



Energy Conservation

Annual Report – Fiscal Year 2011

Final Report

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1. EXECUTIVE SUMMARY

In fiscal year 2011, energy conservation teams, as well as design and operations teams, continued to expand energy conservation efforts in University of Michigan Hospital and Health Centers (UMHHC) facilities and as a result, UMHHC continues to show improvement in overall energy efficiency.

Energy Conservation Projects

In fiscal year 2011, fifteen energy conservation projects were completed in the Cardiovascular Center, Med Inn, Taubman Health Center, and the University Hospital Building. These projects are anticipated to save approximately \$528,000 annually. In total, these projects cost \$52,755 to implement, yielding a 0.1 year overall payback period. For further details, see section 2, “Energy Conservation Projects” of this report.

General Utility Information

As a result of combined energy conservation efforts by all departments, all UMHHC facilities in total improved in both energy and cost efficiency in fiscal year 2011. Overall, facilities improved 5% in energy efficiency and 3% in utility cost efficiency compared to fiscal year 2010, yielding approximately \$1.1 Million in total avoided utility cost. For further details, see section 3, “General Utility Information” of this report.

Environmental Impact

In addition to the demand reduction and cost benefits of energy conservation, improvements also provide a significant environmental benefit by reducing the greenhouse gas emissions associated with the generation of building utilities. Overall, facilities improved greenhouse gas emission efficiency associated with building utilities by 3% compared to fiscal year 2010, yielding nearly 4,000 MTCO₂ of avoided greenhouse gas emissions. This is equivalent to removing over 700 automobiles from the road. For further details, see section 4, “Environmental Impact” of this report.

Building Summary

Based on analyses of building utilities and efficiencies, the following buildings are identified as the most efficient UMHHC facilities, categorized by their primary Energy Star building type:

- Hospital Building: University Hospital – 226,961 BTU/ft²
- Medical Office Building: Briarwood 4 – 49,252 BTU/ft²
- General Office Building: Traverwood I – 48,136 BTU/ft²

For further details and a complete listing of UMHHC building performance, see section 5, “Building Summary” of this report.

2. ENERGY CONSERVATION PROJECTS

In fiscal year 2011, 15 energy conservation projects were completed, with a total estimated annual energy savings of approximately \$528,000. These projects cost \$52,755 to implement in total, yielding a 0.1 year overall payback period. These projects are summarized in Figure 2.1 below.

Figure 2.1: Energy Conservation Projects Completed in FY2011

Building	Project Description	Project Cost	Estimated Savings	Payback (Years)
Cardiovascular Center	Implemented modulating ventilation control strategy in first floor zone.	\$0	\$20,000	0.0
	Optimize auditorium HVAC control settings to reduce ventilation demands during unoccupied periods.	\$0	\$3,000	0.0
	Changed check valve type at condensate return unit to reduce leakage and false readings at steam utility meter.	\$0	\$50,000	0.0
	Adjusted air handling unit temperature control setpoints.	\$0	\$20,000	0.0
	Set fixed temperature range for connecting corridor areas to reduce simultaneous heating & cooling between areas.	\$0	\$5,000	0.0
	Increase modular ventilation control range in office areas where feasible.	\$0	\$50,000	0.0
	Upgrade control of HVAC units serving the penthouse mechanical room for demand based operation.	\$9,110	\$26,000	0.4
	Modify the temperature control sequence in the outside air pre-treatment air handling units.	\$3,758	\$75,000	0.0
	Schedule groups of areas to shut off ventilation during unoccupied periods.	\$20,722	\$160,000	0.1
Med Inn	Converted existing vacuum condensate return system into gravity return.	\$0	\$3,000	0.0
	Updated HVAC unit schedules to reduce operation during unoccupied periods.	\$0	\$20,000	0.0
Taubman Health Center	Updated HVAC unit schedules to reduce operation during unoccupied periods.	\$0	\$40,000	0.0
University Hospital Building	Pilot advanced HVAC sequence to automatically control air mixture based on cost of cooling vs. humidification.	\$4,690	\$5,600	0.8
	Modify process chilled water plant operation to improve plant efficiency during winter time (part of a larger plant project).	-	\$40,000	-
	Rebalance terminal HVAC equipment in one pilot zone to reduce excess ventilation and repair operational deficiencies.	\$14,495	\$10,000	1.4
Totals:		\$52,755	\$528,000	0.1

As seen in Figure 2.1, fiscal year 2011 energy conservation projects primarily focused on the Cardiovascular Center, Med Inn, Taubman Health Center, and the University Hospital Building. Significant energy efficiency improvements were realized in all four of these facilities in fiscal year 2011. These improvements are summarized in Figure 2.2 below. Since these projects were functionally completed during the fiscal year, and therefore only accrued energy savings for a portion of the fiscal year, it is anticipated that realized savings will be even greater in the following year when energy savings have the entire fiscal year to accrue. It should also be noted that the energy projects listed in Figure 2.1 above are only those generated and directly monitored by the Energy Conservation Project team. This does not include the additional savings generated by implementing efficient design practices on new renovation projects, or by effective measures implemented by operations and maintenance teams. As seen in Figure 2.2 below, this is especially relevant in the high level of avoided utility cost in the University Hospital Building, which is mostly attributed to the effective operation and monitoring of the building air handling units. Figure 2.2 below indicates total building performance and therefore includes all efforts in these facilities.

Figure 2.2: Performance in FY2011 Focused Buildings

Building	FY2010 Efficiency (BTU/ft²)	FY2011 Efficiency (BTU/ft²)	% Energy Efficiency Improvement	FY2011 Avoided Utility Cost
Cardiovascular Center	250,260	232,668	7%	\$158,000
Med Inn Building	167,554	150,158	10%	\$39,000
Taubman Health Center	132,730	122,603	8%	\$93,000
University Hospital Building	239,464	226,961	5%	\$489,000

3. GENERAL UTILITY INFORMATION

In fiscal year 2011, the total utility cost for all UMHHC facilities was \$22,366,651. This is a decrease of \$22,421 from fiscal year 2010, despite the addition of 150,100 ft² of new building area and an effective increase of approximately 2% in total utility cost rates. Based on a comparison of utility efficiencies between fiscal year 2010 and 2011 with current utility rates and current building area, utility efficiency improvements resulted in approximately \$1.1 Million in total avoided utility cost for fiscal year 2011. This is detailed in Figure 3.1 below.

Figure 3.1: Breakdown of Avoided Utility Cost vs. FY2010

Utility	FY2010 Efficiency	FY2011 Efficiency	FY2011 Average Utility Rate	Avoided Utility Cost
Electric	29.8 KWH/ft ²	29.7 KWH/ft ²	\$0.083/KWH	\$44,970
Steam*	0.0639 MLB/ft ²	0.0545 MLB/ft ²	\$19.42/MLB	\$989,066
Natural Gas	0.0252 MCF/ft ²	0.0251 MCF/ft ²	\$8.32/MCF	\$4,508
Water/Sewer	0.0601 CCF/ft ²	0.0586 CCF/ft ²	\$6.38/CCF	\$51,851
			Total:	\$1,100,000

*Note: Steam utility figures include a billing credit applied in 2011 for billing errors incurred in 2010 for the North Ingalls Building. This accounts for approximately \$150,000 of the avoided steam utility cost.

Since utility cost rates and the UMHHC portfolio of building area are continually changing, it is important to normalize utility figures for comparison and evaluation of efficiency and performance from year to year. Figure 3.2 illustrates the recent history of total UMHHC building energy efficiency (measured in BTU/ft²) and utility cost efficiency (measured in \$/ft²). Energy efficiency normalizes electric, steam, and natural gas utility into a common energy unit, BTU. This chart does not include water & sewer utility. Historical efficiency shows a 20% improvement in total energy efficiency since fiscal year 2005, and a 5% improvement since fiscal year 2010.

Figure 3.2: Total UMHHC Historical Energy & Cost Efficiency

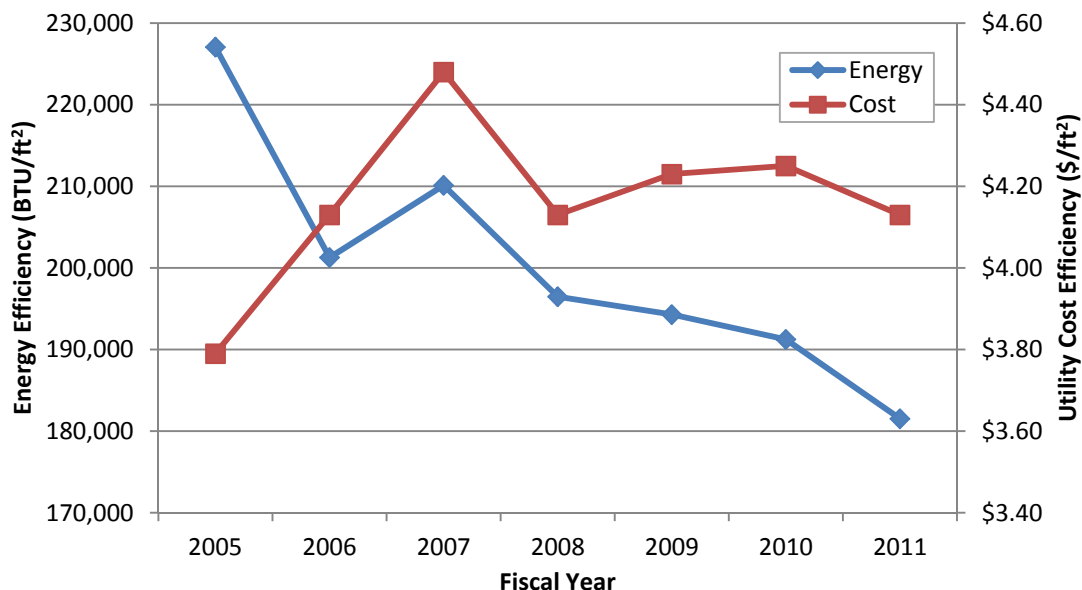


Figure 3.3 below shows the history of total energy and utility cost in recent history without normalizing against the continuous increases in total UMHHC building area.

Figure 3.3: Total UMHHC Historical Energy Use & Utility Cost

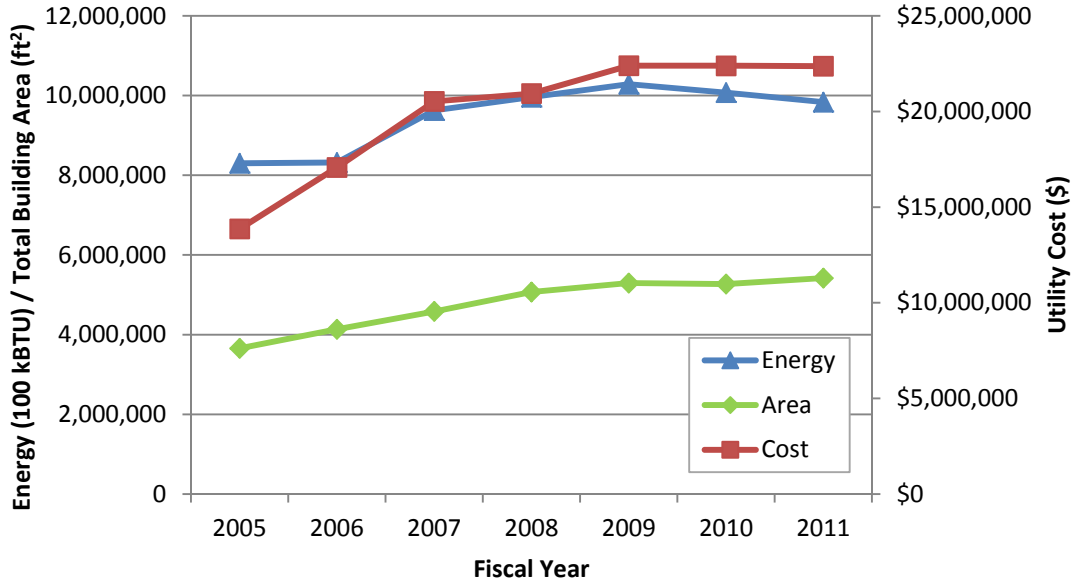
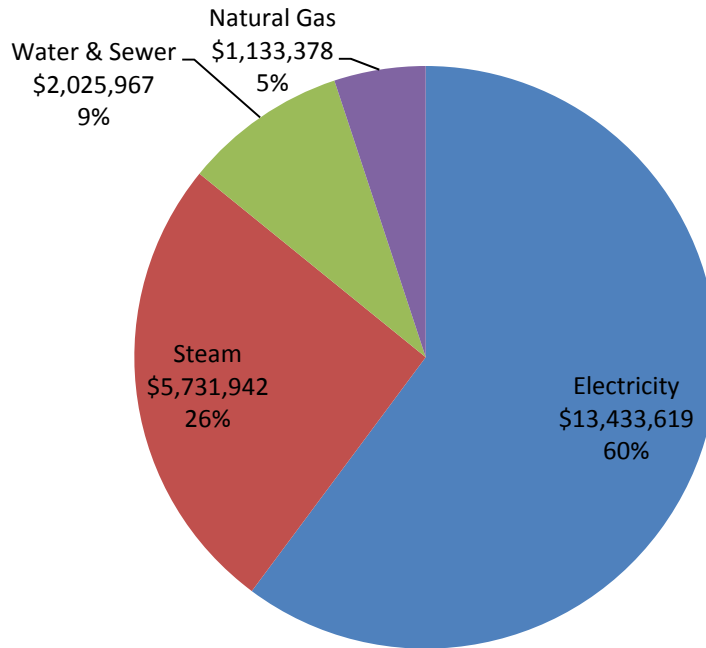


Figure 3.4 below illustrates the distribution and total costs of each of the four primary utilities included in UMHHC facilities for fiscal year 2011.

Figure 3.4: Total FY2011 UMHHC Utility Cost Distribution

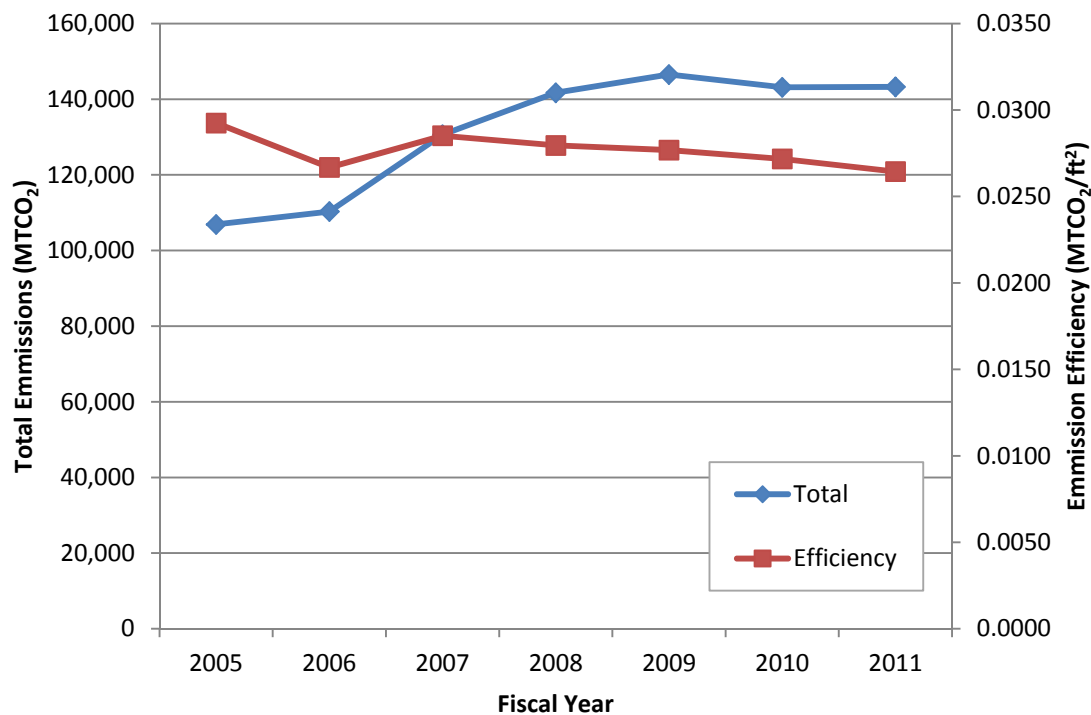


4. ENVIRONMENTAL IMPACT

In addition to the benefits of reducing overall energy and utility resource demands, efficiency improvements provide further benefits by reducing the greenhouse gas emissions generated during the production of utilities. Figure 4.1 below shows the total historical UMHHC greenhouse gas emission quantities and greenhouse gas emission efficiencies, normalized against total UMHHC building area. Emissions are measured in metric tons of carbon dioxide equivalent (MTCO₂). Please note that these figures only include greenhouse gas emissions due to the generation of utilities consumed by facilities, and do not include emissions from other institution operations.

Historical efficiency shows a 10% improvement in total greenhouse gas efficiency since fiscal year 2005, and a 3% improvement since fiscal year 2010. This equates to nearly 4,000 MTCO₂ of avoided greenhouse gas emissions in fiscal year 2011 compared to 2010. This is equivalent to removing over 700 automobiles from the road.

Figure 4.1: UMHHC Utility Driven Greenhouse Gas Emission History



5. BUILDING SUMMARY

Figure 5.1 indicates the most efficient UMHHC buildings in fiscal year 2011, sorted by the primary Energy Star building type. Due to combined metering and shared utilities between facilities, several buildings are not included in this list because the available utility data does not represent the total utility consumed by the building, and therefore does not provide an accurate measure of efficiency.

Figure 5.1: UMHHC FY2011 Most Energy Efficient Buildings

Rank	ID	Building	Efficiency (BTU/ft ²)	Total Utility Cost
<i>Hospitals</i>				
1.	0316	University Hospital	226,961	\$9,496,962
2.	5109	Cardiovascular Center	232,668	\$2,474,279
<i>Medical Office Buildings</i>				
1.	8042	Briarwood 4	49,252	\$25,252
2.	8155	Livonia Health Center	69,986	\$24,124
3.	8149	Dexter Family Practice	72,190	\$14,234
4.	8160	Beser Medical I	77,589	\$2,735
5.	8111	Howell Health Center	83,640	\$6,700
<i>General Office Buildings</i>				
1.	8162	Traverwood I	48,136	\$15,848
2.	8137	Michigan House	54,009	\$164,700
3.	0327	University Hospital Education Center	58,167	\$13,026
4.	5153	Traverwood III	64,128	\$48,444
5.	8100	M-Care / 2101 Commonwealth	68,838	\$66,758

Figure 5.2 below shows fiscal year 2011 utility information, efficiency, and change in efficiency since fiscal year 2010. Data is not directly comparable since data for several buildings does not include total consumed utility due to combined meters and shared utilities.

Figure 5.2: FY2011 UMHHC Building Utility Summary

ID	Building	Energy Star Building Type	Total Cost	Efficiency (BTU/ft ²)	Change vs. FY2010
301	Cancer Geriatrics Center	Laboratory	\$1,135,126	370,674	-2%
306	East Mechanical Building	Other	\$384,305	1,621,458	69%
308	Med Inn Building	Medical Office	\$468,481	150,158	-10%
309	Women's Office Building	Office	\$171,651	104,727	0%
312	Mott Children's Hospital	Hospital	\$451,169	64,604	6%
314	Holden Perinatal Research Lab	Laboratory	\$84,767	203,331	3%
316	University Hospital	Hospital	\$9,496,692	226,961	-5%
317	Taubman Health Center	Medical Office	\$1,328,143	122,603	-8%
318	Maternal Child Health Center	Medical Office	\$370,687	107,130	5%
319	Medical Professional Building	Office	\$97,061	94,502	-2%
325	Parkview Medical	Medical Office	\$116,327	136,078	-31% ⁽¹⁾
327	University Hospital Education Ctr	Office	\$13,026	58,167	6%
328	Scott Turner	Medical Office	\$55,303	90,001	-30% ⁽¹⁾

332	North Ingalls	Office	\$540,009	97,258	-29%
348	Chelsea Family Practice	Medical Office	\$62,209	105,103	-8%
350	East Ann Arbor Health Center	Medical Office	\$773,211	420,604	-2%
390	Child Care Center	Other	\$44,111	117,880	-11%
399	North Campus Admin. Complex	Office	\$398,871	168,167	0%
419	Laundry Services Building	Other	\$545,697	767,541	3%
5011	Burlington Office Center	Medical Office	\$86,986	40,326	0%
5019	Canton Health Center	Medical Office	\$136,304	96,159	2%
5029	Brighton Health (New)	Medical Office	\$195,173	242,162	4%
5038	EAA Ambulatory Surgical	Medical Office	\$140,181	235,587	-11%
5056	New Hope	Other	\$2,354	123,456	18%
5058	Michigan Visiting Nurses	Office	\$1,522	74,209	12%
5070	Medical Equipment Warehouse	Warehouse	\$68,135	75,055	12%
5098	Kellogg Milford Eye Clinic	Medical Office	\$5,570	106,377	11%
5109	Cardiovascular Center	Hospital	\$2,474,279	232,668	-7%
5117	Rachel Upjohn Building	Medical Office	\$103,770	87,578	-8%
5143	Traverwood II	Office	\$150,310	262,417	-3%
5153	Traverwood III	Office	\$48,444	64,128	6%
5223	North Campus Data Center	Data Center	\$623,554	381,839	103% ⁽²⁾
5241	Traverwood IV	Office	\$37,368	466,378	148% ⁽³⁾
5296	Howell Teen Clinic	Medical Office	\$1,563	87,217	-3%
8016	Briarwood 5	Medical Office	\$50,368	304,673	-18%
8030	Briarwood 2	Medical Office	\$69,588	211,802	2%
8036	Survival Flight Helicopter Hanger	Other	\$15,259	123,677	6%
8042	Briarwood 4	Medical Office	\$25,252	49,252	-1%
8060	101 Simpson	Office	\$3,003	35,059	17%
8065	Briarwood 3	Medical Office	\$30,728	84,802	12%
8072	Eisenhower Park West	Medical Office	\$323,284	159,803	3%
8076	Briarwood 1	Medical Office	\$89,788	287,125	-1%
8096	Livonia Specialty Care	Medical Office	\$184,500	163,733	20%
8100	M-Care / 2101 Commonwealth Rd	Office	\$66,758	68,838	14%
8110	West Ann Arbor Health Center	Medical Office	\$17,141	85,352	17%
8111	Howell Health Center	Medical Office	\$6,700	83,640	7%
8112	South Main Orthopedic Surgery	Medical Office	\$41,642	241,007	9%
8116	Medsport At Ice Arena	Medical Office	\$3,465	41,063	-16%
8121	Saline Health Center	Medical Office	\$21,990	211,896	-1%
8126	Kms Fusion Bldg.	Office	\$236,542	90,053	8%
8130	Briarwood 10	Medical Office	\$69,954	219,148	9%
8137	Michigan House	Office	\$164,700	54,009	-7%
8142	Briarwood 9	Medical Office	\$32,963	268,999	-9%
8149	Dexter Family Practice	Medical Office	\$14,234	72,190	7%
8155	Livonia Health Center	Medical Office	\$24,124	69,986	10%
8160	Beser Medical I	Medical Office	\$2,735	77,589	29%
8161	Beser Medical II	Medical Office	\$12,215	92,373	3%
8162	Traverwood 1	Office	\$15,848	48,136	-13%

Notes:

1. These buildings are currently planned for demolition and were primarily unoccupied for a significant portion of fiscal year 2011.
2. The North Campus Data Center is a new building that was being loaded with equipment and occupants during fiscal year 2011.
3. Traverwood IV is a new building that was vacant during fiscal year 2010.