

# OKLAHOMA STATE UNIVERSITY

## *President's Task Force on Sustainability*

**Progress Report, November 2008**  
**Stephen McKeever, Chair**

### *Forward*

An Interim Progress Report was presented to President Hargis and Provost Strathe in Summer 2008. The attached Report represents a more complete evaluation of OSU's Sustainability activities as compiled by the President's Task Force on Sustainability.

### *Executive Summary*

The Task Force's responsibilities were divided among three committees. This report addresses the work of each of these committees. In each section, we report on current status, initiatives underway, and plans for the future.

**Sustainability Applications.** The Task Force's application committee explored opportunities to apply Sustainability development principles at OSU campuses. Current activities and potential applications were identified in recycling, energy and water conservation, renewable energy use, green building construction, integrated transportation, low maintenance landscaping, use of hybrid/electric vehicles, emissions reduction, and waste minimization. There are opportunities for OSU to enhance its sustainability operations across many campus areas.

**Sustainability Education.** The Task Force's education committee worked with departments and interdisciplinary programs interested in Sustainability education to encourage inclusion of Sustainability principles throughout the university's core curricula. The Committee identified 6 current courses for which the central focus was Sustainability, 19 current courses for which Sustainability is a secondary focus, and 76 courses for which Sustainability is a peripheral focus. The idea is to promote existing courses and to develop new courses that focus on Sustainability. Further, the committee encourages the development of Sustainability options within existing degree programs.

**Sustainability Research.** The Task Force's research committee worked with the VPRTT's Institute for Sustainable Environments (ISE) to form groups of like-minded Sustainability researchers organized around identified Sustainability themes. The themes include, but are not limited to, environmental systems, engineered systems, energy systems, waste management systems, and sustainable rural communities.

ISE will sponsor preparation of successful interdisciplinary proposals to take advantage of national, state and private research funding opportunities as they become available. In addition, strategies to leverage the interests of major donors to OSU should be considered in the area of Energy Conservation and Renewable Energy Sources.

**The President's Sustainability Task Force recommends:**

1. Designate Sustainability research, education, and application as a priority at OSU. (Include in speeches, writings, etc.).
2. In support of Item 1, a policy statement by the President should be issued and promoted as part of OSU's strategic directions for the future. Suggested wording is included in the Report.
3. Appoint a 'Sustainability Director' to coordinate sustainability activities across the OSU system. Need not be a new position; could be defined duties given to an existing employee.
4. Work toward being able to justifiably sign the American College and University Presidents Climate Commitment. A detailed summary of the main requirements of the Commitment is included in the Report, along with an assessment of the requirements for OSU.
5. Collaborate with State government, the private sector, non-profit sector, and others to advance and promote Sustainability in Oklahoma.

# REPORT

## Definition

*Sustainability* is the development and use of resources to improve human Quality of Life over the long term and in a sustainable manner. It has become a major topic in both private and public sectors in Oklahoma and elsewhere. Quality of Life improvement requires consideration of economic prosperity, responsible use of resources, and protection of the environment.

## Recommendations

The President's Sustainability Task Force recommends:

1. Designate Sustainability research, education, and application as a priority at OSU. (Include in speeches, writings, etc.).
2. In support of Item 1, a policy statement by the President (see below) should be issued and promoted as part of OSU's strategic directions for the future. The statement should be posted on the OSU web site via a link from the Main Page. Suggested wording is included in the Report.
3. Appoint a 'Sustainability Director' to coordinate sustainability activities across the OSU system, assist with marketing sustainability (in applications, education and research), and be the "go to" person for all queries and interactions (e.g. responses to surveys) relating to Sustainability. This need not be a new appointment; the responsibility can be assigned to an existing individual (e.g. someone in the existing Long Range Planning group).
4. Work toward being able to justifiably sign the American College and University Presidents Climate Commitment, thereby joining 516 other university Presidents who have signed (including OU and UCO). **Appendix 1** lists the commitments in the American College and University Presidents Climate Commitment statement along with the Task Force's assessment of where OSU currently stands with respect to each.
5. Collaborate with State government, the private sector, non-profit sector, and others to advance and promote Sustainability in Oklahoma.

## **Recommended Statement from President Hargis**

The Task Force feels that it is important for the President of the University to be seen publically to endorse Sustainability activities across campus, via all OSU's responsibilities and activities. We recommend that the following statement by President Hargis be placed on the OSU web site, with a link from the Main Page:

“Oklahoma State University affirms a core value articulated in its Mission Statement that we are dedicated to the stewardship of the resources entrusted to us. Through its sustainability practices OSU — the state’s premier land-grant institution — seeks to serve not only the university community but citizens of the State, the Nation and the world. OSU faculty, staff and students will advance sustainability through instruction, research, outreach, administrative decision making, and innovative design and operation of our physical facilities.”

## Summaries of Findings of the Committees

### *1. Sustainability Applications Committee*

**Members:** Nigel R. Jones, University Architect, Long Range Facilities Planning (Chair)  
Theresa Baker, Director, University Dining Services  
Chris Hoffman, Manager, Transportation Services  
Rick Krysiak, Director, Physical Plant Administration  
Khaled Mansy, Associate Professor, School of Architecture  
Stephen Spradling, Director, Parking and Transit Services

The Sustainability Applications Committee has responsibility for reporting on sustainability activities on campus. We organized this section to correspond to the four areas of sustainability identified in the recently published “Sustainability Report Card” from the Sustainability Endowments Institute: climate change and energy; food and recycling; green building; and transportation.

#### **Climate Change and Energy**

*Physical Plant: Rick Krysiak, Director, PPA*

##### Current Status

- We have several ongoing energy savings programs. First is our energy education program. Since the program’s inception in June 2007, OSU has reduced energy consumption by about 1,229,000 MMBTUs (equal to 360 million kilowatt hours), saving \$2.26 million in energy costs. Second, OSU has a program to replace lighting in university residences with more efficient T5 bulbs/ballasts.
- We have an agreement with OG&E to purchase wind power as an alternate energy source.
- The Rural Health Center at OSU-Okmulgee uses an alternative energy source (geothermal energy) for heating.
- Fourteen bus shelters have been equipped with solar panels to provide power for nighttime lighting, in Phase 2 of the bus shelter installation initiative; an additional 12 shelters will be fitted with solar panels.
- Physical Plant has broadened its retrofitting attention to include exterior lighting. They are replacing LPS, HPS, and Mercury with CFL and Pulse Start Metal Halide technology. This provides better re-strike, lamp life, efficacy, and “visual acuity.” They have found they can de-rate the lamp wattage without sacrificing useable light in parking, roadway, and area/walkway lighting. This reduces the amount of “light pollution.”

##### Initiatives Underway

- We are working with OG&E on a wind power partnership. We have asked them to look at section 13 land parcels to see if any are in a good location to construct a wind farm. OG&E is evaluating the maps we sent them.
- We are determining the best way to calculate and verify our carbon footprint (in house or contract). Rick Krysiak has attended a carbon footprint workshop and is scheduled to attend another one at the University of North Texas in November. The decision to be made is whether to obtain the expertise required in house, or contract the assessment to an outside party.

- We are generating and prioritizing additional energy savings projects on campus (metering, controls projects, etc). We will invest in the projects with the largest payback.
- Physical Plant Architectural Services has drafted an Energy Standard (Std 18115) for building design that incorporates energy saving ideas and equipment in the design of new and renovated facilities. The draft is currently in coordination.
- The Physical Plant will look at parking lot lighting to evaluate lighting levels.
- Based on the measurement system we have in place for our current energy conservation program, we qualify to be an Energy Star “Partner”. We have to submit applications and documentation for Energy Star to validate so we can be recognized. We will first get Energy Star “Partner” status, then we can apply for “Leader” status. The Tulsa branch campus has submitted their paperwork for “Partner” status and the rest of the campuses are soon to follow. All campuses should be at “Leader” level within six months.
- The University is currently served by a centralized steam and chilled water system that provides heating and cooling to most campus buildings. The system still has room for expansion although some areas of campus are at or near capacity. Such a centralized system is environmentally sound – depending on the type and efficiency of the central plant – and as new or replacement buildings are planned, the viability of connecting them to the system will be assessed. If it is found that they need to be independent, then systems such as ground source heat pumps, solar/photovoltaics, and wind turbines will be investigated.
- The University currently uses potable (drinking) water for irrigation and in the cooling plant. As the campus expands – especially with the addition of the Athletic Village – this becomes less viable (and less environmentally sustainable) and LRFPPA is currently investigating the use of raw water from Lake Carl Blackwell for campus irrigation, cooling tower water, the Vet Med “animal digester,” and other uses.
- Compressed natural gas – see Transportation below.

### Future Plans

- Obtain at least 75% of our power from alternate energy sources (wind, geothermal, solar, etc).
- Obtain LEED, Green Globes, or Energy Star certification on all new buildings.
- Pursue additional energy savings through energy education and re-investment in more efficient equipment and controls.

## **Food and Recycling**

*Terry Baker, Director, University Dining Services*

### Current Status and Plans Underway

- Locally-Obtained Produce. University Dining Services buys fresh locally-grown produce from vendors who purchase directly from Peach Crest Farms in Stratford, Perinell Produce in Hinton, and J&M Farms in Miami. By buying local products from local vendors, we improve the freshness of our products and at the same time reduce greenhouse gas emissions and pollution from transportation.

- **Organic Options.** After much research this summer, UDS has started featuring organic items on campus. We offer organic mesclun salad mix, carrots, and several grab-to-go organic salads. Other items include the Amy's line of organic products, Seeds of Change, pasta sauces, canned products, beverages, frozen and fresh items. We will soon feature organic yogurt, cereal, grain bars, and dried fruits. The popularity of the organic option on campus is increasing, starting with the Twenty Something convenience store this semester. As organic food popularity grows, we will expand organic options to other food venues on campus. Organic food provides our students with healthy food choices. Also, Fair Trade Coffee is available across campus.
- **Trayless Washing.** Starting the week of October 18<sup>th</sup>, UDS will implement Trayless Tuesdays in our all-you-can-eat facilities at Bennett Hall and Adam's Market. By foregoing cafeteria trays, we support a more sustainable environment by eliminating unnecessary waste and save both water and energy used in washing the trays. UDS will closely monitor savings in food waste.
- **Oklahoma State Products.** This semester, UDS has partnered with Andrea Graves from the OSU Food and Agricultural Products Center (FAPC) to introduce new Oklahoma products in our dining services operations. Andrea has attended several of our production management meetings. These new items include cinnamon rolls, cookies, and beef jerky that can be found in our coffee and sandwich cafes as well as our convenience stores.
- **EcoFriendly Disposable Products.** We are in the final stages of obtaining ecofriendly products in order to "Go Green" with our disposable products in Celebrations Catering. UDS is investigating other possibilities in our retail operations in partnership with our vendors. Eco-friendly cleaning products are available for purchase at campus convenience stores.
- **Education.** UDS management staff recently attended a seminar sponsored by our prime source vendor on eco-friendly and sustainable choices for dining services.
- **Vegetarian and Meatless Options.** All UDS operations offer vegetarian and meatless choices.
- **Cardboard Recycling:** UDS currently sorts cardboard in a separate dumpster at loading docks at our dining locations.
- **Plastic Recycling:** We would like to sort plastic but do not yet have an outlet to take large amounts of plastic bottles and containers.
- **Cooking Oil Reuse and Recycling:** Cooking oils are filtered once per day to extend the life of the oils used and in some cases filtered several times per day. UDS recycles waste oil for alternative fuels such as biodiesel through several professors and community contacts.
- **Aluminum Can Recycling:** UDS coordinates recycling of empty vending soda cans through Habitat for Humanity.
- **Reusable/Recyclable Bags:** In UDS convenience stores, green cloth reusable/recyclable shopping bags (as replacements for plastic bags) are available for purchase.

#### Future Plans

- **Waste Reduction.** UDS is investigating the purchase of a can crusher for all the tin can products we use in our kitchen areas and then establish a process for their pickup and disposal. UDS is also exploring composting and operating its own herb garden for catering.
- **Energy Efficiency.** UDS explores the purchase and use of more efficient water and energy technologies (such as Energy Star rated or equivalent) when replacing existing equipment. We have already purchased two air screen merchandisers with doors to reduce energy waste when the dining operation is closed.

## **Physical Plant**

*Rick Krysiak, Director, PPA*

### Current Status

- The University's recycling program is overseen by the Physical Plant department. Materials recycled include batteries, oil, glass, plastics, and paper. The University currently recycles paper, cardboard, and wood pallets. About 100 tons of paper, 30 tons of cardboard, 45 tons of wood pallets, and 100 tons of scrap metal are recycled annually.
- Additional materials recycled include all types of automotive fluids and telephone directories.
- Landscape wastes are composted and used as fertilizer and soil conditioner.
- University recycles surplus property, including office furniture, electronic equipment, laboratory equipment, and appliances. These items are collected and made available to any state government entity for reuse; remaining items are sold at public auction.
- "Real Cowboys Recycle," a student group, conducts a football game day recycling program. They provide collection stations for recyclable materials.
- The SGA kicked off a new solid waste recycle program this year, primarily for paper products.

### Initiatives Underway

- Expand the SGA recycling program to include plastics and glass.

### Future Plans

- Under development.

## **Green Building**

*Nigel R. Jones, University Architect, Long Range Facilities Planning*

### Current Status

Buildings under construction on the Stillwater and other campuses in the OSU system are incorporating features such as energy efficient lighting; high levels of insulation; connection to existing systems (steam and chilled water) where available, use of high efficiency equipment/alternatives (i.e., ground source heat pumps), and use of daylight. Specific projects include:

- School of Architecture: natural light "harvesting" in design studios with associated controlled artificial lighting; external shading devices at most windows.
- Interdisciplinary Science Research Building: west façade uses external shading devices, energy efficient glass, and fritted glass.
- North Classroom Building: south and west façades uses internal shades, fritted glass.
- Old Central and Murray Hall: reuse of existing building.
- Multimodal Transportation Terminal – encourages the use of public transportation. The parking garage at this facility utilizes an energy saving lighting system that dims the interior lights of the facility based on the amount of external light.

## Future Plans

In 2008, the State of Oklahoma legislature passed HB 3394, the “Conserving Oklahoma Act,” that requires all new state-owned buildings or major renovations of state-owned buildings use as guidelines the US Green Building Council’s LEED (Leadership in Energy and Environmental Design) rating system and the ANSI/ASHRAE/IESNA (American National Standards Institute / American Society of Heating, Refrigerating and Air-Conditioning Engineers / Illuminating Engineering Society of North America) standards. This applies to all buildings over 10,000 gross square feet and will affect most OSU projects. It will include consideration of life-cycle costing; landscaping and irrigation; the building envelope; day-lighting; lighting systems and controls; mechanical systems; equipment and appliances; renewable and alternate energy sources; erosion control; water consumption; indoor air quality; low-emitting materials (adhesives, sealants, paints and coatings, carpets, composite wood and agrifiber products); and indoor chemical and pollutant source control.

Two projects under design will meet LEED criteria:

- The Student Union Renovation at OSU-Stillwater is being designed to achieve LEED-Gold.
- The Institute for Agricultural Biosciences at OSU-Ardmore is being designed to achieve LEED-Silver.

All projects will be designed to meet the requirements of HB 3394 and OSU Building Design Standard, Section 18115 (developed by PPA to interpret HB 3394). LRFP and PPA will keep abreast of the latest developments and innovations and will incorporate appropriate tried and tested designs and technologies.

## **Transportation**

*Chris Hoffman – Manager, Transportation Services*

*Steve Spradling – Director, Parking and Transit Services*

*Rick Krysiak – Director, PPA*

### Current Status and Initiatives Underway

- OSU Transportation Services, in partnership with the Department of Transportation and Transit Services, is soliciting bids for a compressed natural gas (CNG) refueling station on campus. OSU plans to make the fueling station accessible to the public and hopes to encourage local agencies and residents to purchase CNG powered vehicles. The CNG station will be equipped with one fast-fill dispenser and 24 time-fill positions allowing buses and heavy equipment to be fueled overnight.
- We will convert our fleet of 23 transit buses to a dedicated CNG fleet. We currently have the funds for the purchase of 4 or 5 new buses and plan a phased replacement over the next five years.
- Transportation Services is purchasing (10) 2009 Chevrolet Impalas with the CNG conversion option to operate as dedicated compressed natural gas vehicles. These vehicles will be utilized for local use and trips ranging under 250 miles. We also plan to purchase (10) 2009 hybrid sedans for travel outside CNG fueling capabilities. A Miles all-electric low-speed vehicle has been added to the Motor Pool fleet to promote and encourage departments that utilize small utility vehicles to purchase or lease plug-in fully electric vehicles.

- A committee initiated by Ann Hargis comprising members from the Wellness Center, Colvin Center, Transit and Parking, Physical Plant, and Long Range Facilities Planning is developing plans for an OSU Bicycle program to encourage cycling and reduced dependency on automobiles.
- University Mailing Services (UMS) currently operates five electric delivery vehicles. They are also considering CNG for new vehicles as they start to turn over older vehicles.
- We are nearing completion of the Multi Modal Transportation Terminal that will increase the efficiency of the campus and community transit system as well as the intercity bus system that provides service from the OSU Stillwater campus to the OSU Tulsa campus. The parking garage at this facility utilizes an energy saving lighting system that dims the interior lights of the facility based on the amount of external light on a given day thus conserving energy. When complete, the public area will have recycling containers for patrons of the facility.
- UMS is evaluating a CNG vehicle for purchase as a delivery vehicle for their fleet.
- If the University gets a CNG fueling station, the Physical Plant will move to CNG fueled vehicles as they turn over their fleet.

#### Future Plans

- OSU plans to expand the CNG fleet by evaluating all new vehicle purchases and replacing vehicles that can potentially utilize compressed natural gas.
- OSU will require new vehicle purchases to be capable of using an alternative fuel, unless the vehicle qualifies for an exception due to vehicle requirements and alternative fuel vehicle availability.
- Electric powered vehicles will be evaluated for vehicles utilized primarily on campus.
- Physical Plant will conduct life cycle cost analysis of their fleet vehicles to determine which ones should be converted to CNG.

## 2. Sustainability Education Committee

**Members:** *Robert Dooley, Associate Dean for Research, Co-chair*  
*Karen High, Professor, Department of Chemical Engineering, Co-Chair*  
*Will Focht, Director, Environmental Science Graduate Program*  
*John Mowen, Regents Professor, Department of Marketing*

The sustainability education committee is responsible for reporting on the status of the OSU curriculum, including courses, certificates, minors, and degree majors related to sustainability. It also will work to advance sustainability across the curriculum. This section of the report presents its findings to date.

### Sustainability Courses at OSU

#### Current Status

Based on a survey administered this spring and a review of course descriptions included in the 2008 course catalog, we have identified 101 sustainability courses offered at OSU. This list includes 7 courses whose primary focus is on sustainability, 24 courses with a secondary focus on sustainability, and 78 courses that address sustainability in a more peripheral manner.

#### SUSTAINABILITY AS THE CENTRAL FOCUS (N=7)

COURSE #	COURSE TITLE	COURSE DESCRIPTION
ARCH 4233	Sustainability Issues in Architecture	Sustainability topics and their application to architecture.
DHM 4573	Environmental Sustainability Issues for Designers and Merchandisers	Scientific concepts are the basis for the understanding the environmental impacts of textile raw materials, manufacturing, dyeing, finishing, packaging and product lifecycle as related to apparel and interior design products. McDonough and Braungart's "cradle to cradle" design model will be introduced through case study analyses for informed design, buying and specification decisions.
ENVR 5303	Issues in Environmental Sustainability	The course reviews human-nature relationships and how they affect the ability of future generations to sustainably improve their quality of life. The course also considers methods of environmental stewardship that can contribute to sustainability. In-class and/or online discussions of issues, guest presentations by outside experts, and reports on selected topics are included.
ENVR 5500/6500	Environmental Management Practicum	This course explores methods of analyzing sustainable solutions to complex environmental, safety and health problems using an integrated team approach. This approach combines technical, legal, economic, and sociopolitical information into a coherent analytical framework. ENVR 5500 required for masters students pursuing a plan of study in environmental management. ENVR 6500 required for doctoral students pursuing a plan of study in environmental management.
PLNT 4673	Cropland Ecosystems	Designing sustainable cropping systems that optimize yield potential, economic and environmental benefit based upon climatic and social conditions.
SOC 6463	International Issues in Environmental Sociology	Advanced study of the international context of environmental issues. Particular emphasis is placed upon the international institutional contexts that enable and constrain the achievement of sustainable development.
ETM 5481	Sustainable Enterprise Strategies	The principles of sustainability in the context of industrial enterprises. The implications of sustainability in design of products, industrial systems and infrastructure. The importance of life cycle cost analysis as a key engineering economy tool.

### SUSTAINABILITY AS A SECONDARY FOCUS (N=24)

COURSE #	COURSE TITLE	COURSE DESCRIPTION
AGEC 4503	Environmental Economics and Resource Development	Economic, social, and political factors relating to conservation, natural resource development, and environmental quality. Valuation of priced and non-priced natural and environmental resources. Analysis of environmental and natural resource policy and the role of public and private agencies in conservation and development.
BOT 3253	Environment and Society	The impact of human activities and population growth on the natural world. Analysis of the potential of technological and societal changes to have an impact on the environment. For the non-biology major.
CHE 4343	Environmental Engineering	Application of science and engineering principles to minimize the adverse effects of human activities on the environment. National and state environmental regulations. Predictive movement and fate of chemicals in the geospheres. Multi-media pollution assessment, analysis and control. Consideration of safety, health and environmental issues from a process standpoint.
CHE 5343	Advanced Environmental Engineering	Science and engineering principles to minimize the adverse effects of human activities on the environment. National and state regulations. Predictive movement and fate of chemicals in the geospheres. Multimedia pollution assessment, analysis, and control. Consideration of safety, health, and environment issues from a process standpoint. Special project required. Credit not allowed if CHE 4343 was taken.
CIVE 5923	Water Resources Planning and Management	Application of engineering economics and microeconomic theory to the planning and management of water resources projects, including flood control, hydroelectric, water supply, and urban storm water. Systems analysis approaches, primarily linear and dynamic programming, and their application in water resources.
CIVE 6923	Industrial Wastes Engineering	Theory and methods of waste minimization, waste product reduction or reuse; process changes and treatment of residuals to reduce volume and toxicity of industrial wastes.
ENVR 5210	Special Topics in Environmental Science	Topics and issues in the broad field of environmental science. Group discussions and projects not covered by existing courses such as ecological risk assessment, water chemistry, environmental law, and sustainability.
ENVR 5123	Environmental Problem Analysis	This course reviews the process of environmental problem analysis using current practical examples. This course draws on theories from various disciplines and applies appropriate techniques of analysis.
ENVR 5510	Environmental Management Internship	The student must identify and solve an environmental problem under the supervision of a competent professional environmental manager, and submit and defend a formal report presenting the problem, solution analysis methodologies, and recommended solution. The internship must involve at least 240 contact hours with the manager. The course is required of all masters students pursuing a plan of study in environmental management.
ENVR 5523	Industrial Ecology for Environmental Scientists	Provides students with an overview and broad understanding of ecology principles as applied to an industrial setting. The course begins with an overview of general ecological principles such as ecosystem components and structures, biogeochemical cycles, energy flows, and properties of populations. The course concludes with a consideration of industrial ecology principles such as sustainability, pollution prevention, life cycle assessment and waste minimization.
ENVR 6310	Advanced Topics in Environmental Science	This course covers current topics and issues in environmental science. Though the topics will vary, each course will typically include environmental assessment, environmental sustainability, and environmental policy. Group discussions and team projects may be required.
GEOL 1014	Geology and	The influence of geology and related earth sciences on the human

	Human Affairs	environment. Energy and material resources, beneficial and hazardous natural processes, and the planetary and biological evolution of earth. Lab investigations environmentally oriented.
GEOG 1114	Physical Geography	Distribution and analysis of natural features of the earth. Landforms, soils, minerals, water, climates, flora and fauna. Emphasis on human-environment relations where appropriate.
GEOL 4663	Global Geologic Resources	Distribution and analysis of global mineral, energy and water resources. Economic, environmental, social, and political impact of selected resources on local to global scales.
IEM 4953/ 5953	Industrial Assessment and Improvement	Plant assessment and improvement-based concepts, strategies, and tools for manufacturing operations. Emphasis is on small to medium-sized manufacturing operations. Issues include energy, water, waste, quality, and productivity analysis across the organization from a systems perspective. Justification of improvement projects and measurement of results.
SOC 4433	Environmental Sociology	Critical assessment of the social causes and consequences of problems with resource scarcity and environmental degradation. Environmental problems viewed as social problems, requiring an understanding of the structural conditions producing environmental problems and inhibiting resolutions.
SOC 4453	Environmental Inequality	Prerequisite(s): 1113. Considers the connection between environmental problems and race/ethnicity and class inequality. Focuses on environmental justice/equity, social movements, health, policy and risk at the local, national and global levels.
SOC 5463	Seminar in Environmental Sociology	Critical overview of contemporary developments in environmental sociology. Environment concern, disasters, health issues, risk assessment, and environmental conflict.
SOC 5473	Seminar on the Contemporary Environmental Movement	Critical overview of contemporary theory and research on the environmental movement. Analysis of crucial movements dynamics, including historical development, central organizing themes, strategies and tactics, and movement activities, environmental health movements, and transnational movement campaigns.
SOC 5493	Seminar in Environmental Justice	Considers racial, class and equity implications of environmental degradation and regulation. Includes discussion of controversies over the siting of hazardous facilities in urban and rural areas, the extraction of resources from native lands, national and transnational export of toxic waste to the South and the development of a distinct environmental justice movement.
SOIL 3893	Soil Chemistry and Environmental Quality	Soil chemical processes that affect plant nutrition, nutrient cycling, and fate of environmental pollutants. Chemistry of soil surfaces and soil solution, of important soil processes, and of agronomic and environmental topics such as water quality, soil acidity, pesticide residues, environmental chemistry and risk assessment, soil remediation and contaminant bioavailability, land application of municipal and industrial wastes, long-term reactions, and environmental fate.
SOIL 4234	Soil Nutrient Management	Soil fertility and use of fertilizer materials for conservation, maintenance, and improvement of soil productivity and to minimize environmental concerns.
SOIL 4363	Environmental Soil Science	Presentations of soil processes and interpretation for natural resource management; land reclamation; identification of wetlands; oil and soil

		damages; impact of fertilizer, pesticide and other agricultural chemicals on soil and water quality; water resources; long-term soil erosion and landscape formation; transformations of manure, sewage sludge, and other organic by-products.
SOIL 5813	Soil-Plant Nutrient Cycling and Environmental Quality	Theory and application of soil plant relationships in production and non-production environments. Nutrient cycling, mass balance, soil nutrient supply and plant response. Methods to reduce the impact of nutrients on environmental quality, soil-plant buffering and response models.

### **SUSTAINABILITY AS A PERIPHERAL FOCUS (N=76)**

These are listed in **Appendix 2**

### Initiatives under Consideration Concerning Curriculum Development

- Create a sustainable environments “option” in the Environmental Studies Certificate program.
- Create a sustainable environments “option” in a new Environmental Studies minor in the College of Arts and Sciences.
- Create a sustainability specialization within the Environmental Science Graduate Program.

### Future Plans (intermediate term, 2-3 years)

- Create a separate sustainability certificate (perhaps in the College of Arts and Sciences, both graduate and undergraduate).
  - 18 hours (9 core + 9 electives from specialization areas such as sustainable communities, sustainable energy, sustainable development (land and structures), sustainable products and manufacturing, and sustainable entrepreneurship (ecopreneurship).
- Create a sustainability minor in the College of Arts and Sciences.
  - 24 hours (9 interdisciplinary core + 6 unidisciplinary core + 9 electives).
- Create a Gen Ed category for environmental sustainability (E) and make it a requirement.
  - Current potential candidate courses are GEOL 1014, GEOG 1114, and a revised BOT 3253 to eliminate pre-requisites (most current courses in sustainability are upper division, especially 4000).
  - Encourage development of new courses and revisions to existing courses to expand list of options.

### Future Plans (long term, 4-5 years)

- Create a sustainability major, both graduate and undergraduate.
  - Potentially affiliated with the existing Environmental Science Graduate Program in CAS and either the Environmental Sciences Undergraduate Program in CASNR or the Environmental Studies Undergraduate Program in CAS.

### 3. Sustainability Research Committee

**Members** *Will Focht, Director, Institute for Sustainable Environments, Chair*  
*Dale Maronek, Head, Department of Horticulture and Landscape Architecture*  
*Mike Woods, Head, Department of Agricultural Economics*  
*Ray Huhnke, Professor, Biosystems and Agricultural Engineering*  
*Todd Halihan, Associate Professor, School of Geology*  
*Jerry Malayer, Associate Dean for Research, College of Veterinary Medicine*

The Sustainability Research Committee is charged with reporting on, and advancing, sustainability research at OSU. It works with the Institute for Sustainable Environments, located within the Division of Research and Technology Transfer, to promote this research. This section presents our findings and plans so far.

#### Results of the Sustainability Research Survey

##### Current Status

The Institute for Sustainable Environments (ISE) administered an online survey this spring to identify those faculty members at OSU who are engaged, or plan to be engaged, in sustainability research. Altogether, 105 faculty members indicated an interest in sustainability research. They come from all colleges, as follows: CASNR = 44, CAS = 26, CEAT = 15, CHES = 9, COE = 4, SSB = 4, and CVM = 3.

Their research interests fell into 11 research themes. Each of these is briefly summarized below, in descending order of the number of faculty members involved. One or two projects in each theme are also identified as examples of the work being conducted.

- **Sustainable Agriculture.** This theme addresses agricultural practices aimed at water and soil conservation, low inputs, integrated pest control, waste reduction, and other activities that can produce sustainable agricultural product yields. Twenty-one faculty members are currently researching this area. Michael Anderson's "Plant Growth Promoting Bacteria" project aims to increase agricultural yields and reduce fertilizer inputs. Hailin Zhang's "Sustaining Oklahoma's Wheat Production by Soil Testing" uses improved testing technology to help farmers to make better sustainable economic decisions.
- **Conservation of Natural Resources.** Enlightened stewardship of natural resources is crucial to sustaining their production and use. Twenty-one faculty members are also involved in research this area. Bill Fisher's "Application of Gap Analysis to Biodiversity Conservation in Oklahoma" provides an initial step to a more detailed and comprehensive effort at long-term planning for biodiversity conservation in Oklahoma. Keith Owens's "Patch Disturbance for Ecosystems Restoration: Vegetation, Grazing, and Wildlife Interactions in Heterogeneous Landscapes" investigates the impacts of heterogeneity and distribution on ecosystems and possible restorative practices.
- **Energy.** Energy research, especially into renewable energy sources, can yield results that reduces cost, reduces pollution, conserves resources, increases energy security, reduces reliance on foreign energy sources, and creates jobs. Seventeen faculty members are currently researching this area. Yanqi Wu's "Improving Biomass Yield and Seed quality in Switchgrass" seeks to improve the genetic makeup of switchgrass to increase its potency as an energy crop. Carol Jones's "Harvesting and Handling Equipment to Meet the Demands of Oklahoma Lignocellulosic Biomass under Indigenous Growing Conditions" is looking for sustainable ways to produce

biofuels here in Oklahoma. OSU is also a part of the Oklahoma Bioenergy Center (OBC) along with the University of Oklahoma and the Noble Research Foundation. OBC-funded projects related to biofuels are currently underway. Additionally, OSU and OU have partnered on licensed technology to produce biofuels from any carbon-based material.

- **Zero Waste/Waste Management/Pollution Prevention.** Cutting down on waste production can free up landfill space and promote product reuse. Sixteen faculty members are currently involved in this area. Jeff Hattey's "Animal Waste Management in Semiarid Ecosystems" seeks to develop plans for the sustainable use of livestock waste. Tim Bowser's "Food Byproduct Utilization" project optimizes waste streams at a large food processor in Oklahoma.
- **Social/Community Sustainability.** Strengthening communities is an important aspect of sustainability, which can be accomplished through the promotion of social justice and equity. Thirteen faculty members are currently pursuing research in this area. Riley Dunlap's "International Attitudes toward Environmental Issues" measures public acceptance of sustainable development. Mike Woods' "Entrepreneurial Communities" project identifies the traits and characteristics that lead communities to nurture successful entrepreneurs.
- **Sustainable Development.** Sustainable rural, urban, and suburban development that minimizes their ecological footprints are also essential components of sustainability. Thirteen faculty members are engaged in this research. John Veenstra's "Sustainable Development in Northwest Costa Rica" measures the impacts of cattle ranching and reforestation on pollution loads to rivers and economic development in this region of Costa Rica.
- **Green Architecture/Landscape Architecture.** Green building design reduces energy and water use, uses recycled and recyclable materials, minimizes ecological disruption, and promotes the aesthetic value of green spaces. Ten faculty members are conducting this type of research. Huatian Cao's "Design of Sustainable Relief Housing in Africa: An Implementation of 'Cradle to Cradle' Model in Earthbag Construction" project creates new construction techniques for African relief housing.
- **Green Product Design.** Producing everyday items in a sustainable way, whether by using less non-renewable materials, making products that are reusable, reducing energy consumption, reducing waste generation, or using less toxic materials, is the goal of "design for the environment" initiatives that promote green manufacturing and green product design. Seven faculty members are currently researching this area. Huatian Cao's "C2CAD: A Sustainable Apparel Design and Production Conceptual Framework" integrates the 'cradle to cradle' model into apparel design and production models to provide sustainable production guidelines for apparel designers and manufacturers.
- **Industrial Ecology.** Industrial ecology applies the lessons of biomimicry and other natural systems designs to industrial/manufacturing operations. Five faculty are currently researching this area. Bill Kolarik's "Industrial Assessment Center" aids manufacturing businesses in energy conservation and efficiency.
- **Ecotourism.** Sustainable ecotourism educates people on the environment. Four faculty members are involved in this research. Lowell Caneday's "Resource Management Plan: Natural Falls and Eucha" developed a resource management plan for two of Oklahoma's state parks.
- **Business Sustainability.** This theme seeks to maintain a healthy economy while also addressing environmental and social sustainability. Three faculty members are interested in this area. We

were not able to identify any current research projects, though we suspect that this area is ripe for development at OSU given the new entrepreneurship program.

## Initiatives Underway

### *Institute for Sustainable Environments (ISE) Research Workshop*

The purpose of this workshop was to encourage the formation of interdisciplinary, intercollege teams of researchers to submit competitive sustainability research proposals to external sponsors such as US Department of Energy, US Environmental Protection Agency, National Science Foundation, US Department of Agriculture, and other agencies and organizations. ISE will fund up to four \$5K proposal development grants each year to support the preparation of research proposals that address at large, interdisciplinary projects.

- Colloquium was held on November 4, 6-9 pm, at Meditations.
- Invitations were issued to 54 faculty who were identified as interested in sustainability research.
- Five themes were defined to correspond to funding opportunities.
  - Sustainable environmental systems
    - Leads = Dale Maronek (HLA) and Will Focht (POLS and ISE)
  - Sustainable engineered systems
    - Leads = Karen High (CHE) and Bill Kolarik (IEM) (invited)
  - Sustainable energy systems
    - Leads = Ray Huhnke (BAE) and Bill Henley (BOT)
  - Sustainable waste management systems
    - Leads = Doug Hamilton (BAE) and Janet Cole (HLA) (invited)
  - Sustainable rural communities
    - Leads = Mike Woods (AGEC) and Renee Daugherty (HDFS)

## Future Plans

ISE will work with research offices in the various colleges to continue to promote sustainability research and encourage participation in our proposal development program.

An opportunity also exists to combine Sustainability research with research into Energy Conservation and new Renewable Energy sources. Interests of several of OSU's major donors could be leveraged, as described in a Summary by the VPRTT of Security and Energy research, submitted to President Hargis on Oct. 14<sup>th</sup>, 2008. The Energy part of that Summary document is appended to this Report as Appendix 3.

# Appendix 1

## American College and University Presidents Climate Commitment

“We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities. **Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality:** “

Required Steps	OSU Status
1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible	
a. Within two months of signing this document create institutional structures to guide the development and implementation of the plan.	<b>Although not specifically formed to monitor carbon neutrality and so develop a strategy to achieve this, the President’s Sustainability Task Force could take on this responsibility. The ‘Sustainability Director’ could be the individual with prime responsibility.</b>
b. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter.	<b>This is currently underway, under the direction of the Physical Plant director, Rick Krysiak</b>
c. Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:	
i. A target date for achieving climate neutrality as soon as possible.	<b>No action at this time</b>
ii. Interim targets for goals and actions that will lead to climate neutrality.	<b>No action at this time</b>
iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all	<b>Already underway. Several research themes related to Energy will contribute to carbon neutrality.</b>

students.	
iv. Actions to expand research or other efforts necessary to achieve carbon neutrality.	<b>No action at this time.</b>
2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.	
a. Establish a policy that all new campus construction will be built to at least the US Green Building Council's LEED Silver standard or equivalent.	<b>Already established.</b>
b. Adopt an energy efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.	<b>Already underway.</b>
c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.	<b>No action at this time.</b>
d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.	<b>Already successfully done.</b>
e. Within one year of signing this document begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.	<b>This initiative is already underway; we plan to purchase wind power from OG&amp;E.</b>
f. Establish a policy committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.	<b>This would be a decision for the OSU Foundation.</b>
g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.	<b>Although we do not compete in the RecycleMania competition, we have adopted several measures to reduce waste.</b>
3. Make the action plan, inventory, and periodic progress reports publically available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination.	<b>Planned</b>

## Appendix 2

### Courses with Sustainability as a Peripheral Focus (N=78)

COURSE #	COURSE TITLE	COURSE DESCRIPTION
ACCT 5033	Natural Resource Taxation	Federal income tax laws applicable to the acquisition, operation, and disposal of natural resource properties.
AGCM 4403	Planning Campaigns for Agriculture and Natural Resources	Communications campaign development for agriculture and natural resources activities and issues, including development of materials, budgets and contracts.
AGEC 4723	Rural Economic Development	Concepts and theories of regional and community economics, including input-output, economic base, simulation, budget location and routing. Oklahoma applications.
AGEC 5503	Economics of Natural and Environmental Resource Policy	Economics of long term resource use with particular emphasis on agricultural and forestry problems. Methods for estimation of nonmarket prices. Cost benefits analysis of long term natural resource use and environmental policy. Elementary computer simulation of long term resource use and environmental policy.
AGEC 6700	Agricultural Policy and Rural Resource Development Seminar	Frontier issues in agricultural policy, natural resources, and rural development.
ARCH 4183	History and Theory of Architecture: Cities	The development of cities as an aspect of architecture from ancient times to the twentieth century.
BAE 2023	Physical Properties of Biological Materials	Basic engineering fundamentals applied to characterization and determination of physical properties of biological materials, including water relations, rheological, thermal, and electromagnetic properties, materials drying concepts, fans, psychrometrics, and refrigeration.
BAE 4400	Special Problems	Investigations in specialized areas of biosystems engineering.
BAE 5030	Engineering Practice	The identification, analysis and synthesis of an authentic problem in agricultural and biological engineering. Solution of the problem will involve making engineering decisions tempered by real-time restraints, economic realities, and limited data with due consideration for environmental and social implications.
BAE 6343	Groundwater Contaminant Transport	Principles of solute and multiphase transport in soils and ground water. Effects of advection, diffusion, dispersion, degradation, volatilization and adsorption. Relationships between laboratory and field scale transport. Contamination by nonaqueous phase liquids.
BIOL 3034	General Ecology	Physical and biotic environment, responses of organisms to the environment, behavioral and community ecology, natural ecosystems and man's interaction with ecosystems.
CHEM 1414	General Chemistry for Engineers	Survey course for engineers needing only one semester of chemistry. Thermodynamics, atomic structure, solid state, materials, equilibria, acids and bases, and electrochemistry.
CHEM 3353	Descriptive Inorganic Chemistry	Structures and properties of the elements and their many compounds in the broadest sense which includes the modern technologically important materials, organometallics, and inorganic substances of biological significance.
CIVE 6853	Modeling of Water Resources Systems	Application of finite-difference and finite-element methods to predict water flow and chemical and biological water quality in saturated-unsaturated ground waters, streams, lakes, urban areas, and watersheds.

CIVE 6953	Advanced Biological Waste Treatment	Advanced biological treatment processes and new process developments. Nutrient management, anaerobic wastewater treatment, hazardous waste bioremediation, land treatment, and macrophyte systems. Use of kinetic models for system design.
DHM 4003	Environmental Perspectives on Apparel and Interior Design	Analysis of apparel and interior design, development and use from physical, technological, economic, political, religious, social and aesthetic perspectives.
ECEN 5153	Direct Energy Conversion	Energy conversion techniques and applications; thermo-electrics, thermionics, fuel cells, MHD and other processes involving electrical, mechanical and thermal energies. State-of-the-art developments in direct energy conversion using selected papers from journals and other publications. Gives the student a proper perspective of the possibilities and problems associated with satisfying future energy requirements.
ECON 5013	Contemporary Environmental Policy	Economic, social and political factors that influence the formation and implementation of environmental policy. Environmental policy instruments (including pollution taxes, standards and marketable pollution permits), measurement of environmental damages and risk. Risk comparison, regulatory issues, health risk assessment, and risk communication. Political-economic considerations.
EDLE 6603	Organizational Theory in Education	Selected organizational typologies, conceptualizations and theoretical frameworks as they relate to organizational behavior and behavior of personnel in organizations.
ENTO 2003	Insects and Society	Course for non-majors that emphasizes the impact of insects on society. Influence of arthropods in beliefs, culture and fears and the view of insects in folklore and mythology from ancient times to present. Focus on the use of insects as model systems in biological research. Exposure to the use of insects in teaching, music, art, literature and the cinema.
ENTO 2992	Introduction to the Science of Entomology	Basic biology and classification of insects and closely related animals. Overview of the ecological roles of insects in both natural and managed ecosystems.
ENTO 4464	Insect Biology and Classification	Insect phylogeny, taxonomy, behavior, morphology and physiology in the context of ecosystem function. Major roles of insects in shaping ecosystem diversity, as indicators of environmental integrity, and as vectors of plant and animal pathogens and parasites.
ENTO 4483/5483	Aquatic Entomology	Biology, taxonomy and ecology of insects and other invertebrates, inhabiting freshwater environments. Emphasis is placed on identification and biology of individual taxa. Roles of insects in aquatic ecology, as a forage base, and as indicators of biotic integrity of aquatic systems. Linkages between aquatic systems and terrestrial systems are also examined. No credit for students with credit in ENTO 5483 or ZOOL 5483. (Same course as ZOOL 4483)
ENVR 6210	Advanced Seminar in Environmental Science	This course is offered as a special topics course for doctoral students. The theme of the course will vary in accordance with recent advances in environmental science and the interests of the faculty instructor. No masters student may enroll in this course.
ETM 5110	Seminar	Guided study in a topic area selected to enhance a student's program.
GEOG 3023	Climatology	Characteristics and distribution of world's climate. Patterns and associations of temperature, precipitation, pressure and winds. Regional climates of Earth. Climate change.
GEOG 3153	Conservation of Natural Resources	Problems and corrective methods of conservation of land, water, forests, wildlife, minerals and people.
GEOG 4163/5163	Resource Management in the National Parks	Contemporary resource management issues in US National Park units. The role of human and natural processes in the management of water, air, biotic and cultural resources.

GEOG 5113	Landscape Ecology	Principles of landscape ecology, including structure and function of landscape elements such as patch, corridor, boundary, and matrix. Role of geographic processes, climate, biota, disturbance, and human influences in landscape structure and function. Interaction among landscape elements and role of landscape structure in ecosystem and landscape dynamics. Applications of landscape ecology to biodiversity conservation, wildlife management, and landscape planning. Survey of quantitative methods used in landscape ecology.
GEOG 5123	International Resource Management	Spatial perspectives on the assessment and management of natural resources. The role of resources in world trade, security and international environmental concerns.
GEOL 3503	Environmental Geology	Application of geologic principles to environmental issues, including human use of the surface and subsurface of the earth and human interaction with extreme natural events such as earthquakes, floods and landslides. Field trip is required.
GEOL 4453	Hydrogeology	The water cycle and ground-water systems as well as general problems related to ground-water occurrence, quantity, quality and pollution. Field trip required.
GEOL 4463	Physical Hydrogeology	Physical ground-water systems. Realistic problems to acquaint students with ground-water occurrence and movement. Geologic, geophysical, hydraulic testing and modeling techniques used to define an actual ground-water system. Ground-water regulations. Field trips required.
GEOL 5453	Advanced Hydrogeology	Advanced quantitative techniques used to address ground-water management and pollution. Advanced field and laboratory techniques as well as management and chemical transport models applied to actual field problems and case studies.
GEOL 5503	Advanced Environmental Geology	Utilization of geologic principles to resolve environmental issues in land use, land management and development. Methods of acquiring, compiling, and applying geologic information for site assessment and environmental impact. Application of these methods to an interdisciplinary project. Field trips required.
GEOL 5523	Environmental Organic Geochemistry	Introduction to some environmental aspects of organic geochemistry. Soils and sediments as pollutant receptors, sources of pollutants and selected aspects of environmental health.
HORT 4543	Nursery Production	Commercial production of field- and container-grown woody ornamental crops.
IEM 5923	Advanced Energy and Water Management	Continuation of material covered in 4953 with emphasis on modern management techniques. Cogeneration, energy management control systems, private purchases of gas, energy accounting. Significant case study or term paper required.
LA 4573	Recreation Planning	Theory and methods for small and large scale area planning with emphasis on natural and cultural resources.
LEIS 4463	Areas and Facilities in Leisure Services	Planning, design and development of areas and facilities in leisure service delivery systems.
LEIS 4473	Outdoor Recreation	Theory and practical application of outdoor recreation concepts with emphasis on philosophies, principles, policies, economics, trends, and problems.
LEIS 6023	Special Topics in Leisure Studies	Special topics related to recreation, parks and leisure studies. Investigation, discussion and analysis of contemporary topics.
NREM 1214	Introduction to Wood Properties and Products	Basic understanding of anatomical, physical and mechanical properties of solid wood and wood products. Macroscopic and microscopic identification of wood. Principles of manufacture of lumber, plywood and wood composites. Biological deterioration of wood and main wood preservation techniques. One weekend field trip required.
NREM 2114	Timber Harvesting	Theory and strategies of planning and management of timber harvesting.

		Harvesting techniques including felling, bucking, skidding operations, and cable yarding. Timber harvest cost analysis, safety aspects of harvesting, and principles of forest road building. Field practices in road design and surveying. Field trips to industrial timber harvesting operations.
NREM 3513	Principles of Conservation Biology	Application of ecological principles to the maintenance and restoration of biological diversity at genetic, population, and community levels.
NREM 4323	Timber Management	Regulation of forest growing stock to meet management objectives. Land and timber appraisals. Organization of the forest enterprise to meet financial objectives of management.
NREM 4333	Forest Resource Management: Planning and Decision-Making	Integrated problem solving, to apply biological, quantitative, economic, political, and administrative principles in solving forest resource management problems.
NREM 4403	Wetland Ecology and Management	Ecology, classification, restoration, and management of wetlands. Adaptations of wetland plants and animals, structure and function of wetlands, field identification of wetland plants, restoration techniques, wetland classification systems, management and conservation of wetlands, and regulatory processes.
NREM 4413	Watershed Hydrology and Water Quality	A study of the effects of land management on non-point source pollution of surface waters. Basic watershed hydrology and the role of hydrologic processes and watershed characteristics in controlling the quantity and quality of water from watersheds. Forest, range and agricultural land uses. Discussion of methods of non-point source pollution control.
NREM 4414	Fisheries Management	Techniques and principles involved in management of fishes. Field trip fee required.
NREM 4513	Wildlife Management	Biological basis for the management of wildlife populations and habitats, with emphasis on current management problems.
NREM 4524	Wildlife Management Techniques	Research techniques and methodology in wildlife science. Experimental design, wildlife population and habitat analysis, wildlife and vegetation sampling techniques, aging and sexing techniques, and report preparation and presentation.
NREM 5433	Fisheries Science	Principles of fisheries science as they relate to fish and aquatic biota, their habitats, and the humans who utilize them.
NREM 5464	Stream Ecology	Ecology of streams and rivers, physical and chemical properties, biotic assemblages and interactions, ecosystem processes and theories and human impact.
NSCI 5713	Advanced Community Nutrition	Current issues in community nutrition with emphasis on program development and evaluation of community nutrition programs. Analysis of the impact of economic, political, legislative and cultural diversity factors in the field of community nutrition.
PLNT 4613	Forage and Grazing Lands Resource Management	Designing forage systems that optimize yield potential, economical livestock production and pasture system development.
PLP 3343	Principles of Plant Pathology	Introduction to basic principles and concepts of plant pathology, including the nature, cause and control of biotic and environmentally induced plant diseases, with emphasis on principles and methods of disease management. Offered in combination with PLP 5343. No credit for both 3343 and 5343.
POLS 4363	Environmental Law and Administration	Statutory law, case law, and administrative practices relating to regulation of the environment including environmental impact statements, pollution, public lands, and preservation law.
POLS 4593	Natural Resources and Environmental Policy	Current issues in the law, politics and administration of energy, land, water, mineral and other natural resources policy with particular emphasis on relations to environmental policies and law.
POLS 5620	Seminar in Natural	Analysis of the legal and public policy aspects of environmental regulation,

	Resource Policy, Law, and Administration	including special emphasis on one of three components: environmental law, administrative law, and national resource law and policy.
POLS 5633	Practical Environmental Compliance	Environmental decision-making, reading and understanding environmental statutes and regulations, and effectively dealing with the EPA. Environmental permitting and enforcement, policies and procedures. Review of hazardous waste regulations with emphasis on ground water problems.
SOC 4463	Technology and Society	Exploration of various aspects of the relationship between society and technology. Analysis of arguments about the role of technology in society. Examination of the social contexts within which technology is created and discussion of the mechanisms and processes through which technology is embraced or discarded, such as peer review, politics, religion, and legal frameworks.
SOC 4473	Oklahoma Environmental Sociology	Critical assessment of the social causes and consequences of environmental problems in Oklahoma, both historical and contemporary. Examines the Land Run, the Dust Bowl, the Oil Boom, land ownership and use patterns.
SOC 4533	World Population Problems	Fertility, mortality and migration, and other factors related to population size, density, and composition; the population explosion, worldwide famine, birth control, and other serious social issues.
SOC 5223/INTL 5223	Culture, History & the World System	The modern world system and its new social formations resulting from increasing globalization. Examination of cultural, socio-economic, and political changes in developed and developing societies. Modern societies, their historical developments, the cultural politics of difference, and the re-emergence of ethnic groups worldwide. Existing theoretical models of change for profit and non-profit organizations.
SOC 5333	Global Population and Social Problems	Study in world, regional and national population characteristics, changes and associated problems and cultural influences.
SOC 6460	Advanced Studies in Environmental Sociology	Intensive examination of selected topics in environmental sociology.
SOC 6493	Sociology of Disaster	Critical examination of contemporary theory and research on the social aspects of disasters. Social system response to large-scale crises. Vulnerability, warnings, preparedness, recovery, mitigation, and sustainability.
SOC 4950	Current Topics in Sociology	Special topics in sociology; topics vary from semester to semester.
SOIL 2124	Fundamentals of Soil Science	Principal physical, chemical, and biological properties of the soil related to plant growth; soil testing and fertilizer usage; formation and classification of soils, rural and urban land use.
SOIL 4213	Precision Agriculture	Introduction to the concepts of precision agriculture including analysis of spatial variability, relationships of fertility and crop response, geographical information systems, variable rate technology, optical sensing, global positioning systems, and yield monitoring. Case studies included for detailed analyses. (Same course as BAE 4213*)
SOIL 4463	Soil and Water Conservation	Assess the importance, quality, and quantity of soil and water as natural resources for ecosystems and societies. Principles of soil erosion processes and management practices to decrease erosion in urban, cropland and rangeland systems. Understand the principles of hydrology cycle to improve water use efficiency of precipitation and irrigation resources. Examine resource mismanagement that have resulted in desertification, salinization and deforestation.
SOIL 4563	Dynamics of Wetland, Forest, and Rangeland Soils	Dynamics of soils that receive minimal or no production input. Identification of wetland soils and the biogeochemical reactions occurring in wetland soil environments. Nutrient cycling, physical, chemical, and

		biological properties of forest and rangeland soil systems.
SOIL 4863	Animal Waste Management	Aspects of animal waste management related to animal nutrition, system design, land application, and economic acceptance.
SOIL 5224	Soil Chemical Processes and Impact on Environmental Quality	Chemical and physical properties of soil minerals as they pertain to solution chemistry; nutrient and contaminant availability and speciation as dictated by ion exchange, precipitation/dissolution, and adsorption reactions; soil acidity; surface chemistry and adsorption reactions. Review of current research in soil and environmental chemistry literature and writing of scientific peer-reviewed articles.
SOIL 5613	Laboratory Methods of Soil, Plant, and Environmental Analysis	Methods in soil and environmental sample analysis. Presentation and discussion of the theory behind chemical analysis of soils, plants, and waste materials for agricultural and environmental purposes. Hands-on laboratory analysis of personal soil samples. Theory and practices of common laboratory techniques and equipment/instrumentation such as colorimetric spectroscopy, charge analysis of soils, forms of acidity, phosphorus extractions and behavior, ICP-AES. The course is heavily lab-based.
ZOOL 4115	Biology of Fishes, Amphibians, and Reptiles	Systematics, evolution, and natural history of fishes, amphibians and reptiles; laboratory emphasis on Oklahoma species. Offered spring semester of even-numbered years. Weekend field trips required.
ZOOL 5112	Advanced Herpetology	Selected advanced aspects of evolution, systematics, biogeography, natural history, physiology, husbandry, nutrition, ecology, behavior, and population biology of reptiles and amphibians as drawn from the primary literature.

## Appendix 3

The Energy Section of the Summary provided by the VPRTT to President Hargis on October 14<sup>th</sup>, 2008 is included herein.

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### ENERGY

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#### RESEARCH AT OSU

The topics of energy supply, use and conservation are well represented in the research interests of OSU faculty members but, unlike the areas of Security and Food Safety, no identifiable Centers yet exist. Energy conservation is a research interest of OSU's Institute for Sustainable Environments (ISE), but it is not the sole interest of this group. There is no Energy equivalent to the UML.

Nevertheless, significant research is underway. In 2005, President Schmidly and Provost Strathe initiated the Energy Task Force, led by Dr. Kalid Gassem (Chemical Engineering). The Task Force's charge was to create an inventory of current and potential energy research, instruction and outreach, and plan an Energy Summit on campus in the 2006 academic year. Despite hard work by the Task Force in which they successfully completed an inventory of research interests in this arena, the idea of the Energy Summit was placed on indefinite hold. Ultimately the Task Force was disbanded. Despite this, a comprehensive database of the research and teaching interests of OSU faculty was established, although it is now perhaps a little out of date. The survey indicated that over 90 faculty were actively engaged in energy-related scholarship, covering all colleges except CVHS.

Topics under study at OSU include (in alphabetical order):

- Accounting
- Building design for greater energy efficiency
- Conservation and sustainability
- Conversion
- Distribution and transmission
- Economics
  - Commodities
  - Economic impacts
  - Hedging
  - Pricing
- Energy forecasting
- Energy Security
- Environmental issues
  - Clean-up
  - Contamination
  - Pollution
- Exploration and drilling
- Financing
  - Mergers and acquisitions
- Fuels
  - Alternatives
  - Biofuels
  - Coalbed methane
  - Fossil
  - General
  - Oil & Gas

- Ground source heat pumps
- Load calculations
- Management
- Process control
- Recycling
- Sensors
- Solar
  - Photovoltaics
- Storage
- Wind energy

Again, while not meant to be all-inclusive, the list gives a good assessment of the overall research and scholarship interests of OSU faculty members in the energy sector.

What is missing at OSU is a centralized entity through which all such research interests can be coordinated. I.e. we do not have an “Energy Center” or its equivalent. Unlike the Security & Food Safety subject areas, the Energy research landscape at OSU is characterized by individual groups working separately.

However, there is emerging one area that appears to be an exception to this, namely research in biofuels. This coalescence and organization of research programs, primarily but not exclusively in DASNR, has been stimulated by the establishment of the state-level organization, the Oklahoma Bioenergy Center (OBC). The OBC is funded (\$14M so far) by the state as part of a \$40M authorization for the Center initiated by Gov. Henry in 2007. Funds from the OBC have been distributed to the three partners – OSU, OU and the Noble Foundation – and OSU has used its funding to initiate several coordinated research projects in the general area of biofuels. This promises to be a major success for the university and is a program that is growing in both size and reputation.

Another area that has self-organized is that of Sustainability. A recent survey by the OSU Institute for Sustainable Environments (ISE) inventoried 105 faculty members involved in scholarship on sustainability across all colleges. Since sustainability has such a wide definition it is understandable that sustainability research covers an enormously wide area on campus. However, included in these interests is energy sustainability, including conservation. A Sustainability Task Force currently exists.

## **CONCLUSIONS AND NEXT STEPS**

Although there is no identifiable Center at OSU through which energy research is coordinated or promoted, we do possess a particular advantage that other universities do not. I speak, of course, of Mr. T. Boone Pickens. Through his personal interests and commitment in energy, energy conservation, and his energy plan, Mr. Pickens now has the attention of the nation. His influence is highly significant and he is listened to by CEOs and politicians. OSU should find ways to use this influence to establish a nationally-recognized program in energy studies.

In addition, we have opportunities with another OSU benefactor in the energy arena, William Spears of Energy Education Inc. (EEI). EEI focuses exclusively on energy usage reduction through education. To Mr. Pickens and Mr. Spears we can also add Benham Companies LLC from Oklahoma City. The significance of Benham in the energy arena is that they have recently been purchased by Science Applications International Corp. (SAIC) to promote and build SAIC’s energy portfolio, including R&D into alternative fuels and clean fuels. Benham are already in discussions with OSU regarding potential research projects and other collaborations in this field.

Add to the above OSU’s developments in biofuels (via the OBC) and sustainability (via ISE) and the three outside entities mentioned above (Pickens, Spears/EEI and Benham) represent a significant opportunity for OSU to establish itself as an “Energy Center of Excellence”, particularly in the area of energy planning, conservation and use of alternative fuels. With the above in mind I recommend the following:

- Follow the work of President Schmidly's Energy Task Force by creating an **Energy Strategic Planning Group** with the specific charge of determining the necessary strategies for OSU to be established as a Center of Excellence in energy research (planning, conservations, alternatives). Membership of the Planning Group should be carefully selected from the OSU faculty, the OSU Foundation, and influential outside entities.
- The envisioned Center of Excellence should not include all aspects of energy research at OSU. Instead, we should focus on those areas in which we can make an immediate impact. The topics of energy planning, conservation and alternative fuels represent a preliminary suggestion. In any case, the Center should focus on particular aspects of the energy business where we can make a rapid and significant name for ourselves. Furthermore, the focus should be of interest to Mr. Pickens, Mr. Spears/EEI and Benham Companies.

Devise strategies for leveraging the interest and support of Mr. Pickens. Mr. Spears/EEI and Benham Companies to fund such a Center.