

# Chilled Water System Optimization at Donaldson Company

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UNIVERSITY OF MINNESOTA  
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# Donaldson Company

## Company description

- Bloomington, MN
- 1,250 Employees
- 600,000 Square Feet

## Industrial Filter Uses

- Dust, Fumes & Mists
- Engine Filters / Hydraulics
- Aerospace
- Disk Drives / Semiconductors



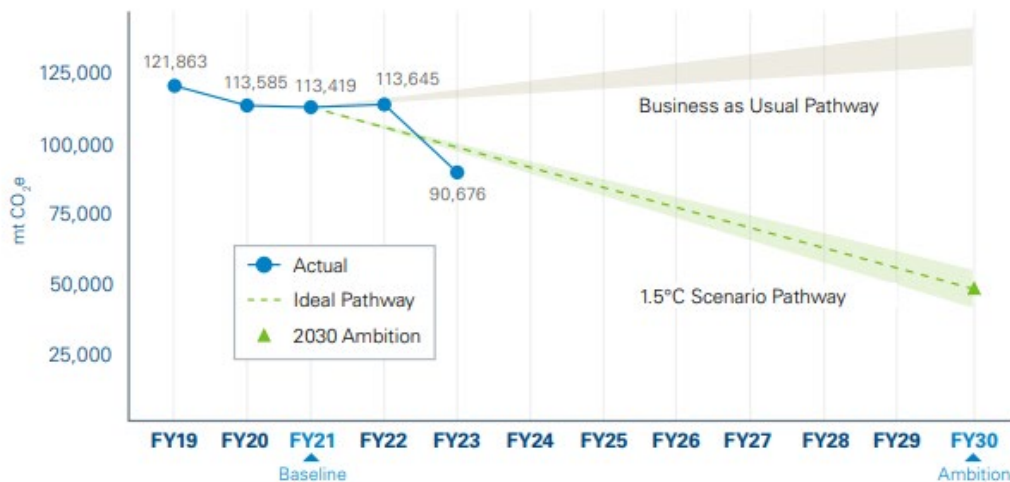
# Incentives to Change

## Donaldson's Goals

- Reduce energy consumption and increase clean energy portfolio.
- Target an absolute reduction of Scope 1 & 2 GHG emissions by 42% by FY30 in accord with the IPCC 1.5°C global warming scenario.

### 2030 AMBITION – MAPPING GHG EMISSIONS REDUCTION GOAL

Actuals (mt CO<sub>2</sub>e) and Scenario Pathways Considered



Donaldson Company's FY23 Sustainability Report  
2030 Ambition – Mapping GHG Emissions Reduction Goal

# Incentives to Change

## Liquid Lab Cooling

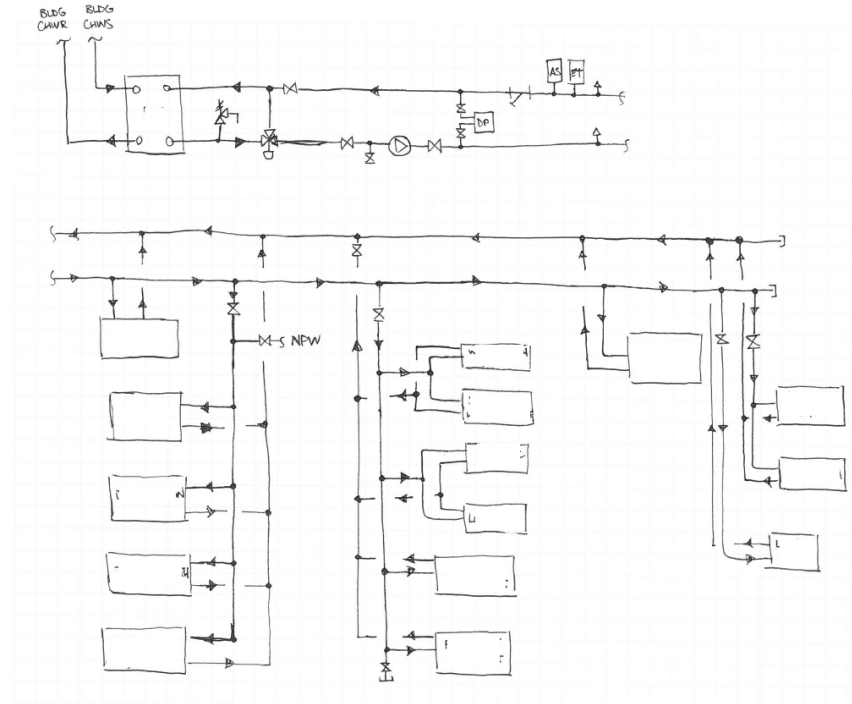
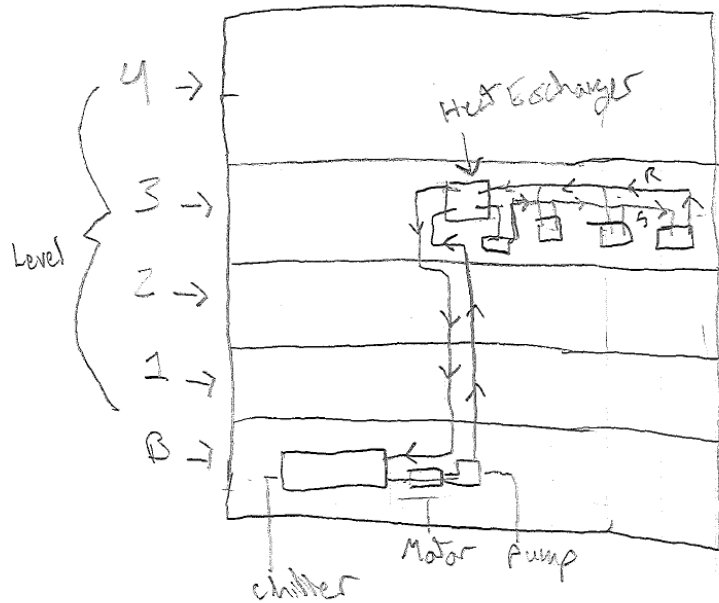
Donaldson's liquid lab had investigated a new chiller in Fiscal Year 2023 for a performance increase.

### Project Incentives:

- Supply more cooling capacity to the Liquid Lab.
- Avoid purchasing of an oversized new chiller for the Liquid Lab.
- Understand if testing efficiency can be improved with the current Chilled Water (CHW) supply.



# Process Overview Diagram

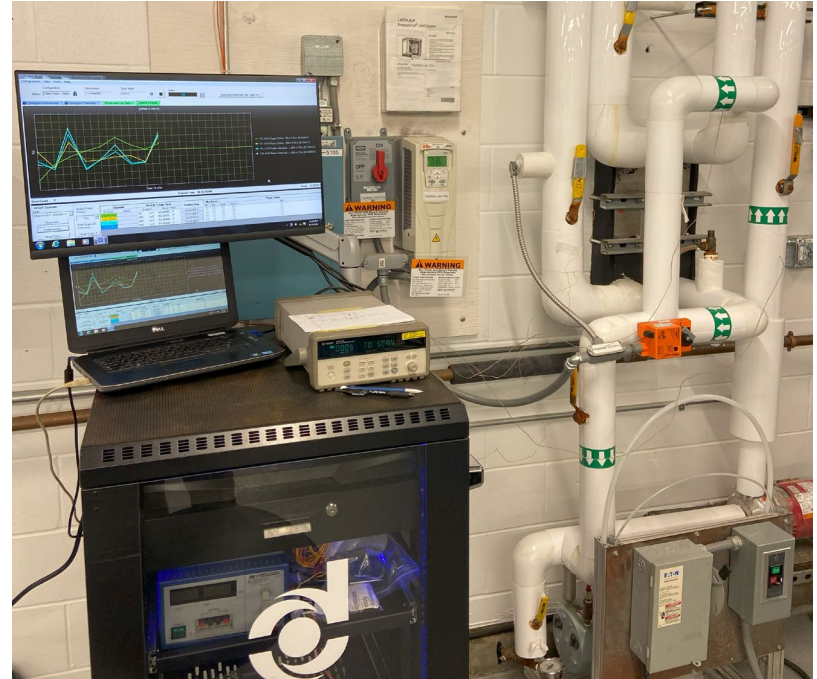




# System Characterization: Chilled Water System

## Chiller Characteristics

- Chiller Capacity  
20 Refrigeration tons (RT)
- Process Load  
Current Average Cooling Load: 8.2 RT  
Current Load + Critical Bench: 13.3 RT
- Age of Chiller Unit: >40 years



# System Characterization: Chilled Water System

- **Heat Transfer Results**

Analysis showed that a new chiller is not required, The lab's concerns about shocking the CHW system were valid and now alleviated.

If the chiller's lifespan is nearly over, installing a slightly smaller chiller would achieve the same level of operation today.

- **Energy Savings**

Utilize the CHW system controls to prevent overcooling in the lab. (Needs Investigation)

Optimize pump flowrates - Chiller & Lab (Needs Investigation)



# Lean & Cost Avoidance: Chilled Water System

## System Analysis:

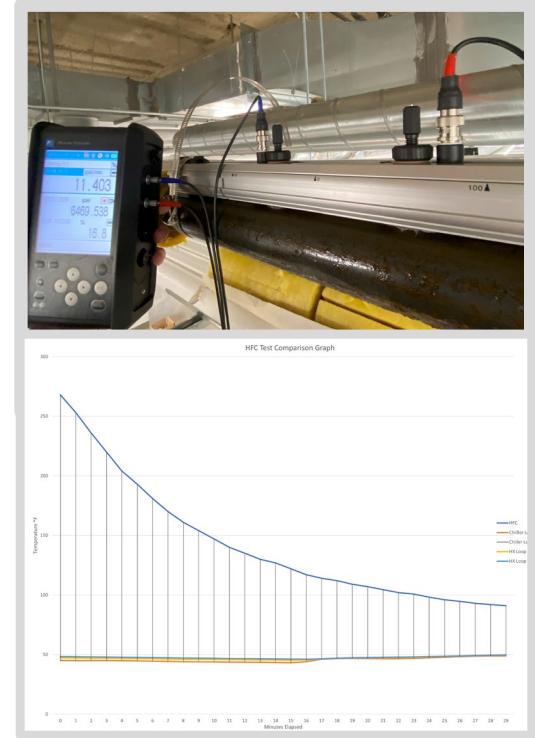
- CHW effectively supports increased testing load.
- There's no need for immediate system upgrades or replacements.

## Immediate Cost Avoidance:

- Not replacing the CHW system avoids \$250,000 - \$300,000

## Operational Efficiency:

- Time between testing reduces from 2-3 hrs air cooling to 30 mins.
- Annual R&D testing efficiency and productivity increases.





# Solutions

Recommendation	Annual reduction	Total cost	Annual savings	Payback period	Status
Improve Utilization of Current Chiller	One-Time New Chiller Project Cost Saving, \$250k-\$300k	\$0	\$0	N/A	Recommended
Reduce Chiller Water Pump Impeller Diameter	9,700 kWh	TBD	\$975	TBD	Investigating
Reduce Lab-Side Pump Flowrate by 20%	19,500 kWh	\$0	\$2,150	Immediate	Recommended
Remove Heat Exchanger	10,500 kWh	TBD	\$1,200	TBD	Not Planned

# Personal Benefits

- Getting to work on a real-world system
- Practicing scientific engineering concepts
- Helping in sustainable systems design / analysis
- Receiving mentorship from working professionals in the field

Special Thanks to MnTAP Staff, Donaldson Staff/Facilities, and the Better Plants Team at Oak Ridge National Laboratory

