HVAC Reimagined

The City of Coquitlam’s City Centre Civic Campus Thermenex System

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Removed
3-30 ton specific heat reclaim chillers
415 tons of air cooled chillers (3)
TOTAL 505 tons

Added
Thermal Gradient Header
Piping between buildings
400 tons of holistic heat reclaim chillers
Shared Fluid Cooler
TOTAL 400 tons
First Principle Thinking

“...you boil things down to the most fundamental truths you can and you reason up from there.”
– Elon Musk
HEATING is COOLING
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THING 1

THING 2
We heat by cooling burning stuff
The chart shows the heating and cooling requirements throughout the year. The red bars represent heating, and the blue bars represent cooling. The graph indicates that heating is required more in the winter months (Jan, Feb, Nov, Dec) and cooling is required more in the summer months (Jun, Jul).
Buildings are dynamic energy logic puzzles

Energy In = Energy Out
(or the temperature in the building changes)
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Solar

Winter Outdoor Air

Exhaust Air or Relief Air

Building Envelope

Thermal Energy Winter

Lights
Computers
Pumps
Fans

Electricity
Buildings are dynamic energy logic puzzles

Energy In = Energy Out (or the temperature in the building changes)

Net Negative in winter add heat

Winter Outdoor Air

Exhaust Air or Relief Air

Solar

Building Envelope

Electricity

Natural Gas

Energy Flow Diagram:
- Solar
- Thermal Energy Winter
- Energy In = Energy Out
- Net Negative in winter add heat
- Building Envelope
- Energy Logic Puzzles
- Winter Outdoor Air
- Exhaust Air or Relief Air
- Lights
- Computers
- Pumps
- Fans

Diagram Elements:
- Solar
- Thermal Energy Winter
- Winter Outdoor Air
- Exhaust Air or Relief Air
- Building Envelope
- Electric Power
- Natural Gas
Buildings are dynamic energy logic puzzles

Energy In = Energy Out (or the temperature in the building changes)

Net positive in summer remove heat

Solar

Thermal Energy Summer

Summer Outdoor Air

Reject Heat

Lights
Computers
Pumps
Fans

Building Envelope

Electricity

Natural Gas
Buildings are dynamic energy logic puzzles

Energy In = Energy Out (or the temperature in the building changes)

Net Negative in winter add heat
Net positive in summer remove heat

Solar

Winter Outdoor Air
Summer Outdoor Air
Exhaust Air Reject Heat

Thermal Energy Summer
Thermal Energy Winter

Lights
Computers
Pumps
Fans

Building Envelope

Cold Domestic Water
Warm Sanitary Waste

Natural Gas

Electricity
The interior of a large building is a heat factory.

Energy In = Energy Out (or the temperature in the building changes)

Net Negative in \textit{winter} add heat
Net positive in \textit{summer} remove heat
HVAC Reimagined

(9 Logic Differences available in a handout)
Thermal Gradient Header

Heat Pumps

Heating

Cooling

Heat Reclaim

Heat Rejection

ONE PIPE
'The buildings at the City of Coquitlam’s Civic Centre were particularly challenging to find energy and GHG savings because they are already so far ahead of their peers.'

Brad White, P.Eng.
SES Consulting
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Coquitlam Leads The Way To A New Future