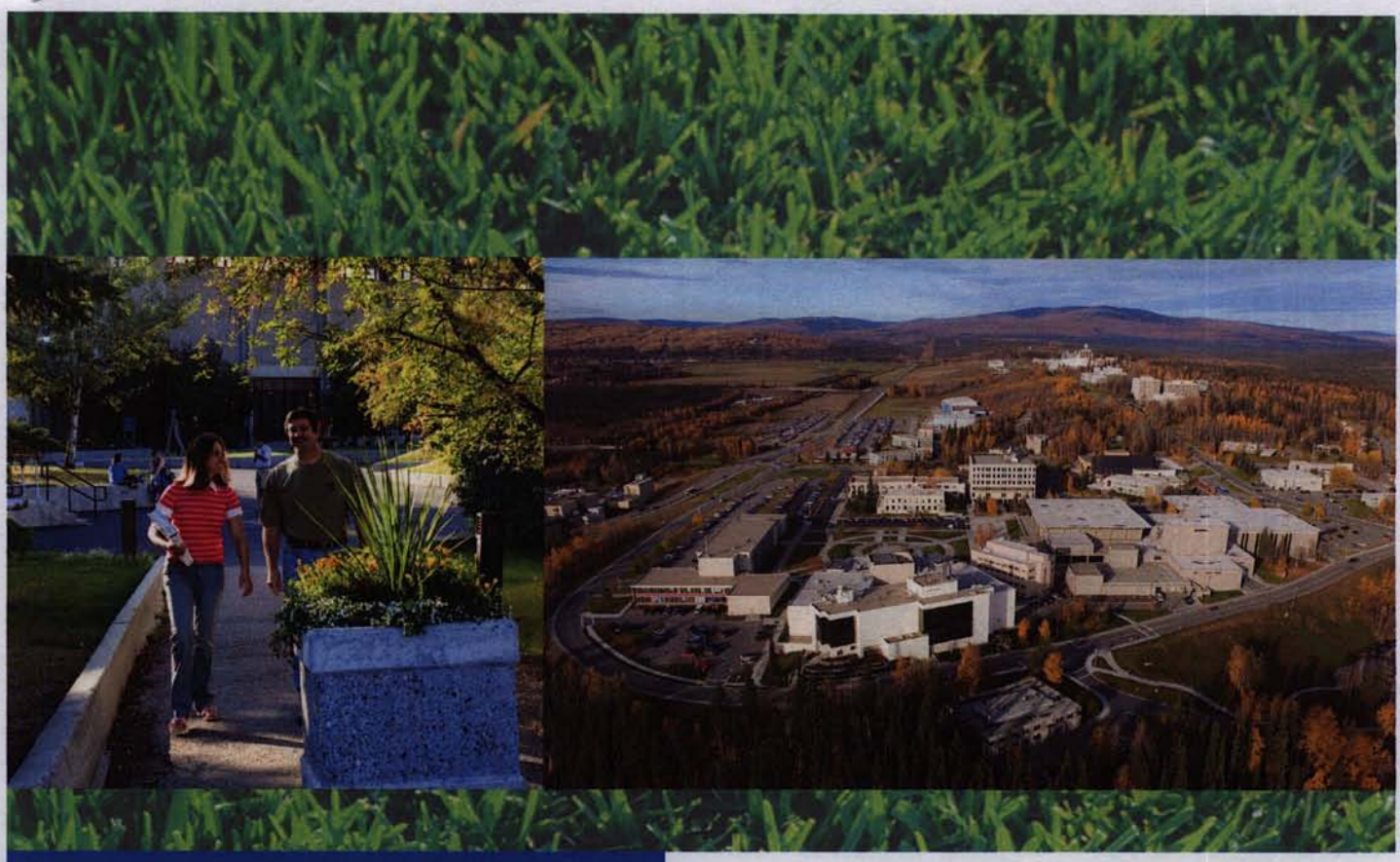

UNIVERSITY OF ALASKA FAIRBANKS

CAMPUS SUSTAINABILITY REPORT

2007 (DRAFT)

University of Alaska Fairbanks

Campus Sustainability Report
2007

Acknowledgements

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Financial Support
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(Letter from Campus Sustainability Committee Chair)

Introduction

""The role of the market place is to be an instrument of environmental change and policy making. We are all consumers with a great potential for change. Environmental protection begins at home."

— Noel Brown
Director of the UN Environmental Program

Sustainable development, sustainable community, sustainable industry, sustainable agriculture. You may have heard these words used in many different ways, but what does "sustainability" really mean and how can you tell if your community is sustainable? Sustainability is related to the quality of life in a community -- whether the economic, social and environmental systems that make up the community are providing a healthy, productive, meaningful life for all community residents, present and future

Through campus environmental stewardship we can make campus operations less consuming of natural resources and less polluting of natural ecosystems. By committing ourselves to becoming a "green campus" we can better fulfill our educational mission, demonstrate environmental leadership, and set an example for the wider community. We have started on this critically important endeavor --though we have a long way to go before we achieve anything approaching genuine environmental sustainability.

In the late 1980's, UAF's environmentally aware began focusing on energy conservation and recycling. With the help of the Associated Students of UAF and the advent of our Campus Sustainability Task Force in 2005, the UAF green campus effort accelerated and produced numerous campus environmental policies and additional green campus programs. In addition to developing new programs, the Cooperative Extension continues to promote agriculture and natural resources, community resource and economic development, home economics and consumer science, 4-H and youth development, and housing and energy. Several UAF programs such as School of Natural Resources and Agricultural Sciences, School of Engineering and Mines to School of Natural Sciences and Mathematics and the School of Fisheries and Ocean sciences continue to emphasize interdisciplinary environmental research designs to resolve community environmental problems.

The immediate global need for ecological proactive attention has reinforced our on-going campus environmental efforts by focusing on increased energy efficiency, green building design, and green power purchases.

Transportation

In Alaska, the major ambient air quality issue associated with our use of fossil fuel resources is excessive levels of ambient carbon monoxide (CO) in urban areas during the winter. Despite air quality improvements recorded in in recent years, Fairbanks is still vulnerable to strong inversions.

In an effort to reduce to address one of the planets most urgent needs, UAF offers a variety of energy saving transportation options.

Walking, Biking and Skiing

One of the best ways to move about campus is by foot. Whether walking, biking, skiing or by use of any other self-powered transportation, walkways and trails can get campus travelers where they need to be.

UAF provides paved connections to all areas of campus. From Signer's Hall to West Ridge, one can find sidewalks with convenient ramps and pedestrian crossing signs. Facilities Services' Grounds Crew maintains the safety and attractiveness of campus walkways.
Bike racks can be found outside of nearly every building.

Another way to move about campus is on its trail system. UAF Trails are used extensively by runners, walkers, commuters, bikers, skiers, researchers, teachers, horseback riders, birdwatchers, and ice skaters. These historic trails have been in use since 1923. Trails are managed to provide safe, year-round access for education, research, non-motorized recreation, physical fitness, athletic training, nature study, solitude and commuting.

Whenever self-powered transportation is feasible, it is clearly the mode of choice from the standpoint of sustainability.

For many UAF individuals, parking and campus transportation plays a significant role in campus transportation.

Parking

The major component of most university parking management programs, including UAF, is the parking permit system.

Carpool to Work

By saving fuel and saving on vehicle wear, carpooling will save you money. Carpooling can reduce the stress of driving to work, by making the drive a social event. Carpools help reduce traffic, reduce pollution, and reduce consumption of non-renewable fossil fuels.

Take the Bus

While buses use fuel, they can move many more people with the same amount of it. So, riding the campus shuttle bus is a great way to help conserve fuel. The Fairbanks North Star Borough Transit bus makes over 40 stops at the UAF Wood Center Monday through Friday.

UAF has ample parking for students, faculty, staff and visitors. There is additional visitor parking in metered parking spaces at various campus locations.

Car Pool

Carpooling to UAF is now easier for fall 2007 with a new carpooling matching service. The service is free, fast and simple. Sign up at www.uaf.edu/parking to become a member, set up a ride, and find someone to ride with.

Campus Shuttle

UAF Shuttles provide rides free of charge to students, faculty, staff and visitors. Heated bus shelters are conveniently located at three high volume campus areas.

Shuttles provide alternative transportation to aid in improving air quality. Less vehicles driving on campus means less CO levels. Riders support the goal of shifting parking to the campus perimeter. Keeping campus traffic down further promotes a pedestrian-friendly campus.

Biodiesel

Biodiesel is a fuel that replaces conventional diesel fuel and is derived from a renewable feedstock. Engines running on biodiesel have reduced CO and particulate emissions, no sulfur emissions, and possibly increased nitrogen oxide emissions.

The UAF Energy Research Center operated a 125 kW diesel electric generator on various blends of fish oil based biodiesel. This engine experienced fuel injector failure after approximately 200 hours of operation.

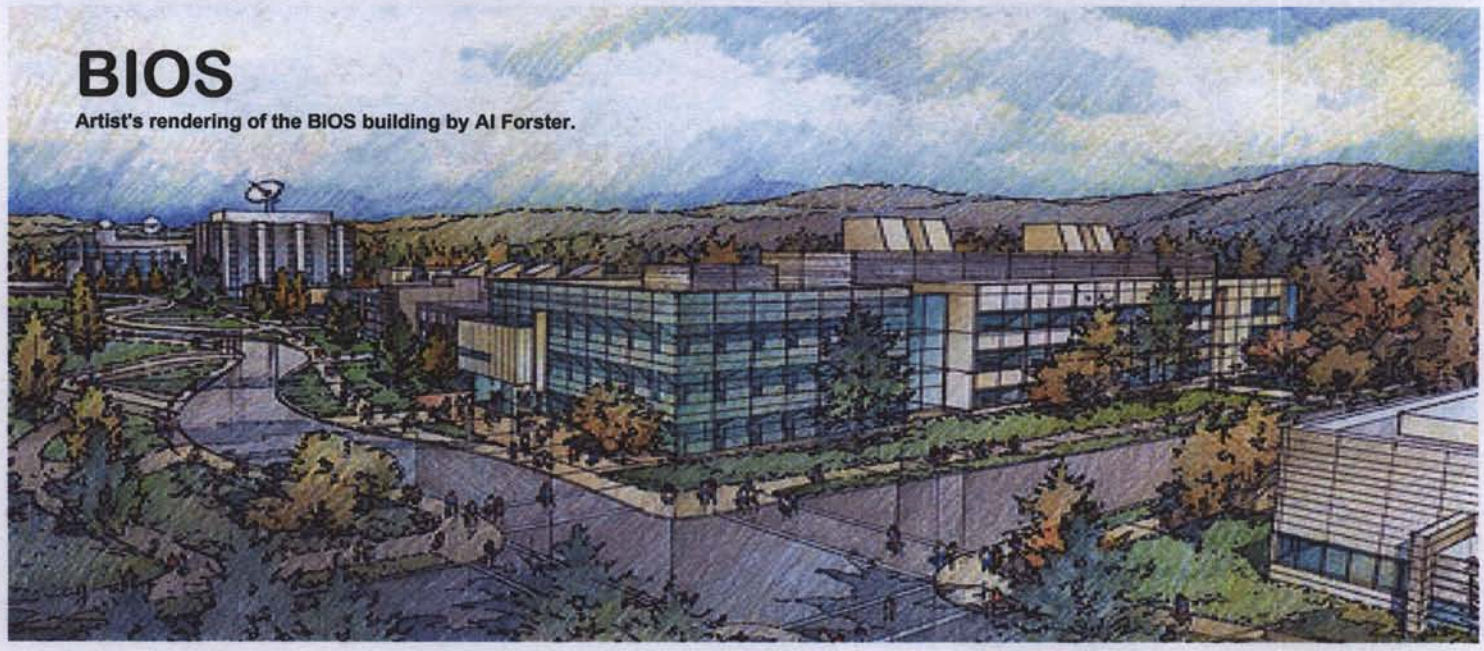
Biodiesel is not a good low temperature fuel because its cloud point and pour point are higher than those of conventional diesel. Additionally, biodiesel is less stable than conventional diesel. As the fuel ages it is more likely to create gums and varnishes on critical fuel injections system components.

UAF will continue to revisit biodiesel reliance when more cold weather treatments/ reprocessing options have been researched.

The carbon emissions from the U.S. transportation sector amount to 5 percent of global carbon emissions - more than those of any other sector in any country.

UAF shuttle buses have diesel engines.

Diesel performance enables cars to travel at least 30% farther on a gallon of fuel than comparable gasoline models.



BIOS

Artist's rendering of the BIOS building by Al Forster.

High Efficiency Buildings

Where practical, all new facilities are to be designed to meet the basic requirements of the adopted energy code. Each Facility shall consider sustainable design and materials during each phase of the building's life from concept to occupancy.

BIOS

The University of Alaska Fairbanks is planning a biological sciences facility to meet Alaska's educational, research and workforce development needs in the life sciences.

Not only will the building be a state of the art research facility, this will be UAF's first "Green Building." The U.S. The core purpose of building green is to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life.

Listed are just some of the energy saving components that will go into BIOS:
Steam Absorption Chillers — Steam from the production of electricity at our Power Plant will be used in a chiller to make cold water. The cold water will in turn cool the building in the summer. This concept is called co-generation, using a substance twice to produce some from of energy

Day Light Controls — In public spaces and offices that face south, there will be lighting controls that will dim the electric lights as the sun provides some useful light.

Occupancy Sensors — Sensors will be placed into labs, offices, and public spaces that will turn off the lights when no one is around. The same sensors will also cut back on the ventilation system, only providing the required quantities of air when the office is occupied.

Kalwall — This innovative exterior wall system has a very high r-value while still letting in natural light to the space.

Steam Absorption Chillers—Steam from the production of electricy at our Power Plant will be used in a chiller to make cold water. The cold water will in turn cool the building in the summer. This concept is called co-generation, using a substance twice to produce a form of energy.

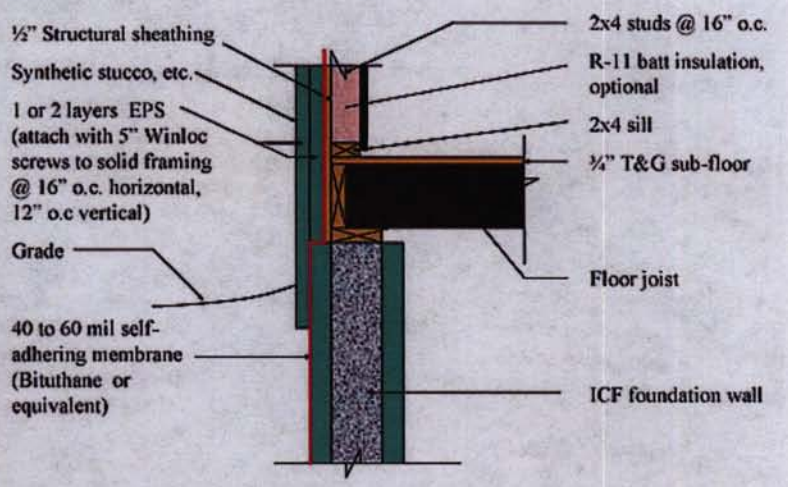
Fan Units—Fan units will utilize cutting edge air plan technology to supply air into the labs and offices. The fan units will reduce the amount of electricity used by at least 30% over traditional fan units.

The Cold Climate Building and Infrastructure Research and Testing Facility was designed by staff of the Cold Climate Housing and Research Center.

While the facility itself has laboratories for conducting experiments, the building itself is a showcase of, and test bed for innovative building technology for northern climates.

The CCHRC building was designed to the standards of the LEED—Leadership in Energy and Environmental Design Green Building Rating System, a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

CCHRC REMOTE Wall/Foundation Detail



Cold Climate Housing Research Center (CCHRC)

Starting from below the ground and rising all the way to the roof, the CCHRC building is loaded with earth-friendly shelter technology.

- The building site is marginal for "normal" building techniques. There's permafrost under the building, creating at least the possibility of some settling and ground movement over time. A year before construction began, a storm water retention pond was dug to the east of the building site. The soil excavated from the pond location was placed on the site of the future building to add mass and compact the soil to prepare it for the weight of the building.

- The building's foundation can be raised to compensate for any ground movement because of the special footings at the base of the walls that allow the entire building to be jacked up with 50-ton jacks and leveled with an injection of grout or structural foam into the resulting void.

- The wall systems in the building are examples of the Residential Exterior Membrane Outside Insulation Technique—a new approach to residential wall construction design that extends the life of a house by treating the wood elements of the wall structure as an internal component of the structure. Unlike a traditional wall, the vapor barrier is *outside* the structural components of the wall. Various insulation materials were used in different parts of the building to test their effectiveness.

- The basement contains a wastewater treatment system that recycles gray water, tanks for rainwater catchments and delivered potable water. Gray water from the sewage treatment system will be recycled to flush toilets and water the grounds. Composted sewage sludge will provide fertilizer for the site.

The Cold Climate Building and Infrastructure Research and Testing Facility was designed by staff of the Cold Climate Housing and Research Center.

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- A sophisticated ventilation system incorporates indoor and outdoor air quality measurement with recirculation, filtration and heat recovery to maximize good air quality for occupants.

- The lighting systems use the highest efficiency fixtures and feature controls that sense ambient light levels as well as occupancy and adjust the light levels automatically.

- There are several heating systems in the building. On the ground floor, a 12,000-pound wood-fired masonry heater will provide gentle, long-lasting radiant heat. Three high-tech oil-fired boilers provide additional radiant heat via a network of tubing embedded in the floors. One of the boilers can be switched to run on waste cooking oil or other alternative fuels. In the future a co-generation plant will convert oil or wood to heat and electricity.

- Part of the building's roof is flat and is designed to be an area to grow plants. These green areas provide a measure of evaporative cooling in summer and meter out water that falls on them instead of just shedding water and sending it down the downspouts as with a more traditional roof.

- More than six miles of Ethernet cables connect to more than 400 sensors and instrumentation installed both on the grounds and within the building, from the basement to the roof, to collect moisture and temperature data on the performance of various building materials as well as the structure's effect on the site.

"We've had to rely on a considerable amount of information from other circumpolar countries of the world because there hasn't been a central point for broad-based Alaska housing research--until now," Seifert said. "With the arrival of the Cold Climate Housing Research Center on the Fairbanks campus, all that is going to change."

-- Rich Seifert
Energy Specialist

Creating a Culture of Conservation

UAF highly encourage campus-wide recycling of paper, aluminum and glass. Environmental dumpsters for paper products are located throughout campus; blue recycle paper trash-cans are available in most classrooms and offices on campus. Recycling of aluminum cans and glass is provided by the Associated Students UAF. Students will collect recycled cans from departments upon request.

Making a Difference

The University paid in excess of $_____ for electric, water, and gas for fiscal year 2006. The costs are increasing for 2007 ant that means increased burdens for students, faculty, and staff. Together we can alleviate some of the costs by consuming less energy.

It is important that we all work together to conserve energy and natural resources on campus. Here are some ways to help:

At the Office

- Close shades or blinds when it is warm to reduce solar heat gain. Open them when you are cool or need natural lighting.
- Use a light jacket or sweater to help take the chill off.
- Use a portable fan when you are warm.
- Do not use a portable space heater when you are cool. Space heaters are considered a fire hazard and may cause problems with adjacent computer equipment.
- Keep outside doors and windows closed.
- Turn off lights in a space whenever it will be unoccupied for more than 5 minutes.
- Turn off equipment not being used, including computers, monitors, coffee makers, copiers, printers and fax machines. Turn off lights and equipment, including copiers, printers, faxes, computers and other office equipment, during nights and weekends.
- Have the building proctor develop assignments to manually turn-off lights when not in use.
- Adopt a last person out policy. The last person leaving labs, lecture rooms, offices and meeting rooms should be responsible for turning off lights and equipment.
- Conserve water by reporting leaky faucets and running toilets.
- Report uncomfortable building conditions to the appropriate area maintenance shop.

Trash is More Than Talk

By Carla Browning

UAF's paper recycling program has saved the university approximately $6,000 a year in tipping fees at the Fairbanks North Star Borough landfill since it began in April 2000.

The university pays a $50 per ton tipping fee to take garbage to the landfill, but separated waste paper is accepted at the landfill at no charge. According to Ed Foster with UAF facilities Services, approximately 130 tons of paper is separated at UAF annually. The waste paper is eventually taken to Eielson Air Force Base where it is made into charcoal briquette-like "pellets which are used to generate electric power. Recycling could save the university even more money, if everyone on campus participated.

Creating a Culture of Conservation

- Report water or energy waste to the appropriate area maintenance shop.
- Laboratory workers should keep fume hood sashes at minimum working height after set-up.
- When purchasing PCs, monitors, fax machines and copiers, look for the Energy Star models.
- Implement paper reducing strategies such as double-sided printing and using e-mail instead of sending memos and faxes. Saving paper saves energy because it takes 10 times more energy to manufacture a piece of paper than it does to put an image on it.
- Campus thermostats will be set to predetermined temperatures as specified by the utility committee. Area Maintenance should be contacted if a thermostat needs to be adjusted.

At the Residence Halls

- Become aware of the costs for air conditioning, heating, appliances and other equipment.
- Use a light jacket or sweater to help take the chill off during heating months.
- Use a portable fan when you are warm during the cooling months.
- Do not use a portable space heater when you are cool. Space heaters are considered a fire hazard and may cause problems with adjacent computer equipment.
- Turn off lights, computers, printers, coffee makers, television, VCR, DVD, radios and other equipment when not in use.
- Wear heavier clothes in the winter and lighter clothes in the summer.
- Use low flow control settings on air conditioners whenever leaving the room for an extended period of time, such as evenings and weekends.
- Set thermostats to comfortable settings. Do not set settings to the extreme.
- Turn everything off while you are gone for the winter break, spring break, summer break, holidays and weekends.
- Wash and dry full loads of clothing and clean lint filters after each use.
- Conserve water by taking short showers.

"Turn it off" stickers have been placed on light switch plates in offices, hallways and classrooms to remind staff, faculty and students of what they can do to improve energy efficiency.
Students, staff and faculty can help to achieve greater energy efficiency by monitoring lighting and computer and office equipment use.

- Conserve water by not leaving water running while brushing your teeth.
- Rinse your razor in a sink filled with a few inches of water. You can rinse your blade just as easily as with running water and a lot less wastefully.
- Conserve water by reporting leaky faucets and running toilets.
- Do not use toilets as a trashcan. Each time you flush trash down the toilet you waste up to seven gallons of water.
- Report energy waste to Resident Hall Managers.

Everyone's actions, individually or collectively through society, incur ecological impacts. We consume natural resources, release pollutants and generate waste. These impacts are referred to as "ecological footprints."

Saving the planet is a big job. You can help by incorporating a few simple actions into your everyday life. You can change our world for the better — for today and for generations to come. Being a conservationist has never been easier!

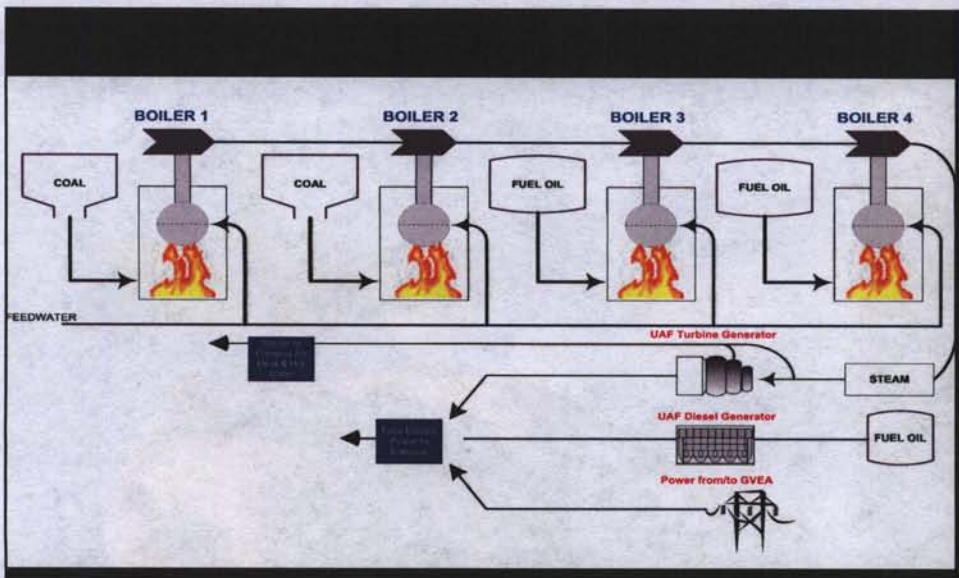


Diagram of the University of Alaska Fairbanks Power Plant

Energy

The Utilities Division at UAF operates a combined heat and power plant (CHP) that provides electric power, steam heat, domestic water, and district-chilled water to campus. The power plant has a peak load of 9 MW and a power generating capacity of 23 MW. Two coal fired and two oil fired boilers generate the steam that powers the three steam turbines. After the steam goes through the chillers for campus cooling. The power plant also has a 9.6 MW backup diesel generator. The Utilities Division is progressive in its approach to modernization and energy savings efforts. The power plant was built in 1964 and is in the process of continually being upgraded.

The University also operates its own water treatment plant that produces over 87 million gallons of safe drinking water per year. The two primary wells and one emergency well are housed in heated and security alarmed buildings. High purity water to various labs is also produced.

How it Works

Like many CHP facilities UAF is limited by its ability to condense steam. When it is cold outside, we can condense our steam by heating the campus building and by using the Air cooled condensers. This allows UAF to generate a lot of electric power. Our CHP facility uses most of the steam twice, once to generate electric power, and again to heat the buildings. When it is winter our CHP facility will achieve over 71% efficiency.

When it is summer, the campus buildings do not need much heat, and our ability to generate electric power is greatly diminished. Most of the steam we produce is only used to generate electric power, and this steam is condensed by our air-cooled condensers. This is an additional cost for UAF. Without the need for the heating steam, the CHP facilities efficiency drops to around 32%.

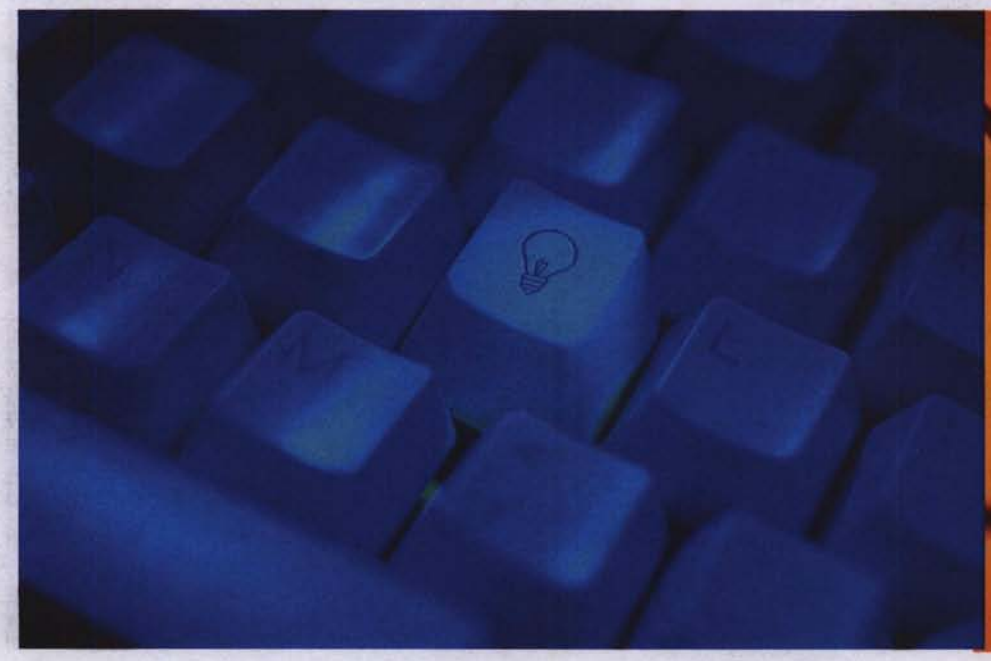
R-values are nothing more than a materials ability to "resist" the conduction of heat flow thru a solid.

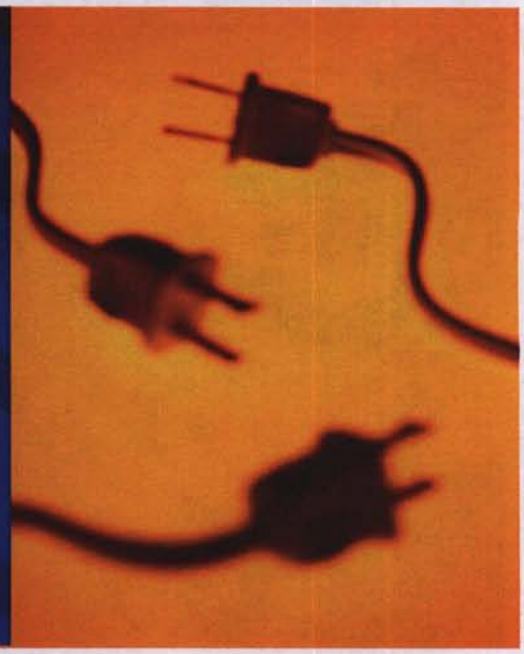
Insulating value increases with an increase in r-value.

A megawatt (MW) is a unit of electric capacity or electric load. A MW is equal to 1,000 kilowatts (kW).

Generators depending on size have rated capacities reported as MW, kW or watts.

The Load of electric equipment such as light bulbs, homes, businesses and industries are rat3d in kW or watts.





Energy

As the use of steam absorption chilling on campus grows, and the use of electric power chillers drops, the efficiency of the CHP facility will continue to grow.

Solar Bus Shelter

UAF facilities has installed a small scale solar system on a bus shelter. This will consist of a small photovoltaic array and an inverter. This system will take energy from the sun and convert it to electric power. This power will go directly into the power system at UAF. All power produced will offset either power purchased from Golden Valley Electric Association, or power that is generated at the UAF power plant.

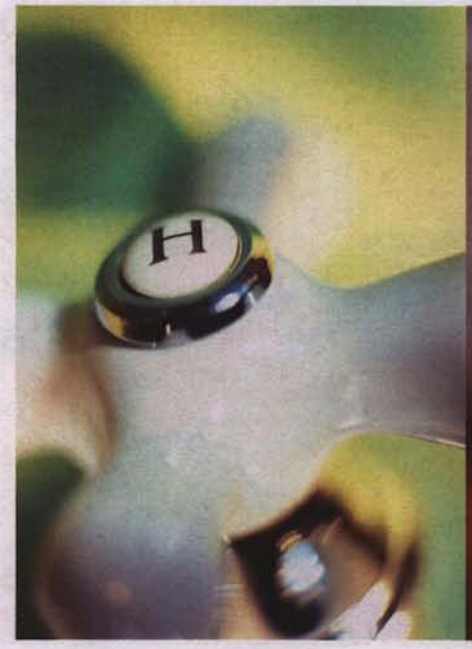
SNAP
(Sustainable Natural Alternative Power)

UAF began participating in Golden Valley Electric Association's (GVEA) SNAP (Sustainable Natural Alternative Power) program for the 2007 fall semester. The program connects producers with purchasers of renewable energy. UAF's participation will allow students, faculty and staff to actively participate in alternative energy production.

SNAP producers are members producing renewable power using solar panels of wind turbines. The energy is mixed with the existing power supply and transferred across the electric grid and finally received by homes and businesses.

SNAP purchasers support the continued development of alternative energy resources in interior Alaska. Contributions will develop sustainable, natural power and advance UAF's efforts to establish a Sustainable Campus Initiative. Contributions can be made anytime at the UAF Residence Life Office, and UAF will pay GVEA all the money it collects. All contributions will go directly to the producers of alternative energy.

Solar panels on the Nenana parking lot bus shelter.



Reclaimed Water

Water is one of our most precious and valuable resources. Without a gallon a day, you will perish. Plants and animals need a reliable supply, and it is critical to growing crops.

UAF is fortunate to have our own Water Treatment Plant. The Plant's goal is to provide a safe and dependable supply of drinking water of sufficient quantity and high quality. Drinking water at UAF is regularly and routinely monitored for various contaminants to be sure that the water meets all the Federal and State laws and regulations.

The sources of drinking water (both tap water and bottled water) includes rivers, lakes, streams, ponds, reservoirs, springs and wells.

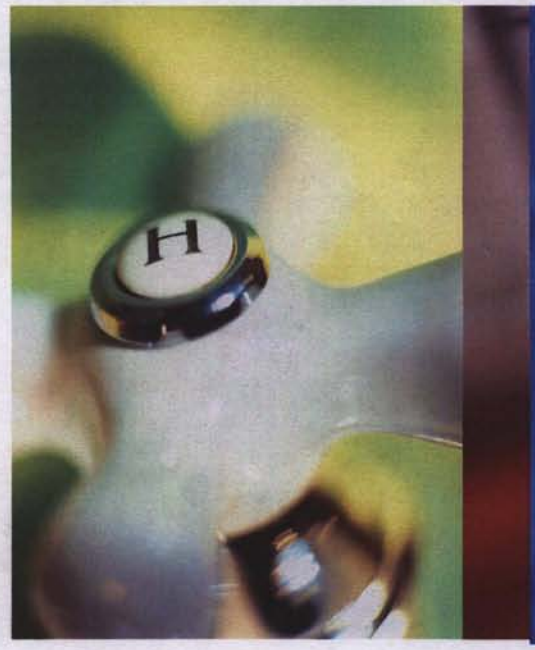
The source of the UAF drinking water is groundwater. Groundwater is water that has slowly seeped down into the ground through layers of sand, gravel and fractured rock. As gravity pulls this water down into the ground, it begins collecting at various levels between the particles of sand, gravel and fractured rock and this area is called an aquifer (ah-kwah-fur).

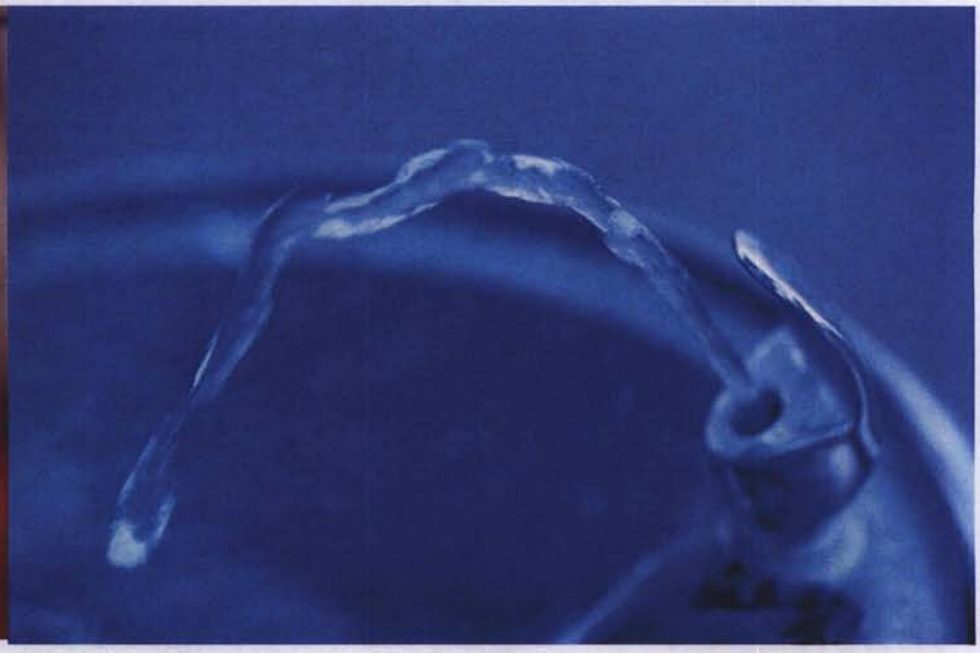
The temperature of the water coming out of the ground is 34-36°F. The cold, untreatred water provides a very vital funtion necessary for the continuous operation of the UAF Power Plant. The untreated water is referred to as Raw Water. The raw water is pumped directly from the wells to the UAF Power Plant. Here the water is passed through two enclosed loop heat exchangers.

The outer jacket of the shell of the heat exchanger contains the hot water that is returning from throughout the Power Plant. This outer jacket is circulating the primary cooling water for the many water-cooled bearings; motors and steam operated turbines ini the Power Plant. Housed inside the core of the heat exchanger is a sealed bundle of many 1/2" tubes. The cold raw water is passed through thes internal tubes. The energy of the cold water inside the tubes is trnsferred out into the hot water and the hot water energy is transferred into the cold water. The heat transferred to the raw water raises the temperature to 50-55° F. The water now enters the water treatment plant for the first step of the drinking water treatment process.

UAF's Three Wells

1. Primary production well drilled in 1984 to a depth of 70 ft. Can produce a flow rate of 500 gallons per minute.
2. Secondary production well drilled in 1979 to a depth of 90 ft. Can produce a flow rate of 750 gallons per minute.
3. Emergency well drilled in 1993. Can produce a flow rate of 300 gallons per minute.





Reclaimed Water

Co-Generation

As mentioned in the Energy section, when an absorption chiller is added to a combined heat and power plant (CHP) system like ours, it takes the steam that is normally used to heat the buildings and uses the steam to make cold water. This cold water is used to cool the campus buildings. This does several things for UAF. The steam is now being used more than once, which improves the efficiency. In addition, it also allows the CHP plant to produce more electric power, because it can now condense more steam. Last summer UAF was up to 60% efficiency at the plant.

Visit the Water Treatment Plant website to find out more about the filtration process from beginning to end at www.uaf.edu/fs/water.html.

Campus Events and Planning