

Green Bean Analysis, LLC

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Sustainability Initiatives – 1989-2009 TCU Physical Plant September 1, 2009

Sustainability has many definitions. One of the most popular is “Using the resources you need now without compromising the ability of future generations to have the resources they will need then.” To be sustainable requires the efficient use of all resources including natural, human, economic, synthetic and societal resources. While acknowledging that they have not reached sustainability yet, the Texas Christian University Physical Plant team has spent years improving the efficient use and re-use of all its resources – natural/synthetic, human/societal and financial/economic. This report will highlight the progress made by the TCU Physical Plant team over the last twenty-one years and point to potential accomplishments in the near future.

Over the last two decades, the campus has enjoyed significant growth in student and faculty population along with building square footage increases of 56.25% through new construction and renovation. Concurrently the campus facilities are being used more days and hours per day than was the norm in the early ‘90s. Through this time period, the Physical Plant team has completed numerous upgrades and improvements to campus buildings, landscaping, and maintenance practices to make TCU more efficient and sustainable. The efficiencies implemented led to lower operating costs, reduced resource consumption and improved sustainability of the campus. Since savings -- the amount of energy, water and materials not used -- are not normally tracked by any institution, we cannot provide an academically precise number for the costs and resources saved over the last two decades. However, based on the ten to fifteen percent of the quantifiable items listed later in this report, a conservative estimate for the amount saved by the TCU Physical Plant is approximately \$1.66 million in annual utility costs. Also there are one time savings for many of these projects, such as the \$198,000 in one time savings that is quantifiable from just six projects.

During this period of unprecedented campus growth and activity, the TCU Physical Plant has consistently demonstrated inspired, creative and resourceful foresight which has allowed it to achieve remarkable measures of success that far exceed the corresponding relatively modest operating budget and manpower increases it has received over that same timeframe. By creating a culture and environment where continual re-engineering and evaluation of its processes and methods have become the norm, the team has essentially been able to absorb the accompanying ever-increasing workload, despite only moderate increases in key resources.

In addition to the dollars saved, TCU’s efficiency programs have also significantly reduced greenhouse gas and vehicle emissions, the carbon footprint for the campus and potable water consumption. At the same time, recycling has increased, safety has been enhanced and campus landscaping has been markedly improved through the use of native and adapted plants. The extensive recycling program, for example, is one of the best for any major university in the country. Additionally, TCU is only the third university in the United States to receive the Cleaning Industry Management Standard (CIMS) certification for its green cleaning program – and with honors, no less – from the International Sanitary Supply Association (ISSA) which is “the leading international trade association in the cleaning industry.” Finally, TCU’s water

efficiency and landscaping programs have been reviewed by a third party and have received highly positive results. Each of these items will be addressed in more detail later in this report.

The merger of the Facility Services department with the Physical Plant provides efficiencies in communication, resource management and improves the culture of process evaluation. These combined teams can now be even more efficient with their time, natural resources and budgets. When previously separate departments collaborate on a consistent basis, ever more sustainable solutions can be found in everyday practices. Going forward, all the TCU departments, divisions and stakeholders are encouraged to communicate and work together towards the next generation of sustainability.

TCU can be proud that for the last two decades the Physical Plant has been focused on improving efficiency and reducing resource consumption. Now that sustainability has become popular with the general public, TCU can point to its long track record of being a responsible steward of resources. The programs already implemented and listed below are proof that TCU has been taking sustainably focused actions for twenty-one years.

In general, the efficiency projects that have a short payback period – less than three years – have already been completed by the Physical Plant team, which judges all current and future projects, among other factors, by the payback of the investment. The projects with the best payback are done immediately and the savings generated are used to fund longer return projects. Although the team continues to search for projects with short payback periods, unless new tools and technologies are invented the majority of the projects to be implemented in the near future will likely have a medium length payback period of three to five years.

Considering the progress already achieved by the previous implementation of efficient internal operating procedures, tools & equipment, the TCU Physical Plant team will be challenged to find the next incremental improvement required to reach benchmarks within the President's Climate Initiative Challenge. Other universities who have not been as aggressive in pursuing energy, water and resource efficiencies as TCU may have more "low hanging fruit" to harvest than TCU who implemented some of the current best practices years ago.

Energy Efficiency

The TCU Physical Plant department has implemented numerous energy efficiency programs. These energy efficiency programs often provide a good return on investment for the university but also reduce the green house gas emissions generated upstream by the energy provider's power plants. Given that most of the current energy in North Texas is generated by coal fired power plants which emit airborne pollution, all the energy efficiency programs listed below help in small incremental ways to improve our regional air quality.

It must be recognized that the campus has grown considerably over the last two decades as previously noted. The conditioned square footage for the campus buildings has increased 56.25% since 1989. In 1989, the campus had 2.23 million square feet of conditioned building space while in 2009 there is over 3.49 million square feet of conditioned building space. As was previously stated, during this time there has also been an increase in student and faculty

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population, a tightening of building code standards for environmental conditions of conditioned space plus an increase in the days and times the buildings are used on a regular basis. Also significant amounts of technology have been incorporated into the offices, classrooms and residence halls. Despite these increases, the energy consumed on a per square foot basis has only increased 18.83% from 1989-2009. In the last few years there has been marked improvement, since the total energy consumed on a per square foot basis from 2004-2009 has stayed relatively flat (1.96% increase 2004-2009).

Over the last twenty-one years, the rate charged for energy has changed significantly. Even though the amount of energy consumed on a per square foot basis from 1989-2009 has only increased 18.86% and the amount of conditioned buildings has increased 56.25%, the total utility costs have increased 249%. The Combined Energy and Gas Costs per Conditioned Square Foot (Energy Cost Index or ECI or \$/SF/YR) has been tracked since Fiscal Year 1989. During that time the ECI rate has more than doubled from \$1.05 \$/SF/Yr in 1989 to \$2.36 \$/SF/YR in 2009. If the TCU Physical Plant team had not implemented the numerous energy efficiency measures listed below, today's utility bills would be even higher.

Completed Energy Efficiency Projects:

- Boiler system upgrades provide an estimated 30% energy savings annually
- Central plant chillers (Air Conditioning systems) are high efficiency, non-ozone depleting and use CFC-free refrigerants
- All CFC refrigerants voluntarily eliminated prior to mandate deadlines
- Power factor improvement capacitors installed to remove fee penalty from utility company
 - Saves an estimated \$72,000 annually
- Night time ice storage system levels the chilled water loading energy costs. 9000 ton-hours of ice storage allows TCU to take advantage of lower night time utility rates
- Utility rates lowered due to level utility load during 24 hour period and signing 5 year utility agreement
- Infra-red surveys performed on roofs and building envelopes to identify energy loss sources in the form of air leaks and infiltration
- Energy efficient entry doors installed in major buildings
- Motion sensors extensively used for light control in classrooms, offices and administrative space
- All incandescent lights replaced with higher efficiency fluorescent fixtures
- All light ballasts replaced with higher efficiency PCB-free ballasts
- Higher efficiency heating system installed
- Higher efficiency lighting system installed campus wide
- Improved Energy Management System
- Improved pumps and motor efficiency by replacing larger electric units with smaller high efficiency units
- Improved and balanced chilled water distribution system
- Replaced old windows with energy efficient windows as needed
- Installed variable speed drives on pumps & motors

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- New energy efficient air handling units in all major buildings across campus
- Most steam heating boilers converted to more efficient and lower maintenance hot water systems
- Campus-wide HVAC closed loop chilled water system motors upgraded in 2005 resulting in annual energy savings of approximately \$47,000

Monitoring and Verification

Constant monitoring and verification insures the equipment is optimally calibrated for efficient operation. When there is a problem with the equipment, it can be identified and solved quickly to help reduce wasted energy, water and money.

- HVAC systems and chilled water loop are balanced on a regular schedule to continue to receive efficiencies
- Newer buildings have individual control and monitoring systems to individually optimize the HVAC systems
- Boiler flame and pilot light air flow trimmed for increased efficiency
- Air handler coils are cleaned regularly to assure efficient air flow

Water & Landscaping Savings

Significant water saving projects have been implemented throughout the campus both inside the buildings and in the landscape. Many millions of gallons of potable water are saved annually by the efficiency programs listed below.

- Dedicated water meter for irrigation – Saves 40% on bill annually by not paying sewage fees
- TCU had a credit with the City of Ft Worth from previous demolition projects where old water meters were removed so many of the building renovations and irrigation improvements were done with no municipal impact fees. As old facilities were removed and new larger, but more efficient facilities were installed often there was no net impact on the municipal water supply
- Installed Freeze & Rain sensors throughout campus. Rain sensors reduce irrigation watering by one third. Freeze sensors greatly improve safety of students, faculty and staff by not introducing water on freezing days
- Automatic irrigation systems improve efficiency of watering landscapes made possible by looping systems and increasing line sizes
- Run irrigation systems at night to minimize evaporative loss
- Low flow faucets, showerheads, toilets and urinals have been installed as older units needed replacing throughout the campus to reduce the potable water demand.
 - These low flow plumbing fixtures are estimated to save over 8.8 million gallons of potable water annually compared to the old fixtures
 - The water savings for the low flow fixtures reduces the campus water bill by an estimated \$27,700 annually
- Monitors have been installed to supply needed amount of water for all mechanical systems and eliminate excess

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- An irrigation audit began in June 2009 with highly positive results so far on areas tested
 - Plants have been selected to be adapted to local conditions to minimize water requirements, herbicides and pesticides
 - Extensive use of low requirement ground cover
 - Winter grass over-seeding was minimized
 - Soil samples show healthy water absorption and retention
 - Large canopy trees provide shade, reduce ground level temperatures and reduce evaporation
 - Irrigation water meters are installed to reduce water sewage costs
 - Rain and freeze sensors are installed to conserve water, improve safety for pedestrians and vehicles plus reduce campus liability
- On-site growth and planting of flowers/plants saves 55% compared to hiring commercial landscape maintenance firm
- Renovating landscape on annual basis using in-house resources is a fraction of the outside contractor cost
- Modern grounds keeping equipment saves 25% in man-hours for mowing
- Reduced pesticide and herbicide use by installing native and adapted plants

Recycling

The recycling program at TCU is extensive though it may not be obvious to the casual observer. TCU utilizes multiple mixed use containers for gathering the recycling material which is then sorted off-site. Each year approximately 50%-75% of the entire potential recyclable waste stream on campus is recycled. An impressive 95% of the non-residential paper waste stream is recycled. Details of the campus recycling program can be found below.

- 75% of paper waste stream is recycled, with 95% of the non-residential paper waste stream being recycled. (See explanation below on residential hall recycling)
- Converted twelve trash dumpsters to recycling dumpsters in early 1990s
 - Distributed throughout the campus and painted a distinctive color
 - Pay reduced fee for recycling dumpsters vs. trash dumpsters
 - An estimated \$30,000-\$35,000 is saved annually by using recycling dumpsters
- Blue recycling bags are supplied to all dormitories for student use
- 60+% of tree trimmings and yard wastes are recycled and reused as mulch
- Installed compactors on site and use more efficient trucks which reduced number of trips to the dump by four times
 - Eliminated need for two large compactor trucks
 - Less emissions due to fewer truck trips
 - Less chance of an accident
 - Less fuel costs
- Recycle carpet from renovation projects
- Reused wood from trees harvested on campus to make lectern, coasters, pens, and commemorative items to be used on campus
- Prior to 1995 a Recycling Area was designated for the recycling of excess material. A Hazardous Material shed was built for the storage and separation of batteries, hazardous chemicals, asbestos, mercury, and paint. The hazardous material is returned to the

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manufacturer for proper reuse or destruction. Scrap metal, computers and monitors are also recycled.

Items recycled & reused on campus or returned to manufacturer for recycling:

- Air Conditioning units
 - Aluminum cans
 - Asbestos
 - Batteries
 - Cardboard
 - Carpet
 - Computers, monitors and printers
 - Copper, brass, steel, aluminum
 - Electrical transformers
 - Freon
 - Furniture – desks, chairs, filing cabinets
 - Glass bottles, shards and remnants
 - Grass and tree trimmings are chipped and composted
 - Hazardous materials
 - Mercury
 - Motor oil
 - Paint
 - Paper
 - Parking bumpers
 - Parking lot lights
 - Pavestones
 - Plants
 - Scrap metal
 - Tires
 - Wood
- During football games bottles and cans are collected and recycled using green bins and recyclable cardboard containers
 - SODEXHO, the campus food service contractor, manages its own recycling of food waste and waste reduction
 - Prior to 1995 a wash rack was installed to wash all the campus vehicles. A sand trap was installed to capture all the oil, gas, metal and other waste particles so these pollutants would not end up downstream in the municipal water supply. The dirty sand traps are recycled back into their respective particles by a local third party company

Despite all the recycling listed above, normally a relatively small percentage of the residence hall paper waste stream is recycled due to contamination by food and other non-recyclable materials. Per a November 2008 third party recycling analysis, there is no room in the residence halls to increase the number or location of containers for recycling so continuing the current system of blue bags was recommended by that analysis. Per that report, the current residential hall

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recycling system is as “efficient as possible given current restraints of space limitations, aesthetics and labor limitations.” (Evergreen Recycling 11/25/08)

Green Cleaning

Texas Christian University has one of the premier university Green Cleaning programs in the country. As mentioned earlier, TCU is only the third university to achieve the International Sanitary Supply Association (ISSA) Cleaning Industry Management Standard (CIMS) certification for green cleaning operations & procedures, and TCU received the certification with honors. Per the ISSA website, green cleaning provides improved productivity, increased occupant satisfaction and enhanced professionalism. The CIMS certification is recognized internationally by organizations with high green cleaning procedures and implementation. TCU is also currently pursuing the Green Seal certification which is an additional nationally recognized Green Cleaning third party verification of the processes and standards used by the facilities team.

- Green Seal Certification – pursuing currently, applied in fiscal year 2009
- The vast majority of cleaning products used meet Green Seal Certified standards
- HEPA filters are used on all vacuums to reduce dust returning to air while cleaning
- Cleaning solutions use 3M meters to dispense the proper amount of cleaning solution in each mix
- Wasteful and expensive tri-fold paper towels in restrooms have been exchanged for more efficient 40% post consumer recycled fiber paper towel rolls
- Kai-vac touchless cleaning processes utilized
- All cleaning materials are launderable for reuse or recycled

Vehicle Efficiency

The campus vehicle efficiency and maintenance programs have greatly reduced TCU vehicle emissions, vehicle trips, improved longevity and reduced pollution and liability. Several of the vehicle related initiatives are listed below.

- Downsized vehicle fleet plus using smaller, more efficient vehicles now
- Using electric vehicles for work carts
- Purchased four hybrid vehicles for Physical Plant work on and off campus
- Regular in-house maintenance of vehicles extends useful life of \$350,000 worth of grounds equipment
- 12 point checklist used on each vehicle on a regular basis
 - Oil changes performed in-house
 - Buy oil in bulk and recycle used oil
 - Checklist insures vehicle maintenance is performed on-time and thoroughly checked
- Texas Clean Fleet Fuel Program compliant
- Licensed Low Emission or Ultra Low Emission Vehicles
- Vehicles used until useful life is exhausted -- twenty year old tractor is still functioning well due to maintenance and care

- Vehicle use rotation assures even use, wear and tear on each vehicle

Vehicle Wash Rack

As mentioned in the recycling section, prior to 1995 a wash rack was installed to wash all the campus vehicles. A sand trap was installed to capture all the oil, gas, metal and other waste particles so these pollutants would not end up downstream in the municipal water supply. The dirty sand traps are recycled back into their respective particles by a local third party company.

Indoor Air Quality

High indoor air quality standards are mandated throughout the campus. Many people are allergic to Volatile Organic Compounds (VOC) so minimizing or eliminating VOCs from campus may help to improve the health of those on campus.

- Low & no VOC paint, glues, and solvents are now standard supply items
- Low & no VOC floors, cabinets, appliances and carpets are being phased into the campus as older items wear out
- Campus wide contract for all indoor plants to insure indoor air quality stays clear of plant spores that may cause allergic or harmful reactions. Since going to this system instances of Sick Building Syndrome have greatly reduced
- Installed Kathabar System in library for humidity control to preserve books and library resources

Safety

Safety is an important aspect of a sustainability program. Many of the initiatives listed throughout this report also improve safety for students, faculty, staff and visitors to the TCU campus. Below are just a few of the safety programs already in place.

- VOC free solvents and inks
- In Tandy building moved 500 gallon diesel fuel tank for emergency generator from inside the building to outside
- Installed Freeze & Rain sensors throughout campus. Freeze sensors greatly improve safety of students, faculty and staff by not introducing water on freezing days
- Fuel storage tanks and dispensing system are regularly tested to remain in compliance with the Texas Commission on Environmental Quality Standards
- Installed leak detection systems on all in-ground fuel storage tanks
- Removed PCB ballasts and PCB oil switches to eliminate a potential carcinogen

Programs Considered then Rejected

Sustainable projects by definition need to be good for the environment, our social community and be profitable. The Physical Plant team has recently considered a number of projects that may have improved resource efficiency, but were ultimately rejected because of a poor return on investment. Examples:

- Re-utilizing chiller blowdown water -- Rejected
 - Cost to implement over \$250K
 - Annual savings approximately \$7000

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- Poor return on investment
- Rainwater storage under the new University Union -- Rejected
 - Water storage tanks would be too large
 - Not cost effective
- Use of well water for irrigation -- Rejected
 - Not cost effective
- Installing solar collectors in the new Gameday (Soccer) facility -- Rejected
 - Not cost effective

Projects in the near future

The TCU Physical Plant team continues to build on their success and improve efficiency even further. As indicated earlier, all current and future projects are judged, among other sustainable factors, by the payback of the investment as well as the impact on natural resources and on the campus community. The projects with the best payback are done immediately and the savings generated are used to fund longer return projects.

LEED Certification

The non-profit US Green Building Council created the Leadership in Environmental and Energy Design (LEED) Standards to establish a non-partisan, third party verification process to determine what is a “Green Building”. A LEED Certified building is rapidly becoming the nationally recognized standard for sustainably focused building practices. There are four levels of LEED Certification, each progressively more difficult to achieve – Certified, Silver, Gold and Platinum. The LEED standards incorporate sustainably focused design and building practice in the following areas – Site Selection, Water Efficiency, Energy Efficiency, Materials & Resources, Indoor Environmental Quality and Innovation in Design.

As of the date of this report, three project managers have completed LEED training and become LEED Accredited Professionals. The rest of the project management team and Physical Plant department heads are in the process of becoming potential LEED Accredited Professionals.

As of the date of this report, the following campus buildings have achieved or are in the process of becoming LEED Certified facilities.

1. Sherley Hall, LEED Gold Certified – Achieved Summer 2009 – only the second facility in Tarrant County to receive LEED Gold certification
2. Scharbauer Hall, LEED Silver, possible Gold status – construction completing, certification notice anticipated January 2010
3. Milton Daniel, LEED Silver, points show Gold is attainable – construction beginning Summer 2009
4. Soccer Fieldhouse, LEED Silver, construction starts October 2009
5. Olympic Sports Facility, LEED Silver, in design stage, may use geothermal for heating /cooling, construction begins in Fall 2010
6. Amon Carter Stadium Renovation, LEED Silver targeted, starting design Summer 2009

Current and Future Energy Efficiency Projects

- TCU has adopted a policy of designing all future buildings to the LEED silver certification level as a minimum
- Admissions building design objective is Net Zero Energy use
- Solar Collectors are being considered for the Recreation Center to heat the swimming pool with an annual estimated savings of \$40,000
- Outside energy audit on 1 million square feet of conditioned buildings is currently in process

The University Union and other newer buildings on campus will have touch-screen kiosks where students, visitors, faculty and staff will be able to see real-time data on the amount of building energy consumption and energy efficiency, water consumption and water efficiency, plus education on the special efficiency features installed in the building. The kiosks will also report on the amount of dollars being saved in real time compared to a traditionally built building.

In the future, the Physical Plant team may implement Crime Prevention Through Environmental Design (CPTED) standards in landscaping to further improve safety.

Possible Reduced Future Liability

Given the popularity and benefits of green building, including LEED certification for buildings, it is possible that five to ten years from now a class action lawsuit may be raised against building owners who are not using green standards. A case may be made in the future that building owners and managers who have buildings which have Volatile Organic Compounds (VOCs) or no outside views may be liable for any Sick Building Syndrome occurrences in their buildings. Since the Physical Plant team has already embraced green building practices, TCU may be able to avoid this potential future liability.

Similarly, insurance companies may provide lower rates in the future for green buildings (or charge higher premiums for non-green buildings) due to the possible health and productivity benefits being observed currently in green buildings. The insurance companies are beginning to examine whether there are lower risks for these types of buildings which may entitle TCU to lower building insurance payments in the future.

Sustainability and Environmental Stewardship Goals

TCU's new Master Plan will incorporate sustainability goals for efficiency to guide the next five years of operations. Sustainability and Environmental Stewardship are so fundamental to the operations of the TCU Physical Plant that they have formalized it into their Annual Guiding Organizational Goals. The sustainability goals include:

- A. Develop an action plan for compliance with the American College and University President's Climate Commitment in the pursuit of climate neutrality by 1 September 2009.
 - a. Serve as a host site for the Texas EPA Initiative Peer Audit Training Program in the Fall 2009
 - b. Complete the ICUT EPA compliance self inspection by 31 December 2009

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- c. Establish a campus carbon footprint baseline by 30 May 2010
- d. Actively support the campus “Think Purple, Live Green” initiative
- B. Actively pursue Leadership in Energy and Environmental Design (LEED) certification through the US Green Building Council for all new construction
- C. Assure continued compliance with all applicable EPA/OSHA/ADA and TAS mandates. Aggressively pursue correction of identified discrepancies
- D. Develop a plan to comply with State H.B. 3693 to implement energy efficiency measures, to include a reduction of energy consumption by 5% over six years, and report progress to the State Energy Conservation Office
- E. Reduce annual energy consumption by 2% over the 1 June 2000 base line. Efforts should include, but not be limited to, the following:
 - a. Complete a campus wide energy audit and identify cost effective energy retrofit projects for inclusion in the FY11 budget of 1 March 2010
 - b. Develop a sustainability web page and public education package for Physical Plant sustainability and energy conservation efforts
 - c. Have all project managers LEED certified by 1 March 2010
 - d. Upgrade and expand the capability of the Johnson Controls Metasys Energy Management Control System (EMCS) to optimize campus-wide environmental control system operation. Formulate a plan to expand EMCS graphics capability by 1 October 2009
 - e. Periodically review and document irrigation system operation to assure optimum water resource use

In conclusion, TCU can recognize and embrace the sustainably focused projects completed by the Physical Plant team over the last twenty-one years. After two decades building a solid foundation of efficiency, TCU can be justified in touting its accomplishments toward a more sustainable future. The Physical Plant team will continue to build on its efficiency ethic for current and future projects which helps bring the entire campus closer to a sustainable university. Much still needs to be done, but the TCU trustees, administration, faculty, staff and students can be proud of the efficiencies already implemented at Texas Christian University.

The above report is effective as of September 2009. For questions concerning details of information in this report please contact the TCU Physical Plant team at (817) 257-7955.

Written by Jackson Murphy, President of Green Bean Analysis, LLC (a division of Prism3 Solutions, LLC), which is an applied sustainability consulting company based in Dallas, Texas that specializes in the financial aspects of sustainable business and green buildings.

**Green Bean Analysis, LLC
TCU Sustainability Report**

Budget Growth from 1991 to 2009 Nominal Data				Budget Growth from 1991 to 2009 (2009 Dollars)		
	1991	2009	% increase	1991 (in 2009 \$)	2009	% increase
Total Budget	\$6,809,648	\$20,911,067	207.08%	\$11,940,758	\$20,911,067	75.12%
One Time Major Maintenance (MM) Accounting Adjustment	n/a	\$864,000		n/a	\$864,000	
Utilities	\$2,963,500	\$10,100,500	240.83%	\$5,207,036	\$10,100,500	93.98%
Budget less Utilities and MM Adjustment	\$3,846,148	\$9,946,567	158.61%	\$6,733,722	\$9,946,567	47.71%
Salaries	\$2,346,221	\$6,476,921	176.06%	\$4,114,112	\$6,476,921	57.43%
Budget less Utilities, MM Adjustment & Salaries	\$1,499,927	\$3,469,646	131.32%	\$2,619,610	\$3,469,646	32.45%
Building Conditioned Space SQ FT	2,237,457	3,496,743	56.28%	2,237,457	3,496,743	56.28%
Budget less Utilities and MM Adjustment / SQ FT	\$1.72	\$2.84	65.48%	\$3.01	\$2.84	-5.48%
Budget less Utilities, MM Adjustment and Salaries / SQ FT	\$0.67	\$0.99	48.02%	\$1.17	\$0.99	-15.25%

Accounting adjustment begun in Fiscal Year 2003

No change for inflation

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TCU Physical Plant Team**

Item	Annual Savings	One Time Savings
Installed power factor improvement capacitors	\$72,000	
Recycled Pavestone		\$10,000
Use Mid-Size Trucks instead of Full Size		\$4,000
Improved Trash Compactor		\$110,000
Purchase See Snake camera	\$6,500	
Underground cable locator	\$10,000	
T Puller	\$18,200	
Upgraded mowers	\$8,000	
TXU Energy Profiler	\$18,000	
Reused Flat Files		\$9,000
Restructured Grade 36 Supervisor to 31	\$20,620	
Recycling Dumpsters	\$35,000	
Annual Landscape Improvements	\$50,000	
Installed plant material in-house		\$45,000
New Chiller Plant	\$900,000	
Replaced 28,600 light fixtures	\$300,000	
Water Supply Protection Specialists In-house		\$20,000
Permanent Power connections	\$4,400	
TCU distribution meters	\$36,000	
Irrigation Meters		
Wood chipper -- reduced trips to landfill and dump fees	\$2,000	
Recycled Tree and shrub trimming into bark mulch	\$5,000	
Mower reel sharpening machine	\$15,000	
On-site growth of Flowers for seasonal color	\$27,500	
Install modern plant propagation system	\$5,000	
Small and Large annual landscape & irrigation projects	\$55,000	
Low Flow Plumbing Fixtures	\$27,700	
Energy Savings from Chilled Water system motor improvements	\$47,000	
Total Savings	\$1,662,920	\$198,000
	Annual	One Time

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Client: Texas Christian University Physical Plant
Date: Summer 2009

TCU Facility Conditioned Space

Year	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	% Increase FY09 vs FY89	% Increase FY08 vs FY04
Total Conditioned Space (SQ FT)	2,237,457	2,237,457	2,237,457	2,237,457	2,255,128	2,255,128	2,255,128	2,255,128	2,275,128	2,280,030	2,367,653	2,367,653	2,856,341	2,880,357	3,005,067	3,032,636	3,032,636	3,043,670	3,139,479	3,424,623	3,495,971	56.25%	12.93%
Million BTU (Electricity & Gas Combined)	235,375	225,029	220,874	225,180	227,954	226,191	221,232	229,557	229,912	247,458	236,328	259,495	308,164	299,430	353,269	371,593	368,511	376,049	400,264	421,537	437,029	85.67%	13.44%
Total Utility Costs	\$2,358,418	\$2,346,965	\$2,373,948	\$2,437,795	\$2,531,660	\$2,840,519	\$2,701,547	\$2,709,655	\$2,817,193	\$2,793,736	\$2,690,436	\$2,773,893	\$3,895,911	\$3,925,985	\$4,199,123	\$4,405,116	\$5,643,417	\$8,547,497	\$7,206,022	\$8,093,523	\$8,238,256	249.31%	83.73%
Energy Consumption per Conditioned Sq Ft (EUI) (BTU/SF/YR)	105,197	100,574	98,716	100,641	101,082	100,300	98,102	101,793	101,951	109,731	104,796	115,068	136,650	101,593	156,651	122,604	121,540	123,551	127,494	123,090	125,009	18.83%	0.40%
EUI % Difference from previous year	4.53%	-4.60%	-1.71%	1.95%	0.44%	-0.77%	-2.19%	3.76%	0.03%	7.60%	-4.50%	15.52%	24.92%	-25.65%	54.19%	-21.73%	-1.81%	1.65%	3.20%	-3.45%	1.56%		
Energy Cost per Conditioned Sq Ft (ECI) (\$/SF/YR)	\$1.05	\$1.05	\$1.06	\$1.09	\$1.12	\$1.26	\$1.20	\$1.20	\$1.24	\$1.18	\$1.14	\$1.17	\$1.36	\$1.31	\$1.40	\$1.45	\$1.86	\$2.81	\$2.30	\$2.36	\$2.36	124.43%	62.76%
ECI % Difference from previous year	0.00%	-0.48%	1.05%	2.69%	2.99%	12.16%	-5.19%	0.33%	3.90%	-4.80%	-3.70%	3.33%	40.82%	-3.97%	6.96%	3.79%	28.01%	50.94%	-18.15%	2.96%	0.00%		
All energy (\$/MMBTU)	\$10.02	\$10.43	\$10.75	\$10.83	\$11.11	\$12.56	\$12.21	\$11.80	\$12.25	\$11.29	\$11.38	\$10.69	\$12.64	\$13.11	\$11.89	\$11.85	\$15.31	\$22.73	\$18.00	\$19.20	\$18.85	88.12%	62.03%
All energy % Difference from previous year	3.70%	3.93%	3.05%	0.80%	2.59%	13.07%	-3.07%	-3.30%	3.87%	-7.83%	0.84%	-6.09%	18.35%	3.70%	-9.34%	-0.30%	29.21%	48.42%	-20.81%	6.65%	-1.82%		