## EMP Campus Visits

<table>
<thead>
<tr>
<th>Campus</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAMUC</td>
<td>May 21 – 24</td>
</tr>
<tr>
<td>TAMUK</td>
<td>June 11 – 14</td>
</tr>
<tr>
<td>TAMUS CFO Quarterly Meeting</td>
<td>July 18</td>
</tr>
<tr>
<td>TAMUCC</td>
<td>July 23 – 26</td>
</tr>
<tr>
<td>TAMUT</td>
<td>August 20 – 23</td>
</tr>
<tr>
<td>PVAMU</td>
<td>September 3 – 6</td>
</tr>
<tr>
<td>TAMUG</td>
<td>September 24 – 27</td>
</tr>
<tr>
<td>WTAMU</td>
<td>October 8 - 11</td>
</tr>
<tr>
<td>TAMUS EMP Workshop</td>
<td>October 16-17</td>
</tr>
<tr>
<td>TAMUCT</td>
<td>November 5 - 6</td>
</tr>
<tr>
<td>TSU</td>
<td>November 6 - 9</td>
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<tr>
<td>TAMUS CFO Quarterly Meeting</td>
<td>November 13</td>
</tr>
<tr>
<td>TAMUSA</td>
<td>December 10-11</td>
</tr>
<tr>
<td>TAMIU</td>
<td>December 11-14</td>
</tr>
</tbody>
</table>
TAMUS EMP Objectives

- Establish a framework and gain support
- Develop energy consumption and cost baseline
- Identify capabilities, opportunities and targets
- Implement ‘low hanging’ energy consumption reduction opportunities
- Identify opportunities for organizational, operational and efficiency improvements
- Establish and manage ongoing program to ensure high quality service at most effective cost
EMP Phase 1

- Visit each campus to evaluate & identify opportunities
  - Metering, monitoring and trending capability
  - Building Automation System (BAS) capabilities
  - HVAC scheduling and setback opportunities
- Verify data and establish baseline EUI
- Leverage existing capabilities to optimize
- Establish and communicate standards and support
- Reduce consumption nights, weekends & holidays
EMP Phase 2

- Develop target EUI and ECI with each campus
- Report monthly and annual campus EUI performance
- Share performance with management and constituents
- Develop Energy Stewardship Program at each campus
- Identify cost saving opportunities available through operational improvement & equipment/system upgrade
- Establish System-wide standard for energy efficiency 20 percent better than minimum required by ASHRAE 90.1
- Ensure effective ongoing communication and support
EMP Phase 3

- Ensure effective scheduling in all buildings
- Fully leverage BAS and temperature setbacks
- Optimize HVAC and plant operation
- Improvements to maintain precise operating standards
- Identify ECRM upgrades needed at each campus
- Develop program to implement ECRM upgrades

Leverage Existing Data and information

- Ensure meters and data are accurate
- Data-driven reporting and management
- Optimize resources to maximize results
Campus Growth and Energy Consumption
Texas A&M University, College Station, Texas

Energy consumption per GSF reduced by 40 percent over 10 year period (FY02 - FY12)
$140 million in purchased energy cost avoidance

Requires continuous optimization and improved operational efficiency

Significant growth in campus square footage

Campus Energy Consumption

Campus Square Footage

Fiscal Year

Total Campus (million GSF)

Total Campus Energy Consumption (trillion Btu)
$140 million cost avoidance realized over 10 years (from FY02 baseline through FY12)

Achieved 40 percent reduction of energy consumption per GSF over ten years (from FY02 baseline through FY12)

EAP 2012 goal is to reduce overall EUI 20% over 5 years (from FY10 baseline)

Fiscal Year

Notes: FY10 through FY15 data projected with new CHP operating in FY12
General Services Complex

<table>
<thead>
<tr>
<th>Status</th>
<th>#</th>
<th>Building</th>
<th>GSF</th>
<th>EUI</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>1800</td>
<td>general services complex</td>
<td>203,369</td>
<td>119</td>
<td>$450,971</td>
</tr>
</tbody>
</table>

[Graph showing energy use and cost trends from 8/2011 to 8/2012]
Evans Library

Status | #   | Building          | GSF    | EUI | Annual Cost
-------|-----|-------------------|--------|-----|---------------
       | 0468| evans library     | 712,093| 167 | $2,075,027    

Last Two Weeks Profile Summary for Bldg 1800 GENERAL SERVICES COMPLEX

Electricity in kWh

Consumption Profile

Average Consumption per thousand sq.ft. Profile

Chilled Water in mBtu

Consumption Profile

Average Consumption per thousand sq.ft. Profile
System Performance

- **System Energy Use Index**
- **System Energy Cost Index**

Campus Performance

- **Campus Energy Performance**
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- **Campus Consumption**
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

Building Performance

- **Building Energy Use Index**
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- **Building Consumption**
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- **Building Data Quality**
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M
System Performance

- System Energy Use Index
- System Energy Cost Index

Campus Performance

- Campus Energy Performance
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Campus Consumption
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

Building Performance

- Building Energy Use Index
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Building Consumption
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Building Data Quality
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M
Texas A&M University-Texarkana Energy Use Index

Texas A&M University-Texarkana Energy Cost Index

<table>
<thead>
<tr>
<th>Date</th>
<th>Campus Size (GSF)</th>
<th>Campus Consumption (mmBtu)</th>
<th>Campus Cost ($)</th>
<th>Energy Use Index EUI (mBtu/BSF)</th>
<th>Energy Cost Index ECI ($/Btu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-11</td>
<td>326,668</td>
<td>5,806</td>
<td>$37,249</td>
<td>17.77</td>
<td>$0.11</td>
</tr>
<tr>
<td>Nov-11</td>
<td>326,668</td>
<td>5,924</td>
<td>$35,905</td>
<td>18.13</td>
<td>$0.11</td>
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<tr>
<td>Dec-11</td>
<td>326,668</td>
<td>6,930</td>
<td>$41,931</td>
<td>21.22</td>
<td>$0.13</td>
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<tr>
<td>Jan-12</td>
<td>326,668</td>
<td>6,470</td>
<td>$39,537</td>
<td>19.81</td>
<td>$0.12</td>
</tr>
<tr>
<td>Feb-12</td>
<td>326,668</td>
<td>5,831</td>
<td>$36,799</td>
<td>17.65</td>
<td>$0.11</td>
</tr>
<tr>
<td>Mar-12</td>
<td>326,668</td>
<td>6,353</td>
<td>$38,686</td>
<td>19.48</td>
<td>$0.12</td>
</tr>
<tr>
<td>Apr-12</td>
<td>326,668</td>
<td>5,030</td>
<td>$36,601</td>
<td>17.65</td>
<td>$0.11</td>
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<tr>
<td>May-12</td>
<td>326,668</td>
<td>5,602</td>
<td>$36,182</td>
<td>17.15</td>
<td>$0.11</td>
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<td>Jun-12</td>
<td>326,668</td>
<td>4,719</td>
<td>$33,768</td>
<td>14.45</td>
<td>$0.10</td>
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<td>Jul-12</td>
<td>326,668</td>
<td>5,439</td>
<td>$39,673</td>
<td>15.65</td>
<td>$0.12</td>
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<td>Aug-12</td>
<td>326,667</td>
<td>5,111</td>
<td>$37,236</td>
<td>15.64</td>
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<td>Sep-12</td>
<td>326,667</td>
<td>4,101</td>
<td>$32,949</td>
<td>12.55</td>
<td>$0.10</td>
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</table>
Campus Energy Performance for the last 12 months

Texas A&M University-Texarkana Electricity Meter # 10176989643715500

Consumption Profile

<table>
<thead>
<tr>
<th>Date</th>
<th>Consumption (mmBtu)</th>
<th>Cost ($)</th>
<th>Rate ($/mmBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov-11</td>
<td>19/20</td>
<td>10/17</td>
<td>0.04</td>
</tr>
<tr>
<td>Dec-11</td>
<td>11/17</td>
<td>19,172.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Jan-12</td>
<td>02/21</td>
<td>22,761.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Feb-12</td>
<td>02/21</td>
<td>22,578.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Mar-12</td>
<td>02/21</td>
<td>20,983.00</td>
<td>0.05</td>
</tr>
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<td>Apr-12</td>
<td>02/21</td>
<td>24,033.00</td>
<td>0.05</td>
</tr>
<tr>
<td>May-12</td>
<td>02/21</td>
<td>23,140.00</td>
<td>0.05</td>
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<tr>
<td>Jun-12</td>
<td>02/21</td>
<td>23,167.00</td>
<td>0.05</td>
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<tr>
<td>Jul-12</td>
<td>02/21</td>
<td>22,002.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Aug-12</td>
<td>02/21</td>
<td>27,341.99</td>
<td>0.06</td>
</tr>
<tr>
<td>Sep-12</td>
<td>02/21</td>
<td>24,069.66</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Total: 5,155,200 $250,099.14 $0.05

List of Buildings Served by Meter # 10176989643715500

Building 101: SCIENCE AND TECHNOLOGY 44,572 GSF
Building 102: UNIVERSITY CENTER 181,450 GSF
Building 103: CENTRAL UTILITY PLANT 14,729 GSF
# Texas A&M University-Texarkana Energy Performance

## Energy Consumption and Cost Profile

**Consumption Profile**

![Graph showing consumption profile over 12 months]

**Cost Profile**

![Graph showing cost profile over 12 months]

### Table: Electricity Consumption and Cost Breakdown

<table>
<thead>
<tr>
<th>Start Date</th>
<th>End Date</th>
<th>Consumption (mmBtu)</th>
<th>Cost ($)</th>
<th>Rate ($/mmBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov-11</td>
<td>10/29</td>
<td>85,400</td>
<td>$4,341.00</td>
<td>$0.05</td>
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<tr>
<td>Dec-11</td>
<td>11/17</td>
<td>108,800</td>
<td>$5,340.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>Jan-12</td>
<td>12/21</td>
<td>92,400</td>
<td>$4,334.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>Feb-12</td>
<td>01/24</td>
<td>91,200</td>
<td>$4,537.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>Mar-12</td>
<td>02/21</td>
<td>90,000</td>
<td>$4,572.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>Apr-12</td>
<td>03/28</td>
<td>85,800</td>
<td>$4,304.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>May-12</td>
<td>04/28</td>
<td>81,600</td>
<td>$4,035.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>Jun-12</td>
<td>05/29</td>
<td>75,000</td>
<td>$3,910.00</td>
<td>$0.05</td>
</tr>
<tr>
<td>Jul-12</td>
<td>06/25</td>
<td>93,000</td>
<td>$5,065.11</td>
<td>$0.05</td>
</tr>
<tr>
<td>Aug-12</td>
<td>07/27</td>
<td>78,200</td>
<td>$4,240.18</td>
<td>$0.05</td>
</tr>
<tr>
<td>Sep-12</td>
<td>09/25</td>
<td>100,200</td>
<td>$5,476.07</td>
<td>$0.05</td>
</tr>
<tr>
<td>Oct-12</td>
<td>09/24</td>
<td>96,600</td>
<td>$4,935.56</td>
<td>$0.05</td>
</tr>
</tbody>
</table>

**Total:** 1,081,200 mmBtu $55,069.92 $0.05

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**List of Buildings Served by Meter # 1017639644031100**

Building 104: BRINGLE LAKE VILLAGE

85,915 GSF
System Performance

- System Energy Use Index
- System Energy Cost Index

Campus Performance

- Campus Energy Performance
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Campus Consumption
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

Building Performance

- Building Energy Use Index
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Building Consumption
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Building Data Quality
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M
System Performance

- System Energy Use Index
- System Energy Cost Index

Campus Performance

- Campus Energy Performance
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Campus Consumption
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

Building Performance

- Building Energy Use Index
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Building Consumption
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M

- Building Data Quality
  - Central Texas | College Station | Commerce | Corpus Christi | Galveston | Health Science Center | International | Kingsville | Prairie View | San Antonio | Tarleton | Texarkana | West Texas A&M
Building Consumption Profile
from 10/8/12 to 10/15/12

Heating Hot Water Consumption (mmBTU)

Average Consumption Profile

Hour of Day

Weekday  Weekend
<table>
<thead>
<tr>
<th>PROCUREMENT</th>
<th>TRANSMISSION</th>
<th>PRODUCTION</th>
<th>DISTRIBUTION</th>
<th>METERING &amp; BILLING</th>
<th>DEMAND-SIDE MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate and nominate campus energy requirements</td>
<td>TAMU owns: Domestic water transmission system</td>
<td>Management of: Four campus utility plants</td>
<td>TAMU owns campus delivery systems: 12.5kV electrical</td>
<td>Over 2,000 revenue-quality meters in over 500 buildings</td>
<td>First response to ensure customer comfort</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>System Building utility plant</td>
<td>Domestic water (hot &amp; cold)</td>
<td>Manage utility rate model and rate setting</td>
<td>Building automation and HVAC regulation</td>
</tr>
<tr>
<td>Review and recommend payment of energy invoices</td>
<td>ERCOT/ BTU owns: 138kV electrical transmission system</td>
<td>Solid Waste &amp; Recycling</td>
<td>Chilled Water</td>
<td>Cost recovery for all utilities and energy – both operating budget and purchased energy</td>
<td>Energy stewardship &amp; building system optimization</td>
</tr>
<tr>
<td>Serve on TAMU energy risk management committee</td>
<td>UES coordinates closely with Atmos and ERCOT/ BTU</td>
<td>2 wastewater treatment facilities</td>
<td>Heating Hot Water</td>
<td>Direct customer invoicing through FAMIS</td>
<td>Design review and capital project coordination</td>
</tr>
</tbody>
</table>

Atmos owns: LP & IP natural gas delivery system

Energy efficiency improvement services

Key performance indicators and resource management
Jim Riley, Executive Director
ph: 979-845-1210
jimriley@tamu.edu

Les Williams, Director
ph: 979-862-4470
leswilliams@tamu.edu

Rosemary Shaunfield, Executive Assistant
ph: 979-458-1588
rshaunfield@utilities.tamu.edu

Website
http://utilities.tamu.edu
Recommended EMP Operating Standards

- CHW Supply Temperature 42 to 46 F – adjusted based on outside air temperature
- HHW Supply Temperature 130 to 170 F – adjusted based on outside air temperature
- Building Space Temperatures & Humidity –
  - Cooling – 74 to 76 F occupied hours, up to 85 F while unoccupied
  - Heating – 69 to 71 F occupied hours, down to 50 F while unoccupied
  - Relative Humidity – maintain below 60%
- Typical HVAC run-time for buildings during occupied hours – 6:00am-6:00pm, M-F
- Typical unoccupied hours – 6:00pm to 6:00am, M-F, and all weekend
- Unoccupied hours extended as required to meet essential occupant needs
- Requests for extended building HVAC run-time must be closely scrutinized with cost/benefit consideration
- Requests for exceptions should be reviewed and approved by management
- Senior management support is essential to establish and maintain clear standards and emphasize program importance
12 Steps to Implement a Successful EMP

Initial 6 Steps are Low Cost with High Return on Investment
- Establish standards & develop thorough understanding of opportunities for improvement
- Engage senior management & campus community to share vision and get commitment
- Educate, inform, and enlighten campus community on the benefits of the EMP
- Schedule building HVAC off when not required. Verify & closely manage scheduling program
- Turn off lights, office equipment, lab equipment, etc. when not required
- Close fume hoods when not in use and ensure proper operation

Next 6 Steps Require More Time and Investment, but Pay Significant Dividends
- Optimize utility plant production and distribution systems
- Optimize building operating efficiency with energy system retro-commissioning
- Proper air flow & balance in laboratories. Maintain 8 ACH occupied, 4 ACH unoccupied
- Meter & monitor utility consumption. Report results and ensure ongoing progress
- Identify needed capital upgrades that will improve services and reduce consumption
- Reinvest savings in energy systems and facilities to achieve optimal performance
Effective Capital Planning

Comprehensive utilities and energy plan

- Update plan every five years
- Utility infrastructure – includes production & distribution
- Building energy systems and automation
  - Building design standard (ASHRAE 90.1-2010 establishes minimum)
  - New construction – target 20% more efficient than minimum
  - Major renovation – target 15% more efficient than minimum
- Establish capital renewal and upgrade program
- Include debt service and depreciation in cost recovery
- Reinvest savings to improve infrastructure and facilities
Energy Action Plan (EAP) 2015

Energy Stewardship Program (ESP)
Awareness, Education, Outreach and Engagement
Comprehensive Building Automation & HVAC Management
Precise Utility Metering, Data Management, & Cost Recovery
Building Energy Retro-Commissioning
Server Room Consolidation and Virtualization
Utilities and Energy System Capital Planning
Utility Production and Distribution Optimization
Academic and Research Collaboration and Partnering
Building Energy Efficiency Upgrades and Optimization
Sustainability and GHG Reduction (Environmental Benefit)
Energy Action Plan 2015 Advisory Committee