

Data Center Energy Savings Through Heat Recovery

Our Mission

To advance environmental and economic well-being by providing unmatched energy services, products, education and information based on world-class research.

About Us

Our staff of over 100 people (energy engineers, energy specialists, technical experts, software developers, energy research librarians, and more) work out of our Olympia, Spokane and satellite offices. Operating similar to a consulting firm, the WSU Energy Program is a self-supported department within the University. Our customers include large and small businesses, public and private utilities, local and state governments, tribes, federal agencies and facilities, manufacturing plants, professional and trade associations, schools, universities, national laboratories, and consumers. For more information, visit our website, www.energy.wsu.edu.

© 2013 Washington State University
Energy Program

This publication contains material written and produced for public distribution. You may reprint this written material, provided you do not use it to endorse a commercial product. Please reference by title and credit the Washington State University Energy Program.

WSUEEP13-001 • February 2013



The WSU Energy Program IT specialists excel in computer programming, telecom and computer networking, wireless networking, Internet administration and other telephony technology.

Increasing electricity use by data centers is a growing issue – at server farms run by big Internet corporations as well as in the data centers of universities, public agencies and companies across the country. This energy use is anticipated to grow as we transfer more activities online.

Servers are among several components in data centers that consume energy. Industrial cooling systems and circuitry to keep backup batteries charged can account for 50 percent of the total energy consumed in a data center.

The Washington State University (WSU) Energy Program is among the top-tier U.S. academic

institutions, research groups and companies that are implementing vastly more efficient practices to cool state-of-the-art data centers. The WSU Energy Program is reducing energy use in its data center by:

- Using heat pumps to remove heat produced by computing equipment. This saves energy by reducing heat buildup in the data center and by providing heat for the offices and library that occupy the rest of the building.
- Arranging the servers in racks to maximize the efficiency of the cooling system. This also concentrates waste heat so it can

more easily be transferred out of the data center by the heat pumps.

- Using virtual servers to reduce the need for additional hardware, thus reducing power consumption and cooling requirements.

Removing waste heat with heat pumps

The WSU Energy Program data center was designed to collect and re-use waste heat produced by large computing systems and servers. This heat is used to help warm the rest of the building.

Heat produced by equipment in the data center is transferred to an adjacent area where water used by the HVAC system enters the building. The cold water in the HVAC loop is warmed by this waste heat. This pre-heated water is then sent to the HVAC boiler, where it is heated to its final temperature and used to heat the air that enters the office spaces and library.

Pre-heating the water before it reaches the boiler reduces the work the boiler must do – and the fuel it must consume – to produce the warm air that is distributed throughout the building.

When the office spaces do not require heating, the excess heat from the data center is expelled outside.

Arranging servers to maximize cooling efficiency

Many older data centers are cooled by pumping cool air into the room through the floor. This method is not very efficient because it bathes the entire room in cool air when only certain parts of the equipment require cooling.



Hot air is expelled from the back of the racked components in the WSU Energy Program data center

To create a more energy-efficient cooling system, WSU Energy Program IT staff arranged the servers and other computer components in racks. They positioned the racks near the center of the room, where the cool air enters from the HVAC system. The cool air is pulled through the front of the racks where it is needed to cool the equipment.

Hot air is expelled from the back of the racked components along the room's periphery. This waste heat is then transferred by the heat pumps to warm the water in the building's HVAC system.

Using virtual servers

Virtualization allows tremendous processing power to be concentrated on fewer computers. In the short-term, this can save energy and reduce waste heat. However, organizations may find that their computer equipment consumes more energy and produces more waste heat because the new, ultra-dense computer architecture is doing more work.

Organizations need to meet the challenge of providing a stable computing environment while saving money and staff time.

The IT staff with the WSU Energy Program offers insights and expertise to help meet these challenges.

Our IT Team

Our IT team excels in computer programming, telecom and computer networking, telephony technology, wireless networking, Internet administration, email maintenance, computer backup and video conferencing.

In addition to serving the WSU Energy Program offices in Olympia and Spokane, our IT team applies their entrepreneurial skills to support the IT needs of local and regional organizations, including:

- Washington State Office of Public Defense
- Washington Health Care Facilities Authority
- Washington State Department of Transportation
- WSU Government Relations Office
- WSU Provost Office
- Thurston County and Mason County conservation districts
- Western Washington Indian Employment & Training Program
- CH₂O, Inc.
- Washington State Council of Presidents

Contact us

For more information, contact:

Jim Colombo

Information Technology Manager
360-956-2027

ColomboJ@energy.WSU.edu