Energy Exchange

Federal Sustainability for the Next Decade

U.S. Department of Energy

Extending the Reach of Campus Renovation through Combined Financing

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Learning Objectives

- Define Energy Performance Contracting (EPC) as a new way to scale up the number and pace of deep energy refurbishment in the public sector
- Describe how Energy Performance Contracting is contributing to overcome the scarcity of public funding
- Describe how combined financing strategies can be used to deliver large-scale deep energy retrofits in federal government facilities
- Apply the lessons learned from the example project to improve the effectiveness of this strategy on future projects with similar challenges

Presentation Outline

- Background: Issues, Challenges
- Case Study: Intelligence Community Campus – Bethesda
  - Project Overview
  - Utility Energy Services Contract
    - Baseline / Existing Conditions
    - Phased Modeling Challenges
    - Implementation in Phases
    - Azimuth Corrections
    - Lessons Learned
- Summary / Benefits

The Issue

- Budget Pressure / Capital Funding Constraints
- Repurposing of Federal Property Holdings
- Energy Efficiency / Sustainability Mandates
- Energy Security / Reliability Concerns
- Accountability for Energy Performance

The Challenge

– Combining Renovation with ESPC

- Energy retrofits are less costly to implement during major building renovations, but renovations and energy upgrades are usually performed separately
- Combining them requires a method of integrating the performance of a general contractor (performing renovations) and an ESCO (installing energy conservation measures)
- Not easy to coordinate the activities of the two contractors…

Source: Extract from slide used in presentation by Cyrus Nasseri, FEMP, at DOE ESPC Contract Holders meeting on October 28, 2014

Case Study – UESC at ICC-B

Keys to Success

- Coordination
- Partnership
- Innovation
- Reliability
- Flexibility
- Value

ICC-B UESC Development Team

Owner
- Office of Director of National Intelligence

Executive Agent
- Defense Intelligence Agency

Program Management Office (PMO)
- Markon Solutions

SATOCC

US Army Corps of Engineers
BALTIMORE DISTRICT

WT Whiting-Turner

URS

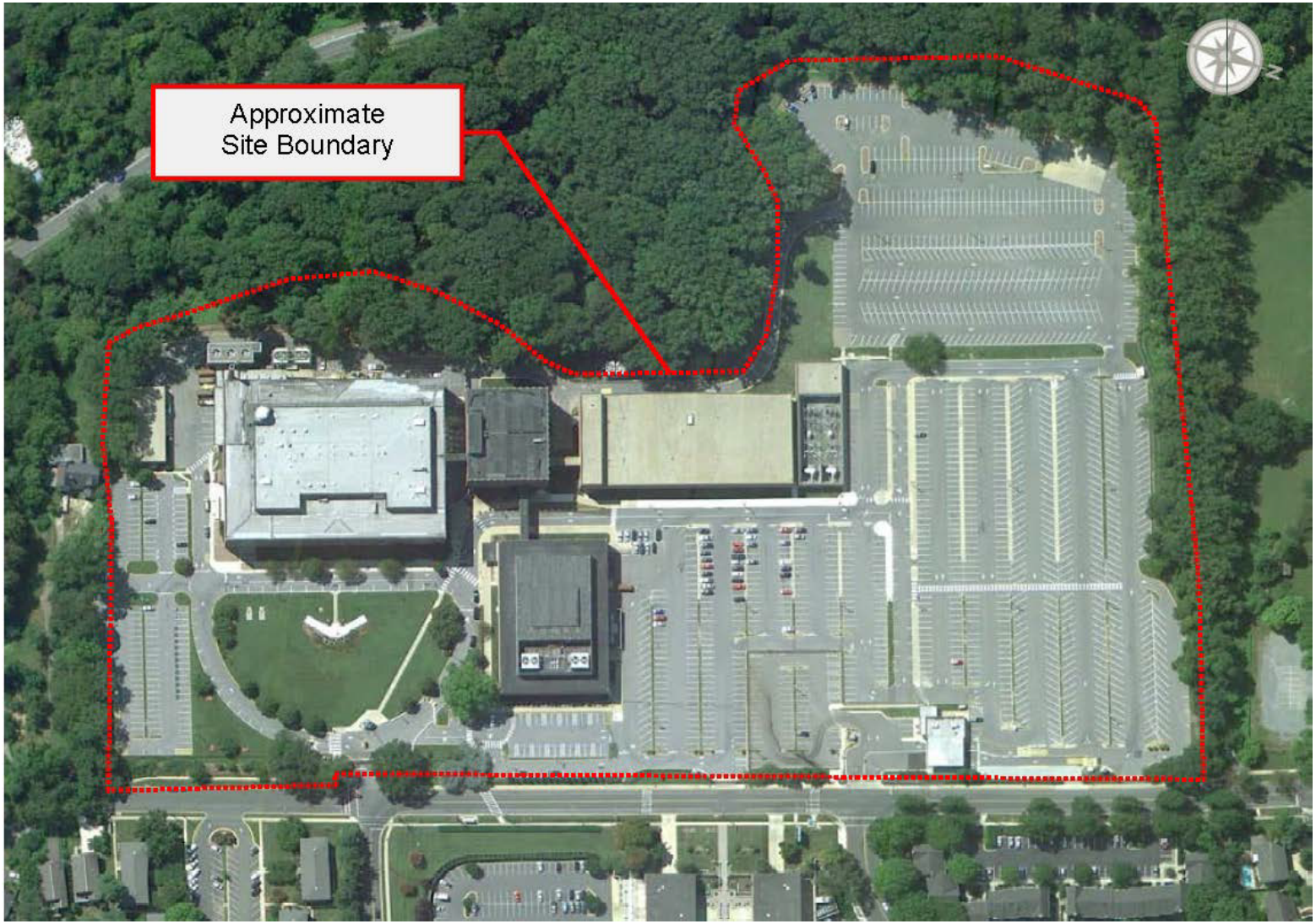
UESC

US Army Corps of Engineers

Washington Gas

Honeywell

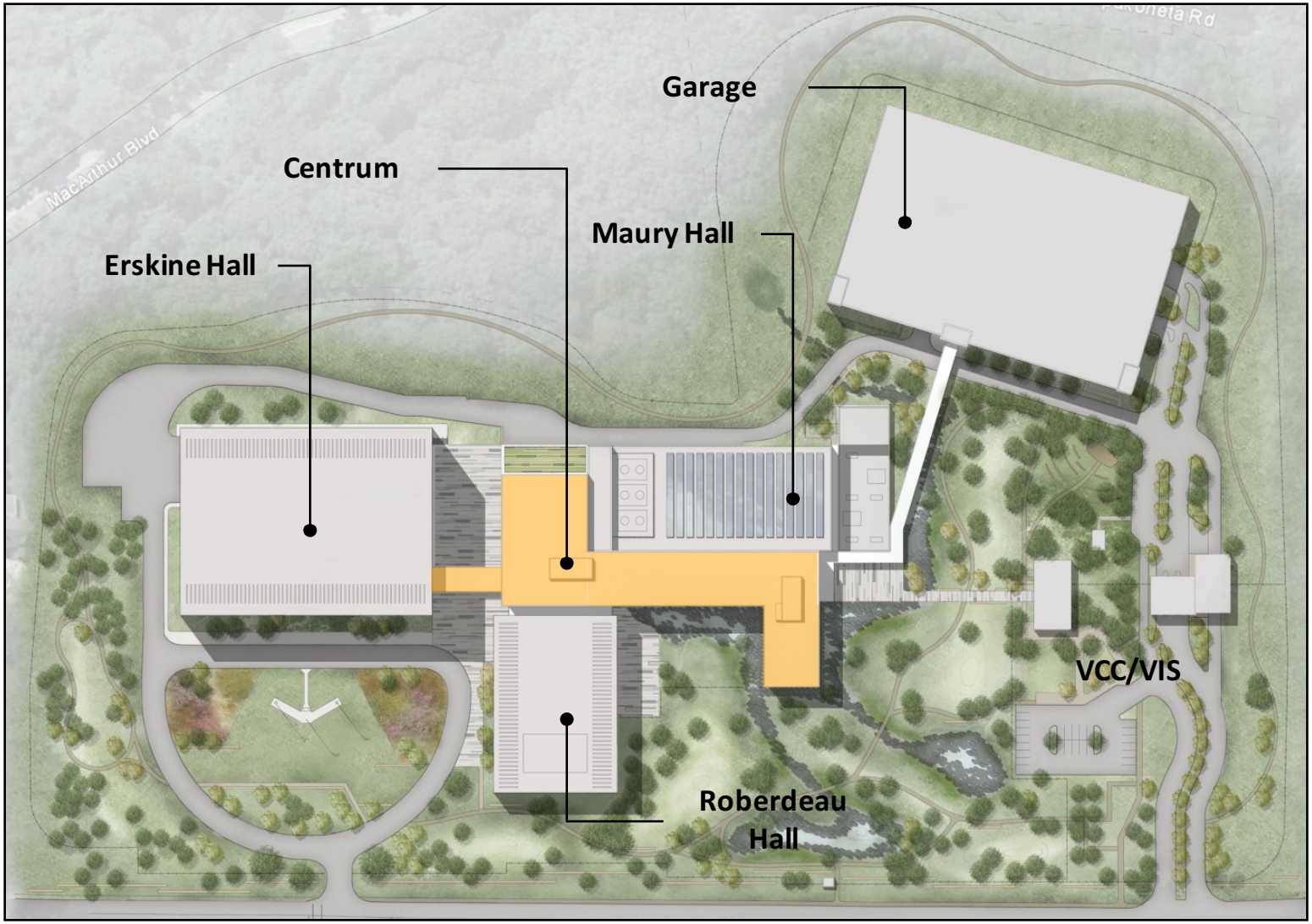
Former NGA Sumner Campus



Existing Facilities (prior to renovation)

Original Campus Building List			
Building Name	**Square Footage (Gross)**	**Year Built**	**Building Status**
Erskine Hall	<400,000	1946	To be Renovated
Abert Hall	<95,000	1962	To be Demolished
Emory Building	<15,000	1963	To be Demolished
Roberdeau Hall	<140,000	1966	To be Renovated
Maury Hall	<155,000	1988	To be Renovated
Visitor Center	<1,500	2005	To be Demolished

ICC-B Campus Vision



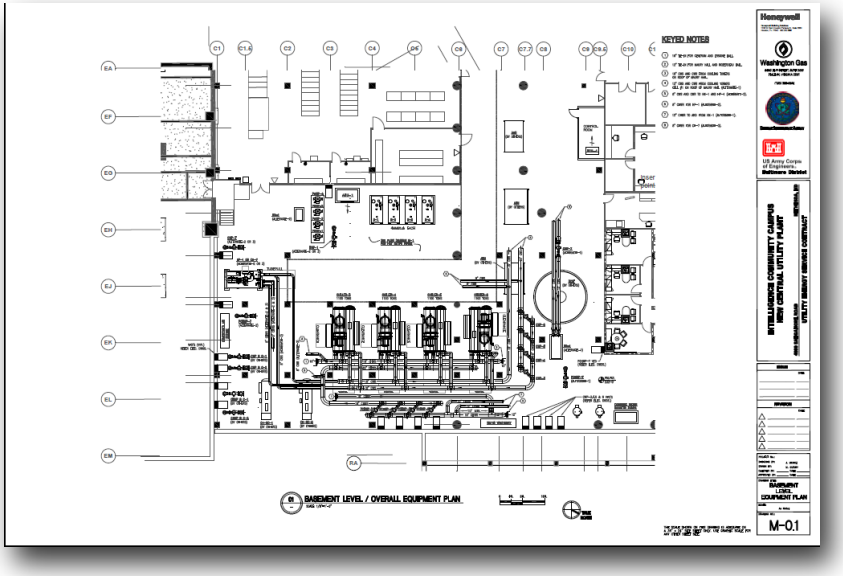
ICC-B ECM Descriptions

ECM #	ECM Description
ECM-1	New Central Utility Plant (CUP)
ECM-2	New AHUs and Fan Powered Terminal Devices with Control Strategies
ECM-3	Airside Energy Recovery
ECM-4	Upgrade Campus Wide Energy Management System (EMS)
ECM-5	New Gas Fired Water Heaters
ECM-7	Lighting Upgrades and Lighting Controls
ECM-8	New Backup Generators
ECM-11	Photovoltaic (PV) Systems
ECM-13	Solar Domestic Hot Water Generation
ECM-15	Operations and Maintenance (O&M)
ECM-18	Additional Back-Up Chiller for Maury Hall
ECM-19	Smart Power Strips

ICC-B UESC Program Elements

UESC Structure

- Phase I (Base): CUP Construction
- Phase II: Roberdeau Hall ECMs
- Phase III: Erskine Hall ECMs
- Phase IV: Maury Hall ECMs



Savings Goals

- Reduce up front costs
- Energy efficiency
- Maintenance & Repair cost avoidance

ICC-B UESC Phase I: Equipment Elements

- 10,400 Square Foot Central Plant (basement of Centrum)
- Electrical Generation
  - One: 2.0 MW Diesel Generator
- Chilled Water
  - Three: 1,100 Electric VFD Centrifugal Chillers
  - One: 340 Ton Heat Recovery Chiller

1100-ton Chiller

- Hot Water Condenser Boilers
  - Three: 4MMBtu/Hr

4 MMBtuh Condensing Hot Water Boiler

Master Plan	Square Footage	Campus Population
2015	400,000	800
2017	900,000	2,500

ICC-B UESC Phases I and II

- **Phase I (CUP in basement of Centrum Bldg) -- Original**
  - UESC contractor designs and installs equipment and systems comprising the Central Utility Plant (CUP) in space prepared by the SATOCC contactor – the CUP will provide utilities to the entire campus at end-state
- **Phase I (CUP in basement of Centrum Bldg) -- Revised**
  - Essentially the same as originally envisioned, but changes required to address issues associated with structural nature of space provided by SATOCC contractor to the UESC contractor

- **Phase II (Roberdeau Hall renovation) -- Original**
  - UESC contractor furnishes items of mechanical and electrical equipment to SATOCC contractor as Government Furnished Equipment; UESC contractor installs Building Automation System (BAS)
- **Phase II (Roberdeau Hall renovation) -- Revised**
  - Essentially the same as originally envisioned, but changes required due to redesign of mechanical and electrical systems serving tenant spaces (National Intelligence University)

ICC-B UESC Phases III and IV

- **Phase III (Erskine Hall renovation) -- Original**
  - UESC contractor furnishes items of mechanical and electrical equipment to SATOCC contractor as Government Furnished Equipment; UESC contractor installs Building Automation System (BAS)
- **Phase III (Erskine Hall renovation) -- Revised**
  - UESC contractor handles tenant fit-out spaces on Floors 4 and 5 as originally envisioned, but designs and installs core mechanical and electrical systems in the building

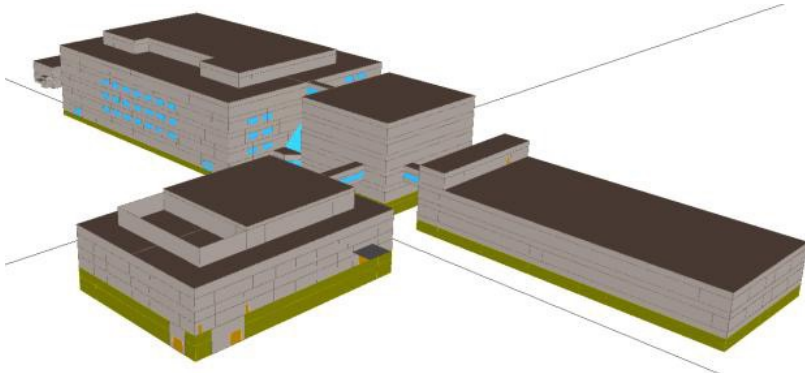
- **Phase IV (Maury Hall renovation) -- Original**
  - Expected to be similar to Phases II and III, but more modest in scope; PV (which was initially going to be split between phases) aggregated and included in this phase to minimize disruption and realize economies of scale
- **Phase IV (Maury Hall renovation) -- Revised**
  - Essentially the same as originally envisioned, but O&M responsibility will be picked up by the UESC contractor in advance of renovation activities (Maury Hall is currently occupied)

Baseline and Existing Conditions Modeling Challenges

- Buildings largely unoccupied during IGA development
- Last Full Occupancy period in 2008
- Inability to conduct baseline performance testing
- Establishing the savings baseline
  - Demolished buildings
  - Addition of Centrum
  - Building envelope renovation
  - Space use changes

2008 Baseline Campus Model

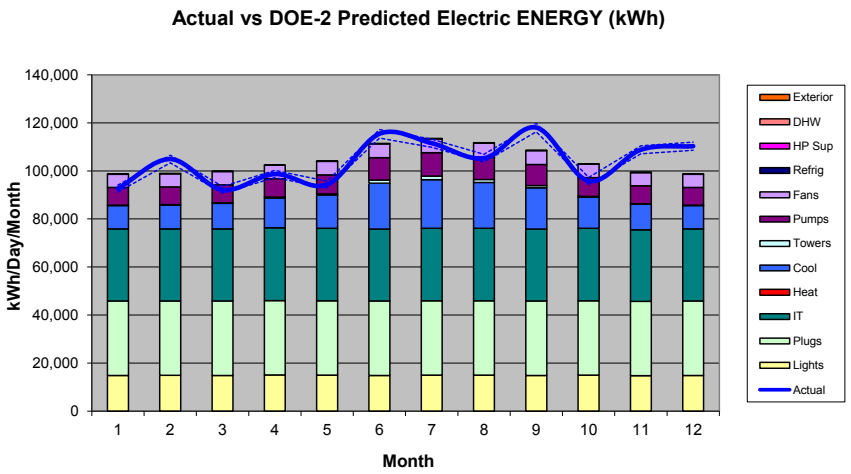
- Model includes all original campus buildings
- Original distributed chilled water distribution (5,285tons)
- Original central steam system (1,200BHP)
- Mostly 24hr operating schedule
- High internal gains from analyst stations / computer rooms



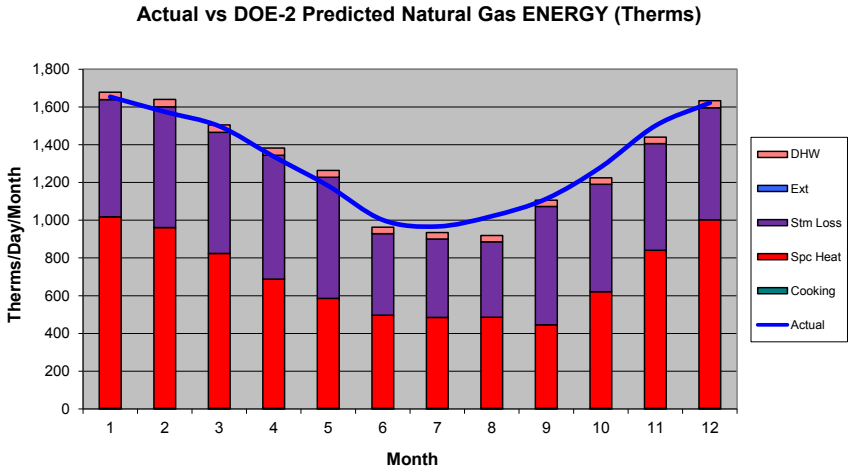
Baseline Model Calibration

- Using the 2008 Utility Data
  - Electric data missing the demand profile
  - Combined natural gas and fuel oil usage
- Actual Weather Data File Created for model calibration
- Plug load / IT Load estimates based on site surveys and maintenance personnel interviews
  - Plug Loads: 2.0W/ft^2 (Erskine, Abert, Emory) – 3.0W/ft^2 (Roberdeau, Maury)
  - 1,500kW of IT Data Center loads (Primarily Maury and Erskine)
- Estimated steam system losses based on surveys, interviews and overall energy balance

Baseline Calibration Results



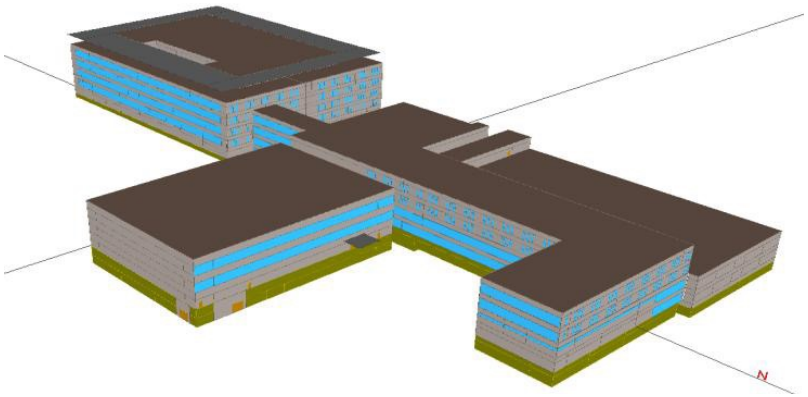
MBE +0.7%



MBE -0.2%

Adjusted Baseline

- Added the Centrum Building
- Upgrades to building envelope thermal performance
- Expanded 3rd floor RH
- Significant increase in window –wall ratio
- Space use based on projected tenants
- Buildings served by existing chilled water / steam system



ECM Modeling Results

- 39% energy usage reduction from 2008 Baseline
- ~ $2,000,000/yr cost savings from 2008 Baseline
- 47% energy usage reduction from Adjusted Baseline
- ~ $1,100,000/yr cost savings from Adjusted Baseline

Energy-related (O&M) Savings

- Baseline / Existing Conditions
  - Multiple Plants (3 separate locations)
  - Vintage Equipment; “Breakdown” Maintenance following BRAC decision
  - High Pressure Steam Boilers (24/7 monitoring)
  - Actual O&M Expenditures, FY2009 (NGA)
- Savings Opportunities
  - Consolidate Plant Equipment
  - Capture Near-Term Repair/Replacement Cost Avoidance
  - Condensing Boilers => Manpower Reductions
  - Bottoms-up Performance-Based Costing
- O&M Savings Value
  - $2.4M for Central Plant (Year 1 value)
  - $2.1M for Campus Buildings (Year 1 value)

Implementation Phases: Phase I

- Design and Construction of the CUP
  - DBT was at 65% Design for the Centrum
  - UET was progressing from 35% design to construction documents for Mechanical and Electrical systems
  - Extensive coordination with DBT for utility placeholders
  - CUP estimated to be online by Summer 2015

Implementation Phases: Phase II

- The Renovation of Roberdeau Hall
  - UET's involvement started at the DBT's 35% Level
  - UET provide alternative HVAC and lighting design
  - GFCI Equipment:
    - HVAC & DHW
    - Main Electrical Equipment
    - Lighting and Controls
  - BAS provided and installed by the UET

Implementation Phases: Phase III

- Design and Construction of Erskine Hall
  - Hybrid approach = GFCI and Design Build
  - UET will Design and Build the core mechanical and electrical systems related to the DFS ECMs
    - UET will progress the DBT's 65% design to construction documents
    - GFCI Equipment will be provide for 2 floors:
      - VAV boxes
      - Lighting and controls

Implementation Phases: Phase IV

- Design and Construction of Maury Hall
  - Occupants will be moved from the space in November
  - New tenants return April 2016
  - Significant increase in space internal loads
    - Going from 6CPU workstations to 9
    - Expansion of the data center
  - Require replacing the HVAC equipment
  - Add chiller capacity to the plant
  - Campus wide PV system is slated for this phase
    - Estimated production goal is 1MW
    - Render Roberdeau Hall NZEB

Azimuth Corrections

- Flexibility Exhibited by Huntsville
- Original Course was changed
- Phase I
  - CUP water supply and return temperatures
  - Supplemental Structural Steel
  - Installation of Utilities to support future phases
- Phase II
  - UET's HVAC Approach
  - Contract Award requirements
  - GFCI Modifications due to Design Progression
  - GFCI Delivery Schedules

Azimuth Corrections

- Phase III
  - Contract Award requirements
  - Maintain the HVAC Approach from Phase II
  - Provide additional shafts to house utilities outside the DBT's obligations
  - Provide additional electrical closets

- Phase IV
  - TBD

Lessons Learned

- Combined Financing extended the mission on Campus
- Earlier Calibration with all stakeholders
  - Contractual Requirements
  - Design Efforts
  - Scope Gaps
- Scheduling Constraints
- Required Instant and Continuous Communication

Conclusions

- Energy Performance Contracting (EPC) represents a viable means for enhancing energy performance in Federal new construction and/or major renovations
- EPC can be used to provide funding for Deep Energy Retrofits that might otherwise be unaffordable
- Blending of EPC and appropriated funding is challenging on many levels – needs buy-in from all stakeholders
- Specific methodology can be adapted during execution to meet evolving program requirements
- Early consideration of blending EPC with appropriations in facilities acquisition strategy development is recommended

Questions?

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