UCI Utilities Deficit Reduction Plan
June 2005

Executive Summary

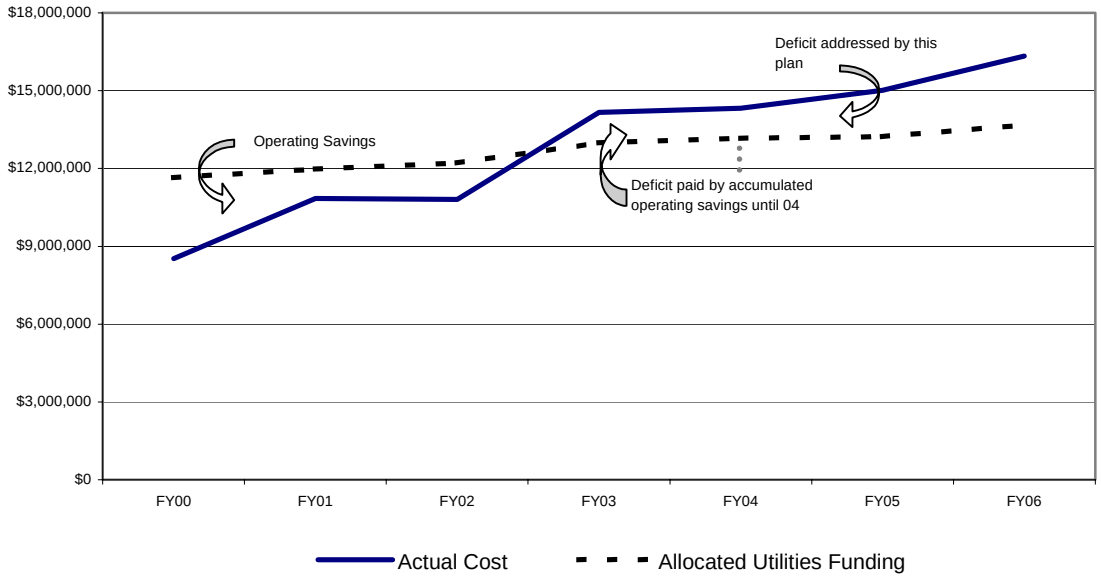
The campus' utilities budget purchases electricity, natural gas, water, and sewage disposal for State-maintained space. In 2005-06, the allocated utilities budget will be $13.6 million. The actual cost of utilities for State-maintained space is projected to be $16.3 million, resulting in a deficit of $2.7 million. This deficit is driven by two major factors:

- Utilities allocations have not recognized price increases over the last five years, exacerbated by…
- the opening of energy-intensive research buildings with greater-than-budgeted utilities consumption.

The deficit will continue to grow as utility prices increase and as the campus adds more research space, reaching a deficit of $5.0 million (per year) on an allocation of $15.7 million by 2007-08. Other UC campuses are experiencing comparable utilities deficits, for the same reasons noted above.

UCI experienced a utilities deficit problem fifteen years ago. Efficiency retrofits in older buildings, combined with improved efficiency standards for new construction, successfully reduced energy use. This brought utility expenses *below* funded levels for several years, creating a surplus that was used to offset costs as energy prices increased beginning in 2000-01. After 2003-04, the surplus was depleted and an actual deficit began to accumulate (Chart 1).

Chart 1 - Utilities Costs versus Allocations



Since 2000-01, price increase allocations from the State have not been allocated to the utilities budget since energy conservation projects had accumulated surpluses which were initially tapped to cover increased costs. However, in the future it will be necessary to allocate price increase funds to the utility budget until new energy-saving projects can decrease net utility expenses.

This plan addresses measures planned and currently underway to reduce utilities costs and to minimize the deficit, including:

- utility purchasing contract change;
- numerous curtailment actions and an associated radical change in occupant comfort standards, to be effected campus-wide;
- efficiency measures, of which many will require a capital investment in order to realize ongoing utility savings;
- complete cost recovery from non-State functions that consume recharged utilities;
- price increase funds (noted above).

This plan is organized into six sections:

1. Causes, scale, and intractability of the utilities deficit.
2. Measures that can be enacted within two months (including actions already implemented).
3. Measures that can be enacted within one year (including a number of measures that will require a capital investment by the campus in order to realize needed savings).
4. Measures that can be completed within two years (all require a capital investment, of which the majority has already been approved by the campus).
5. Risk factors that could improve or reduce deficit relief.
6. A summary comparing all planned and proposed actions against projected deficits.

Causes, Scale, and Intractability of the Utilities Deficit

State funding of the utilities budget (in terms of a per-square-foot allocation) has remained constant since 2000, while utilities' costs have soared. The biggest impact is the rising cost of electricity, which represents 75 percent of campus utility expenses. However, the increases have been across-the-board for all utilities, resulting in a weighted-average, five year price escalation of 83 percent. Table 1 illustrates the details:

Table 1 - Utility Prices Past Five Years

Fiscal Year	Electricity per kWh	Gas per MMBtu	Water per ccf	Sewer per mgd
FY00	$0.0557	$3.577	$0.6084	$979
FY01	0.0562	9.256	0.6125	823
FY02	0.0617	6.885	0.6202	942
FY03	0.0905	6.690	0.6715	1,039
FY04	0.0999	6.678	0.7344	1,119
FY05	0.1023	7.204	0.8552	1,441
Overall increase 2000 - 2005	84%	101%	41%	47%
Weighted average all utilities 2000-2005: +83 percent				

During the past five years when utility prices skyrocketed, the campus' utilities deficit has been further compounded by the fact that 70 percent of newly completed space has been energy-intensive research facilities, including Natural Sciences 1, Croul Hall, and Sprague Hall. Research buildings are much more energy-intensive than office or classroom space. (The UCOP allocation formula for utilities does not recognize the costs of operating a research building versus other types of space.) Table 2 illustrates the difference between utility budget allocations and the actual costs of utilities:

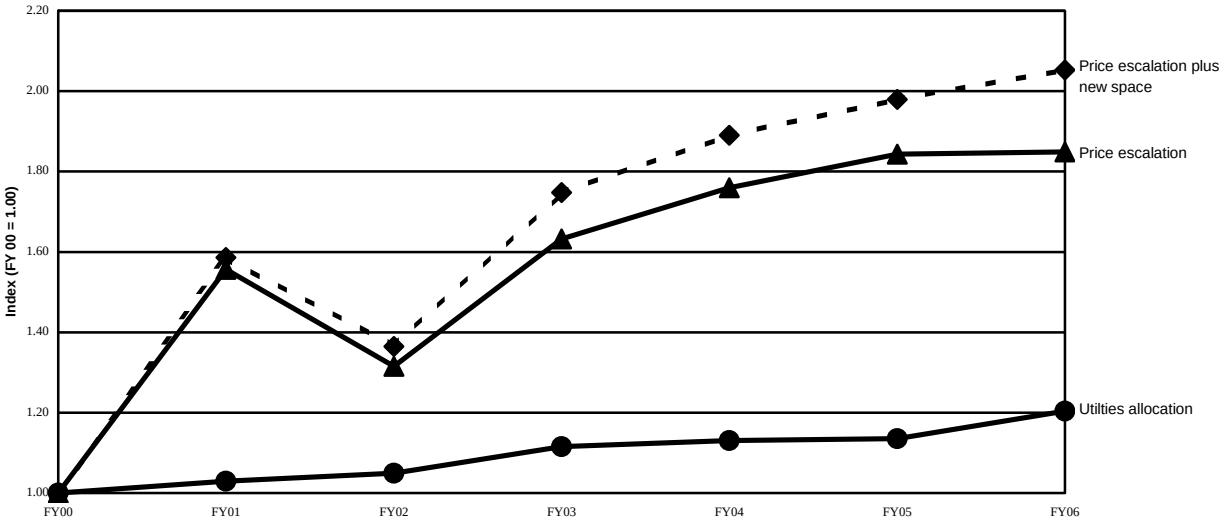
Table 2 - Utility Allocations versus Actual Costs
(in 2005 $)

Building	Allocation	Costs	Difference
Natural Sciences 2 (*projected*)	$543,900	$ 672,966	($129,066)
Natural Sciences 1	$377,144	$522,000	($144,856)
Croul Hall	$217,911	$247,000	($29,089)
Sprague Hall	$201,125	$311,000	($109,875)

High energy-consuming equipment is becoming more commonplace as research instrumentation becomes smaller, denser, and more sophisticated. And as the campus falls below CPEC space standards, extended operating hours and intensified use of space also increase the utilities expense of research buildings.

Taken together, the lack of funding for increased costs and the under-allocation of utility funds are creating a widening budget gap. Chart 2 indexes allocations and costs starting with the year 2000 -- the last year of stable pricing before the California energy crisis impacted energy markets.

Chart 2
Utilities Allocations versus Prices and New Space
(Cumulative from FY 00)



Note that the gap between the campus' utilities allocation and its total utilities expense is staggering, and growing. Equally troubling, the scale and persistence of this problem have not been addressed in OP budget plans or in the "Governor's Compact."

Other UC campuses are reporting even larger deficit problems (Table 3):

Table 3 - Campuses' FY 05 Utilities Deficits

Campus	Approximate State Utilities Budget	Approximate FY 05 Deficit
UCB	$18.5M	$8.3M
UCD	$27.0M	$9.9M
UCI	$13.6M	$1.7M
UCLA	$29.9M	$5.2M
UCR	$7.6M	Zero (UCR currently buys power from a municipality at 5.5cents/kWh)
UCSB	$8.5M	$1.4M
UCSC	$5.1M	$1.1M
UCSD	$22.0M	$4.7M
UCSF	$17.0M	$5.8M

While most campuses do not have firm plans in place to manage utility deficits, several patterns are apparent:

- allowing the deficit to accumulate without a solution
- prorating unfunded costs to coordinating points across campus
- energy conservation investments
- building operation cutbacks
- policies that limit energy use, for example, strictly limiting comfort cooling.

Clearly, some of these measures do not reduce campuses' utility deficits, but merely *distribute* them.

Several factors make the utilities deficit problem particularly intractable:

- High-payback energy retrofit projects have already been completed during the 1990s.
- Most of the campus' utility expenditure *cannot be managed* by central administrative actions or policies. Almost two-thirds of the campus' electric utilities expense stems from the aggregate plug load -- the total power consumed by all the devices that building users, campus-wide, plug into electrical receptacles, and the associated costs of removing the resultant heat from our buildings. In fact, if air conditioning were completely eliminated for all buildings (except vivaria), 24 hours a day, 365 days/year, only an 11 percent reduction in electricity would be realized -- about $1.4 million/year.
- UCOP allocation methodology will further disadvantage UC Irvine as the campus continues to build a high proportion of research and laboratory space.
- Energy retrofit investments will not generate savings for 1-2 years, while the projected deficit and its underlying causes continue to escalate. It will be difficult for the campus to invest in, and complete, energy retrofit projects fast enough to keep pace with a moving target.
- Operational changes and other proposed actions will have a significant campus-wide impact and will be unpopular with faculty and staff. Sharp curtailments in ventilation and air-conditioning, a key element of the plan, will negatively impact the daily comfort of building occupants. Additionally, recharges for extraordinary energy usage by research and increases in utilities recharges for auxiliaries and after-hour programs will impact operating budgets. All of these actions will generate broad and vociferous resistance. Implementation will require a clear directive from the Executive Vice Chancellor and support from the deans as well as the vice chancellors for research and student affairs.

Implementation of all of the actions in this plan is estimated to yield an ultimate annual benefit of approximately $6.2 million to the utilities budget. This includes approximately $3.8 million from energy-retrofit project savings and various recharge increases, of which portions will not be realized in the first two years. The remaining $2.4M stems from proposed operational curtailments.

Measures That Can Be Enacted Within Two Months

Many of these actions are already being implemented, and planning for others is nearly completed:

- Move the electricity purchase contract from a direct access contract with Arizona Power Services (APS) to bundled service purchased from the regulated utility, SCE. (The system-wide contract for direct access power from APS expires July 1, 2005. UCOP bid the new contracts to direct access suppliers, and they have been unable to produce a price that is equal to or less than the terms currently available from SCE.) This change in purchase contract from APS to SCE has been implemented for the Irvine campus, which reduces projected 2005-06 deficit by $1 million. (However, the key assumption is that SCE will not seek a rate increase soon after they have reinstated direct-access customers.)
  Estimated annual savings $1M.
- Implement rebate incentive program to encourage replacement of older, inefficient refrigerators and freezers, and change policy for office refrigerators to require Energy Star equipment.
  Estimated annual savings $2K.
- Charge for energy used by all water coolers on campus. Departments with Energy Star water coolers will pay half, as these coolers consume 50 percent less energy.
  Estimated annual recharge recovery $16K.
- Establish a standard operating schedule of Monday-Friday, 8:00 a.m. - 6:00 p.m. in all non-lab, non-classroom spaces. Eliminate air-conditioning and ventilation of spaces outside of this standard operating schedule.
  Estimated annual savings $50K.
- Establish a standard operating schedule of Monday-Friday, 8:00 a.m. - 6:00 p.m. for all lab buildings (excluding vivaria). Eliminate air conditioning outside of standard operating schedule, providing ventilation only. Occupants will experience after-hours and weekend interior temperatures well into the 80s. Definite impacts to off-hours research work.
  Estimated annual savings $75K.
- Set temperatures for all classrooms, seminar rooms, conference rooms, etc. campuswide to heat to 68° and cool to 78° (currently set at 70° and 74°). The campus community will experience a wider range of temperature variations in occupied space. Rooms will be colder in the mornings and warmer in the afternoons. Based on past experience implementing this type of measure, there will be significant negative campus feedback.
  Estimated annual savings $50K.
- Eliminate after-hours heating and cooling in office portions of lab buildings. This will be implemented in newer lab buildings that have suitable controls. This action will impact the comfort of researchers and staff working in offices after-hours. In the winter, savings will be partly offset due to increased occupant use of electric space heaters (which will also entail a fire hazard).
  Estimated annual savings $20K.
- Eliminate heating and cooling of lecture halls and large classrooms when they are not occupied. This will result in longer times to cool the spaces when they are reoccupied.
  Estimated annual savings $16K.

- Eliminate air conditioning and ventilation in spaces with operable windows.
  Estimated annual savings $31K.
- Continue end-of-year holiday closure and utility reductions. Although the deficit projection already assumes these savings, we will evaluate buildings that are currently exempted from holiday shutdowns for possible inclusion.
  Estimated annual savings $104K.
- Eliminate domestic hot water in restrooms.
  Estimated annual savings $60K.
- Fully recharge housing areas for utilities costs, including path and street lighting, sewer connection fees, and electrical infrastructure installation and maintenance costs.
  Estimated annual recharge recovery $50K for FY 2005-06.
- Ensure full utility cost recovery for all non-State users, e.g. increase electrical recharge for vending machines campus-wide.
  Estimated annual recovery $120K.
- Recharge for electrical usage by streetlights and bikeway path lighting at Vista del Campo.
  Estimated annual recovery $2K.
- Recharge UNEX and Summer Session full cost of utilities. We will work with the Budget Office to identify an appropriate source of funds for Summer Session costs. These costs are not handled by State OMP allocations.
  Estimated annual recovery $94K.
- Place stickers on fume hoods advising lab users to close sash for safety and energy efficiency.
  Estimated annual savings $3K.
- Implement a public awareness campaign to campus, including Zotmails, meetings with various stakeholder groups, UCI News articles to inform the campus community about energy conservation practices and impacts, presentations to administrative groups to explain the utilities deficit problem and this plan, etc.

Projected savings from actions that can be completed in two months: $1,589K

Measures That Can Be Enacted Within One Year

Funds have been approved and earmarked to complete many of the following measures; other projects will require "small cap" funding in order to move forward.

- Reduce lighting at stairwells, vestibules, and other non-occupied spaces. Control lighting operation through occupancy sensors.
  Estimated annual savings $25K.
- Retrofit elevator lighting to compact fluorescent lamps or LEDs.
  Estimated cost savings $12K.

- Install occupancy sensors on existing Phoenix Control fume hoods.
  Estimated annual savings $14K.
- Recharge departments for extraordinary energy usage by research equipment, based on federal costing principles and guidelines.
  Estimated annual recharge recovery $90K.
- Consolidate weekend and after-hours activities into specific buildings. Establish recharge schedules that allow full cost recovery for use of facilities.
  Estimated annual recharge recovery depends on success of schedule changes.

  (NOTE: Many buildings do not have controls that isolate air conditioning on a small zone basis, so the cost for operating some space will reflect this. Currently, classroom space is used extensively after hours by students, departments, and outside organizations. Such utilization has increased with the closure of the Student Center.)
- As part of this deficit reduction plan, it is proposed that reduced Student Center utility recharge associated with the partial closure of the Student Center be reallocated to the utilities fund until construction is complete, to cover the utilities expense of displaced utilization.
  Estimated annual recovery $150K.
- Upgrade air-handling controls and re-commission McGaugh Hall, improving energy efficiency. (Funded with CPUC rebate funds.)
  Estimated annual savings $40K.
- Upgrade air-handling controls and re-commission Berkeley Place, improving energy efficiency. (Funded with CPUC rebate funds.)
- ***Estimated annual savings $25K.***
- Install occupancy sensors to control air-conditioning in all trailers, campus-wide.
  Estimated annual savings $15K.
- Install occupancy sensors in intermittent-use locations and replace dysfunctional occupancy-sensors, campuswide. Includes lighting control in hallways and intermittent use areas such as kitchenettes.
  Estimated annual savings $12K.
- Install occupancy-sensor switches for restroom fans, wherever cost-feasible campuswide. Requires a $36K minor cap project.
  Estimated annual savings $7K. (Payback 5 years)
- Install solar film in high-priority locations. Requires a $120K minor cap project. ***Estimated annual savings $20K.*** (Payback 6 years)
- Install energy management controls and variable-frequency drives on air-handlers for the Multipurpose Science & Technology Building. Requires a $59K minor cap project. ***Estimated annual savings $7.4K.*** (Payback 8 years)
- Install energy management controls, economizer section, variable-frequency drives, and occupancy sensors on HVAC system in the Physical Science Lecture Hall. Requires a $16K minor cap project.
  Estimated annual savings $2.4K. (Payback 7 years)

- Install energy management controls, repair economizer section, and install occupancy sensors in the Physical Science Classrooms. Requires a $25K minor cap project.
  Estimated annual savings $3.5K. (Payback 7 years)
- Replace fixed-speed, constant-duty motors with "right-sized" HP based on measured load, wherever cost-effective. Requires a $33K minor cap project.
  Estimated annual savings $9K. (Payback 4 years)
- Implement VAV+ control parameters (in conjunction with building recommissioning) in newer buildings where it is technically feasible and cost-beneficial. Requires a $100K minor cap project.
  Estimated annual savings $36K. (Payback 3 years)
- Reduce air changes in lab buildings to 6X/hr. for all operating hours, wherever technically feasible. Between 11PM and 7AM, where feasible technically, cut air exchange rate to 4X/hour. Lab occupants will be advised to use window coverings and to dress comfortably. Requires a $120K minor cap project.
  Estimated annual savings $57K. (Payback 2 years)
- Retrofit office trailers with high efficiency heat pumps (as well as occupancy-sensors) for air-conditioning. Requires a $100K minor cap project.
  Estimated annual savings $16K. (Payback 7 years)
- Energy Monitors -- Provide stipends to Building Facility Managers (BFM) who are willing to perform periodic energy audits and ongoing, day-to-day monitoring. Training and certification would be required. A checklist would be developed that BFMs would use to ensure that unnecessary lights are turned off, building operations curtailments take effect, fume hoods are closed, over-lamping is corrected, powered-down standby settings are used for office equipment, and unused equipment is turned off. BFMs would check HVAC temperatures and report anomalous conditions in addition to looking for other wasteful energy practices and educating users regarding efficient energy practices.
  Estimated net savings $75K/year.
- Replace air handlers in Berkeley Place. Requires $715K in energy conservation/deferred maintenance funding.
  Estimated annual savings $46K. (Payback 15 years; also addresses a deferred maintenance problem.)

Projected savings for actions that can be completed within one year: <u>$662K</u>

Investment required: Nine "small cap" projects totaling $1,324K.

Measures That Can Be Completed Within Two Years

The following projects require a capital investment, of which the majority has already been approved by the campus:

- Complete lighting retrofits to replace electrical lamps, ballasts, and fixtures with more efficient equipment in multiple buildings.
  Estimated annual savings $341K. Project already approved by the campus.
- Perform HVAC recommissioning to review, replace, repair, and optimize air handling equipment and building systems in multiple buildings.
  Estimated annual savings $414K. Project already approved by the campus.
- Improve energy management systems and controls in multiple lab buildings to reduce energy usage.
  Estimated savings $250K. Project already approved by the campus.
- Retrofit constant-volume fume hoods with higher efficiency units. Requires a $300K minor cap project.
  Estimated annual savings $43K. (Payback 7 years)
- Reduce airflows in teaching labs to zero outside of scheduled class hours, to the extent technically feasible. This will preclude the use of teaching labs outside of scheduled classes. Requires a $570K minor cap project.
  Estimated annual savings $100K. (Payback 6 years)
- Retrofit air-handling equipment in Engineering Gateway to variable-air-volume (VAV). Requires $1.9M in energy conservation/deferred maintenance funding.
  Estimated annual savings $254K. (Payback 7 years)
- Rowland Hall – Replace air handlers and associated equipment and controls as part of seismic upgrade. Projected completion Spring 2007.
  Estimated annual savings $167K. Project already approved by the campus.

Projected savings for measures that can be completed within two years: $1,569

Capital investment already approved: Four projects, $14.5M.

Additional capital investment required: Four projects, $2.77M

Risk Factors That Could Improve or Reduce Deficit Relief

UC is currently engaged in litigation against Enron, and the anticipated settlement plays a role in reducing the FY 07 deficit. A favorable outcome would return funds in the amount of $1.2 million to the utilities budget.

The cogeneration project, currently under construction, is projected to be fully operational in FY 2007-08 and could have a positive impact on the deficit at that time. However, analysis shows that cogeneration will not have a positive initial impact if the markets for natural gas and electricity remain out of balance, that is, if natural gas prices remain high relative to electricity, as is currently reflected in market conditions. During such conditions regulated utilities lose money and so will cogeneration. However, over the longer-term markets adjust and cogeneration is projected to have a substantial positive impact.

Other factors could improve upon, or reduce and delay, the deficit relief projected in this plan:

- Some energy-saving capital improvements could be completed early if funding is available.
- Natural gas prices could affect the plan in either the positive or negative direction, depending on whether prices moderate or continue to rise.
- The ENRON settlement could take longer than projected, or yield less than expected.
- SCE could seek a rate increase for customers returning from direct access contracts (once it is too late for them to reconsider).
- The campus may not be able to sustain unpopular actions and curtailment measures, particularly in the face of PI criticism.
- Borrowing for needed energy-saving capital projects may be difficult to get approved, or delayed.
- UC could obtain system-wide budget relief, especially in view of the University-wide scale and extent of the utilities deficit problem.
- The weather could be warmer in the summer or colder in the winter than has been the pattern in recent years.

Finally, a public awareness campaign will aim to help the campus community understand the impacts of the operational changes and the reduced comfort and operational impacts that will be experienced. Since much campus usage is driven by the aggregate, individual decisions by thousands of building users, a successful campaign that solicits energy-aware individual behaviors has the potential of improving the energy deficit. On the other hand, when reduced productivity and equipment failures are blamed on energy curtailments, cooperation may erode.

Summary Comparing All Planned And Proposed Actions Against Projected Deficits

	FY 05-06	FY 06-07	FY 07-08
Projected Surplus/(Deficit) Before Planned Actions	**($2,650)**	**($3,400)**	**($5,010)**
Less Savings:			
Measures that can be enacted within two months	$1,589	$1,589	$1,589
Measures that can be enacted within one year		$662	$662
Measures that can be completed within two years			$1,569
Subtotal: Operating Surplus/(Deficit)	**($1,061)**	**($1,149)**	**($1,190)**
Less price increase allocations:			
FY 05-06	$300	$300	$300
FY 06-07		$410	$410
FY 07-08			$430
Favorable Enron settlement (one-time)		$1,200	
Carry forward from prior year surplus/(deficit)		($761)	$0
Net Surplus/(Deficit)	**($761)**	**$0**	**($50)**

Note: All figures thousands of dollars.

Attachment 1

Completed Energy Efficiency Projects

These measures, implemented during the 1990's, save more than $2.5M annually, for an estimated 18% savings, measured in today's usage:

- Retrofitted older, less efficient T-12 lights with T-8s in School of Medicine.
- Replaced traffic signals with energy efficient LED lamps.
- Retrofitted exit lights with LED lamps.
- Replaced old technology fluorescent, metal halide, and incandescent lamps with newer, more energy efficient types.
- Installed occupancy sensors.
- Installed window film to reduce radiant heat gain in buildings.
- Optimized air-conditioning and heating systems in buildings by installing variable speed drives on pump and fan motors and fine-tuning after installation.
- Constructed a 4.5 million gallon thermal energy storage tank in 1997. By making chilled water at night, it aids the offset of 4-5 megawatts of expensive on-peak electricity.
- Retrofitted high temperature water system with more efficient heat exchangers.
- Retrofit fume hoods with Phoenix controls to more efficiently manage fume hood operation.
- Replaced inefficient pumps with newer, high efficiency ones.

Attachment 2

Summary of Newly Proposed Energy-Saving Projects Requiring Capital Investment

Description	Investment Needed	Estimated Annual Savings	Estimated Payback
Install occupancy-sensor switches for restroom fans, wherever cost-feasible campuswide.	$36,000	$7,000	5 yrs.
Install solar film in high-priority locations.	$120,000	$20,000	6
Install energy management controls and variable frequency drives on air-handlers for the Multi-purpose Science & Technology Building.	$59,000	$7,400	8
Install energy management controls, economizer section, variable frequency drives and occupancy sensors on HVAC system in the Physical Science Lecture Hall.	$16,000	$2,400	7
Install energy management controls, repair economizer section, and install occupancy sensors in the Physical Science Classrooms.	$25,000	$3,500	7
Replace fixed-speed, constant-duty motors with “right-sized” HP based on measured load, wherever cost-feasible.	$33,000	$9,000	4
Implement VAV+ control parameters (in conjunction with building recommissioning) in newer buildings where it is technically feasible and cost-beneficial.	$100,000	$36,000	3
Reduce air changes in lab buildings to 6X/hr. during the days for all operating hours, wherever technically feasible. Flow rate of general exhaust will be reduced before that of fume hoods. Between 11PM and 7AM, where feasible technically, cut air exchange rate to 4X/hour.	$120,000	$57,000	2

Description	Investment Needed	Estimated Annual Savings	Estimated Payback
Retrofit office trailers with high efficiency heat pumps and occupancy-sensors for air-conditioning.	$100,000	$16,000	7
Replace air handlers and associated equipment in Berkeley Place.	$715,000	$46,000	15*
Retrofit constant-volume fume hoods with higher efficiency units.	$300,000	$43,000	7
Reduce airflows in teaching labs to zero outside of scheduled class hours, to the extent technically feasible. This will preclude the use of teaching labs outside of scheduled classes.	$570,000	$100,000	6
Retrofit air-handling controls and equipment in Engineering Gateway to provide variable-air-volume (VAV).	$1,900,000	$254,000	7

* Also addresses a deferred maintenance problem.