Campus Operations and Risk Management
The University of British Columbia | Okanagan Campus
1060 Diversity Place | Kelowna BC | V1V 1V7 Canada

UBC Okanagan District Energy Decarbonization Strategy

Updated August 2024

Overview

UBC Okanagan (UBCO) district energy systems are well positioned for modernization, renewal, and growth. Existing infrastructure has high value for decarbonization when combined with measures to reduce energy demand in both new and existing buildings. Low temperatures enable broad integration of waste heat and renewable energy and leverages the very green power grid in the region.

This document communicates UBCO district energy decarbonization strategy in a transition to a future state that is affordable, sustainable, and resilient in service to connected customers. Important new elements include a first cluster plant in the XSS building, CO2 Air Source Heat Pumps at the district level and thermal storage adjacent to the GEO building to displace natural gas use.

With this transition strategy, existing UBCO district energy infrastructure is made flexible to support different renewal and expansion scenarios. A foundation is laid for strategically aligned and resource efficient investments in the future. Clusters are connected. Future building connections are simple. Sustainable, affordable, and resilient service is provided to campus customers.

The stage is set for deep decarbonization at campus scale.

Current State of District Energy Systems

The UBC Okanagan District Energy System provides centralized heating and cooling to multiple buildings across campus. There are currently two district energy systems on campus:

1. The Medium Temperature District Energy System (MDES) distributes heating at 80 °C and relies on a combination of natural gas boilers, electric chillers, and geothermal energy to produce heating and cooling for the legacy buildings on campus (Arts, Science, the library, the gym and the administration building). It distributes this energy through a network of underground pipes carrying medium-temperature water.

2. The Low Temperature District Energy System (LDES) designed for energy sharing, with supply temperatures maintained in a range of 8°C to 25°C uses centralized heat pumps to extract heat from sources like the ground, ambient air, or waste heat from buildings. It also integrates renewable energy sources like solar thermal panels. The system circulates low-temperature water through a loop to provide heating and cooling for all academic buildings on campus including Nechako.

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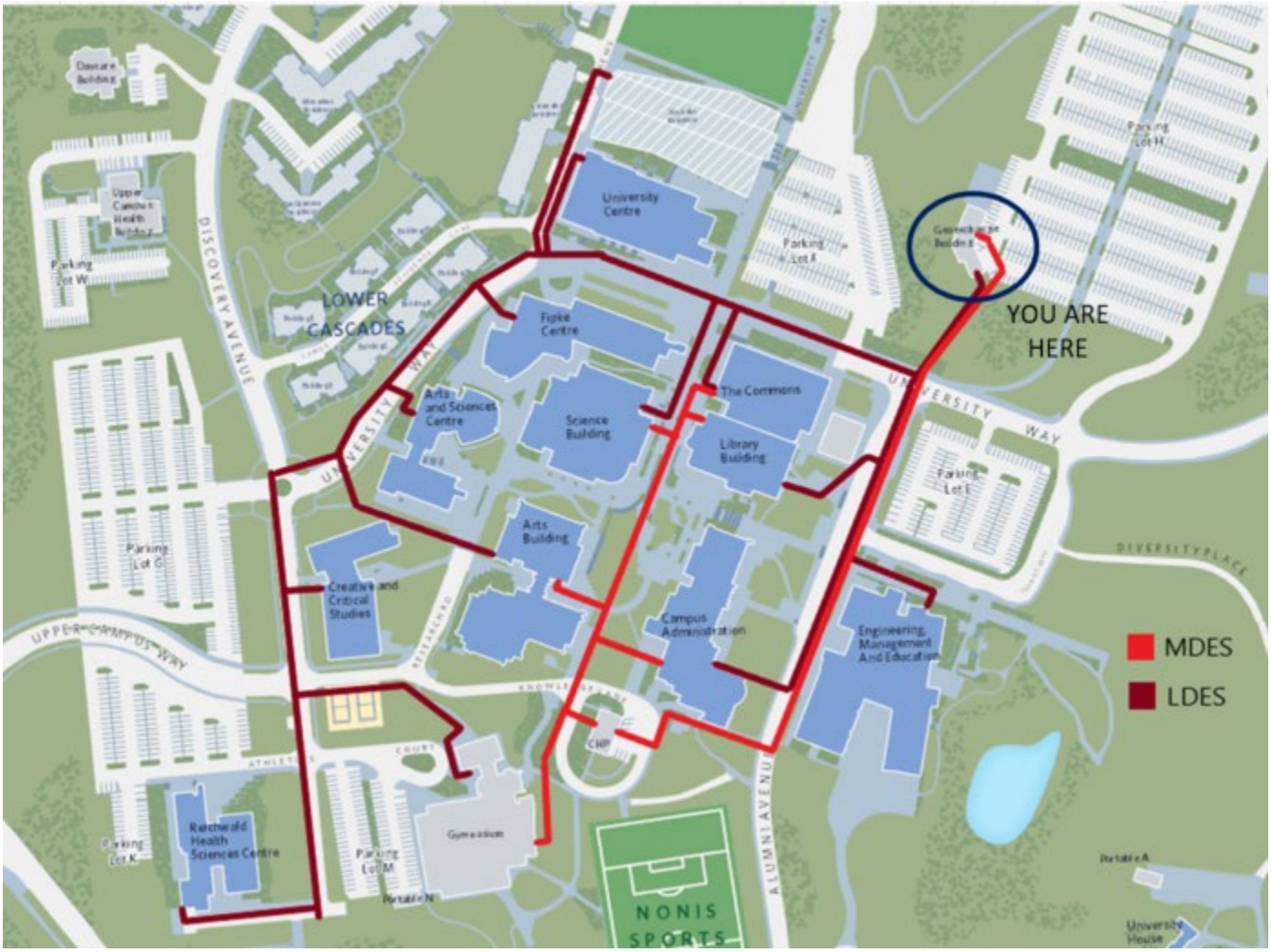

The Need for Campus District Energy Systems

UBC Okanagan has experienced exponential growth over the last 10 years. The staff, faculty and student population has increased from 3,975 to 12,279 and the number of buildings on campus has increased from 12 to 46. Despite this extraordinary growth, GHG emissions from buildings have dropped by 7% thanks to investments that have made the Okanagan campus a leader in providing low-carbon district energy supply to buildings. The next stage of development of the DES is to prepare it for increased capacity to handle campus expansion of the new x̌əl sic snpax̌nwixʷtn (XSS) building, which is scheduled to be completed in 2025.

During this growth the way forward was analysed and District Energy was found to be the lowest cost and best placed to achieve GHG targets and strategic goals. This strategy has been adopted and implemented in technical guidelines for all new and existing buildings.

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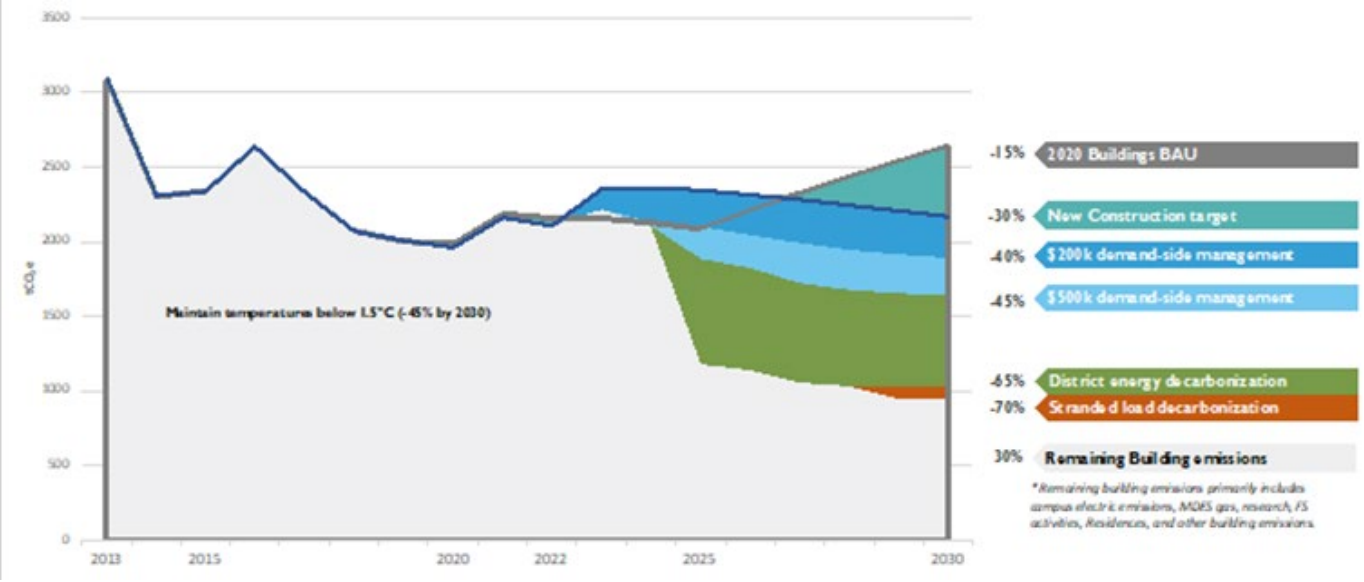
Consistent with the UBC Okanagan Climate Action Plan (CAP) 2030, and in support of achieving the Plan's target to reduce operational GHG emissions by 65% below 2013 levels by 2030, UBC Okanagan (UBCO) has developed an Integrated Energy Strategy to achieve deep decarbonization at the campus scale, as well as improve operational resiliency while reducing overall operating costs. Through implementation of this strategy, the campus's LDES will become a common sustainable thread that connects a series of cluster plants on the main campus and Innovation Precinct.

This figure illustrates that since 2013, UBC Okanagan has reduced GHG emissions by 33%. The strategies identified on the right can potentially exceed the CAP 2030 operational GHG reduction target of 65% by 2030.



The proposed solution is to install a 1.5MW CO2 Air Source Heat Pump (ASHP) which will provide 98% of the required LDES load and decarbonize the campus by 815 Tons CO2.

UBCO CO2 Air Source Heat Pump Project Summary

A key strategy in decarbonizing UBCO's core operations cost-effectively is the expansion of central plant using low carbon energy equipment (air source heat pumps). These heat pumps would be used to address the base load heating requirements instead of gas boilers which would be used during peak heating demand (during the coldest months). Continuing to use the gas boilers to handle peak heating loads results in reduced capital costs for Air-Source heat pumps and enables significant decarbonization with a relatively modest equipment size. Two

new condensing boilers (3,000 MBTU and 5,000 MBTU) are installed in the UBCO District Energy system to handle the peaking demand by campus.

The proposed 1.5MW CO2 air source heat pump solution not only addresses environmental concerns (possibility of per- and polyfluoroalkyl substances (PFAs), which could pose significant long-term environmental hazards) linked to conventional refrigerants but also provides significant improvements in efficiency and operational flexibility. This project improves the Overall system efficiency from 72% to 174%. UBCO's low-temperature district energy system (5th generation district energy network) provides a unique opportunity and novel application for CO2 refrigerant-based Air-source heat pump.