Design for Off: Key Mechanical Design Strategies for Low Energy buildings

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President
End Use Breakdown for Average Commercial Buildings

End Use Breakdown

- **Fire Stations**: EUI 85.3 kBtu/sf-yr
  - DHW: 14
  - HVAC: 23.1
  - Plugs & Lights: 25

- **Office**: EUI 67.8 kBtu/sf-yr
  - HVAC: 2

- **Libraries**: EUI 50 kBtu/sf-yr
  - HVAC: 2

Typical Modern HVAC Design

- All-in-One HVAC
- Large Central Fan-forced Rooftop Equipment
- Multiple zones with tight temperature settings
- If some is good, more is better “Factor of Safety”
THEN:
Perimeter Offices, Poor Insulation, High Gains

NOW:
Open Office Floor Plans, Well-insulated, Low Gains
Cooling EUI of 3
Heating EUI of 29

Simultaneous Heating and Cooling

King County EUI vs. Outdoor Temp Trend
01. Move away from large central HVAC systems
... toward smaller zonal systems

02. Move away from all-in-one HVAC systems
2. Right-Sized Mechanical Systems
Believe (Do) the Load Calculations

Case Study: Kettleson Library
Sitka, AK
### Kettleson by the Numbers

<table>
<thead>
<tr>
<th>Glazing</th>
<th>PRE</th>
<th>POST</th>
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<tbody>
<tr>
<td>Insulation</td>
<td>Mostly Uninsulated</td>
<td>Super-Insulated</td>
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<tr>
<td>Heating</td>
<td>Oil Boiler</td>
<td>VRF Heat Pump</td>
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<tr>
<td>Distribution</td>
<td>Big Fan Systems</td>
<td>Radiant Floor</td>
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<tr>
<td>Ventilation</td>
<td>Outside Air</td>
<td>Heat Recovery</td>
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<td>Water Heat</td>
<td>Electric</td>
<td>Heat Pump</td>
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<td>Lighting</td>
<td>Florescent</td>
<td>LED</td>
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<tr>
<th>EUI</th>
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<table>
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<th>CO2 Emissions</th>
<th>PRE</th>
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<td>72,000 lbs/yr</td>
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1. Separate Ventilation from Heating and Cooling

2. Zonal: Turn Off Heating and Cooling Equipment When not in Use

3. Right-Size Equipment

Questions?

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