8,274	$3,153	0	17137	2.62	I	___	___	
LA#31 Patient Rooms South wing 10th floor 258, 257, 234, 233, 232,229, 230	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26wattCFL & (4) 2'x4'F32T8 & (2) 2'x2'F17T8 24/7 Each room	Install day Light harvesting system (14) 2'x26watCFL (28) 2'x4'F32T8 (14) 2'x2'F17T8	$4,494	$1,713	0	9308	2.62	I	___	___	
LA#32 Patient Rooms South wing 10th floor 235, 238, 259, 260	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26wattCFL & (4) 2'x4'F32T8 & (1) 2'x2'F17T8 24/7 Each room	Install day Light harvesting system (8) 2'x26watCFL (16) 2'x4'F32T8 (4) 2'x2'F17T8	$2,364	$901	0	4896	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#33 Patient Rooms West wing 10th floor 240 through 256	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (3) 2'x26wattCFL & (2) 2'x4'F32T8 & (1) 2'x2'F17T8 24/7 **Each room**	Install day Light harvesting system (51) 2'x26watCFL (34) 2'x4'F32T8 (17) 2'x2'F17T8	$8,109	$3,090	0	16795	2.62	I	___	___	
LA#34 Patient Rooms North wing 10th floor 221, 222, 223	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (2) !'x2' F32T8 / 24/7 **Each room**	install day Light harvesting system (6) 2'x4'F32T8 (3) 2'x2'F17T8 (6) 1'x2'F32T8	$1,017	$388	0	2106	2.62	I	___	___	
LA#35 Patient Rooms Central 10th floor 214, 215, 216	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (1) 2'x18watt CFL / 24/7 **Each room**	install day Light harvesting system (6) 2'x4'F32T8 (3) 2'x2'F17T8 (3) 2'x18wCFL	$891	$340	0	1845	2.62	I	___	___	
LA#36 Patient Rooms Central 10th floor 200-203, 204, 205, 206, 207, 220, 221, 222,227, 228, 229	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (4) 2'x4'F32T8 & (1) 2'x2'F17T8 & (2) 2'x26 watt CFL / 24/7 **Each room**	install day Light harvesting system (56) 2'x4'F32T8 (14) 2'x2'F17T8 (28) 2'x18wCFL	$8,274	$3,153	0	17137	2.62	I	___	___	
LA#37 Patient Rooms Central 10th floor 223, 203, 225, 226	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (2) 2'x26 watt CFL / 24/7 **Each room**	install day Light harvesting system (8) 2'x4'F32T8 (4) 2'x2'F17T8 (8) 2'x18wCFL	$1,596	$608	0	3306	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#38 Patient Rooms South 11th floor 258, 236	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (1) 2'x18 watt CFL / 24/7 **Each room**	install day Light harvesting system (4) 2'x4'F32T8 (2) 2'x2'F17T8 (2) 2'x18wCFL	$594	$226	0	1230	2.62	I	___	___	
LA#39 Patient Rooms North 11th floor 200, 201, 202, 203, 204, 205, 206, 207, 208, 209	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (1) 2'x18 watt CFL / 24/7 **Each room**	install day Light harvesting system (20) 2'x4'F32T8 (10) 2'x2'F17T8 (10) 2'x18wCFL	$2,970	$1,132	0	6151	2.62	I	___	___	
LA#40 Patient Rooms North 11th floor 221, 222, 223	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (1) 2'x18 watt CFL / 24/7 **Each room**	install day Light harvesting system (6) 2'x4'F32T8 (3) 2'x2'F17T8 (3) 2'x18wCFL	$891	$340	0	1845	2.62	I	___	___	
LA#41 Patient Rooms North 11th floor 211, 212, 215, 216, 217	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32T8 & (1) 2'x2'F17T8 & (1) 2'x18 watt CFL / 24/7 **Each room**	install day Light harvesting system (10) 2'x4'F32T8 (5) 2'x2'F17T8 (5) 2'x18wCFL	$1,485	$566	0	3076	2.62	I	___	___	
LA#42 Patient Rooms North 14th floor 235-255	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (5) 2'x26watt CFL's / 24/7 **Each room**	install day Light harvesting system (105) 2'x26wCFL's	$8,190	$3,121	0	16963	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#43 Patient Rooms North 14th floor 213 - 220	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (5) 2'x26watt CFL's / 24/7 & (1) 39watt LED & (2) 2'x4' F32T8 & (1) 1'x4' F32T8 / 24/7 Each room	install day Light harvesting system (40)2'x26wCFL (8) 39wLED (16) 2'x4' f32T8 (8) 1'x4'F32T8	$5,508	$2,099	0	11408	2.62	I	___	___	
LA#44 Patient Rooms North 14th floor 202 - 211	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (3) 2'x3'F25T8 & (4) 2'x26watt CFL & (1) 13watt CFL & (1) 1'x4' F32T8 / 24/7 Each room	install day Light harvesting system (30) 2'x3'F25T8 (40) 2'x26wCFL (10) 13wCFL (10) 1'x4'F32T8	$6,045	$2,304	0	12520	2.62	I	___	___	
LA#45 Patient Rooms South 8th floor 218-226, 245	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 1'x13watt CFL &(4) 2'x4'F32T8 / 24/7 Each room	install day Light harvesting system (20) 1'x13wCFL (40) 2'x4'F32T8	$4,230	$1,612	0	8761	2.62	I	___	___	
LA#46 Patient Rooms South 8th floor 227,228, 229 230, 231	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x26 watt CFL &(4) 2'x4'F32T8 / 24/7 Each room	install day Light harvesting system (10) 2'x26wCFL (20) 2'x4'F32T8	$2,700	$1,029	0	5592	2.62	I	___	___	
LA#47 Patient Rooms South 6th floor 405, 406, 407	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (3) 2'x26watt CFL & (1) 2'x4' F32T8 Each room	install day Light harvesting system (9) 2'x26wCFL (3) 2'x4'F32T8	$990	$377	0	2050	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#48 Patient Rooms West 4th floor 402 through 419	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (1) 2'x26watt CFL 24/7 **Each room**	install day Light harvesting system (18) 2'x26wCFL	$1,404	$535	0	2908	2.62	I	___	___	
LA#49 Patient Rooms 5th floor 141,132, 142	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 3'x4' F32T8 24/7 **Each room**	install day Light harvesting system (6) 3'x4'F32T8	$864	$329	0	1790	2.62	I	___	___	
LA#50 Patient Rooms 5th floor 236-242, 200-206, 213-222, 120, 121, 124	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 26watt CFL **Each room**	install day Light harvesting system (54) 26wCFL	$2,106	$803	0	4362	2.62	I	___	___	
LA#51 Patient Rooms 5th floor 207 - 212	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (1) 26watt CFL24/7 **Each room**	Install day Light harvesting system (6) 26wCFL	$234	$89	0	485	2.62	I	___	___	
LA#52 Patient Rooms 5th floor 224-233	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 26watt CFL & (2) 2'x4'F32T8 24/7 **Each room**	Install day Light harvesting system (20) 26wCFL (20) 2'x4'f32T8	$2,700	$1,029	0	5592	2.62	I	___	___	
LA#53 Patient Rooms 5th floor 117, 119, 127	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 2'x4'F32t8 24/7 **Each room**	Install day Light harvesting system (6) 2'x4'f32T8	$576	$220	0	1193	2.62	I	___	___	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#54 Patient Rooms 5th floor 324	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (6) 2'x26watt CFL & (4) 4'x4'F32T8 & (4) 1'x4' F32T8/24/7	Install day Light harvesting system (6) 2'x4'f32T8 (4)4'x4'F32T8 (4) 1'x4' F32T8	$1,428	$544	0	2958	2.62	I	___	___	
LA#55 Patient Rooms 5th floor 323	Utilize daylight to supplement elect lighting during daytime when daylight is adequate (2) 3'x4' F32T824/7	Install day Light harvesting system *(2) 3'x4' F32T8*	$288	$110	0	597	2.62	I	___	___	
LA#56 Patient Rooms 5th floor 323	Utilize daylight to supplement elect lighting during daytime when daylight is adequate *(3) 3'x4' F32T8/24/7*	Install day Light harvesting system *(3) 3'x4' F32T8*	$432	$165	0	895	2.62	I	___	___	
LA#57 Nourishment & Medications 5th floor 344, 345	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#58 Nourishment & Medications 6th floor 344, 327	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#59 Nourishment & Medications 6th floor central 344, 145	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#60 Nourishment & Medications 6th floor north 143, 144	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#61 Nourishment & Medications 7th floor west 329, 329A	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#62 Nourishment & Medications 7th floor South 150, 156	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#63 Nourishment & Medications 7th floor North 132, 121	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#64 Nourishment & Medications 8th floor 329, 329A	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#65 Nourishment & Medications 8th floor South 150, 156	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#66 Nourishment & Medications 8th floor North 121, 121A	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#67 Nourishment & Medications 10th floor South 160, 143	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#68 Nourishment & Medications 10th floor West 143, 143A	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'x4' F32T8	$300	$77	0	420	3.88	___	___	___	___
LA#69 Medications 10th floor North 126	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)2'x26watt CFL/24/7	Install Occupied Sensors with Occupant Override switch (1) 2'x26wCFL	$150	$21	0	114	7.16	___	___	___	___
LA#70 Medications 10th floor Central 134, 117	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)2'x26watt CFL/24/7	Install Occupied Sensors with Occupant Override switch (2) 2'x26wCFL	$300	$42	0	228	7.16	___	___	___	___
LA#71 Medications 10th floor Central 126	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)2'x26watt CFL/24/7	Install Occupied Sensors with Occupant Override switch (1) 2'x26wCFL	$150	$21	0	114	7.16	___	___	___	___

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA#72 Nourishment & Medications 10th floor North 134, 117	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1)3'x4' F32T8/24/7	Install Occupied Sensors with Occupant Override switch (2) 3'X4'F32T8	$300	$77	0	420	3.88	—	—	—	—
LA#73 Medications 11th floor South 146	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (2) 3'x4'F32T8 24/7	Install Occupied Sensors with Occupant Override switch (2) 3'X4'F32T8	$150	$77	0	420	1.94	I	—	—	
LA#74 Nourishment & Medications 11th floor North 118,123	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches. (1) 3'x4'F32T8 24/7	Install Occupied Sensors with Occupant Override switch (2) 3'X4'F32T8	$300	$77	0	420	3.88	—	—	—	—
LA#75 Nourishment & Medications 14th floor 137	Spaces originally had Occupancy sensors, due to issues maintenance removed and replaced with wall switches (2) 42watt CFL /24/7.	Install Occupied Sensors with Occupant Override switch (2) 42watt CFL	$150	$34	0	184	4.43	—	—	—	—

Plumbing and Domestic Hot Water Systems

The Greenberg Pavilion Low and High Zone Domestic Hot Water Systems that were Retro-Commissioned on 2/09/12 and 2/10/12 include the following:

- **Domestic Hot Water System (Floors 1 - 12)**

  Domestic Hot Water Semi-instantaneous hot water generators located in the 12th floor Mechanical Equipment Room (MER) utilize low pressure steam and two (2) sets of three (3) heat exchangers installed as two (2) separate zones. The high zone consists of floors 9 through 11 and low zone includes floors 1 through 8. Common headers are used to provide 140°F Domestic Hot Water and maintain a set GPM to floors one through twelve. The water is tempered by introducing Return and Domestic Cold Water through a manual mixing valve.

  Two (2) recirculating pumps (lead-lag) for the high zone and two (2) Recirculating pumps (lead-lag) for the low zone circulate hot water through 2" risers. Hot water passes through a Copper Silver Ionization System also located in the 12th floor MER before being distributed through multiple risers. A Triplex Domestic Water Booster Pump set maintains water pressure by introducing DCW to the system.

  DHW system was generally found to exceed local requirements. Refer to FPT for specific information. New York State Guidelines for DHW outlets require 95°F within 3 minutes and no greater than 115°F.

- **Domestic Hot Water System (14 floor)**

  Domestic Hot Water Semi -instantaneous hot water generators located in the 12th floor Mechanical Equipment Room (MER) utilize low pressure steam and two (2) heat exchangers. A common header is used to provide 160°F Domestic Hot Water and maintain a set GPM requirement to the 14th floor. The water is tempered by introducing Return and Domestic Cold Water through a manual mixing valve.

  Two (2) recirculating pumps (lead-lag) circulate hot water through a 2" riser and pass through a Copper Silver Ionization system also located in the 12th floor MER before being distributed throughout the 14th floor.

  Though the water temperature leaving the semi - instantaneous hot water heaters is set at 160°F the temperature at faucets in patient rooms, nurse's stations, and bathrooms were found to be between 60°F and 70°F. They are manually set at concealed mixing valves using a hand held device.

  DHW system was generally found to be below local requirements. Refer to FPT for specific information. New York State Guidelines for DHW outlets require 95°F within 3 minutes and no greater than 115°F.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

No Cost / Low Cost Facility Improvement Measures (FIMs)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
DHW #1 Low Zone	Reset discharge temperatures to meet NYS guidelines as stated above. On DHWH's: NAN-DWH-001, NAN-DWH-002, NAN-DWH-003	Manually Adjust Temperature	$1,000	$37,035	2987	0	0.03	*	—	—	
DHW #2 High Zone	Reset discharge temperatures to meet NYS guidelines as stated above. On DHWH's: NAN-DWH-004, NAN-DWH-005, NAN-DWH-006	Manually Adjust Temperature	$1,000	$6,906	557	0	0.14	*	—	—	
DHW #3 Low Zone	Install new Pressure and Temperature gauges to better monitor system	Design / Specification Required	$4,000	$12,962	1045	0	0.31	I	—	—	
DHW #4 High zone	Install new Pressure and Temperature gauges to better monitor system	Design / Specification Required	$4,000	$2,417	195	0	1.65	I	—	—	
DHW#5 14th Floor	Reset discharge temperatures to meet NYS guidelines as stated above	Manually Adjust Temperature	$1,000	$6,906	557	0	0.14	*	—	—	
DHW#6 14th Floor	Adjust Mix CW and HW mixing valves at faucets to meet NYS guidelines as stated above	Manually Adjust Temperature	$7,318	-$5,524		0	FIM	*	—	—	

*The NYPH water committee has recommended not to implement this water temperature reduction as a conservative approach to prevent the possible development of Legionnaires Disease.

Energy Conservation Measure (ECM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
DHW #1 Low Zone	System lacks BSM interface	Install interface controls to BMS, monitor Return, Mix, and Discharge temperatures along with alarms for high and low temperature and water levels and associated BMS controls	$10,500	$5,185	418	0	2.03	*	—	—	
DHW #2 High Zone	System lacks BSM interface	Install interface controls to BMS, monitor Return, Mix, and Discharge temperatures along with alarms for high and low temperature and water levels and associated BMS controls	$10,500	$967	78	0	10.86	I	—	—	
DHW #3 Low Zone	System lacks BSM interface	Replace existing steam control valves and interface with BMS to monitor and modulate to maintain temperatures	$9,000	$5,555	448	0	1.62	I	—	—	
DHW #4 High zone	System lacks BSM interface	Replace existing steam control valves and interface with BMS to monitor and modulate to maintain temperatures	$9,000	$1,036	84	0	8.69	I	—	—	
DHW #5 Low Zone	System lacks automatic temperature monitoring and control	Install automatic three way temperature control valve to mix DCW and DHW to maintain constant temperature. Interface with BMS	$6,000	$12,962	1045	0	0.46	I	—	—	
DHW #6 High Zone	System lacks automatic temperature monitoring and control	Install automatic three way temperature control valve to mix DCW and DHW to maintain constant temperature. Interface with BMS	$6,000	$2,417	195	0	2.48	I	—	—	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
DHW #7 14th floor	System lacks BSM interface	Investigate the installation of interface controls to BMS, monitor Return, Mix, and Discharge temperatures along with alarms for high and low temperature and water levels and associated BMS controls	$10,500	$552	45	0	19.01	I	—	—	
DHW #8 14th Floor	System lacks BSM interface	Replace existing steam control valves and interface with BMS to monitor and modulate to maintain temperatures	$6,000	$518	42	0	11.58	I	—	—	
DHW #9 14th Floor	System lacks automatic temperature monitoring and control	Install automatic three way temperature control valve to mix DCW and DHW to maintain constant temperature. Interface with BMS	$6,000	$1,381	111	0	4.34	I	—	—	

NYPH Cornell Greenberg Domestic Hot Water System Replacement

The existing domestics hot water system at the Greenberg building is original and is approaching the system useful life span.

This energy conservation measure recommends the phased installation of a new “state of the art” domestic hot water system with the systems controller interfacing with the building energy management system. The system replacement would include controls, pumps, valves and heat exchangers.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measure (ECM) Room Summary

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
DHWR #1	DHW system is approaching useful life span	Replace DHW system with newer DHW system	$400,000	$30,758	2480	0	7.44				

NYPH Cornell - Greenberg Pavilion Med Gas Compressors

An existing Quadplex Nash Liquid Ring Air Compressor is located in the twelfth (12) floor Mechanical Equipment Room in the Greenberg Pavilion. The quad set compressors are water cooled dumping thousands of gallons of city water annually into the sanitary sewer system. This system was installed during the original building construction and are outdated and energy inefficient.

The compressors are driven by four (4) seventy (75) horse power electric motors powered by 460V/3ph/60 hz power source.

The system is being replaced with a Beacon Medaes Model number ZT 37 USD MED Air Cooled Triplex that is outfitted with three (3) one hundred (100) horse power motors and equipped with a variable speed drive.

In addition to the new installation a water cooled option will be provided to cool the compressors with Chilled Water from a future Heat Exchanger closed loop system.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measures (ECM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
COM #! 12th fl MER	Medical air compressors using city water for cooling	Replace dated med air compressors with new energy efficient air cooled compressors. Equip with water coil for future cooling w/ closed loop system using CHW and Plate & Frame Heat exchanger	Waiting for quotation from NYPH	$40,126	0	155,100	?	I	?	?	?

Greenberg Building - HVAC Testing and Balancing

The Greenberg building is a 982,411 SF hospital building. Other than the operating room suites the building HVAC system has not been fully tested and balanced since the building was constructed. This energy conservation measure recommends that a testing and balancing company balance the HVAC system (air and water).

This effort should be done under a building specific HVAC testing and balancing specification developed by a professional engineer.

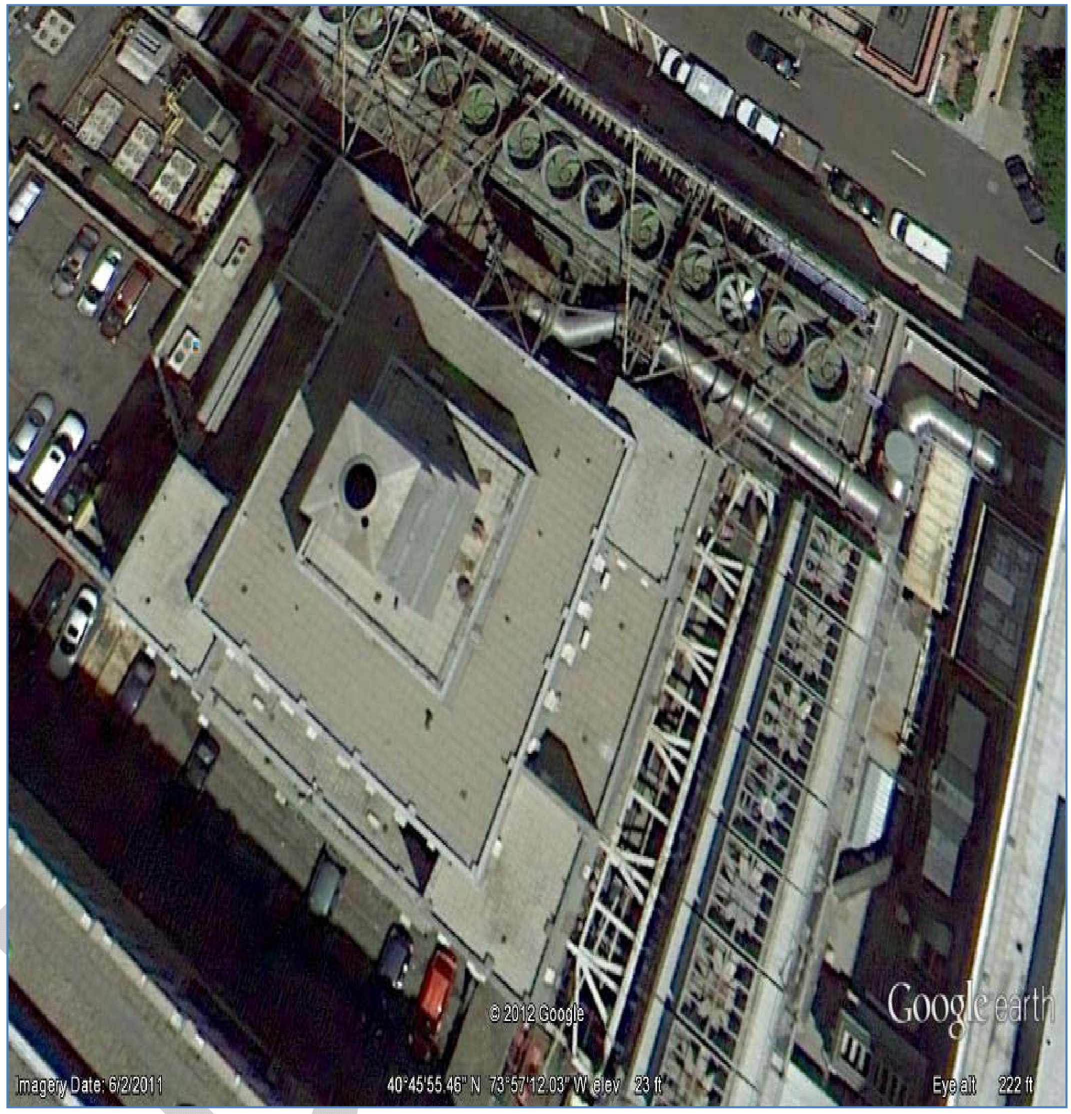
- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measure (ECM) Room Summary

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
TB #1	HVAC systems have not been tested and balanced since construction	Test and Balance HVAC systems	$370,780	$193,139	2061	910,714	1.92	I	—	—	

15. Summary of Projects' Master List of Findings for Annex Building Campus Boiler/Chiller Plants



Commissioning Summary

R.G.Vanderweil Engineer's, LLP (Vanderweil) and Horizon Engineering was commissioned to perform Retro-Commissioning Procedures at the New York Presbyterian Hospital, Cornell Campus.

The Campus Central Chiller Plant is located within the Annex Building. The Annex Building is located at 523 East 70 Street in the Hospital's Cornell campus. The purpose of the retro-commissioning is to verify that the buildings' energy related systems are calibrated, functioning and performing optimize energy usage and to identity Facility Improvement Measures (FIM's) and Energy Conservation Measures (ECM's). The commissioning process was executed in accordance with Vanderweil submitted Retro-Commissioning Plan.

The New York Presbyterian Hospital provided a list of equipment and systems to be retro-commissioned. A walk-through of the facility was conducted by Vanderweil / Horizon and developed functional performance testing procedures based on this equipment list and reviewed the testing / inspectional procedures with the hospital personnel prior to the actual testing. The functional testing took place during the spring and summer of 2012.

The building automation system (BMS) is by Siemens.

LEVEL 1 ENERGY AUDIT

Introduction

Vanderweil Engineers has conducted an energy audit of the Annex Building at the New York Presbyterian University Hospital of Cornell. The study was performed in accordance with the guidelines of the *ASHRAE Procedures for Commercial Building Energy Audit* standard. For the purpose of this report, the documentation is limited to a Level 1 evaluation. A more comprehensive Level 2 analysis is in the next section of this report. The purpose of this report is to document field observations and energy analyses of the building, so the current energy performance of the building can be determined.

Executive Summary

The New York Presbyterian University Hospital requested an energy performance evaluation of the existing Annex Building to identify opportunities for energy savings. This work was conducted by Vanderweil Engineers to observe existing system deficiencies and identify potential Facility Improvement Measures (FIM's) and Energy Conservation Measures (ECMs).

The activities performed for this study were conducted in accordance with the Level 1 guidelines of the *ASHRAE Procedures for Commercial Building Energy Audits* standard and included a site walk-through, utility bill analysis, FIM / ECM analysis, and energy benchmarking of the existing facility.

Key findings for the Annex Building are as follows:

Our work identified many of FIMs (Facility Improvement Measures) and many ECMs (Energy Conservation Measures). The FIMs are generally maintenance items necessary to bring the buildings into correct operation sufficient to meet codes and occupants' requirements.

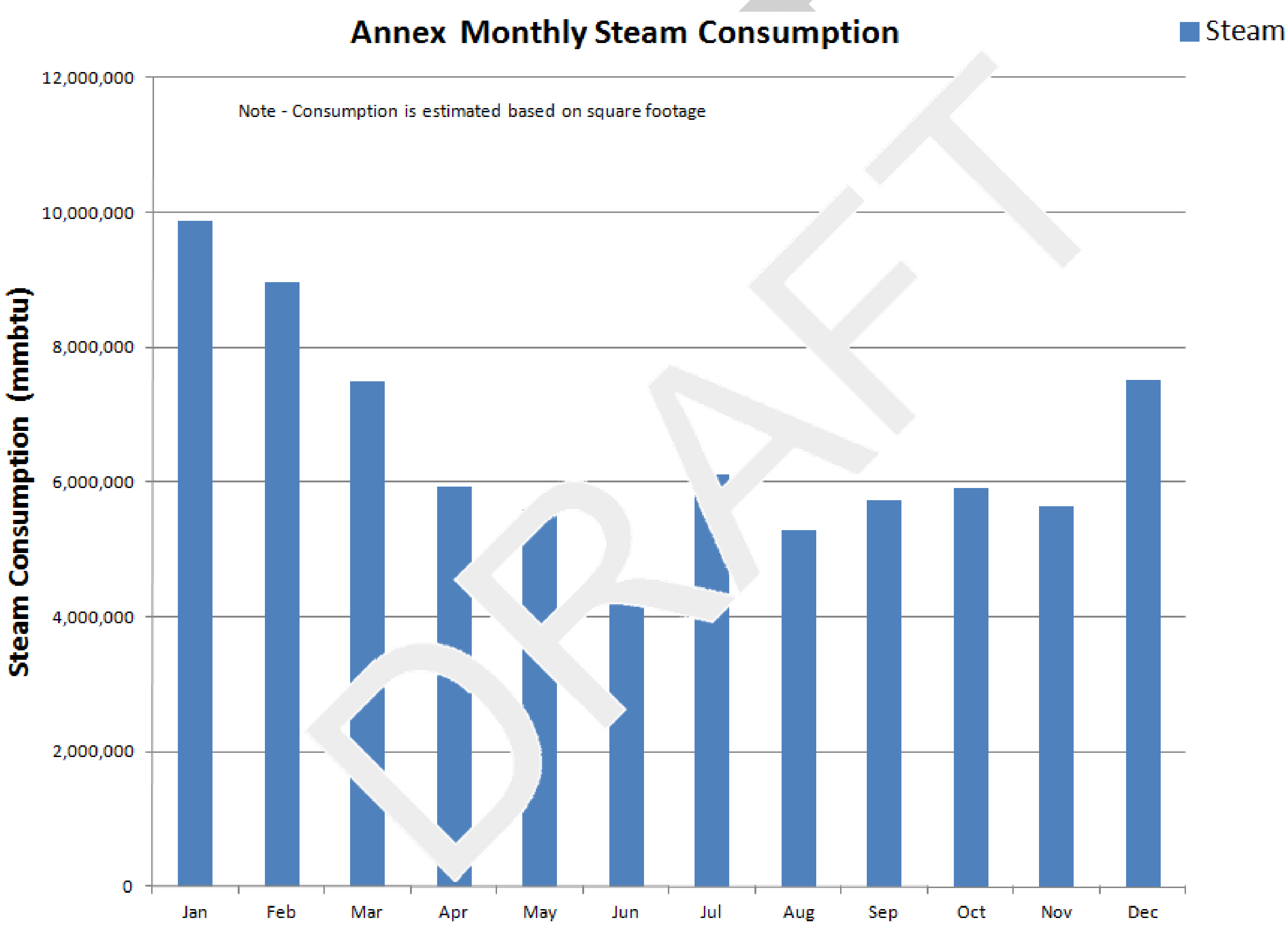
The ECMs are a mixture of capital and low/no cost items each of which offers energy savings. The low/no cost items should be implemented immediately. The capital items should be prioritized and implemented according to economic benefit. We have estimated their economic benefit and have recommended groups of ECMs to implement in each building, with estimated costs and payback periods.

This report includes sections related to building system descriptions, existing energy use summaries, and energy conservation measures. Level 1 calculations represented in this report are preliminary estimates only, and initial cost numbers and payback represent an opinion of cost only.

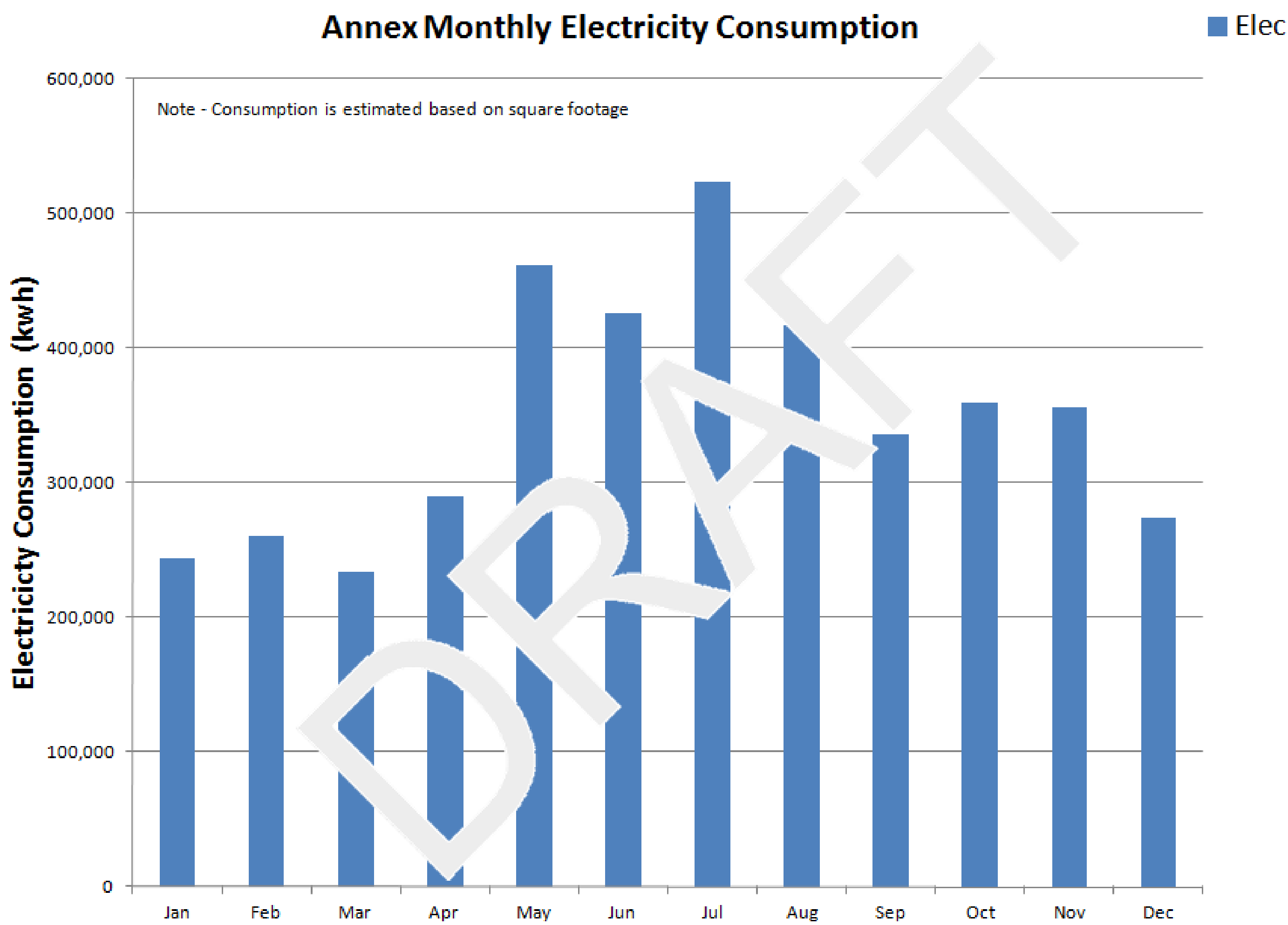
Energy Use Summary / Benchmark Data

The estimated site energy intensity value of the existing the Annex Building is 258 kBtu/SF/yr. A typical hospital building type has an average site intensity value of214 kBtu/SF/yr.

Annex Building Estimated Energy Consumption		
Annex Square Footage	392,573	sf
Annex Steam Consumption	78,448,725	lbs
Annex CHW Consumption	1,035,494	ton hrs
Annex Electric Consumption	4,182,079	kwh
Annex EUI	258	



Utility Summary



Summary of FIM/ECM Tables

This section of the report provides Summary Tables for Facility Improvement Measures (FIMs) / Energy Conservation Measures (ECMs). Detailed FIM/ECM descriptions can be found in the Specific Building Appendices.

Cornell Campus-wide - *Energy Audit Level 1 FIM/ECM Summary*

FIM / ECM #	Description	Estimated Payback (years)	Low Cost/No Cost	Recommended for Level 2 Evaluation
ECM 1	Develop Single Equipment Numbering System.	—	Y	
ECM 2	Steam Condensate Recovery Study	TBD	Y	Y
ECM 3	Campus wide Hydronic Free Cooling Study	6	Y	Y
ECM 4	AHU and Heating System Set Point should be Optimized to Meet Requirement	>1	Y	N

Annex Campus Central Chiller / Boiler Plant - *Energy Audit Level 1 FIM/ECM Summary*

FIM / ECM #	Description	Estimated Payback (years)	Low Cost/No Cost	Recommended for Level 2 Evaluation
ECM 1	Lighting Measures- Annex	2		Y
ECM 2	Develop "Look Ahead Load Profile for the Chiller Plant	—	Y	
ECM 3	Develop / Document Chiller Plant Operation	—	Y	
ECM 4	Install Hydronic FREE Cooling Plate & Frame Heat Exchanger and Replace Air / Water Cooled System in the Chiller Plant	6		Y
ECM 5	Reduce Steam Discharge Operating Pressure in the Boiler Plant - Study	TBD	Y	Y
ECM 6	Develop "Look Ahead Load Profile for the Boiler Plant		Y	
ECM 7	Review and develop inventory system terminal device pressure requirements (i.e., sterilization, steam humidification, autoclaves, etc.) Part of Condensate Return Study.	TBD		Y
ECM 8	Review and refine number of boilers in operation (including standby)	—	Y	
ECM 9	Review the limitation on cogeneration (turbine is rated at 7.5 MW. The system is limited to 5 MW. Update agreement with ConEd. Review Con-Ed upgrades and maximize output of Co Gen accordingly.	TBD	Y	
ECM 10	Review Cooling Tower Control/Staging	6	Y	Y
ECM 11	Install VFDs on fans for Variable Air Flow on Cooling Towers	6		Y
ECM 12	Install open/close motorized valves on individual CT cells.	6		Y
ECM 13	Install warm-up coils in boilers (for standby)		Y	
ECM 14	Refine/Implement Condenser and Chilled Water Supply Temperature Modulation	6		Y

FIM / ECM #	Description	Estimated Payback (years)	Low Cost/No Cost	Recommended for Level 2 Evaluation
ECM 15	Install "State of the Art" Burner Optimization Controls for Boiler/Burners -	—	—	N
ECM 16	Replace/ Upgrade Building CHW Isolation heat exchangers and associated valve control	—	N	Y
ECM 17	Install VFDs on the motor driven boiler feed water pumps	—	N	Y

Recommendations

The following Energy Conservation Measures (ECMs) have been determined using existing building drawings and the site walk-through information. The energy costs savings and simple payback rates shown for each ECM initial estimates only. Further Level 2 analysis is recommended for selected ECMs prior to implementation.

LEVEL 2 ENERGY AUDIT

Introduction

Vanderweil Engineers has conducted a Level 2 Energy Audit of Annex Building / Campus Central Chiller Plant at the New York Presbyterian University Hospital of Cornell. The study was performed in accordance with the guidelines of the *ASHRAE Procedures for Commercial Building Energy Audit* standard.

This report provides detailed information for energy conservation opportunities. The information contained herein is to be used as the basis for either an investment grade, Level 3 Energy Audit, or directly as the basis for energy conservation projects within the building Implementation Stage.

Energy Conservation Measure Summary

The New York Presbyterian University Hospital requested an energy performance evaluation of the Annex Building / Campus Chiller Plant to identify opportunities for energy savings. This work was conducted by Vanderweil and Horizon Engineers to observe existing system deficiencies and identify potential Energy Conservation Measures (ECMs).

Overview

Each ECM is presented with an initial estimate of annual energy and dollar savings for electricity, steam and chilled water, capital costs for installation, and the simple payback with consideration of operation/ maintenance costs or utility incentives where applicable. Units of electric energy savings are presented in terms of end-use energy. Utility costs associated with the ECMs are priced at $ .184/kWh for electricity, $12.397/mmbtu (NG+oil). Initial judgments of capital costs are based on RS Means Mechanical Cost Data and previous experience on similar projects.

The estimated site energy intensity value of the existing Annex Building is 258 kBtu/sf/yr. A typical hospital building type has an average site intensity value of 214 kBtu/sf/yr.

The following table provides a summary of the measures that have been considered and their associated simple payback periods. For detailed information including supplemental calculations and equipment information, please refer to the corresponding section of the Appendix.

Annex Lighting Audit

The Annex Building Lighting Audit consists of the Boiler Plant, Chiller Plant, associated Pumping rooms, ground floor and floors one (1) though eleven (11). This audit Team walked the facility viewed fixtures, lamp type and quantity, occupancy time of each space, and mode of operation for the fixtures.

With that information we were able to calculate an energy costs analysis, and give recommendations to lower energy usage.

The Comments and Recommendations are grouped by, space types, occupancy, size, and or method of operation for an easier understanding of the energy use breakdown.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

No Cost / Low Cost Facility Improvement Measures (FIMs)

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #1 Sub Sub basement elevator lobby	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (10) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (10) F32t8	$150	$258	0	1402	0.58	I	—	—	
LA #2 Fire pump room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (2) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #3 Compressor room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (15) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (15) F32t8	$150	$387	0	2102	0.39	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #4 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	I	—	—	
LA #5 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (13) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (13) F32t8	$150	$335	0	1822	0.45	I	—	—	
LA #6 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (20) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (20) F32t8	$200	$516	0	2803	0.39	I	—	—	
LA #6 Boiler room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (22) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (22) F32t8	$220	$567	0	3084	0.39	I	—	—	
LA #7 Boiler room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (3) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (3) F32t8	$150	$77	0	420	1.94	I	—	—	
LA #8 Boiler room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (11) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (11) F32t8	$150	$284	0	1542	0.53	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #9 Feed pump room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (32) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (32) F32t8	$320	$825	0	4485	0.39	I	—	—	
LA #10 Ice plant	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (20) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (20) F32t8	$200	$516	0	2803	0.39	I	—	—	
LA #11 Chiller room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (8) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (8) F32t8	$150	$206	0	1121	0.73	I	—	—	
LA #12 Chiller room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #13 Chiller room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #14 Generator / Power house	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (36) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (36) F32t8	$360	$928	0	5046	0.39	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #15 Boiler room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (11) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (11) F32t8	$150	$284	0	1542	0.53	I	—	—	
LA #16 Sub basement Elevator lobby	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (5) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (5) F32t8	$150	$129	0	701	1.16	I	—	—	
LA #17 Corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (19) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (19) F32t8	$190	$490	0	2663	0.39	I	—	—	
LA #18 Corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (5) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (5) F32t8	$150	$129	0	701	1.16	I	—	—	
LA #19 Printing	can reduce energy use by only having lights on when occupied Wall switch (12) F32T8 16-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (12) F32t8	$150	$309	0	1682	0.48	I	—	—	
LA #20 Printing	can reduce energy use by only having lights on when occupied Wall switch (13) F32T8 16-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (13) F32t8	$150	$335	0	1822	0.45	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #21 Printing	can reduce energy use by only having lights on when occupied Wall switch (1) F32T8 16-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #22 Old electric shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (8) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (8) F32t8	$150	$206	0	1121	0.73	I	—	—	
LA #23 Old electric shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (26) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (26) F32t8	$260	$671	0	3644	0.39	I	—	—	
LA #24 Transformer room 1	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (2) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #25 Transformer room 1	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #26 Transformer room 2	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (3) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (3) F32t8	$150	$77	0	420	1.94	I	—	—	
LA #27 Hazardous waste	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (22) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (22) F32t8	$220	$567	0	3084	0.39	I	—	—	
LA #28 Hazardous waste	Lights stay on 24/7 can reduce energy use by only having lights on when occupied (2) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #29 Basement Elevator lobby	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (5) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (5) F32t8	$150	$129	0	701	1.16	I	—	—	
LA #30 Corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (22) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (22) F32t8	$220	$567	0	3084	0.39	I	—	—	
LA #31 Shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied wall switch (20) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (20) F32t8	$200	$516	0	2803	0.39	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #32 1st floor Switch gear room	Lights stay on 24/7 can reduce energy use by re-lamping wall switch (15) F32t8 24-7	Change T-12 bulbs to T-8 bulbs (15) F32t8	$1,200	$290	0	1577	4.14	—	—	—	
LA #33 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied wall switch (31) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (31) F32t8	$310	$799	0	4345	0.39	I	—	—	
LA #34 Switch gear room	Lights stay on 24/7 can reduce energy use by re-lamping (1) F32t8 24-7	Change T-12 bulbs to T-8 bulbs and install occupancy sensor (1) F32t8	$80	$19	0	105	4.14	—	—	—	
LA #35 2nd floor Ironing and sorting	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (62) F32T8 24-7	Recommend changing fixtures to single lamp with reflector and installing passive infrared occupancy sensor (62) F32t8	$620	$1,599	0	8690	0.39	I	—	—	
LA #36 Ironing and sorting	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (34) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (34) F32t8	$340	$877	0	4765	0.39	I	—	—	
LA #37 Ironing and sorting	Lights stay on 24/7 can reduce energy use by re-lamping circuit (2) F32t8 24-7	Change T-12 bulbs to T-8 bulbs and install occupancy sensor (2) F32t8	$160	$39	0	210	4.14	—	—	—	
LA #38 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied wall switch (9) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (9) F32t8	$150	$232	0	1261	0.65	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #39 Men's Locker room shower	Lights stay on 24/7 can reduce energy use by only having lights on when occupied wall switch (42) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (42) F32t8	$420	$1,083	0	5887	0.39	I	—	—	
LA #40 Ladies Locker room shower	Lights stay on 24/7 can reduce energy use by only having lights on when occupied wall switch (42) F32T8 24-7	Recommend the installation of a Wall mounted passive infrared occupancy sensor. (42) F32t8	$420	$1,083	0	5887	0.39	I	—	—	
LA #41 Corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (11) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (11) F32t8	$150	$284	0	1542	0.53	I	—	—	
LA #42 3rd floor Laundry	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (2) F32T8 24-7	Recommend changing fixtures to single lamp with reflector and installing passive infrared occupancy sensor (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #43 laundry	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit wall switch (17) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (17) F32t8	$170	$438	0	2383	0.39	I	—	—	
LA #44 Toilet	Lights stay on 24/7 can reduce energy use by only having lights on when occupied wall switch (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #45 Toilet	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Existing wall switch (6) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (6) F32t8	$150	$155	0	841	0.97	I	—	—	
LA #46 4th floor lobby	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit Existing wall switch (6) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (6) F32t8	$150	$155	0	841	0.97	I	—	—	
LA #47 4th floor lobby	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit Existing wall switch (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #48 Shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Existing wall switch (51) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (51) F32t8	$510	$1,315	0	7148	0.39	I	—	—	
LA #49 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Existing wall switch (4) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (4) F32t8	$150	$103	0	561	1.45	I	—	—	
LA #50 office	reduce energy use by only having lights on when occupied Existing wall switch (12) F32T8 13-5	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (12) F32t8	$150	$119	0	649	1.26	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #51 office	reduce energy use by only having lights on when occupied Existing wall switch (3) F32T8 13-5	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (3) F32t8	$150	$30	0	162	5.02	—	—	—	
LA #52 office	reduce energy use by only having lights on when occupied Existing wall switch (3) F32T8 13-5	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (3) F32t8	$150	$30	0	162	5.02	—	—	—	
LA #53 5th floor corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Circuit (2) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #54 corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Circuit (9) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (9) F32t8	$150	$232	0	1261	0.65	I	—	—	
LA #55 Toilet	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #56 Carpenter shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (33) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (33) F32t8	$330	$851	0	4625	0.39	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #57 Carpenters shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (2) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #58 Paint shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (10) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (10) F32t8	$150	$258	0	1402	0.58	I	—	—	
LA #60 Paint shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (11) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (11) F32t8	$150	$284	0	1542	0.53	I	—	—	
LA #61 Refrigeration shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (22) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (22) F32t8	$220	$567	0	3084	0.39	I	—	—	
La #62 Refrigeration shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (10) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (10) F32t8	$150	$258	0	1402	0.58	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #63 Locker room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (4) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (4) F32t8	$150	$103	0	561	1.45	I	—	—	
LA #64 Office	reduce energy use by only having lights on when occupied Wall switch (10) F32T8 13-5	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (10) F32t8	$150	$100	0	541	1.51	I	—	—	
LA #65 6th floor Corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (9) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (9) F32t8	$150	$232	0	1261	0.65	I	—	—	
LA #66 Toilet	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #67 Electrical shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (17) F32T8 24-7	Recommend the installation of a wall mounted passive infrared occupancy sensor. (17) F32t8	$170	$438	0	2383	0.39	I	—	—	
LA #68 Electrical shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (3) F32T8 24-7	Recommend the installation of a wall mounted passive infrared occupancy sensor. (3) F32t8	$150	$77	0	420	1.94	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #69 HVAC shop	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (13) F32T8 24-7	Recommend the installation of a wall mounted passive infrared occupancy sensor. (13) F32t8	$150	$335	0	1822	0.45	I	—	—	
LA #70 Office	reduce energy use by only having lights on when occupied Wall switch (12) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (12) F32t8	$150	$119	0	649	1.26	I	—	—	
LA #71 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #72 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #73 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #74 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #75 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #76 Office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #77 Office	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (4) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (4) F32t8	$150	$40	0	216	3.77	—	—	—	
LA #78 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #79 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #80 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #81 7th floor corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (9) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (9) F32t8	$150	$214	0	1164	0.70	I	—	—	
LA #82 Toilet	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #83 Toilet	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #84 Elevator mach. room	reduce energy use by only having lights on when occupied Wall switch (4) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (4) F32t8	$150	$40	0	216	3.77	—	—	—	
LA #85 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #86 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #87 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #88 OFFICE	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
La #89 Office	reduce energy use by only having lights on when occupied Wall switch (8) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (8) F32t8	$150	$80	0	433	1.88	I	—	—	
La #90 Office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
La #91 Office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #92 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #93 Office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #94 Office	reduce energy use by only having lights on when occupied Wall switch (9) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (9) F32t8	$150	$90	0	487	1.67	I	—	—	
LA #95 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #96 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #97 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #98 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #99 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #100 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #101 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #102 Office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #103 Office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #104 Office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #105 8th floor corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (20) F32T8 24-7	Recommend the installation of a wall mounted passive infrared occupancy sensor. (20) F32t8	$200	$516	0	2803	0.39	I	—	—	
LA #106 toilet	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #107 toilet	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #108 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #109 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #110 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #111 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #112 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #113 office	reduce energy use by only having lights on when occupied Wall switch (9) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (9) F32t8	$150	$90	0	487	1.67	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #114 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #115 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #116 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #117 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #118 office	reduce energy use by only having lights on when occupied Wall switch (5) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (5) F32t8	$150	$50	0	270	3.01	—	—	—	
LA #119 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #120 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #121 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #122 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #123 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #124 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #125 9th floor lobby	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (3) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensor. (3) F32t8	$150	$77	0	420	1.94	I	—	—	
LA #126 (44) Dormitory rooms	(44) single bed dormitory rooms with single F32t8 Each has a wall switch (44) 16-7	Recommend the installation of a wall mounted passive infrared occupancy sensor. (44) F32t8 & (44) sensors	$6,600	$754	0	4100	8.75	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #127 corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (13) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (13) F32t8	$150	$335	0	1822	0.45	I	—	—	
LA #128 Corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (6) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (6) F32t8	$150	$155	0	841	0.97	I	—	—	
LA #129 Food service kitchen	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (2) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #130 Laundry	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #131 Toilet	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (1) F32t8	$150	$26	0	140	5.82	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #132 Toilet	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #133 toilet	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (1) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (1) F32t8	$150	$26	0	140	5.82	—	—	—	
LA #134 10th floor corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (20) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (20) F32t8	$200	$516	0	2803	0.39	I	—	—	
LA #135 10th floor corridor	Lights stay on 24/7 can reduce energy use by only having lights on when occupied circuit (6) F32T8 24-7	Recommend the installation of a ceiling mounted passive infrared occupancy sensors. (6) F32t8	$150	$155	0	841	0.97	I	—	—	
LA #136 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #137 office	reduce energy use by only having lights on when occupied Wall switch (3) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (3) F32t8	$150	$30	0	162	5.02	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #138 Copy room	reduce energy use by only having lights on when occupied Wall switch (3) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (3) F32t8	$150	$30	0	162	5.02	—	—	—	
LA #139 toilet	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #140 Library	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #141 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #142 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #143 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #144 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #145 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #146 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #147 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #148 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #149 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #150 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #151 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #152 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #153 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #154 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #155 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #156 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #157 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #158 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #159 office	reduce energy use by only having lights on when occupied Wall switch (2) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (2) F32t8	$150	$20	0	108	7.54	—	—	—	
LA #160 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #161 office	reduce energy use by only having lights on when occupied Wall switch (1) F32T8 13-5	Recommend the installation of a wall mounted passive infrared occupancy sensor. (1) F32t8	$150	$10	0	54	15.07	—	—	—	
LA #162 Mechanical room	Lights stay on 24/7 can reduce energy use by only having lights on when occupied Wall switch (5) F32T8 24-7	Recommend the installation of a wall mounted passive infrared occupancy sensor. (5) F32t8	$150	$129	0	701	1.16	I	—	—	
LA #163 Active stairwell	Lights stay on 24/7 Circuit (28) F32t8	Recommend stairwell be retrofitted with Occupancy sensor and dimming control (28) F32t8	$280	$722	0	3924	0.39	I	—	—	
LA #164 Active stairwell	Lights stay on 24/7 Circuit (1) F32t8	Recommend stairwell be retrofitted with Occupancy sensor and dimming control (1) F32t8	$150	$26	0	140	5.82	___	—	—	
LA #165 Active stairwell	Lights stay on 24/7 Circuit (2) F32t8	Recommend stairwell be retrofitted with Occupancy sensor and dimming control (2) F32t8	$150	$52	0	280	2.91	I	—	—	

Finding Number	Finding / Issue Description (Quant. Fixtures / type / hrs/days)	Recommended Action or Action Taken (total fixtures)	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
LA #166 Active stairwell	Lights stay on 24/7 Circuit (19) F32t8	Recommend stairwell be retrofitted with Occupancy sensor and dimming control (19) F32t8	$190	$490	0	2663	0.39	I	—	—	
LA #167 Active stairwell	Lights stay on 24/7 Circuit (2) F32t8	Recommend stairwell be retrofitted with Occupancy sensor and dimming control (2) F32t8	$150	$52	0	280	2.91	I	—	—	
LA #168 Active stairwell	Lights stay on 24/7 Circuit (20) F32t8	Recommend stairwell be retrofitted with Occupancy sensor and dimming control (20) F32t8	$200	$516	0	2803	0.39	I	—	—	

NYPH Cornell Chiller Plant Analysis

The Chiller Plant Retro-Commissioning Functional Testing process was performed at the Cornell campus on April 24, 2012. Construction checklists were use to identify any discrepancies between Design and Installation and work that has been done and equipment that has been modified throughout the years. All equipment related to the Chiller Plant operation including Pumps, Chillers, Cooling Towers and Building Automation System has been verified.

An in-depth understanding of the systems operation was necessary to evaluate the operation and performance of the Chiller Systems related to energy usage and to identify Facility Improvement Measures and Energy Conservation Measures.

Vanderweil Engineers has placed an emphasis on verification and identification of proper control strategies, sequences of operation and maintenance plans along with other optimization strategies.

The Distribution system for the condenser water has several problems that were noted. First being there is no BAS system to control the Pumps, Towers or the Chillers. The system is monitored but not controlled by the BAS. All valves are opened and closed, and Chillers and Towers are started and stopped manually.

The Towers regularly overflow due to the Hot decks being clogged with scaling, and Pumps, Towers and Chillers, have no VFDs to control flow / speed, thus everything run at 100% 24/7 during the cooling season.

The branch take off from the main header for RM-8 also is connected to RM-4 this poses a problem at RM-8 that caused damage to the main baffle when the intake valve is opened to 100%. The valve must be throttled back to approx. 75% which makes the associated pumps work harder to maintain flow. Causing unnecessarily wasted energy, the entire Condenser Water system needs balancing.

The average life expected service like of a centrifugal chiller is approximately twenty (20) years. Chillers RM-3, RM-7, RM-8 and RM-9 are approaching the end of their expected service life. Based on age and derated operation, resulting in a decrease in efficiently and capacity. They should be replaced with higher efficiency, larger capacity chillers. The new Electric chillers should be outfitted with Variable frequency drives to increase efficiency.

The following are our recommendations to improve the performance of the Chilled water system.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Facility Improvement Measures (FIM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
CH #1	Scaling in system piping	Verify / modify water treatment system	TBD	FIM	0	0		I	—	—	
CH #2	CT air flow restricted	Verify air flow at CT's w/ T&B	$20,000	FIM	0	0		I	—	—	
CH #3	Temperature issues with CW maintain 85Deg Return	Trend plant operations with BAS and compare w/ utilivisor	0	FIM	0	0		I	—	—	
CH #4	Towers overflow	Balance CW System	$40,000	30,000	0	163043	1.33	Included in separate package	—	—	
CH #5	Towers overflow	Monitor square D power logic system for CH & CHW pumps	0	FIM	0	0		I	—	—	
CH #6	Loose pipe at RM-8	Properly brace CHWS piping at floor from RM-8	$450	FIM	0	0		I	—	—	
CH #7	Water flow at towers not consistent	Replace hot decks on all marley towers include baffle @ outlet to catch scaling	$600,000	$88,099	0	478801	6.81		—	—	
CH #8	Water flow at towers not consistent	Clean all CW piping to remove sediment and scaling	$139,800	$59,336	0	322481	2.36	Included in separate package	—	—	
Ch #9	RM-4 & RM-8 connected to same Header take off	Re-pipe supply to RM-8 to header eliminate connection to RM-4	$10,000	FIM	0	0			—	—	
CH #10	CT fan run 100% 24/7 when operating	Install VFD's on CT fan motors	$411,800	$149,035	0	809975	2.76	Included in separate package	—	—	
CH #11	No automatic isolation on towers only manual operation	Install Motor operated valves on main branches of marley and BAC tower banks and individual cells	$260,000	FIM	0	0		Included in separate package	—	—	

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
CH #12	No automatic valves on chillers only manual operation	Install motor operated valves on CW & CHW piping at Chillers	$55,000	$31,418	0	170755	1.75	I	—	—	
CH #13	No balancing valves at individual Ct cells for balancing	Install balancing valves at CT individual cells and branch lines for proper balancing	$182,000	$44,290	0	240711	4.11	I	—	—	
Ch #14	Chillers run 100% no VFDs	Install VFDs on all electric chillers	$440,000	247,100	0	1343160	1.78	-	—	—	
Ch #15	Chillers underperforming reaching end of service life	Replace Chillers RN-3, 7, 8, & 9 add VFDs	$4,064k	$684,544	0	2269440	5.94	-	—	—	

NYPH Cornell Campus Hydronic Free Cooling

The existing campus has no central hydronic free cooling system at the main chiller plant. This proposed ECM recommends the installation of a new plate and frame heat exchanger (estimated at 1000 tons), pumps, piping and controls.

The new plate and frame heat exchanger would be connected to the condenser and campus chilled water system. The heat exchanger would operate during the winter and shoulder season months providing free cooling to existing air and water cooled compressors, medical equipment, and local air conditioning units.

Vanderweil Engineers recommend an approach as follows:

- Design and build a new central hydronic free cooling system (plate and frame hx, piping, pumps, and controls.
- Conduct a campus wide survey to identify local air and water cooled systems and opportunities to connect to the chilled water system.
- All new equipment should be equipped with a water cooled coils for future connection.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measure (ECM) Room Summary

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
HFC #1	No Hydronic Free Cooling installed	Install Hydronic Free cooling heat exchanger	$425,000	$70,020	0	380,545	6.07	I	—	—	

NYPH Cornell Campus Condenser Water / Cooling Tower
Piping Reconfiguration and Cleaning - Cooling Tower Fan Control

Energy Conservation Measure

The existing Condenser water System is lacking automatic control valves, balancing valves which would allow for Energy efficient operation of the Cooling Towers and add to the systems flexibility.

In conjunction with the installation of new valves and branch piping modifications the existing Condenser water and Cooling Towers would undergo a Mechanical / Chemical treatment flushing of all piping and cleaning of the Cooling towers to remove rusting and scaling from the system.

The piping flushing effort would be divided into two major efforts. Above and below the roof.
The piping would be cut and capped at the roof line.

- **Above Roof Operations:**
  - Mechanically / Chemically clean piping, install new valves, clean Cooling Towers, and install new fan speed control for the towers.
  - New Cooling Tower Operating sequence would be installed at the building Automation system with new VFDs and Fan controls.
- **Below Roof Operations:**
  - Flush and clean all condenser water piping, valves and Chiller condenser water piping below roof line.

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
CW #1	See Description above	Clean/flush condenser water system and install VFD systems on CTs with new valves	$799,800	$128,235	0	696,932	6.24	—	—	—	

NYPH Cornell Boiler Plant- Steam Pressure Reduction

This measure proposes a reduction in the overall operating steam pressure at the boiler plant by resetting plant discharge pressure. The reduction of steam pressure will require the adjusting and resetting of plant alarms, controls, and some equipment (i.e. steam pumps).

We recommend that this steam pressure reduction occur in one plant adjustment. During this modification the plant operators would adjust, monitor, and review in-house equipment building equipment, campus equipment, and clients served by the boiler plant. The plant typically operates at 170-175 psig. The steam chillers are served off the 175 psig header. The chillers and steam turbine pumps are rated at 150 psi, but typically operate at a maximum of 130-140 psi.

Energy calculations estimate a 1% energy savings from each 10 psig pressure reduction. Savings are obtained from the following:

Steam leaks	Flash steam
Combustion losses	Boiler radiation and convection losses
Boiler blowdown loss	Pipe heat loss
Steam supplied to deaerator	steam trap leakage
Enthalpy Savings effect	

Based on Retro Commissioning observations and calculations, we recommend that an In-Depth Implementation study to develop a plan for the reduction of plant steam pressure.

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated document

Facility Improvement Measures (FIM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
BPR #1	High Pressure Steam at 175 PSI	Reduce boiler pressure Study Phase Only	$40,000 Study Only	$72,299	6243	0	0.55	I	—	—	

NYPH Cornell Boiler Plant Analysis

The Boiler Plant Retro-Commissioning Functional Testing process was performed at the Cornell campus on June 28, 2012. Construction checklists were used to identify any discrepancies between design and Installation and work that has been done and equipment that has been modified throughout the years. All equipment related to the Boiler Plant including Boilers, Forced Draft Fans, Deaerator Tanks, Condensate Return and Feed Water Pumps, Economizers, Master Controllers and the Building Automation System has been verified.

An in-depth study of the systems operations was necessary to evaluate the operation and performance of the Boilers and HRSG (Heat Recovery Steam generator) systems related to energy usage and to identify Facility Improvement Measures and Energy Conservation Measures.

Vanderweil Engineers has placed an emphasis on verification and identification of proper control strategies, sequences of operation and maintenance plans along with other optimization strategies.

The following observations were made during our testing and were targeted for improvement.

- Automatic Boiler Blow Down had been installed but has since been disconnected due to functional issues. Boiler continuous blow down is currently controlled through a manual needle valve. All Boiler blow down is piped to into a blow down tank located in the basement. Currently the blow down water heat is not being recovered.

- NYPH is a Vendor as well as a Consumer of Steam produced, therefore to accurately bill customers, metering condensate as well as steam gives accurate measures for billing. Condensate return from customers is not accurately monitored as well as there are many leaks and unnecessary venting of steam throughout the system. Currently the condensate return is estimated through the use of meters located on the make-up water softeners.

- One (1) feed water pump is capable of handling the entire make-up load. There are two (2) steam Turbine and one (1) electric pump. One (1) Turbine was down for repair and the system was operating with the electric pump, operating at 388 PSI. discharge pressure.

- The HRSG Duct Burner was operating at fifteen (15) percent capacity. Boiler #3 was operating at forty (40) percent to handle the steam load on this particular day. The forced Draft Fan for Boiler #3 was operating on electricity.

- Boilers #1 and #5 do not have VFDs on their forced draft fans.

Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)

See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measures (ECM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
BP #1	Blow Down water heat is not being recovered	Install heat recovery heat exchanger on the continuous blow down to pre heat make-up water	$120,000	$50,400	4,067	0	2.38	I	—	—	
BP #2	Unable to meter Condensate return and steam supply from Boiler plant	Conduct study. Install Condensate return meters, steam supply meters and monitoring devices as necessary	$500,000	ECM	0	0	N/A	I	—	—	
BP #3	Electric feed water pump operating at 388 psi discharge	Investigate reducing the discharge pressure from the boiler feed water pumps	$130,000	$12,654	0	68,772	10.27	—	—	—	
BP #4	Steam turbine forced draft air fans not utilized	Conduct Study to review LPS sizing.	$25,000	$70,347	-6,094	601,904	TBD	—	—	—	
BP #5	Boiler #1 &5 forced draft fans do not have VFD's	Purchase and install VFD's on Boiler #1 & 5 forced draft fans	$140,000	$16,380	0	89,026	8.54	—	—	—	

VANDERWEIL

NYPH Cornell Campus Non - Insulated Piping

Vanderweil Engineers has observed throughout the Boiler Plant and the tunnels within the campus, piping with missing Insulation and improperly Insulated pipes on the High Pressure Steam Distribution system. This was found to be a significant Energy loss. This was mentioned in the 2010 original Retro - Commissioning High Level Assessment and Red Book Infrastructure Master Plan study.

To address this, Vanderweil conducted an extensive walk thru with NYPH technicians to identify all missing and improperly insulated Piping related to the High Pressure Steam system. Starting at the Boilers in the Annex Building (all levels) and included the entire tunnel system throughout the Campus.

*ECM savings and costs are tabulated on a per room basis first, with individual findings listed afterwards.

Our findings are as follows:

- **Summary List of Facility Improvement Measures (FIM) and Energy Conservation Measures (ECM)**

  See Appendix F for functional Test Scripts, Results and all associated documents.

Energy Conservation Measure (ECM) Room Summary

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
***INS-1** **Boiler Plant**	Missing Valve Insulation	Supply and install missing insulation	$7,756	$16,313	1316	—	0.48	I	—	—	—
***INS-2** **Pump Room**	Missing Pump Insulation	Supply and install missing insulation	Ongoing	0		—	Ongoing		—	—	—
***INS-3** **Tunnels**	Missing Valve Insulation	Supply and install missing insulation	$5,246	$11,441	923	—	0.46	I	—	—	—
***INS-4** **Boiler Plant**	Missing Pipe Insulation	Supply and install missing insulation	$32,520	$61,248	4939	—	0.53	I	—	—	—
***INS-5** **Tunnels**	Missing Pipe Insulation	Supply and install missing insulation	$5,074	$9,500	766	—	0.53	I	—	—	—

*ECM savings and cost are tabulated on a per room basis with individual findings listed afterwards. See attached calculation sheet.

Energy Conservation Measure (ECM)

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-1 Boiler Plant	1" pipe insulation missing - 2ft	Supply and install missing insulation	SEE ROOM SUMMARY TABLE								
INS-2 Boiler Plant	1½" pipe insulation missing - 20ft 4 valves 1½" size insulation missing	Supply and install missing insulation	↓								
INS-3 Boiler Plant	4 valves 3" size insulation missing	Supply and install missing insulation	↓								
INS-4 Boiler Plant	1 valve 28" size insulation missing	Supply and install missing insulation	↓								
INS-5 Boiler Plant	1 valve 8" size insulation missing	Supply and install missing insulation	↓								
INS-6 Boiler Plant	8" pipe insulation missing - 2ft	Supply and install missing insulation	↓								
INS-7 Boiler Plant	3" pipe insulation missing - 3ft 4 valves 3" size insulation missing	Supply and install missing insulation	↓								
INS-8 Boiler Plant	6" pipe insulation missing - 2ft	Supply and install missing insulation	↓								
INS-9 Boiler Plant	4" pipe insulation missing - 10ft 6 valves 4" size insulation missing	Supply and install missing insulation	↓								
INS-10 Boiler Plant	1 valve 11" size insulation missing	Supply and install missing insulation	↓								
INS-11 Boiler Plant	1 valve 10" size insulation missing	Supply and install missing insulation	↓								
INS-12 Boiler Plant	7" pipe insulation missing - 6ft 1 valves 7" size insulation missing	Supply and install missing insulation	↓								

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-13 Boiler Plant	18" pipe insulation missing - 8ft 1 valves 18" size insulation missing	Supply and install missing insulation					↓				
INS-14 Boiler Plant	1 valve 5" size insulation missing	Supply and install missing insulation					↓				
INS-15 Boiler Plant	1 valve 22" size insulation missing	Supply and install missing insulation					↓				
INS-16 Boiler Plant	5" pipe insulation missing -10ft 1 valve 5" size insulation missing	Supply and install missing insulation					↓				
INS-17 Boiler Plant	4" pipe insulation missing - 7ft 1 valve 4" size insulation missing	Supply and install missing insulation					↓				
INS-18 Boiler Plant	4" pipe insulation missing - 7ft 6 valves 4" size insulation missing	Supply and install missing insulation					↓				
INS-19 Boiler Plant	10" pipe insulation missing - 7ft	Supply and install missing insulation					↓				
INS-20 Boiler Plant	8" pipe insulation missing - 8ft	Supply and install missing insulation					↓				
INS-21 Boiler Plant	8" pipe insulation missing - 8ft	Supply and install missing insulation					↓				
INS-22 Boiler Plant	10" pipe insulation missing - 18ft	Supply and install missing insulation					↓				
INS-23 Boiler Plant	1" pipe insulation missing - 2ft	Supply and install missing insulation					↓				
INS-24 Boiler Plant	2" pipe insulation missing - 25ft	Supply and install missing insulation					↓				
INS-25 Boiler Plant	7" pipe insulation missing - 8ft	Supply and install missing insulation					↓				

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-26 Boiler Plant	3" pipe insulation missing - 4ft 5 valves 3" size insulation missing	Supply and install missing insulation					↓				
INS-27 Boiler Plant	5" pipe insulation missing - 2ft 3 valves 5" size insulation missing	Supply and install missing insulation					↓				
INS-28 Boiler Plant	3 valves 3" size insulation missing	Supply and install missing insulation					↓				
INS-29 Boiler Plant	1 valve 5" size insulation missing	Supply and install missing insulation					↓				
INS-30 Boiler Plant	20" pipe insulation missing - 2ft	Supply and install missing insulation					↓				
INS-31 Boiler Plant	1 valve 16" size insulation missing	Supply and install missing insulation					↓				
INS-32 Boiler Plant	12" pipe insulation missing - 2ft	Supply and install missing insulation					↓				
INS-33 Boiler Plant	10" pipe insulation missing - 2ft	Supply and install missing insulation					↓				
INS-34 Boiler Plant	9" pipe insulation missing-15ft	Supply and install missing insulation					↓				
INS-35 Boiler Plant	12" pipe insulation missing - 238ft	Supply and install missing insulation					↓				
INS-36 Boiler Plant	14" pipe insulation missing - 5ft 1 valve 14" size insulation missing	Supply and install missing insulation					↓				
INS-37 Boiler Plant	12" pipe insulation missing - 20ft	Supply and install missing insulation					↓				
INS-38 Boiler Plant	1 valve 24" size insulation missing	Supply and install missing insulation					↓				
INS-39 Boiler Plant	14" pipe insulation missing - 4ft	Supply and install missing insulation					↓				

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-40 Boiler Plant	10" pipe insulation missing - 5ft	Supply and install missing insulation					↓				
INS-41 Boiler Plant	8" pipe insulation missing - 5ft	Supply and install missing insulation					↓				
INS-42 Boiler Plant	1 valve 14" size insulation missing	Supply and install missing insulation					↓				
INS-43 Boiler Plant	10" pipe insulation missing - 3ft	Supply and install missing insulation					↓				
INS-44 Boiler Plant	5" pipe insulation missing - 3ft 1 valve 5" size insulation missing	Supply and install missing insulation					↓				
INS-45 Boiler Plant	1" pipe insulation missing - 6ft 2 valves 1" size insulation missing	Supply and install missing insulation					↓				
INS-46 Boiler Plant	12" pipe insulation missing - 4ft 1 valve 12" size insulation missing	Supply and install missing insulation					↓				
INS-47 Boiler Plant	1 valve 22" size insulation missing	Supply and install missing insulation					↓				
INS-48 Boiler Plant	1 valve 22" size insulation missing	Supply and install missing insulation					↓				
INS-49 Boiler Plant	5" pipe insulation missing - 4ft	Supply and install missing insulation					↓				
INS-50 Boiler Plant	1 valve 5" size insulation missing	Supply and install missing insulation					↓				
INS-51 Boiler Plant	1 valve 18" size insulation missing	Supply and install missing insulation					↓				
INS-52 Boiler Plant	1 valve 6" size insulation missing	Supply and install missing insulation					↓				
INS-53 Pump Room	All pump are not insulated	Supply and install missing insulation					↓				

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-54 Tunnels	14" pipe insulation missing - 3ft	Supply and install missing insulation					↓				
INS-55 Tunnels	8" pipe insulation missing - 4ft	Supply and install missing insulation					↓				
INS-56 Tunnels	1 valve 16" size insulation missing	Supply and install missing insulation					↓				
INS-57 Tunnels	10" pipe insulation missing - 3ft	Supply and install missing insulation					↓				
INS-58 Tunnels	16" pipe insulation missing - 4ft	Supply and install missing insulation					↓				
INS-59 Tunnels	1 valve 12" size insulation missing	Supply and install missing insulation					↓				
INS-60 Tunnels	3" pipe insulation missing - 1ft 2 valves 6" & 3" size insulation missing	Supply and install missing insulation					↓				
INS-61 Tunnels	8" pipe insulation missing - 3ft 1 valve 8" size insulation missing	Supply and install missing insulation					↓				
INS-62 Tunnels	12" pipe insulation missing - 3ft	Supply and install missing insulation					↓				
INS-63 Tunnels	1 valve 6" size insulation missing	Supply and install missing insulation					↓				
INS-64 Tunnels	1 valve 12" size insulation missing	Supply and install missing insulation					↓				
INS-65 Tunnels	1 valve 6" size insulation missing	Supply and install missing insulation					↓				
INS-66 Tunnels	14" pipe insulation missing - 2ft	Supply and install missing insulation					↓				
INS-67 Tunnels	6" pipe insulation missing - 2ft 1 valve 6" size insulation missing	Supply and install missing insulation					↓				

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-68 Tunnels	6" pipe insulation missing - 4ft 1 valve 6" size insulation missing	Supply and install missing insulation					↓				
INS-69 Tunnels	12" pipe insulation missing - 2ft 1 valve 12" size insulation missing	Supply and install missing insulation					↓				
INS-70 Tunnels	3" pipe insulation missing - 2ft 1" pipe insulation missing - 1ft 2 valves 3" & 1" size insulation missing	Supply and install missing insulation					↓				
INS-71 Tunnels	14" pipe insulation missing - 5ft	Supply and install missing insulation					↓				
INS-72 Tunnels	14" pipe insulation missing - 7ft	Supply and install missing insulation					↓				
INS-73 Tunnels	10" pipe insulation missing - 5ft 2 valves 10" size insulation missing	Supply and install missing insulation					↓				
INS-74 Tunnels	1 valve 12" size insulation missing	Supply and install missing insulation					↓				
INS-75 Tunnels	2 valves 12" size insulation missing	Supply and install missing insulation					↓				
INS-76 Tunnels	6 valves 10" size insulation missing	Supply and install missing insulation					↓				
INS-77 Tunnels	6" pipe insulation missing - 6ft 4 valves 6" size insulation missing	Supply and install missing insulation					↓				
INS-78 Tunnels	10" pipe insulation missing - 6ft 3 valves 10" size insulation missing	Supply and install missing insulation					↓				
INS-79 Tunnels	3" pipe insulation missing - 5ft	Supply and install missing insulation					↓				

Finding Number	Finding / Issue Description	Recommended Action or Action Taken	Total Estimated Installation Costs	Annual Identified FIM/ECM Savings	Annual Identified Savings (mmbtu)	Annual Identified Savings (kwh)	Simple Payback	Recommended Measure	Actual Date Implemented FY '12	Calculated 2012 Savings Hercules	Calculated 2013 Savings Hercules
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement											
INS-80 Tunnels	6" pipe insulation missing - 10ft 3 valves 6" size insulation missing	Supply and install missing insulation	↓								

16. Follow-up Phase

The intent of the Turnover Phase is to ensure a smooth hand off and transition from the commissioning process/team to the personnel responsible for operating and maintaining the building over its life-cycle (the O&M personnel). Successful transitions ensure that all necessary documentation, training, knowledge and systems are provided to the O&M personnel, that the O&M personnel demonstrate the effective use of these tools, and that the implemented improvements become a part of the standard operating practice.

Update O&M Manuals and As-Built Documentation
Update O&M manuals and as- built documentation as required. If the Owner has acceptable, up-to-date O&M manuals, then O&M manuals only need to be modified to include any changes to equipment or operations that were made as part of the RCx project. If existing manuals are not adequate to support effective O&M of the existing equipment, the Owner should consider including a task in the RCx scope to improve them.

Develop Final Report & Update Documentation
This final report is a record of the RCx activities and measures that were implemented for the Owner and will become an important document for the building and an invaluable resource to current and future building operators..

Establish a Plan for Operational Sustainability, and Ongoing Commissioning
The plans developed during the Implementation Phase for operational sustainability and ongoing commissioning is developed during this process to ensure the persistence of results and continuous improvement, and is a key deliverable of the Turnover Phase. The plan will provide the building personnel with detailed instructions, systems and tools for strategic operational, monitoring and maintenance tasks that help maintain the commissioning process performance benefits and support continuous improvement. The plan may include recommendations and instructions related to: establishment and monitoring of energy and non-energy facility performance benchmarks, energy tracking, preventive and/or predictive maintenance, BAS trending, training, and procedures for updating documentation.

Develop Training Plan
Develop Training Plan, provide training and plan for future training. The Owner's building operating personnel should be part of the Commissioning Team and be involved in all phases of the RCx process to understand the findings, changes and improvements stemming from the commissioning process. Training should be pervasive throughout the commissioning process. The Turnover Phase provides an excellent opportunity to provide focused training on the RCx process, the associated FIMs implemented, system optimization techniques and strategies for persistence and continuous improvement. Establish a Training Plan for future training based upon the current training needs, estimated future needs (including "refresher" training), and training for continuous improvement of skills.

Hold a Lessons Learned Meeting

Hold a Lessons Learned Meeting with the Owner's building operating personnel and other Commissioning Team members. This can help the operating personnel in maintaining the performance benefits for RCx and can increase their knowledge, expanding their ability to identify and address improvement measures in the buildings in which they work.

17. Index of Appendices

Appendix A - Appendix A - Owner Project Requirements

Appendix B - NYSERDA Project Requirements

Appendix C - Project Schedule

Appendix D - Benchmark Energy Data / Utility Cost

Appendix E - Appendix E - Boiler / Chiller Plant Trending Data

Appendix F - Appendix F - Site Inspection Functional Performance Test

<u>Greenberg Pavilion</u>
- HVAC including Hot Water Heating Systems and Operating Rooms (ORs)
- Lighting
- DHW
- DHW Heater Replacement
- BMS
- Plumbing Compressors

<u>Annex Campus Central Chiller Boiler Plant</u>
- Lighting
- BMS
- Chiller Plant
  - Cooling Towers
  - Cooling Tower CPIs
  - Chillers
  - Condenser and Chilled Water Pumps
  - Condenser Water Piping CPI
  - Chilled Water Pump CPIs
- Hydronic Free Cooling
- Boiler Plant
  - Boilers
  - Boiler and Forced Draft Fan CPIs
  - Deaerator and Receiver Tank CPI
  - Feedwater Pump CPI
  - Condensate Water Pump CPIs
  - Steam Piping CPI
- Combustion Air
- Reduced Steam and Make-up Water Pressure
- Boiler Turndown
- BMS

Appendix G - Data Logger Trend Data

Appendix H - Identified Facility Improvement Measures (FIMs)

Appendix I - Identified Energy Conservation Measures (ECM)

Appendix J - NYPH Implemented Facility Improvement Measures

Appendix K - NYSERDA - Implemented Facility Improvement Measures

Appendix L - NYPH Implemented Energy Conservation Measures

Appendix M - NYSERDA - Implemented Energy Conservation Measures

Appendix N - NYSERDA - Project Summary Sheets & Case Studies

Appendix O - Meeting Notes & Agendas

Appendix P - Energy Savings

Appendix Q - Implementation Phase

Appendix R - Follow-up Warranty Phase

Appendix S - Documents Reviewed

Appendix T - Horizon Engineering NYPH Cornell Campus Final Report

Horizon Appendix A – Greenberg Pavilion HVAC Checklists
Horizon Appendix B – Annex Building HVAC Checklists
Horizon Appendix C – Trending Data
Horizon Appendix D – Current Facility Requirements Sample
Horizon Appendix E – Calibration Reports