ASHRAE LEVEL II
ENERGY SURVEY ANALYSIS

The Energy Survey Analysis provides a summary of energy use and cost associated with each energy use for all major energy using systems. See table labeled "Components of Annual Energy Use" located within the appendix of this report.

MAJOR ENERGY USING SYSTEMS of the project building include:
Space Heating
Outdoor Air (OA) Heating
Space Cooling
Outdoor Air (OA) Cooling
Fans
Pumps
Domestic Hot Water
Lighting Within the Conditioned Area
Lighting Outside the Conditioned Area
Receptacles
Kitchen
Laundry
Central Computer
Conveyance
Laboratory Equipment

The mechanical description is provided within the Systems Narrative.

The Energy Survey Analysis identifies both practical and impractical Capital Improvement Measures. Capital Improvement Measures considered but felt to be impractical have been provided with a brief reason for rejecting. Capital Improvement Measures deemed practical have been provided with the following details:

- Description of the existing situation and why it contributes to excess energy consumption.
- Outline of the improvement measure, including its effect on occupant health, comfort, and safety.
- Description of any repairs required for the measure to be effective.
- The effect on occupant service capabilities, such as ventilation for late occupancy or year-round cooling.
- An outline of the effect on operating and maintenance procedures.
- The expected life of new equipment and the effect on the life of the existing equipment.
- The financial attractiveness (payback time, rate of return, cost-benefit ratio)

This report also includes a description of any recommended measurement and verification method(s) that will be required to determine the actual effectiveness of the recommended measures.

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The ASHRAE Level II Energy Survey Analysis builds on the findings and recommendations of the Level I Walk-Through Analysis. Therefore the no-cost/low-cost energy conservation measures identified in the Level I have been further reviewed during this stage and are acceptable based on the Level II findings, ergo they will be implemented. No additional no-cost/low-cost energy conservation measures were found during the Level II Energy Survey Analysis stage.

FINANCIAL ATTRACTIVENESS

The analysis reflects the impact of each practical Capital Improvement Measure investigated on energy operating costs, maintenance costs (both preventative and corrective), and any other relevant non-energy operating costs. Additionally all energy costs were assessed using actual energy rates as charged by the local energy supplier, including all costs for energy consumption and peak demand. The financial attractiveness calculations include the simple payback period, return on investment, and cost-benefit ratio. A description of each is as follows:

Payback Time

The payback time is the length of time required to recoup the initial investment form an operational improvement or capital investment. This calculation is useful for understanding when the investment will effectively pay for itself and begin to generate actual net savings.

Payback Time (years) = Project Cost / Annual Operating Savings

Rate of Return

The rate of return is the ratio of cost savings generated by an improvement or upgrade relative to the amount of money invested to implement the improvement. Knowing the rate of return helps determine the profitability of the investments that may be undertaken now or at a future time.

Rate of Return (%) = Annual Savings / Project Cost

Cost/Benefit Ratio

The cost/benefit ratio determines the total financial return for each dollar invested in operational improvements and upgrades. The cost/benefit ratio indicates the effectiveness of each dollar invested in generating operational cost savings. The cost-benefit ratio is used to determine the effectiveness of a project over its lifetime, rather than simply annual savings.

Cost/Benefit Ratio = Total Operational Savings / Project Cost

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Capital Improvement Measures considered but felt to be IMPRACTICAL

- Ice Storage Chillers
- Roof Replacement
- Regenerative Braking Elevators
- Energy Recovery System

Capital Improvement Measures deemed PRACTICAL

1. Chiller Replacement

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IMPRACTICAL Capital Improvement Measures

Ice Storage Chillers

Ice storage chillers make ice during off peak hours, and if sized correctly, can be idle during peak hours. This can reduce the total tonnage of the chiller system when compared to a conventional chiller system. Reason for Rejecting: Ownership does not want to devote floor/roof/site space for the location of the ice storage tanks.

Roof Replacement

The existing roof is original to the building and is a dark surface. The use of dark, nonreflective roofing surfaces contributes to heat island effect by absorbing the sun's warmth, which then radiates into the surroundings. As a result, ambient temperatures are artificially elevated, increasing cooling loads, electricity consumption, and the emissions of greenhouse gases and pollution. Reason for Rejecting: The existing roof is still under warranty.

Regenerative Braking Elevators

This type of conveyance system saves energy compared to conventional systems. When the carriage goes down, on regenerative braking elevators, the motor acts as a generator and pumps current back into the electrical network. Reason for Rejecting: This technology is relative new and ownership does not want to implement until regenerative braking elevators become more common.

Energy Recovery System

The building's exhaust and outside air system(s) could be retrofitted such that the building's exhaust/outside air is routed through an energy recovery ventilator. This strategy will reduce energy spent heating/cooling the outside air needed to ventilate the building. Reason for Rejecting: The installation of energy recovery ventilators will reduce maintenance access to existing equipment.

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PRACTICAL Capital Improvement Measure #1

Replace existing R-22, 100 ton air cooled scroll chiller with new high efficient R-410a, air cooled scroll chiller.

1. Description of the existing situation and why it contributes to excess energy consumption:
   The existing chiller is beyond its life expectancy, has an efficiency less than the current code minimum, and is regularly experiencing failures. A new high efficiency chiller will cost less to operate.

2. Outline on the improvement measure, including its effect on occupant health, comfort, and safety:
   The proposed chiller will increase reliability for comfort and computer room cooling. R410a is considered nonflammable, nontoxic and has less atmospheric ozone impact than R-22.

3. Description of any repairs for the measure to be effective:
   Replace existing chiller and implement manufacturer's recommended preventative maintenance procedure on the proposed chiller.

4. The effect on occupant service capabilities:
   Not applicable to this capital improvement measure.

5. The effect on operating and maintenance procedures:
   The proposed chiller will operate and be maintained the same as the existing chiller.

6. The expected life of the new equipment and the effect on the life of the existing equipment:
   The new chiller has an expected life expectancy of 20 years and would have little influence on the life of the existing equipment.

7. The financial attractiveness
   a. Simple Payback = cost of measure/annual savings = xx years
   b. Rate of Return = annual savings/cost of measure = xx%
   c. Cost/Benefit Ratio =
      (expected life of measure x annual savings) / cost of measure = x.xx

Recommended measurement and verification method(s) that will be required to determine the actual effectiveness of the recommended measures:

Install energy sub-meter and log energy consumption on a monthly basis.