

Energy & Environment
July 2019
(September 2022 update)

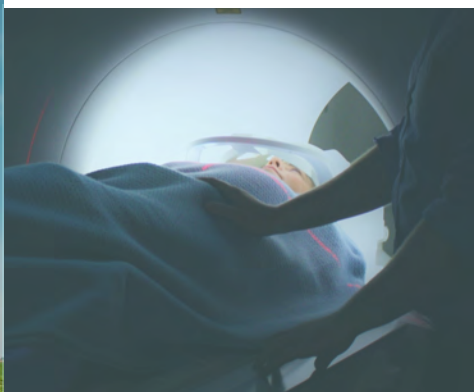
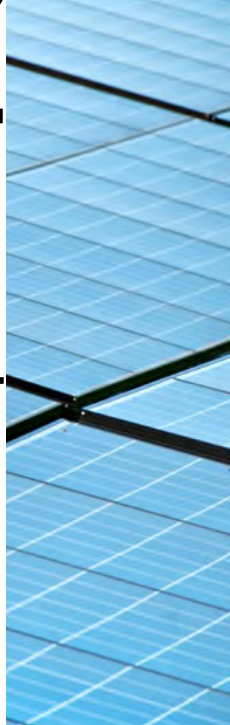


UNIVERSITY HEALTH NETWORK

ENERGY MANAGEMENT PLAN 2019 - 2024



 **UHN** Toronto General
Toronto Western
Princess Margaret
Toronto Rehab
Michener Institute





Environmental Stewardship, including the efficient use of energy, water and other resources, has been a part of the University Health Network (UHN) for over 20 years. This latest update to UHN’s Energy Management Plan not only continues the hospital’s commitment towards energy efficiency by building on our progress to date, but further strengthens the link between environmental sustainability and UHN’s values of safety, compassion, teamwork, integrity, and stewardship.

UHN’s vision is *A Healthier World*, which includes the drive for “continuously elevating our ambitions and not settling for less when it comes to improving the lives of others and all those on TeamUHN.” I am confident that our updated Energy Management Plan will continue to play an important role in supporting this vision as well as overall excellence in healthcare.



Mike Nader
Executive Vice President and Chief Operating Officer
University Health Network
July 1, 2019



Background

Though energy management has been a part of the University Health Network (UHN) since the start of its Energy & Environment program in 1999, the hospital's *Energy & Water Conservation Program* took a large step forward in 2007 when development of a more robust strategic energy management plan began. Branded *Operation TLC – Care to Conserve*, the plan presented a comprehensive and flexible approach to energy management, with a focus on integrating behaviour change, building operations, capital investment and equipment efficiency to optimize the identification and implementation of energy efficiency measures. *Operation TLC* was fully implemented in 2012 and was used as the basis for the development of [University Health Network Energy Management Plan: 2014 to 2019](#).

UHN has been recognized numerous times for its leadership and stewardship in environmental and energy management.

UHN's Energy Management Vision

UHN's energy management vision, stated below, is part of the hospital's *Energy & Water Conservation* policy, first approved in 2002.

“University Health Network (UHN) is aware of the global impact that energy and water consumption have on its environment and financial resources. UHN is committed to providing ongoing awareness and training to assist staff in mitigating these impacts. At UHN, all staff will endeavor to practice energy and water conservation where practical to do so.”

The Business Case for Energy Management

UHN's business case for the development of an energy management program goes beyond financial payback. Combined, the elements of the business case outlined below form guiding principles for energy management at the hospital.

- **Improved Financial Health and Operating Cost Reduction:** Utility costs are a significant portion of UHN's operating budget. The cost savings associated with investments in energy efficiency can be reinvested in patient care and other hospital needs.
- **Enhanced Patient Care, Safety and Working Environment:** Efficient building operations not only conserve energy, but also contribute to patient and employee safety and comfort through enhancements such as more stable temperatures, better indoor air quality and improved lighting.
- **Optimization of Building Systems and Equipment:** UHN's energy efficiency projects regularly include optimization of building equipment and systems. This operational efficiency, in turn, reduces equipment maintenance and life-cycle costs and can often eliminate or delay the need to replace or add new building infrastructure.

- **Resiliency:** Efficiency is a key aspect of resiliency, allowing resources to last longer and be used more effectively should supply be interrupted. UHN has also made resiliency a key aspect of energy efficiency projects by including items such as redundancy (e.g., for cooling and heating equipment, etc.) and additional safeguards for equipment and building infrastructure.
- **Employee Engagement:** Staff at UHN have indicated that energy efficiency is important to them. Actively promoting energy management allows for the aligning of personal and organizational values and supports an engaged workplace. In return, engaged employees are more likely to contribute to UHN’s energy management goals.
- **Strengthened Community Leadership and Environmental Stewardship:** Energy management is a visible, public commitment to the community, environment, and human health. Through energy management, the hospital can provide leadership in promoting sustainable communities, efficient business practices, health and environmental stewardship.
- **Supporting UHN’s Vision:** UHN’s vision is “[A Healthier World](#)”, and includes “a shared commitment to the betterment of all”. At the same time, climate change is recognized as a major threat to health with energy management playing a key role in mitigating the causes and impacts of climate change.

Energy Planning Horizon and Scope

This energy management plan covers the five year period from 2019 to 2024 and builds upon [University Health Network Energy Management Plan: 2014 to 2019](#). The plan provides a framework for all energy management activities taking place at UHN with a focus on the following locations.

- Toronto General Hospital (TGH)
- Toronto Western Hospital (TWH)
- Princess Margaret Cancer Centre (PMH)
- Toronto Rehab – Bickle Centre (BC)
- Toronto Rehab – Lyndhurst Centre (LC)
- Toronto Rehab – Rumsey Centre (RC)
- Toronto Rehab – University Centre (UC)
- Princess Margaret Cancer Research Tower (PMCRT)
- Krembil Discovery Tower (KDT)
- The Michener Institute (MI)

Planning Framework

UHN’s energy management plan continues to draw from the strategic framework shown in Figure 1. The framework has four interlinked elements:

- **Demonstrate organizational commitment:** A visible demonstration by UHN of its commitment to energy efficiency, conservation and greenhouse gas reduction in day-to-day operations and planning activities.
- **Monitoring and tracking:** Implementation of systems to track, analyze and report on energy consumption, costs, greenhouse gas emissions, behaviours and changes over time.
- **Culture, awareness and behaviour change:** Use of behaviour change theories to engage staff, influence culture, and permanently change habits associated with energy use at UHN.
- **Opportunity identification and implementation:** development of on-going processes to identify and implement energy efficiency opportunities.

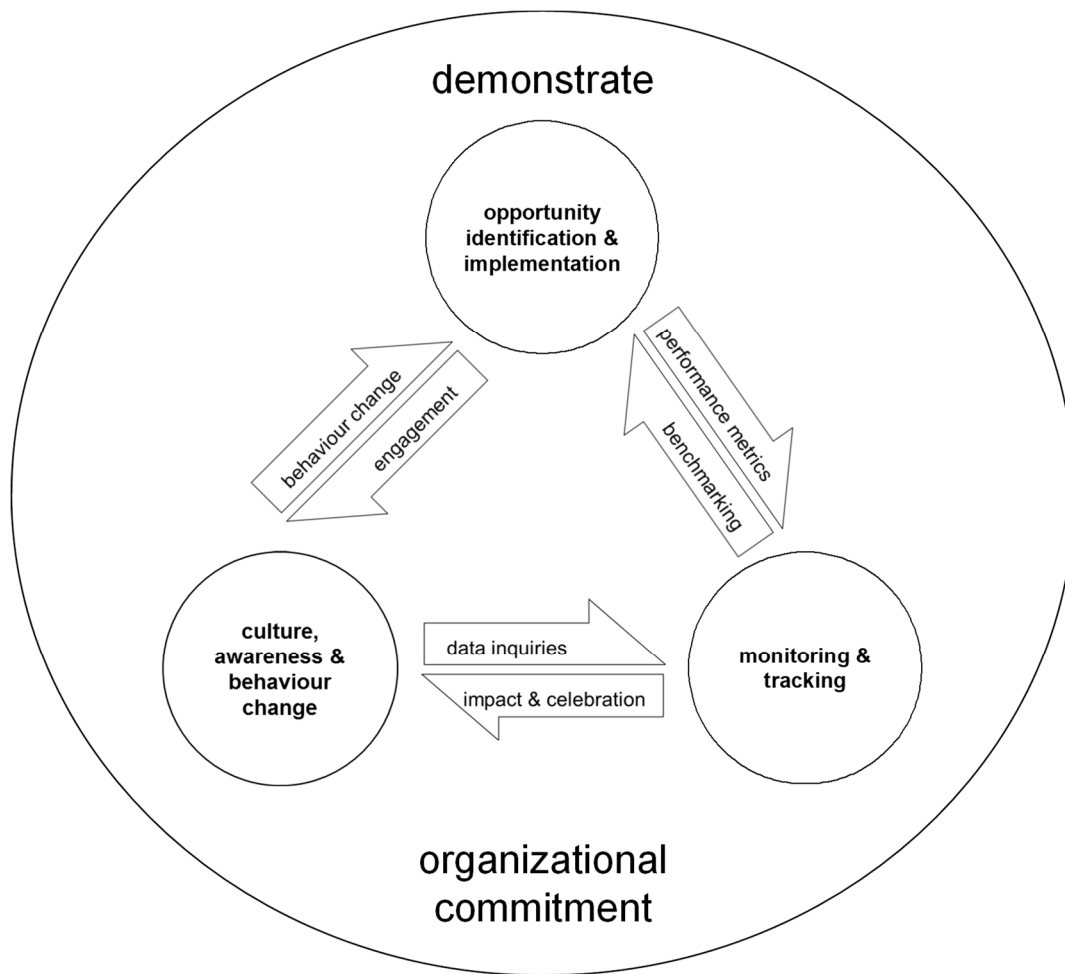


Figure 1: UHN's Energy Management Framework

Planning Process

This plan continues the energy planning process developed by UHN in 2012. The major steps in the planning process are as follows:

- **Describe the current state of energy management at UHN:** Review projects, plans, energy management processes and facilities operations already undertaken in order to understand what is working well, and if possible why, and what obstacles may be encountered.
- **Define the future state of energy management at UHN:** Drawing on insights from a wide range of hospital departments (e.g., Energy & Environment, Facility Operations, Redevelopment, etc.) discuss future possibilities for energy management.
- **Develop an action plan to move from current to future state of energy management:** Identify gaps as well as the resources and processes needed to advance energy management.
- **Define Measure of Success:** Set measures of success to assist in recognizing when results have been accomplished and identify gaps along the process of continual improvement.
- **Review the plan:** Review and update the plan at least annually. The annual review will involve confirming the current state, updating progress to date and making relatively minor adjustments to measures of success. A major review of the plan will be conducted every five years near plan expiry.

Current State of Energy Management at UHN

Energy Management at UHN: Results to Date

A summary of results achieved under [University Health Network Energy Management Plan: 2014 to 2019](#) is provided below:

- Culture, awareness and behaviour change:
 - Formation of site based Energy Teams at all UHN locations. Energy Teams meet monthly or bi-monthly to oversee the identification, implementation and verification of energy saving opportunities.
 - Recruitment of over 750 Green Team members to act as energy and sustainability champions for their departments, through awareness raising and implementation of department specific energy efficiency measures.
 - Continued roll-out of a broad enterprise communication plan and engagement strategy, including regularly “targeted” training sessions for key hospital departments impacting energy use.
 - Continuation of the [Shut the Sash](#) awareness program in PMCRT and KDT, with compliance rates in recent months consistently greater than 98%

- Monitoring and tracking:
 - Implementation of real time electricity metering at all UHN locations.
 - Ongoing planning and implementation for metering of all utilities.
 - Weekly reporting of site based electricity consumption.
 - Incorporation of scope 1 and scope 2 greenhouse gas emissions into UHN utility tracking.
 - Ongoing investigation and piloting of advanced fault detection software.

- Opportunity Identification and Implementation:
 - Organization wide conversion to LED lighting, starting with high-use areas and currently focusing on locations with unique lighting requirements.
 - Building automation system (BAS) commissioning and re-commissioning, including adjustment of schedules and set-points, sensor calibration and equipment upgrades.
 - Implementation of variable speed drives (VSDs), variable air volume (VAV) systems and demand control ventilation (DCV), including installation of advanced DCV at KDT.
 - Replacement of key heating, ventilation and air-conditioning (HVAC) equipment with more efficient units, including chillers, cooling towers, boilers and air-handling units.
 - Investigation of district energy systems, including connection of TGH to Enwave Energy's Deep Lake Water Cooling system and ongoing construction to connect PMH.
 - Removal of multiple pieces of equipment from once-through municipal water cooling.
 - Building envelope improvement including insulation and installation of roofing with high solar reflectance index (i.e., "cool" roofs).
 - Enhanced maintenance including steam trap audits & repairs, removable insulation jackets and focused repair of equipment components critical to efficient operations.

- Demonstrate organizational commitment:
 - Ongoing Executive support for UHN's Energy and Water Conservation policy.
 - Implementation of monthly energy updates for UHN Leadership.
 - Development of energy efficiency guidelines and specifications for inclusion in redevelopment and construction projects.

Over 230 energy conservation projects were implemented between 2012 and the end of 2018, resulting in an annual energy use reduction and/or avoided increase of over 290,000 gigajoules per year and associated annual cost savings of over \$5 million. As of December 31, 2018 more than 100 additional projects were also being implemented or actively investigated, with associated savings of over 300,000 gigajoules per year and \$5.4 million in annual utility costs. Further detail is provided in Appendix A

Figures 2 & 3 compare net UHN energy use in 2011, using the year prior implementation of *Operation TLC* as a baseline, to 2018, indexing to weather where appropriate. Both the Krembil Discovery Tower, which was not built in 2011, and The Michener Institute, which did not join UHN until 2016, are excluded from the figures.

As shown below, UHN annual energy use decreased by approximately 12% between 2011 and 2018. It is important to note that Figures 2 & 3 present the net change in energy use and include both decreased use as a result of *Operation TLC* as well as increased use associated with the addition of new equipment, increased building density, extended operating hours and more stringent safety requirements, such as increased air flow for infection prevention and control.

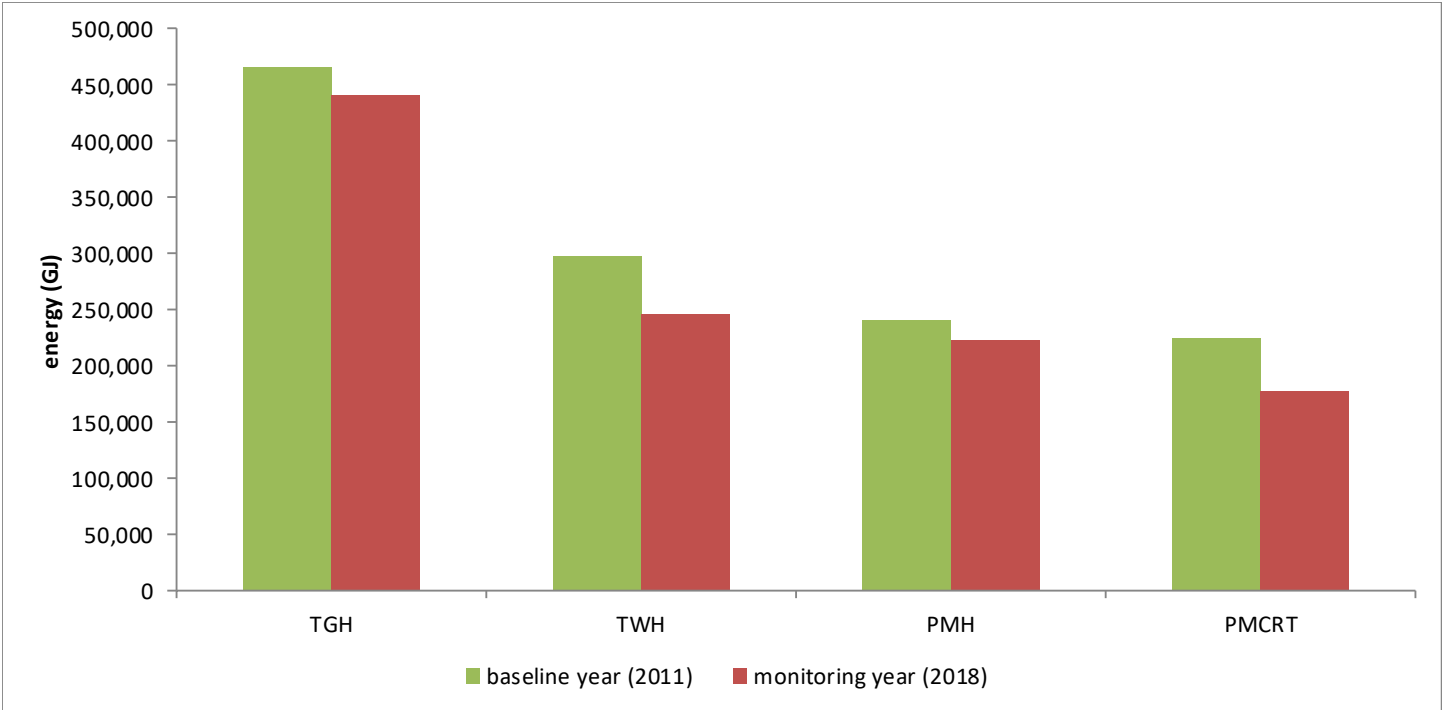


Figure 2: Comparison of UHN 2018 Energy Use to 2011 Baseline – Higher Consumption Sites

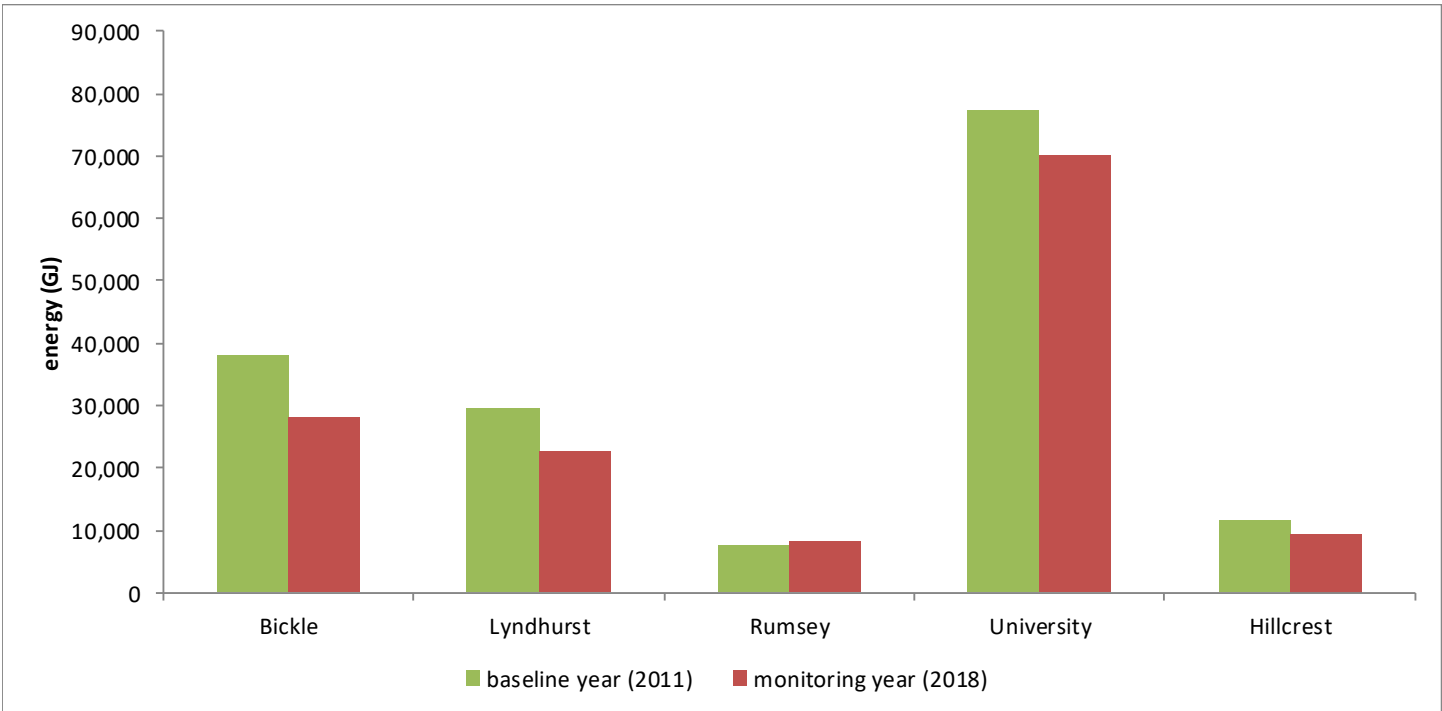


Figure 3: Comparison of UHN 2018 Energy Use to 2011 Baseline – Lower Consumption Sites

Energy Management at UHN: Current Energy Use

Figures 4 to 7 provide a breakdown of UHN energy use in 2018.

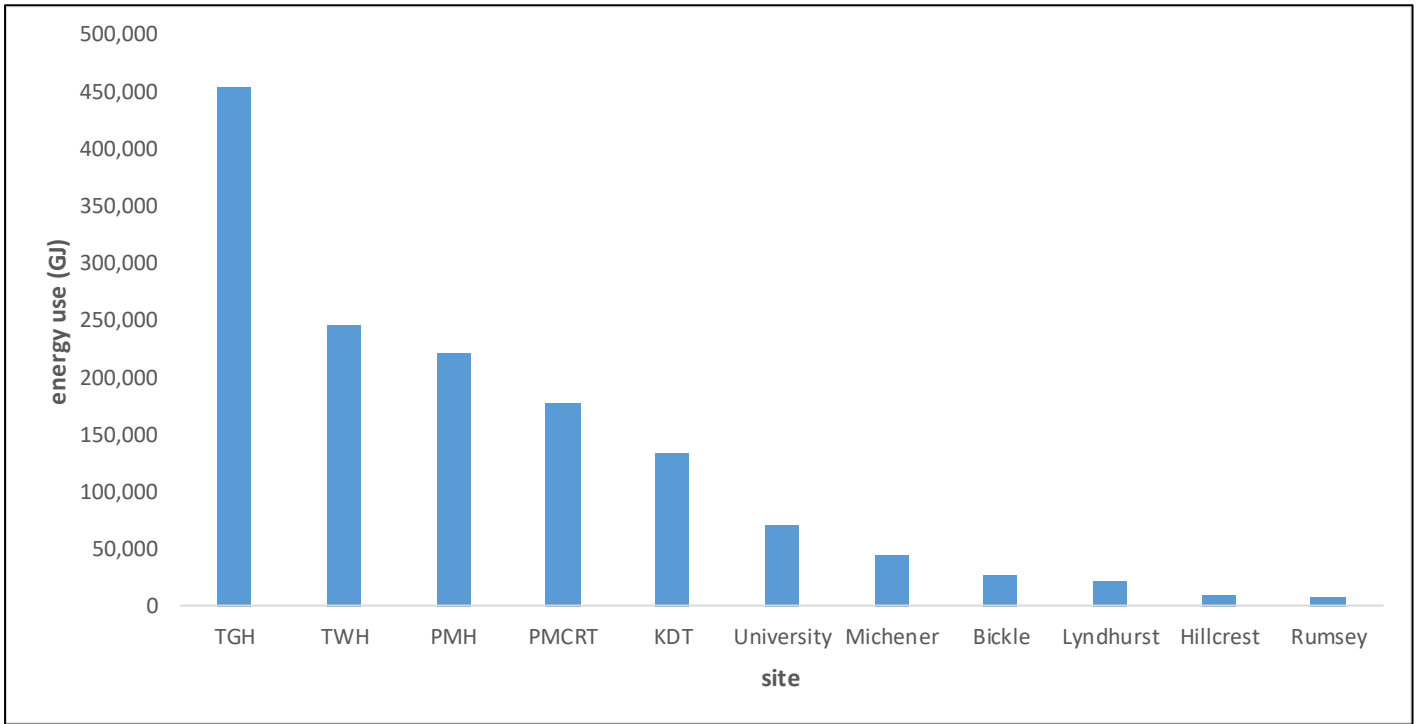


Figure 4: 2018 energy use by site.

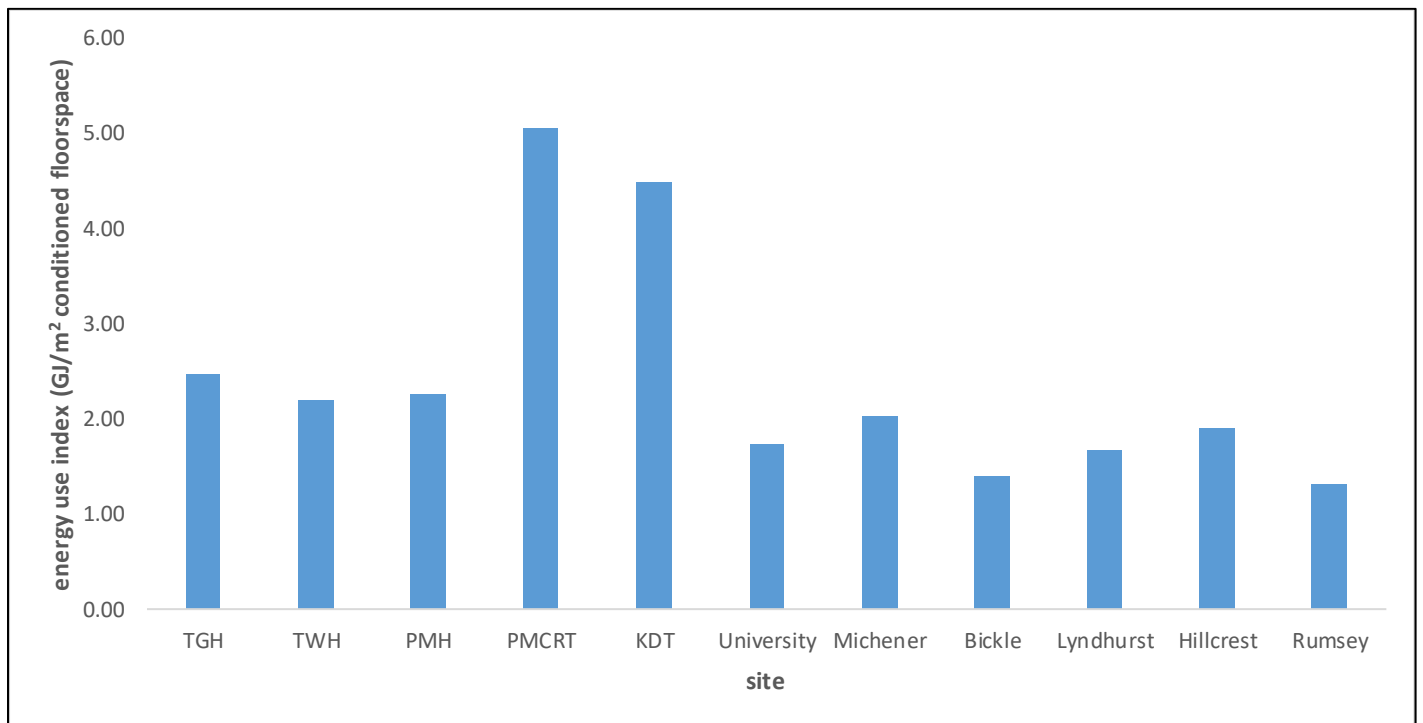


Figure 5: 2018 energy use index by site.

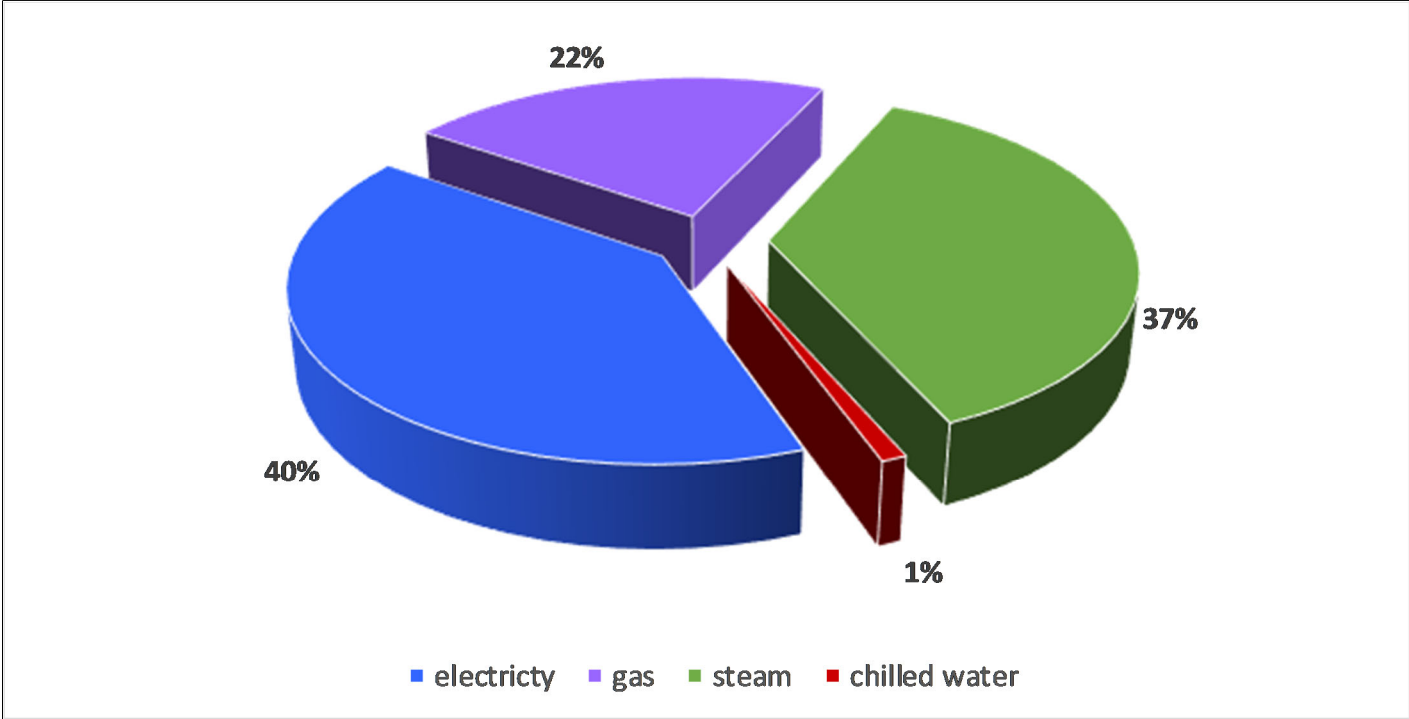


Figure 6: Breakdown of 2018 energy consumption by service.

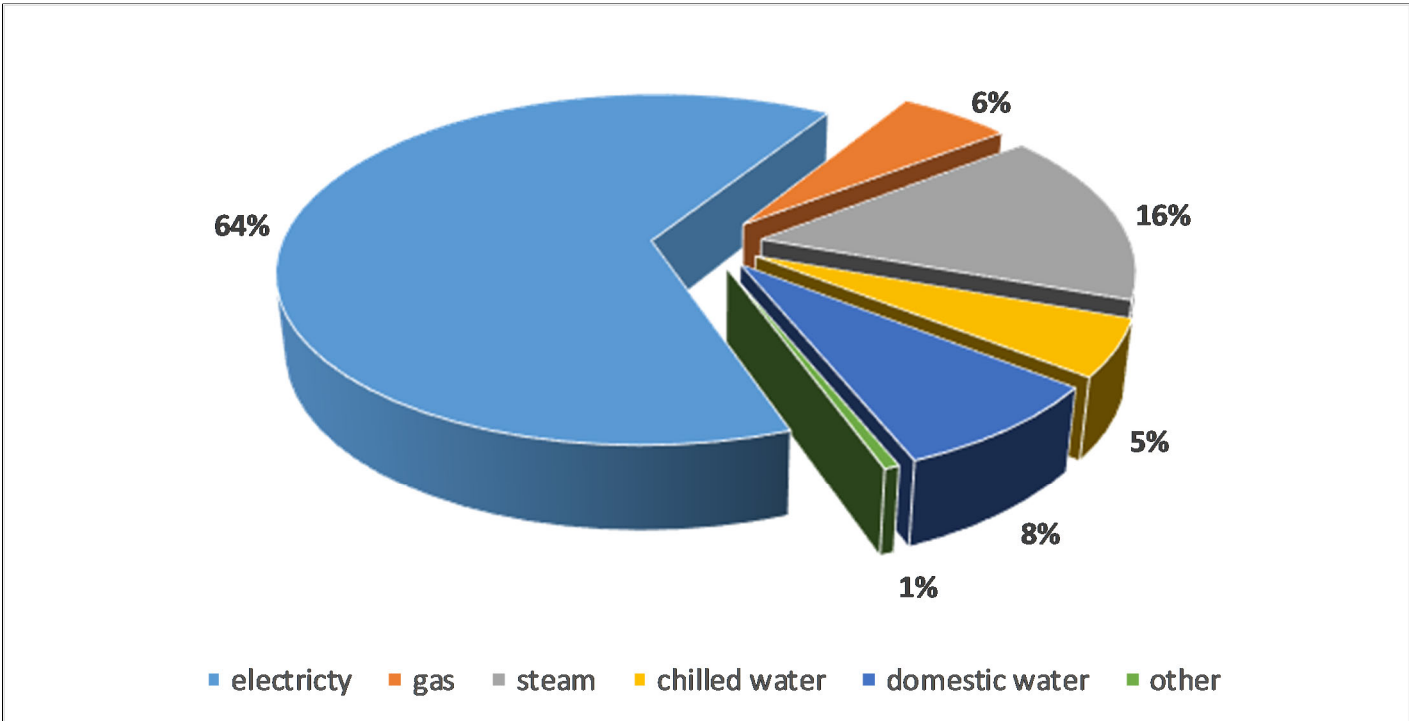


Figure 7: Breakdown of 2018 utility costs by service.

Moving Towards the Future State of Energy Management at UHN

This energy management plan provides a framework for all energy management activities taking place at UHN. In the development of the plan the current situation of energy management and use at UHN was documented, a vision of desired future energy management was defined, and action plans to move from the current to the future state, representing UHN's vision of how energy should be used and managed in the next five years and beyond, were developed. Details for these three elements (current state, future state and action plan) are presented in the action tables found in Appendix A. It is anticipated that completion of the actions detailed in Appendix A will further reduce UHN's energy use by between 5% and 10%.

The action tables are designed to be easy to understand by those who are not familiar with UHN's energy management planning framework, while at the same time being rigorous enough to be useful to UHN's Energy Teams working on implementing and sustaining the plan. The tables can be used both to get a snapshot of active energy management at UHN as well as provide a more in depth summary of initiatives and plan for the coming five years.

Next steps in utilizing this energy management framework and plan include:

- Continuing to implement ongoing actions that move UHN from the current to the future state.
- Beginning to plan and implement those new actions that have been identified as priorities.
- Integrating the Energy Plan with other UHN strategic and planning initiatives.

More Information on UHN's Environmental Programs

To learn more about environmental sustainability at UHN please visit <http://talkintrashwithuhn.com>.

Appendix A
Energy Plan Action Tables

Area of Focus: Building Automation Systems (BAS), Controls & Metering				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • No current UHN BAS standard. • Incomplete BAS and mechanical drawings. • Multiple BAS vendors across sites and sometimes within single site. • Multiple generations of controls within each site including areas with obsolete equipment. • Significant use of pneumatic controls across all sites. • Addition and/or upgrade of BAS controls included in scope of capital and redevelopment projects where applicable. • Energy & Environment completing survey of existing BAS at all sites. • Energy & Environment leading replacement of obsolete BAS components. Building optimization included in project scope. 	<ul style="list-style-type: none"> • BAS systems within individual sites have been consolidated to a single vendor or fully integrated system using current technology. • Energy & Environment fully integrated into BAS related components of project planning and delivery. • BAS drawings updated and current. 	<ul style="list-style-type: none"> • Develop UHN construction and design guidelines for BAS, including: <ul style="list-style-type: none"> • naming convention for devices, panels, etc. • open access communication protocols (e.g., BACnet); • graphics standard; • installation guidelines; and, • drawing standards. • In coordination with UHN Planning and Facility Operations teams, continue and complete UHN wide BAS surveys for each hospital, listing which areas have DDC, pneumatic or no controls. For DDC controls, indicate the generation of products, and remaining lifetime. <ul style="list-style-type: none"> • Review Technical Building Assessments completed as part of UHN Master Planning Process for BAS related observations. • Based on results of BAS surveys, prioritize opportunities, including key mechanical systems such as chiller and boiler plants, then develop and implement site-based upgrade plans, integrating building optimization and energy efficiency. <ul style="list-style-type: none"> • Continue ongoing Energy & Environment led and facility recapitalization driven replacement of obsolete BAS components. • Pilot pneumatic to DDC control conversion to develop standards and determine best practice. • Pilot conversion of obsolete BAS components to newer generation BACnet controls. • Work with Planning, Project Implementation and Facility Operations teams to consolidate BAS drawings. 	<ul style="list-style-type: none"> • Common BAS front-end implemented for UHN. • Obsolete BAS components have been replaced. • Conversion of pneumatic controls to DDC underway, with measurable implementation milestones. • UHN construction and design guidelines for BAS developed, kept current and used consistently. • BAS drawings consolidated and gaps identified. 	<ul style="list-style-type: none"> • BAS section included in UHN Design & Construction Guidelines. Update to begin Fall 2022. • BAS drawings are consolidated and updated as systems are upgraded. • Development of a common BAS front end has been lowered in priority. Common graphics, developed for TWH and TR. • Replacement of obsolete BAS components funded and ongoing. • TGH: 2022 - Upgrade most AHUs, glycol, reheat system and other units in GW from Honeywell to JCI. Upgrade 90 VAV controllers and thermostats in RFE; 2023 - Upgrade GW AHU-102, ICUs and ground floor hemodialysis east from Honeywell to JCI; complete migration from Honeywell to JCI. Upgrade remaining VAV controllers and thermostat in RFE; gradually convert RFE N2 trunk to MS/TP trunk. Upgrade BAS graphics from SMP to MUI; 2024 - Upgrade RFE AHU DX9100 controllers; convert all RFE N2 trunk to MS/TP trunk. Upgrade Eaton AHU DX9100 controllers. If possible convert N2 trunk to MS/TP trunk. • TWH: Upgrade is 80% complete, including majority of main systems; 2022 – Continue the upgrade; 2023 – Complete upgrade. Integrate energy metering into BAS; 2024 – convert pneumatic system to DDC. • TRI: 2022- Convert Honeywell XL5000 and LNS system at UC to BACnet;2023 – Replace remaining XL5000 controllers in BC. Recommission controls at BC and LC. Integrate energy metering into BAS; 2024 – Convert pneumatic system in selected areas to DDC.

Area of Focus: Building Automation Systems (BAS), Controls & Metering				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> Inconsistent maintenance of BAS between sites. 	<ul style="list-style-type: none"> UHN BAS systems are brought-up to and maintained in a state of good repair. 	<ul style="list-style-type: none"> Develop business case for BAS maintenance. Create a list of temperature and humidity sensors for each site. Provide list alternative parts for maintenance and inventory purposes. Develop consistent scope and expectations for BAS maintenance and service contracts. Develop BAS preventative maintenance program and incorporated into new integrated work management system (IWMS) being implemented across UHN. 	<ul style="list-style-type: none"> Sensor calibration and maintenance included as part of preventative maintenance program. BAS alarms for major systems reduced to no more than 20 per day per site. BAS trending and alarm criteria standardized across UHN. BAS systems at all sites have redundant servers. 	<ul style="list-style-type: none"> Draft BAS maintenance plan, funded through deferred maintenance budget, developed for TGH and TWH, with standardization to other sites ongoing. Sensor calibration, maintenance and replacement being performed as needed. Work ongoing to reduce ongoing BAS nuisance alarms. BAS trending and alarm criteria standardization done for TWH during recent retro—commissioning. Being implemented at TGH during component upgrades. Pending for TR as part of planned system upgrades. UHN BAS are now on UHN servers, which are regularly backed-up, allowing systems to be restored if needed.
<ul style="list-style-type: none"> Real time electricity data available for all sites through web portals, but not tied to BAS. Inconsistent metering and sub metering of other utilities across sites. 	<ul style="list-style-type: none"> Real time and historic utility data is available and regularly used. 	<ul style="list-style-type: none"> Develop utility metering template and pilot. If successful, roll-out across UHN. 	<ul style="list-style-type: none"> All main utility meters tied into BAS. Where applicable, sub-meters installed and tied into BAS. Energy dashboards(s) available and regularly utilized for troubleshooting and decision making. 	<ul style="list-style-type: none"> Development of metering plan originally included as part of 2022-2023 Energy Projects budget; deferred to 2023-2024.

Area of Focus: Building Automation Systems (BAS), Controls & Metering				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • Inconsistent operation of BAS between sites. • Significant number of manual overrides on BAS. • Ongoing pilots of fault detection and automated building optimization software at multiple sites. 	<ul style="list-style-type: none"> • Building operations and energy use are optimized. 	<ul style="list-style-type: none"> • Continue working with Facility Operations to document existing BAS sequences, concerns and Building Operator expectations. • Detail environmental condition requirements (e.g., temperature, humidity, pressure, etc.) for various departments across sites. • Continue to explore training opportunities for Building Operators, including potential partnerships with external organizations. • Develop energy performance index for major systems and equipment. • Continue fault detection and automated building optimization pilots and, if successful, develop UHN wide implementation plan. 	<ul style="list-style-type: none"> • Majority of Building Operators have completed BAS and energy efficiency training. • Energy performance index for major systems and equipment available on BAS. • Manual overrides reduced to maximum of 20 per day per hospital. • Number of temperature and humidity complaints are reduced. • Building energy use reduced and strongly correlated with hospital activity and outside temperature. 	<ul style="list-style-type: none"> • Pilot Building Operator training completed at TWH in March 2021. New Building Operators receive BAS training as required. • Pilot energy performance index under development at TWH. • Review and tracking of manual overrides and temperature/humidity complaints not yet started. • Strong correlation between hospital energy use and outside temperature now seen for all UHN hospitals

Area of Focus: Maintenance & Commissioning				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • Energy performance not included as part of preventative maintenance. • Inconsistent use of commissioning on major capital and redevelopment projects. 	<ul style="list-style-type: none"> • Equipment energy performance incorporated into preventative maintenance program. • Commissioning included in project cycle for all major capital and redevelopment products. 	<ul style="list-style-type: none"> • Perform environmental and industry scan to determine best practice incorporating energy performance into preventative maintenance. • For UHN equipment and systems, identify key maintenance activities impacting energy performance and develop preventative maintenance protocols. • Investigate opportunities to include energy performance into new integrated work management system (IWMS) being implemented across UHN. • Develop UHN standards for commissioning including criteria for when to incorporate into capital and redevelopment projects. 	<ul style="list-style-type: none"> • Energy performance measurement and maintenance incorporated into preventative maintenance work orders. • UHN commissioning guidelines and standards incorporated into project planning and implementation cycles. 	<ul style="list-style-type: none"> • Real-time steam trap monitoring pilot underway at UC and TGH; evaluation ongoing. • Pilot VFD maintenance programs, including evaluation of energy performance, being rolled out at TGH and TWH. • Incorporation of energy efficiency and performance into preventative maintenance into Archibus CMMS being investigated. • Commissioning section included in new UHN Design & Construction Guidelines released April 2021. Active Engagement of Energy & Environment into capital process ongoing.

Area of Focus: Lighting				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • Several types of lamps have been largely converted to LEDs, including screw-in incandescent lamps, screw-in compact fluorescent lamps (CFLs), HID lamps and halogen MR16s. • Most 24/7 areas containing fluorescent T8 lamps have been converted to LED lamps that use existing ballasts. Installation of LED tubes being expanded to non-24/7 areas across all sites. • Some areas with unique lighting requirements (e.g. mechanical rooms, outdoor lighting, high bay lighting, etc.) have been converted to LED. • Conversion of some lamp types and areas to LED has proven challenging, including: <ul style="list-style-type: none"> • 4-pin CFLs; • 2x2 fluorescent PL-40 “biax” lamps; and, • areas with low level dimming requirements (e.g. ultrasound and endoscopy). • UHN Sustainable Lighting Design Guideline in place. • Specification of LEDs standard for capital and redevelopment projects. • Wide variety of LED lamps and fixtures in use across UHN as a result of project-by-project specification during capital and redevelopment projects. • Inconsistent use of lighting controls throughout UHN. Pilots of several systems on-going • Lighting audits in various stage of completion across UHN. 	<ul style="list-style-type: none"> • UHN lighting standard, including standardized fixtures, developed and in use. • LEDs are used exclusively throughout UHN. • Where applicable, lighting controls are implemented and optimized. 	<ul style="list-style-type: none"> • Complete lighting audits at all sites, detailing: <ul style="list-style-type: none"> • base inventory of lighting equipment; • current and required light levels; and, • opportunities to install localized lighting controls. • Work with Facility Operations to develop standardization plan for types of LED lamps and fixtures used throughout UHN, including: <ul style="list-style-type: none"> • solutions for challenging fixtures and areas; and, • ensuring serviceability. • Leverage end-of-life TGH RFE lighting control system to investigate replacement options and potential to expand centralized control across UHN. 	<ul style="list-style-type: none"> • Updated UHN lighted guidelines and standards used for all capital and redevelopment projects. • Documented energy savings from lighting retrofit and control projects. 	<ul style="list-style-type: none"> • Lighting section included in new UHN Design & Construction Guidelines released April 2021. • Conversion of lighting to LED ongoing; most common area complete with focus now on “non-standard” areas. Initiatives and energy savings are documented. • New lighting standard under developed and will be piloted in TGH RFE building.

Area of Focus: Fans, Pumps & Motors (including ventilation & air handling)				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> Fans and pumps across UHN being assessed and replaced under recapitalization projects including those used for air-handling units (AHU) and domestic cold water (DCW) distribution. Energy efficiency incorporated into planning, design and replacement. VFDs added to several AHU, DCW and other systems across UHN as stand-alone energy efficiency projects. UHN construction and design guidelines for fans, pumps, motors and HVAC developed, though opportunity to use more consistently in capital and redevelopment projects. Incomplete mechanical drawings. 	<ul style="list-style-type: none"> Real-time energy dashboard, performance index and trending available for all fan and pump systems. Fan and pump preventative maintenance scheduled through BAS based on performance. Energy use optimized for all fans and pump systems. 	<ul style="list-style-type: none"> In conjunction with Facility Operations, conduct fan and pump surveys at each site identifying which area require upgrade or replacement for energy efficiency and/or reliability purposes. Implement measures based on survey results, including: <ul style="list-style-type: none"> addressing fan system air leaks, prioritizing older AHU systems; replacing standard V-belt with clogged belts on belt drive fans; and, where applicable, installing VFDs on fans and pumps and connect to BAS. Develop and implement pilot project for real time pump monitoring system including dashboard and energy performance index for individual systems and/or motors available on the BAS. Investigate connecting energy performance index to preventative maintenance work orders via new integrated work management system (IWMS) being implemented across UHN. Reduce condenser water flow rate by 50% for winter operation at TWH. Complete installation of round-around loop heat recovery system between exhaust air and fresh air at PMH. Continue to investigate opportunities for reducing fume hood air flow, particularly at PMH. Complete air system balancing for most AHUs across UHN. 	<ul style="list-style-type: none"> Documented reduced energy use by fan and pump systems. Real-time fan and pump dashboard and performance monitoring available on BAS. Documented repair of fan system air leaks. UHN construction and design guidelines for fans, pumps, motors and HVAC developed, approved, regularly reviewed and used consistently. 	<ul style="list-style-type: none"> Multiple motor replacements and VSD addition projects completed or ongoing, with documented energy savings. Summary page, with fan and pump details, set-up for main TWH and TR systems. Implementation of performance monitoring to be piloted at TWH where fan/pump information already available on BAS. Duct sealing pilot at LC was planned as part of 2021-2022 Energy Saving Projects, however no area suitable for “proof-of-concept” study could be found at any of the UHN hospitals. HVAC section included in new UHN Design & Construction Guidelines released April 2021.

Area of Focus: Water				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> City of Toronto water audits conducted at all locations. Numerous once-through municipal domestic-water cooling units have been replaced. Several units remain with initiatives to replace in various stages of implementation. Domestic water used as back-up cooling for critical equipment. Water efficient fixtures specified for capital and redevelopment projects, where consistent with infection control requirements. Water use reduced at TGH through connection to Deep Lake Water Cooling district system. Water treatment service-providers engaged to reduce cooling tower water use through increased cycles of concentration. Concern with inefficient water use by TWH cooling towers. Solutions being investigated and implemented. Rain water at KDT being harvested and used for flushing toilets. 	<ul style="list-style-type: none"> Use of once-through domestic water for primary cooling eliminated. Use of water for cooling towers optimized. Grey water re-used on-site. 	<ul style="list-style-type: none"> Continue projects to remove fridges at LC, BC and TGH's MBRC building from once-through domestic water cooling. Continue implementation of measures to optimize TWH cooling tower water use. Develop UHN standards for cooling-tower water treatment. Re-audit, assess and prioritize additional water reduction opportunities at all sites including: <ul style="list-style-type: none"> conversion of handwashing sinks to 5.7 lpm laminar flow, or less, where consistent with infection control requirements; opportunities to re-use grey water on-site; and, optimization of water use for landscaping. Examine opportunities to reduce hardscaping to decrease volume of storm water runoff to sewer system. 	<ul style="list-style-type: none"> Measurable decrease in water use. Fridges at LC, BC and TGH have been removed from once-through domestic water cooling. 	<ul style="list-style-type: none"> UHN wide water use reduced 11% between 2018 and 2019, 21% between 2019 and 2020; 10% between 2020 and 2021 (estimated). Replacement of water cooled compressor for BC morgue fridge with air cooled unit completed September 2019. Replacement of water cooled fridge at LC ongoing, completed June 2021. Construction of TWH WET system will significantly reduce cooling tower water. Completion expected by Summer 2023. Implementation of overflow alarm for TWH cooling towers, to prevent wastage through overflowing and overflow, under investigation.

Area of Focus: Heating & Cooling Plants				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> Primary heating for TGH, PMH, UC and PMCRT through district steam system. Primary cooling for TGH and UC through Deep Lake Water Cooling (DLWC) district system. Connection of PMH to DLWC system expected to be complete by Fall 2019. Incomplete mechanical drawings. 	<ul style="list-style-type: none"> Performance of heating cooling plants has been optimized. Resiliency and reliability of heating and cooling plants has been improved. Where feasible, primary heating and cooling is provided by district energy systems. 	<ul style="list-style-type: none"> Complete connection of PMH to DLWC system. Complete feasibility study for connection of TGH's MBRC building to Deep Lake Water Cooling district system. Continue development and implementation of plans to address maintenance concerns with TWH cooling plant and optimize performance. Develop and implement real time heating and cooling plant monitoring system including dashboards and energy performance indexes which can be used to generate maintenance work orders. 	<ul style="list-style-type: none"> Measurable improvement in cooling and heating plant performance. Real-time dashboard and performance monitoring for heating and cooling plants available on BAS. Connection of PMH to DLWC system complete. If feasible, connection of TGH's MBRC building to DLWC system. 	<ul style="list-style-type: none"> Real-time performance dashboard available for LC and BC cooling plants. Performance data available for TWH, but not tied to BAS. PMH connected to DLWC system in April 2020. Construction of district Wastewater Energy Transfer (WET) System to heat and cool TWH & KDT underway; completion expected Summer 2023. Active investigations into district energy systems underway for, PMCRT, MBRC, CBS and Michener.

Area of Focus: Building Envelope & Insulation				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • Preliminary envelope audits completed for TWH and PMH. Some opportunities implemented, though poor payback for many measures. • Energy efficient repair and optimization specifications included in capital and redevelopment projects involving building envelope. • “Cool” roofs installed at BC and RC. • Areas of uninsulated heating and cooling distribution piping located throughout all sites. Significant repairs completed for TWH steam distribution piping. • Removable steam system insulating jackets installed at KDT and being piloted at TGH. • Passive solar wall feasibility study completed for PMCRT. 	<ul style="list-style-type: none"> • Building envelopes at all sites are designed, operated and maintained so that cooling and heating loads are minimized. • All heating and cooling distribution piping and ducts are appropriately insulated. 	<ul style="list-style-type: none"> • Audit all sites to identify all areas with missing or damaged insulation on heating and cooling distribution pipes and ducts. • Complete comprehensive building envelope audit for all sites, including: <ul style="list-style-type: none"> • thermal imaging; • vestibule improvement and backup plan; and, • opportunities to install window reflective film. • Complete TGH removable steam insulating pilot and expand across UHN if results favorable. • Develop UHN building envelope standards. • Develop building envelope preventative maintenance plan, including: <ul style="list-style-type: none"> • weather stripping & caulking; • insulation of cracks; • sealing of utility and other penetrations; and, • proper fitting and operation of fenestration. • Investigate duct sealing technologies. 	<ul style="list-style-type: none"> • Measurable reduction in heating and cooling load requirements from building envelopes. • Documented replacement, repair and/or addition of insulation to heating and cooling distribution piping and ducts. 	<ul style="list-style-type: none"> • Multiple areas of steam/hot water piping insulation repaired or added at TWH, with tracked results. • Steam/hot water piping insulation audits completed for TGH and PMH. Work completed at PMH March 2022, with completion of TGH expected by Fall 2022. • Scope being developed for addition of removable insulation jackets to PMCRT steam system. • Duct sealing pilot at LC was planned as part of 2021-2022 Energy Saving Projects, however no area suitable for “proof-of-concept” study could be found at any of the UHN hospitals

Area of Focus: Onsite Energy Generation, Storage & Renewable Energy				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • Deep Lake Water Cooling (DLWC) district system providing primary cooling for TGH and UC. Connection of PMH to DLWC expected to be complete by Fall 2019. • Feasibility study for connection of TGH’s MBRC building to DLWC district system ongoing. • Use of ground- and air-source heat-pumps actively being investigated. • Use of battery storage actively being investigated. • Feasibility studies for combined heat and power (CHP) completed for BC and TWH. • Cursory investigations into solar walls and photovoltaics completed. 	<ul style="list-style-type: none"> • Renewable and low carbon energy form a significant portion of UHN’s energy mix. • Renewable energy incorporated into new construction. • Peak electricity demand has been minimized. 	<ul style="list-style-type: none"> • Complete feasibility study for connection of TGH’s MBRC building to Deep Lake Water Cooling district system. • Continue preliminary and, if warranted, detailed investigations into use of ground- and air-source heat-pumps, battery storage and other low carbon energy sources. • Develop renewable energy guidelines for new construction (e.g., solar PV, etc.). 	<ul style="list-style-type: none"> • Feasibility studies into low-carbon energy sources have been completed and, where feasible, planning and/or implementation has started. • Guidelines for incorporating renewable energy into new construction have been developed and approved. • Documented and quantified renewable energy production. 	<ul style="list-style-type: none"> • Construction of district Wastewater Energy Transfer (WET) System to heat and cool TWH & KDT underway; completion expected Summer 2023. • Active investigations into district energy systems underway for PMCRT, MBRC, CBS and Michener, including potential connection to DLWC system. • Preliminary investigation into low-carbon energy systems underway for LC/RC.

Area of Focus: Plug Load & Information Technology				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • UHN Green Procurement policy specifies evaluation of energy consumption were appropriate. Policy is to purchase Energy Star rated appliances when certification is available. • Program in place to purchase energy efficient ultra-low temperature (ULT) freezers when needed. • Energy & Environment involved in UHN enterprise print management strategy and program. • Computers <ul style="list-style-type: none"> • Inconsistent ability to implement power saving modes due to wide variety of computational needs and required response times. • Energy use from monitors greatly reduced through improved technology. • Full lifecycle costing, including energy use, and third-party certification (e.g., EPEAT, Energy Star, etc.) not consistently taken into account during procurement. • Location of on-site data centers not always optimized to minimize cooling energy requirements. 	<ul style="list-style-type: none"> • Use of energy consumption criteria and third party certification embedded into procurement process. • Computer and peripheral equipment power-saving mode implemented consistently where applicable. • Optimization and minimization of cooling requirements considered when locating, designing and building on-site data centers. 	<ul style="list-style-type: none"> • Continue to promote and expand use of energy consumption criteria and third party certification during procurement processes. • Schedule regularly occurring Energy & Environment meetings with UHN Digital to investigate and implement power shut down opportunities. • Develop UHN construction and design guidelines for data centers and other IT related requirements. • Investigate methodologies for estimating plug load in health care settings. 	<ul style="list-style-type: none"> • Regularly occurring Energy & Environment meetings with UHN Digital scheduled and well attended. • Consistent messaging and protocols developed for computer power saving. • UHN construction and design guidelines for data centers and other IT related areas developed and used consistently. • Estimate developed for UHN plug load. 	<ul style="list-style-type: none"> • Ongoing meetings between UHN Digital and Energy & Environment to discuss power shut down - paused during pandemic and roll-out of EPIC system. • UHN construction and design guidelines to be updated starting Fall 2022. Energy & Environment to lead development of standards for IT rooms.

Area of Focus: Greenhouse Gas Emissions				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> Over 15 years of UHN utility data available for historical trending and comparison. Scope 1 and scope 2 greenhouse gas emission metrics incorporated into UHN utility tracking platform. <ul style="list-style-type: none"> Scope 1 and scope 2 greenhouse gas emissions from UHN hospitals and research towers publically reported since 2013. Greenhouse gas emissions included in UHN Energy & Environment annual report. Primary focus of energy projects has been cost savings with a higher proportion of electricity related projects due to rates and other market forces. Electric vehicle charging stations installed at TGH and TWH to help address scope 3 greenhouse gas emissions. 	<ul style="list-style-type: none"> Consideration of greenhouse gas emissions more heavily weighted when evaluating energy projects, including health and other non-monetary costs. Long-term vision of all new UHN buildings being carbon-neutral and/or net-zero energy. Greenhouse gas reduction goals of district energy partners are aligned with UHN. Scope 3 greenhouse gas emissions measured and reported. 	<ul style="list-style-type: none"> Perform environmental scan of appropriate methodologies to determine scope 3 greenhouse gas emissions from healthcare facilities. Perform environmental scan and develop methodology for estimating the social cost of greenhouse gas emissions. Develop UHN greenhouse gas reduction targets. Develop and implement UHN construction standards to enable transition to low carbon energy. Engage with district energy suppliers to develop a plan to reduce the greenhouse gas intensity of the utilities they supply. 	<ul style="list-style-type: none"> UHN greenhouse gas emission targets established; all buildings on track to meet targets. UHN’s scope 1, scope 2 and scope 3 greenhouse gas emissions are tracked and reported on. Greenhouse gas impacts of energy and capital projects are actively determined and used for evaluation. 	<ul style="list-style-type: none"> Development of UHN “zero-carbon” pathway ongoing, and presented to UHN Board. Scope 1 and Scope 2 greenhouse gas emissions reported regularly. Review of appropriate methodologies for calculating Scope 3 emissions ongoing, including work with external groups (e.g. CASCADES program at UofT). Greenhouse gas impact of individual energy projects tracked and reported.

Area of Focus: Behaviour Change & Engagement				
Current State	Vision for Future State	Action Plan	Measure(s) of Success	Update - 2022
<ul style="list-style-type: none"> • Broad enterprise communication plan and engagement strategy for Energy & Environment programs in place. Energy awareness campaign, branded “Operation TLC – Care to Conserve”, encourages “lights off” behaviour. • Well established “Green Team” with over 700 staff acting as energy and environmental champions for their work area. • “Targeted” regular (annual or biannual) training for key operational departments impacting energy use (e.g. Facility Operations, Environmental Services, Security, etc.) • High level training started for capital project planning and delivery teams. • Limited energy training for new Building Operators. • Limited assessment of third-party service provider experience with energy management. 	<ul style="list-style-type: none"> • Ongoing comprehensive energy training for all UHN teams impacting energy use. • Demonstrated energy management experience, where applicable, for third parties providing services to UHN. 	<ul style="list-style-type: none"> • Develop tools and metrics to assess efficacy of enterprise communication and engagement strategy. Examine re-instituting Energy & Environment engagement survey. • Continue to investigate tools and opportunities to further support Green Team members. • Formalize and enhance energy training and education for project planning and delivery teams. • Determine current state of Building Operator knowledge (e.g., through surveys, current certifications, etc.) and: <ul style="list-style-type: none"> • perform environmental scan and evaluate existing training opportunities (e.g., Building Environmental Systems Operator Certificate, etc.); and, • explore training development opportunities with external partners (e.g. IESO, CHES, etc.). 	<ul style="list-style-type: none"> • Methodology for assessing enterprise engagement identified and being used. • New tools developed for Green Team members, with increased enrollment. • Internal training programs established for all UHN teams impacting energy use. • Training opportunities identified for new and current Building Operators with active enrollment. 	<ul style="list-style-type: none"> • Successfully using events (e.g. volunteer gardening opportunities, cycling workshops, etc.) to generate Green Team engagement and enrollment. • New Green Team specific “train-the-trainer” presentation completed. • Refresh of the Green Wall of Fame and Golden Light Switch in progress • Large components of Energy & Environment communication and engagement plan paused due to pandemic. Re-engagement has started and will include updating Energy & Environment communication plan and tools. • Creation and roll-out of collaborative model of training development and execution, partnering with leaders in key departments (e.g. Environmental Services, Facilities, etc.) to promote their ownership sustainability. • Pilot Building Operator training completed at TWH in March 2021. New Building Operators receive BAS training as required.