The University of Maine System

System-wide Energy & Environmental Sustainability Initiatives
A National Leader in Energy & Environmental Sustainability

The University of Maine System

Established in 1968
State of Maine’s largest educational enterprise
Annual enrollment in excess of 44,000 students

7 Universities -- some with multiple campuses

9 University Colleges
16 county Cooperative Extension outreach centers
75 interactive distance learning sites
One Law school

7 distinct universities share two overarching goals:

To provide high-quality, accessible and affordable learning opportunities
To undertake and share creativity, innovation and outreach to improve Maine's economy and quality of life
The University of Maine System’s commitment to Energy and Environmental Sustainability is demonstrated continuously, as evidenced by the many initiatives and accomplishments throughout the system and across the state....
Renewable Energy, Alternative Fuels, & Innovation
**PROP Child Care Center**

- Solar thermal and radiant slab.
- Integrated supplemental high efficiency gas boiler.
- Radiant floor system - circulates warm water through tubing cast within the floor slab.

- Provides domestic hot water.
- Heats water for radiant slab and baseboard systems.
- Reduces fossil fuel consumption by 45%.
- Saves $3,300 annually in fuel costs. This is equivalent to 90% of what an average house in Maine would consume and spend in natural gas.
Completed in 2006, the Education Center’s heating and cooling systems are served entirely through Geothermal (ground source) pumps.

A comparison of the Education Center’s energy performance (from FY2007 through FY2010) to a similarly sized UMF building renovated in 2000 yields:

- A cumulative difference of in excess of 1,371 Metric Tons of Carbon Dioxide equivalent (MTCO2e), which is equivalent to the emissions from 262 passenger vehicles for one year.

- A cumulative difference in excess of $275,000 in energy costs, at current pricing.
600 kW Wind Turbine

- At a total height of 90 meters and a capacity of 600KW, this $2 million project produced 680,000 kilowatt-hours of electricity in its first year alone, avoiding approximately 519 Metric Tons of CO2 emissions, equivalent to 99 passenger vehicles.

- The University of Maine at Presque Isle has also been honored by receipt of the inaugural 2010 Second Nature Leadership Award for Institutional Excellence in Climate Leadership in the public baccalaureate category.

- In recognizing UMPI, Second Nature highlighted the University's installation of its turbine on campus.

- UMPI’s Wind Turbine project promises to serve the campus’ energy needs, significantly reduce energy costs, reduce the University’s carbon footprint, and provide an incredible and unique educational opportunity for years to come.
Abromson Community Education Center:
Geothermal Heating and Cooling System and 7800 Watt Solar Photovoltaic Array

- The geothermal (or ground source) heating and cooling system utilizes the energy stored in the water and bedrock deep below the court yard.
- The system works by pumping heat removed from the groundwater into the building during the winter and pumping heat from the air in the building into the groundwater on hot summer days.

- Solar Photovoltaics (PVs) convert sunlight directly into electricity.
- The Abromson Center features three arrays with 6 panels in each array.
- Generates enough electricity to power 2-3 reasonably electrically efficient Maine homes.
Renewable Energy, Alternative Fuels, & Innovation

Powell Hall Expansion, Renovation, and Air Source Heat Pump Installation:

- 70% of the electricity will be derived from renewable sources.
- New energy efficient windows were installed throughout the entire building.
- The building’s heating and air conditioning systems were integrated with the campus energy management system.
- Projected 30% reduction in water usage.

The Powell Hall expansion and renovation project installed air source heat pumps in the renovated portion of the building.
Folsom and Pullen Halls: Building Envelope, Air Source Heat Pumps, and Biomass Boiler Installation:

• Building envelope improvements included new windows and building insulation.

• Prior to the heat pump installation, Folsom and Pullen halls together consumed 55,509 gallons of fuel oil per year. The following year the complex used less than half that total.

UMPI has also been distinguished through two recent grant awards that will be implemented in the same Folsom and Pullen complex:

• The first award: $750,000 for the installation of a wood chip biomass boiler to heat Folsom and Pullen Halls, with a total project cost of $1,260,000.

• The project will displace 3,060 MMBTU (22,000 gallons of fuel) and 1,600 MTCO2e emissions per year.

• The second award: $800,000 funded through federal legislation, which will provide for the installation of solar photovoltaic panels and an automated weather station on the roof of Folsom and Pullen.

• The weather station will be utilized to collect information on solar radiation levels, and both assets will be utilized as teaching tools, further expanding the educational experience and opportunity on campus.
Planned conversion of the Plant’s newest and largest boiler (Boiler #3) from #6 Residual Fuel Oil to Natural Gas, with provision for future alternative fuel.

Boiler #3 is the primary boiler used by USM and is large enough to carry the entire campus load throughout the year.

Boilers #1 and #2 will serve a reliability function as backups and will not be converted at this time.

Expected Cost: $273,400

Less Efficiency Maine/ARRA Grant award of $100,000.

At current market prices, the estimated simple payback period with the grant award is less than 1 year, to be realized through fuel switching and combustion efficiency improvements.

Expected annual greenhouse gas emissions reduction of approximately 1,048 Metric Tons, equivalent to the amount of carbon removed annually by 223 acres of pine or fir forests.
UM Central Steam Plant: Boiler Replacement Project

- Planned installation of one new, nominal 55,000 lb/hr boiler and flue gas economizer, replacing the two oldest and least efficient boilers in the Plant.

- The new boiler, preliminarily designated “Boiler 8,” will have dual fuel capability, fired on natural gas with provision for future alternative fuel.

- The Project is expected to be implemented in 2012, at a Budgeted Cost of $2,760,000 (less Efficiency Maine/ARRA Grant award of $700,000).

- Projected Annual Savings in excess of $800,000, for a Payback Period of 2.5 years.

- Expected annual heating fuels reduction of approximately 30,000 MMBTU (million BTU), which is equivalent to 216,000 gallons of #2 fuel oil per year, or the total energy consumption of approximately 230 New England households per year.

- Expected annual greenhouse gas emissions reduction of approximately 6,000 Metric Tons CO2e, the equivalent of taking in excess of 1100 passenger vehicles off the road.
UMA has reduced fuel oil consumption at the University College of Bangor by nearly 19% to equivalent space in the last four years, and is currently in negotiations to supply natural gas to the campus.

The conversion from #2 fuel oil to natural gas would replace approximately 70,000 gallons of fuel oil per year currently serving 14 buildings on the University College campus.

This investment would result in a 27% reduction in carbon footprint and an expected two year simple payback period.
Energy Efficiency, Conservation, & Optimization

Continuous Building Monitoring and Optimization:

• Process of monitoring and analyzing continuously collected building automation data from
  – buildings heating, ventilating, and air conditioning systems
  – equipment and telemetry

• Equipment failures and other abnormal operating conditions are identified.

• Recommendations are made that enable Facilities Management to optimize efficiency, indoor environmental quality, and occupant comfort, and lower operating and maintenance costs.

• Continuous Commissioning is ongoing in several large, energy intensive buildings across the system. Cumulative savings since 2005 total in excess of $460,000 and 2,339 MTCO2.
Ongoing System-wide Projects

Thermal Imaging Heat Loss Surveys:
Images serve as qualitative support for identifying energy management opportunities, and as a tool to evaluate before and after analysis of building envelope projects.
• Constructed in 2007, the Michael Klahr Center, located on the UMA campus was designed to complement the Bennett D. Katz Library.

• UMA replaced two Katz Library air handling units and one chiller unit, all of which were 1975 vintage, added economizing to the mechanical cooling system, and replaced the building’s pneumatic controls with direct digital controls.

• The results:
  • Fuel oil consumption has been reduced in excess of 40%.
  • Electrical consumption has been reduced by 12%.
  • The upgrades provided such greatly improved system efficiencies that the existing Library electrical & heating system was able to provide the Klahr Center with its electrical and heating needs and avoid the costs of a dedicated system.
Building Envelope and Energy Management System Improvements

The University of Maine System office

- Located on Central Street in Bangor
- Building renovation reached substantial completion in October of 2005
- Energy improvements include:
  - Forced hot water heating system with three gas-fired, condensing boilers
  - Occupancy sensors
  - Water free urinals
  - LED (light emitting diode) exit signs
  - Vending machine energy control
Eastport Hall Building Envelope & Heating Controls Improvements:

• Existing roof was replaced with a new rubber membrane and insulated to R-36.

• Existing single pane windows were replaced with double pane, insulated glass.

• The building’s heating controls were upgraded and replaced with direct digital controls.

• Improvements resulted in a savings of 25% on fuel oil consumption.
Gentile Hall Retracted Pool Cover System

Fuel Consumption

Before pool cover installation: 37,907 Gallons
After pool cover installation: 21,737 Gallons

Result: a 42% reduction in fuel oil and emissions
USM has been replacing outdated controls with new, direct digital controls (DDC), in its buildings. The DDC controls are integrated with USM’s building automation systems and energy management systems, in many cases providing the ability to centrally and/or automatically manage much of the buildings’ energy systems.

- 30 buildings currently have at least some DDC controls.
- The controls have significantly improved energy efficiency and occupant comfort.
- Energy usage is also being displayed in some occupied areas, providing direct feedback to the occupants of their energy usage.
Fitness and Recreation Center Lighting Retrofit

- Installed in September 2010, for an investment cost of $39,000.
- Each existing 400 watt high pressure sodium lamp was replaced with 6, 32 Watt, 5000K T8 fluorescent lamp units.
- New units are dual switched for half-on, half-off operation. Each court is also switched separately, which allows for lighting to each court only when in use.

- Office, restroom, locker rooms, and weight room were fitted with 25 Watt 5000K T8 lamps in lieu of 32W watt T8 lamps (20% less energy used per hour).

Project Expectations:

- Improved indoor environmental quality through better, true color lighting.
- $19,000 per year savings, for a Simple Payback Period of approximately 2 years.

The Results thus far:

- 28% reduction in electricity use realized in October 2010 vs. October 2009.
Exterior Lighting Improvements:

Perkins Parking Lot - LED Lighting Retrofit:

• 14 existing 250 Watt metal halide fixtures replaced with 9 new 156 Watt LED fixtures.

• LED lamps are estimated to last 4-5 times longer than metal halide lamps.

• Longer lifespan will result in greater reliability and preclude four series of changes involving a lift rental and related labor to replace bulbs.

• Installed in October 2010, the project is expected to reduce electricity use by 60%.
Aubert Hall: The project scope included the construction of 3 new teaching labs, each equipped with 7 new fume hoods, and the remodeling of one existing chemistry lab, equipped with 7 existing fume hoods; providing greater student capacity and an improved educational environment for teaching laboratories.

Rather than installing conventional constant volume fume hoods, 21 new variable air volume fume hoods were installed, and the 7 existing constant volume hoods were converted to variable air volume. Additionally, the laboratory HVAC and lighting systems were integrated for occupied and unoccupied control while ensuring safe operation and use of the laboratory.

The incremental cost of the low-flow fume hoods over conventional hoods was $105,000.

Project benefits to the University included:

- Construction cost savings through the use of smaller HVAC equipment, piping, and duct distribution systems, the elimination of exterior rooftop ductwork, and reduced size of the duct plenum which provided more useable space to laboratory occupants.
- The elimination of one air handling unit, resulting in an avoided cost of $251,000.
- A reduction in ongoing energy costs estimated at $64,000 per year.
With 11 buildings encompassing in excess of 294,000 square feet of space, for the last six years the University of Maine at Machias has maintained its physical footprint while dramatically reducing its energy consumption and carbon footprint.

In FY2004, the campus consumed 184,968 gallons of fuel oil and 1,938,240 KWH of electricity, for a total of 32,324 MMBTU in that year.

The University has prudently managed its facilities and implemented energy measures such as:

- programmable building temperature controls
- building temperature sensors
- run-time meters on boilers
From FY2004 to FY2010:

- The delivered unit cost of electricity increased by 33% and fuel oil increased in excess of 100%.
- Total oil and electrical energy consumption was reduced by nearly 26%, the equivalent of 59,776 gallons of fuel oil.
- Carbon footprint was reduced in excess of 24%.
- Cumulative avoided costs of $554,000 from 2004 baseline consumption.
In 2009, UM partnered with Bangor Area Transit, Orono, and MDOT to develop the Black Bear Orono Express shuttle, a free service to UMaine faculty, staff, and students. Ridership exceeds 39,000 rides per year.

USM purchased 3 gas-electric Toyota Prius hybrid vehicles for the motor pool, replacing 3 gasoline passenger vehicles.

The result: an 8% drop in average fuel use for the entire fleet of 56 vehicles.

There are 46 UM Campus Carpool participants receiving free parking permits.

UM and UMF feature Anti-Idling Policy.
Plans to continue improving the pedestrian-friendly campus at UM

Plans underway to rebuild 2.6 miles of bike path

- Original path built in 1976
- Partnership with Orono Land Trust, and towns of Orono and Old Town
- Scheduled completion by Spring/Summer 2011
- Promotes alternative transportation and fitness.

UM Campus Master Plan includes a peripheral vehicular traffic loop concept with a pedestrian priority zone, as well as east-west and north-south pedestrian travel corridors.
Leadership in Energy & Environmental Sustainability ("LEED")

The University of Maine System has 13 facilities with LEED certification or impending certification. LEED certification features may include:

- **Sustainable Site Development**
- **Water use efficiency**
  - Landscaping
  - Building
- **Energy & Atmosphere**
  - Optimized Energy Performance
  - On-site Renewable Energy
- **Materials & Resources**
  - Materials used in building construction
- **Indoor Environmental Quality**
  - Air Quality, Ventilation
  - Low-emitting materials
  - Occupant thermal comfort
- **Innovation & Design Process**
Sustainable Building and Design Construction

**USM:** PROP Child Care Center
**UM:** Student Recreation and Fitness Center
**USM:** Abromson Community Education Center
**UMF:** Education Center
**UMFK:** Powell Hall
**USM:** Wishcamper Center
**UMF:** Francis Allen Black Hall
**USM:** Upperclass Hall
**UM:** Wells Conference Center
**USM:** John Mitchell Center School of Applied Science, Engineering, and Technology
**UM:** Foster Student Innovation Center
**USM:** Osher Map Library
**UM:** Advanced Engineered Wood Composites Center (AEWC)
Located on the Portland Campus, the Abromson Center was completed in spring 2005.

The Center is the home of USM’s University Outreach Programs.

Plantings: The Center’s landscape is planted primarily with native and non-invasive plants that thrive in the Portland climate.

White Roof: A highly reflective white roof reduces the “heat island effect” common to buildings with black roofs.

Water Conservation and Storm Water Harvesting System: Use of a “storm water harvesting system” and waterless urinals avoids use of valuable potable water. “Excess” water from the building’s Geothermal system and rain water collected from roof drains is used to avoid using expensive, potable water. 1.6 gallon low flow flush toilets, low-flow faucets and waterless urinals are all used throughout the building.

Renewable Energy: This building gets ALL of its power from the wind and sun. USM buys enough wind generated electricity in the form of Green-e Renewable Energy Credits (RECs) to meet all building needs.

Building Automated Systems: The facility is equipped with an intelligent direct digital controls energy and operations system. The system allows for automated facility operations depending on usage, time of day, and occupancy.

Forest Stewardship: Use of Forest Stewardship Council (FSC) certified wood products in this building.
This nearly 88,000 square foot facility opened August 2007, receiving a LEED Silver rating in 2008.

Facility has won multiple awards, including:

- 2008 Athletic Business Facility of Merit Award from Athletic Business Magazine; as one of 10 winning buildings that “demonstrated sound design principles in the areas of transparency, organization, detailing, sustainability, functionality and appropriateness to their surroundings.”

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Key features include:

- Green housekeeping products through the entire building, including fitness area, bathrooms, locker rooms, and administrative suites.
- 90% of the spaces in the building have views to the surrounding natural environment.
- Exterior copper panels containing 90% post-industrial recycled material.
- Low flow plumbing fixtures in locker rooms, bathrooms, and laundry facilities achieve a 37% reduction in water consumption.
Outreach, Advocacy, and Public Service for Our Communities and Our State
University of Maine Cooperative Extension

- Providing research-based information on how to save money through energy conservation and alternative energy sources.

- For over 90 years, Cooperative Extension has been putting university research to work in homes, businesses, farms, and communities—in every corner of Maine. Educational efforts focus on managing agriculture, natural resources, and the environment; enhancing economic opportunity; and encouraging lifelong wellness.

- UM Cooperative Extension is part of the nationwide Cooperative Extension System, which works through the land-grant universities in each U.S. state.

- In addition to state offices in Orono, is a network of county-based offices staffed by experts who provide practical, locally based solutions for farmers, small business owners, parents, children, consumers, and others.
The Muskie School's more than 300 faculty and research staff come from a wide variety of academic, public management, and direct service backgrounds, including sociology, health and social policy, business, finance, psychology, social work, public health, law, public administration, and mental health.

Approximately half the faculty hold joint teaching/research appointments.

Informing Policy and Practice

The School's extensive applied research programs directly contribute to organizational, program and policy innovation and capacity.

The School is increasingly recognized nationally for applying the university's analysis and research resources to critical issues in the fields of community planning, and environment.
Outreach, Advocacy, and Public Service for Our Communities and Our State

Some of the clubs, groups, and organizations within the System that are engaged and advocating for environmental sustainability across the State.

**UMFK** Center for Rural Sustainable Development

**UMM** Creating a sustainable showcase home for the University and community

**UMPI** Green Campus Action Committee

**UMF** Sustainable Campus Coalition
UMFK: Dining Services Recycling, Resource Recovery, and Conservation:

- UMFK Dining Services has implemented a recycling program.
- Eliminated trays in the dining hall to reduce the amount of energy and water used, and minimize food waste and pollutants in the environment.
- In partnership with the Environmental Studies Club on campus, a pilot program is under way in which organic waste and compostable materials are separated and reused.
- All cleaning supplies are being converted to the Eco-Friendly line from EcoLab™. This product is less toxic to the environment and the packaging is smaller and recyclable.
- SCA brand 100% recycled napkins in all locations. When introduced these dispensers reduced napkin usage and related waste by 40%.
Revolving Loan Programs:
Funding for Energy and Environmental Sustainability Projects on Campus:

- USM Revolving Green Fund
- UMaine Green Loan Fund, in collaboration with the University of Maine Foundation

Projects supported through these programs are funded in the form of a loan, repayable through actual energy cost savings.
The Path Forward: Commitment, Planning, Opportunities
Environmental Stewardship, one of the five pillars of the University of Maine System’s Agenda for Action

The Goal:
• UMS will be recognized as one of the most environmentally responsible university systems in America.
• This work will be a common thread in all activities of the System, including:
  • being embedded in the curriculum
  • building standards
  • energy usage
  • recycling programs
  • transportation, and monitoring systems
Each campus President of the University of Maine System signed the agreement.

The seven universities joined the greater than 670 colleges and universities that have signed to date, recognizing their unique responsibility to serve as role models for their communities and to develop solutions to reverse global warming.

Each institution pledges to develop a plan for carbon neutrality.
From 2006 to 2010, the seven Universities cumulatively reduced their Carbon Footprint for Scope 1 and 2 emissions in excess of 18.6%.
The Path Forward: Commitment, Planning, Opportunities

In June of 2010, the University of Maine System received $9,500,000 in funding through a State Bond toward energy and infrastructure projects for which the System will improve educational programming space, and the campus environment while continuing to reduce energy and greenhouse gas emissions through conservation and efficiency measures, such as:

UMM – Kilburn Commons Renovations: Includes replacement of the existing boiler and air handling units with more efficient units; replacement of existing large, single glazed windows; and replacement of existing roof with improved roof insulation.

UMA – University College of Bangor - Dental Program Relocation: Renovating the existing College Center building to accommodate an expanded campus Dental Program. New windows and a new roof will be installed. The improvements to the building envelope are expected to save up to 15% in thermal demand.

UMFK – Sports Center Reconstruction: Involves replacing the existing roof and adding insulation to the roof deck. New ceilings, light fixtures, and lighting controls will be installed. Improved insulation is expected to result in a 10% reduction in thermal energy demand to the space. Lighting and controls improvement is expected to reduce electrical demand to the space by up to 5% annually.

UM - Nutting Hall Renovation and Stewart Commons Renovation: Projects will include building envelope improvements; windows, doors, roof, insulation; temperature controls; and lighting controls and efficiency improvements.
Funding Sources Exist Through Upcoming and Ongoing Opportunities:

- Efficiency Maine Grants, Rebates, and Incentives.
- Regional Greenhouse Gas Initiative ("RGGI") auction revenues implemented through the Energy and Carbon Savings Trust and Efficiency Maine.

System-wide, many grants and incentives have already been realized, such as $300,000 funded through RGGI, awarded under Efficiency Maine for UM Alfond Arena electrical reduction improvements.

Through preparation and planning the Universities will continue to realize these and other funding opportunities that may exist.
System-wide, the Universities are continuing to identify and implement projects through prudent management and strategic planning, including:

- Energy and utility metering and benchmarking
- University Master Plans
- Energy and utility master plans
- Climate Action Planning
- Comprehensive engineering studies
- Investment grade energy audits

Collectively, these efforts promise to result in projects and initiatives that will continue the University System’s significant and meaningful impact across the State while also positioning the System for ongoing funding opportunities that will further support these goals and objectives.
Thank you for your time and attention