

# State Agency Annual Energy Usage Report

Submitted  
By:



ARIZONA DEPARTMENT OF COMMERCE  
*Our Job is JOBS!*

July 1, 2006

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## **Introduction and Executive Summary**

The Department of Commerce, in accordance with A.R.S. §34-451, submits the following report detailing the annual energy savings progress in state buildings. This statute requires three state building systems, the Department of Administration, the Department of Transportation and the Board of Regents, to reduce energy usage in their buildings by 10 percent by July 1, 2008 and 15 percent by July 1, 2011. The baseline year for energy usage per square foot is FY01-02.

In FY03-04, the first year that this report was required, agencies implemented a considerable number of actions towards meeting the energy saving goals authorized by the legislature. The agency reports showed a **2.5 to 3.0 percent reduction** in energy usage in the first year.

In the second year of reporting, agencies continued to reduce energy usage. The Department of Administration (-14%) and the Department of Transportation (-9.9%) report reductions **above or near the mandated 10 percent reduction by 2008.**

Now into the **third year** of reporting, agencies are continuing their energy savings efforts.

The Arizona Department of Emergency and Military Affairs is leading the way in reducing their energy usage. Their energy usage is 31% below their FY01-02 level. With cooperation from their Department of Defense partners, DEMA was able to make over \$1,000,000 in energy improvements to their facilities to reduce energy usage and to improve their energy security. The University of Arizona reports energy usage down 6.5% from the baseline period. And during the past year, ADOA was awarded Energy Star Building labels from the US EPA for the ADOA, the ADEQ building and the DHS office buildings. All three of these buildings were constructed under the Privatized Lease to Own methodology known as PLTO.

However, it has become more difficult for other agencies to reduce energy usage as many of the low cost actions, the “low-hanging fruit” of energy efficiency were implemented in the first two years since the legislation. There is also more pressure on their utility budget because of utility price increases. Natural gas spot market prices, that were \$3 per million Btu in 2002, reached \$11.50 per million Btu in January of 2006. These high natural gas prices caused a ripple effect in fuel costs to electric companies whose electric generating stations use natural gas. As an example, the Corporation Commission reviewed price information and granted APS price increases of 4.1% in April 2005, 5% in February 2006 and 7.6% in May 2006. With operating budgets going to pay higher utility, there are few funds left to make energy improvements.

Changes are occurring that could make it easier for agencies and universities to make energy improvements. The Corporation Commission has mandated that APS offer a Demand Side Management Program to help their commercial customers make energy efficiency improvements. APS is providing incentives ranging from 10 percent to 50 percent of the cost of an improvement. A large proportion of state facilities are located in APS territory and they will be able to take advantage of these incentives. Southwest Gas Corp. should have a similar program later this year. An energy savings performance contract is helping the Department of Corrections to make energy and water saving improvements to their Tucson facility.

### **Department of Commerce Technical Assistance**

The Department of Commerce is providing technical assistance to state agencies by helping to conduct energy audits, by providing training and by sending announcements to facility staff of any other training opportunities. Commerce has sponsored training sessions on tracking utility bill histories, energy-efficient lighting and motors, compressed air systems and steam systems. Commerce staff has become LEED Accredited, a certification program on the designing of green features of energy efficiency, renewable energy, water conservation and indoor air quality into buildings. Staff is also developing a system for state agencies to use to obtain Renewable Energy Credits (RECs) for new buildings.

### **Methodology**

Two methodologies were utilized to track compliance. First, the agencies were asked to submit the actions they have taken to reduce energy usage and to estimate the amount of energy saved. The second methodology is to track the progress towards achieving the 10 and 15 percent reduction goals by gathering utility data on their buildings. The methodology is to compare the most recent 12 months of utility bills with the 12-month baseline period of July 1, 2001 – June 30, 2002. A.R.S. §34-451 requires the progress report to be submitted by July 1 of each year. Because June utility bills are not available until July, agencies were directed to use the most recent 12 months as the time period for comparison to the baseline period.

### **Weather and Its Affect on Energy Costs**

Unusual weather conditions can affect energy usage and measurement in a number of ways. The most obvious is the affect that higher than normal temperatures have on cooling bills. Unfortunately, most cooling equipment operates less efficiently at higher outdoor temperatures. This has two effects. With higher temperatures more cooling is needed, but at higher temperatures cooling equipment is less efficient. Hence, a 10 percent increase in temperature can mean a 15, 20 or even 25 percent increase in cooling costs.

Weather conditions are important to this analysis because one of the tasks in determining compliance with the law is to compare the energy usage during the baseline period with the energy usage for the most recent 12-month period. Data from the National Weather Service is used in this report to help normalize weather conditions.

# **Agency Reports**

## Building System Summary Table

Building System	Energy Usage Baseline 7/1/01 - 6/30/02	2008 Target 10% Reduction	Energy Usage Reported FY03-04	Energy Usage FY04-05	Energy Usage FY05-06	Percent Change FY 05-06 from Baseline
	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
Administration (ADOA)	73,234	65,911	62,249	62,466	<b>70,410</b>	<b>-3.9%</b>
Corrections (DOC)	135,653	122,087	115,305	133,569	<b>124,278</b>	<b>-8.4%</b>
DEMA	46,000	41,400	39,100	35,700	<b>31,700</b>	<b>-31.3%</b>
DES	72,895	65,606	61,533	66,564	<b>74,183</b>	<b>+1.8%</b>
Health Services State Hospital	137,154	123,439	116,581	143,444	143,444	+4.0%*
DPS	150,512	135,460	127,352	140,012	<b>138,420</b>	<b>-8.0%**</b>
ADOT	55,264	49,738	46,974	*****	<b>53,570</b>	<b>-3.1%</b>
ASU	122,744	110,469	103,865	119,294	<b>143,846</b>	<b>+15.7%</b>
ASU West	74,246	66,821	63,109	79,747	<b>82,061</b>	<b>+7.41%**</b>
ASU East	65,333	58,800	55,533	78,500	78,500	+20.1%*
NAU	120,870	108,783	102,740	119,600.	119,600	-1.0%*
U of A	140,948	126,853	****	145,931	<b>131,816</b>	<b>-6.5%</b>

\* Previous year's data, agency did not report in time to meet the July 1, 2006 deadline.

\*\* DPS is only presenting data for accounts where they have the bills thru June 30, 2005. (10 of 52 accounts)

\*\*\* ASU Main campus added 400,000 sq.-ft. of laboratory space. When opened, it did not have sub-metering. Therefore, the consumption could not be isolated from the rest of the campus. Sub-metering has now been installed and will allow separate metering and reporting.

\*\*\*\* ASU West had 4,387 students in 2001 and 6,309 in 2005, a 44% increase. ASU East had 1,939 students in 2001 and 3,983 in FY04-05.

\*\*\*\*\* University of Arizona has installed two gas turbines rated at 6.5 MW and 4.0 MW to generate electricity and to produce steam. This actually increases the energy consumption on campus, but it also makes their whole system more efficient. 100 units of Natural gas used in the turbines will produce 31 units of electricity and 43.7 units of steam. This is very efficient.

## Agency Reports

### Arizona Department of Administration (ADOA)

The Department of Administration building system has two major categories:

1. Buildings managed by ADOA for other agencies
2. And buildings managed by the other agencies.

In addition to the building space ADOA manages for their employees, ADOA manages additional space for their agency tenants including the departments of Agriculture, Attorney General, Commerce, Corporation Commission, Corrections, DES, Education, Land, Revenue, Supreme Court, and many Boards and Commissions. During the first year of reporting, FY03-04, ADOA reported a 3.7 percent reduction in energy use per square foot. In this second year, FY04-05, ADOA reported an additional 11.0 percent reduction in energy use per square foot. Energy usage for FY05-06 was up a bit, but it is still 3.9% less than the baseline year. During the past year, ADOA was awarded Energy Star Building labels from the US EPA for the ADOA building (100 N. 15<sup>th</sup> Ave.), the ADEQ building (1110 W. Washington St.), and the ADHS building (150 N. 18<sup>th</sup> Ave.). All three of these buildings were constructed under the Privatized Lease To Own methodology known as PLTO.

Actions Taken in FY05-06	Project Cost	Quantity	Est. Avoided Cost
Arizona State Hospital Replace HVAC in General Services	\$500,000	1	\$1,876
Arizona State Hospital Boiler Air Handler	\$300,000	1	\$976
Arizona State Hospital Replace two 900-hp with two 300-hp boilers	\$700,000	2	\$73,584
Arizona State Hospital Replace Dietary Air Handlers	\$600,000	1	\$3,752
Reduce Temperatures in Unoccupied Areas For Capitol Mall	-	5	\$576
Installed Energy-Efficient, Low Glare Uplighting in Phoenix Day School Cafeteria	\$10,000	1	\$76
Variable Speed Drives Capitol Mall	\$10,000	5	\$4,875
Energy Efficient Motors for Capitol Mall	\$10,000	5	\$1,625
Replace Roofs Several Buildings	\$482,359	5	\$14,470
<b>Totals</b>	<b>\$2,612,359</b>	<b>26</b>	<b>\$101,810</b>

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from
ADOA managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
ADOA	73,234	65,911	62,249	70,410	-3.9%

**Arizona Department of Corrections**

The Department submitted a 30-page report containing the utility bill histories and the energy saving measures for their 11 prison complexes. The report covers their 1,436 buildings containing, 7,417,948 sq.-ft. of space. The department has designated a system wide Energy Manager as well as designating an Energy Coordinator at each prison. Staff prepares a monthly energy newsletter that is distributed to all employees via email. Facility Maintenance staff is encouraged to take training courses to learn more about how to reduce their energy costs. Data for the most recent year when compared to the baseline year of 2001-2002 show that electricity consumption was down 8.4%! In contrast to other state agencies, the department's facilities operate 24/7. The result is night and weekend consumption of natural gas to be a greater factor in overall energy consumption than for other state agencies. Still, they have made great strides. Below is an executive summary of their actions. Space would not allow us to list all of the actions initiated. A copy of their report is on file with Commerce. **Actions, too many to list all, partial list follows.**

**Arizona Department of Corrections**

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Quantities</b>	
Convert light fixtures to energy-efficient lighting	Materials & In-house labor \$56,958		
Convert to compact fluorescent lamps	Materials & In-house labor \$1,314	1,236	
Replace A/C Units with more efficient units:	Contractor \$62,291		
Renew/Replace AC Gas Packs	Contractor \$97,446	27	
Install energy-efficient exit signs	Materials & In-house labor \$1,317	many	
Install programmable thermostats	Materials & In-house labor \$2,671	63	
Energy efficient Washer/Dryer replacements	Materials & In-house labor \$47,717	47	
Install water saving devices	Materials & In-house labor \$29,424	17	
Install demand hot water heaters	Materials & in-house labor \$6,000	Many	
Install energy efficient water heaters	Materials & in-house labor \$73,340	Many	

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Quantities</b>	
Install photocells on exterior lighting	\$639	30	
Install occupancy light switches	\$550		
<b>Totals</b>	\$379,667		To be determined

**Arizona Department of Corrections**

	<b>Baseline Energy Usage 7/1/01 - 6/30/02</b>	<b>2008 Target 10% Reduction</b>	<b>2011 Target 15% Reduction</b>	<b>Energy Usage (Last 12 months)</b>	<b>Percent Change from</b>
	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
<b>Corrections</b>	135,653	122,087	115,305	124,278	-8.4%

**Arizona Department of Economic Security**

DES continues to monitor utility usage, encourage staff to conserve energy when possible and upgrade current HVAC equipment to more energy efficient equipment when replacement is required. DES has requested funding to retrofit light fixtures, retrofit HVAC equipment and HVAC controls in the last two Capital Improvement Plans submitted to ADOA, but DES has not received funding for these projects to date. DES did install a new 12,000 SF polyurethane roof on the DAC West Building at the Arizona Training Program in Tucson at a cost of \$ 29,000 dollars.

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Est. Avoided Cost</b>	<b>Estimated Savings</b>
DES continues to encourage energy conservation by employees. To turn off computer equipment, office equipment and lights when not in use	Staff		
Set Temps at 76-79 Summer, below 75 winter months.	Staff		
Procurement Unit purchased Energy Star equipment per State Procurement rules.	Staff		
Office of Facilities Management works with their private sector lessors to encourage implementation of energy conservation measures and equipment, such as, programmable thermostats, motion sensors and efficient lighting.	Staff		
Installed 12,000 sq.-ft. of polyurethane roof on the DAC West Building at the Arizona Training Program in Tucson.	\$29,000		Positive, but unknown
Lowered hot water heater temperatures.	Staff		
<b>Totals</b>	<b>\$29,000</b>		<b>\$0</b>

	<b>Baseline Energy Usage</b> 7/1/01 - 6/30/02	<b>2008 Target</b> 10% Reduction	<b>2011 Target</b> 15% Reduction	<b>Energy Usage</b> (Last 12 months)	<b>Percent Change</b> from
<b>DES managed Buildings</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Baseline</b>
	72,895	65,606	61,961	74,183	+1.8%

**Arizona Department of Emergency and Military Affairs (DEMA)**

DEMA has reduced their energy consumption from 46,200Btu/sq-ft in FY02 to 42,700Btu/sqft in FY03 and to 35,700Btu/sq.-ft. in FY04 and to 31,700 Btu/sq.-ft. in FY 06. This is a 31.3% reduction. The sharing of facilities with federal entities has allowed DEMA to use programs available from the federal government. DEMA is currently demonstrating solar photovoltaic systems and wind energy systems at their facilities.

Note: DEMA’s energy conservation program began in 1997/98. Since then, they have been benefiting from many Energy Conservation Measures (ECMs) which carry-over their financial and performance year after year.

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Est. Avoided Cost</b>	<b>Est. kwh Avoided</b>
On-going bldg energy audits and verification of lighting levels: reduced if applicable (not to affect security or productivity or safety of employees.) *	In-house staff	\$12,800	140,000
Continued awareness campaign to get employees involvement (adopting the Governor's Smart Energy Usage Plan). Employees shutting off unneeded lighting and/or office equipment. **	In-house staff	\$15,700	160,000
Continue to raise temperatures to 76-77 degrees in summer months, and lower to 70-71 degrees in winter. (Adjusted/ controlled 24/7 in 33 of our buildings by BACnet EMCS.)	In-house staff	\$12,000	120,000
Completed retro-commissioning HVAC system and central plant for PPMR CSMS/MATES Facility (M5701)	\$82,300	\$19,000	278,000
Completed installation of solar water heater at DEMA HQ	\$500	\$2,000	
Completed installation of BACnet EMCS at renovated PPMR "1-Stop Shop" Facility. (Contract and in-house-staff).	\$28,945	\$5,000	62,500
Completed installation of BACnet EMCS at Belmont Readiness Center. (Contract and in-house staff).	\$9,400	\$1,500	15,000
Completed 9 KW photovoltaic array at Valencia (Bushmaster) Armory in Tucson (partnership with TEP).	\$32,500	\$530	Na
Completed 31 KW photovoltaic array at WAATS (eg: WAATS Solar Farm)	\$196,000	\$20,000	113,000
Completed R&R of CMSB boiler (L4525) @ WAATS new high efficiency boiler and controls	\$25,800	\$2,600	520 mbtu
Completed R&R installation of Valencia Readiness Center drill hall, high efficiency lighting and timed controls.	\$2,300	\$2,175	18,600
Began optimization (& retro-commissioning) of WAATS (L4500) Administration Facility; R&R VAV AHUs and complete central plant renovations.	\$653,200	\$20,000	200,000

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Est. Avoided Cost</b>	<b>Est. kwh Avoided</b>
Began retro-commissioning HVAC system and central plant for WAATS Dfac and Dorm (L4535) Facility(central plant and dorm FCUs)	\$97,500	\$23,500	346,500
Began super T8 lighting replacement at PPMR RTI Facility (in leau of scheduled group relamp project). 34W T8 lamps and ballasts replaced with 28W super T8's with new ballasts.	\$11,700	\$3,000	50,600
Began PHASE 3 of WAATS Solar Farm: additional 15 KW photovoltaic array.	\$94,000	\$2,500	
Began installation of 100 low flow shower heads at Camp Navajo Billets.	\$1,800	\$300	
Began installation of Apache hangar night / security lighting inside AASF #2 (L4600) @ WAATS (ICETRON highbay fixtures).	\$19,500	\$4,500	58,700
<b>Totals</b>	<b>\$1,255,445</b>	<b>\$147,105</b>	<b>1,562,900</b>

- ❖ \* On-going building energy audits includes adjusting settings of ALL equipment (temperature settings, occupancy sensors, photocells, etc)
- ❖ \*\* We have seen a noticeable increase in number of employees who are actively participating in our energy program.

	<b>Baseline Energy Usage</b> 7/1/01 - 6/30/02	<b>2008 Target</b> 10% Reduction	<b>2011 Target</b> 15% Reduction	<b>Energy Usage</b> (Last 12 months)	<b>Percent Change</b> from
<b>Building System</b>	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
<b>DEMA</b>	46,200	41,400	39,100	31,700	-31.3%

### Arizona Department of Health Services

- The State Hospital worked with the Arizona Department of Administration to complete the following projects. ADOA was the project manager.

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Quantity</b>	<b>Est. Avoided Cost</b>
Arizona State Hospital Replace HVAC in General Services	\$500,000	1	\$1,876
Arizona State Hospital Boiler Air Handler	\$300,000	1	\$976
Arizona State Hospital Replace two 900-hp with two 300-hp boilers	\$700,000	2	\$73,584
Arizona State Hospital Replace Dietary Air Handlers	\$600,000	1	\$3,752
<b>Totals</b>	<b>\$2,100,000</b>		<b>\$80,100</b>

At the Department's new office building at 150 N. 18<sup>th</sup> Ave., a number of actions were taken to reduce energy usage. These actions resulted in the Department receiving the U.S. EPA's Energy Star Building label. It became the third state agency building to receive the award.

Here is a list of the specific energy features taken after construction:

- Variable Frequency Drive pump, fan and compressor motors.
- CO2 sensors in all return air plenums.
- Humidity sensor to assist calculating demand.
- Additional plate & frame heat exchanger for added efficiency and redundancy.
- Totalized electricity meter cabinets (two meters located at 150-Building).
- Installed a timer on both hot water heaters to shut down weekends and nights.
- Installed re-circulating pumps on first floor Men's/Women's shower restrooms water heater.
- De-lamped over 250 fluorescent lamps to reduce energy cost (adjusted to 30 candle-feet).
- Added additional motion sensors in rooms where possible, including the receiving dock.
- Changed 50 watt lamps to 9 watt lamps with longer lamp life (2,000 hours to 8,000 hours) elevators.
- Installed vending/snack miser controls.
- Installed cooling tower make-up and blow down meters (adjustment in sewer water fees).

Annual Dollar Savings:

Compared to a standard office building built in 2003 without these features, the building is 28% more efficient and saves almost \$74,000 a year. Energy costs are approximately \$1.08 per sq.-ft. per year.

Annual energy savings:

Saves over 832,000 kwh when compared to a standard office building.

Benefits to employees of energy efficiency measures:

It provides a safe, healthy and productive environment of the employees and their visitors.

**Arizona Department of Health Services**

	<b>Baseline Energy Usage</b> <b>7/1/01 - 6/30/02</b>	<b>2008 Target</b> <b>10% Reduction</b>	<b>2011 Target</b> <b>15% Reduction</b>	<b>Energy Usage</b> <b>(Last 12 months)</b>	<b>Percent Change</b> <b>from</b>
<b>Building System</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Baseline</b>
DHS	137,154	123,438	116,581	143,444	+4.0%

- This is data from the previous year. DHS did not submit data in time for the July 1, 2006 deadline.

**Narrative:**

**Note: Data from their FY2004-2005 report.**

The largest increase in Btu/sq-ft/year at the Arizona State Hospital can be attributed to the increase in Btus of gas used from the baseline year compared to the last 12 months.

Gas use has increased from 65,766 Btu/sq-ft/year in base line year to 72,735 Btu/sq-ft/year for the last 12 months (about +10.6%).

The installation of a gas fired boiler at the Dietary building last year, additional gas hot water heaters in the Civil hospital and the inefficiency inherent to the use of the oversized gas fired boilers in the Central plant to heat water in the older parts of the campus have contributed to this increase.

Electrical use has decreased from 71,388 Btu/sq-ft/year base line year to 69,535 Btu/sq-ft/year for the last 12 months (-2.5%).

**Arizona Department of Public Safety**

The Department replaced five inefficient A/C units with five high efficient units. And, 23 light fixtures were converted from T12 lighting to T8 lighting.

<b>Actions Taken in FY05-06</b>	<b>Project Cost</b>	<b>Quantity</b>	<b>Est. full year savings</b>
Removed 46 T12 lamps and 23 ballasts and replaced with 23 T8 lamps and 23 ballasts	\$412	23 light fixtures	Estimated at \$230/yr.
Five old inefficient A/C units were replaced with high efficient units.	\$19,241	5 ac units	Unknown as units not metered, but should be about 15% savings compared to the old units.
<b>Totals</b>	<b>\$19,653</b>		<b>\$</b>

	<b>Baseline Energy Usage</b> <b>7/1/01 - 6/30/02</b>	<b>2008 Target</b> <b>10% Reduction</b>	<b>2011 Target</b> <b>15% Reduction</b>	<b>Energy Usage</b>	<b>Percent Change</b> <b>from</b>
<b>Building System</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Baseline</b>
DPS	150,512	135,460	127,352	138,420*	-7.0%

DPS is only presenting data for accounts where they have the bills thru June 30, 2005. (10 of 52 accounts)

**Arizona Department of Transportation (ADOT)**

For the baseline year of FY 2001-02, ADOT collected utility bill history for their 91 largest buildings and determine energy usage on a square foot basis. In FY2004-05, use of two buildings was discontinued. This necessitated a change in the original baseline. This year's report has their building energy usage 3.1% lower than the baseline in FY01-02.

<b>Actions Taken by ADOT in FY 05-06</b>	<b>Quantity of the Action</b>	<b>Estimated Dollar Savings for a Full Year FY 05-06</b>	<b>Region</b>
Replaced old HVAC with new Energy Star compliant units	12	\$2,556	Southern
Replaced incandescent lamps with compact fluorescents	45	\$458	Southern
Replaced incandescent vanity lamps with compact fluorescents	36	\$268	Southern
Replaced old CRT monitors with new flat panel units	14	\$266	Southern
Replaced old roof or applied new white reflective roof membranes	5	\$1,500	Southern
Replaced 30 and 40 gallon water heaters with 2.5 and 5 gallon water heaters	8	\$1,600	Northern
Replace magnetic ballasts with electronic ballast (T12 with T8)	65	\$500	Northern
Replaced old HVAC with new Energy Star compliant units	3	\$639	Northern
Replaced old HVAC with new Energy Star compliant units	97	\$20,661	Central
Replaced old roofs or applied new white reflective membranes	3	\$1,000	Central
Central Materials Lab, 1221 N 21st Ave - Upgrade chiller controls system	1	\$1,500	Central
Engineering Bldg, Interstate Sign Shop, Traffic Operations Center - Upgrade chiller control systems	3	\$2,000	Central
Engineering & Administration buildings, Interstate Sign Shop, Traffic Operations Center, Central Mat Lab - Upgrade/repairs to HVAC systems	3	\$600	Central
West Phoenix, Avondale, and South Mtn MVD - Upgrade chiller control systems	3	\$4,500	Central
New MVD Bldg, West Phoenix MVD - Upgrade/repairs to HVAC systems	2	\$2,000	Central
Install 22 thermostat lock out covers various buildings	22	\$220	Central
Replaced T12 lamps and ballasts with T8 on light fixtures at South Mountain, Chandler, Avondale and Tempe Enforcement MVD locations	420	\$3,230	Central
<b>Total Estimated Savings</b>		<b>\$43,497.00</b>	

**Arizona Department of Transportation (ADOT)**

	<b>Baseline Energy Usage</b> <b>7/1/01 - 6/30/02</b>	<b>2008 Target</b> <b>10% Reduction</b>	<b>2011 Target</b> <b>15% Reduction</b>	<b>Energy Usage</b> <b>(Last 12 months)</b>	<b>Percent Change</b> <b>from</b>
<b>Building System</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Btu/sq.-ft./year</b>	<b>Baseline</b>
ADOT – 2001-02 Original 91 buildings	78,440	70,596	66,674	70,656	-9.9%
2005-06 89 buildings *1 & 2	55,264	49,738	46,974	53,570	-3.1%

The data submitted by ADOT is very comprehensive.

**\* The following locations were removed from the baseline because operations moved to buildings not in baseline and contributed to the change in values.**

1. Douglas MVD service disconnected December 2005. Parker MVD disconnected June 15, 2005.
2. Because of the change in the # of buildings, the baseline calculations were adjusted to reflect these changes.
3. In FY 2006, a Programs and Projects Specialist II was assigned duties to monitor the agencies requirements in response to the Governor's Executive Orders for Energy and Water Reduction. This individual did initiate a 100% audit of all utility bills that resulted in adjustments to earlier reports. Assignment of employee to the energy and water conservation program resulted in a 100% QC of all accounts. This resulted in a six month intensive effort that changed the baseline number from 78,440 to 55,264.
4. FY05 data was used for the months of May and June. ADOT will submit corrected report with actual data by August 28, 2006.

**The Arizona Board of Regents (ABOR)**

**Arizona State University at the Tempe Campus**

An energy saving performance contract provides ongoing energy conservation through the improved the performance of thermal systems and buildings. A new 8 MW cogeneration natural gas turbine system with combined heat and power capabilities and full heat recovery steam generation was installed to provide part of the campus power and improve heating efficiency for buildings. To enlist the support of staff and students, the Energy Conservation Committee has a campus-wide awareness campaign that includes a website, an energy hotline and articles placed in campus newsletters. Four new buildings were constructed and are designed to be, at a minimum LEED Silver certified. The university has adopted a policy that all new buildings will be LEED certified to ensure energy-efficient design.

<b>Actions Taken FY '05-'06</b>	<b>Quantity of Action</b>	<b>Estimated Annual Energy Savings FY '05-'06</b>	<b>Estimated Dollar Savings for FY '05-'06</b>
Established a new guideline for campus general use of air conditioning at 76 degrees for cooling, up from 74 degrees, and 72 degrees for heating, down from 74 degrees.	Adjust 2,000 thermostats	22,000 MBTU	\$349,403
Lighting modification in Parking structure # 3	1 system	275 MBTU	\$4,675
Utilization of Performance Contract Operations	557 Points	\$ 112,596	\$ 2,793,745
Energy Suggestion Hot line and E-mail	Telephone & E-mail access	unknown	unknown
Lighting Switch plate conservation reminder decals		unknown	unknown
Campus-wide awareness promotion for Energy Conservation project.	Energy Conservation Committee website, and three media articles published	unknown	unknown
<b>Total</b>		<b>134,871 MBTU</b>	<b>\$ 3,147,823</b>

## Arizona State University at Tempe Campus

	<b>Baseline Energy Usage</b> 7/1/01 - 6/30/02	<b>2008 Target</b> 10% Reduction	<b>2011 Target</b> 15% Reduction	<b>Energy Usage</b> (Last 12 months)	<b>Percent Change</b> from
ASU Tempe Campus	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
ASU	122,744	110,469	103,865	143,846	+15.7%

\* Includes new research laboratory space of 396,400 sq. ft. on Main campus. When opened, the lab did not have sub-metering. Therefore, the consumption could not be isolated from the rest of the campus. Sub-metering has now been installed and will allow separate reporting on the facility's consumption. And, it will allow them to compare the existing buildings' consumption with the 2001-2002 baseline.

### ASU West Campus

Since the baseline year of 2001-2002, the student FTE population has increased by 44%, from 4,387 to 6,309 in the fall 2005. With the campus growing, and becoming a more "full service" campus, we now have 12% of the building space open 24 hours a day. This increases energy usage. Additionally, 110,000 sq.-ft. of classroom space, which includes 5 science laboratories, equipped with natural gas equipment, was added to the campus in FY04-05. Since FY01-02, building space has increased by 18.3%.

New energy management system controls allowed for improved operation of boiler Gas usage down 16.33% over last year.

ASU West Campus reported completing the following list of projects.

<b>Actions Taken FY '05-'06</b>	<b>Quantity of Action</b>	<b>Estimated Project Cost</b>	<b>Estimated Dollar Savings for FY '05-'06</b>
Upgraded Sands building Energy Management System with Direct Digital Controls that allow improved modifications of cooling and heating systems. Reducing utility usage and electrical demand control during peak billing hours.	1 classroom building	\$98,508	\$21,200
Installed 26 high efficiency motors Central Plant Pumping Systems.	26 motors	unknown	\$unknown
<b>Total</b>			\$21,200

	<b>Baseline Energy Usage</b> 7/1/01 - 6/30/02	<b>2008 Target</b> 10% Reduction	<b>2011 Target</b> 15% Reduction	<b>Energy Usage</b> (Last 12 months)	<b>Percent Change</b> from
ASU West buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
Electricity	66,817	60,035	56,795	68,566	2.56%
Natural Gas	7,429	6,686	6,315	13,495	+81.0%
<b>Total</b>	<b>74,246</b>	<b>66,821</b>	<b>63,109</b>	<b>82,061</b>	<b>+9.6%</b>

**ASU Polytechnic Campus**

Through an energy saving performance contract, ASU at the Polytechnic campus has been actively monitoring the savings through Sempra Energy that was part of the performance contract and capital improvements to their buildings. Currently the Polytechnic campus is in its fourth year of the performance contract. To enlist the support of staff and students, the Energy Conservation Committee has a campus-wide awareness campaign that includes a website, an energy hotline and articles placed in campus newsletters. One new building is under construction and is designed to be LEED certified.

The Polytechnic campus is in a growth state and the energy usage will vary until it establishes its consistent baseline of student population. When comparing to the fiscal year 2001-02 as the baseline year for reporting, the student population was 1,939 with 567,366 of operating square footage. For this fiscal reporting year the Polytechnic campus has a student population of 3,983 with 778,777 of operating square footage. With the introduction of the new Student Union facility food service has quadrupled its preparation of meals for the academic year. Also the campus has experienced longer hours of operations due to additional course offerings based on student demand with the addition of the Agribusiness facility.

With a dynamic growing Polytechnic campus energy conservation will continue to increase in awareness and Facilities Management monitoring and minimizing waste by identifying potential opportunities to save energy and funding. The polytechnic campus will be exploring use of solar power for various applications in the next fiscal year.

ASU West Campus reported completing the following list of projects.

<b>Actions Taken FY '05-'06</b>	<b>Quantity of Action</b>	<b>Estimated Project Cost</b>	<b>Estimated Dollar Savings for FY '05-'06</b>
Monitoring 2002 lighting retrofit	1	Staff	\$59,780
Monitoring 2002 HVAC Equipment	1	Staff	\$87,268
Monitoring of chiller replacement from 2002	1	Staff	\$25,923
Monitoring of energy management system from 2002	1	Staff	\$143,481
Strategic changes to billing rates 2004-05	22	Staff	\$49,714
Campus-wide awareness promotion for Energy Conservation.	website for campus	Staff	Unknown
<b>Total</b>		\$	\$366,165

	<b>Baseline Energy Usage 7/1/01 - 6/30/02</b>	<b>2008 Target 10% Reduction</b>	<b>2011 Target 15% Reduction</b>	<b>Energy Usage (Last 12 months)</b>	<b>Percent Change From</b>
ABOR managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
ASU Polytechnic	65,333	58,800	55,533	78,500	+20.1%

**Northern Arizona University**

Conservation efforts in 2004/2005 centered on planning needs for a variety of USGBC certified facilities under construction or being renovated.

Applied Research and Design Building (seeking Platinum rating) is under construction and slated for completion in spring 2007. It is targeted for a substantial reduction of energy consumption than a typical building of its type. Planned strategies for this facility include alternative energy production, solar orientation, and use of reclaimed water for irrigation and waste conveyance, and broad focused educational venues to explain and further the application of sustainable technologies for implementation by other building projects.

College of Engineering and Natural Sciences (CENS) (seeking Silver rating) was completed in December 2005. This renovation and expansion will employ green building technologies similar to those in the ARD Facility with a slightly lower overall reduction in utility consumption.

College of Business Administration (seeking Silver rating) was also completed in December 2005. This newly constructed facility also employs green building technologies similar to those in the ARD Facility with a slightly lower overall reduction in utility consumption.

Both CENS and CBA will have an overall benefit to campus utility consumption as the aggregate savings in each facility will contribute a tremendous impact on campus utility consumption.

Additional projects in the schematic to construction document planning and design stages include New Laboratory Facility and the renovation of the College of Health Professions and the School of Nursing.

	<b>Baseline Energy Usage</b> <b>7/1/01 - 6/30/02</b>	<b>2008 Target</b> <b>10% Reduction</b>	<b>2011 Target</b> <b>15% Reduction</b>	<b>Energy Usage</b> <b>(Last 12 months)</b>	<b>Percent Change</b> <b>from</b>
ABOR managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
NAU	120,870	108,783	102,740	119,600	-1.0%

NAU did not submit utility data in time for the publishing of the preliminary report.

**University of Arizona**

As fiscal year 2006 rolls to a close, the University of Arizona has implemented numerous strategies to reduce and conserve energy usage and costs. As noted in the data below, the number, size and effects of the implemented projects provides knowledgeable indicators of the University of Arizona’s commitment to energy and cost savings for its customers, the community and the State. The University diligently strives to exceed the ten and fifteen percent mandatory reductions.

<b>Energy Conservation Projects – Status, Costs, and Savings FY 2005 - 2006</b>			
<b>Actions Taken</b>		<b>Project Costs</b>	<b>Estimated Annual Energy/Utility Cost Savings</b>
1	Optimization of UA campus buildings summer/winter steam consumption. Adjust air handling unit hot deck/cold deck temperature parameters. *See Building Steam Usage for supporting material. Entire campus summer/winter steam consumption spreadsheet data gathered FY05-06.	\$ 4,640	Est. Avg. Reduction 10%-15% Target (to be realized FY06-07)
2	Rebuild/refurbish equipment room building systems related to building heat steam/hot water in 5 campus buildings.	\$145,260	Est. Avg. Reduction 10%-15% Target (to be realized FY06-07)
3	Campus-wide replacement of 10 failed Variable Frequency Drive Units to allow variable speed fan operation on building VAV Air Handler Systems.	\$52,496	Est. Annual Savings to be realized after completion of in-house installation \$85,086
4	Shutdown building HVAC systems during Campus Holiday Shutdown 05-06.	\$4,223	Est. Annual Savings in excess of \$120,000
5	Expansion of campus wide Air Handler Scheduling Program, including installation of 2 new remote workstations complete with software packages for remote scheduling and troubleshooting capabilities.	\$2,610	Est. Annual Savings \$262,812
6	Replacement of 44 aging standard efficiency large horsepower fan motors with new premium efficiency motors in 3 campus buildings.	\$60,353	Est. Annual Savings \$29,597
7	Finalization and enhancement of the Main Library HVAC retrofit project resulting in the installation of 429 digitally controlled VAV terminal units including controller factory design modifications and digital control program improvements developed by UA in-house personnel resulting in tighter temperature control and lower energy consumption.	\$ 3,253,758	Conversion From Constant Volume to Variable Volume Est. Annual Savings \$418,147 Additional VAV System Enhancement Est. Annual Savings \$13,000

	<b>Actions Taken</b>	<b>Project Costs</b>	<b>Estimated Annual Energy/Utility Cost Savings</b>
8	Installation & optimization of Arizona Stadium Scholarship Suites' digitally controlled heating and cooling system including establishment of occupied/ unoccupied mode.	\$ 700,000	Est. Annual Savings is \$20,000 Additional Occupied/Un-occupied Annual Savings \$6,703
9	Consolidation of campus building occupancy to optimize HVAC systems related energy consumption to maximize utility savings for Summer 2007—four day workweek and classes.	\$119,500	Est. Annual Savings \$1,000,000 Target
10	Modification of existing HVAC system digital programming in the Marshall Foundation Building resulting in enhanced system performance and reduced utility costs.	\$ 464	Est. Annual Savings \$3,000
11	Optimization of annual Chiller runtime at the University Services Annex, resulting in 4 months of building operation with no on-line chiller operation.	\$ 1,464	Est. Annual Savings \$26,000
12	Replacement of 17 aging, inefficient package heat pumps with new energy efficient 13 SEER rated units at AHSC Temporary Faculty Office Building.	\$ 78,254	Est. Avg. Annual Savings to be realized FY 2006 - 2007 30%
13	Retrofit Arizona Stadium Wildcat Club 20 ton HVAC system to operate with infrared occupancy sensor/motion detector and eliminate existing programmable thermostat.	\$ 216	Est. Annual Savings \$1,000
14	Modify UA Manual of Design Standards & Specifications HVAC controls guide spec to comply with new LONWORKS criteria for compatibility and standardization related to new campus buildings systems interface with remote workstations.	\$1,000	Est. Avg. Annual Savings 10%-15% Target
15	Purchase additional cooling tower to be installed in tandem with the existing unit to enhance building performance, provide system redundancy and extend no on-line chiller operation to 5 months at the University Services Annex.	\$ 27,025	Est. Annual Savings to be realized after completion of installation \$6,000
16	Implemented 3-D campus building energy conservation policy memo specifying air handler scheduling practices and consolidation of building equipment requiring stand-alone cooling independent of house air. See attached memorandum	\$500	Est. Annual Savings \$262,812
17	Plumbing Shop steam trap repair/replacement program. Resulting in a potential \$8,000 per year annual savings per steam trap.	\$17,172	Est. Annual Savings \$648,000
18	Water conservation in campus buildings (1,380,000 gallons of water per year saved) - flushometers/waterless urinals/autoflushers.	\$17,520	Est. Annual Savings \$1,104

	<b>Actions Taken</b>	<b>Project Costs</b>	<b>Estimated Annual Energy/Utility Cost Savings</b>
19	CRB-Installed bypass around plate and frame booster pump	\$ 17,000	\$2,155 per year (see Utility Calculations)
20	CRB-Increased ice storage capacity by 53%, added one 870 Ton ice chiller, and one 2200 Ton plate and frame. Thermal storage capacity is now at 23,100 Ton- hours, with displacement of water chiller capacity during electrical peak demand of approximately 3,000 Tons – with full build out.	\$1,989,834	\$420,000 savings on a new water chiller purchase (one time savings) \$141,000 per year
21	CRB-Balanced flows between 2-600 HP CHW pumps	\$1,000	\$3,485 per year (see Utility Calculations)
22	CHRP-repaired a 1.4 MW steam turbine generator to fully utilize excess steam from the two co-generation units during periods of light steam use in the summer months. The steam interconnects between the main and AHSC campus enables utilization of all excess steam from both campuses.	\$5,617	\$42,200 (Savings for FY 2005 - 2006)
23	CHRP-Rebuilt three wooden cooling towers at the Main Campus plant to restore tower efficiency.	\$68,167	\$11564.00/year-see attached sheet
24	Installed capacitors for power factor correction, AHSC Campus	\$7,700	Est. Annual Credit from TEP \$3600 (approx.) (see Utility Calculations)
25	Began measurement of phosphate levels in reclaimed water to enable blending of reclaimed and potable water in all plant cooling towers. Increases the ratio of reclaimed to potable water without exceeding condenser water calcium phosphate scaling limits. (Cost of Analyzer = \$1,000) Note: Reclaimed Costs more than potable water. However, it is more environmentally responsible.	\$1,000	N/A
	Totals	\$6,576,773	\$2,527,265

**Example of an Energy Action at the U of Arizona**

**MEMORANDUM:**

**DATE:** August 9, 2005  
**TO:** Deans, Directors and Department Heads  
**FROM:** Joel D. Valdez, Senior Vice President of Business Affairs  
**RE:** New Energy Conservation Policy For Climatically Controlled Campus Buildings

The vast majority of U of A buildings across campus are conditioned by large air handling systems utilizing chilled water for cooling and hot water or steam for heating, supplied by the campus utility infrastructure. Typically, air is delivered to the conditioned building spaces via large supply fans, driven by electric motors that can be 100 horsepower or larger. Annual utility costs to run a 100 horsepower electric motor constantly, at full load, will exceed \$52,000.00 per year. Consequently, heating and cooling our campus buildings comprises a major portion of the overall University utility bill.

With this concept in mind, and with recent advancements in industrial grade digital controls for building air handling systems, the time has come to establish a campus-wide energy policy, outlining specific operational guidelines related to these building systems. During the past year, Facilities Management has established an aggressive on-going air handler scheduling program, limiting the hours of operation for large air handling units in several campus buildings, resulting in a substantial projected annual utility cost savings based on fan horsepower. I applaud this type of proactive effort to combat rising utility costs directly affecting the University budget, while continuing to provide an environment conducive to higher learning.

As an integral part of this on-going project, wherever possible, standard hours of operation for additional existing campus air handling systems will be limited to the normal business hours established for that building. Additionally, any new or remodeled conditioned space, created to house either people or temperature sensitive equipment requiring 24/7 climatic conditioning, should incorporate as an integral design/budget component, a properly sized, stand alone HVAC system, either independent of or in tandem with house air. New campus buildings should be designed such that all space requiring 24/7 climatic conditioning is centrally located on a common HVAC system or systems, allowing for prudent air handler scheduling practices during unoccupied hours, throughout the majority of the building. This centralization of temperature sensitive equipment concept can also be a viable approach in existing buildings under certain conditions.

The long-term goal of this program is to establish and maintain permanent, aggressive time scheduling for air handling systems, in as many campus buildings as possible, by evaluating, addressing and eliminating existing obstacles that currently prevent this ultimate energy saving measure. The success of such a program requires continued support and cooperation at many different levels, especially building occupants. So when the time arrives for your building to be evaluated and the energy train rolls into your station, climb on board and endorse this effort to conserve energy and lower utility costs related to the air conditioning of our campus buildings.

**Utility Calculations**

Provided by University of Arizona

**CHRP rebuild east cooling towers**

**CRB – installed bypass**

<p>Chillers # 6 and #9 ran from May 05- April 06 for a total number of 5782333.75-ton hours.  Efficiency improvement on the cooling towers went from .71 kW/ton to .685 kW/ton.  Savings = 144558.3438 kW x .08 cents per kWh = \$11,564.6675/year savings.</p> <p><b>CRB-Balanced flows on distribution pumps</b>  1 pump at 20 Hz not moving water 10% of the time  8760 x 10% = 876 hours  600 HP/10 = 60 HP reduction  60 HP x .746 kW/HP/90% eff. = 49.73 kWh  49.73 kW x 876 hours = 43,566.4 kWh  .08/kWh x 43,566.4 kWh = \$3,485/year</p>	<p>125 HP/10 = 12.5 HP reduction  10 hours/day x 5 days/week x 52 weeks/year = 2600 hours  12.5 HP x .746 kW/HP/.90% efficiency = 10.36 kW  10.36 kW x 2600 hours x .08 = \$2155/year</p> <p><b>Power Factor calculations</b>  (Example taken from June 2006 bill)</p> <p>Actual power factor 90.854 – minimum power factor 90.000 = .854  .854 x .013000 x actual demand 8674 kW = \$96.30 credit</p> <p><b>Thermal storage increased capacity</b>  974 tons x .685 x 10 hrs/day x 22 days x 12 months x .08 = \$140,910.528  <b>Note:</b> 974 tons is the melt rate for the ice storage system increased capacity</p>
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**University of Arizona**

University of Arizona has installed two gas turbines rated at 6.5 MW and 4.0 MW, respectively, to generate electricity and to produce steam. This actually increases the energy consumption on campus, but it also makes their whole system more efficient. 100 units of natural gas used in the turbines will produce 31 units of electricity and 43.7 units of steam. Very efficient.

	<b>Baseline Energy Usage</b> 7/1/01 - 6/30/02	<b>2008 Target</b> 10% Reduction	<b>2011 Target</b> 15% Reduction	<b>Energy Usage</b> (Last 12 months)	<b>Percent Change</b> from
U of A managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Baseline
U of Arizona	140,948	126,853	119,806	131,816	-6.5

U of A also installed a large ice storage system that makes ice at night when electricity rates are cheaper. During the day, the ice is used to cool their buildings and allows them to use fewer chillers. This actually increases the Btu consumption because it takes more Btus to make ice. However, the result is lower overall electricity costs. In 2006, the University of Arizona expanded their ice storage system to full capacity (23,100/ton-hours) to assist with peak demand.

## Appendices

### Copy of A.R.S. §34-451

#### 34-451. Energy conservation standards for public buildings

A. The department of commerce in consultation with persons responsible for building systems shall adopt and publish energy conservation standards for construction of all new capital projects as defined in section 41-790, including buildings designed and constructed by school districts, community college districts and universities. These standards shall be consistent with the recommended energy conservation standards of the American society of heating, refrigerating and air conditioning engineers and the international energy conservation code.

B. The standards shall be adopted to achieve energy conservation and shall allow for design flexibility.

C. The following state agencies shall reduce energy use in public buildings that they administer by ten per cent per square foot of floor area on or before July 1, 2008 and by fifteen per cent per square foot of floor area on or before July 1, 2011, using July 1, 2001 through June 30, 2002 as the baseline year:

1. The department of administration for its building systems.
2. The Arizona board of regents for its building systems.
3. The department of transportation for its building systems.

D. The state energy office shall provide technical assistance to the state agencies prescribed in subsection C of this section. On or before July 1 of each year, the state energy office shall measure compliance with subsection C of this section, compile the results of that monitoring and report to the speaker of the house of representatives and the president of the senate as to the progress of attaining the goals prescribed in subsection C of this section. The state energy office shall include in its report an explanation of the reasons for any failure to achieve energy reductions in specific building systems as prescribed in subsection C of this section.

E. All state agencies shall procure energy efficient products that are certified by the United States department of energy or the United States environmental protection agency as energy star or that are certified under the federal energy management program in all categories that are available unless the products are shown not to be cost-effective on a life cycle cost basis.