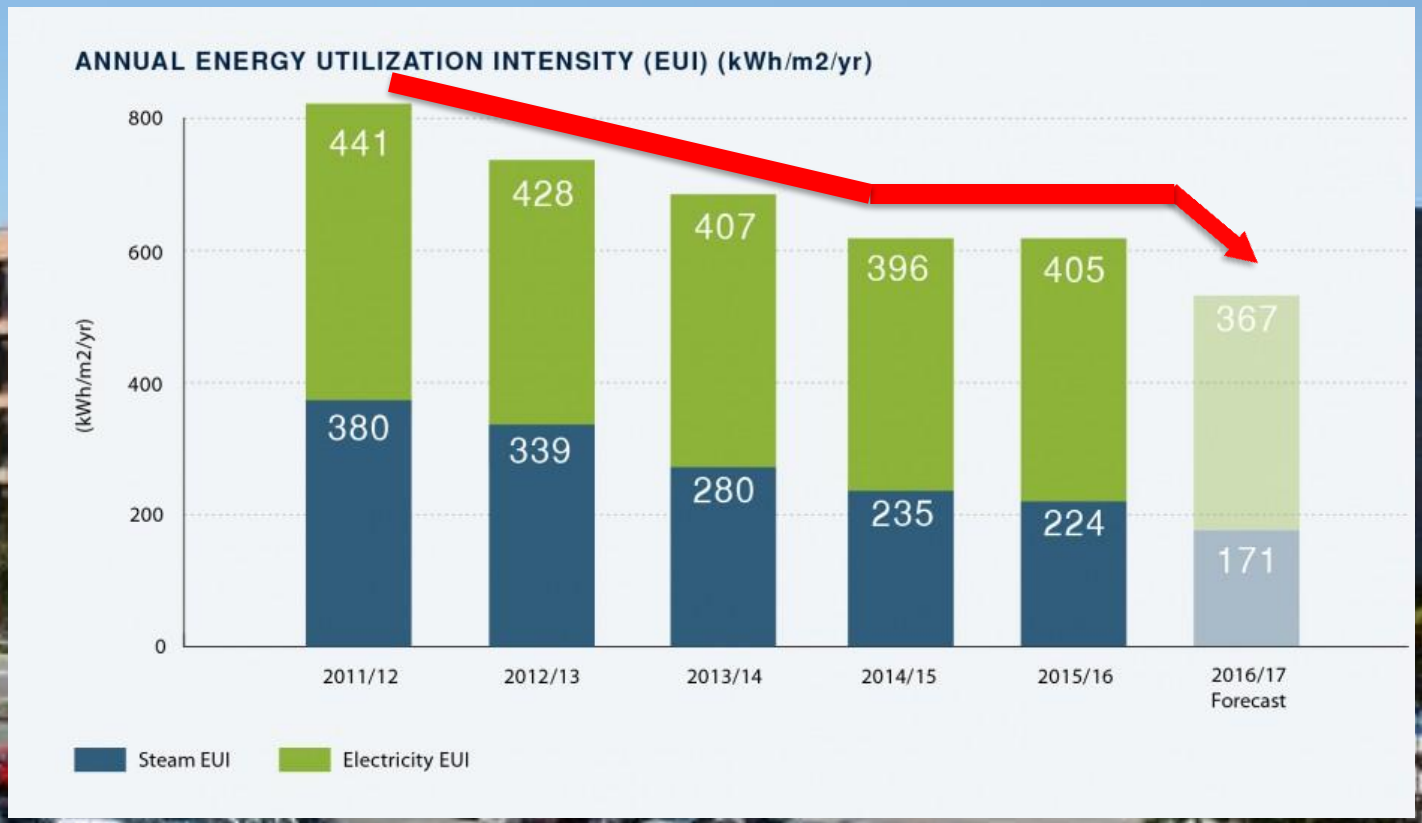
Bang for Buck

Achieving a 35% reduction in energy use through low to no cost ECM's

Jeff Giffin Energy Conservation Manager
University of British Columbia Energy and Water Services



The University of British Columbia

- 15 million sq.ft. of institutional & residential buildings over 1,000 acres
- Day time pop. ~ 65,000, with 30% growth expected over the next 20 years

Energy and Water Services

Saving Energy, Water and Greenhouse gases

Seamless delivery of utility services (electricity, water, gas, sewer)

Mandated energy savings and greenhouse gas emissions reductions

Manage ~$36M/year commodities budget

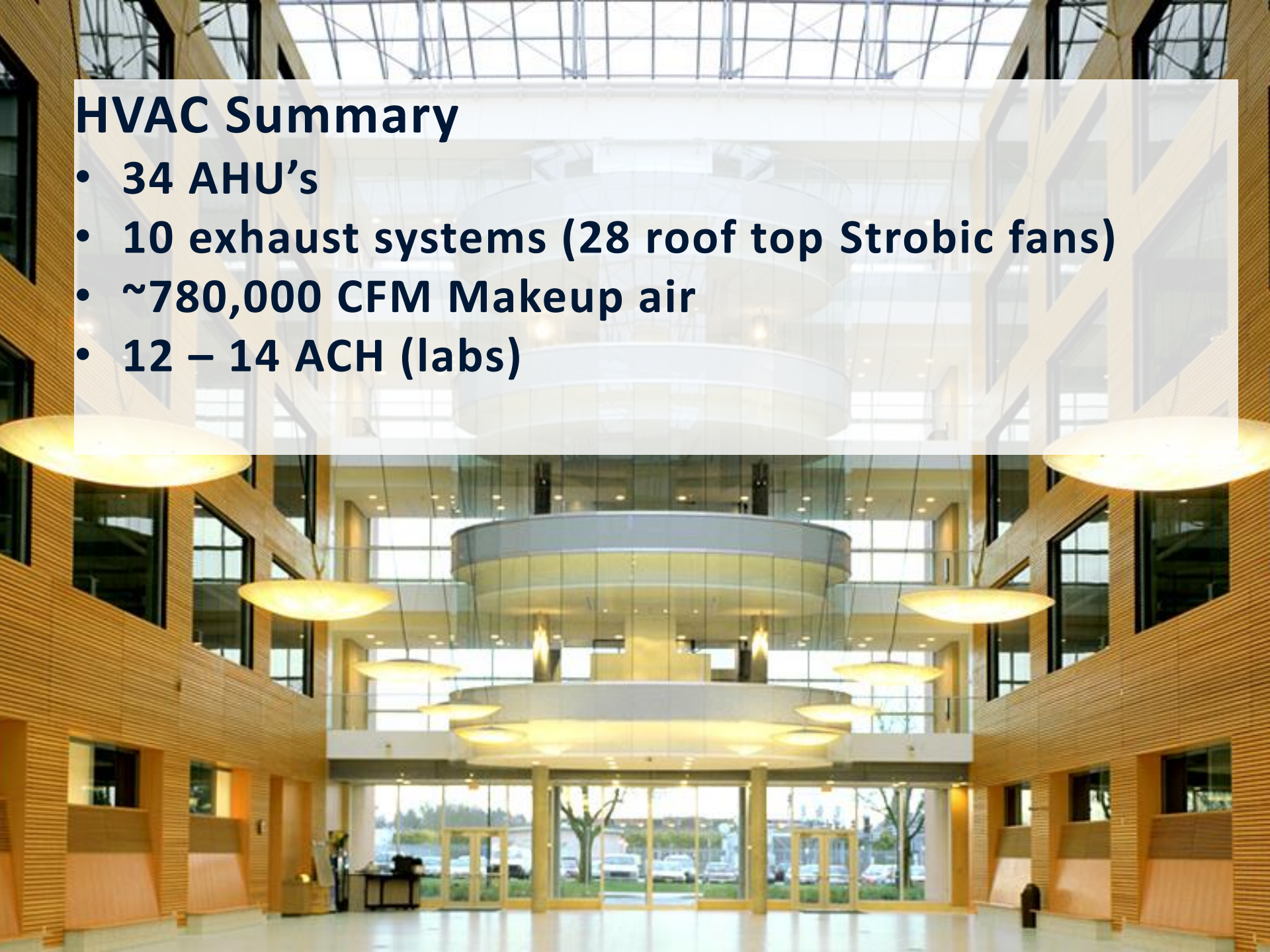
Presentation overview (Add dates)

Energy Savings chart with events,

1) 2012 Coil cleaning
2) F2012 ilter changing
3) 2013 COP
4) 2013 Chiller recommissioning
5) 2015 Cascaded District Energy
6) Heat Recovery chiller
7) Variable air volume exhaust
8) Laboratory air change rates

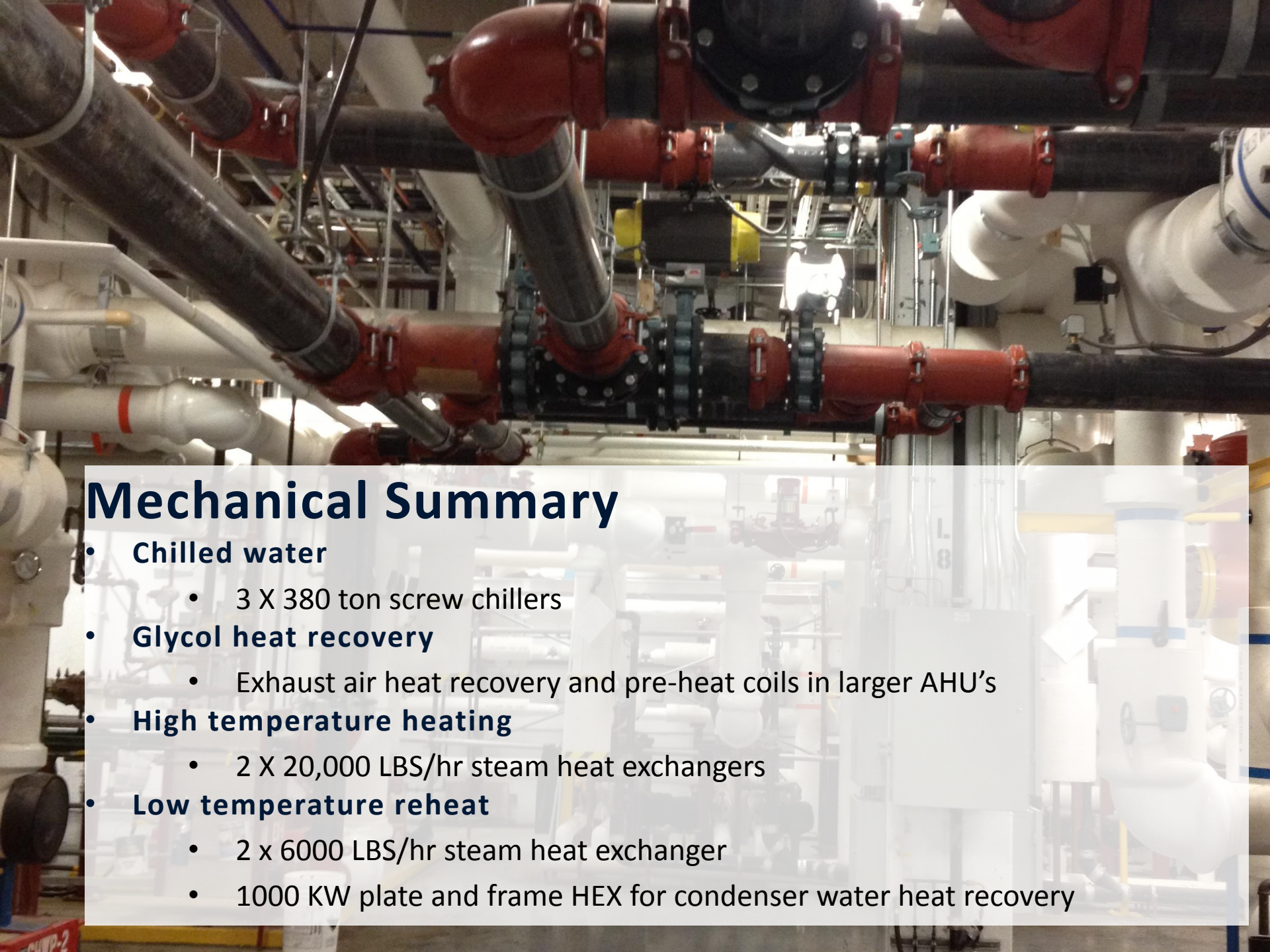
Background: Life Sciences Centre

- 1st LEED Gold Building on campus completed in 2004
- Largest teaching/research building on campus **560,000 sq/ft**
- Medical research and education with animal care and level 3 biohazard lab
- 3% of space yet 12% of campus energy (~22 GWh/yr electrical and ~70,000 GJ/yr thermal)
- 2.5X more energy then modeled



HVAC Summary

- 34 AHU's
- 10 exhaust systems (28 roof top Strobic fans)
- ~780,000 CFM Makeup air
- 12 – 14 ACH (labs)



Mechanical Summary

- **Chilled water**
  - 3 X 380 ton screw chillers
- **Glycol heat recovery**
  - Exhaust air heat recovery and pre-heat coils in larger AHU's
- **High temperature heating**
  - 2 X 20,000 LBS/hr steam heat exchangers
- **Low temperature reheat**
  - 2 x 6000 LBS/hr steam heat exchanger
  - 1000 KW plate and frame HEX for condenser water heat recovery

Post-Traumatic Commissioning Disorder (PTCD)

- Major commissioning issues such as air pressurization
- Building users strongly resistance to any changes


Scratching the surface

Cleaning Coils

Molds and bacteria

Dirt and leaves

Decomposed filter media

- Improves air quality (bacteria/molds)
- Saves energy (reduced pressure drop)
- Better heat transfer (heating and cooling)
- <1 year payback with utility incentives
- Recommend every 5 years

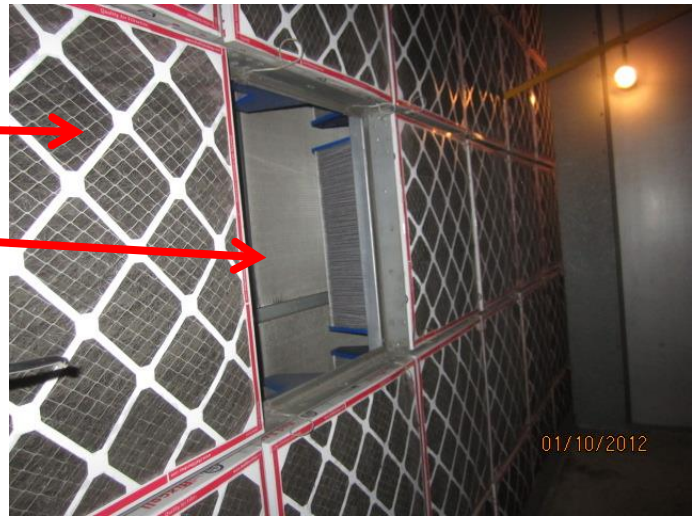
High Performance Air Filters

Lower pressure drop, longer life, better filtration, lower life cycle cost

2 filters (before)

MERV 8 Pre-filter

MERV 13 Box filter

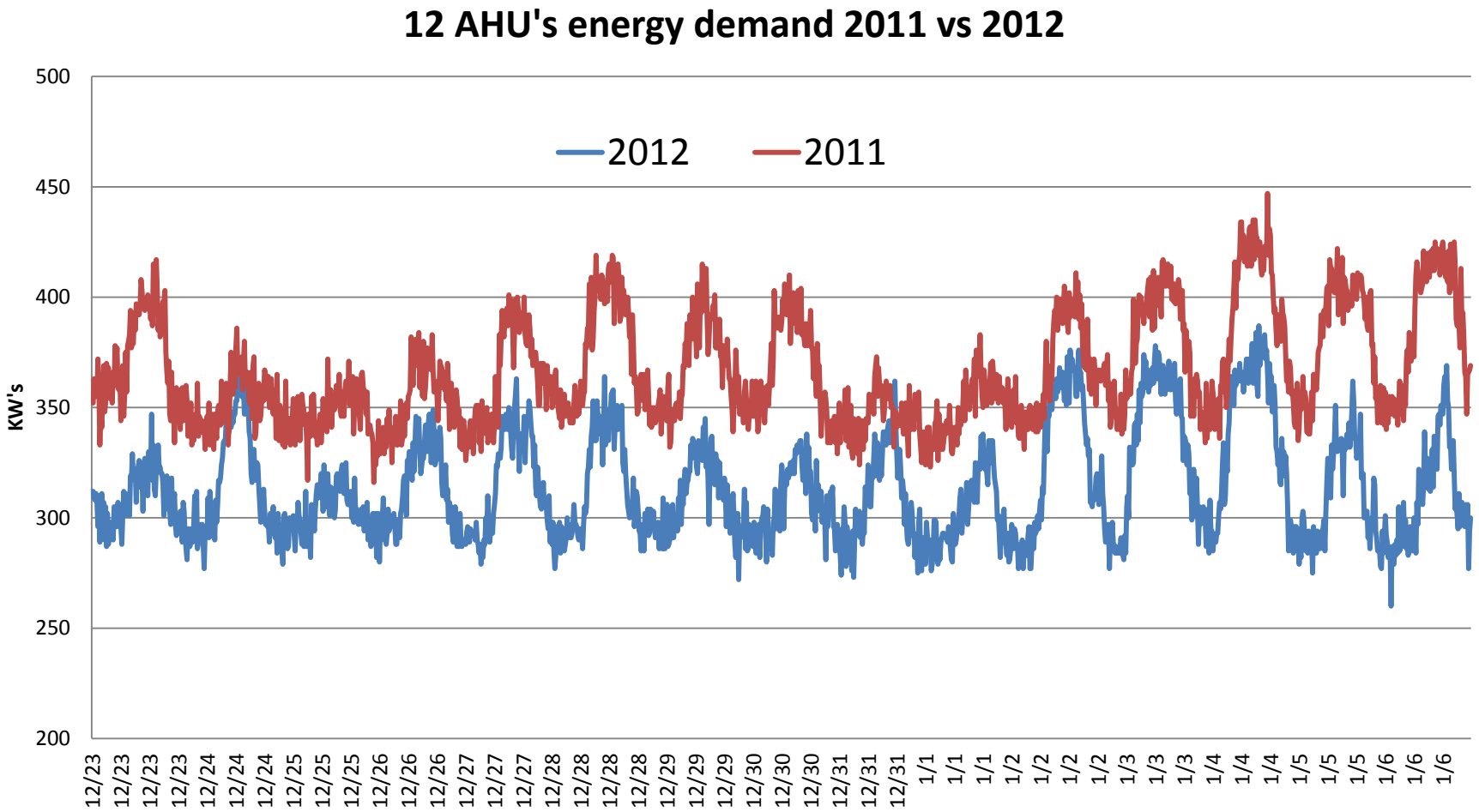


1 filter (after)

MERV 14 Mini-pleat filter with gaskets

- Reduced labour (Less filter changes)
- Reduced waste / inventory
- Reduced energy (Less resistance)
- Better air quality (MERV w/ 14 Gaskets)
- < 1 year payback
- Change on Dp (every 2-3 years)

1 Year Later



Measured demand savings from 12 AHU's ≈ 50 KW's

Continuous optimization

Talk to what Cop is

- **OAT Lockout / Weather Predictor**
- **Lecture Hall Motion and Scheduling Upgrade**
- **Classroom Motion and Scheduling Upgrades**
- **Office Schedule Reduction**
- **DHW Optimization**
- **Café Schedule Reduction**

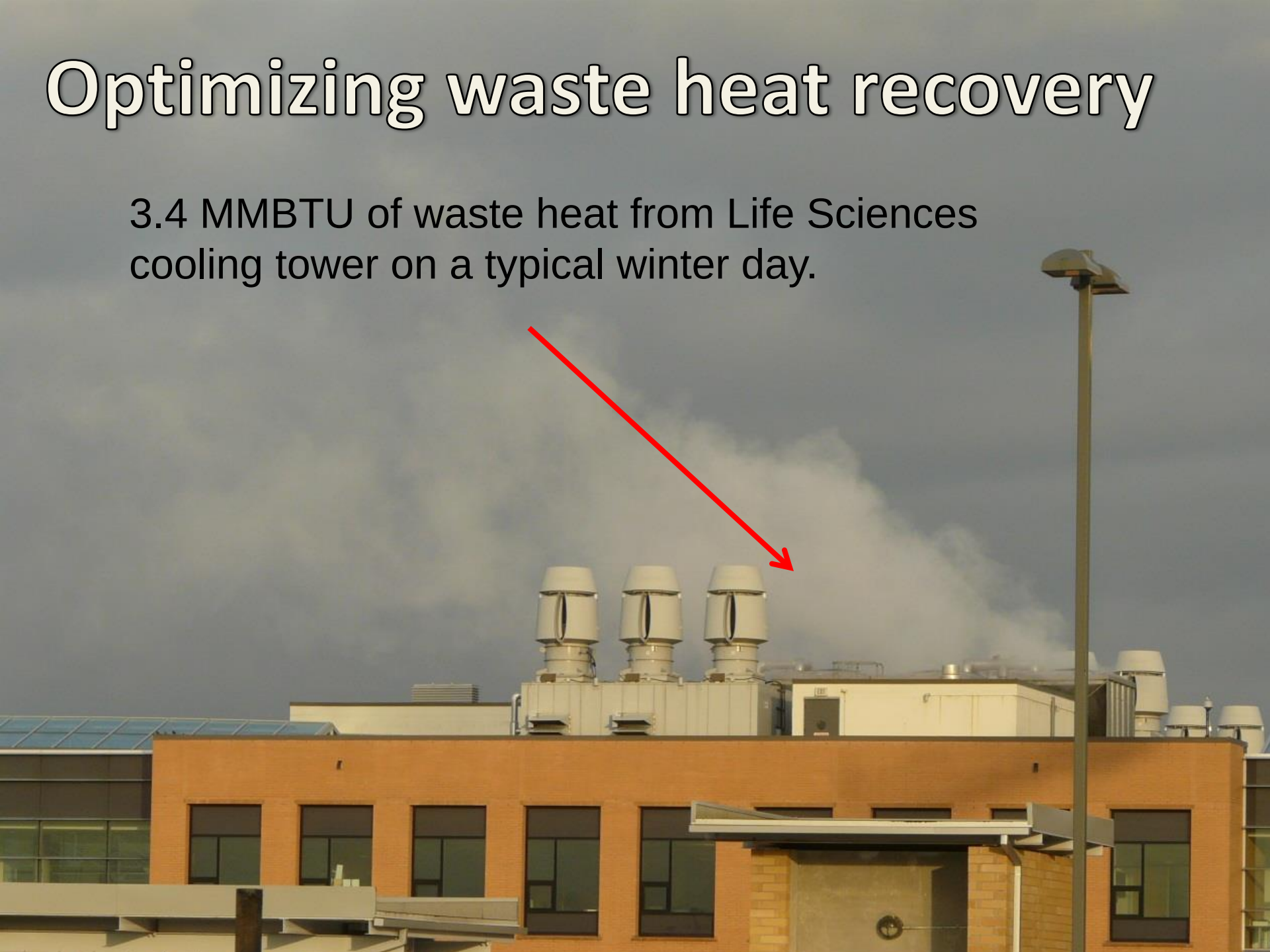
Energy Savings
300 MWh/yr Electrical
3600 GJ/yr Gas
< 1 year payback

BC hydro
powersmart

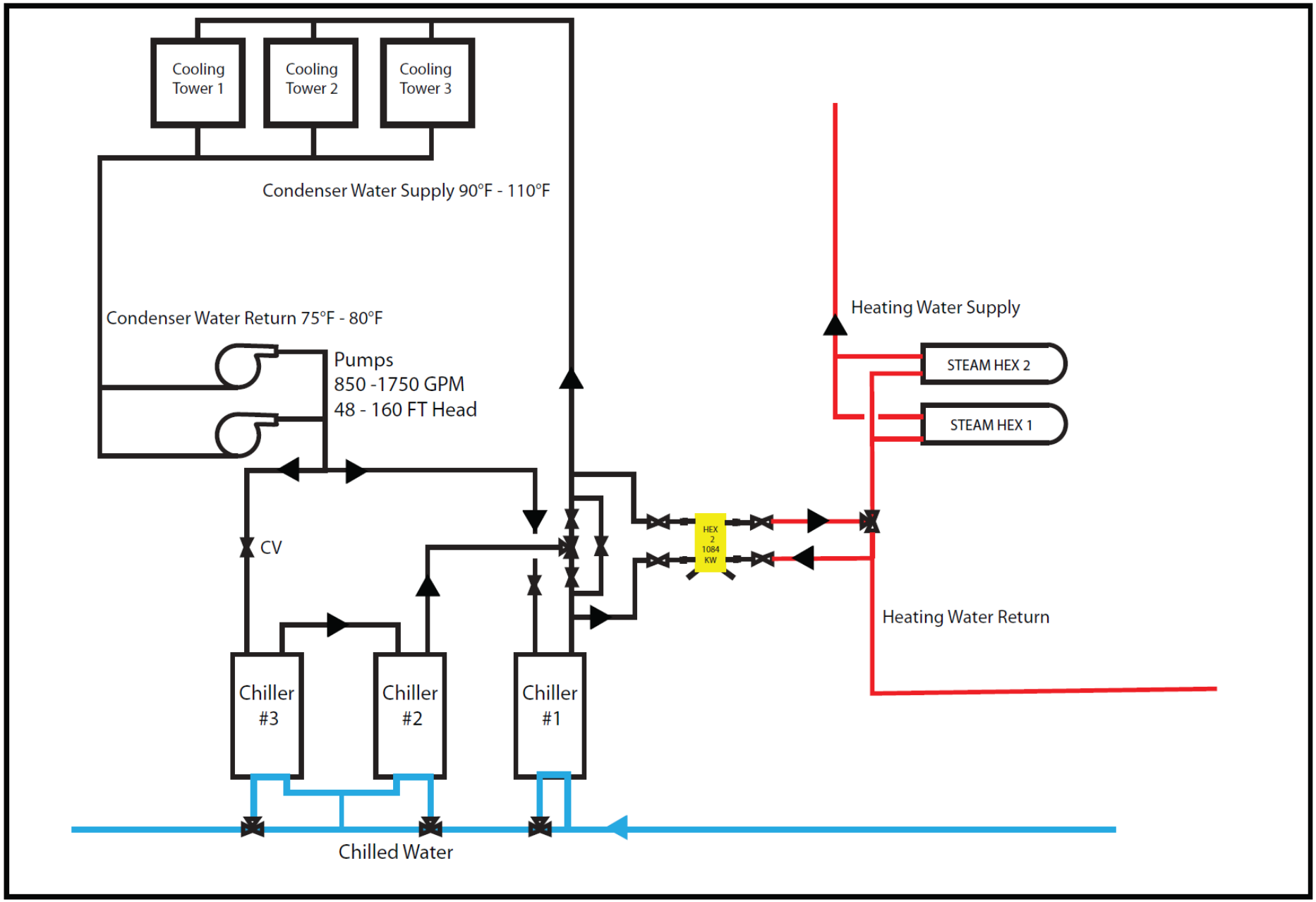

Digging In

Optimizing waste heat recovery

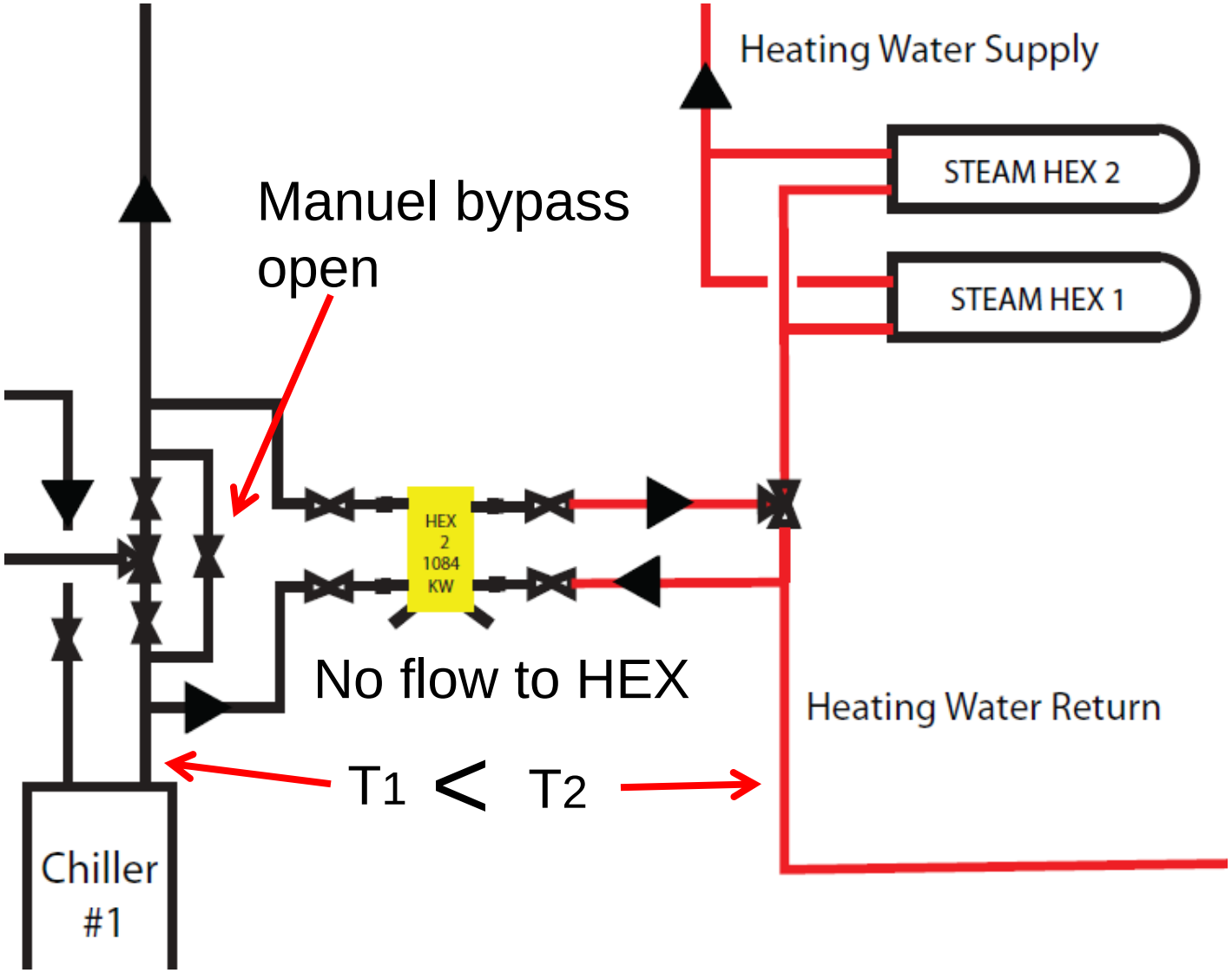
3.4 MMBTU of waste heat from Life Sciences cooling tower on a typical winter day.



Simplified Chilled Water Schematic As-built

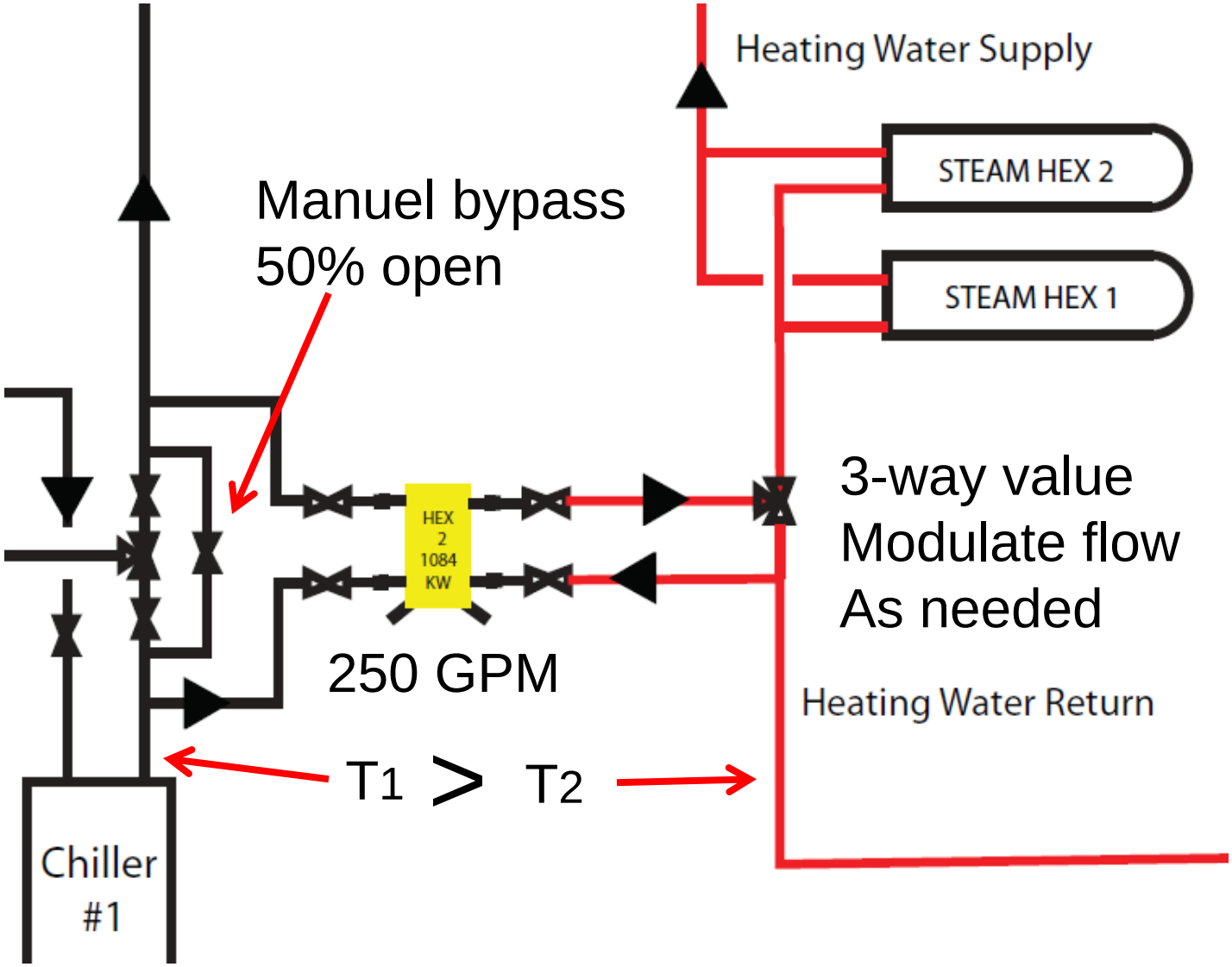


Heat recovery as found



- Hot water return greater then Condenser water supply.
- Heat exchanger is piped backwards (parallel flow)

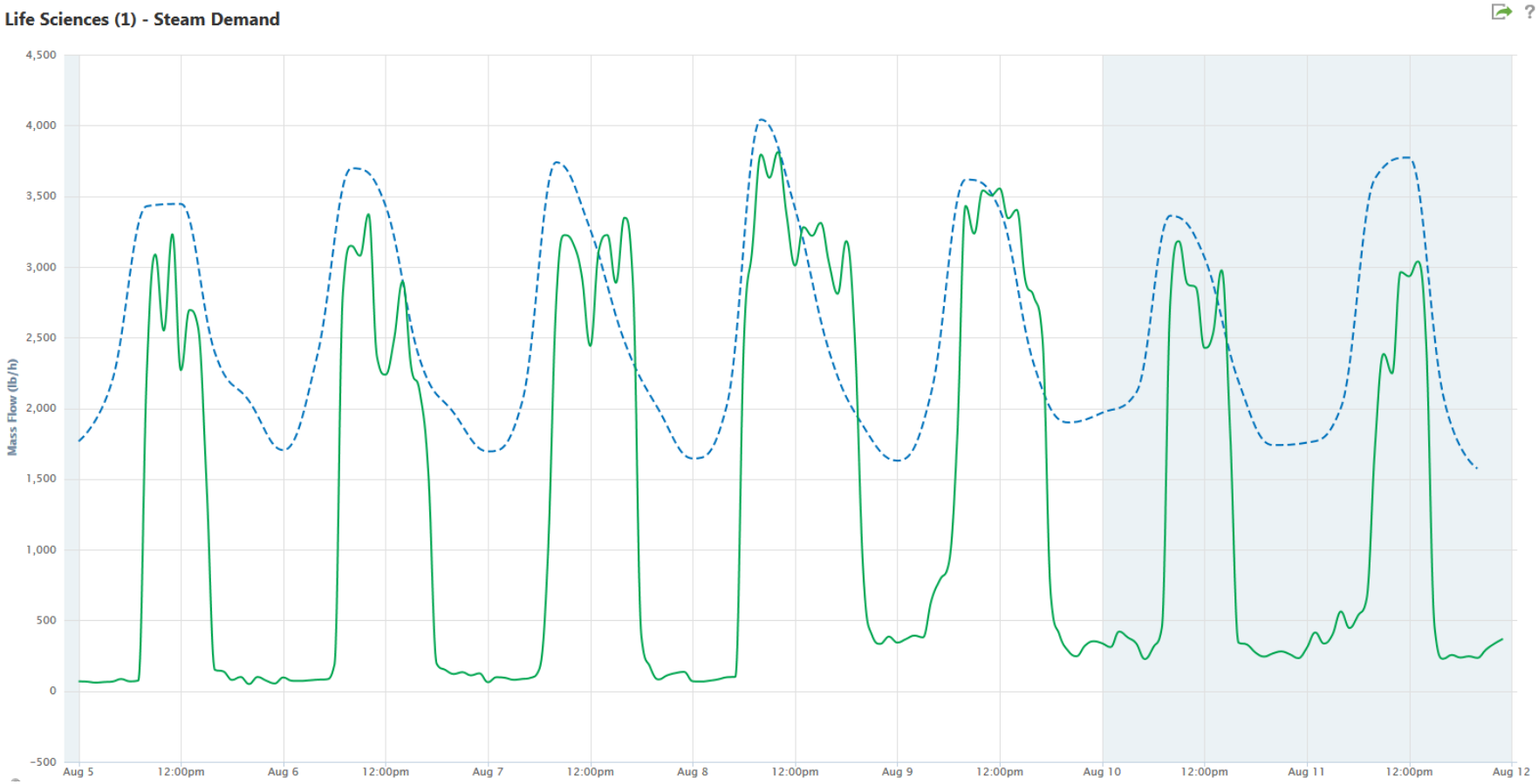
Recommissioned and Optimized



- Increased condenser water temp by adjusting cooling towers discharge
- Decreased heating water supply 10˚ F
- Manuel Valve adjusted to provide 50% flow to HEX.
- Three – Way valve programed to modulate

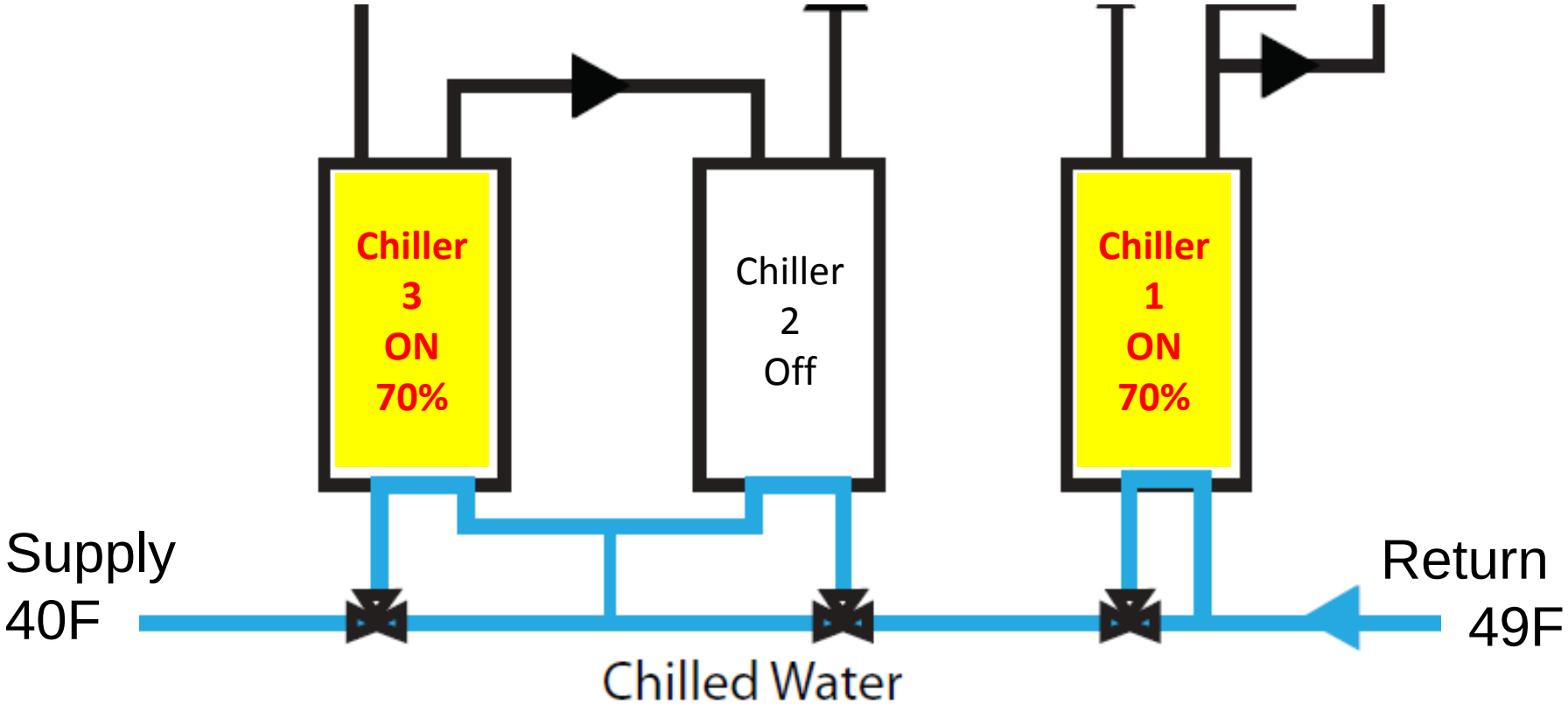
Results

Average of ~1800 LBS/hr steam savings and 16,000 GJ/yr



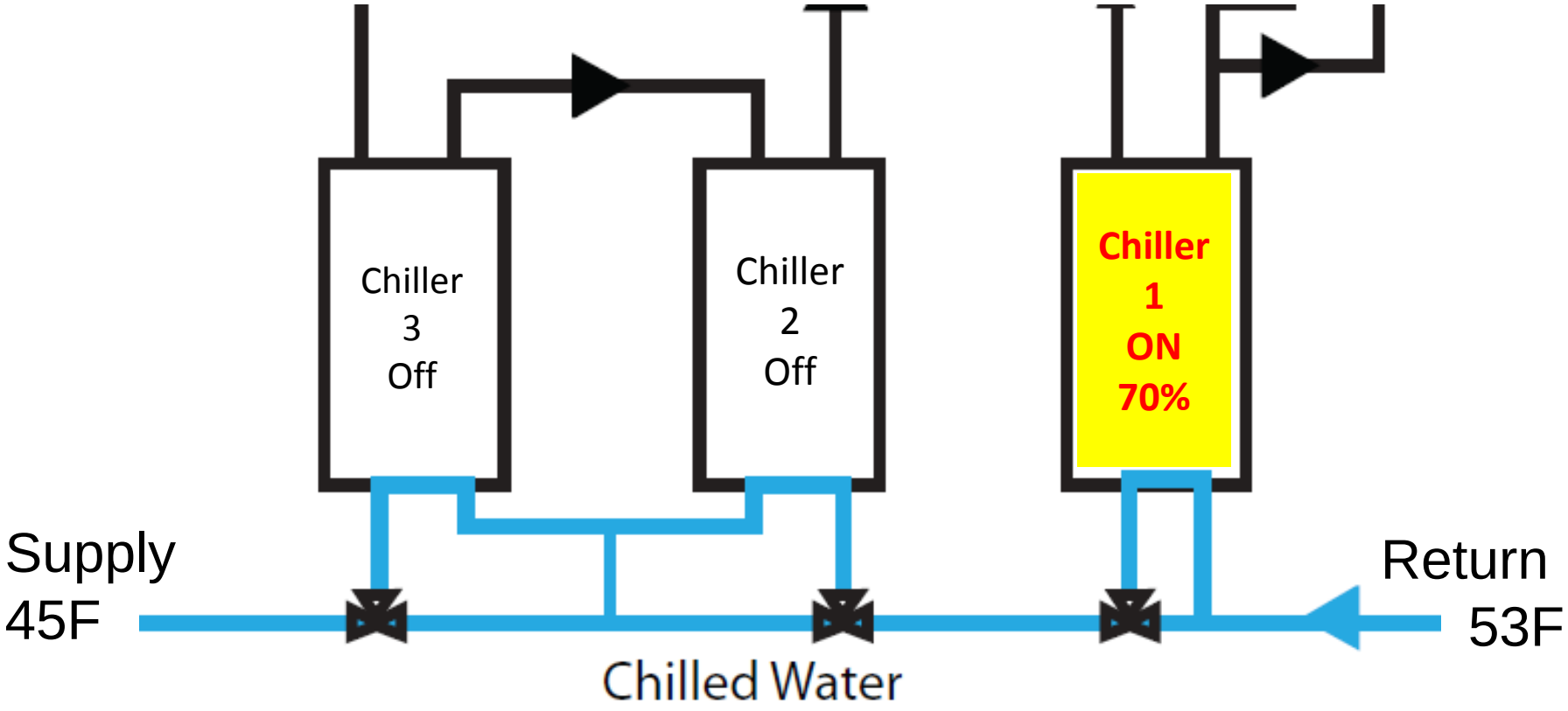

Optimizing the chilled water syste
CHILLED WATER SUPPLY
CHILLED WATER SUPPLY

Chilled water system as found (winter)



2 chillers in operation 24/7
Average cooling ~300 tons
Average COP 3.8

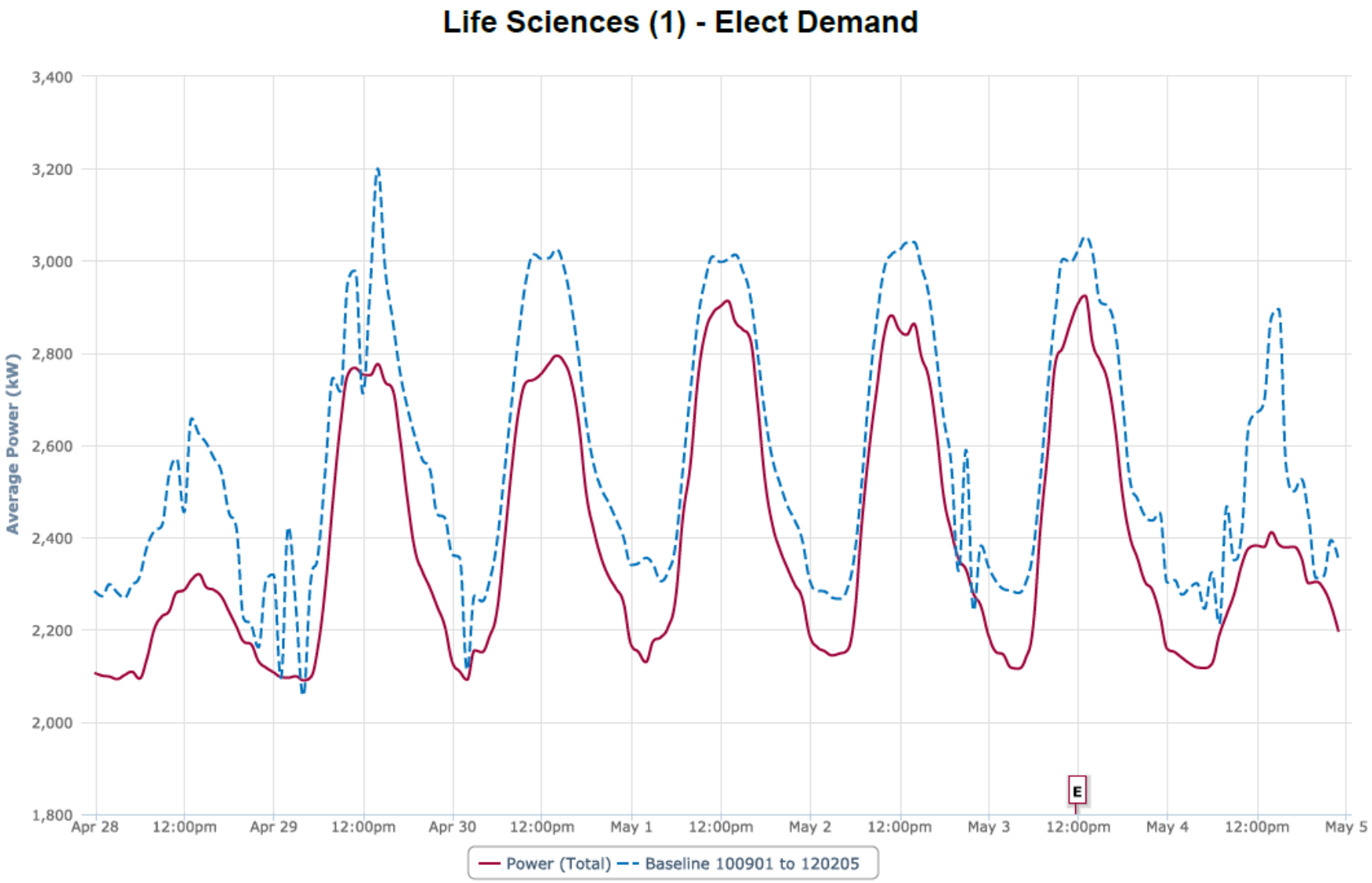
Chilled water system Optimized (winter)



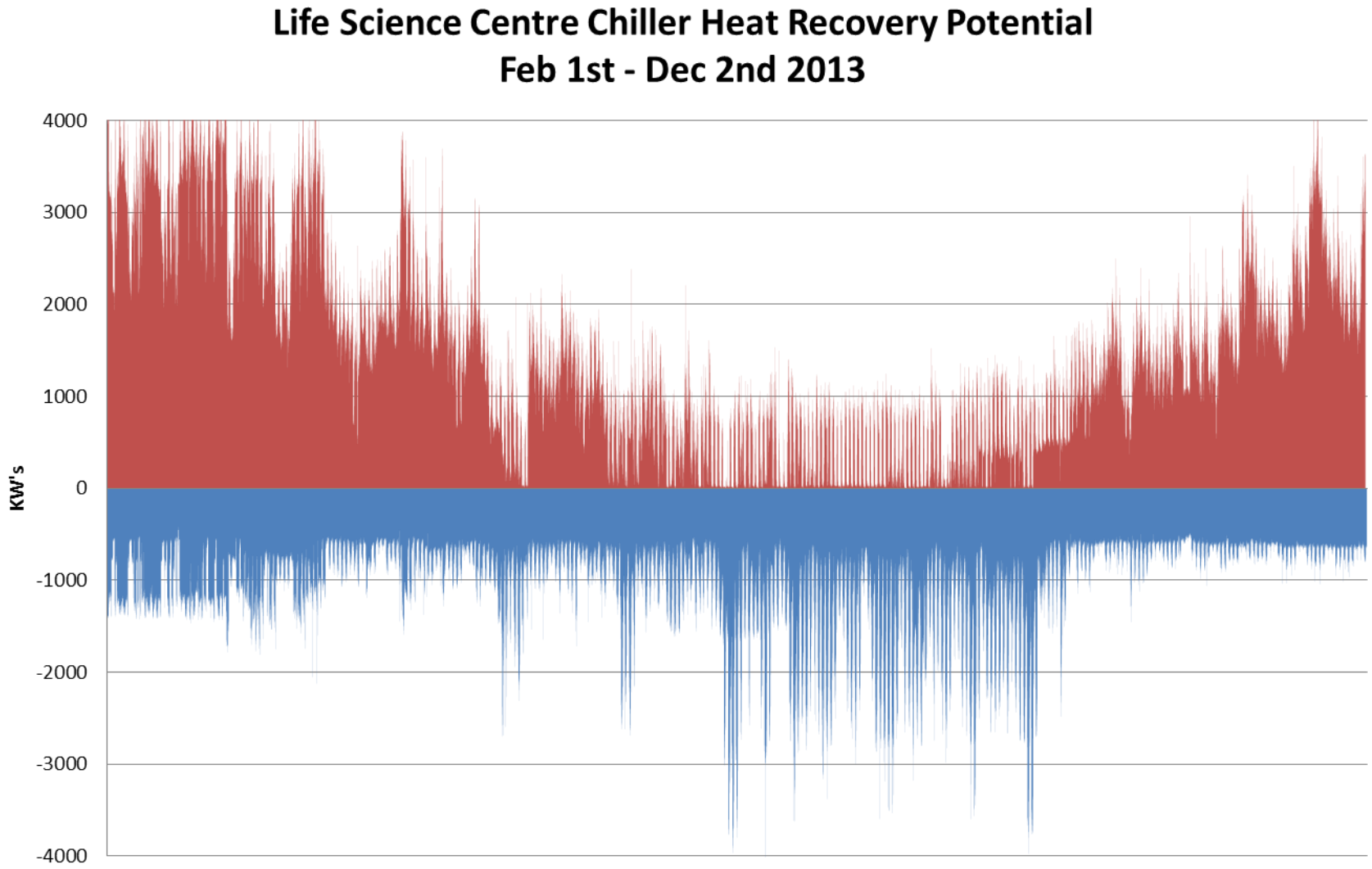
1 chillers in operation 24/7
Average cooling ~200 tons
Average COP 5

Results

Average of 150 KW's Electrical Savings and 1.3GWh/yr



Digging Deep



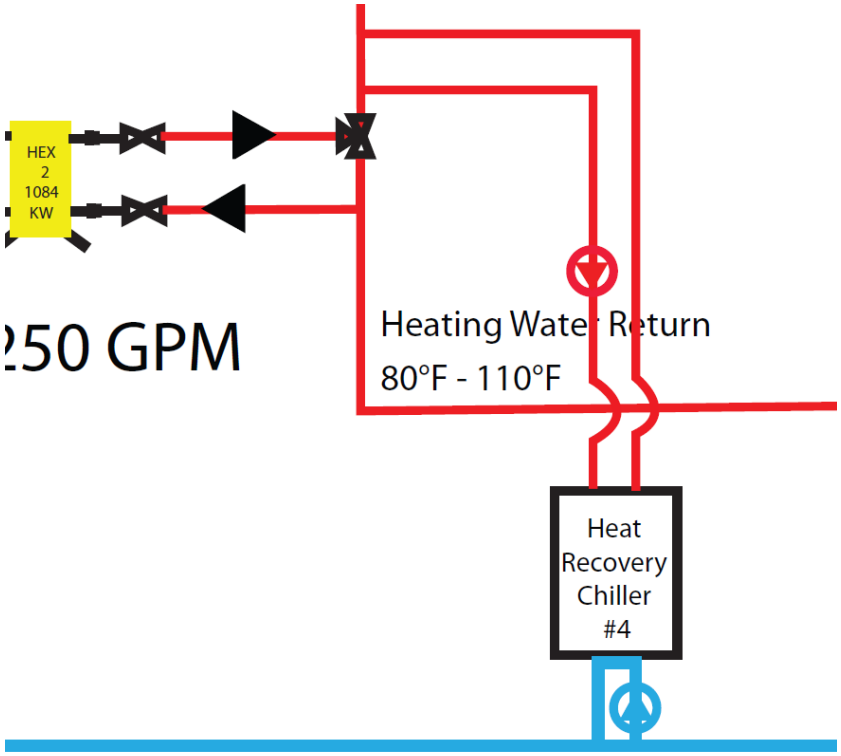
Despite improvements significant opportunity remains to recover waste heat from cooling system

Dedicated heat recovery chiller

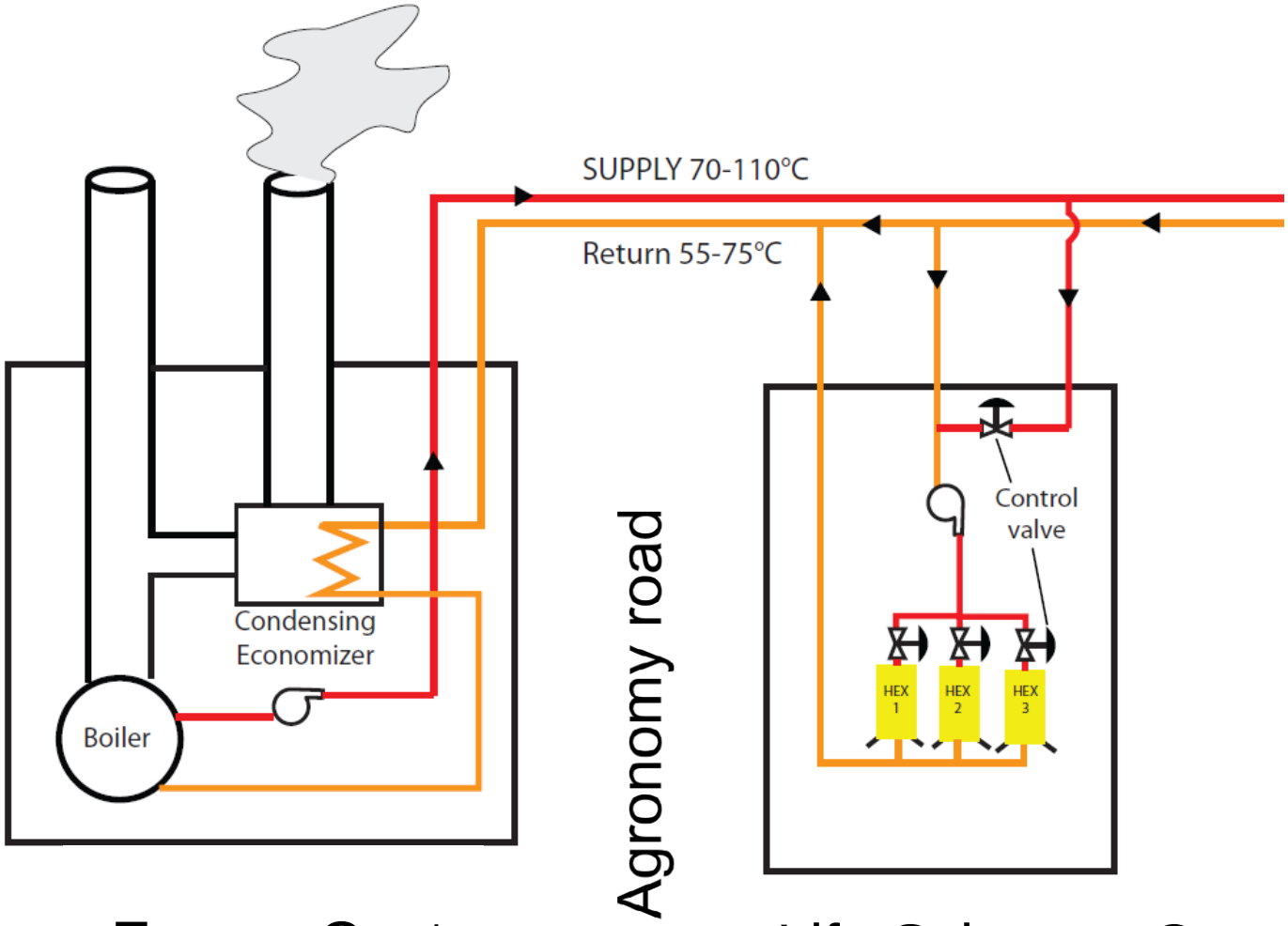
Provides simultaneous heating and cooling sized for winter cooling loads.

- 10,000 GJ/yr Natural Gas savings
- Negligible electrical effects
- 100% funding through utility incentives and government grants

FORTIS BC™
Energy at work



Steam to Hot Water Conversion

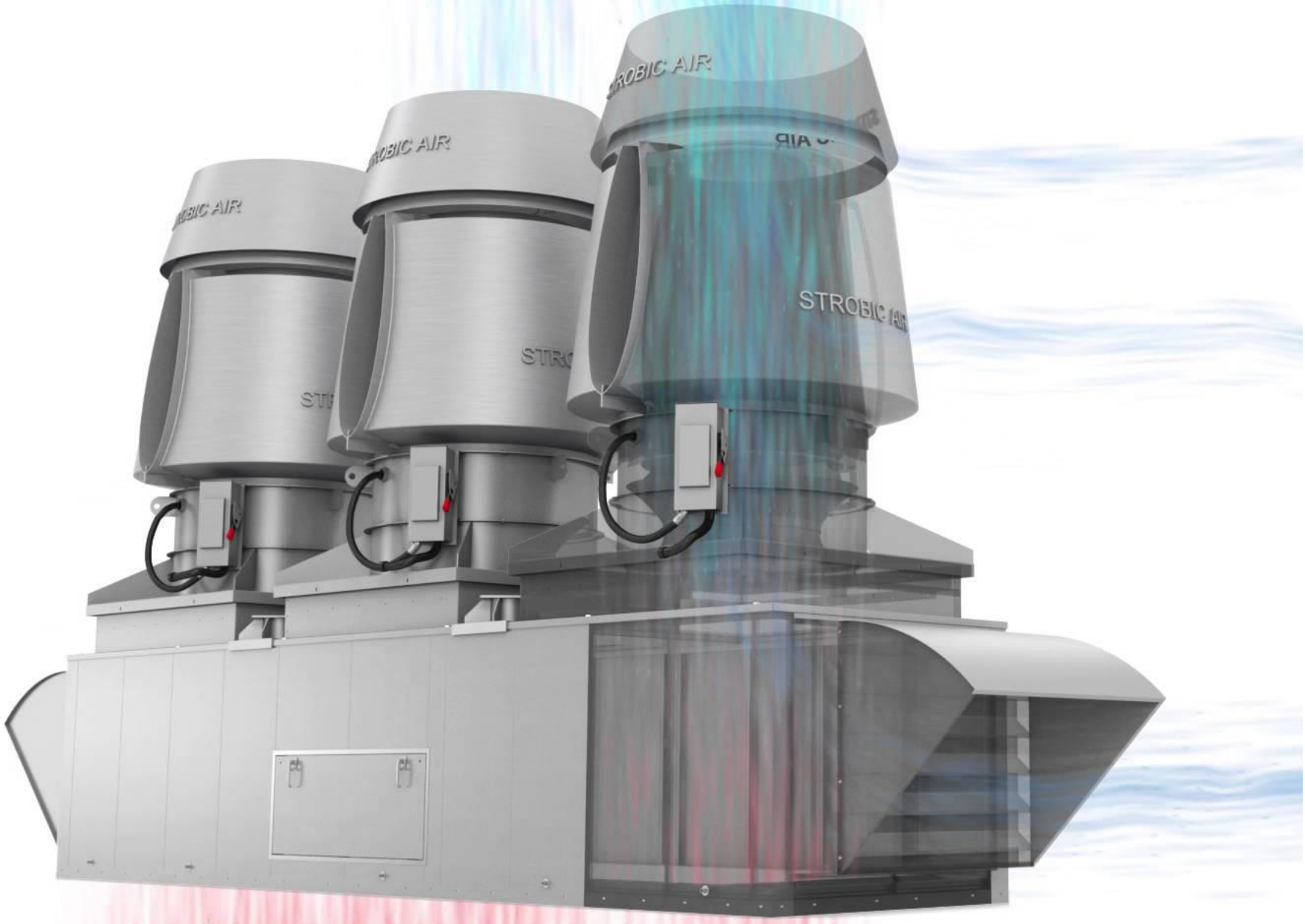


Campus Energy Centre

Life Sciences Centre

Digging Deeper
Future projects

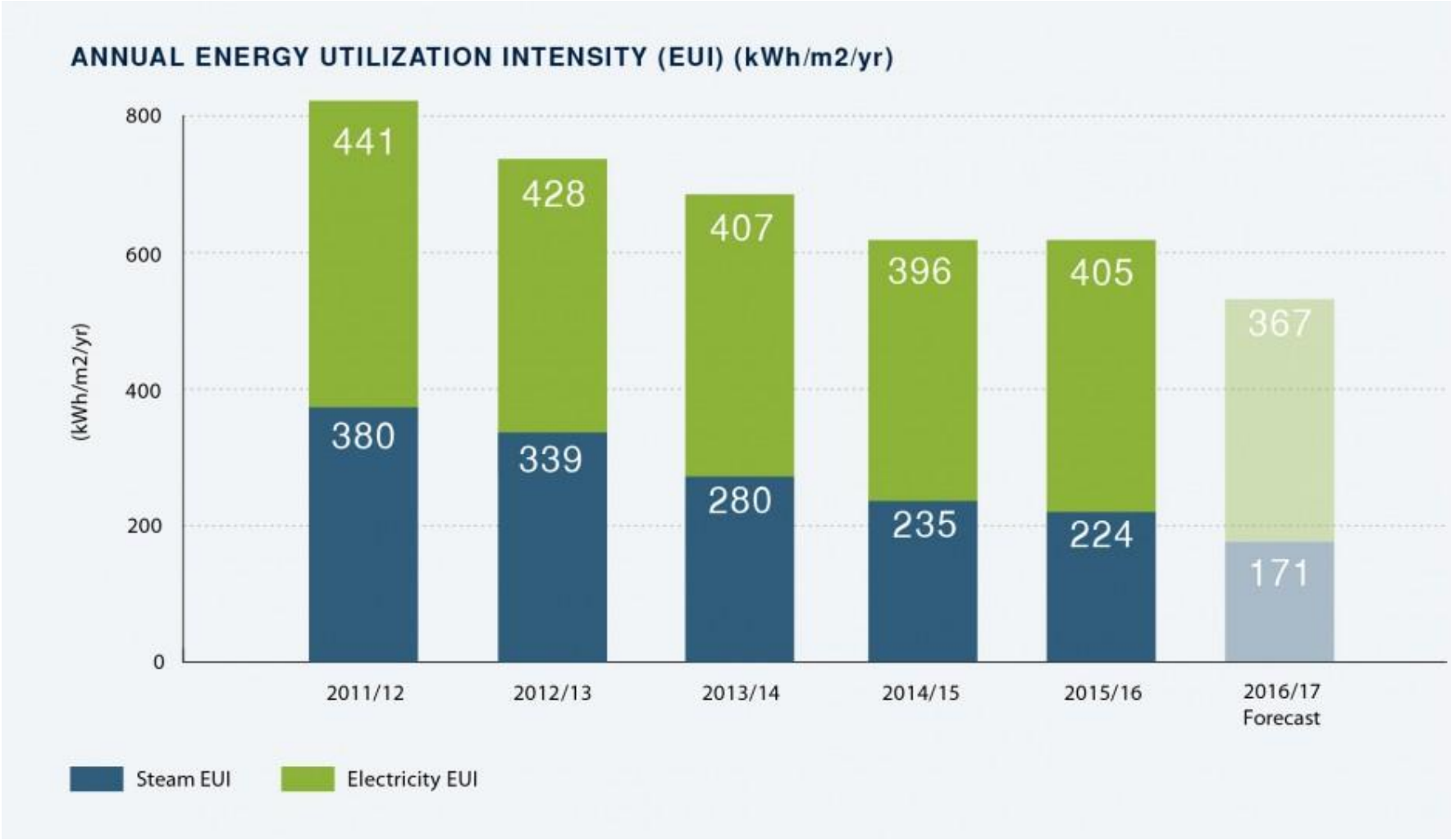
Exhaust Fan Optimization



Laboratory Airflow Optimization

- UBC standard is 8 ACH during occupied hours and 4 ACH during unoccupied hours.
- LSC currently supplying 12 ACH (occupied) and 6 ACH (unoccupied)
- Will reduce energy consumption at LSC by 10,000 GJ and 27 MWh ($100,000)

Life Sciences Centre Actual and forecast



Cost/Savings Summary

Life Sciences Centre projects	CapEx	Utility Incentives	Grants/other	UBC Cost	Verified Cost Savings	Payback yrs
Coil Cleaning	$16,500	$12,750		$3,750	$21,410.34	0.2
Filter Changing	$29,519		$16,497	$13,022	$20,160.00	0.6
Continious Optmizaiton	$14,077			$14,077	$48,342.00	0.3
Heat Recovery Optimization	$0			$0	$128,000.00	0.0
Chiller Water Optmization	$0			$0	$78,000.00	0.0
Dedidicated Heat Recovery Chiller	$425,000	$260,000	$165,000	$0	$80,000.00	0.0
Cascaded Hot Water Conversion	Part of DES project					
Strobic VSD Optimization	$800,000	$200,000	$500,000	$100,000	$120,000.00	0.8
Laboratory Air Change Rates	$80,000			$80,000		
TOTAL	**$1,365,096**	**$472,750**	**$681,497**	**$210,849**	**$495,912**	**0.4**

Energy Savings

Life Sciences Centre projects	Verified Electrical Savings KWh/yr	Verified Gas Savings GJ/yr	% Energy Reduction
Coil Cleaning	356,839		1%
Filter Changing	336,000		1%
Continious Optmizaiton	313,700	3690	3%
Heat Recovery Optimization		16000	10%
Chiller Water Optmization	1,300,000		3%
Dedidicated Heat Recovery Chiller		10000	7%
Cascaded Hot Water Conversion		?	
Strobic VSD Optimization	2,000,000		5%
Laboratory Air Change Rates	?	?	
TOTAL	**4,306,539**	**29,690**	**30%**

Thank you

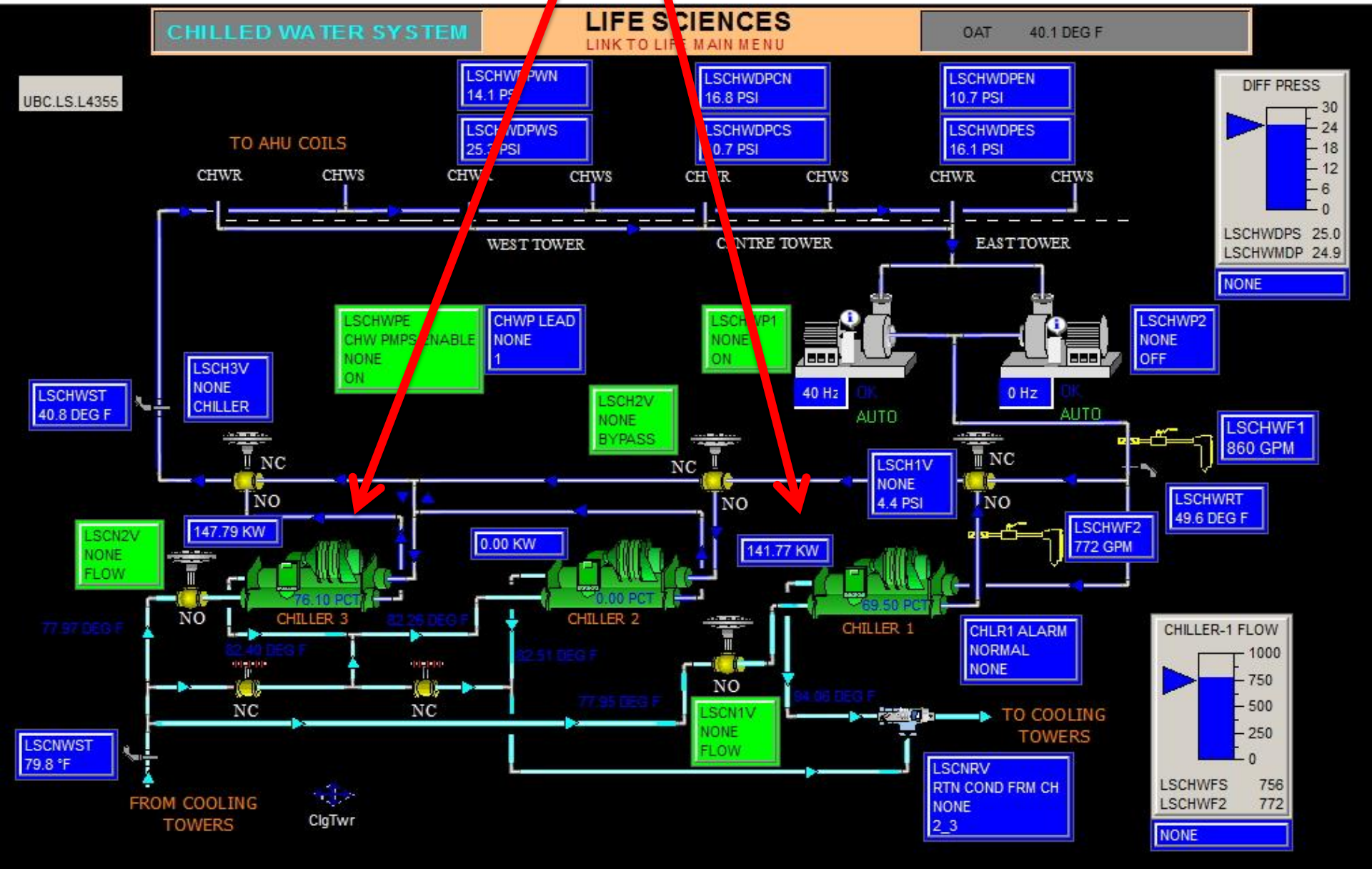
?'s

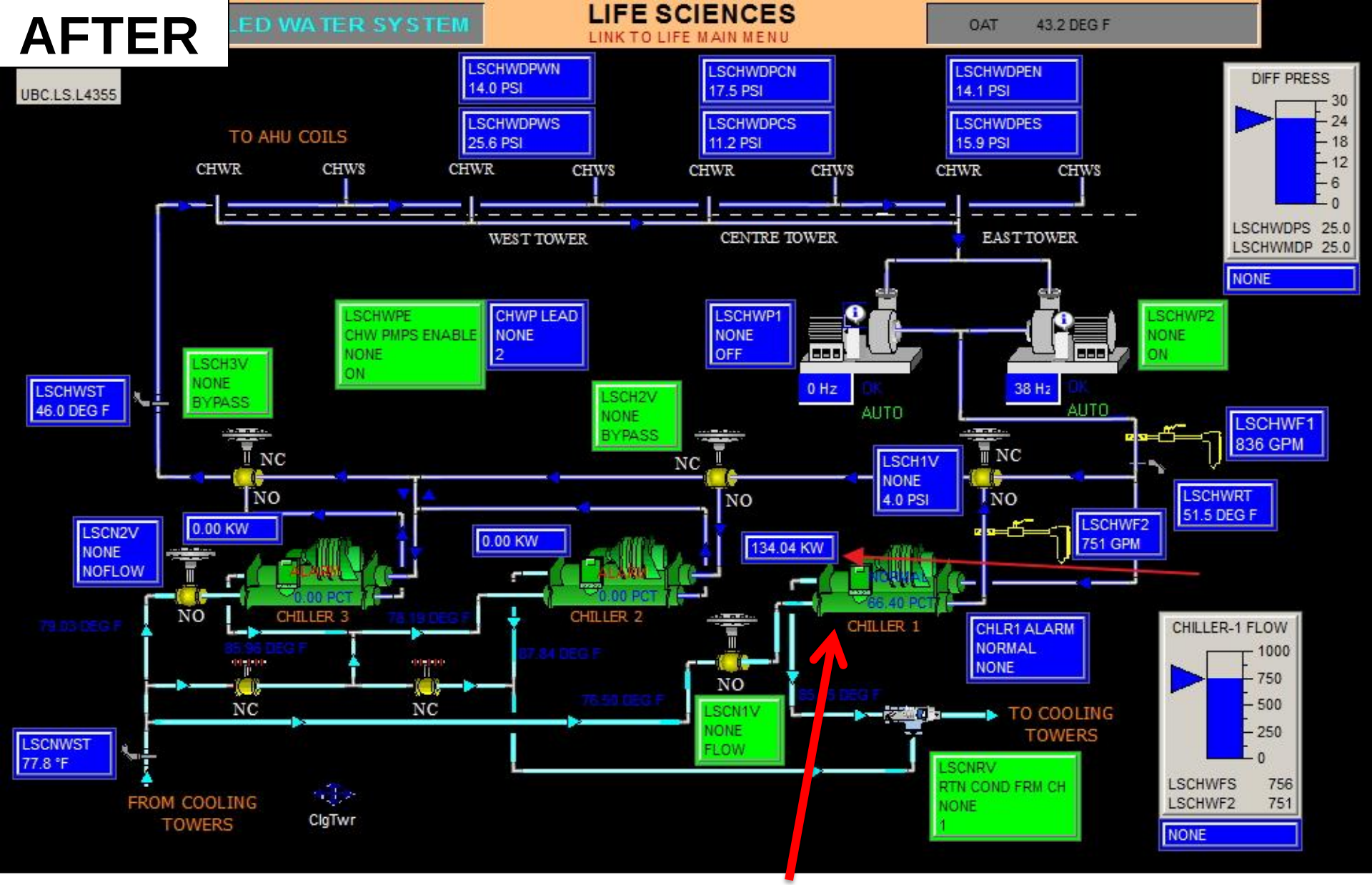
Jeff Giffin M.Eng CEM
Energy Conservation Manager
Jeff.giffin@ubc.ca

BEFORE

2 chillers running (316 tons cooling)

OAT 40F Overall cooling COP 3.8





1 chiller running (192 tons cooling)

OAT 43F Overall cooling COP 5