Residential Housing and Landscape Sustainability:
An On-line Curriculum

Energy Sciences Education
To Nebraska Center for Energy Sciences Research
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**Residential Housing and Landscape Sustainability: An On-line Curriculum**

Community and Residential Environment Action Team (CRE): Healthy Homes Energy Workgroup

**Abstract**

The need to reduce energy use in homes and the resulting emissions is critical and challenging. U.S. residential housing accounts for about 21 percent of the U.S. energy use and causes about 18 percent of the total greenhouse gas emissions in the U.S. Residential housing also contributes about 20 percent of the U.S. carbon dioxide emissions. A University of Nebraska collaborative group of extension specialists and educators with expertise in housing and landscape architecture are focusing on energy sciences education. Researched-based education for Nebraskans will be made available through first developing outreach education materials as a base curriculum on energy efficiency, conservation and sustainability as a part of residential housing and landscaping. The ten energy and sustainable practices publications will then be adapted to incorporate in the University of Nebraska-Lincoln Extension existing Web site as an Energy and Residential Housing and Landscaping segment. This new Web site segment will focus on energy management and conservation best practices in residential housing and landscaping for sustainability. Information on the latest technological advances in materials, equipment, appliances, lighting, will also be included in the base curriculum. The expected outcomes and impacts are increased use of best practices to reduce residential energy and water use, to reduce use of nonrenewable natural resources, and to reduce pollutant emissions from fossil fuels.
Project Description

This project focuses on the development of educational materials and a residential housing and landscaping sustainability Web site with a focus on energy science and energy-related issues critical to Nebraska.

Impact goals:
The overall goals are to improve energy management practices to minimize nonrenewable natural resource consumption and deterioration of the environment while reducing or maintaining residential housing energy costs. Participants will adopt energy conserving measures to reduce nonrenewable resource use, contributions to global warming, and their increasing energy costs. These measures include:

1. Selecting efficient materials, processes and equipment for use in residential housing that reduce energy and resource consumption (EnergyStar, green building, sustainable housing concepts, technology advances in equipment, lighting and appliances, etc.).
2. Adopting landscapes or modifying existing landscapes to reduce energy and water use while protecting natural resources (xeroscaping, windbreaks, site orientation)
3. Adopting water-wise and energy-saving methods in residential housing and landscaping.
4. Adopting energy and natural resource consumption reduction and management practices by households and by businesses focusing on home building or remodeling and landscaping.

This proposal supports the Community and Residential Environment Action Team goals and action plan focused on environmental issues and sustainability in residential housing environments, Extension priority areas of natural resources and the environment, and the IANR priority Goal 4 internal action of “new knowledge from research and creative work will be integrated in teaching and extension education programs for the benefit of Nebraskans.”

Educational objectives
It is expected that:

$ Based in part on the curriculum, 5% of the users of the Web site will choose at least two measures to increase energy efficiency in their own home or rental unit or in landscaping

$ Based in part on the curriculum, 5% of the builders/contractors and remodelers and landscaping professionals using the site will change one practice or material to reduce the water and energy usage in the homes and/or the landscapes.

These objectives will more easily be measured through educational programs in direct contact with consumers and housing and landscaping professionals after the curriculum and Web site has been completed or in Phase II. Phase II is not a part of this grant application.

Justification:
The University of Nebraska-Lincoln Extension is a key educational player in helping to educate Nebraskans about energy use, conservation, alternatives and technological advances. We have partnered previously with the Nebraska Energy Office, MUD, and OPPD and other entities in our efforts. Currently, UNL does not have a segment of the Extension Web site devoted to residential housing and landscaping focused on energy management and resource conservation, new technology, and best practices. Further developing our energy education curriculum and a Web-based segment focused on residential housing and landscaping for energy efficiency and resource use reductions will provide a strong base for education that
can bring about behavior and practice changes. Assistance is needed to move forward on developing new publications for the curriculum base and then to adapt that to a web-based format with photos and other graphics and interactive questions and answers. This project is part of the Community and Residential Environment Action Team workgroup on energy.

Energy and resource conservation are critical issues that are facing and will face Nebraskans and the world into the distant future. Proactive education is needed to significantly address this issue in NE. Conserving existing resources and fossil fuel energy supplies reduces the pollutants that contribute to global warming and allows more time for research and technology advancements in alternative energy sources that will supplement and/or replace some existing energy sources. Conservation will also slow the increase in carbon dioxide emissions and other pollutants that impact the environment. Education in housing, landscaping and energy conservation to bring about behavior change and adoption of best conservation practices is needed.

The need for education is critical. Residential housing production and energy use contributes to carbon dioxide (CO$_2$) production, global warming, greenhouse gases, other pollutants and environmental degradation. The most important actions to take to slow global warming are to: 1) reduce emissions of heat-trapping gases, 2) reduce greenhouse gas emissions, and 3) protect and restore forests (National Academy of Sciences, 2000). “Recent warming appears to be linked to burning of oil, coal and gas for energy in vehicles, businesses and homes and the increased CO$_2$ atmospheric levels.” CO$_2$ concentrations are 20% higher than the highest concentrations of the past 160,000 years. Energy used in U.S. homes accounts for about 20% of the CO$_2$ emissions, a major contributor to global warming.” [U.S. Dept. of Energy (DOE) Energy Information Administration (EIA), Office of Integrated Analysis and Forecasting, Emissions of Greenhouse Gases in U.S., Dec. 2005]. The U.S. with 6% of the world’s population uses about 30% to 50% of world’s nonrenewable resources. According to University of Colorado physicist A. Bartlett (2000), the current rates of consumption of oil cannot continue for many generations, and present U.S. and world rates of oil consumption are not sustainable.

World energy consumption is expected to increase 59% over the 1999 level by 2020 according to projections in International Energy Outlook by the Energy Information Administration (DOE Office of Integrated Analysis and Forecasting, 2005) According to DOE, reducing emissions of CO$_2$ is a key strategy for slowing global warming. Fossil fuel combustion for energy consumption is the largest single contributor to greenhouse gas emissions in the U.S. and world.

The U.S. Department of Energy (DOE) indicates that energy use in the residential, commercial, and industrial sectors account for about two-thirds of the U.S. CO$_2$ emissions (3.49 billion metric tons/yr.) Industry is the largest contributor, at nearly half the total. The residential sector accounts for about 29% and the commercial sector accounts for 22% of the total emissions. DOE also indicates that the residential sector is the fastest growing source of emissions with an increase of 7.5% between 1990 and 1995, U.S. homes account for about 21% of the U.S. energy use and cause about 18% to 20% of the total greenhouse gas emissions in the United States.

Reducing CO$_2$ emissions is key to slowing or preventing additional global warming. Fossil fuel combustion is the largest single contributor to greenhouse emissions in the world. The U.S. creates about one-fourth of the global emissions (NRC, U.S. CIA). U.S. emissions have risen about 12% in the last ten years. With increasing fossil fuel demand in developing countries, energy costs are expected to escalate. “Long-term trends in residential CO$_2$ emissions are strongly influenced by living space attributes, and
Residential energy use can be reduced through changes in methods, practices and products. Further developing our energy education curriculum will provide a strong base for additional resource development and programming and is essential in educating Nebraskans. Education will play a strong role in achieving reductions in residential energy use.

**Work Required and Educational Methods**

**Actions**

- The team will develop ten publications focused on energy conservation and sustainability in housing and landscaping to be used as a base curriculum.
- This base curriculum, along with existing publications already developed by team members, and members extensive photo libraries will be used to develop the base of an energy focus area on the existing UNL Extension Web site. The focus of the Web site segment is energy and residential housing and landscaping with a question and answer format, sketches and photos, an incorporated evaluation instrument, and interactive features where possible.
- It is expected that from this base, additional content will be added in the future as the site is further developed.

The development includes ten Web-based publications to address heat loss and gain, purchasing energy efficient materials and appliances, landscaping for energy efficiency, ensuring healthy indoor environments while reducing energy use, low-cost energy management methods, making choices based on energy rating labels (EnergyStar, SEER, EER, NFCR, etc.), the new Nebraska 2006 Energy Codes, air barriers, and selecting insulation and windows for Nebraska’s climate zones. These publications and other existing materials for the curriculum base will be modified and adapted to a Web site focused on segments with Housing and Landscaping under a general category of Energy Management and Conservation.

**Expected educational outcomes, course materials, outputs and impacts**

The overall goal is to proactively further develop the energy education curriculum and resources and then to adapt the material to an interactive Web-based site. The curriculum is intended to help educate and to change practices of housing and landscape related professionals including landscapers, remodelers, builders/contractors, Realtors, and other housing professionals as well as consumers. The publications and Web resources will provide the information needed for making informed decisions in order to change practices and actions to reduce and manage energy use more efficiently.

**Materials and outputs:**

Ten publications focused on energy resources and conservation will be developed. These publications and existing resources will serve as the content for developing an energy and residential environment segment on the UNL Extension Web site. The Web site is expected to be the initial development and frame work along with initial materials and graphics. Future additions will be made as more materials are developed that focus on residential housing and landscaping sustainability and energy efficiency.

**Outcomes:** (see outcomes and impacts implied in the goals and objectives)

- Ten research-based and best practices publications focused on energy conservation and management.
- Initial development the Web site segment focused on residential housing and landscaping sustainability to increase energy efficiency and adopt resource conservation practices.

**Impacts:** (see impacts indicated in the goals and objectives)

The overall expected impact is to improve energy use and management practices to minimize natural resource consumption and deterioration of the environment while reducing or maintaining residential
housing energy costs. Participants will adopt energy conserving measures to reduce non-renewable resource use, contributions to global warming, and their increasing energy costs. This overall expectation will be accomplished by the participants . . .

1. Selecting efficient materials, processes and equipment for use in residential housing that reduce energy and resource consumption (EnergyStar, green building, sustainable housing concepts, technology advances in equipment, lighting and appliances, etc.).

2. Adopting landscapes or modifying existing landscapes to reduce energy and water use while protecting natural resources (xeroscaping, windbreaks, site orientation)

3. Adopting water-wise and energy-saving methods in residential housing and landscaping.

4. Adopting energy and natural resource consumption reduction and management practices in households and businesses focused on home building/remodeling.

*Audience:* Ultimately landscapers, nursery businesses, builders/contractors, remodelers, and other housing and landscaping professionals as well as consumers.

*Leverage resources:* With an up-to-date curriculum base, we will be positioned to seek funding from the NE Energy Office (NEO) and U.S. Department of Energy (DOE) with greater likelihood of success. Past work with NEO has been beneficial to both agencies with cooperation on video footage, photos, and planning the Healthy Indoor Environment Symposium in Omaha last year that in part addressed energy efficiency and the related air quality issues. Some of the publications will be reviewed by professionals in the Nebraska Energy Office, and from UN-L Departments of Construction Management and Architectural Engineering having expertise in the areas.

*Evaluation:* This initial stage will be evaluated through outcome and output measures (publications completed and accessible via Web site). Follow-up impact evaluation will include measuring of how the publications and Web site were used by extension educators. An on-line instrument embedded in with each topic segment and similar to that used by LSU will be developed for evaluation of the Web site resources. Phase II, not a part of this grant, will more accurately measure the impacts and outcomes as the publications and resources are used with the targeted audiences.

**Time line: 2007**

*Jan. or when notified:* Secure part-time technology/student help. Plan details of meetings, curriculum, draft detailed time chart and responsibilities, listing of reviewers for publications. Team holds monthly conference calls throughout project.

*Jan. - April:* authors develop publication drafts. Part-time student assists with securing reviewers, library searches, editing, and obtaining additional graphics or photos. Technology assistant takes training to learn format of the UNL Extension Web site to meet standards and criteria, and begins to create the format needed along with the outline or framework for the site.

*April - July:* Technology assistant inputs the existing energy related resources and publications in a question and answer format in consultation with authors. Inserts photos and obtains additional photos needed. Student assist with moving publications through to reviewers and back for edits.


NCESR Research Grant Budget Request format

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<thead>
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<th>Item</th>
<th>FY2006/07</th>
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<tr>
<td><strong>Salaries</strong></td>
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<td>Technical/student support positions</td>
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<td>Hourly help: Part-time: $8/hr. x 12 hr./wk for 40 weeks</td>
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**Budget Justification**

1. Student (strong in environmental sciences, journalism, or resource/library research)
   Part-time @ $8.00 hr./12 hr. week/40 weeks.
   Conduct research and library searches to ensure accuracy, basic editing, tracking publications, and obtaining reviewers (agencies, educators and specialists in other states) and the reviewer follow-up. Ensuring the publications for the curriculum are completed in timely manner and are modified for the Web site in an interactive and question and answer format.

2. Student or other hourly worker (strong in computer skills and/or some experience in Web base development)
   Part-time @$20.00/hr./ for 7hrs./wk. for 40 wks.
   Assist the specialists and educators in adapting their existing curriculum, photos, sketches etc. to a format that is more suitable for Web-based learning. Incorporate question and answer formats, explanatory photos and sketches and/or obtain photos as needed. Assist in developing the Web format outline and sequencing for the Energy in Housing and Landscaping content site on the UNL Web site based on existing format requirements. Input the text and photos onto the Web site in collaboration with the authors. Incorporate a survey that users can easily use to record their comments about the usefulness of the information similar to that used by LSU. Arrange for evaluation throughout the process by representative users.

3. The publications dollars will be used to print copies of the new publications developed for use in current and future programming.

4. The displays, based on an existing display focuses on Energy Star, are resources to use in expanding the education and creating awareness of the Web site and new publications.