Extending the Reach of Campus Renovation through Combined Financing

Mark “Dusty” Wheeler, Honeywell
Phil Smith, Honeywell
August 12, 2015
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
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

UESC
- US Army Corps of Engineers
- Washington Gas
- Honeywell
- Whiting-Turner
- URS
Former NGA Sumner Campus
## Existing Facilities (prior to renovation)

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Square Footage (Gross)</th>
<th>Year Built</th>
<th>Building Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erskine Hall</td>
<td>&lt;400,000</td>
<td>1946</td>
<td>To be Renovated</td>
</tr>
<tr>
<td>Abert Hall</td>
<td>&lt;95,000</td>
<td>1962</td>
<td>To be Demolished</td>
</tr>
<tr>
<td>Emory Building</td>
<td>&lt;15,000</td>
<td>1963</td>
<td>To be Demolished</td>
</tr>
<tr>
<td>Roberdeau Hall</td>
<td>&lt;140,000</td>
<td>1966</td>
<td>To be Renovated</td>
</tr>
<tr>
<td>Maury Hall</td>
<td>&lt;155,000</td>
<td>1988</td>
<td>To be Renovated</td>
</tr>
<tr>
<td>Visitor Center</td>
<td>&lt;1,500</td>
<td>2005</td>
<td>To be Demolished</td>
</tr>
</tbody>
</table>
ICC-B Campus Vision
## ICC-B ECM Descriptions

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

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

<table>
<thead>
<tr>
<th>Master Plan</th>
<th>Square Footage</th>
<th>Campus Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>400,000</td>
<td>800</td>
</tr>
<tr>
<td>2017</td>
<td>900,000</td>
<td>2,500</td>
</tr>
</tbody>
</table>

1100-ton Chiller

4 MMBtu/h Condensing Hot water Boiler
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 contractor – 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)
ICCB 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

Actual vs DOE-2 Predicted Electric ENERGY (kWh)

Actual vs DOE-2 Predicted Natural Gas ENERGY (Therms)

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
• 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
• **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?

Mark “Dusty” Wheeler P.E.
dusty.wheeler@honeywell.com
Phone: 703-999-8719
Cell: 703-789-3265

Phillip L. Smith P.E.
phil.smith2@honeywell.com
Phone: 770-632-0672
Cell: 770-633-6171