Modernization of Control and Information Infrastructure for a Utility Plant Control System

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Controls Engineer, Utilities & Energy Services

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Power and Energy Business Manager
OVERVIEW

- 5,200+ acres
- 800+ buildings
  - 30+ million gross square feet
  - 26+ million GSF conditioned
- Over 6 million GSF added since 2016
- 69,000 students
- Over 10,000 faculty and staff
- $950+ million total annual research
Operate/maintain seven utility plants:
• CUP, SUP1, SUP2, SUP3, HSC, RELLIS, MCB

Utility Plant Capacities:
• 50MW power generation
  • 34 MW gas turbine
  • 16 MW steam turbines
• 66,000 tons of cooling (both electric & steam driven)
  • 37 chillers
  • 24,000 ton-hours of thermal storage
• 440,000 PPH of steam
  • 3 steam boilers
  • 8 steam to hot water heat exchangers
• 500 million BTU/hr of heating hot water
  • 56 hot water boilers
UTILITIES CONTROLS UPGRADE

- Building Name: 12.5kV Switching Station
- Abbreviation: ARSS
- Central Utility Plant
- Abbreviation: CUP
- Enterprise Avenue Sub Station
- Abbreviation: EASS
- Heldenfels Substation
- Abbreviation: HESS
- Research Park Switching Station
- Abbreviation: RPSS
- Satellite Plant #1
- Abbreviation: SUP1
- Satellite Plant #2
- Abbreviation: SUP2
- Satellite Utility Plant #3
- Abbreviation: SUP3
- Thermal Energy Storage Tank
- Abbreviation: TES
- UES Distribution Office
- Abbreviation: UDO
- West Campus Data Center
- Abbreviation: WCDC
- West Campus Switching Station
- Abbreviation: WCSS

- UDO
- WCDC
- TES
- SUP2
- ARSS
- CUP
- HESS
- SUP3
- RPSS
- SUP1
- WCSS
66 percent increase in campus square footage with 16 percent decrease in energy consumption projected thru FY20
Target $285 million cost avoidance through FY20 (from FY02 baseline)

Target 50 percent energy consumption reduction per GSF (from FY02 thru FY20)

Source EUI based on total energy consumption
Site EUI reports energy intensity of campus buildings

Energy use per gross square foot (mBTU consumption per GSF)
<table>
<thead>
<tr>
<th>PROCUREMENT</th>
<th>TRANSMISSION</th>
<th>PRODUCTION</th>
<th>DISTRIBUTION</th>
<th>METER &amp; BILLING</th>
<th>ENERGY MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate and project campus energy requirements</td>
<td>TAMU owns: Domestic water transmission system</td>
<td>Management of:</td>
<td>TAMU owns and operates campus delivery systems:</td>
<td>Over 2,500 revenue-quality meters in over 500 buildings</td>
<td>Customer comfort and service</td>
</tr>
<tr>
<td>Specify annual and monthly consumption of electricity and natural gas</td>
<td>Atmos owns: HP (600 psi) NG delivery system</td>
<td>• Seven utility plants</td>
<td>• 12.5kV electrical</td>
<td>Manage utility rate model and rate setting</td>
<td>Environmental control</td>
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<tr>
<td>Review and recommend payment of energy invoices</td>
<td>BTU owns: 138kV ERCOT electrical transmission system</td>
<td>• CUP &amp; 3 SUPs</td>
<td>• Domestic water (hot &amp; cold)</td>
<td>Cost recovery for all utilities and energy</td>
<td>Building automation and HVAC operation</td>
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<tr>
<td>Serve on TAMU energy risk management committee</td>
<td>Coordinate closely with Atmos, ERCOT and BTU</td>
<td>• RELLIS Campus</td>
<td>• Chilled Water</td>
<td>Energy stewardship</td>
<td>Energy Performance Improvement</td>
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<td></td>
<td></td>
<td>• Moore Connally Building</td>
<td>• Heating Hot Water</td>
<td>Project design review</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Solid Waste &amp; Recycling</td>
<td>• Steam</td>
<td></td>
<td>Capital improvement coordination</td>
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<td></td>
<td></td>
<td>• Two wastewater treatment facilities</td>
<td>• Sanitary Sewer</td>
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<tr>
<td></td>
<td></td>
<td>• Domestic water systems</td>
<td>• Storm Drainage</td>
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<td>Production of:</td>
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<td></td>
<td>• Electricity</td>
<td>HSC Campus (Bryan)</td>
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<td></td>
<td></td>
<td>• Chilled water for cooling</td>
<td>RELLIS Campus</td>
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<tr>
<td></td>
<td></td>
<td>• Hot water for heating</td>
<td>Atmos owns:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Domestic cold &amp; hot water</td>
<td>• LP &amp; IP natural gas delivery system</td>
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</table>
TYPICAL FACTORS REQUIRING MODERNIZATION OF CONTROLS

- Data Visualization & Analysis
- System Failures
- Cybersecurity
- Poor Documentation
- New Standards Regulations, and Technology
- Support Cost Issues
- System Limitations
- Potential Safety or Loss Events
- Resource Loss or Retirement
## Upgrade Timetable

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>Emerson WDPF DCS - Installed</td>
<td>1990</td>
</tr>
<tr>
<td>Upgrade WDPF – Upgrade to Ovation</td>
<td>2006</td>
</tr>
<tr>
<td>Ovation expansion and upgrade</td>
<td>2011</td>
</tr>
<tr>
<td>Modernization requirement identified</td>
<td>2016</td>
</tr>
<tr>
<td>Developed preliminary project scope</td>
<td>2017</td>
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<tr>
<td>Evaluated control vendor proposals</td>
<td>2018</td>
</tr>
<tr>
<td>Finalized project delivery and bid evaluation</td>
<td>2019</td>
</tr>
<tr>
<td>Project construction award and kickoff</td>
<td>2020</td>
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</table>

## Compelling Considerations/Justification

- Hardware & Software Obsolescence
- Data Acquisition & Analysis
- System Integration Requirements
- Cybersecurity
UES PROJECT OVERVIEW

Central Utility Plant (CUP)
- 48 MW of power generation capacity
- 27,500 tons of chilled water production
- 17,830 BHP of steam boiler capacity
- Ancillary equipment

3 Satellite Utility Plants (SUPs)
- 29,400 tons chilled water production
- 159,869 MBH hot water boiler production
- Ancillary equipment

Wastewater Treatment Plant
- Permitted for 4 MGD

Controls Upgrade
- Legacy Emerson Ovation DCS
- AB, CLX, SLCs & CMXs

138KV Substation
- SEL Server

TAMU IT Policy
- Control System IT Infrastructure Modification
TECHNICAL EVALUATION AND IMPLEMENTATION TEAM

KEY STAKEHOLDERS

- Executive Director, Utilities & Energy Services
- Director, Utilities & Energy Services
- Associate Director, Utility Production Services
- Manager, Technical Services
- Manager, Utility Production Services
- Controls Engineer, Technical Services
- Supervisor, Instrumentation and Controls
- Supervisor, Water & Wastewater
- Technical Staff, Instrumentation and Controls
- UES IT Services
- TAMU Procurement Services/Contract Admin
- Office of General Counsel

TEAM RESPONSIBILITIES

- Specification Development with 3rd parties
- Vender Qualifications
- RFP Questions & Addendums
- Vendor Management
- Project Approvals
- Proposal evaluation and ranking by UES
- Vendor presentations
- Automation Partner selection
- Best and Final Offer/Bid Award
- Contract Negotiations
- Terms & Conditions
- Issue NTP for construction
PROJECT CONSIDERATIONS

Contracting
- Design-Build/EPC
- Competitive Sealed Proposal
- Contractors/Subcontractors
- State and University Terms

Technology/Platform
- Existing Controls
- Existing Third Party Components (SEL, PI, Cisco, etc.)
- DCS, PLC, Hybrid, Modern DCS

Delivery and Integration
- Vendor Led
- System Integrator
- EPC/Design Build Firm
UEP PROJECT SCOPE OF WORK

CONTROL SYSTEM MODERNIZATION

Upgrade or replace existing Emerson Ovation distributed control system
- Hardware and software
- Maintain redundancy
- Improve data access and sharing
- Maintain and improve upon third-party connectivity

Provide package design, drawings, installation, startup and commissioning

Utilize either pre-qualified vendor Emerson Ovation DCS or replacement with Rockwell
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<tr>
<th>Campus</th>
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<th>Location</th>
<th>Drop No</th>
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<th>OEM Interface</th>
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<td><strong>TOTAL</strong></td>
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<td></td>
<td><strong>6,048</strong></td>
<td><strong>13,147</strong></td>
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**15 CONTROLLERS**
- 9 Ovation
- 6 Q-Line

**6 RIO**
- 4 Ovation
- 2 Q-Line
- 2 Combined

**3 EXTENDED IO**
- 1 Ovation
- 2 Q-Line

**5 ALLEN BRADLEY**
- 2 ControlLogix
- 1 CompactLogix
- 2 SLCs
Over 13,000 IO from OEM controllers networked via communication gateways
• Unified platform that delivers the functionality required
• Single technology environment with a smaller toolset
• Enhanced asset visibility
• Limit foreign device interfaces between disparate systems
• More effective resource skillset
• High Availability Graphics to optimize the operation experiences
• System Architecture Diagram
• Hardware Design Document
• Functional Specification
• System Design Specification
• FAT Test Procedure
• Startup Test and Acceptance Checklist
• O&M Manual
• Training Manuals for: Operators, Engineers, Administrators
<table>
<thead>
<tr>
<th><strong>EXPECTED OUTCOME</strong></th>
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</thead>
<tbody>
<tr>
<td>1. Rapid system deployment</td>
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<tr>
<td>2. Simplified Commissioning</td>
</tr>
<tr>
<td>3. Faster time to operation</td>
</tr>
<tr>
<td>4. Simpler installation coordination</td>
</tr>
<tr>
<td>5. Future ready</td>
</tr>
<tr>
<td>6. Secure and resilient</td>
</tr>
<tr>
<td>7. Informative reporting</td>
</tr>
<tr>
<td>8. Lower Total Cost of Ownership (TCO)</td>
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</table>
Rockwell Automation has extensive experience and a large installed base in the Campus Energy Ecosystem

- Leading automation player in Campus Utilities
- Ability to mitigate risk on the project schedule

Products and services are helping Universities today

- Provide Scalable architecture
- Enhanced Platform/technology capabilities
- Heightened Cyber Security

Life Cycle support

- Low Total Cost of Ownership
- Scalable and Long-term support capability
TYPICAL FUTURE STATE

Energy Inputs
- 3 air compressors
- 4 Free Cooling
- 1 TESS
- 12 Electrical Driven Chillers
- 3 Steam Driven Chillers

Energy Production & Optimization Model
- Fuels & Fans
- Boilers
- Steam
- Hot Water
- Cogen
- HRSG
- Electricity

Energy Supply

Campus Buildings

DISTRIBUTION

Energy demand

DEPARTMENT FINANCIAL ALLOCATION

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