"Innovative Best Practices"
Simon Oswald Architects and CM Engineering
www.soa-inc.com or www.cmeng.com
https://www.youtube.com/watch?v=Rro4dsjdW_w&index=7&list=PLRUFCaIrdezZhJ0Hpw03CriOWBt1Pley_7

OHM: SOA & CM ENGINEERING
Projected Energy Star rating of 99/100
Reuses rainwater for flushing toilets and landscape irrigation
Geothermal system saves 30-40% on cooling and 50-60% on heating
Office constructed using reclaimed materials
Goal: “showcase what has worked”

CMEng.com – contains multiple case studies of renovated schools – we know Geo works

“This is proven technology – keep it simple”, Kirk Mescher

<table>
<thead>
<tr>
<th>School</th>
<th>retrofit cost $/sq. ft.</th>
<th>Energy B4 Kbtu/sq. ft./yr.</th>
<th>Energy After Kbtu/sq. ft./yr.</th>
<th>Energy % of B4</th>
<th>Peak B4 Kbtu/sq. ft./mo.</th>
<th>Peak After Kbtu/sq. ft./mo.</th>
<th>Peak Month % of B4</th>
<th>Energy Star rating</th>
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<tbody>
<tr>
<td>Brigham</td>
<td>17.24</td>
<td>43.75</td>
<td>26.51</td>
<td>60.59%</td>
<td>9.00</td>
<td>3.50</td>
<td>38.89%</td>
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<tr>
<td>Douglas</td>
<td>20.00</td>
<td>55.40</td>
<td>24.80</td>
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<td>13.00</td>
<td>3.50</td>
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<td>Fairview</td>
<td>16.25</td>
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<td>22.60</td>
<td>33.24%</td>
<td>10.00</td>
<td>4.00</td>
<td>40.00%</td>
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<tr>
<td>Glenn</td>
<td>15.75</td>
<td>68.00</td>
<td>23.60</td>
<td>34.71%</td>
<td>14.00</td>
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<td>35.71%</td>
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<td>Jefferson</td>
<td>19.20</td>
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<td>15.00</td>
<td>6.00</td>
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<tr>
<td>Oakdale</td>
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<td>26.00</td>
<td>38.81%</td>
<td>16.00</td>
<td>5.00</td>
<td>31.25%</td>
<td>96</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>17.53</strong></td>
<td><strong>63.58</strong></td>
<td><strong>26.40</strong></td>
<td><strong>42.69%</strong></td>
<td><strong>12.83</strong></td>
<td><strong>4.50</strong></td>
<td><strong>35.46%</strong></td>
<td><strong>97.67</strong></td>
</tr>
</tbody>
</table>
Concept to Completion

above is a concept  and below is the real thing
Owner Requirements – It has to be a functioning building
Architect and MEP in one building plus a tenant!

Fishbowl
“A large format, wall-mounted LCD monitor is connected to the firm’s network, allowing any SOA employee to remote in to their desktop computer from the “Fishbowl.” The “Fishbowl” and SOA’s office is completely acoustically separated.”

This is an HVAC Challenge:
“The two layers of glass separated by an airspace, combined with a gasketed, well-sealing door, make this space ideal for private conversations or larger meetings that might otherwise disrupt the office.”
Are people in their office or in a meeting? or another “HVAC challenge”

“The Battleships are two standing height tables with storage areas beneath. As their name implies, they are quite large, and the entire SOA team can gather ‘round for our Monday meetings.”

“One Lounge is a great space for small, private meetings with clients or conference calls. The room size and lighting is also appropriate for a private office, should the firm need to transition its use in the future.”

One-pipe Design accommodates design changes now and in the future
“By locating the building’s Training Room off the main entry lobby and coordinating event scheduling, three businesses are able to maximize the use of a space that, however necessary, is frequently vacant.”

The “Diner” adjustable height tables and reconfigurable seating (with built-in outlets and USB ports!) is located just off our break room.
Hybrid or One-pipe design
4-pipe performance, Demand Controlled

To showcase simple design practices all the equipment is visible in the CM Engineering side of the building.

An additional “Owner Requirement”

WSHP’s Heat or Cool based on each occupant thermostat

The One-Pipe System operates within design Delta-T. Efficiency and capacity changes very little over the designed temperature range
move **Cost** from building to Ground

- No evaporative cooler and water use
- No Boiler, no gas service
- Simple pipe design, easy to communicate and manage
  - Less pipe
  - Fewer fittings
  - Couplings, adapters, insulation, hydronic specialties, even hangers
- Self-Balancing
- Low cost CONTROLS
Ground loop under parking lot

1” dia. HDPE loop, fused U-bend
5.125” diameter bore
18-300 ft. deep
Thermal grout elite
(power tec graphite, 1.2 tc)
**Ground Source Water Loop Diagram**

**Entering CM Engineering you meet Jill and the Mechanical Room**

One-pipe Geothermal through the building to the ground and back
Energy Management

Energy Transport Horsepower
Variable digital control
- Minimum pressure
- Loop Delta-T
- Units have individual circulators
  - Demand controlled
  - Self-balancing
  - Control signal and power from the unit
- One primary pump set for building and ground HX
- Water uses 1/10\(^{th}\) the energy to move Btu’s Vs. air

System Pump Horsepower 9 watts
One-pipe in the building thermostat call starts flow

This system “Nets” the energy in the building before it goes to the ground
Flow in the main, a one-pipe design for entire building – or typically - reverse return mains for multi-story buildings to one-pipe distribution. Each loop is sized for the load at a delta-t.

EWT to next unit is slightly higher or lower? One-pipe “Nets” energy as units offset each other

Compressor Activated in “heat” or “cool”

 Thermostat signal
To Circulator
Instead of two-way valve

Moving Btu’s - primary secondary pumping – One-pipe distribution (1x4-Pipe system)
Hydraulic Decoupler
(no primary pump)

Variable flow
Compressor, Fan, and Pump HP
Only when there is “demand”
Mechanical Showroom

Demand Control Power
Control signal Circulator fusing
By WaterFurnace
Planning to Performance

Kirk Mescher, CM Engineering, Owner:
“I’m a businessman and an energy guy. $34 a working day for 12,000 sq. ft. I think we can afford it!”

24 hour real time display
Adrienne Stolwyk, RA, LEED AP BD+C
Architect

• “Architects and Interior Designers, like many professionals, often work in teams. Teams need to meet frequently and for a variety of purposes. Having a variety of spaces for SOA’s designers to meet was an important part of the design for our new office.”

• Question:

“How do I explain the efficiency of a Water Source Heat Pump versus an air source heat pump?”
Response, Kirk Mescher, PE, Owner:

• “They are both heat pumps, and can be 400% efficient, but water transfers heat 10 times better than air.

• One difference is that the air source efficiency is reported as adjusted, based on seasonal and part-load operating points.
  – Water Source efficiency is calculated at the extremes of operation.
    • Air Source capacity and efficiency is penalized when it is hot and cold outside.
    • A double penalty because that’s when utility rates and equipment loads peak
  – Water Source always operates inside the “certified” test points.

• It is like buying energy where it is never hotter than 90 degrees or colder than 37°F outside.”
Planning for Performance

• Owner requirements for the Whole Building
  – SOA ...what we believe
    • Good design is a thoughtful process producing inspiring spaces and places to enrich people’s lives.
    • The result is “appropriate design”
  – CM Engineering...the new office building is another example of our commitment to the environment
    • to engineering excellence
    • In budget
    • Simple – Low Maintenance

• “Our new building showcases many of the same technologies that we utilize in our client work. It will be among the most energy-efficient buildings in the area.”
Thanks to OHM for selecting WaterFurnace Equipment

**In The Loop**

By far the biggest energy savings comes from our one-pipe, closed loop, ground source geothermal exchange HVAC system. With it, we’re able to remove excess heat energy from the indoor environment in warm months. This energy is stored in the ground until cooler months when it can be re-introduced to the building.

**Bountiful Harvest**

We’re protecting the environment in other ways, too. Our rainwater harvesting system will supplement our gray water and irrigation needs. It will limit run-off into local storm drains and water ways and it will reduce our demand on the municipal water system.

The new office building is another example of our commitment to the environment and to engineering excellence.

On December 1, find us at 2801 Woodard Drive, Suite A, in north Columbia. Zip code will be 65202.

Kirk Mescher passed away after this was prepared. He always was searching for a way to keep designs simple and perform better than expected. He is already missed.