Donaldson Company

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Organization Background

Donaldson Company, Inc. is a vertically integrated filtration company specializing in producing and marketing air filters across multiple industry sectors. Founded in 1915 and headquartered in Bloomington, Minnesota, the company's product portfolio includes filters for applications in agriculture; construction; transportation; manufacturing; and controlling the contamination of dust, fumes, and mists. Donaldson's research and development (R&D) headquarters plays a critical role in advancing filtration technologies and enhancing product performance.

"The opportunity to have my summer internship with MnTAP bolstered my techical skills from initial research to publication. I am very grateful to be given the chance to directly apply my skills in sustainability to improve an real industrial system." ~ DR

Project Background

This project focused on foot printing and optimizing the Liquid Lab's chilled water processes. It included helping Donaldson better understand its current cooling loads, cooling capacities, and energy opportunities associated with the chilled water system. In Fiscal Year 2023, the company contemplated installing a new chiller to enhance performance. This could provide additional cooling capacity to the Liquid Lab, avoid the costs associated with purchasing an oversized chiller, and present an opportunity to assess whether the current Chilled Water (CHW) system could be optimized to meet the lab's needs more efficiently. By deepening our understanding and improving the existing cooling infrastructure's efficiency, this project would support Donaldson's broader sustainability objectives while ensuring operational effectiveness.

Incentives To Change

Donaldson Company is committed to sustainability, as outlined in their Fiscal Year 2023 (FY23) Sustainability Report. This project directly contributes to their 2030 Environmental and Social Ambitions, which aligns with global efforts to mitigate climate change. Donaldson is focused on reducing its energy consumption and expanding its clean energy portfolio. They are aiming at a 42% absolute reduction in Scope 1 and 2 greenhouse gas (GHG) emissions by fiscal year 2030 and in line with the Intergovernmental Panel on Climate Change (IPCC) 1.5°C global warming scenario. This initiative not only supports regulatory compliance and enhances environmental stewardship but also addresses the economic impacts of energy costs, raw material use, and waste management.

"Daniel's work was a great example of how small changes can drive significant impact. He focused on improving the performance of the chiller system in our Liquid Lab, demonstrating through careful data collection that we could increase efficiency without any additional cost. His findings gave us the confidence to implement changes that will improve the performance of our test benches while also identifying quantifiable opportunities for energy savings."

~ Hans Wucherpfennig
Donaldson Company, Inc.

Solutions

Improve Utilization of Current Chiller

In the short term, optimizing the use of the current chilled water chiller and addressing any maintenance needs it has would help its operational efficiency. This avoids the one-time project cost estimated between $250,000 and $300,000. Conversely, the chiller is older than 40 years and there are legitimate reliability concerns, so replacing it with the same refrigeration tonnage of 20 tons or less should be considered given its current heat load. Replacing the chiller would align with both the long-term goal of maintaining operational efficiency and would ensure the chiller's continued reliability.

Reduce Chiller Water Pump Impeller Diameter

Reducing the impeller diameter of the basement chiller pump could reduce up to 4,500 kilowatt-hours (kWh) annually and result in a potential savings of approximately $450.

Reduce Lab-Side Pump Flowrate by 20%

We recommend reducing the flow rate of the lab-side pump by 20%. The implementation of this adjustment is immediate and would make it a practical and cost-effective solution for optimizing the system's energy consumption. Implementing this could result in an annual reduction of 10,000 kWh and result in a potential savings of $1,000.

Remove Heat Exchanger

There is a water-to-water heat exchanger which exchanges heat between the lab process cooling loop and the chiller cooling loop. Because both loops contain water and using a heat exchanger would incur an efficiency loss, the calculation was completed for the energy and cost savings behind removing this heat exchanger. The team later learned that the loops were separated to prevent safety concerns from any cross contamination between the lab process and the general cooling loop, so this opportunity is not planned for implementation.

Recommendation	Annual Reduction	Annual Savings	Status
Improve Utilization of Current Chiller	To be determined	$0	Recommended
Reduce Chiller Water Pump Impeller Diameter	4,500 kWh	$450	Investigating
Reduce Lab-Side Pump Flowrate by 20%	10,000 kWh	$1,000	Recommended
Remove Heat Exchanger	3,222 - 22,284 kWh	$322 - 2,284	Not Planned

MnTAP Advisor: Jon Vanyo, Senior Engineer