Global Environmental Education, Lacking Energy

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ABSTRACT

Educating young people about current and future environmental hazards is paramount to changing behavior and preparing the next generation to confront our myriad environmental challenges.

Climate change heads the list of future environmental degradation that we must confront. We should focus our efforts on curtailing the leading contributor to climate change – the burning of fossil fuels to generate electricity.

Here in the United States, some work has been done to assure that energy conservation and energy efficiency curriculum are infused into environmental education campaigns and programs as well as stand-alone energy education programs. However, a broad survey of existing energy efficiency education programs is lacking to better understand how the topic currently fits within a larger environmental education framework.

In order to build capacity internationally as well as in developing countries, we must take the following actions in order to expose students to environmental issues at a young age:

- Expose students to energy concepts and the link between energy and the environment,
- Prepare them to wisely use and manage energy as adults, and
- Create an on-ramp to green careers in energy.

This paper explores the attitudes toward energy education and the perceived need for such curricula, barriers to adopting formal energy education, need for instructional resources related to energy, and factors that would lead to greater uptake.

Statement of Need

Energy Efficiency Is Under-Represented in National and International Environmental Education Programs

The majority of leading environmental education programs addresses sustainability issues – water, waste, population, or transportation– but do not include energy and energy efficiency as major components. Programs that do include a focus on energy overwhelmingly prioritize renewable energy rather than efficiency. Likewise, most climate education resources do not feature energy efficiency (those targeting developing countries mostly focus on adaptation), despite efficiency being the cleanest, cheapest, and most reliable short-term path towards a low carbon future. Given its foundational significance in these fields, there is an urgent need to increase energy efficiency's prominence within environmental and climate education programs.

Energy-Literate Communities Are a Necessary Precondition for a Low Carbon Future

The success of programs to reduce energy and to achieve climate objectives rest on an energy literate citizenry equipped with the knowledge and skills to make low carbon choices. A demonstrated way to build community energy literacy is to educate students – at primary, secondary and post-secondary levels –who in turn become energy and climate ambassadors in their homes and within the broader community. Students are the ideal vehicle for such training and community outreach. Through energy efficiency, students and communities can "learn by doing" about the many tangible ways in which they can conserve energy (and money) in their schools, homes, offices and vehicles.

Energy Efficiency Education Faces Unique Barriers as a Focus for environmental Education

Energy is intangible, and energy efficiency can't be seen. For example, it is very difficult to know whether a building is efficient by just looking at it, and it is difficult to know whether activities undertaken to save energy have actually saved energy. It is also difficult to know how one's energy use compares to others to assess whether one is a relatively big user.

Topics such as recycling, water quality, habitats and ecosystems, etc are more tangible, familiar and visible, making it easier to for instructors and leaders to perceive the problems and the resulting actions taken. Energy efficiency education requires specific skills and knowledge that environmental educators may not have. The inclusion of energy efficiency as a part of the training for environmental educators, if it is included at all, is a recent phenomena and so most environmental educators are not prepared to educate students in how appliances and electronics use electricity, what types of windows are most efficient, or how to assess the energy efficiency of the building envelope.

Circumstances of interest and competing environmental problems often dictate what sort of environmental topics are covered. For example, climate change is a hot topic, and should argue for a heavy focus on energy efficiency, but instead has taken the back seat to renewables – again, we believe this is because energy efficiency is "invisible" and does not have appealing visuals such as wind farms and photovoltaics.

Also, regional specific environmental problems (like water quality or biodiversity) often trump energy efficiency, especially in rural and very underdeveloped areas.

Finally, teachers as well as others in educational organizations and governments tend to not be comfortable with energy efficiency content which leads to a lack of strong local promoters and champions to provide support to environmental education initiatives (especially teachers).

Procedure for Collecting Information from the International Environmental Education Community

In order to compare existing global environmental education programs and their focus (or lack thereof) on energy efficiency, the following procedure was carried out:

Establish Criteria for Strong Energy Efficiency Curricula

The National Science Teacher' Association's (NSTA) has created declarations regarding criteria for strong, general environmental education. NSTA asserts environmental education "should be a part of the school curriculum because student knowledge of environmental concepts establishes a foundation for their future understandings and actions as citizens. The environment also offers a relevant context for the learning and integration of core content knowledge, making it an essential component of a comprehensive science education program" (NSTA). The globally relevant NSTA declarations on environmental education are:

- Environmental education programs should foster observation, investigation, experimentation, and innovation. Programs should be developed with grade-appropriate materials and should use a range of hands-on, minds-on instructional strategies that encourage active learning.
- Environmental education programs and curricula should…be grounded in sound research, and reflect the most current information and understandings in the field.
- All learners are expected to achieve environmental literacy and an appreciation for and knowledge of a range of environmental issues, perspectives, and positions.
- All learners should be taught how to think through an issue using critical-thinking skills, while avoiding instructor or media bias regarding what to think about the issue.
- Environmental education should provide interdisciplinary, multicultural, and multi-perspective viewpoints to promote awareness and understanding of global environmental issues, potential solutions, and ways to prevent emerging environmental crises.
- Developers of environmental education programs should strive to present a balance of environmental, economic, and social perspectives.
- Appropriate technologies should be used to enhance environmental education learning experiences and investigations.
- Environmental education programs and activities should be fostered through both formal and informal learning experiences.
- Collaborations among schools, museums, zoos, aquaria, nature centers, government agencies, associations, foundations, and private industry should be encouraged to broaden the availability of educational resources, engage the community, provide diverse points of view about the management of natural resources, and offer a variety of learning experiences and career education opportunities.

In addition to these basic principles of good science education (many of which also apply to other academic subjects) it is necessary to address the unique barriers to education about energy, and more specifically, about energy efficiency. The Alliance to Save Energy has implemented Green Schools, a K-12 energy efficiency education program, since 1996 and Green Campus, a community college, college, and university energy efficiency education program, since 2004. The programs' success is based on a number of principles and best practices. The Alliance presented a draft set of principles to several other national energy/efficiency organizations, and incorporating their input, these principles were identified:

- Energy efficiency instruction supports curriculum standards in many academic subjects, and energy efficiency instructional materials should be correlated to state standards of learning in multiple disciplines.
- Teachers and professors need time and support to learn about energy efficiency and to determine how energy efficiency lessons fit best into the curricula in their district, school and individual classrooms.
- It is important for students to learn about energy efficiency while undertaking projects that actually save energy -- the two activities reinforce each other to make the learning tangible and rewarding.
- Learning about energy efficiency should include hands-on activities incorporating inquiry-based learning. In lecture settings where hand-on activities may be limited, smaller group exercises or demonstrations could work.
- Student leadership development should be an important element of energy efficiency education. Young people who understand energy efficiency are a community asset – the dearth of knowledge about energy efficiency among the general public makes educated students a valuable resource for promoting energy efficiency to their families, fellow students, and communities.
- Teaching the value of energy efficiency is most effective when energy consumption is made visible and meaningful, using actual billing data where possible to teach the connection between energy consumption and energy costs and the wide variation in efficiency of different schools, campuses or buildings, for example using Energy Star Portfolio Manager to see the relative efficiency of different schools.
- Likewise, because the energy consumed by equipment is invisible, it is important to provide tools to students, such as inexpensive watt meters, that show energy consumption of different equipment as well as demonstrating relative energy consumption of similar products, such as comparing incandescent, CFL and LED lighting.
- Energy education is most effective when the connection between energy and the environment is made tangible and meaningful by translating energy savings into avoided CO2 emissions and other environmental impacts.
- Where possible, student energy saving initiatives should be evaluated in part by tracking energy consumption before and after the initiative. A policy of returning a percentage of avoided cost expenditures due to no-cost behavior and operations savings is a powerful educational and motivational strategy.
- Energy efficiency should be taught in the context of the broader topic of energy, with the understanding that energy efficiency is underrepresented and should be a primary focus.

Curriculum Review of Leading International Environmental Education Programs

Preliminary research uncovered the 28 leading environmental programs working internationally to educate K-12 and college-aged students about the environment.

A cursory curriculum review of these leading environmental education programs reveals a lack of strong material about and emphasis on energy efficiency based on the above criteria. With the potential to educate communities about energy efficiency as the cornerstone of a low carbon future, there has never been a more urgent need to effectively include energy efficiency as a featured component within environmental education programs.

Based on the need to learn more about the specific energy efficiency offerings of these organizations, 11 with the broadest reach and deepest impact were selected to focus on more in depth. Below is a summary of the top 11 organizations in terms of reach and impact, but similar information was collected on all 28 organizations:

Organization	Countries Served	Reach	Mission	Energy efficiency education
Academy for Educational Development (AED)	50 states and more than 150 countries		Nonprofit organization working globally to improve education, health, civil society and economic development	Yes – some
Centre for Environment Education (CEE)	India	3,000 schools	National institution engaged in developing programs and material to increase awareness about the environment and sustainable development; leader in the Asia Pacific region	Some
UNESCO – Education for Sustainable Development	178 countries	8,500 institutions	Facilitating networking, and collaboration among stakeholders in ESD; fostering greater quality of teaching and learning of environmental topics; supporting countries in achieving their millennium development goals through ESD efforts; and providing countries with new opportunities and tools to reform education	Yes
Foundation for Environmental Education (FEE): Eco-Schools Project (in the U.S., run by NWF)	52 countries	32,000+ schools, 9,000,000+ students, 620,000+ teachers, 5,000+ local authorities	International program for environmental education and management, which aims to raise students' awareness of sustainable development issues through classroom study as well as school and community action.	Minimal
UN Environment Program (UNEP): TUNZA	106 countries	30,000 children and young people's organizations	Develop activities in the areas of capacity building, environmental awareness, information exchange and youth in environmental decision making processes	No
INFORSE (International Network for Sustainable Energy) School Project for Application of Resources and Energy (SPARE)	17 countries	3,000 schools; 150,000 youth	To fight climate change and to stabilize CO2 emissions by reducing total energy consumption	Yes
North American Association for Environmental Education (NAAEE)	56 countries		Promotes excellence in environmental education and serves environmental educators for the purpose of achieving environmental literacy in order for present and future generations to benefit from a safe and healthy environment and a better quality	Very minimal

Organization	Countries Served	Reach	Mission	Energy efficiency education
			of life.	
National Council for Science and the Environment	United States of America	160+ universities	Improve the scientific basis for environmental decision-making.	Minimal to none
TERI: The Energy and Resources Institute	India, Japan, Malaysia, United Arab Emirates, United States of America, United Kingdom	800 employees; TERI University	**T**ackle issues of concern to Indian society, and the world at large, and develop innovative and cost effective solutions. **E**nhance networking for sustainable interventions. **R**ealize potential for national and international leadership as a knowledge based agent of change in the fields of energy, environment, other natural resources and sustainable development. **I**nspire and reach out to diverse stakeholders for realizing a shared vision of global sustainable development.	Some, but not directed at students.
Peace Corps	76 countries	2,500+ volunteers involved in education; 1000+ volunteers involved in environment related programs	1. Helping the people of interested countries in meeting their need for trained men and women. 2. Helping promote a better understanding of Americans on the part of the peoples served. 3. Helping promote a better understanding of other peoples on the part of Americans.	None
United Nations Volunteers	140 countries	6,000 volunteers	Contributes to peace and development through volunteerism worldwide.	Yes – but only in their Eco-Schools program

Findings

Having identified six of the more broad-reaching and impactful environmental education programs, more in-depth phone interviews were conducted with staff at each of these organizations to get a deeper understanding of their energy efficiency offerings. See appendix A for the questions used in the survey. The questions are grouped according to their scope (broad or narrow) and also by their area of focus.

The results of the follow-up phone interviews suggest that most organizations do not feature an official energy efficiency component in their environmental education curriculum. INFORSE's (International Network for Sustainable Energy) School Project for Application of Resources and Energy (SPARE) is the only major organization we investigated that focuses on energy efficiency-related activities and incorporates it into its curriculum.

Excluding SPARE, the dearth of a major, robust energy efficiency component presents an opportunity for the infusion of energy efficiency in international environmental education.

Attitudes toward Energy Education and the Perceived Need for Such Curricula

Most people we spoke with acknowledged that energy and energy efficiency education is a necessary element of environmental education.

All organizations, however, seem to realize the importance of the students' role in spreading their energy knowledge to their homes and communities – whether through school presentations to parents, school or local publications, and even outdoor theater performances.

Organizations Agreed that Energy Efficiency Education is Both an Essential and Under-Emphasized Element of Environmental Education

Of the topical areas addressed at Decade for Education in Sustainable Development Conference on Environmental Education hosted by CEE in India in 2007, none mentioned energy or energy efficiency education (a list that included over 30 topic areas, with 1500 attendees). In order to achieve our climate goals, energy efficiency education needs to be integrated into classrooms, school buildings, curriculum, and student hands-on activities.

Some Significant International Environmental Education Programs do not Include a Specific Topic Focus – Thereby making Energy Efficiency Less Likely to be Included

Some major environmental education programs are programmatically very general. For example, TUNZA's primary goals are to create connections between youth advocates for the environment and resources for interested children and young people. There is no set program to implement; it is a collection of various projects relating to climate change. TUNZA's program is more concerned with creating and facilitating activity in general than honing in on any one topic. Planting trees is just as important as starting a recycling program is just as important as drafting statements made by and for youth. TUNZA's youth program for environmental action is focused on climate change this year, but the topics of interest and projects related to climate change are so broad and diffuse that tangible results and measured successes are difficult to discern. In this context, it is understandable that energy efficiency would not be a primary focus, considering the barriers mentioned above of the unfamiliarity and invisibility of energy efficiency.

On the other hand, CEE, an implementer for UNESCO's Decade of Sustainable Development (DESD) which overseas their activities and helps to foster connections between resources and people, does have specific curriculum and specific teacher trainings in environmental education. They have specific thrust areas, but few of these areas of interest explicitly deal with energy efficiency. Where there is mention of energy as part of broader work done on DESD or to help with India's own directive at Environmental Education, it exists as a part of larger topic thrusts. CEE does have systematic training programs (3-month, 5-day, 1-day course) for teachers and others involved in environmental education and is active in promoting the sharing of best environmental education practices between countries. They share ideas and collaborate to create better ways of teaching environmental education, but the programs don't emphasize energy efficiency in a step by step or automatic way. While their structure is more systematic, there could be greater emphasis on energy efficiency.

Energy Efficiency Education Programs Do not Seem to be Well Resourced

The one international program focused specifically on energy efficiency, SPARE, has only 5 people working in Northern Europe to support its whole program.

Environmental Educators Perceive that Students and Young People can be a Force for Change, and Design Programs Accordingly

There is ample evidence that students can make a major impact on energy use. Quantifiable program results as well as much anecdotal evidence demonstrate students' ability to influence energy use. The Alliance's Green Schools Program verifies energy savings averaging five to 15 percent using bill-based analysis. The LivingWise Program, provides curriculum for 6th grade classroom and provides a kit of energy savings items that students help install in their homes; the program is used by many utilities as a "resource" program that contributes to utilities' resource capacity.

Factors that Would Lead to Greater Uptake

Based on this research, the Alliance believes that several actions would lead to greater uptake of energy efficiency education programs.

Development of a Robust Web-Based Database

Almost every other organization either lacked or underutilized existing web-based information sharing programs. Most organizations see a benefit to having a robust web-based database so participants from different countries can share their findings as well as contribute new ideas. A web-based database can strengthen and help grow a program while at the same time establishing a much more real connection between international participants. For example, SPARE stressed that it wants to impact a wider age range so that energy efficiency is emphasized throughout the academic lives – elementary through high school; a data base would not only help them expand but would also promote international awareness of SPEAR's activities and best practices .

Ensuring a Strong Training Foundation

All organizations stressed that creating a strong training foundation for teachers and instructors is essential to the success and growth of a program. Recruiting and hiring inspirational and competent trainers will not only secure the correct implementation of energy efficiency education programs, but it will also ensure the long-term effectiveness of the program as will providing training to existing teachers and trainers

Determining a Specific and Concerted Focus on Particular Regions

There is a need to create specific and concerted focus regions (perhaps Eastern Europe and South Asia) that would most benefit from energy efficiency.

Establish Energy Efficiency as a Specific Priority Area within Environmental Education

Taken as a whole, organizations that have broad reach also have diffuse foci. Locally specific needs are met in different ways, and all fall under environmental education rubric. This means, for example, that no one person at Peace Corps knows all that is taught in classrooms by Peace Corps environmental educators, just like no one person knows what the millions of volunteers for the environment at TUNZA are doing. The goal has been with these organizations to get students active and literate about the environment and environmental issues, especially for sustainable development. TUNZA's goal and UNESCO's goals are being met with large networks, and online resources for all topic areas environmentally related. In this way energy efficiency education is thrown into the mix to varying degrees, in varying organizations, in often unsatisfactory ways.

A Clear Need is Targeting Organizations that do Broad Environmental Education and Helping Them to Focus in and Execute Effective Energy Efficiency Education

Climate change and sustainable development as topic areas drive environmental education programs like UNESCOs DESD, CEE-India's curriculum guides, and TUNZA volunteers; energy efficiency education is the means to accomplishing goals in these areas for these organizations.

Next Steps

Our review of leading global environmental education programs reveals a need for a stronger emphasis on energy efficiency in these programs' curricula and activities. Given the key role of energy efficiency in addressing climate change and growing demand for the next generation of green workforce professionals, there has never been a more urgent need to effectively include energy efficiency as a featured component of environmental education programs.

The Alliance to Save Energy proposes a collaborative *Global Energy Efficiency Education Initiative* (GEEEI), to significantly expand the presence and the impact of energy efficiency resources within environmental education programs and training institutions around the world. There are unique barriers to implementing energy efficiency, including the "invisibility" of energy use and the difficulty in seeing concrete results. Using the principles developed by the Alliance's Green Schools and Green Campus Programs as well as other energy efficiency programs, GEEEI aims to provide educational resources and training opportunities to help environmental and climate education programs engage students and communities in learning about energy efficiency as the cornerstone of a low carbon future. The GEEEI also will orient students toward the energy-efficiency career opportunities in the emerging clean energy economy.

GEEEI will be carried out in partnership with established environmental education leaders and training institutions to deliver energy efficiency program resources for both in-school and outside of schools at the primary, secondary, and post-secondary levels worldwide.

The GEEEI strategy will be to coordinate existing resources and networks with new institutional and governmental support to:

1. Engage students in energy efficiency by developing "best practice" educational resources.
2. Empower communities to make energy-efficient choices, starting with influencing students to apply energy efficiency practices on a macro level on campus, at home, and in their neighborhood and community.
3. Enable students to pursue careers in the clean energy workforce by orienting them toward future career paths in the burgeoning energy efficiency sector.
4. Create an international network of motivated students and alumni to sustain collaboration and diffusion of energy efficiency literacy.

GEEEI's founding principle is that education is key to achieving meaningful reductions in energy use and CO_2 emissions.

Planning Meeting

More than 25 stakeholders from the academic, international, educational NGO, and business sectors gathered on May 12, 2010 at the Washington, DC Convention Center to discuss the state of energy efficiency education internationally, particularly in the context of environmental education, and specifically the need for a stronger focus on energy efficiency curricula. The purpose of this meeting was to begin to bring together representatives from international and U.S.-based environmental education programs, energy efficiency experts. These 29 individuals developed a shared vision and potential next steps in coordinating a collaborative effort to strengthen energy efficiency education (EEE) in environmental education programs worldwide.

The group defined the scope of GEEEI to be K-12, higher education, and new graduates under age 25. Workforce re-training for adults over the age of 25 was also discussed and all agreed on its merit, but it was agreed that the issues surrounding such an effort would be different enough to require separate partners and tasks (which could eventually be considered as an addition to GEEEI).

The following list is a summary of the distilled next steps made during the breakouts and whole-group discussions:

1. Conduct research in the following areas:
    - Compile information on labor-market assessments, and survey businesses on workforce development needs in the area of energy efficiency.
    - Research and build the energy workforce business case by market segment for educators and students. Show that EEE advances a more stable, greener economy in developed & developing countries, and establish the linkage between curriculum and facilities/real world concerns.
2. Continue to inventory and categorize potential partners and identify how they can contribute.
    - Devise a template for taking stock of existing initiatives and institutions – for replication in each country.
    - Survey the companies who are involved in energy efficiency (in addition to gathering information on the non-profit and education sectors).

- Consider reframing energy efficiency in terms of high-tech/tech innovation to match up with interests in clean energy industry.

3. Organize Taskforce
   - Set up structure and functions.
   - Identify members and roles.
   - Initiate efforts to identify funding and develop message and marketing strategy.

4. Identify potential funders.
5. Hold an international summit. If possible, piggyback on other international organization events (i.e., OECD, ISO/IEC, IEA, UN Agencies), and involve academia, commercial companies, education agencies, researchers. Use event to obtain international endorsement (e.g., from IEA, IPEEC).
6. Choose a pilot project. Parameters to consider:
   - Select region with greatest shortage of skilled workers.
   - Align with priorities of national departments/agencies of education.
   - Choose country or region with highest energy intensity.
   - Design pilot based on activities of partners in network that are already active (e.g., that have established relationship with Education Departments in targeted areas).
   - Prioritize opportunities based on highest energy efficiency savings potential.
   - Select region with the greatest number of environmental education organizations that are interested in participating.

Appendix A: Survey questions

Category	Question
How does your environmental program work?	What is its goal?
	How does the program reach young people?
	How are the teachers/leaders prepared and supported to carry out the program?
	If your program takes place in the classroom, do your resource materials tie to the standards of learning in academic classes?
	Does your program have a mechanism for schools to share data/findings with one another on the web?
Overall description of energy efficiency elements:	Do you have an energy efficiency component in your environmental education program?
	If so, what percentage of your overall environmental education effort is devoted to energy, and what percentage of the energy portion is dedicated to energy efficiency?
	How does it link to broader environmental/social issues (climate change, GHG, population shifts, building codes)?

Category	Question
Reach and intensity:	How many young people actively participate in your program's activities?
	How many students participate in energy efficiency-related activities?
	How much time does a typical young person spend on program activities? (i.e. one-time, ongoing class or club)
	How big is your program (i.e. how many schools does it involve)?
	What is the geographical reach of your program (i.e. which countries does it operate in)?
Hands-on aspect:	In addition to (using their description – presumably focusing on building awareness and knowledge), are students applying their learning about energy or energy efficiency to real world applications (i.e. energy audits, etc.)?
	If so, how, and what are the outcomes they are aiming for (i.e. personal awareness and knowledge, school awareness, community awareness, change in energy use)?
	(**If not answered in the previous question**) Do the students actually save energy and do they measure their impact?
	What do you include in your program that develops student leadership/advocacy? Are there student steering committees for schools, regions or countries?
Success:	What are your measures of success?
	Would you share your outcomes with us?
Careers:	Do you provide info about green/energy careers for students?
	If so, what careers?

Narrow Scope Questions

Question
Who is aware/involved with the program besides the students and teachers (i.e. parents, maintenance staff, and administrators)?
Do you get students to apply acquired knowledge outside of the school setting? Do you have environmentally-related after school clubs?
Is there a space to show how what is learned in school can be applied to homes, businesses, and broader community?
If your program works with teacher to reach students, how are teachers trained or prepared?
Is it an in-school, out-of-school, or web-only program?
If it's in school curriculum, what subjects does it tie into (i.e. Math, Science, Language Arts)?
If it's an out-of-school program, how are the leaders trained/prepared?
How much time is devoted to the energy aspect of your education program? How many classes are held, and how often? Is it a one-time event (assembly) or a recurring event (class)?
How many students are involved?
How much of their time is devoted in-class vs. out-of-class (i.e. home energy audit)?
What do students do to learn about energy? Do they apply it as part of your program
Do the students actually save energy and do they measure their impact?

References

[NSTA] National Science Teachers' Association. Feb, 2003. **Environmental Science Education – NSTA Position Statements,** http://www.nsta.org/about/positions/environmental.aspx. Washington, DC.