ARCHITECTURAL ENGINEERING SENIOR THESIS

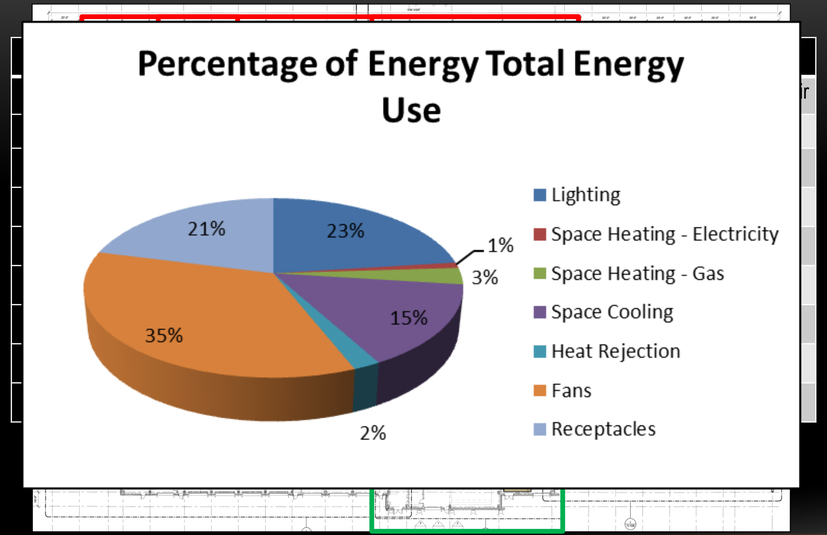
- Michael Tellep
- Montgomery County Equipment Maintenance and Operations Center
- Rockville, MD

BUILDING STATISTICS

- 16624 Crabbs Branch Way, Rockville, MD
- **Project Team:**
  - **Owner:** Montgomery County
  - **Architect:** Michael Baker, Jr., Inc.
  - **GC:** Coakley Williams Construction
  - **MEP:** S3E Klingemann, Inc.
- **Size:** 75,000 SF
- **Cost:** $15 million
- 2 stories above grade
- Completion in February 2013
- LEED Gold

BUILDING ORIENTATION

- Site Orientation
  - Building 1 – Location and Orientation
  - Attached Parking Garage
  - Bus Circulation Around Complex



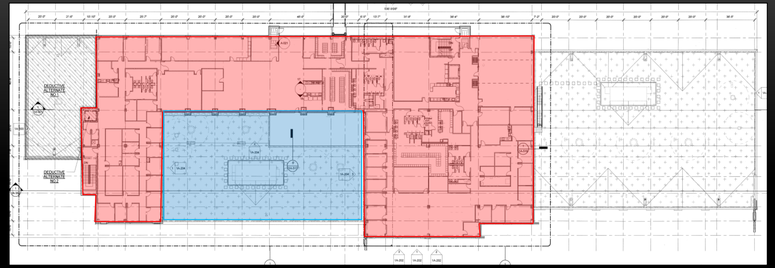
EXISTING MECHANICAL SYSTEM

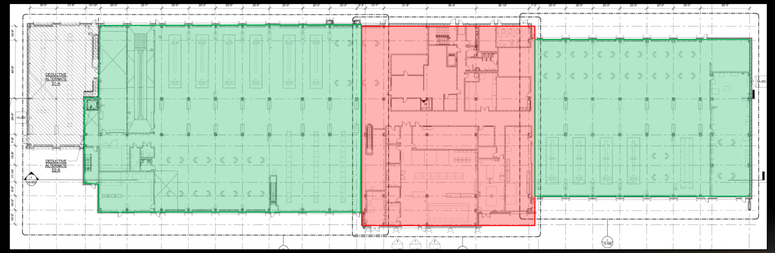
- Equipment
  - VAV Rooftop Units (RTUs) and VAV Boxes
  - Energy Recovery Units (ERUs) and Garage Spaces
- Floor Plans
- RTU and AC Unit Service Areas
  - AC – 1,2,3,4,5,6
  - RTU – 1
  - RTU – 2
    - 2nd Floor
    - 1st Floor
  - RTU – 3
- Energy Distribution (By % of Total)

MECHANICAL DESIGN OBJECTIVES

	Current Energy Use (10^6 BTU/yr)	Current Annual Running Cost ($)
Scope of Project	4,133	29,737.00
Central Plant		

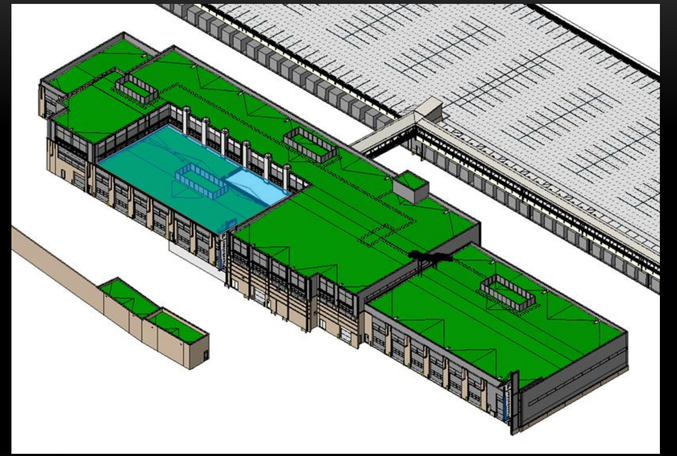
- Reduce the Total Energy used by the building and the central plants
- Keep to all required codes and standards
- Apply passive elements to Office Spaces



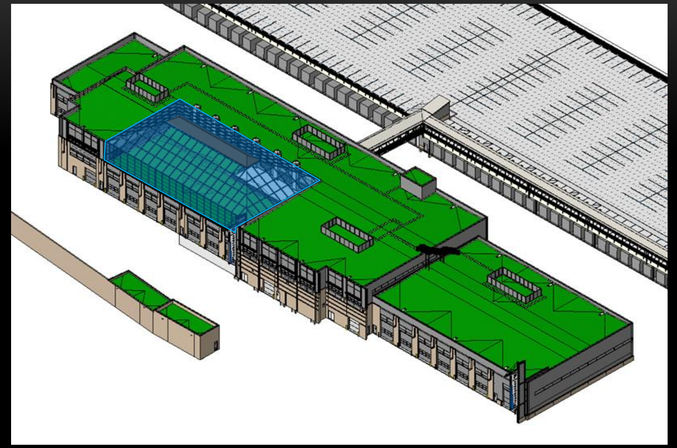


PROPOSAL OVERVIEW

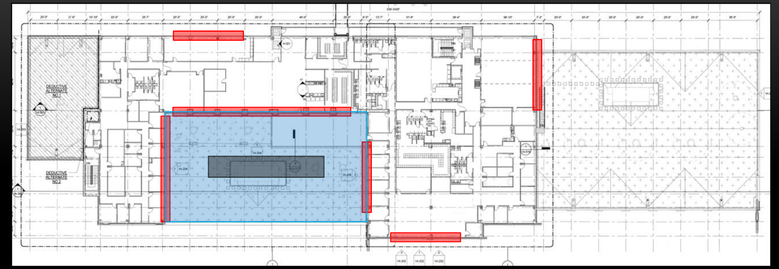
- Scope
  - Office Spaces
  - Garage Spaces
- Passive/Natural Ventilation System
  - Courtyard Enclosure
  - Louvers and Operable Windows
- Combination of RTUs
  - 3 to 2
- Chilled Beams



THE NEW DESIGN

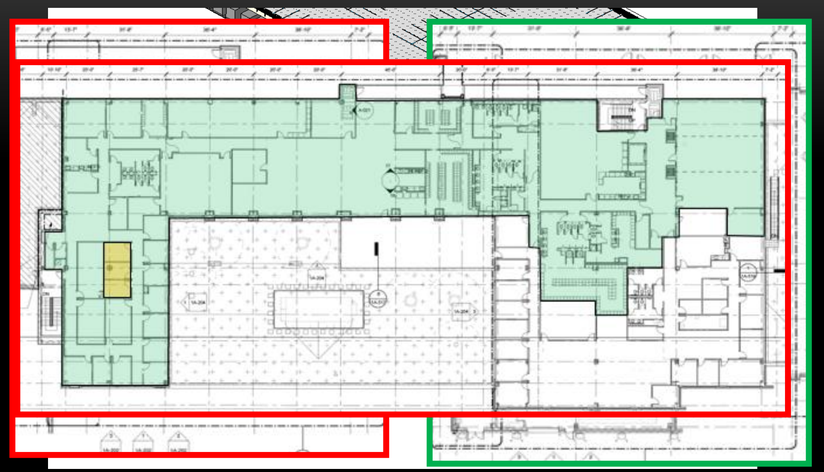


- Passive/Natural Ventilation System
  - Enclosure Design
    - Added Height: 17.5ft
    - Mechanical “Cap”
  - Operable Windows in Office Spaces
  - Calculation Procedure
    - Basic CFM from Indoor and Outdoor Temperatures
    - CFM with Solar Influence

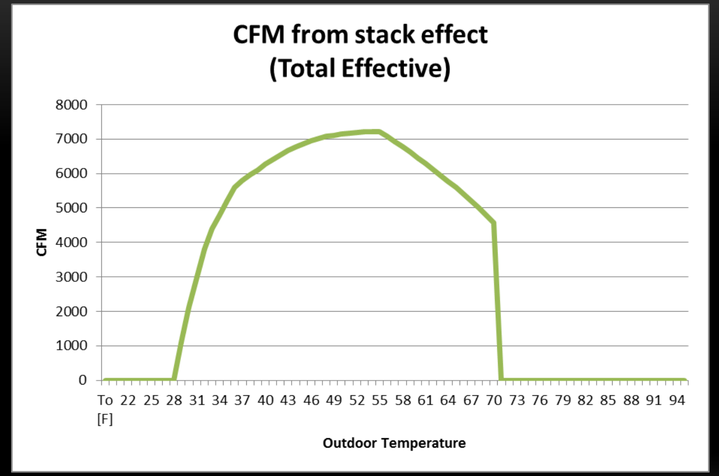


THE NEW DESIGN

- Active VAV Rooftop Unit Combination
  - Purpose
    - Reduce initial construction costs
    - Remove mechanical shed from courtyard
  - New Service Areas
    - AC – 1,2,3,4,5,6
    - RTU – 1
      - 2nd Floor
      - 1st Floor
    - RTU – 2



THE NEW DESIGN



- Combination of Passive and Active Systems
  - System Control
    - Based on outdoor air temperature
    - Favorable vs. Unfavorable days
  - All ventilation and load must be accounted for regardless of outdoor conditoins

RESULTS

Components	Cost
Rooftop Units (From Previous Slide)	30,415
TOTAL:	**30,415**

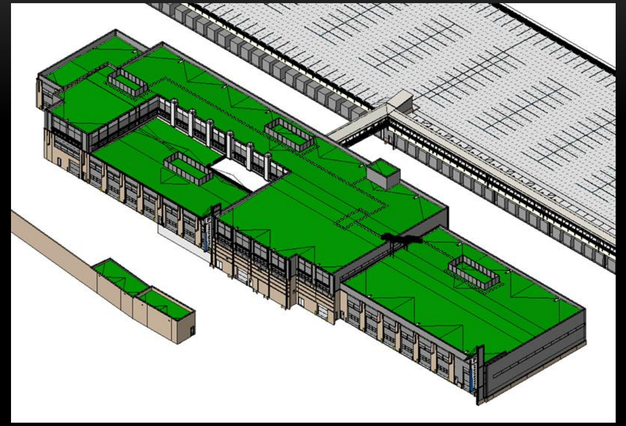
Energy	Original (10^6 BTU/yr)	Revised (10^6 BTU/yr)	Savings
Building	4,133	4,079	8.8%

Components	Cost
Rooftop Units (From Previous Slide)	25,155
Enclosure (Estimate Details in Report)	34,981
TOTAL:	**60,136**

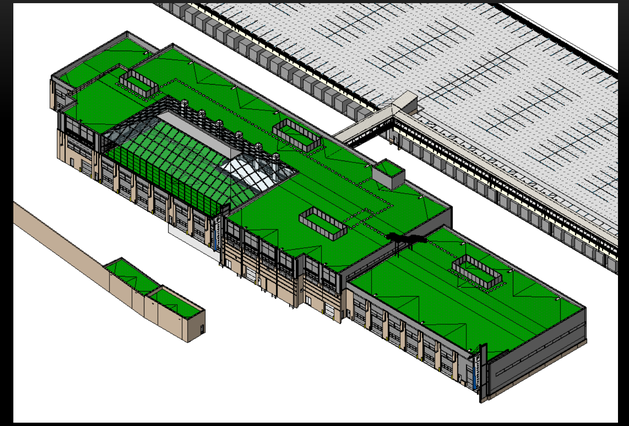
- Energy Use
- Annual Operating Cost
- Payback Period
  - Essential Components System Cost
  - How long would it take to make up for additional cost?

Difference in Operating Cost ($)	Difference in System Cost ($)	Payback Period	Savings
2,775	29,721	10.71 years	9.3%
Central Plant	343,896	341,121	0.8%

ARCHITECTURAL BREADTH



- Integrate with mechanical depth
  - Enclosure serves mechanical and architectural purpose
- Provide better break and relaxation area for off-duty drivers and office workers
  - Courtyard is now usable year-round and more effectively
- Remain within the urban fabric of the site and surrounding community
- Designate this building as the “head” building in the complex
- Promote green building technology



PROJECT DEDICATION

This thesis project is dedicated to the life and memory of

Frances J. Palko

THANK YOU

Questions?