



**University of Michigan
Hospitals and Health Centers**

**Energy Conservation
Annual Report – Fiscal Year 2012**

Final Report

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1. EXECUTIVE SUMMARY

In fiscal year 2012, energy conservation 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 improvements in energy efficiency.

Energy Performance

In fiscal year 2012, existing UMHHC facilities consumed nearly \$22 Million in utilities. These facilities improved their energy efficiency by 5% compared to the previous year, resulting in approximately \$750,000 of total avoided utility cost. This year also included the addition of the new 1.1 Million ft² Children's & Women's Hospital (C&W), which consumed over \$6 Million in utilities and contributed to nearly \$28 Million in total UMHHC utility costs. For further details, see section 2, "Energy Performance" of this report.

Energy Conservation

Fiscal year 2012 continued energy conservation efforts by various energy teams which continue to show significant improvements to the overall UMHHC building portfolio. During this year, 12 energy conservation projects were completed in existing facilities which are anticipated to save \$250,000 annually. Additionally, significant operation and control changes were implemented in the new C&W hospital, anticipated to save \$1.4 Million annually. These projects cost \$212,367 to implement, yielding a 0.1 year overall payback period. For further details, see section 3, "Energy Conservation" 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. Existing facilities improved total utility driven greenhouse gas emission efficiency by 3% compared to fiscal year 2011, yielding nearly 4,000 Tons of avoided greenhouse gas emissions. However, the addition of the new Children's & Women's hospital increased total emissions by 22%. For further details, see section 4, "Environmental Impact" of this report.

Building Summary & Energy Star

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: Cardiovascular Center – 181,462 BTU/ft²
- Medical Office Building: Dexter Family Practice – 59,968 BTU/ft²
- General Office Building: Michigan House – 47,254 BTU/ft²

In total, on a scale of 0 to 100, the UMHHC building portfolio has earned a score of 25 in the U.S. EPA Energy Star rating system. For further details and a complete listing of UMHHC building performance, see section 5, "Building Summary & Energy Star" of this report.

2. ENERGY PERFORMANCE

In fiscal year 2012, the total utility cost for all existing UMHHC facilities was \$21,749,308. The utility cost for the new 1.1 million ft² Children's & Women's Hospital (C&W) was \$6,124,864, yielding a total UMHHC utility cost of \$27,874,172. Existing facilities improved their energy efficiency by 5%, resulting in approximately \$750,000 in total avoided utility cost. This is detailed in Figure 2.1 below.

Figure 2.1: Breakdown of Avoided Utility Cost vs. FY2011

Utility	FY2011 Efficiency	FY2012 Efficiency*	FY2012 Average Utility Rate*	Avoided Utility Cost*
Electric	29.7 KWH/ft ²	29.2 KWH/ft ²	\$0.088/KWH	\$228,934
Steam	0.0545 MLB/ft ²	0.0502 MLB/ft ²	\$16.51/MLB	\$378,102
Natural Gas	0.0251 MCF/ft ²	0.0226 MCF/ft ²	\$7.78/MCF	\$108,744
Water/Sewer	0.0586 CCF/ft ²	0.0579 CCF/ft ²	\$7.35/CCF	\$29,539
Total:				\$750,000

*Note: Data does not include Children's & Women's Hospital utilities.

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 2.2 illustrates the recent history of total UMHHC building energy efficiency (measured in BTU/ft²) and utility cost efficiency (measured in \$/ft²). This figure also illustrates the impact of the new C&W hospital on the UMHHC building portfolio. Energy efficiency normalizes electric, steam, and natural gas utility into a common energy unit, BTU. Since water & sewer are not an energy utility, this data is not included in this chart. Excluding C&W utility data, UMHHC efficiency has improved 24% since fiscal year 2005 and has improved by 5% this year. Including C&W, UMHHC has become 4% less efficient this year.

Figure 2.2: Total UMHHC Historical Energy & Cost Efficiency

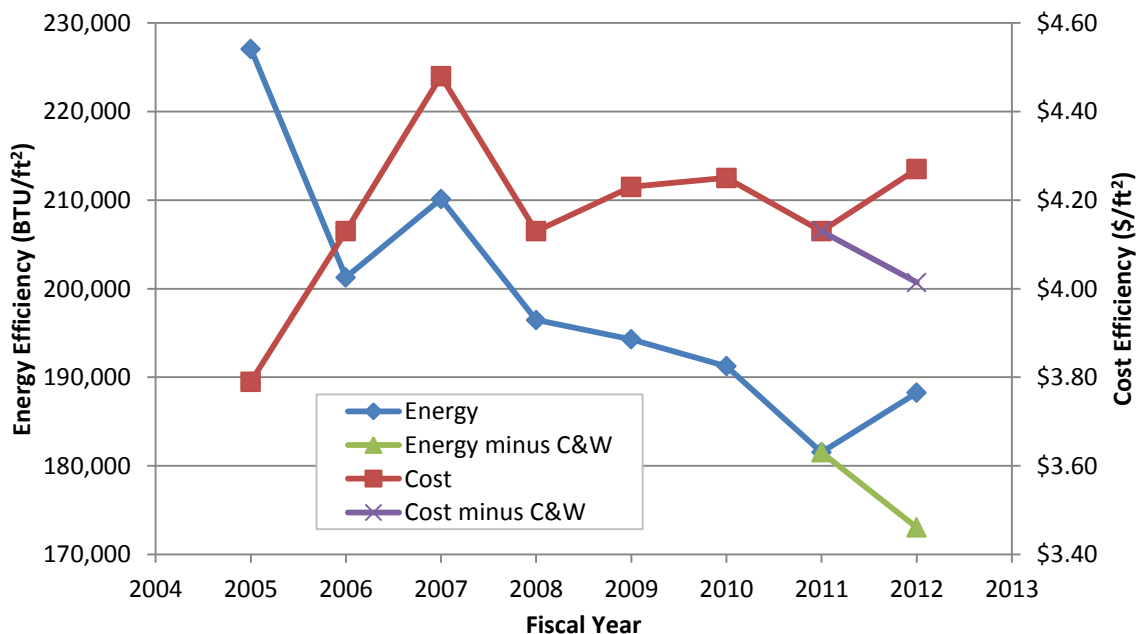


Figure 2.3 below shows the total UMHHC energy and utility cost in recent history without normalizing against the continuous increases in total UMHHC building area.

Figure 2.3: Total UMHHC Historical Energy Use & Utility Cost

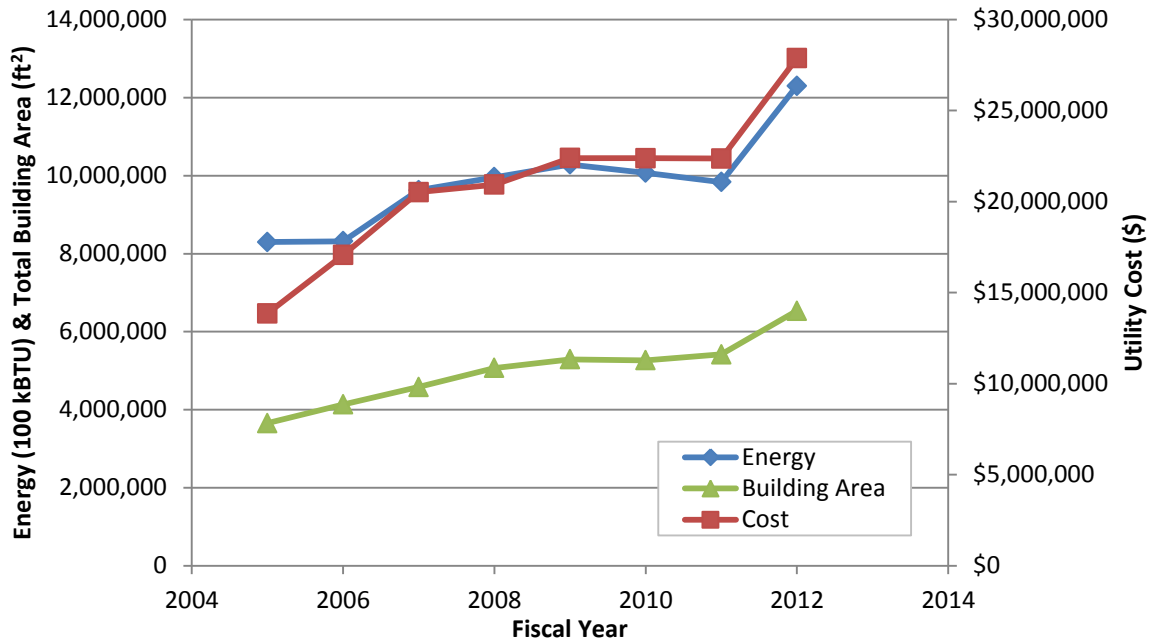
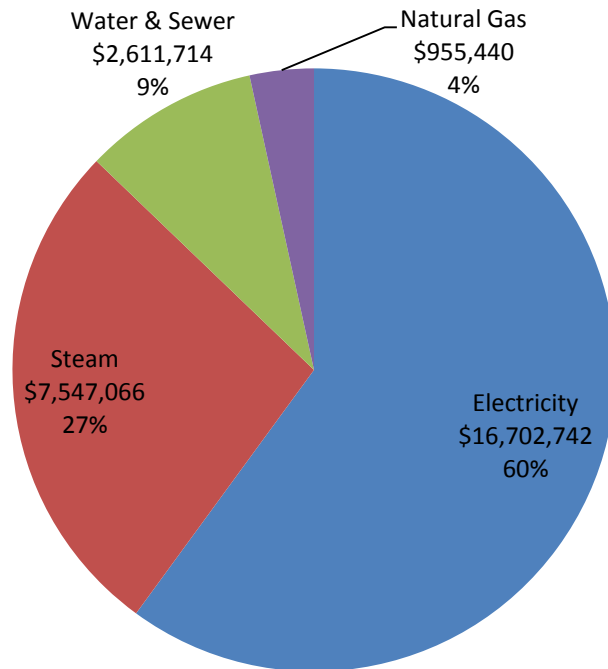


Figure 2.4 below illustrates the distribution and total costs of each of the four primary utilities included in UMHHC facilities for fiscal year 2012.

Figure 2.4: Total FY2012 UMHHC Utility Cost Distribution



3. ENERGY CONSERVATION

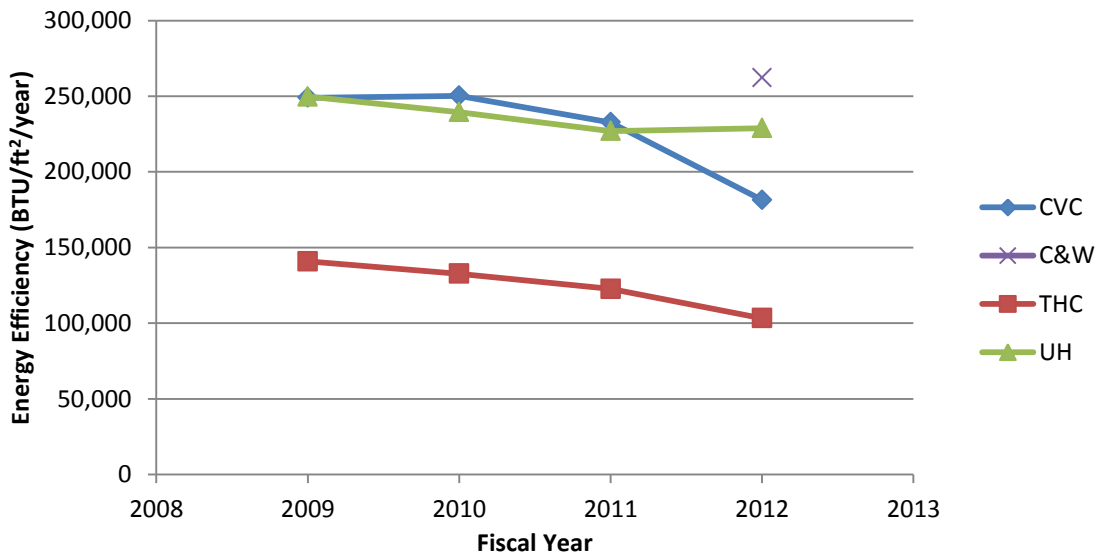
Energy Conservation is a combined effort of numerous groups and departments throughout UMHHC. These efforts primarily fall into the following categories:

- **New Construction**
Efficient design and construction practices for new capital construction.
- **Energy Conservation Measures (ECMs)**
Projects in existing facilities designed to improve energy performance.
- **Operations & Maintenance**
Maintain, manage, and optimize building operational efficiency.
- **GreenIT**
Manage power consumption from UMHS computers and IT equipment.

New Construction and GreenIT team efforts apply across all UMHHC facilities to contribute to total portfolio performance improvements each year. Figure 3.1 below illustrates the energy performance benefits of ECM Projects and Operations Team efforts completed in key focused buildings in recent years. The Cardiovascular Center (CVC) and the Taubman Health Center (THC) have both improved performance by 27% and the University Hospital Building (UH) has improved 8% since fiscal year 2009.

For the first three quarters of FY2012, the new Children's & Women's Hospital (C&W) was operating at approximately 280,000 BTU/ft²/year. Several key ECMs and Operational efforts were completed in this building near the beginning of the fourth quarter, which resulted in a 20% performance improvement and final FY2012 efficiency of 262,062 BTU/ft²/year. Due to these efforts and additional efforts currently in development, it is anticipated that FY2013 C&W performance will be more in line with CVC and UH performance, in the 180,000 to 230,000 BTU/ft²/year range.

Figure 3.1: Energy Performance in Focused Buildings



New Construction

UMHHC strives to incorporate energy efficient strategies and practices in all new capital construction projects. This first includes participation and compliance with the University's energy & water conservation standard ([SID-D](#)), requiring several standardized efficiency practices, in addition to requiring compliance with the ASHRAE 90.1-2007 energy standard for all projects, and requiring 30% improvement from baseline compliance for projects over \$10 Million in construction. Every UMHHC capital construction project is now reviewed for compliance with these energy and water requirements, and for opportunities to implement other energy conserving design innovations where feasible.

During FY2012, UMHHC evaluated and committed to participate in the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design ([LEED](#)) program. This program is designed to encourage sustainable design practices, covering numerous disciplines including site selection & protection during construction, energy & water efficiency, material selection & sourcing, indoor environmental quality, and more. This program offers building certification awards; base certification, silver, gold and platinum. The University had previously committed to achieving LEED Silver, however healthcare buildings were exempt from this requirement. UMHHC has now committed to earning a minimum LEED Silver certification for healthcare facilities as well under the new "LEED for Healthcare" rating system, for all new building & addition projects exceeding a \$10 Million construction budget.

Also during FY2012, the new C&W hospital was certified LEED Silver under the general "LEED for New Construction" rating system. This was accomplished primarily through achievements in site selection & protection, material selection, and indoor environmental quality design elements, as well as design innovations such as the green roof.

Energy Conservation Measures (ECMs)

In fiscal year 2012, 12 energy conservation projects were completed in existing facilities which are anticipated to provide approximately \$250,000/year in incremental energy savings. Additionally, significant operational and control changes were implemented in the new C&W hospital which are anticipated to provide approximately \$1.4 Million/year in energy savings, compared to the energy demand when the building was first opened. Altogether, these projects and efforts provide a combined annual energy savings of over \$1.6 Million/year. This cost \$212,367 to implement, yielding a 0.1 year overall payback period. This is summarized in Figure 3.2 below.

Figure 3.2: ECM Projects Completed in FY2012

Building	Project Description	Project Cost	Estimated Savings	Payback (Years)
Cardiovascular Center	Modify air handling unit controls to reduce heating & cooling loads.	\$13,944	\$115,000	0.1
	Install a new isolation valve in the main steam humidifier line in order to reduce system losses during summer operation.	\$26,754	\$14,800	1.8
	Pilot occupancy sensor based control of ventilation in the board room.	\$4,787	\$2,400	2.0

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	Install new control valves to improve performance and reduce heating demand on the main outside air handling units.	\$39,083	\$15,000	2.6
Children's & Women's Hospital	Modify air handling unit controls to improve performance, and to implement a demand based control strategy that automatically detects dynamic space requirements and automatically adjusts for maximum system efficiency.	\$0	\$1,400,000	0.0
	Pilot occupancy sensor based control of ventilation in multiple offices.	\$2,000	\$600	3.3
Medical Professional Building	Retrofit low flow equipment on restroom sinks and lavatories for water conservation.	\$2,835	\$1,200	2.4
Multiple Buildings	Install daylight sensors for lighting control in building connectors.	\$19,792	\$4,100	4.8
Taubman Health Center	Modified pump control to deactivate unnecessary seasonal pumping.	\$0	\$5,000	0.0
	Rebalance airflow controllers in non-clinical staff areas.	\$51,300	\$52,000	1.0
	Modify controls and complete energy tune-up of five air handling units.	\$29,949	\$6,700	4.5
University Hospital	Pilot air balance work in the inpatient tower to validate potential savings.	\$475	\$1,400	0.3
	Modify air handling unit controls to reduce heating & cooling loads.	\$21,448	\$30,000	0.7
Totals:		\$212,367	\$1,648,200	0.1

Operations & Maintenance

UMHHC Operations & Maintenance teams are continuously working to maintain equipment at peak efficiency, to improve and optimize operations wherever possible, and to quickly respond and resolve operational issues at all 6.5 million ft² of UMHHC buildings. This includes several key tasks for an extensive body of equipment and instruments. Examples of key equipment are listed below:

- Building automation systems
- Environmental controls & instruments
- Room temperature controls
- Air handling units
- Pumps
- Chillers
- Boilers
- Steam Traps

GreenIT

The GreenIT initiative began in 2009 with the goal of reducing desktop computer power consumption to over 15,000 workstations across the health system. This initiative seeks to set automatic on and off times and enable power saving standby modes for system

computers when feasible. This initiative has resulted in more than a 40% reduction in health system computer power consumption.

GreenIT teams are continuously working to further improve computer and IT system power management and to maintain energy performance amidst continuous changes to the Health System equipment and software, which now includes approximately 20,000 workstations. GreenIT teams are currently working to identify and update energy management of remaining departments and workstations unnecessarily operating computers and IT equipment continuously.

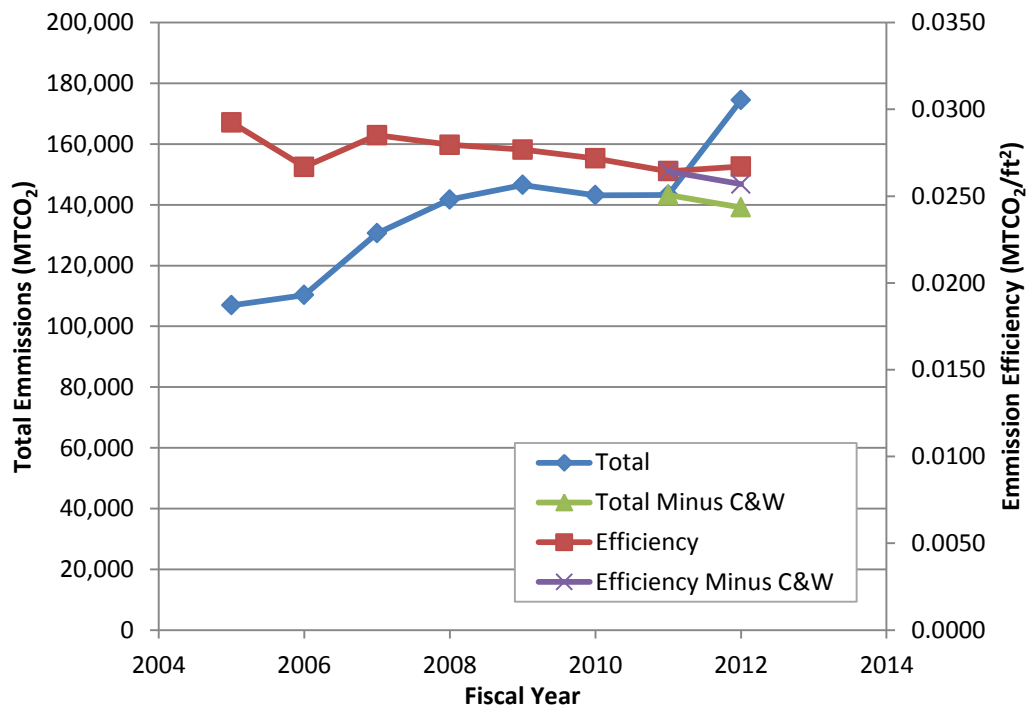
4. ENVIRONMENTAL IMPACT

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 (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.

In fiscal year 2012, UMHHC increased utility driven emissions by 22%, due to the addition of the new 1.1 million ft² Children’s & Women’s (C&W) hospital. Aside from the new C&W hospital figures, the rest of the UMHHC facilities reduced total emissions by 3% in FY2012. This equates to over 4,000 MTCO₂ of avoided greenhouse gas emissions, which is equivalent to removing over 700 automobiles from the road.

This fiscal year, UM President Coleman announced new sustainability commitments for the University. These commitments include a 25% reduction in total greenhouse gas emissions by FY2025, compared to a FY2006 baseline. The University’s plan for achieving this goal is yet entirely clear, however it is anticipated that a significant portion of this will come from major upgrades to onsite utility generation plants, in addition to improvements to existing buildings, University vehicle upgrades, etc. Thus far, UMHHC has increased its total utility driven emissions by 58% compared to FY2006, however this matches a 58% growth in total UMHHC building area in that time. Therefore, UMHHC has significantly expanded but has not compromised emission efficiency during that time.

Figure 4.1: UMHHC Utility Driven Greenhouse Gas Emission History



5. BUILDING SUMMARY & ENERGY STAR

During fiscal year 2012, a comprehensive profile was created for all UMHHC facilities within the Energy Star Portfolio Manager benchmarking tool, provided by the U.S. Environmental Protection Agency (EPA) and the Department of Energy (DOE). This tool organizes facility energy data, normalizes data against building size, geographic location, building use types, occupancy, number of licensed beds, etc., and generates a rating score that can be used for benchmarking. Scores range from 0 to 100. A score of 50 is the national average. A score of 75, qualifies a building for the Energy Star Certification award. UMHHC facility scores range from 1 to 88, but in aggregate calculate to a total portfolio score of 25. This is improved from a baseline score of 22 in fiscal year 2011. Figure 5.1 below illustrates the general distribution of national Energy Star scores vs. the quantity of national buildings with the corresponding score.

Figure 5.1: National Energy Star Scores

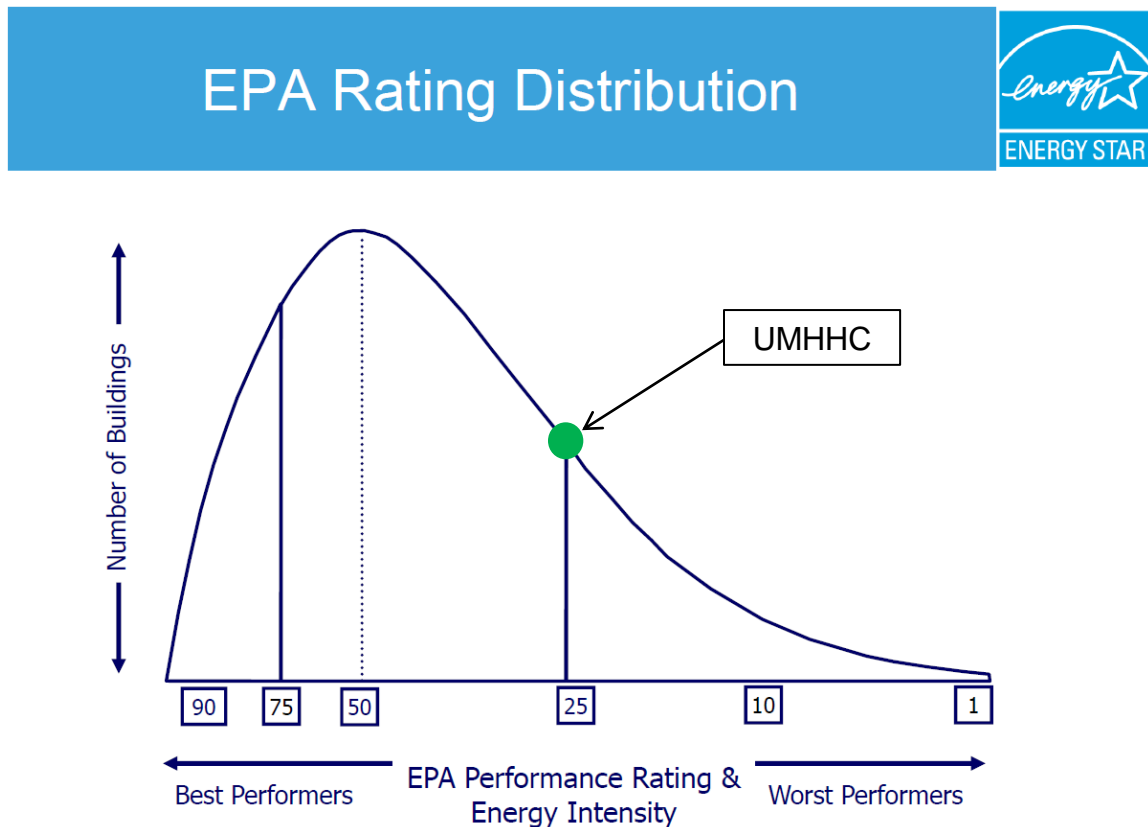


Figure 5.2 indicates the most efficient UMHHC buildings in fiscal year 2012, sorted by the primary Energy Star building type. Due to combined metering and shared utilities between facilities, several buildings are not included in this list because the available utility data does not represent the total utility consumed by the building, and therefore does not provide an accurate measure of efficiency. It should be noted, that energy and efficiency data provided within this report and the table below are based on “site” energy use, which is used for billing. Energy Star ratings are based on “source” energy use

which incorporates the efficiency of the utility plant supplying the facility. For example, the Children's & Women's Hospital has less efficient site energy efficiency than the University Hospital building, but has a better Energy Star rating because the University Hospital building uses far more electricity which is a less efficient plant utility.

Figure 5.2: FY2012 UMHHC Most Energy Efficient Buildings

Rank	ID	Building	Efficiency (kBTU/ft ²)	Energy Star Rating	Total Utility Cost
<i>Hospitals</i>					
1.	5109	Cardiovascular Center	181.5	31	\$1,899,185
2.	0316	University Hospital	228.9	12	\$9,537,121
3.	5173	Children's & Women's Hospital	262.0	23	\$6,124,864
<i>Medical Office Buildings</i>					
1.	8149	Dexter Family Practice	60.0	64	\$13,804
2.	8155	Livonia Health Center	72.0	54	\$26,906
3.	8110	West Ann Arbor Health Center	72.5	34	\$16,623
4.	5019	Canton Health Center	80.1	57	\$134,818
5.	8161	Kellogg Eye Center – Brighton	89.5	38	\$13,767
<i>General Office Buildings</i>					
1.	8137	Michigan House	47.3	88	\$162,054
2.	0327	University Hospital Education Center	53.3	64	\$14,164
3.	8100	M-Care / 2101 Commonwealth	57.1	88	\$61,955
4.	8126	KMS Fusion Building	85.0	60	\$285,285
5.	0332	300 N. Ingalls Building	131.3	66	\$660,387

Figure 5.2 below shows fiscal year 2012 utility information, efficiency, and change in efficiency since fiscal year 2011. Please note that 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: FY2012 UMHHC Building Utility Summary

ID	Building	Energy Star Building Type	Total Cost	Efficiency (BTU/ft ²)	Change vs. FY2011
301	Cancer Center	Laboratory	\$1,087,097	350,813	-5%
306	East Mechanical Building	Other	\$304,264	1,440,352	-11%
308	Med Inn Building	Medical Office	\$427,842	165,537	10%
309	Women's Office Building	Office	\$130,666	88,768	-15%
312	Mott Children's Hospital	Hospital	\$400,296	58,812	-9%
314	Holden Perinatal Research Lab	Laboratory	\$93,118	264,238	30%
316	University Hospital	Hospital	\$9,537,121	228,872	1%
317	Taubman Health Center	Medical Office	\$1,247,129	103,240	-16%
318	Maternal Child Health Center	Medical Office	\$322,864	107,845	1%
319	Medical Professional Building	Office	\$74,115	74,227	-21%
325	Parkview Medical	Medical Office	\$68,271	64,478	-53% ⁽¹⁾
327	University Hospital Education Ctr	Office	\$14,164	53,266	-8%
328	Scott Turner Building	Medical Office	\$35,785	41,497	-54% ⁽¹⁾
332	North Ingalls Building	Office	\$660,387	131,346	35% ⁽²⁾
348	Chelsea Family Practice	Medical Office	\$62,729	114,809	9%
350	East Ann Arbor Health Center	Medical Office	\$961,743	452,510	8%

390	Child Care Center	Other	\$48,916	88,418	-25%
399	North Campus Admin. Complex	Office	\$344,739	162,204	-4%
419	Laundry Services Building	Other	\$478,082	719,652	-6%
829	RP Housing 1322 Wilmott	Other	\$3,438	81,415	-22%
5011	Burlington Office Center	Medical Office	\$96,872	41,651	3%
5019	Canton Health Center	Medical Office	\$134,818	80,124	-17%
5029	Brighton Health	Medical Office	\$202,381	249,901	3%
5038	EAA Ambulatory Surgical	Medical Office	\$116,779	221,667	-6%
5056	New Hope	Other	\$1,978	95,409	-23%
5058	Michigan Visiting Nurses	Office	\$1,094	29,957	-60%
5070	Medical Equipment Warehouse	Warehouse	\$72,395	64,306	-14%
5098	Kellogg Milford Eye Clinic	Medical Office	\$5,718	89,207	-16%
5109	Cardiovascular Center	Hospital	\$1,899,185	181,462	-22%
5117	Rachel Upjohn Building	Medical Office	\$75,436	70,945	-19%
5143	Traverwood II	Office	\$157,578	259,989	-1%
5153	Traverwood III	Office	\$52,340	57,140	-11%
5173	Children's & Women's Hospital	Hospital	\$6,124,864	262,062	N/A ⁽³⁾
5223	North Campus Data Center	Data Center	\$670,041	454,457	19% ⁽⁴⁾
5241	Traverwood IV	Laboratory	\$90,291	853,445	83% ⁽⁵⁾
5296	Howell Teen Clinic	Medical Office	\$1,594	104,085	19%
8016	Briarwood 5	Medical Office	\$49,623	279,929	-8%
8030	Briarwood 2	Medical Office	\$76,708	214,955	1%
8036	Survival Flight Helicopter Hanger	Other	\$11,341	103,317	-16%
8039	RP Housing 1011 Cornwell Place	Other	\$7,021	113,932	-8%
8042	Briarwood 4	Medical Office	\$27,898	50,941	3%
8060	101 Simpson	Office	\$2,618	33,788	-4%
8065	Briarwood 3	Medical Office	\$30,252	77,289	-9%
8072	Eisenhower Park West	Medical Office	\$323,515	137,167	-14%
8076	Briarwood 1	Medical Office	\$98,138	282,738	-2%
8096	Livonia Specialty Care	Medical Office	\$180,300	146,242	-11%
8100	M-Care / 2101 Commonwealth	Office	\$61,955	57,097	-17%
8110	West Ann Arbor Health Center	Medical Office	\$16,643	72,537	-15%
8111	Howell Health Center	Medical Office	\$6,623	72,168	-14%
8112	South Main Orthopedic Surgery	Medical Office	\$36,870	171,199	-29%
8116	Medsport at Ice Arena	Medical Office	\$2,791	35,592	-13%
8121	Saline Health Center	Medical Office	\$18,717	111,581	-47%
8126	KMS Fusion Bldg.	Office	\$285,285	84,972	-6%
8130	Briarwood 10	Medical Office	\$82,135	242,143	10%
8137	Michigan House	Office	\$162,054	47,254	-13%
8142	Briarwood 9	Medical Office	\$40,134	262,977	-2%
8149	Dexter Family Practice	Medical Office	\$13,804	59,968	-17%
8155	Livonia Health Center	Medical Office	\$26,906	72,043	3%
8160	Beser Medical I (W. Bloomfield)	Medical Office	\$2,511	61,314	-21%
8161	Beser Medical II (Brighton)	Medical Office	\$13,767	89,549	-3%
8162	Traverwood 1	Office	\$15,370	37,574	-22%

Notes:

1. These buildings were demolished during fiscal year 2012.
2. A large utility credit was applied during fiscal year 2011 for overages in 2010. Therefore, the comparison of 2012 to 2011 indicates an artificially high increase in utility.
3. Fiscal year 2012 was the first year in which utilities were billed to UMHC for the Children's & Women's Hospital.
4. This increase represents a continued migration of IT equipment from the old Taubman data center to this new facility.
5. This is a high energy use laboratory building that was partially vacant for a portion of fiscal year 2011.