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**Radiant and Hydronic Systems Increase Efficiency**

* Energy use for heating and air conditioning accounts for 48 percent of the primary energy consumed in homes in the United States.[[1]](#footnote-1) Of the roughly 59 billion square feet of total commercial floor space, about 82 percent is heated and 61 percent is cooled. In spite of dramatic improvements in efficiency over the past two decades, energy use for heating and cooling remains a very large portion of the total national energy use and still provides a significant opportunity for energy use reduction.[[2]](#footnote-2)
* Additionally, radiant systems deliver heat where it is needed. Unlike conventional systems, a positive side effect of a radiant system is the elimination of duct leakage, which wastes up to 30 percent of the system’s energy for certain types of buildings.[[3]](#footnote-3)
* As U.S. Department of Energy (DOE) reports have found, dramatically improving the energy efficiency of HVAC systems and appliances is critical to achieving net-zero performance goals because they constitute a large proportion of the energy consumption in buildings. It is impractical and far too costly to design a net-zero building with standard HVAC systems and appliances by attempting to generate all of the required energy through on-site renewable energy. The most practical approach for a net-zero energy building is to greatly reduce the energy needs through efficiency gains, and then – and only then – make up the remaining energy needs through on-site renewable generation.[[4]](#footnote-4)
* These benefits extend to cooling buildings as well. Studies show that hydronic systems provide draft-free cooling, reduce installation space requirements, and reduce the energy consumption for thermal distribution and for space conditioning, and do so at a cost comparable to conventional cooling systems.[[5]](#footnote-5)
* DOE and its affiliated national laboratories have found the following benefits of using hydronic-type heating and cooling systems:
  + Pacific Northwest National Laboratory (PNNL) developed a prototype-building model that just meets the requirements of Standard 90.1-2004 based on the DOE medium office benchmark building. A primary package of energy measures, which includes radiant heating and cooling with dedicated outdoor air system, provides a national-weighted average energy savings of 56.1 percent over the Standard 90.1-2004 for 16 climate settings.[[6]](#footnote-6)
  + Transporting water via pumps is much more energy efficient than transporting air via fans. A given volume of water can absorb almost 3,500 times more heat than the same volume of air. This means that small tubing can replace large, cumbersome ducting. For example, a 3/4”-diameter flexible tube can deliver the same amount of heat as a 14-inch-by-8-inch rigid metal duct when both systems are operated under typical conditions. In addition, the radiant system usually reduces heating and cooling energy because the low-temperature hot water and high-temperature cold water help improve the heating and cooling efficiency of the corresponding equipment. As an added benefit, well-designed radiant systems are more comfortable than forced-air systems.6
  + By using radiant systems, DOE researchers have found that there is the potential for about 81 percent in heating energy savings and about 46 percent in cooling energy savings. The heating and cooling energy savings come from the whole package of energy efficiency measures including building envelope, lighting and plug-in equipment.6

1. http://www.eia.gov/todayinenergy/detail.cfm?id=10271 [↑](#footnote-ref-1)
2. Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume III: Energy Savings Potential. Roth, K.;Westphalen, D.; Dieckmann, J.; Hamilton, S.; Goetzler, W. Pages 2-1 - 2-4. 2002. [↑](#footnote-ref-2)
3. Lawrence Berkeley National Laboratory, Environmental Energy Technologies

   Indoor Environment Department, Energy Performance of Buildings Group. http://epb.lbl.gov/thermal/hydronic.html. Website accessed January 23, 2014. [↑](#footnote-ref-3)
4. US Department of Energy, Energy Efficiency and Renewable Energy. *Building Technologies Program Planned Program Activities for 2008-2012*. Page 2-38. [↑](#footnote-ref-4)
5. Stetiu, C. Radiant Cooling in US Office Buildings: Towards Eliminating the Perception of Climate-Imposed Barriers. Page 29. 1998. [↑](#footnote-ref-5)
6. US Department of Energy*. Technical Support Document: 50% Energy Savings Design Technology Packages for Medium Office Buildings*. 2009. [↑](#footnote-ref-6)