

# **Oakland University**

## **Annual Energy Report**

### **Fiscal Year 2010**

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[www.oakland.edu/energy](http://www.oakland.edu/energy)

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## **EXECUTIVE SUMMARY**

Mild weather coupled with energy and water conservation projects has brought down both utility consumption and cost for the first time since FY 03. Consumption in electricity was down 1.5%, natural gas was down 4.5%, and water was down 8.1%. Both gas and electric rates remained relatively constant for an overall cost savings, while the city water rate was up 21%. Overall, utility cost was down in FY 10 by \$310,000 from the previous fiscal year. The energy conservation savings will continue into future years, and additional cost savings are expected from falling natural gas prices. The university makes forward purchases of natural gas to moderate market fluctuations, therefore the advantages of a falling market will be felt slowly, and FY 10 was the peak in our gas rate. FY 11 is expected to see a 25% reduction in the unit cost of natural gas. This will be the driving factor behind a projected 3.6% or \$220,000 reduction in FY 11 total utility cost, even though the first quarter of FY 11 experienced the increased water and electric consumption and cost due to the hottest summer in recent history.

Recent increases in the City of Detroit water rates are affecting suburban water costs, and this has been reflected in the local rates with increases in FY 09, FY 10, and FY 11 of 4%, 20.7%, and 11%. Variations in campus water consumption have been shown to track the severity of the summer cooling season. A lower playfields irrigation well shifted 4,000,000 gallons off of city water for a savings of almost 6%, or \$27,000, resulting in a 2.8 year payback on the installation. Our most recent summer (first quarter FY 11) was the hottest summer on record, as a result, water consumption is projected to increase by 12% overall for FY 11. However, domestic water/sewer costs are a small portion of the overall utilities, typically ranging between 5 to 10% of the total costs.

Energy conservation, green building, and clean energy infrastructure projects are all underway in various stages of development or construction. A building recommissioning program which began with the RAC has been very successful in reducing costs, a \$2.75M US Department of Energy grant will help supplement the Human Health Building Platinum LEED project with a geothermal / solar-thermal system, an LED lighting pilot program was awarded to OU by Detroit Edison, and work continues on the biomass heating plant and wind power proposals.

## **INTRODUCTION**

Mild weather coupled with energy and water conservation projects has brought down both utility consumption and cost for the first time since FY 03. Consumption in electricity was down 1.5%, natural gas was down 4.5%, and water was down 8.1%. Both gas and electric rates remained relatively constant for an overall cost savings, while the city water rate was up 21%.

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The tables and figures below will detail this information. The unit cost for each utility with comparisons to the previous fiscal year is shown below in Table 1. Table 2 shows the projections for FY 11.

**Table 1 Average unit cost per utility with comparisons to previous year**

	<b>FY 09</b>	<b>FY 10</b>		
	<b>Unit Cost</b>	<b>Unit Cost</b>	<b>Units</b>	<b>% Change</b>
<b>Electricity</b>	\$ 0.0760	\$ 0.0760	per kW hour	0.0%
<b>Natural Gas</b>	\$ 9.58	\$ 9.69	per million BTU	1.2%
<b>Water &amp; Sewer</b>	\$ 4.81	\$ 5.80	per thousand gallons	20.7%

**Table 2 PROJECTED FY 11 average unit cost per utility**

	<b>FY 10</b>	<b>FY 11</b>		
	<b>Unit Cost</b>	<b>Unit Cost</b>	<b>Units</b>	<b>% Change</b>
<b>Electricity</b>	\$ 0.0760	\$ 0.0769	per kW hour	1.1%
<b>Natural Gas</b>	\$ 9.69	\$ 7.25	per million BTU	-25.2%
<b>Water &amp; Sewer</b>	\$ 5.80	\$ 6.44	per thousand gallons	11.0%

The City of Detroit water rates are the driving factor behind water rate increases for all of southeast Michigan including our supplier, the City of Auburn Hills. We also receive a much smaller amount of city water from Rochester Hills on the east campus. East campus utilities are only a 3-4% of the main campus consumption and costs, some of which are paid directly by auxiliary departments.

The effects of mild weather and conservation projects helped reduce consumption in all categories as shown below. The 20.7% increase in the water & sewer rate was relatively small (approximately \$80,000 increase) in relation to these larger savings, resulting in a net decrease of 2.1%, or \$310,000, as compared to the previous fiscal year.

**Table 3 Utility consumption & cost with comparisons to previous year**

	FY 10			FY 10 Cost	
	Usage	Units	% Change		% Change
<b>Electricity</b>	35,981,960	kW hours	-1.5%	\$ 2,734,649	-1.5%
<b>Natural Gas</b>	289,593	million BTU	-5.6%	\$ 2,806,425	-4.5%
<b>Water &amp; Sewer</b>	80,388	thousand gal	-8.1%	\$ 466,389	10.9%
<b>TOTALS</b>				<b>\$ 6,007,463</b>	<b>-2.1%</b>

*Note 1: MMBTU = one million British thermal units (approximately = 1 MCF = thousand cubic ft)*

*Note 2: This data is for the large, main accounts only, the general funded small utility accounts are less than 1% of total expenditures.*

Current and future conservation projects will continue to produce savings, but a very hot summer is projected to increase electrical consumption by 11.2%. However, this is ameliorated a 25.2% reduction in the natural gas unit cost for FY 11. Therefore, FY 11 is still projected to be down another 3.8%, or \$220,000.

**Table 4 PROJECTED FY 2011 utility consumption & cost**

	FY 11 Projected			FY 11 Projected	
	Usage	Units	% Change	Cost	% Change
<b>Electricity</b>	39,567,000	kW hours	10.0%	\$ 3,041,000	11.2%
<b>Natural Gas</b>	298,000	million BTU	2.7%	\$ 2,159,000	-23.1%
<b>Water &amp; Sewer</b>	90,000	thousand gal	12.0%	\$ 580,000	26.3%
<b>TOTALS</b>				<b>\$ 5,780,000</b>	<b>-3.8%</b>

Presently 81% of FY 11, 53% of FY 12, and 18% of FY 13 natural gas has been contracted. Falling prices will show up in future gas contracts, however a rebound is expected as the economy improves.

The recent decade has been much warmer than average, and this trend continued into FY 10. The most recent summer will fall into FY 11 with a projected 1020 cooling degree days. Globally, calendar year 2010 is on track to be the warmest on record. It would have to be warmer than 1998 which is currently the warmest, and 2007 the second warmest. The calendar 2007 summer fell into our FY 06 utilities, and this was manifested by a 6% electrical and 47% water increase. Recent trends towards much warmer weather patterns are expected to continue.

Table 5 below displays a weather measure called “degree days” to gauge how far each day is from a reference 65 deg F for both the heating season and the cooling season.

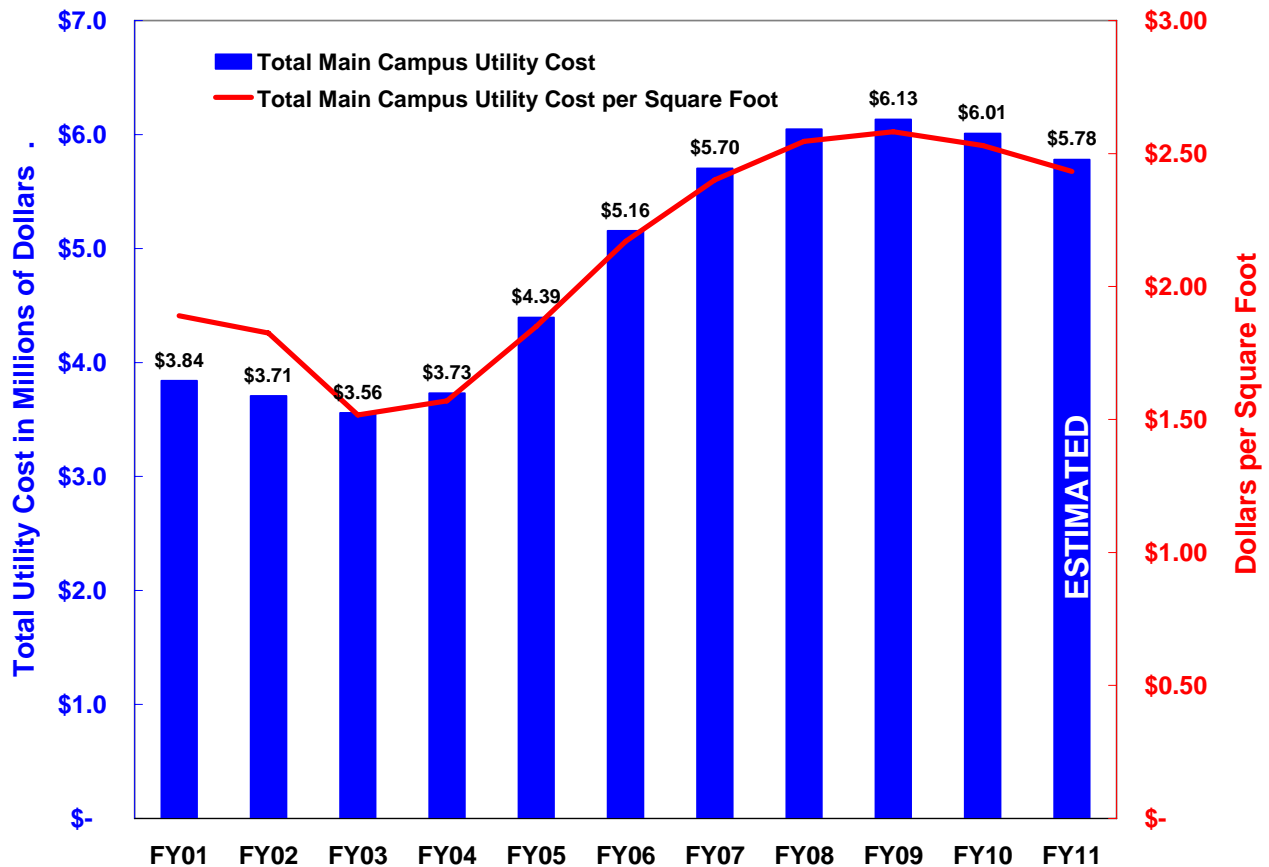
**Table 5 Heating and cooling degree days with comparisons to previous year**

	<b>Average</b>	<b>FY07</b>	<b>FY08</b>	<b>FY09</b>	<b>FY10</b>	<b>% Change</b>
<b>Heating Degree Days</b>	6,444	5,945	6,043	6,420	5,693	11.3% warmer
<b>Cooling Degree Days</b>	736	909	894	774	745	3.7% cooler

*Degree Days are calculated from the difference between the average daily temperature and reference temperature (65 deg F). This gives a measure of how much heating and cooling effort is required to maintain a typical building’s indoor air comfort level. (data source <sup>1</sup>)*

<sup>1</sup> National Oceanic and Atmospheric Administration, National Center for Environmental Prediction, [http://ftp.ncep.noaa.gov/pub/cpc/htdocs/products/analysis\\_monitoring/cdus/degree\\_days/archives/](http://ftp.ncep.noaa.gov/pub/cpc/htdocs/products/analysis_monitoring/cdus/degree_days/archives/)

Figure 1 illustrates the previous cost savings from the electrical Retail Open Access purchasing program in FY 03 & FY 04, followed by several years of increasing utility unit costs (most significantly in natural gas). As projected, FY 09 was the peak in this steady climb in utility costs, with FY 10 decreasing by 2.1% and FY 11 projected to decrease by an additional 3.6%. These decreases in expenditures are due mainly to conservation projects and falling natural gas rates.



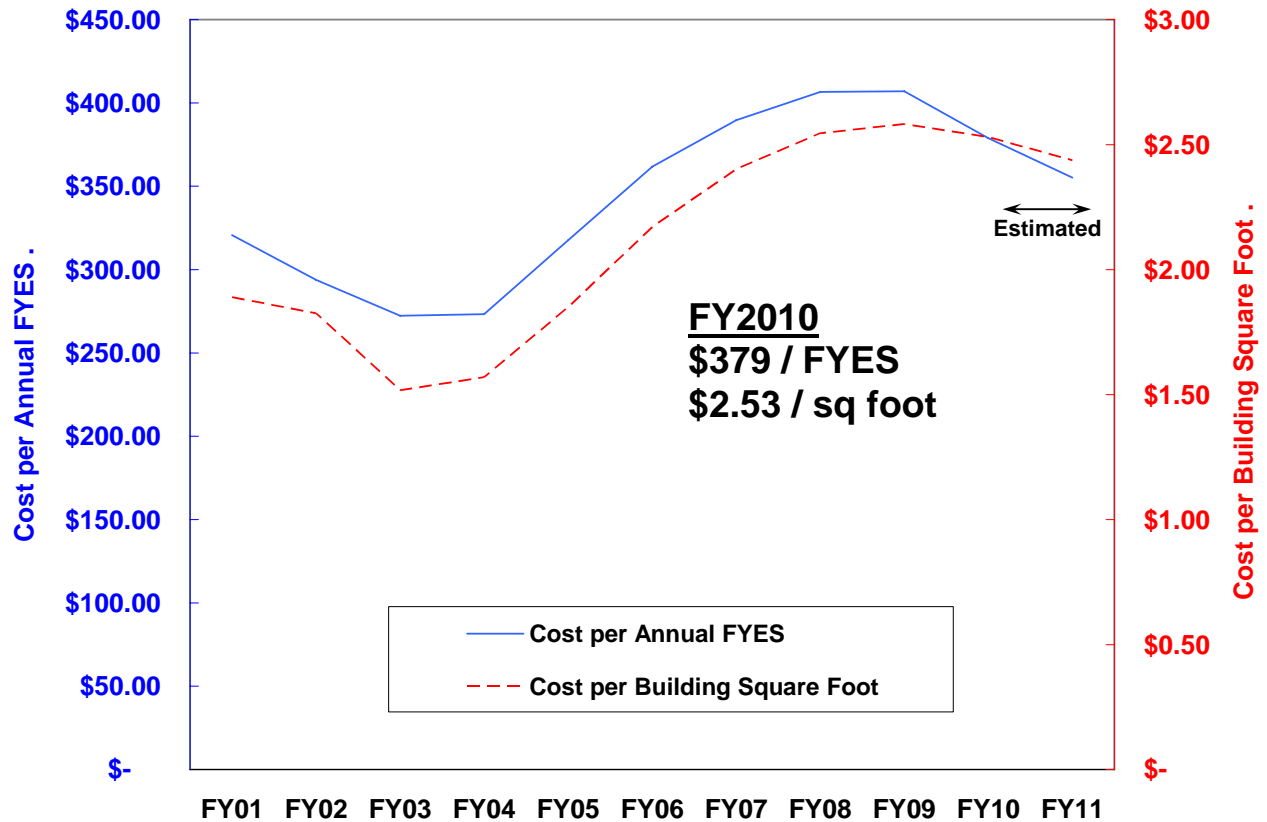
**Figure 1** Eleven year combined west campus utility expenditures with cost per square foot of facility space



## UTILITY COST PER FYES AND SQUARE FOOTAGE

Figure 3 below, depicts this same information adjusted for building square footage and Full Year Equivalent Students (FYES).

This figure is based on our present main campus size of 2,375,000 million square feet, and 15,865 FYES. For a full time, resident undergraduate student with 15 or more credit hours per semester (\$9,870 for both fall and winter semesters), this equates to 3.8% of their annual tuition.



**Figure 2** Total utility cost for the main campus per Full Year Equivalent Student (FYES) and per building square foot.

## HISTORICAL CONSUMPTION AND COST

Figures 3, 4, and 5 illustrate the monthly utility usage and resulting trends over the past decade. Figure 6 illustrates the direct correlation between campus water usage and the severity of the summer cooling season. A significant amount of water is used for air conditioning cooling towers as well as some for irrigation. Both of these values increase in warmer summers. Figure 6 uses a Cooling Degree Day as described in Table 4 above. Although the entire past decade has been warmer than the historical average, the summers of FY 06 and FY 11 were particularly hot.

In the below figures, FY 11 values are estimates.

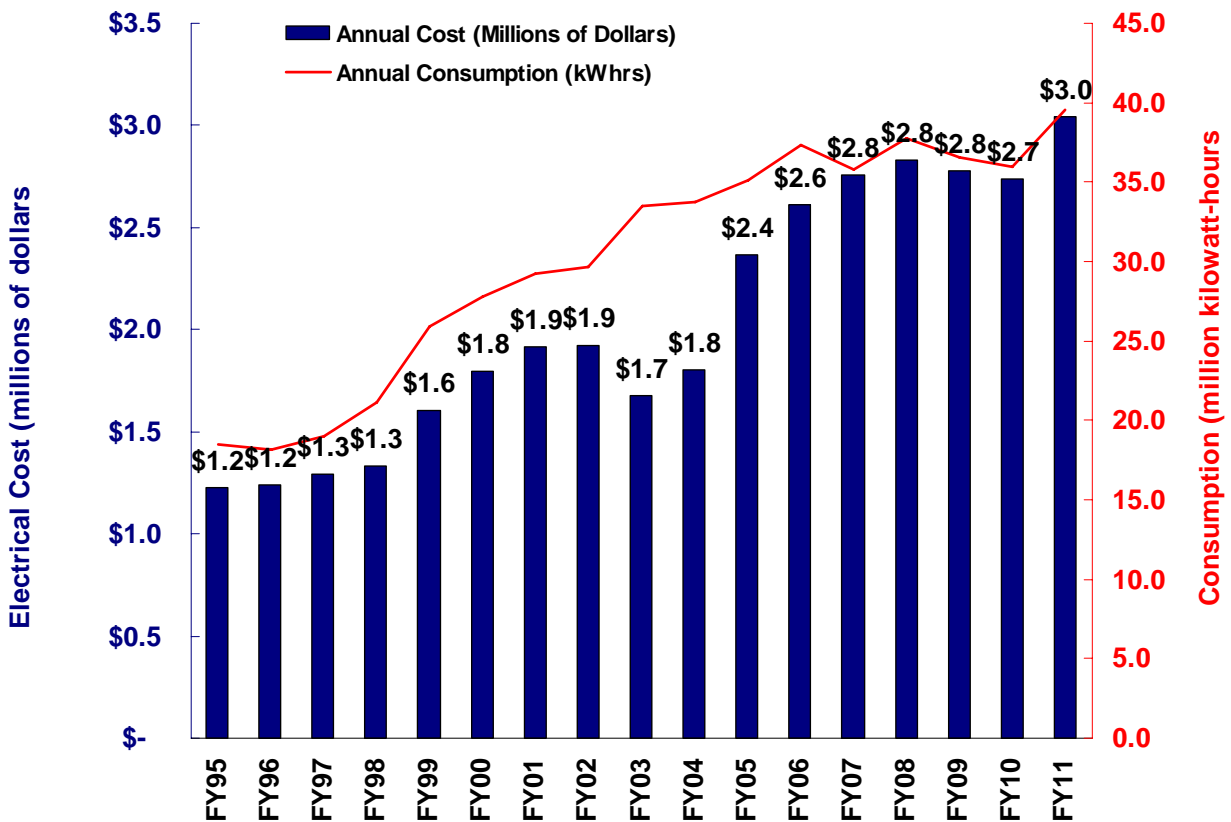


Figure 3 Historical main campus annual electrical cost and consumption

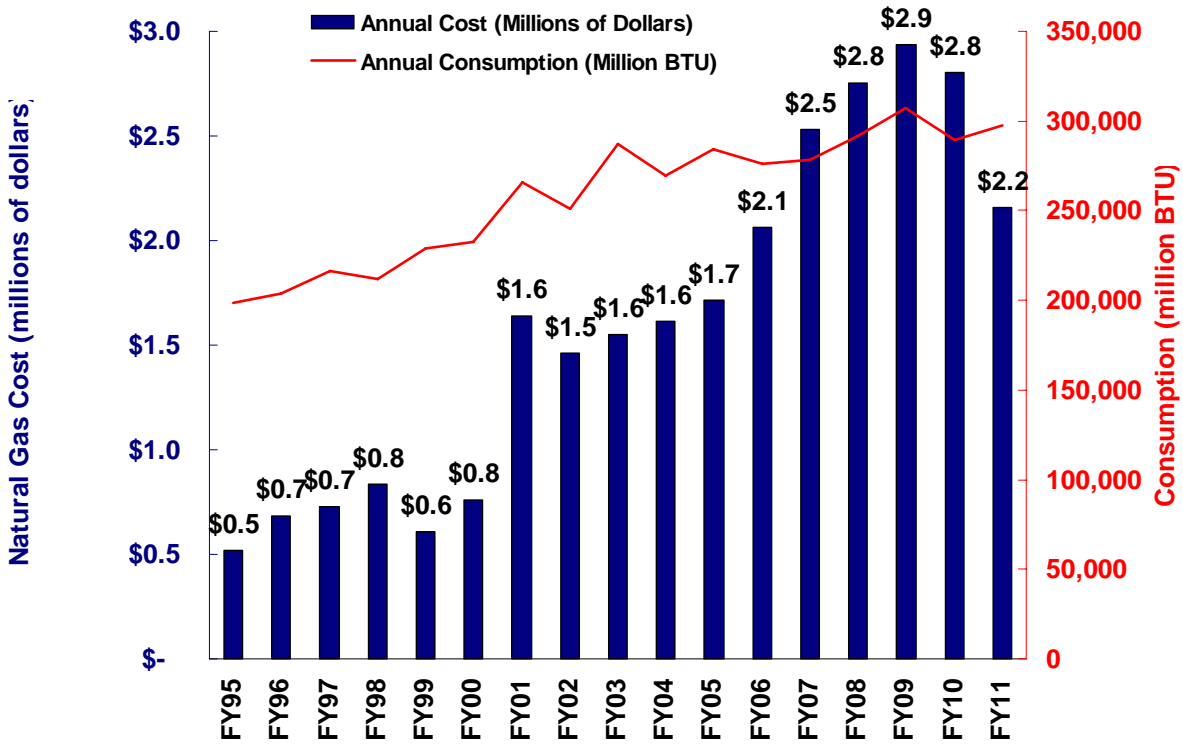


Figure 4 Historical main campus annual natural gas cost and consumption

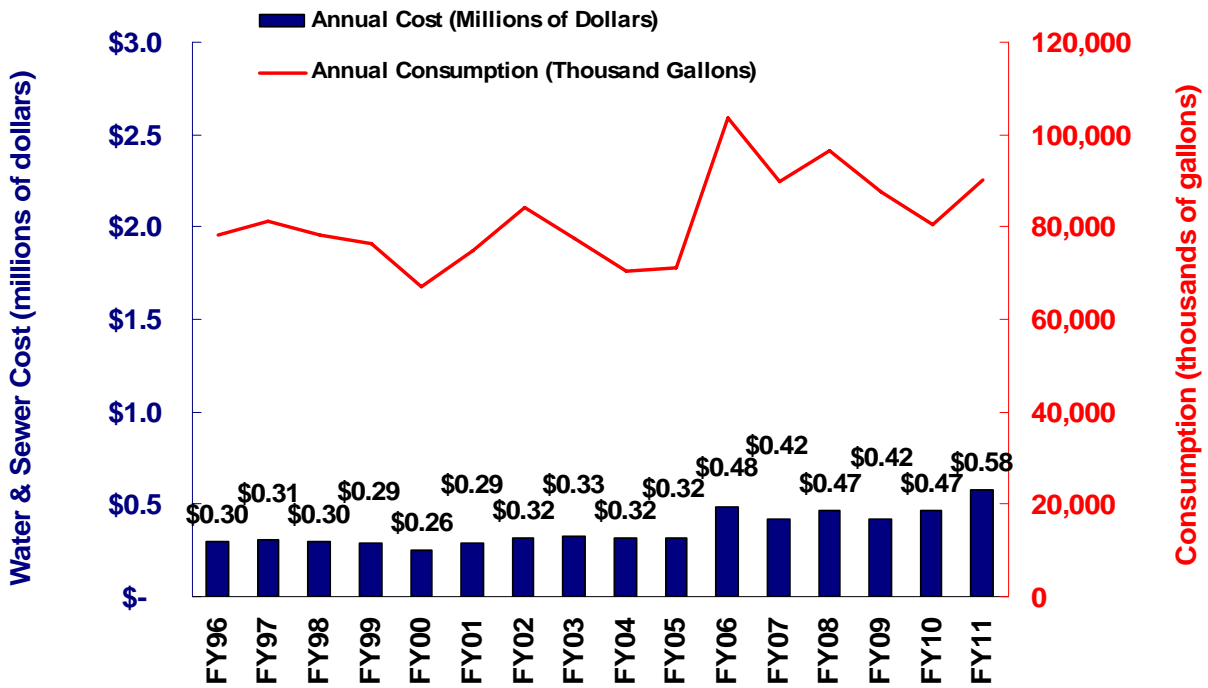
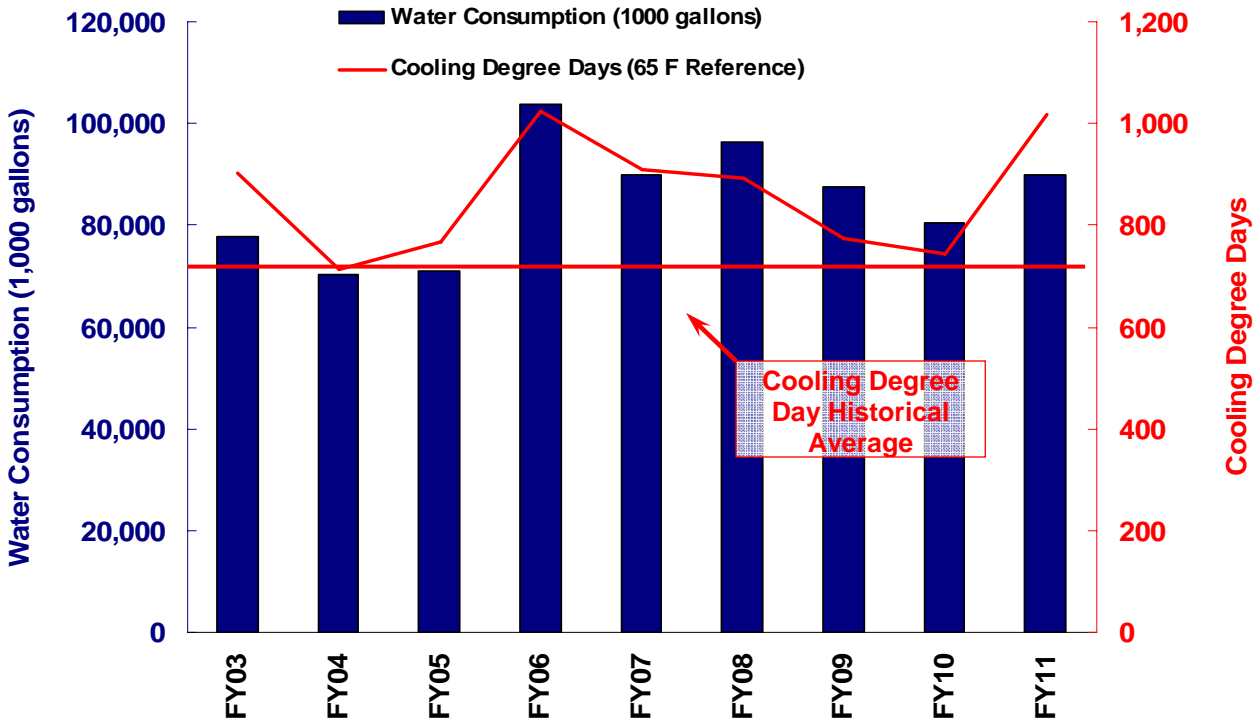


Figure 5 Historical main campus annual water & sewer cost and consumption



**Figure 6** Domestic water consumption showing correlation with summer cooling (*campus square footage remained constant throughout this timeframe*)

## NATURAL GAS PURCHASING UPDATE

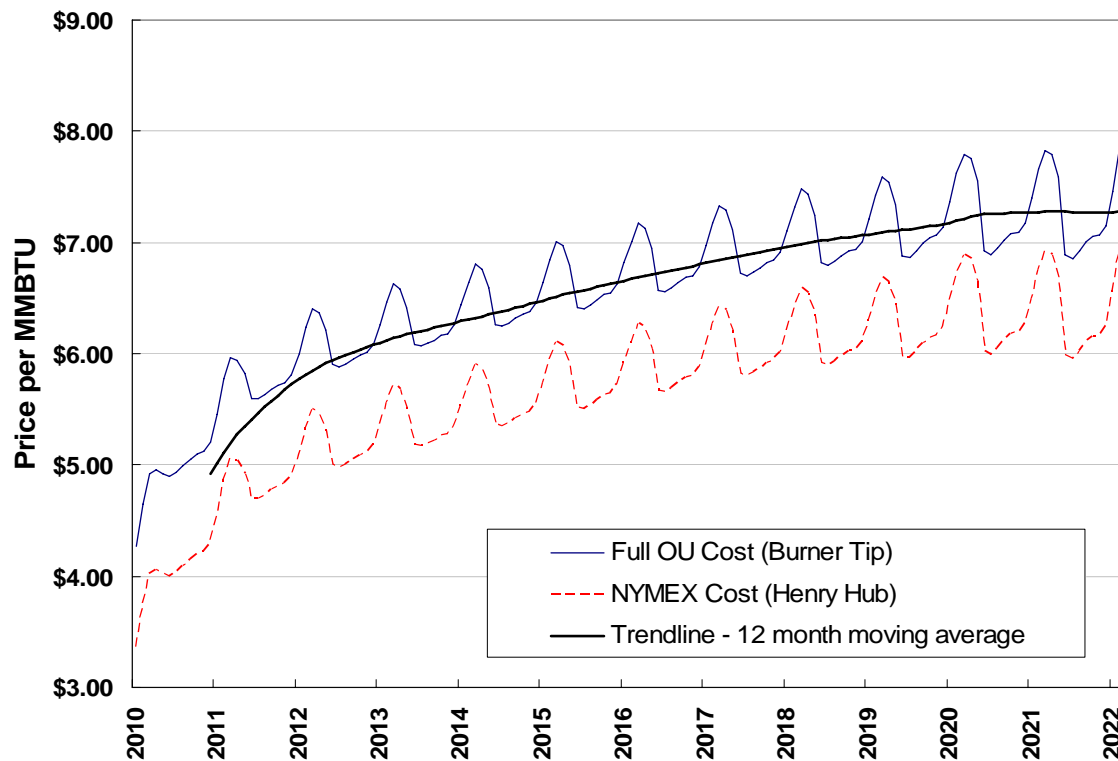
As of October 2010, gas contracts have been purchased for approximately 81% of FY2011, 53% of FY2012, and 18% of FY2013.

Figure 7 below shows the New York Mercantile Exchange (NYMEX) futures contract for gas purchased for delivery in the month of January 2011. Gas prices have fallen precipitously, along with other commodities, during the recent economic slowdown.

Futures contracts as seen on the NYMEX predict that prices will recover and increase. This can be seen in the forward view of futures contracts in Figure 8, as of October 22, 2010. Pipeline costs and local distribution costs to deliver gas to campus is roughly \$1.00 per MMBTU, and is the difference between the two lines on Figure 8. The lower line is the NYMEX futures price, and the top line is the full cost to Oakland. The university makes forward purchases of natural gas to moderate market fluctuations and risk, therefore the advantages of a falling market will be felt slowly. FY 10 was the peak in our gas rate, and FY 11 is expected to see a 25% reduction in the unit cost of natural gas.



**Figure 7** Past 12 month pricing history of NYMEX natural gas contract for January 2011 as of October 22, 2010 (it costs approximately \$1.00 per unit to deliver this gas to OU)



**Figure 8** Natural gas NYMEX futures contracts (top line shows full OU costs delivered to our gas meter) as of market close October 21, 2010.

## **LOWER PLAYFIELDS GROUNDWATER IRRIGATION PROJECT**

A project was completed in the fall of 2009 which installed a 150 GPM groundwater irrigation well for the lower playfields. The project of \$77,000 consisted of a 8 inch well and 20 HP pump package with a variable speed drive. The first year water consumption was shown to be just over 4 million gallons as of late September 2010.



This amounts to 5.7% of the FY2010 domestic water usage, which would have otherwise been supplied by the City of Auburn Hills domestic water supply at a cost of \$27,000, resulting in an estimated payback of approximately 2.8 years. Although we had a very hot summer in calendar year 2010, resulting in increased irrigation and cooling tower water usage, this project will help keep domestic water consumption in check.

## **BUILDING RECOMMISSIONING PROJECTS**

Over the past few years, a program has been started to “recommission” one building at a time by providing an HVAC, lighting, and controls system review and then implementing low to moderate cost changes, repairs, fine tuning, and upgrades to the mechanical and electrical equipment. The first building to undergo a recommissioning project was the Recreation and Athletic Center. A modest \$100,000 investment in control system repairs and software recommissioning effected a sizable decrease in heating and a modest decrease in electrical consumption.

Annual Heating Water Consumption				Annual Electrical Consumption			
FY 07	32,683	MMBTU		FY 07	5.11M	kWhr	
FY 08	38,683	MMBTU	up 18%	FY 08	4.81M	kWhr	down 6%
FY 09	27,678	MMBTU	down 29%	FY 09	4.32M	kWhr	down 10%
FY 10	18,584	MMBTU	down 33%	FY 10	4.17M	kWhr	down 9%

The Energy Services project in 2006 / 2007 also provided a few percent electrical savings, but the substantial savings shown above between were the result of the recommissioning work. The Recreation Department, which directly pays 60% of the RAC building's utility costs, saw a reduction of over \$300,000 per year from FY 08 to FY 10.

Fiscal Year	60% Annual RAC Cost	Percent Change from Previous FY
FY 07	\$ 635,472	36.6%
FY 08	\$ 743,134	16.9%
FY 09	\$ 574,534	-22.7%
FY 10	\$ 443,295	-22.8%

The expected savings from the 2<sup>nd</sup> recommissioning project, Pawley Hall, are not expected to be as large. However, all of these recommissioning savings will be sustained cumulative savings in the coming years. For this project, approximately \$300,000 in energy efficiency upgrades to the chiller plant and HVAC systems will provide a highly efficient building. Results will be communicated in the next year's Board report.

## NEW HUMAN HEALTH SCIENCE BUILDING

### *Oakland University's First Green Building Construction Project*

The new Human Health Building construction will be the University's first venture into a green building project. Facilities Management was



awarded a \$75,000 Kresge Foundation, Green Building Initiative grant as well as a \$2.75M US Department of Energy, Geothermal Technologies Program grant to bolster the green

building features of this project. The project is presently slated to be the first Platinum rated facility for an educational institution in the State of Michigan. To achieve this goal, the building will utilize many environmentally sensitive materials, methods, and energy systems. A 400 ton geothermal heat pump system will be assisted by a million dollar solar thermal array on the roof that will run a desiccant dehumidification ventilation system for increased efficiency in Michigan's humid summer months as well as provide some fraction of winter heating.

This building is scheduled for occupancy in the summer of 2012. Energy savings from this facility is estimated to be half of a conventional building, for a cost savings of roughly \$200,000 per year.

### **DETROIT EDISON LED PILOT LIGHTING DEMONSTRATION PROGRAM**

Detroit Edison has awarded Oakland University Facilities Management \$200,000 to install and evaluate a number of emerging technology outdoor lighting fixtures. Roughly eight manufacturers of LED and induction lighting will be installed on campus parking lots and roadways for evaluation of energy savings, failure rate, light level, and student/faculty perception. Information will be posted on [www.oakland.edu/energy](http://www.oakland.edu/energy) by the end of 2010 which will include the location of fixture types and a questionnaire for the public to register their comments or perception of these new technologies.

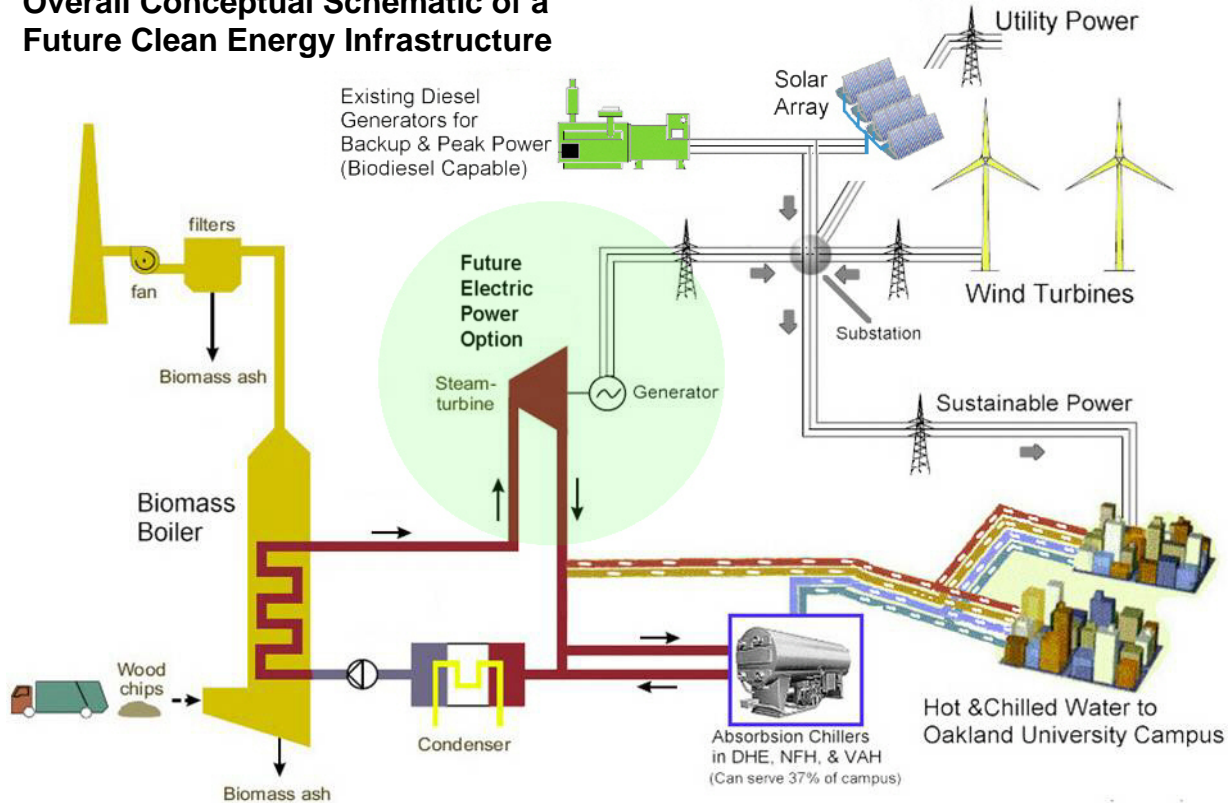
The new lighting will predominantly be a bright white LED or soft white induction lamp, replacing yellowish High Pressure Sodium fixtures.

### **BIOMASS BOILER FEASIBILITY PROPOSAL DEVELOPMENT**

After the completion of wood chip boiler feasibility study in 2007, a request for qualifications and then an RFP was issued to potential project developers for a third party "design, build, own, and operate" combined heat and power Bio-Energy Center, to be located at the south side of campus near the electrical substation.



## Overall Conceptual Schematic of a Future Clean Energy Infrastructure



Oakland University and Oakland Thermal LLC have entered into a Memorandum of Understanding wherein this selected development team has conducted their own due diligence of the project technical and financial merit. In this process multiple boiler sizes and electrical turbine sizes were studied and costed. With the falling gas prices and present economic conditions, the developer has recommended that a smaller, heating only plant is still viable and economical. At the present time, the final proposal is being prepared for review, and work is being done to structure the project so that it will not impact Oakland University's debt capacity. It is proposed that a land lease be given to Oakland Thermal LLC and the University would enter into a Power Purchase Agreement for the purchase of thermal energy over some long term contract. This proposal will be presented to management in December 2010.

## WIND POWER PROPOSAL DEVELOPMENT

In FY 09, Facilities Management completed a two year wind speed data collection and wind power project feasibility study. A request for proposals (RFP) was issued to potential developers for a third party "design, build, own, and operate" project for one or two wind turbines. This project would involve a Power Purchase Agreement (PPA) where the

University would pay for energy produced on a per kW-hr basis only. None of the responses from the prospective developers complied with either the technical or financial terms of the RFP.