University of Manitoba District Energy System

Overview

The University of Manitoba operates a district energy system for heating and cooling most buildings on its Fort Garry campus. Steam and chilled water is generated at the Central Energy Plant which has seven boilers and six chillers. A network of steam and chilled water piping delivers heating and air conditioning to the campus. Most of this piping network is located in pedestrian and service tunnels connecting the various buildings.

The U of M purchases electricity and natural gas from Manitoba Hydro. The majority of energy use on campus is for heating, which is fueled by natural gas (67%), and the remaining energy use is supplied by renewable hydro-electricity (33%). The chillers in the Central Energy Plant are the largest electrical load on campus, accounting for 16% of total consumption during the cooling season.

Figure 1: U of M Central Energy Plant

District Heat Recovery

Throughout the Fort Garry Campus, waste heat is collected and transferred to locations requiring heat. The same pipes that distribute chilled water (shown in Figure 2) for air conditioning during the cooling season are used to distribute recovered heat during the heating season.

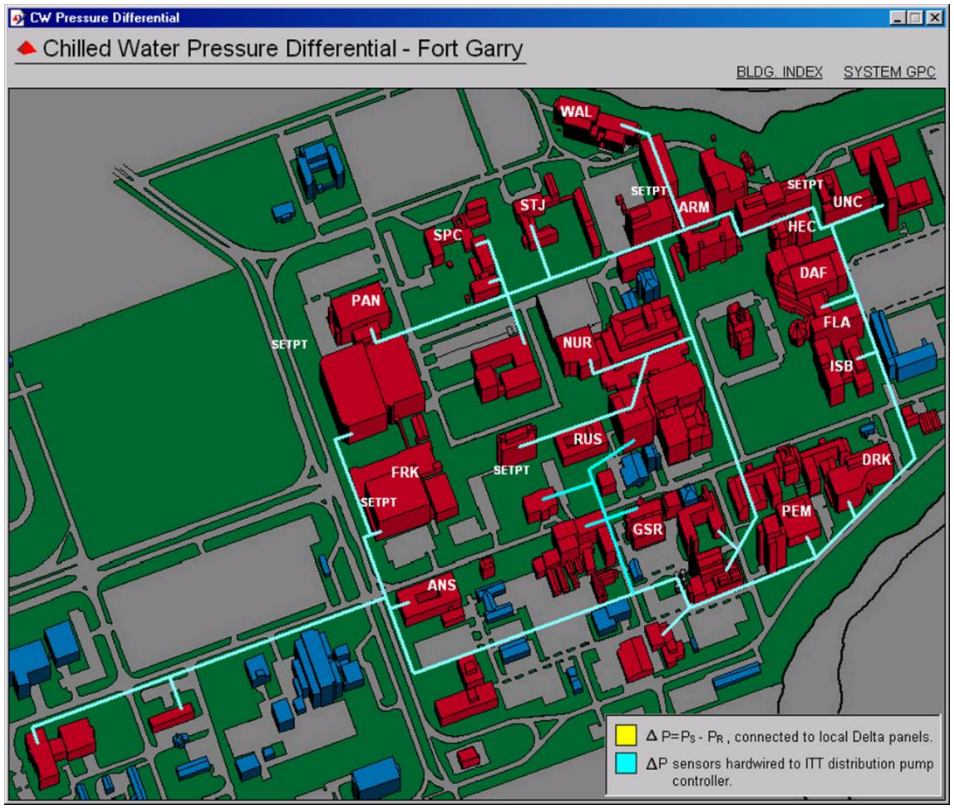

Figure 2: U of M Chilled Water Pipe Network

Most heat recovery takes place in the Central Energy Plant with a boiler flue gas heat recovery system (recuperator). The maximum heat recovery capacity of the recuperator is 20 mmBTU per hour. The heat recovered is transferred into the chilled water distribution piping and pumped out to the campus for primarily pre-heating ventilation air in various buildings and limited pre-heating of domestic hot water. The system is monitored with the campus-wide Delta control building automation system and summarized on the dashboard shown in Figures 3 and 4.

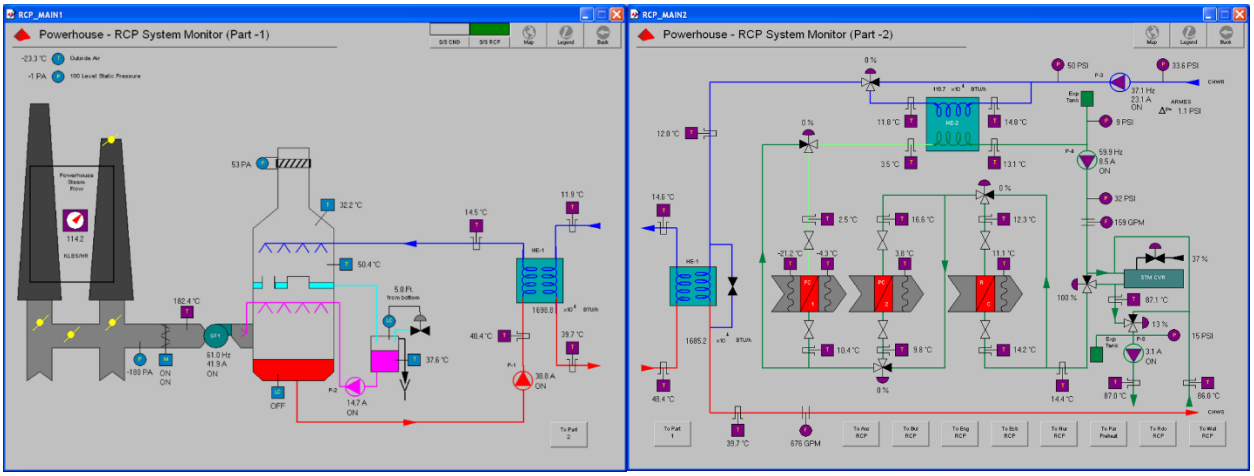

Figure 3: Heat Recovery System in the Central Energy Plant

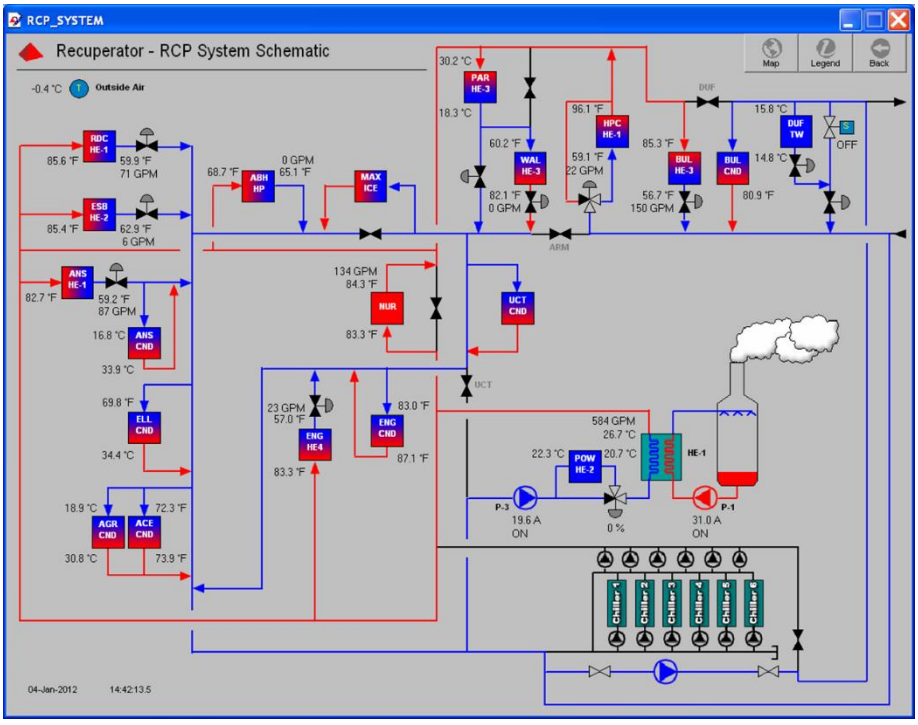

Figure 4: Heat recovery distribution to various buildings

Process Heat Recovery

Heat recovery from numerous water-cooled condensers has been retrofitted in many locations on campus. Previously, domestic cold water was used to cool condensers and accounted for the largest percentage of water use on campus. By utilizing the district heat recovery system, these retrofits effectively eliminated waste water associated with cooling on campus. Figure 5 shows an example of the district heat recovery loop being used to cool growth chambers in the Animal Science building. Domestic cold water consumption on campus has been reduced by 71% since 1990, as a result of the system upgrade as well as plumbing retrofits and upgrades throughout the campus.

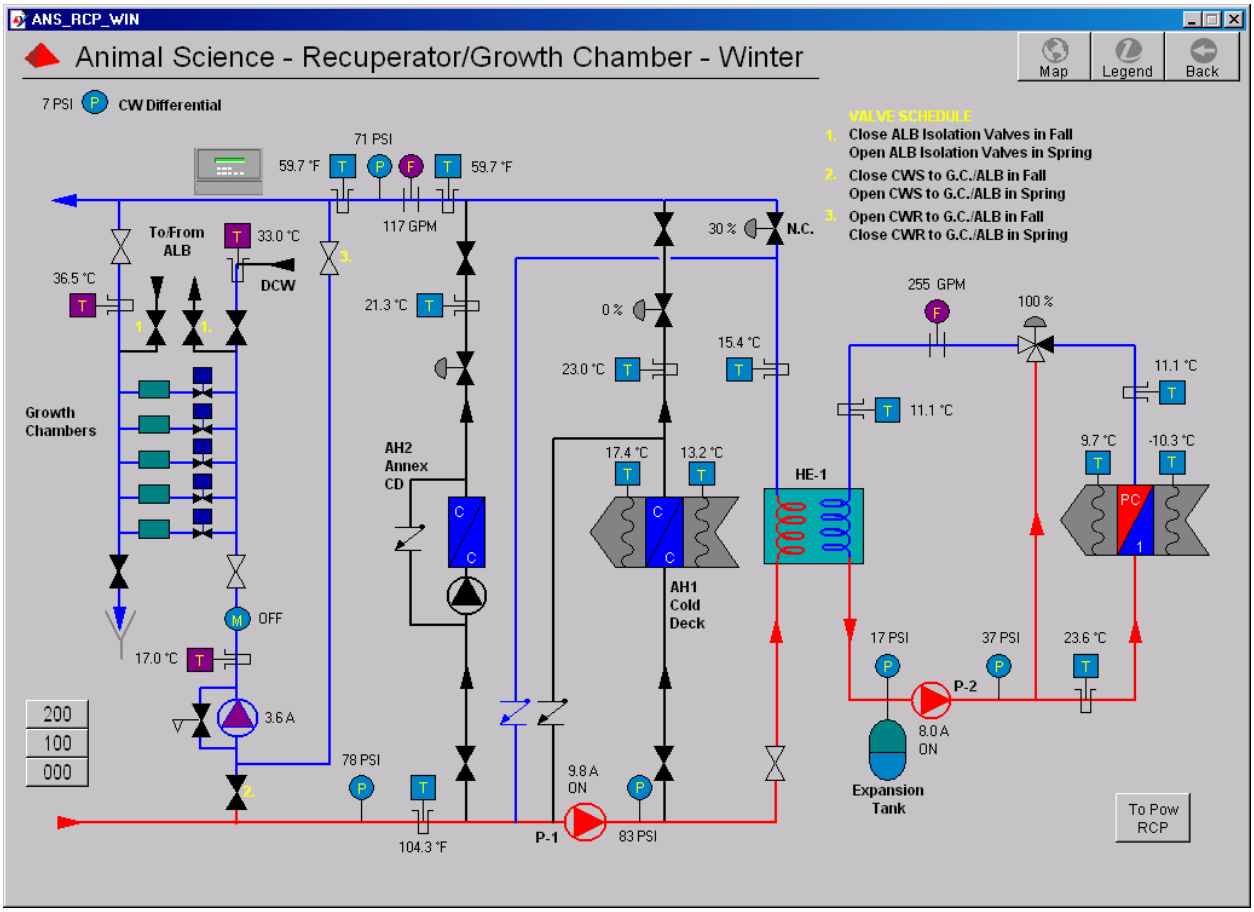

Figure 5: Heat recovery from water cooled condensers

There are other process heat recovery systems on campus which pick up waste energy from other buildings such as the ice plant in Max Bell, and walk-in coolers and freezers located in University Centre. The High Performance Computer Centre also utilizes heat-pumps to concentrate waste heat which is then injected into the district heat recovery system.

Domestic Hot Water

Heat is extracted from the district heat recovery system to preheat domestic hot water in several locations on campus. A de-superheater is used to preheat domestic hot water for Max Bell and the adjacent Investors Group Athletic Centre. Figure 5 shows the connection between the campus recovery loop and the preheat system at University Centre.

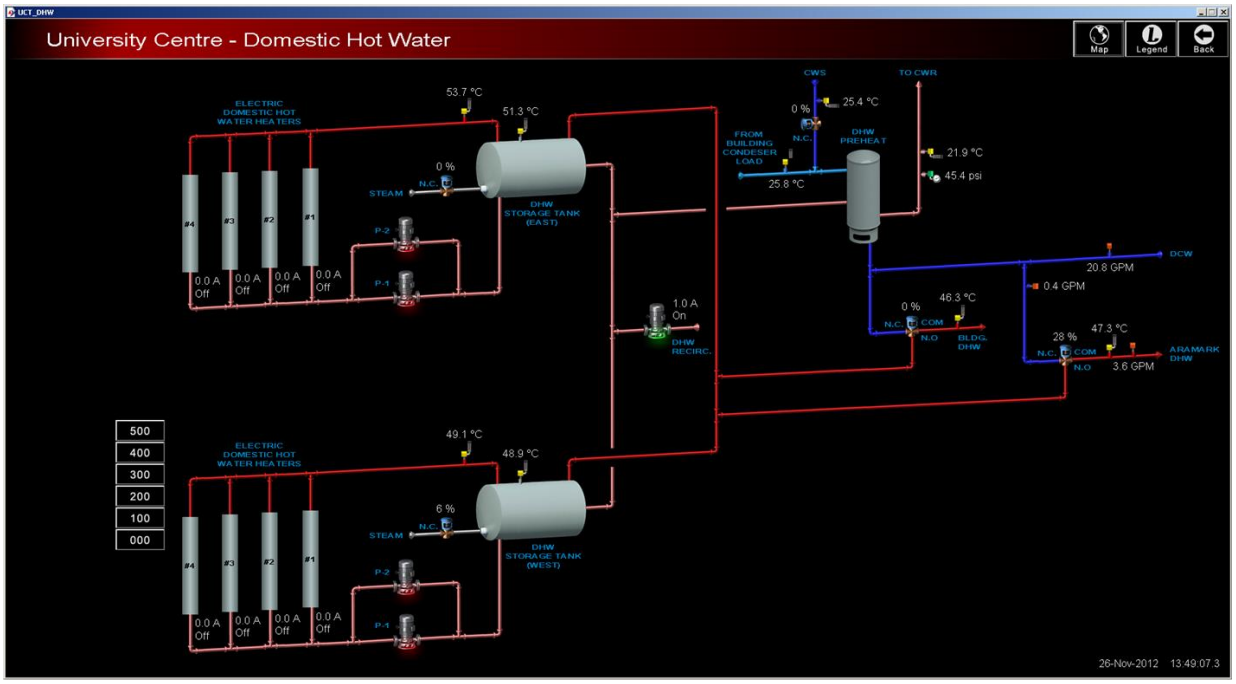

Figure 6: Domestic hot water loop in University Centre

Management

Data collected from the Delta system is trended and archived for use by both Architecture and Engineering Services (AES) and Operation and Maintenance (O&M) on campus. AES is looking for building and system performance optimization opportunities. O&M uses data to feed the Computerized Maintenance Management System to plan and coordinate on-going maintenance to ensure systems are operating efficiently and fixing potential issues before they appear.

As part of the on-going improvements on campus, the U of M has upgraded electricity meters on campus for improved reliability and long-term data logging. In addition, on a rotating four year schedule, each building on campus is subject to a Building Continuance Assessment that evaluates the condition of the building's components. This information is used to plan capital improvements and maintenance schedules.

Water usage on campus is also monitored by AES and O&M following the same protocol as energy, as the two processes are closely interconnected. Design standards for campus require that new and retrofit plumbing projects include water-conserving fixtures and water meters where feasible.

For more information, please see:

Energy & Water: http://umanitoba.ca/campus/sustainability/resources/942.html

Energy Systems: http://umanitoba.ca/campus/sustainability/media/UMFortGarryEnergySystem.pdf

Energy Management: http://umanitoba.ca/campus/physical_plant/arch_eng/1306.html

Central Energy Plant: http://umanitoba.ca/campus/physical_plant/centnrg.html