TEXAS WOMAN'S UNIVERSITY
EST. 1901

Building On The Past

With an Eye on the Future

What We Did

- In 2001 TWU took it's first major step toward environmental neutrality by entering into the largest Energy Performance Contract, at that time, in the State at $19.5 million.
- This resulted in several million tons of CO_2 in the first decade – that was equivalent to removing in excess of 63,000 cars from the road or 78,000 trees saved. Cost savings through that period exceeded twenty four million and continues.
- We knew that to successfully rebuild and expand aging facilities and infrastructure our excitement and vision required a different approach.
- The FMC strategy began with a simple campus wide objective of:
  - Securing the building envelopes (roofing and weatherproofing)
  - Addressing code requirements (life safety, ADA, and fire protection), and
  - Reducing deferred maintenance and increasing capital renewal initiatives.
  - Significantly emphasizing a sustainable campus while enhancing the learning and teaching environment.
- In the process for meeting our future needs we began with needs assessments, evaluations of academic programs, projections of growth patterns, consulting with campus constituencies, facilities audits, and improved operational maintenance requirements.

How We Did It

- We knew that from past experience that performance contracting focused mainly on energy savings while deferred maintenance typically suffered.
- To be successful we had to address our substantial Deferred Maintenance and lack of energy efficient facilities through Capital Renewal and major renovation programs.
- We developed and fully implemented our Enterprise Integration System strategies which takes advantage of open protocol systems to assure more exacting energy control without the impediments of a proprietary system. This flexibility resulted in greater monetary and energy savings.
- All design and construction specifications, standards, etc. were revised to incorporate enterprise integration strategies, earth-friendly construction processes and materials, cleaning products, and maintenance solutions that emphasized conservation.
- We have been rewarded with two LEED Silver Certified buildings.
- In terms of systems integration (which is the consolidation of all building controls and monitoring systems into a common user interface and data sharing utility) few, if any, facilities had accomplished this level of control at that time.

The Campus was Clamoring for Recycling

Since, we implemented a successful paper and plastic recycling program and then went a step further. **Energy Performance Contracts** are derived based on energy and construction cost savings; Our project abandoned in place 21 old chillers, a few cooling towers, pumps and switchgear. FMC hired a vendor to remove and recycle the spent units. The salvage contractor was required to provide receipts of recycled materials.

- Recycled Steel @ 371,760 pounds (185.88 tons) and
- Recycled Copper @ 39,908 pounds (19.954 tons).

Using data published in the June 1993 edition of School and College Magazine we equivalized the unused and abandoned pieces of equipment and publicized the data for the university community.

Based on that, we estimated that TWU contributed to saving approximately:

- 464,700 pounds or 232.4 tons of iron ore,
- 18,588 pounds or 9.3 tons of coal, and
- 7,435.2 pounds or 3.72 tons of limestone for every ton of steel recycled.

Also, using the steel industry's equivalency of recycled product to electrical power, one ton of recycled steel saves:

- 642 kwh of electricity
- 1.8 barrels of oil
- 10.9 million Btu's of energy, and
- 4 cubic yards of landfill space.

Based on that data we surmised FMC's actions contributed to savings of approximately:

- 119,335 kilowatt-hours of electricity
- 335 barrels of oil
- 2,026 million Btu's of energy, and
- 744 cubic yards of landfill space
- An additional cost savings on landfill tipping fees at $41 per ton, were realized as well.

In 2004 We Began…

Our planning to build a state-of-the-art education facility in Houston. Armed with new strategies for energy success and driven by a strong desire to decouple ourselves from regressive proprietary system architecture in building automation components that stifle energy savings and operational creativity.; we embarked on a "Sustainable Way of Life".

Texas Medical Center
Houston, Texas

BACnet LON Modbus

Sustainability As A Way of Life

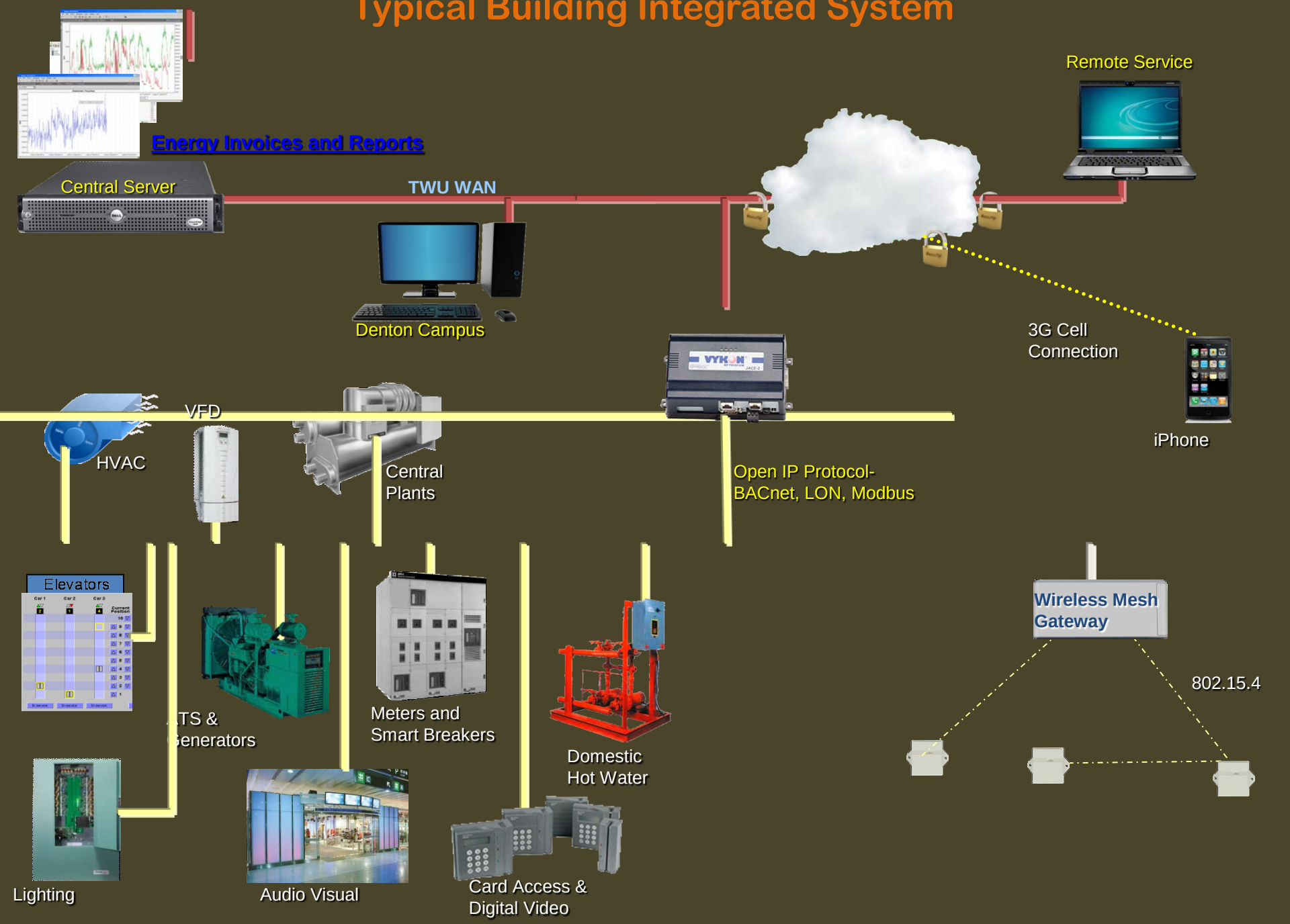
The need that prompted us to look at embedded control systems	❖ The concept grew out of years of frustration with a low bid process that left plant operations personnel with multiple front ends and no common user interface . This limited operational creativity, energy savings, and more importantly, control. ❖ Our overall vision and objective has always been to maximize energy savings and be able to monitor and control all systems and components on our terms. ❖ Proprietary systems were an impediment to dramatic energy savings. ❖ By moving to the more flexible open protocol platform, the buildings processor based systems could be integrated for less and provide endless possibilities to manipulate savings.
How many buildings	❖ All major renovation and/or new construction projects were candidates for the tridium platform first installed in Houston. ❖ There are four new or recently completed construction projects, two on the Denton Campus (the Ann Stuart Science Complex and the Fitness and Recreation Center) and our Houston and Dallas vertical Campuses in a building. ❖ Other facilities are retrofitted separately if no renovation work is needed.

How we went about designing our projects	❖ We structured a team process for programming that consisted of one or more representatives from the college, school, or department(s) occupying the building lead by our facilities management staff. ❖ Each program of requirements provided a conceptual outline of user needs, operational standards, cutting edge learning and teaching environments, and support spaces. ❖ A competitive selection process for design was and still is accomplished using the program team results and the university's increasingly stringent design and construction standards. ❖ We also engaged a consultant to assure that our Enterprise Integration System encompassed all processor based controls. ❖ Houston became the cornerstone for all new projects. Stricter standards evolved from lessons learned.
How we planned and carried out the implementation	❖ Bid documents for each project were modified to include the requirements for fully certified products with open protocols which were recorded by the design drawings and specifications, operational standards, and university policy. ❖ General contractors and their subs committed to the process as part of the special conditions of each project and worked closely with our independent consultant who reviewed submittals to assure that all components met the intent and operational effectiveness.

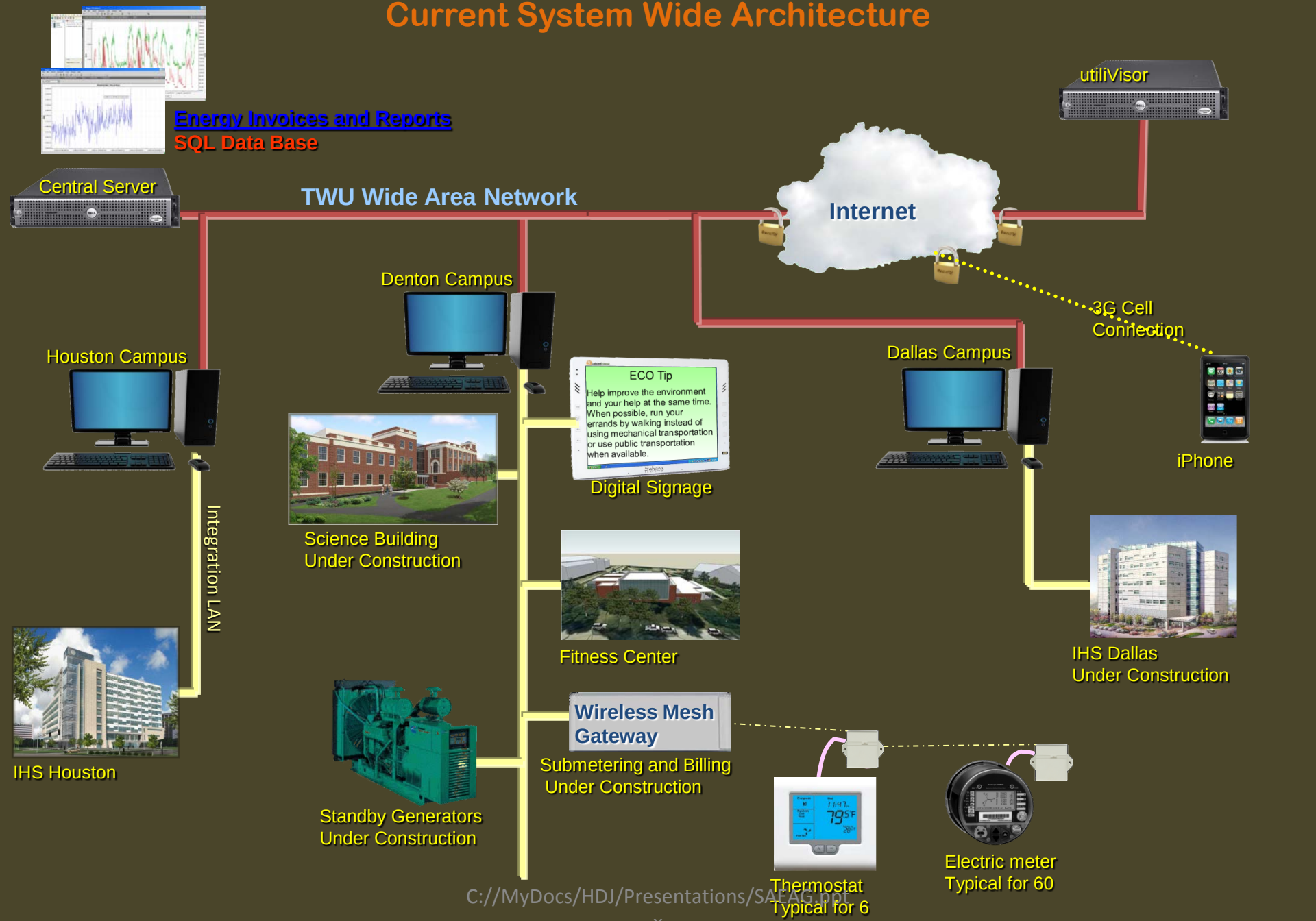
Texas Woman's University
Institute of Health Sciences –
Houston Center

- Our intent in planning this new facility was to incorporate forward thinking concepts that presented aesthetically pleasing high end materials, environmentally sound yet functional learning and teaching spaces, and cutting edge technologies in building automation systems.
- We refer to the aforementioned concept as the university's "Enterprise Integration System", our new standard.
- The Houston facilities features a bright and airy atrium, energy efficient equipment and operating systems (with open protocol), and carefully chosen construction materials and interior finishes with recycled content.
- An interesting side note about this project was the agreement that preceded construction of this facility at that time.
- Texas Woman's University conveyed its right of ownership in 2.4 acres of land with improvements to The Methodist Hospital (TMH).
- This conveyance eliminated millions of dollars in deferred maintenance, code compliance, and environmental concerns for the university.
- In exchange for TWU's conveyance TMH conveyed to TWU its vacant land (1.5 acres) and $30,000,000 to construct the new education facility.
- TMH also agreed to construct a 1,000 space parking garage at its expense contiguous to the TWU education facility. The agreement resulted in a "vertical campus" (shown).

Typical Building Integrated System



Current System Wide Architecture



What the System Consists of:

Describing the system	❖ The system includes 3D graphic floor plans for each integrated system with the ability for any authorized user to connect via the WAN. ❖ Password security with encryption allows each user to be assigned individual authority for viewing and control functions as needed by their job function. ❖ All processor based control systems are installed in a manner that enables us to provide stand-alone control. ❖ Systems are interconnected and integrated into the Enterprise Integration System. ❖ Monitoring and control devices have a consistent user interface through a standard web browser on any web enabled product with university secure WAN connectivity, <u>with no need for a software license</u>.
Notable features	❖Some key features are: • Web Based-viewing and control from your personal PC, tablet, Smart Phone • Individual Views and Functions based on authorized access • Remote alerts and alarms for all connected systems using email, text message, etc. • 3D graphics with simple navigation controls • Optimized control for all connected systems • The ability to connect to 3rd party analysis tools for fine tuning • Expandable to all other building

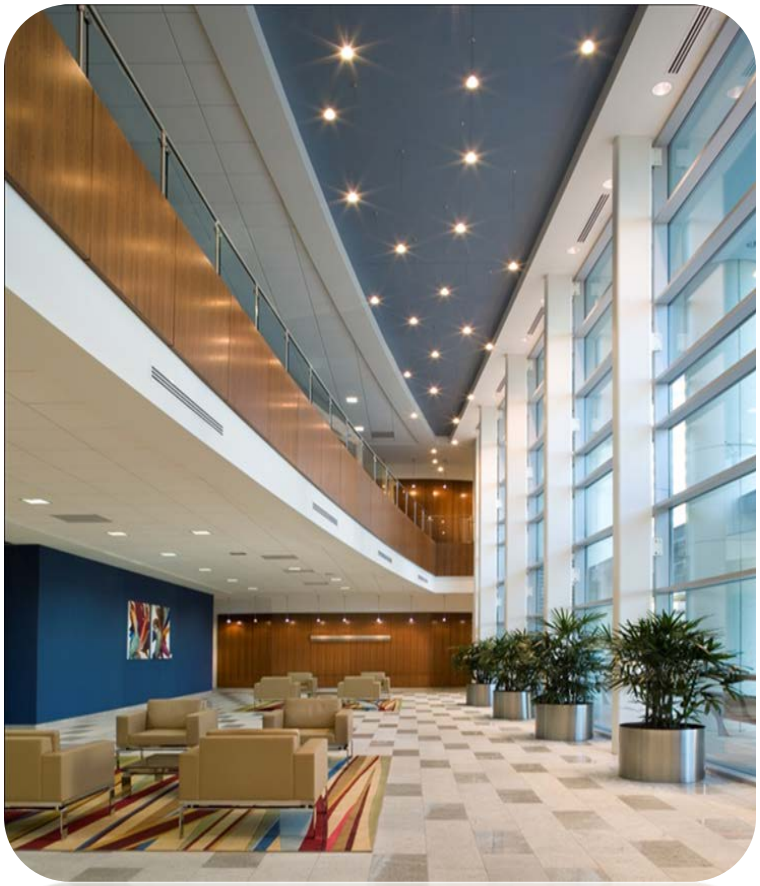
Results	❖ The requirement to certify all integrated products was a new concept that has met with some resistance, especially from companies that provide proprietary systems. ❖ It has taken very strong and firm resolve to enforce the specifications. ❖ The result is a comprehensive, standardized Enterprise Level management system that can embrace new technology as it emerges. ❖ The reaction of users is excitement!
Benefits	❖ Campus wide wireless sub metering with departmental billing. ❖ The ability to use third-party data collection systems that records all energy use in the Chiller Plant. We use Utilivisor which gathers information from electric meters, ultrasonic flow meters, variable frequency drives, chillers, and our building automation system. ❖ This information is collected in our Tridium System and uploaded to the Utilivisor servers. ❖ The information can then be retrieved in a Utilivisor dashboard to produce graphs and/or make comparisons to analyze plant performance in real time or make historical comparisons. ❖ We set up benchmarks, if a breach is detected an email or text notifications are sent to the technician. ❖ Utilivisor allows us to make refinements to the system continually and measure the success of those refinements. ❖ One had the distinction of being the first public university LEED Certified Fitness and Recreation Center in the State of Texas. * ❖ Authorized users can control our buildings from anywhere in the world. * http://www.twu.edu/twunews/twu-brags.asp

Texas Woman's University

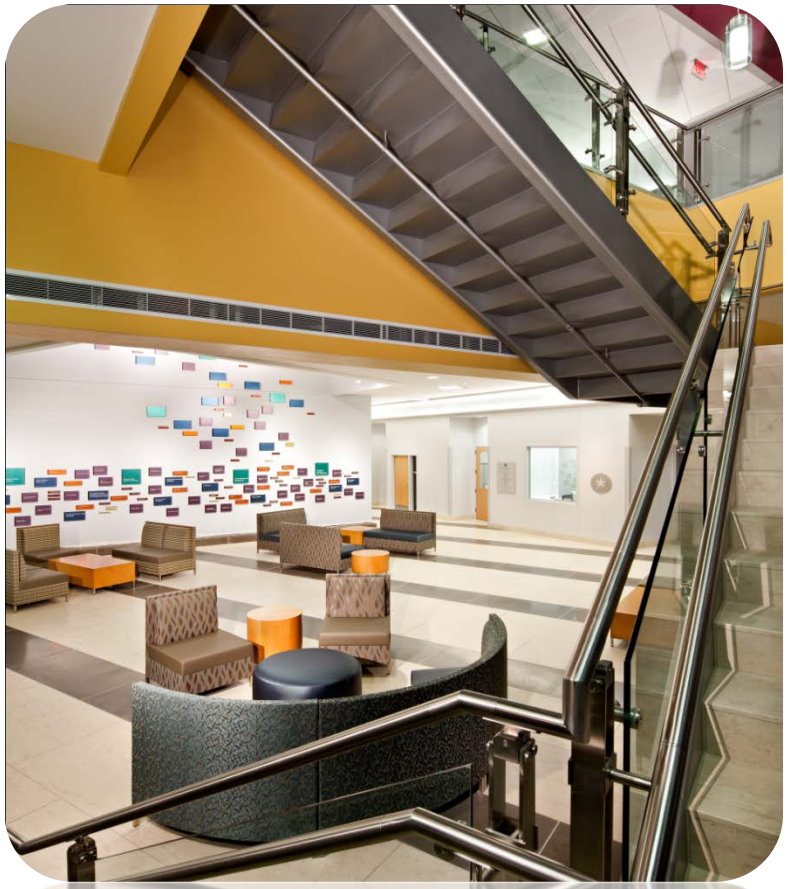
Institute of Health Sciences
Houston Center

T. Boone Pickens Institute of Health Sciences-Dallas Center

Texas Woman's University



Houston Center Lobby



Dallas Center Lobby

Texas Woman's University

Partnership Recognition
Houston Campus

Partnership Recognition
Dallas Campus

Texas Woman's University

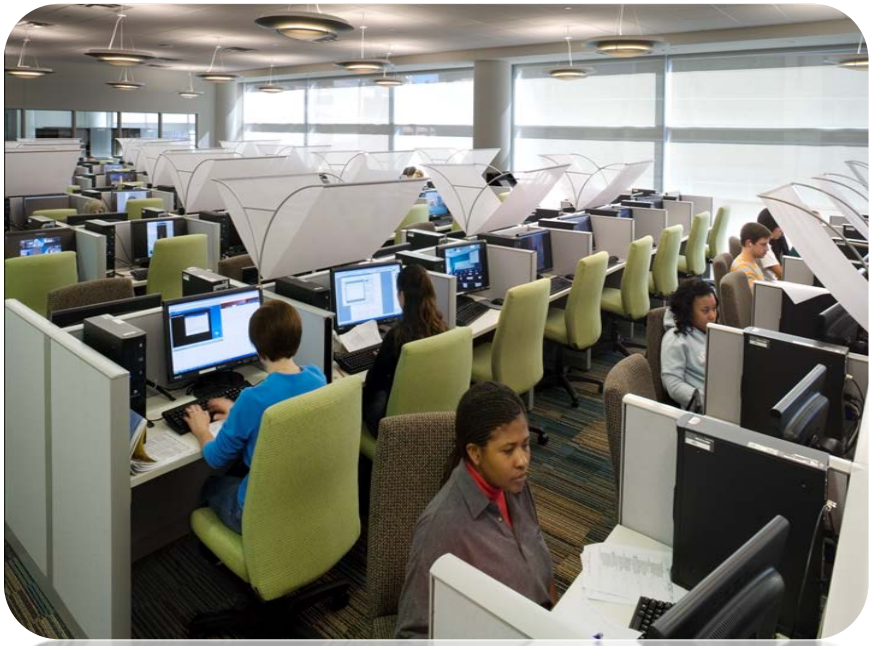
Nursing Laboratories

Houston Center

Dallas Center

Texas Woman's University

Computer Laboratories



Houston Campus

Dallas Campus

What We Have Accomplished

Institute of Health Sciences – Houston Center
Completed: 2006 Cost: $39,491,703

Ann Stuart Science Complex
Completed: 2011 Cost: $26,039,473

LEED SILVER

Fitness and Recreation Center
Completed: 2011 Cost: $12,668,839

LEED SILVER

Institute of Health Sciences – Dallas Center
Completed: 2010 Cost: $54,842,402

To Us Sustainability Means Continuing to Refine:

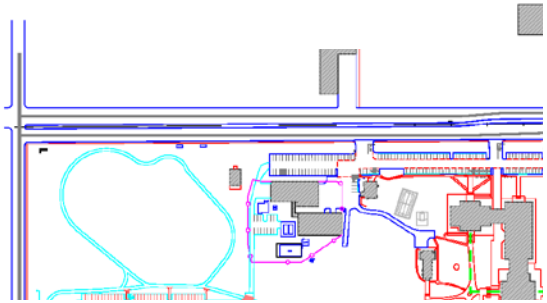
- Design and construction standards and specifications were revised to incorporate enterprise integration strategies, earth-friendly construction processes and materials, cleaning products, and maintenance solutions that emphasize conservation.
- Targeted building envelope restorations, fire code corrections, infrastructure deficiencies, life safety, ADA, and modernization of elevator carrier systems.
- A fully implemented Enterprise Integration System that takes advantage of open protocol MEP components and control systems to assure more exacting energy control. This flexibility results in great monetary savings.
- Roof replacements (approximately 65% to date) on the Denton Campus.
- Enhanced campus safety and security
- Up to 100% green energy on the Denton and currently 40% in Dallas and Houston striving for 100%
- High end finishes with recycled content
- Innovative strategies and concepts that increase energy efficiency and save dollars.
- Energy system innovations and infrastructure management
- Succession planning and
- A “Sustainable Way of Life” on all campuses

OPEN protocol Enterprise Level Integration creates limitless possibilities…

Our Future

TEXAS WOMAN'S UNIVERSITY
Denton / Dallas / Houston

DEVELOPMENT PLAN



Campus Development Implementation

Phase I Projects 2012 – 2017	
Chiller Capacity Upgrades	$3,135,950
Fire Code Mandates	$2,154,969
Satellite Chiller Plant	
Sidewalk and Driveway Infrastructure Improvements	$2,682,881
Old Main Roadway Improvement	$752,000
Stark/Guinn Envelope	$1,870,590
Denton Parking Garage (West)	$10,000,000
New Student Housing (Freshman & Sophomore)	$52,000,000
Denton Parking Garage (East)	$10,000,000
New Student Union	$54,267,143

Phase II Projects 2017 - 2027	
Old Main Renovation (Phase II)	$17,000,000
New Science and Technology Center	$46,000,000
Demolition of Graduate Research Building	$3,700.000
Demolition of Patio Building	$1,500,000
New Student Housing (Junior & Senior)	$50,000,000
Demolition of Jones Hall	$4,500,000
Repurpose Existing Union Building	$37,000,000
Parking Garage (North)	$11,000,000
Athletic and Sports Facility	$3,500,000