

# Synergistic Effects of Energy Efficient Technologies



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# Research Goal & Approach



Body Shop:  
Building  
Strategies

- Goal: Provide useful documentation/tools to allow for design, construction, and operations teams to keep energy efficient, integrated systems as part of a building
- What can be done to keep the integrated systems emphasizing energy efficiency in the building designs?
  - Understanding why and how the technologies are eliminated from or not included as part of a sustainable building design
  - Understanding what information and/or tools might be useful
    - Increased technical information
    - Design documentation information/tools
    - Other

# The Challenges



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- Sustainable Design Challenges
  - First cost considerations often overtake life cycle costs
  - Sustainable design requires integrated design
- Integrated Design Challenges
  - Requires cross-functional communication over the life cycle of the building
  - Requires detailed basis of design documentation to survive first cost focused efforts
  - Requires follow-through from design, construction, and operations teams for optimal performance

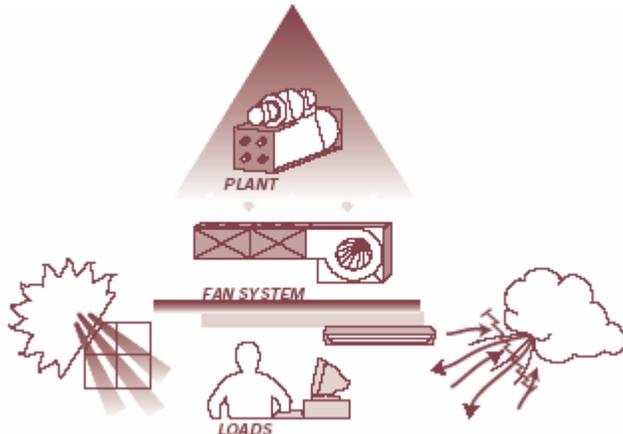


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## ■ Heating & Cooling

- Energy use in a typical:
  - *office: 36%*
  - *residence: 56%*

## ■ Duct & Ventilation



## ■ Lighting

- Energy use in a typical:
  - *office: 30%*
  - *residence: 15%*

## ■ Water Heating Systems

- Energy use in a typical:
  - *office: 9%*
  - *residence: 15%*



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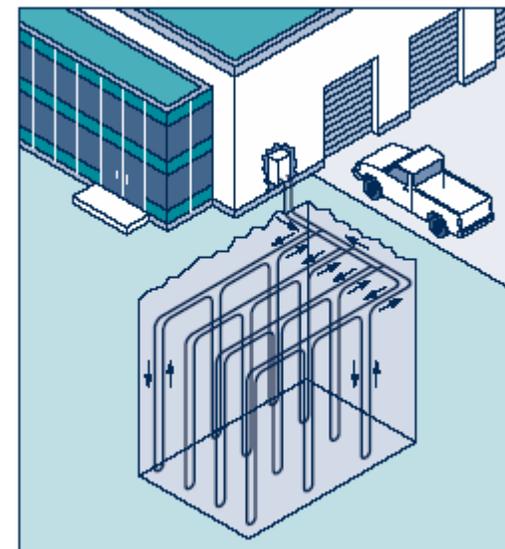
- Geothermal Heat Pumps
- Underfloor Air Distribution Systems
- Ducts in Conditioned Spaces
- Whole House Ventilation Fans
- Cold Air Distribution
- Energy Efficient Lighting
- High Performance Windows and Glazing Systems
- Demand Water Systems
- Heat Recovery from Wastewater

# Geothermal Heat Pump



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<i>Energy Benefit</i>	<i>Non-energy benefit</i>
<i>Geothermal Heat Pumps (GHP)</i>	
44-72% less energy	<ul style="list-style-type: none"> <li>• Reduction in operation and maintenance costs</li> <li>• Greater usable building space</li> <li>• Smaller floor-to-floor heights</li> </ul>



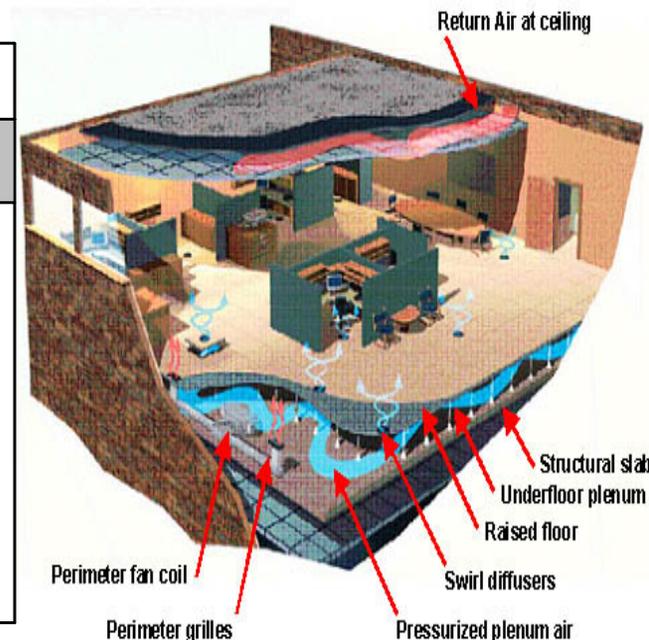
- The GHP uses a series of liquid filled pipes looped either vertically or horizontally buried in the soil that uses the fairly constant soil temperature as either a heat source in the winter or a heat sink in the summer.

# Underfloor Air Distribution Systems (UFAD)



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<i>Energy Benefit</i>	<i>Non-energy benefit</i>
<i>Underfloor Air Distribution Systems (UFAD)</i>	
10-20% less energy	<ul style="list-style-type: none"> <li>• Improved daylighting</li> <li>• Reduced churn costs</li> <li>• May offer lower first costs per square foot</li> <li>• Reduced ductwork</li> <li>• Reduction in operation and maintenance costs</li> </ul>



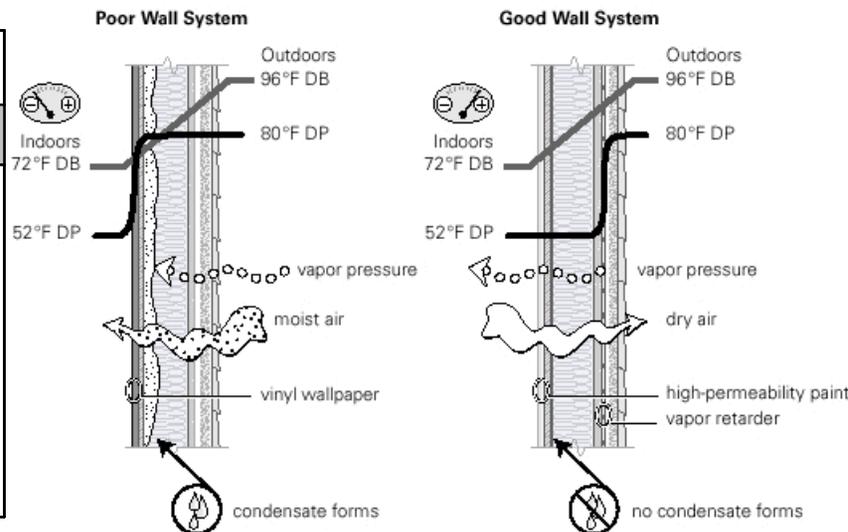
- UFAD systems provides direct heated or cooled air to individual workspaces by using an air supply plenum between the floor slab and floor panels and the return air plenum is above the suspended ceiling.

# Cold Air Distribution



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<i>Energy Benefit</i>	<i>Non-energy benefit</i>
<i>Cold Air Distribution</i>	
Up to 10% less energy	<ul style="list-style-type: none"> <li>Smaller mechanical equipment</li> <li>Smaller ductwork</li> <li>Shorter floor-to-floor heights</li> <li>Increased indoor environmental quality (IEQ)</li> </ul>

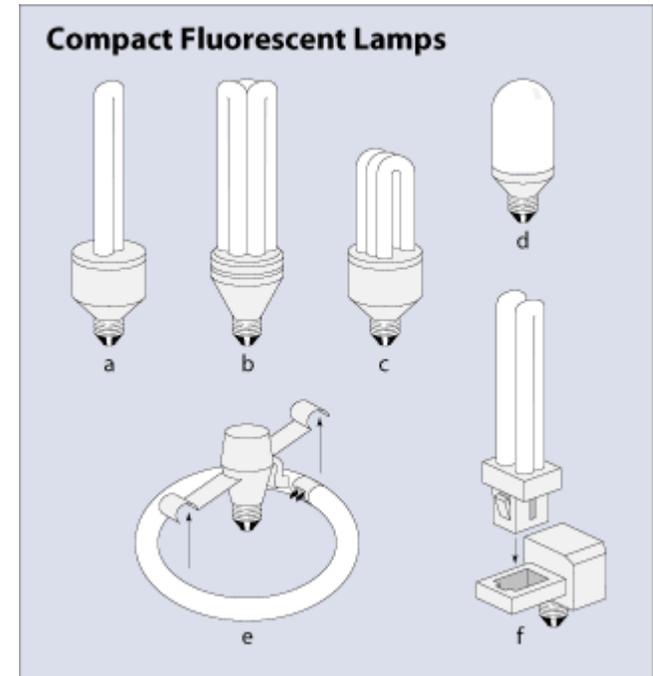


- Cold Air Distribution is an adaptation of conventional all air systems that supply air below 48°F versus the standard of 55°F.



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<i>Energy Benefit</i>	<i>Non-energy benefit</i>
<i>Energy Efficient Lighting</i>	
20-50% less energy	<ul style="list-style-type: none"> <li>• Producing up to 90% less heat</li> <li>• Lamps last up to 10 times longer</li> </ul>



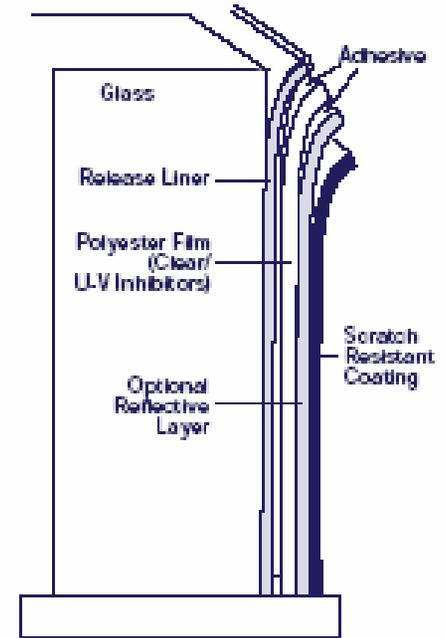
- Energy efficient lighting technologies include compact fluorescent lights (CFLs), high performance (super) T8 lights, and LEDs.

# High Performance Windows and Glazing Systems



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<i>Energy Benefit</i>	<i>Non-energy benefit</i>
<i>High Performance Windows and Glazing Systems</i>	
10-50% less energy, HVAC and lighting costs	<ul style="list-style-type: none"> <li>• Daylighting</li> <li>• Ventilation</li> <li>• Increase the life of room furnishings</li> <li>• Reduced operations and maintenance costs</li> </ul>

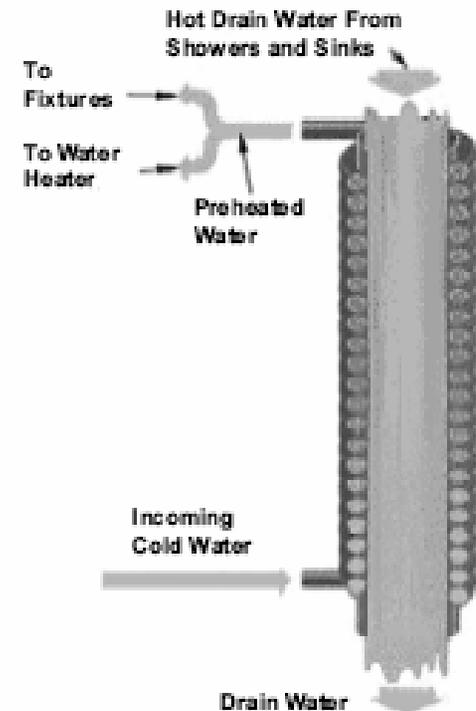


- High performance energy efficient systems are constructed from a variety of glass panes, structural frames, spacers and sealants. The glazing systems refer to the sealant around the window as well as the coating, tinting, and lamination.



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<i>Energy Benefit</i>	<i>Non-energy benefit</i>
<i>Gravity-Film Heat Exchanger (GFX)</i>	
30-50% less energy	<ul style="list-style-type: none"> <li>• Shortens the time needed for the water heater to recover</li> <li>• Smaller water heater needed</li> </ul>



- GFX systems extract heat out of the drainwater and uses it to preheat the cold water entering the building.

# Useful Resources



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- FEMP New Technologies Publications (alerts, fact sheets, installation reviews, focus)  
[http://www.eere.energy.gov/femp/technologies/techdemo\\_publications2.cfm](http://www.eere.energy.gov/femp/technologies/techdemo_publications2.cfm)
- Buildings Technology Program Publications (technical reports, fact sheets, case studies, brochures)  
<http://www.eere.energy.gov/buildings/info/publications.html>
- High Performance Buildings Database  
<http://www.eere.energy.gov/buildings/database/>
- FEMP Sustainable Design and Operations  
<http://www.eere.energy.gov/femp/technologies/sustainable.cfm>
- Building Energy Software Tools Directory  
[http://www.eere.energy.gov/buildings/tools\\_directory/](http://www.eere.energy.gov/buildings/tools_directory/)

# What Comes Next?



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- Gather additional feedback on what information and/or tools would be useful
- Identify additional technologies/strategies to consider in the research
- Select technologies for further analysis, considering
  - Current market penetration vs. market potential
  - Items identified as frequently challenged
  - Availability of whole building information
- Prepare document technical information on selected technologies
- Identify additional on-line resources



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# Feedback?

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