National Council for Science and the Environment

The National Council for Science and the Environment (NCSE) is a not-for-profit organization that improves the scientific basis for environmental decision-making.

NCSE brings together individuals, institutions and communities to advance environmental and sustainability science, education, and their applications in five strategic areas:

• Strengthening Education and Careers;
• Communicating Science to the Public;
• The annual National Conference on Science, Policy and the Environment;
• Science Solutions to Specific Environmental Challenges; and
• Advancing Policy that Improves the Connection between Science and Decision-making.

University Affiliate Program

Members of the NCSE University Affiliate Program receive services and collaborate to advance environmental and sustainability programs on their campuses. Benefits include:

• Participation in the Council of Environmental Deans and Directors;
• Discounted membership in the Council of Energy Research and Education Leaders;
• Exclusive access to information on federal funding for environmental research and education;
• Complimentary participation in the National Conference on Science, Policy and the Environment;
• Campus-wide subscriptions to online environmental and energy news services;
• Opportunities for internships;
• Sabbatical opportunities; and
• Special reports and studies from NCSE’s Center for Environmental Education Research.

Council of Energy Research and Education Leaders (CEREL)

The Council of Energy Research and Education Leaders (CEREL) is a multidisciplinary membership organization made up of heads of academic energy research and education centers, institutes, and programs. It provides the means for leaders in energy research, education, and communication to collaboratively use knowledge about energy to improve education, decision-making, and, more generally, the well-being of society.

Mission

• To increase the contributions of university energy research and education to the challenges facing society.
• To promote, encourage, and support efforts to advance knowledge and learning in the interdisciplinary energy fields (engineering, agriculture, the humanities, and physical, biological, and social sciences).
• To elevate the importance and awareness of the role of energy in human affairs across every segment of society through communication, outreach, engagement, and dissemination of knowledge.
• To promote the exchange of information and knowledge to create, foster, and encourage cooperative efforts among members of CEREL and other scientists and engineers, federal, state, and local agencies, business, and non-governmental organizations.
Energy is the foundation of our economy, of our health, of our habitable environment and of our civilization. Energy is also the challenge for sustaining our economy, maintaining our health, preserving our environment and advancing civilization. The difficult decisions concerning energy systems confronting us as individuals and as a society have increased the need for energy literacy. Humanity could confront increased hardship from climate change and societal disparities if it does not constantly improve energy technology. Yet incorrect choices or pathways may disrupt energy services and create serious risks. Increased energy literacy is required to make informed decisions on energy technology, policy, and behavior.

Our energy economy needs a workforce with new skills, strong knowledge, and reasoned perspectives. Energy literate leaders are desperately needed to assist citizens with the challenges and opportunities of climate change. Yet, very few college and university students in the United States or elsewhere learn about energy as part of their education. Many, perhaps most, students working on energy attend technical courses that inadequately address societal, economic and environmental content and sustainability. Students outside the STEM disciplines have limited understanding of the fundamentals of energy science. New forms of energy education must become a fundamental part of education in the United States and everywhere else in the world.

The National Energy Education Summit aimed to develop and advance partnerships that focus on transitioning the world to a new constantly improving energy system. It emphasized putting ideas into action – moving forward on policy and practice. It challenged the participants’ thinking and spurred their creativity. We hope that this follow up report will provide you with new ideas, will help you to build new relationships, and increased motivation to contribute your part in the rapidly changing energy landscape.

Tim Carr, Ph.D.
President 2013-2015
Council of Energy Research and Education Leaders
Plenary Speakers

*Keynote* – Michael Webber, Deputy Director, The Energy Institute, The University of Texas at Austin

*Plenary Roundtable* – Discussion of How to Advance Energy Education in the US – moderated discussion among multi-sectoral participants – higher education, business, government, philanthropy

Moderator: Scott Sklar, Adjunct Professor, George Washington University, President, The Stella Group

• Dan Kammen, Director, Renewable and Appropriate Energy Laboratory (RAEL), University of California, Berkeley
• Kristina Johnson, CEO, Enduring Hydro LLC
• Pramod Khargonekar, Assistant Director, Engineering Directorate, National Science Foundation

### Workshops

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SUMMIT VISION

Rationale:
The need for effective energy education has never been clearer. On one hand, society needs to move away from energy technologies that threaten climate instability. On the other, changing these technologies raises difficult choices and possible dangers. Humanity may be condemned to great hardship from climate change if it does not change energy technology, yet making the wrong choices or picking the wrong pathways may disrupt energy services and create serious risks.

Citizens and leaders need increased energy literacy to resolve the dilemma by making changes in technology, policy, and behavior. In addition, a new energy economy will also need a workforce with new skills, knowledge, and perspectives. Energy literate leaders in politics, labor, business, and religion must help citizens and the workforce cope with the challenges and embrace the opportunities of change.

Despite the needs for energy literacy, very few college and university students in the United States or elsewhere systematically learn about energy as part of their education. Many, perhaps most, students working on energy attend technical courses that inadequately address societal content and sustainability. Inadequate energy education hinders development of sustainability education. New forms of energy education must become a fundamental part of undergraduate education, in the United States and everywhere else in the world.

The Summit was:
- An opportunity for energy and environmental and STEM educators to gather with leaders from business and industry, government and civil society to raise the profile and expand the impact effectiveness of energy education.
- An opportunity for energy educators in K-12, higher education, and informal education to share best practices and develop new partnerships. The Summit covered what we teach in energy education, how we teach it and how we can collaborate to teach it better, and how we can overcome critical challenges.
- The Summit was designed to catalyze new initiatives and partnerships in energy education.
- The agenda included issues at both the classroom level (content, curriculum and pedagogy) and at the programmatic level (degree and sub-degree programs).

Desired outcomes include:
- Enhanced energy and sustainability literacy for students in all disciplines based on critical thinking about energy and its relationships with environmental issues such as climate change, international security, and the challenges of peak oil;
- New curricular models emphasizing active, interdisciplinary learning and research;
- New degree and certificate pathways for teaching about energy and sustainability;
- Stronger educational research programs that more effectively take innovations in science and technology to the demonstration and deployment stages, with broad public acceptance.

The Journal of Sustainability Education’s January 2015 Special Issue on Energy Education provided an excellent collection of articles from dedicated energy education researchers and practitioners that addresses the challenge of how education can be used to bring about widespread improvement in people's behaviors and attitudes regarding energy use, along with the political and social will to enact system-wide change.

www.susted.org
SYMPOSIA & BREAKOUT WORKSHOPS

Symposia were 90 minutes long and took place in the morning. Participants presented best practices, explored issues, and set the stage for the subsequent workshops where participants can develop actionable outcomes and commitments to further collaboration and work toward implementation. The purpose of the symposia is to highlight significant activities, share experiences and create a common vocabulary and a base of knowledge that will set the stage for further dialogue in the corresponding afternoon workshop.

The afternoon 3-hour facilitated workshops generated pathways for action on key challenges in energy education through refining existing and developing new strategies, tools, and partnerships. Outcomes from each workshop present constructive, action-oriented, non-partisan, science-based approaches to improving energy education. The following section presents an outline of an action plan from each workshop that the participants are interested in helping with following the conference.

CEREL and NCSE look forward to working with workshop leaders, participants and others to help facilitate follow up activities, including as partners in proposals for funding.

SESSION REPORTS

Workshop A. K-12 Education. Combined sessions Acquainting Educators with the Educational Resources Available for Experiential Learning about Energy and K-12 Energy Education

Acquainting Educators with the Educational Resources Available for Experiential Learning about Energy

Organizers:
Remy M. Pangle, Associate Director and Curriculum Coordinator, Center for Wind Energy at James Madison University
George Hagerman, Senior Research Associate, Virginia Tech Advanced Research Institute
Rebecca Lamb, Program Director, National Energy Education Development Project

Symposium:
Remy M. Pangle (Moderator)
• Family and Action for Sustainability - Dave Finnigan, Founder & Director, Climate Change is Elementary
• Energy Literacy and NGSS – Elissa Richards, Vice President, Marketing and Communications. National Energy Foundation
• Energy Education Resources - Rebecca Lamb, Program Director, National Energy Education Development Project (NEED)
• Success Story From a School Administrator - Lindsay Snoddy, Environmental Compliance Manager, Albermarle County Public Schools, Virginia
• Success Story From a Teacher - Neil Sigmon, Professional Instructor of Energy Engineering, Gereau Center for Applied Technology and Career Exploration

Workshop
• Introduction - George Hagerman
• Share-a-thon – Presenters shared energy activities with participants in a more intimate setting:
- Timo Lukkarinen, CEO, Horizon Educational presenting a Clean Transportation activity
- Rebecca Lamb presenting an Oil and Gas activity
- Dave Finnigan presenting “Green Action Checklist”
- Neil Sigmon presenting an energy activity
- Lindsay Snoddy presenting lessons from the Renewable Energy Resource Center
- George Hagerman presenting the Energy Cycle
- Elissa Richards presenting the “Cost of Looking your Best” activity
- Remy M. Pangle presenting activities related to “How to Get Renewable Energy Technology at your School”
- Michael Arquin, CEO, KidWind Project, Inc. presenting “Wind and Solar ReCharge Labs”
  - Wrap up and action plan development - Rebecca Lamb

Session Goal:
We aimed to identify gaps in the available curricula and resources for experiential learning about energy. Participants helped to create a plan to address those gaps and develop an approach to create an online, interactive repository for these resources so they are easily accessible to all educators.

With the ongoing energy crisis in the US and around the world, the discussion of energy is prevalent in many classrooms. Energy presents a real-world context for teaching many of the necessary Science, Technology, Engineering and Mathematics (STEM) concepts in a hand-on, problem-based manner. This session brought together key players in the energy education realm to present case studies and success stories during the symposium. Key players include the NEED Project, the US Department of Energy’s Wind for Schools Program, the KidWind Project, as well as teachers and professors from around the country who are teaching about energy in their classrooms. The workshop began with a Share-a-thon to showcase resources and services that are available to educators. The main goal of these sessions is bring together a community of educators who are educating or want to educate their students on this important topic. Following the session, we will build an online community where participants and presenter can share resource, find resources, and review resources related to energy education.

Innovation in Energy Education at the K-12 Level
Moderator: Mary E. Spruill, Executive Director, National Energy Education Development Project (NEED)

Speakers:
Gillian Roehrig, Professor, Science Education, Department of Curriculum and Instruction, STEM Education Center, University of Minnesota, MN Secondary School Implementation of Climate Change Curriculum in Native American Communities: An Insight into Energy Education (unable to attend)
Michele Putko, Lecturer, University of Massachusetts Lowell World Climate Prep
Pankaj Sharma, Energy Center at Discovery Park, Purdue University The Duke Energy Academy at Purdue: Inspiring Future Leaders in Energy
Monica Brett & Judy Treichel, Las Vegas/Clark County, School District, Nevada Removing the Barrier to Energy Literacy in Elementary School

Energy Education at the K-12 level is a challenge for several reasons. First is the challenge to develop and present energy content in developmentally appropriate and pedagogically sound ways. Second is the challenge of fitting energy education into a curriculum that is increasingly
proscribed and lacks classes labeled “energy”. Related is the challenge of dealing with the administrative structure (bureaucracy) in schools and districts.

Several opportunities exist to help meet these challenges.

- The publication of the next generation science standards (NGSS) in 2014 has created a pathway for energy education to enter the science curriculum.
- Further, the green schools movement, often with a focus on energy savings creates incentives and opportunities for experiential education, linking learning in and outside the classroom with school greening objectives.
- Finally, there are opportunities to partner with colleges, universities, national labs and the energy industry, including in after school and summer programs.

This session included examples of energy education from elementary school through high school. Presenters discussed their experiences - 1. developing energy curriculum at the elementary school or even in middle school or high schools; 2. dealing with the administrative structure in their schools and districts; 3. developing a public-private partnership.

**WORKSHOP A. COMBINED FINDINGS**

Symposia

The K-12 Energy Education Working Groups met separately in the morning for presentations and panels from a diverse groups of presenters including Dr. Pankaj Sharma from Purdue University, Monica Brett from Energy Bridge, Remy Pangle of James Madison University, Michael Arquin of KidWind and Rebecca Lamb of NEED. These presenters, along with their colleagues invited to present, set the stage for a good discussion about the necessity of better energy integration into education, the opportunities and barriers to the teaching and learning of energy in the K-12 environment, and the pathways to increasing energy knowledge in today’s teachers, students and the public. As the groups explored these various issues it became increasingly obvious that the two groups should combine their afternoon sessions for a more robust discussion.

The combined session was engaging with good diversity of energy interests and education practitioners including non-profit organizations and higher education institutions as well as the U.S. Department of Energy. However, both groups noted that the asset most missing were actual K-12 classroom teachers. The Summit’s agenda did not lend itself to easy marketing to the K-12 community. The K-12 group’s recommendation is to engage more in the process for future efforts to bring more classroom teachers into the discussion. In a room of 25 people, there were 4 actual classroom teachers. Understanding the classroom is one of the most important facets of a successful K-12 program.

The discussion was significant, pointing out barriers and opportunities including the new Next Generation Science Standards, funding, teacher professional development, a lack of pre-service training related to energy, and increasing demands on the classroom teacher. All of these things come together to make the opportunity for better integration of energy into the classroom easy
and more complicated as well. The opportunity exists with the new standards, while the teachers’ lack of energy knowledge stands as a barrier.

The group had a combined goal to develop an action plan and partnership options to advance energy and climate action within our topic – K-12 energy education. It believed that a deeper discussion with all possible stakeholders would be warranted. Nationally, the U.S. Department of Energy has hosted similar summits, but not on a completely comprehensive scale. The group’s action plan included the following:

1. A nationwide, interactive summit with at least 2 teachers and 1 state education official from each state along with participation from utilities and industry, NGOS, and universities — to discuss the needs of K-12 students (in class and informal education settings) and the needs of K-12 teachers to confidently and competently teach energy and climate. The convening document will be the U.S. DOE Energy Literacy Framework.

2. Other tools, including an online database and calendar of available teacher professional development opportunities related to energy and climate that would require upkeep and basic work to launch. There is not a known calendar or clearinghouse at this time. This task could be taken on by an NGO if it were to receive funding.

3. A curated, online database of lessons linked to standards was discussed. DOE has done some of this by posting lessons and linking to the DOE Energy Literacy Framework website. Would DOE or the NGOs involved in the group be interested in building out that clearinghouse? The curation would be substantial – similar to the Climate Literacy and Energy Awareness Network (CLEAN) collection. It would take time and resources.

The group members all agreed to continue communication with the idea of exploring these possibilities. The NCSE Summit was an excellent opportunity for the K-12 energy education stakeholders to come together to think, share and discuss.

**Workshop B. The Power of People: Students Promoting A Culture of Energy Efficiency**

**Organizers:**
**Merrilee Harrigan,** Senior Education Advisor, Alliance to Save Energy  
**Colleen Butterfield,** Associate, PowerSave Campus, Alliance to Save Energy  
**Chase Livingston,** Program Associate, Education, Alliance to Save Energy

**Speakers:**
**Kate Crosby,** Energy Manager at Acton, MA Public Schools and author of *Powering Down: A Toolkit for Behavior Based Energy Conservation in K-12 Schools*, a US Green Building Council white paper documenting highly successful conservation programs in five K-12 schools across the country.  
**Scott Thach,** Vice President for Education, Alliance to Save Energy, PowerSave Schools Program  
**Kavitha Nambiar,** Program Associate, Education, Alliance to Save Energy  
**Jennifer Alldredge,** Program Manager, Alliance to Save Energy

This session discussed best practices for teaching about energy efficiency in schools and on campus, using their buildings as learning laboratories and building a culture of energy efficiency that resonates into the homes and communities.
While energy is all around us, it is invisible – how do we know how much we are using, and how much we are wasting? This is a critical topic, as energy consumption is the greatest contributor to climate change, and energy efficiency is the fastest, cheapest and cleanest energy source. One important resource that is often overlooked is engaging students as participants and advocates who can learn about energy, gain hands-on experience taking action in schools and colleges, and achieve savings through their own no-cost behavior changes.

Leaders in energy efficiency education discussed principles and best practices, including ties to STEM topics, project-based methodologies, and specific strategies for engaging students in a topic that is hard to see and measure. Engaging students in real-world applications of their learning enables students can make a real difference for the environment (reducing climate change) as well as saving significant dollars on energy costs.

Applications of these principles and methodologies will examples of college students educating younger students about energy, K-12 students who led energy efficiency campaigns at their schools and saved tens of thousands of dollars on energy costs through behavior change, and academic infusion of energy efficiency into instruction.

No Action Items were developed beyond those to be carried out by the Alliance to Save Energy.

**Workshop C. Professional Education.** Combined BioEnergy Education and: Holistic Education for Energy Professionals

**BioEnergy Education**

**Moderator:**

*Susan Jenkins*, Managing Director, Energy Biosciences Institute, University of California-Berkeley, past-President Council of Energy Research and Education Leaders (CEREL).

**Speakers:**

*R. Justin Hougham*, Assistant Professor, Environmental Education Specialist, Department of Youth Development, University of Wisconsin – Extension *Education at the Speed of Research: Strengthening Outdoor Learning through Research Connections*

*Zhenglun “Glen” Li*, Bioenergy Instructor, Oregon State University *BRR 350: Introduction to Regional Bioenergy, an Interdisciplinary Course to Introduce Bioenergy Concepts*


Biofuels of various types are among the fastest growing fuel sources in the US and are dominant fuel sources in many parts of the world. As scientific and technological advances are leading to advanced biofuels – including algae and various new approaches to extract energy from cellulose and hemi-cellulose, there are new employment opportunities. Colleges and universities and other educational institutions are creating new courses and programs, including degree programs to prepare students for the bio-economy.

There are also needs for education to help the public ensure a realistic understanding of bioenergy, its potential and its limitations and consequences.
This session introduced approaches and programs for bioenergy education at various levels. All participants had an opportunity to share the approaches that they and their institutions are using. Discussion identified common principles, needs and opportunities for scaling up. The group considered the value of creating a bioenergy education network and how such an informal community would operate.

**Holistic Education for Energy Professionals**

*Organizers and Moderators:*
**Tim Carr,** Marshall S. Miller Energy Professor, West Virginia University  
**Hans Blaschek,** Professor Emeritus, University of Illinois at Urbana-Champaign

*Speakers:*
**Eric Anderson,** Visiting Teaching Associate, The Integrated Bioprocessing Research Laboratory (IBRL), University of Illinois at Urbana-Champaign - *Teaching Domestic and International Students About Bioenergy Systems in the U.S.*  
**Peter Ping Liu,** Professor and Coordinator of Graduate Study, School of Technology; Director, Center for Clean Energy Research and Education, Eastern Illinois University - *Developing and delivering a multi-disciplinary master's degree program on Sustainable Energy*  
**Shawn T. Grushecky,** Coordinator, Energy Land Management Program, Davis College of Agriculture, Natural Resources and Design, West Virginia University - *Integrating Renewable Energy and Environmental Sciences into a Petroleum Land Management Program*

Energy Education programs serve both current and future energy professionals for a changing workforce. Employers are looking for graduates at the bachelors and Masters level who are prepared to enter the workforce. Innovative and practical programs provide a holistic education that includes an understanding of sustainability and contextual issues as well as development of technical talents. Such programs include Professional Science Masters programs and other Masters and bachelors programs that are developed and carried out with employer needs in mind and that provide practical experiences.

Participants in this session learned about a range of programs, shared information about their own programs and identified a set of recommendations and best practices to guide program development. At the conclusion of the session, each participant was asked to present a set of actions that they plan to do upon return to their host institution.

Workshop Conclusions

Challenges and potential solutions:
Challenge to integrate research centers with academic programs at universities.  
Differences between multi- vs. interdisciplinary programs are not well defined.  
What is the value of an interdisciplinary degree? Minor vs. major?  
Challenge of new faculty working in multi-disciplinary area: giving credit for their efforts when going through the tenure process – interdisciplinary programs are often the kiss of death for untenured faculty.  
Bureaucracy and administrative challenges of developing something new.

From an undergraduate perspective: Breaking down social language barriers – i.e. engineering
language does not allow for good communication with social scientists. 
Students come in to class with pre-conceived notions or stereotypes. 
The Energy 101 course piloted through the Dept. of Energy uses a flexible approach and an app 
that may be palatable to students 
Having a balanced approach to energy technologies is consistent with Dan Kammen’s presention. 
Developing a capstone project can help to integrate learning.

Can energy be a stand-alone curriculum? 
What is the value of a MS in renewable energy? A Masters in Science plus business may offer more 
opportunities. 
What are employable skill sets in bioenergy? 
Will federal funding of bioenergy programs continue? When federal funds are the gone, the interest 
will wane. 
How employable are bioenergy students in non-biofuels companies? Ensuring understanding of 
fundamentals across the entire bioenergy value chain and at the same time including inter-
connectivity between the disciplines is essential.

What is the rigor of bioenergy curricula relative to traditional disciplines? Academia needs to think 
about changes in expectations in multi-disciplinary subject areas. 
Are bioenergy educators addressing needs? Do they need more assessment tools? 
Bottom up or top down driven curriculum development? Is there a better way? 
How to add value to a curriculum from an interest vantage point? How important is energy in the 
scheme of things? 
Promote more interest in STEM and energy research.

**Workshop D. Climate Energy Water Food Nexus, and People of Color**

*Moderator:*
**Professor Victor Ibeanusi,** Dean, School of the Environment, Florida Agricultural and Mechanical 
University (FAMU)

*Speakers:*
**Robert Gough,** Secretary, Intertribal Council on Utility Policy  
**Felicia Davis,** Board Member, Green 2.0 Initiative

The goal of this session was to identify how science and education can help provide practical 
solutions for three major issues facing the global community. The developing world lacks access 
to clean energy, safe drinking water and food security. According to the International Energy 
Agency (IEA), the amount of fresh water consumed for world energy production is on track to 
double within the next 25 years. The consequences must be addressed if developing countries 
and rural communities of the world are to have access to clean energy, safe drinking water, and 
food security.

The EnergyWaterFoodNexus is a new scientific enterprise that seeks to identify and facilitate 
innovations to solve a range of key issues facing the international community. It requires 
strategic public and private collaboration and reform in education and training in order to 
advance systems approaches, diffuse innovations and sustainable practices across borders.
The issue is receiving increased attention as scientists, policymakers, businesspeople, civic society and educators realize the importance of the connections among these essential resources. An interdisciplinary approach is needed to break the silos and examine the convergence of the energy, water and food sectors.

The human dimension is essential but is less discussed. How do rural and poor communities and countries obtain and sustain access to necessary resources in a crowded and competitive world? What are the imperatives for colleges and universities to educate students, and in particular, people of color to become leaders in a diverse workforce that includes minorities who are competent to help resolve these global issues.

These issues are a challenge for the educational system that often does not prepare students to make connections across disciplines and to explore the multiple dimensions of complex issues such as the nexus between energy, water, and food. Even when those connections are made, the human dimensions may be left behind. Most important is to ensure that the educational programs are combined with relevant research that has the potential of being commercialized and deployed for societal use.

International partnerships among academia, civil society, business and government are needed to make progress in the very near term.

This session helped set the stage for two events –

• The Florida A&M University International Summit on EnergyWaterFoodNexus: Sustainable Industry Solutions for Global Communities, March 26 - 28, 2015. Tallahassee, FL  [http://famuenergywaterfoodnexus.org/](http://famuenergywaterfoodnexus.org/). This is a summit to provide practical solutions on the energy-water-food crisis facing the global community. This summit will identify the current state of science and technology and discuss how to engage industry in participating in solutions. The summit will feature a special Tech Expo, showcasing organizations with emerging technologies in energy, water and food. There will also be special forums for high schools and college students.


FAMU is also working to establish a Scholars in Residence Program as a hub for training next generation students in energy-water-food nexus research, supporting student projects aimed at bridging the EnergyWaterFood gaps; establishing a platform for global community engagement and outreach; and supporting a Private Sector Global Network, a platform promoting research and training leading to commercialization and deployment of EnergyWaterFood solutions.

This session:

1. Identified connections among energy, food and water;
2. Considered the importance of culture, economics and politics in providing adequate resources for all people;
3. Explored curricular reforms needed to prepare students and professionals to explore this multi-dimensional issue;
4. Identified effective programs at a variety of institutions that can be replicated and scaled up;
5. Developed a cross-sectoral strategy for:
   - Creating New Platforms for Global Community Engagement and Outreach
   - Engaging Students, Millennials and Generation Y

Session Report:
Promoting Community and global involvement:
- Removing hurdles so that students without US citizenship can be fully engaged in research
- Framing questions to promote knowledge-based solutions
- Honoring local capacities and translating indigenous capacities into the academy
- Respecting other viewpoints and promoting ethical and value systems
- Promoting small scale and subsistence farming
- Documenting institutional and regional capacities
- Promoting shared decision-making process
- Holding hearings and town meetings to engage communities
- Promoting broad community engagement
- Engaging K-12 educators
- Understanding global conflicts
- Understanding the geography of places
- Connecting climate changes to local communities

Workshop E. Energizing Energy & Climate Education

Organizers:
Tamara Ledley, Senior Scientist, Technical Education Research Centers (TERC)
Mary Jo Leber, Educational Program Manager, Virginia Space Grant Consortium (VSGC)
Frank Niepold, Communication and Education Co-Chair, US Global Change Research Program, NOAA Climate Education Coordinator

Symposium
The Energizing Energy and Climate Education Symposium focused on actions to achieve our mutual goals of improving energy and climate literacy, enhancing access to existing resources and incorporating social media in our strategies. We examined:
1) effective strategies for fostering long-term energy and related climate and global change literacy (Building Critical Mass),
2) effective teaching with energy and climate education resources and increasing the availability to educators of high quality resources (Catalyzing an Energy and Climate Education Explosion),
3) emerging best practices for utilization of tools such as videos and social media to disseminate resources, to inform and engage learners (Initiating a Chain Reaction).
**Building Critical Mass:**
An overview of the range of strategic energy and global-change literacy efforts to build the community and capacity to address energy and climate challenges, including energy and climate literacy frameworks and the use of the Collective Impact model, how these efforts relate to new education standards and Green Schools efforts, the importance of addressing doubt, denial, and despair, and a vision for transforming the nation’s 140,000 schools into engaging, inspiring living laboratories.

**Models for Catalyzing an Energy and Climate Education Explosion:**
Effective teaching methods for generating interest and expanding knowledge in energy and climate education were be described, using examples of energy and climate resources developed by NASA’s Earth Systems, Technology, and Energy Education for MUREP (ESTEEM, formerly NICE - NASA Innovations in Climate Education), including EarthLabs Earth System Science Module, Climate Change in My Backyard, The Green Ninja Project, Climate Science Investigations (CSI), Climate Education in an Age of Media (CAM), the “Ask US” Google Hangout Workshop Series, and the Tri-Agency Climate Education Catalog (TrACE). Following a brief overview of the types of energy and climate resources freely available to educators, the participants discussed how to increase awareness of the current energy and climate resource collections and the need for a collective sustainable resource library/repository.

**Initiating a Chain Reaction: A shared social media strategy for maximizing energy education to combat climate change and support a green economy**
The power of social media to ferment change is proven, from the Arab Spring to the Protests in Hong Kong, from Ellen DeGeneres at the Academy Awards to the “ice bucket challenge”.

Your presence at this conference means you are part of the choir that already recognizes the importance of energy literacy in combatting climate change and leading our nation to develop a new green economy. What can we do to improve our efforts to harmonize? How can we engage in a collective social media strategy to make the desired short term and long term impacts we wish to see in energy education? What would a bottom up approach that engages students in sharing energy educational resources look like? We looked at examples of the effective use of social media within the climate and energy community while also asking, how could we add a shared messaging strategy to them?

**Workshop**

**Overview**
The *Energizing Energy and Climate Education* workshop focused on actions to achieve our mutual goals of improving climate literacy, enhancing access to existing resources and incorporating social media in our strategies. We discussed how to collectively *Build Critical Mass* by leveraging existing initiatives and efforts, including new education standards, green schools networks, and establishing a collaborative organization built on the collective impact model, *Energize Energy and Climate Education* through Professional Development to model effective pedagogies for communicating energy and climate education and by increasing the availability of energy and climate resources through expanding teacher awareness of the existing resources and/or establishing a collaborative, sustainable national resource clearinghouse.
and *Initiate a Chain Reaction* through the incorporation of social media and common messages into our individual strategies.

**Agenda**
The Workshop Facilitators reviewed the major points made in the symposium and the many questions surrounding them. Attendees participated in the strand of the greatest interest to them. The strands encompassed the following topics:

1. **Building Critical Mass** This strand focused on reviewing the prior work and developing clear next steps to move this forward.
   - What are the challenges and opportunities relating to fostering increased literacy through formal and informal education? Energy and related climate education requires a long-term strategy to move beyond short-term, piecemeal efforts, building on existing frameworks, initiatives, and networks. Projects such as the Climate Literacy & Energy Awareness Network (CLEAN) and the Climate Adaptation Mitigation e-Learning (CAMEL) have played a leadership role in developing a long term vision, and potentially can link with a wide range of other efforts, including Green Schools and new education standards.
   - The "Collective Impact" model has provided a framework for identifying share vision and other elements of a strategic plan, particularly the need for a strategic backbone and collective governance.

2. **Models for Catalyzing an Energy and Climate Education Explosion and Fueling Energy and Climate Education with Effective Pedagogies.** We explored effective pedagogies and professional development models for communicating energy and climate education, elaborating upon the teaching methods introduced in the symposium, and worked on an Action Plan to achieve the goal of enhanced access to resources for educators. Many resources have already been collected and reviewed and are available through clearinghouses such as NEED, CLEAN, TrACE, CAMEL, but many other high quality resources have not. How can we make it easy for an educator to find and identify reputable resources amidst the significant number of resources available on the internet? Sustainability is the key issue, as valuable resource collections are subject to abandonment due to loss of funding and the need for maintenance. Recognition of bias in resources and the need for both pedagogical and scientific content review is another key consideration. The potential of existing repositories as models or the basis of a sustainable repository was discussed.

3. **Chain Reaction- developing a shared social media strategy**
The goal of this strand was to develop a shared social media strategy.
   - How can we help teachers quickly access resources for addressing energy as a cross cutting concept in the NGSS?
   - How can we engage non-science teachers in using energy as a discussion theme in their history, English, art, poetry, and civics classes?
   - How can we increase science literacy on issues of climate and energy?
   - What type of student competition models might be used to leverage the social media savvy to support the larger cause?
• How can we get students to be part of the message on energy education resources?
• Devise a shared hashtag (something all agree to use in addition to their own marketing).
• Schedule a regularly held twitter chat using this hashtag.
• How can we leverage a celebrity to join our effort?
• Develop scenarios to encourage teachers to share via social media.
• Investigate collaboration space for making short videos.

Subgroup – Developing a Collective Impact Common Agenda using the Community Climate Literacy Logic Model

Develop within the framework of the Community Climate Literacy Logic Model
http://tinyurl.com/CommunityClimateLitLogicModel

Expanding the Customers / Audiences
• Resource producers (awardees/programs expansion)
  o Agriculture – better food nutrition
  o Transportation

• Unions (Electricians)
  o Teaching energy efficiency
  o Renewables
  o Creating apprenticeships and workforce

• Funders
  o Long term outreach
  o Means to evaluate projects
  o Proposal to address climate and energy issues

• Voters/General Public (The public is needed for climate action)
• Higher education – tenure track faculty at research universities
• Higher education lecturers
• University Administrators
• Local / regional policy makers
• Community leaders
• Advocacy Groups
• Learning scientists / social scientists
• Museum / science centers/ informal education
• Disaster workers – relief / Refugees / Military – Risk Assessment
• Policy Makers
• Middle School students (public)

Outcomes – Intermediate Term
• Architects / City Planners – Should incorporate environmental and climate issues in development of buildings and building developments
• Integration of student work and learning into community discussions and decision making
  o Present climate change science in a format that policy makers can understand
  o Service Learning
  o Effective MOOC-like tools that can be blended with face-to-face techniques
  o Entrepreneurship – creating opportunities to work, teaching learners to innovate
• Immersive experiences and online education
• Supplying extensive outreach for all, but also in-person experience. Find a balance for those two extremes (impersonal and personal)
• Educators – connect with existing resources – know where, how, and determine effectiveness
• Interest students with scientific information concerning global climate change, defining key mental models that we believe are needed
• HOPE

Outcomes – Long-Term
Students
• Network of students who are utilized to gather geographically distributed information as input to understand a problem that will feed into making a decision.
• Students – to obtain a career that reduces one’s carbon footprint

Careers
• Teachers and Students – Engage more middle school and high school students in pursuing STEM Careers – and retain in the undergraduate level
• Awareness to create interest in related careers

Community Members
• Social action to influence policy makers and service providers
• Improved civic education leads to a sustainable future

New Businesses and new business models based on climate and energy education

Policy Makers
• Influence policy makers’ agenda to value climate change
• More climate and energy-related regulations, laws supported by the general public

There were holes in the logic model
Citizenry and workforce strategies need to be thought through together

Subgroup – Catalyzing Shared Social Media Efforts for Climate and Energy Education
Theme: Focus on distribution, not creation of resources. Social media hashtags to share. Sharing among social media. Common repository need - is that CLEAN or a Readit for teachers?

1. Group committed to meeting at least 4 additional times (quarterly) to ensure action on these items
   a. Who is backbone for this group?
   b. Focus on distribution to teachers

2. Create a group calendar of webinars, Google Hangouts, Professional Development events, etc. of interest
   a. Make this public?
   b. Update at least quarterly
   c. Identify a point of contact (POC) to update?
   d. Listserve to alert for new events?

3. Asset inventory of organizations - OSTP, CLEAN, ClimateChangelive.gov, Green Ribbon schools, Green Teachers, Institute for Library and Museum Services (ILMS) who will be connected virtually, what about celebrities and others?
   a. Neil deGrasse Tyson
   b. How to use PBS to amplify the materials and marketing strategy?
   c. Connect with sub-organizations of organizations
   d. 30-second videos on each player

4. How could we use a mascot to help amplify and strategize? (e.g., Smoky Bear, Green Ninja, The Renewables, Captain Planet)

5. Quarterly co-opt holiday social media messaging
   a. Identify hashtag to use
   b. October, Energy Awareness Month (replace Columbus Day)
   c. April, Earth Day
   d. January, MLK Day/Community Service
   e. May/June – Mothers Day and Fathers Day
   f. Could be GIS Day, might want to highlight ESRI
   g. Audience: students and teachers
   h. Resource inventory and showcase 10 highlights at each quarter
   i. Could be identified by resource type (top 10 videos, top 10 emails or resources for non-profits, resources from private sector, resources from government)
   i. Craft message for everyone to share FB/Twitter
   j. Holidays may not be good if not in school, federal holidays
   k. Smaller messaging throughout the year
   l. Engaging questions to generate dialogue prior to the 4 events?
   i. CLEAN, Ask A Scientist, What do you think about STEM?, What is your favorite lesson from a teacher?

6. Could we use a CLEAN call for how to use Twitter to market climate and energy education?
   a. Or ESTEEM can schedule a Google Hangout?
7. Get DOE involved in CAMEL, ASK US and TRACE Catalogue

8. Promote CLEAN, CAMEL, DOE, other existing resources

9. Thoughts for CLEAN: Add a “Pending Approval” Tab for CLEAN – make resources available
   a. Need for Vetting, Non-vetted in terms of sharing

10. Reach out to Library of Congress to explore being a repository (DOE)

11. Start cross-posting among agencies

Summary

- Began to flesh out a Common Agenda for an effective Climate and Energy Literacy
  Collective Impact effort based on the Community Climate Literacy Logic Model – focused
  on Audiences, Outcomes (intermediate and long-term). Conversation to continue in the
  NCSE 2015 conference and in the CLEAN Network

- Effort to work collectively on distribution through social media and connecting existing
  networks more effectively through multiple platforms – Meeting March 30 at 3:30, check
  DOE website for information

- Creating a cross community calendar of climate and energy literacy events e.g. (hangouts
  webinars, conference calls etc.)

**Workshop F. Approaches to Energy Education: Key Issues for Teaching**

*Moderator: John H. Perkins*, Member of the Faculty Emeritus, The Evergreen State College; Senior
Fellow, National Council for Science and the Environment

*Speakers:

- Serpil Guran*, Rutgers EcoComplex Integrating Sustainability & Systems Thinking With Clean Energy
  Concepts
- Ann Batiza, Director, The SUN (Students Understanding eNergy) Project, Milwaukee School of
  Engineering *Life Runs on Fuel Cells - A Gateway to Energy Across Disciplines*
- Lisa Bosman, College of Menominee Nation, *Pedagogical Approaches to Re-Integrate Learning Styles
  into STEM Based Solar Energy Research*
- Mary Annette Rose*, Ball State University; and James Eflin, Ball State University *Promising
  Pedagogies for Energy Education: Immersive and Experiential Learning from a Situated Cognition
  Perspective*
- Stephen Balogh, SUNY, College of Environmental Science and Forestry, *Energy Return on Investment*
- Lado Kurdgelashvili, University of Delaware, *Levelized Cost of Electricity*
- David Murphy, St. Lawrence University, *Energy Return on Investment*
- Kathleen Saul, MES, University of Delaware (PhD candidate) and The Evergreen State College,
  *Political Ecology*
Diversity of student interests, faculty strengths and interests, and institutional missions call for
different approaches to energy education. At the same time, faculty and students need coherence
and commonalities about what is to be taught and how. Future employers in the energy arena
will also want coherence in energy studies, because they will need a sense of what students from
such programs know and can do.

This session featured a variety of approaches to energy education, and each approach comprises
a component of “energy studies.” Three of the contributions to the session focus on the
institutional and pedagogical context developing specific energy topics. Four additional
contributions center on specific methods used to compare different energy sources.

The session sparked a lively discussion about the challenges of melding institutional and
pedagogical approaches with specific methods that have wide-spread uses in energy policy.

1. How does the specific topic of your presentation fit into a course on energy education?
2. What requirements or prior preparation do you require to ensure that students are ready to
   engage in your subject matter?
3. What are the types of classes for which your materials are best suited?
4. Do you have any data on the effectiveness of the learning outcomes? Are they anecdotal
   or systematic data?
5. What sorts of ways do you evaluate the successes of your efforts with your materials?
6. What steps do you see as most in need of change to make your materials more effective?

The questions above guided discussions in the workshop. During the first hour, emphasis was on
different methods for assessing the strengths and weaknesses of energy sources. The second
hour emphasized the use of specific content and approaches. In the third hour all participants,
speakers and audience, discussed (a) how the variety of pedagogical approaches examined can
reinforce each other and (b) next steps needed to strengthen energy education.

Goals and outcomes:
This session aimed to explore a variety of contextual and quantitative approaches to energy
education. The outcome is enhanced familiarity with a variety of techniques useful in different
contexts and the ability to see effective uses of different combinations of approaches and
methods.

Session contents
Diversity of student interests, faculty strengths and interests, and institutional missions call for
different approaches to energy education. At the same time, faculty and students need coherence
and commonalities about what is to be taught and how. Future employers in the energy arena
will also want coherence in energy studies, because they will need a sense of what students from
such programs know and can do.

This session featured a variety of approaches to energy education, and each approach comprised
a component of “energy studies.” Three of the contributions to the session focused on the
institutional and pedagogical context developing specific energy topics.
  • Integration of STEM instruction on solar energy with learning styles relevant to Native
    American students
• Integrated study of electron flow (as in fuel cells) using materials from physics, chemistry, and biology
• Integration of theoretical learning about energy with relevant practical applications

Four contributions centered on specific methods used to compare different energy sources.
• Life-cycle assessment (LCA)
• Energy return on investment (EROI)
• Levelized cost of electricity (LCOE)
• Political ecology

Morning presentations outlined each of the above areas. The afternoon workshop focused on discussing these topics in a workshop to further define and elaborate on the usefulness and the relationships among the seven topics.

Outcomes

A number of key points emerged from the workshop discussion.
• The importance of leading students to an understanding of the nature of “sustainability”
• The critical role of systems thinking about energy
• The need to establish boundaries for systems and the critical role boundaries play in assessments of energy alternatives
• The need to develop graphic demonstrations of key assessment tools: LCA, EROI, LCOE, and political ecology, in order to promote student learning
• The need for students to develop an understanding of energy-exergy-entropy, quantitative for some, qualitative for other students
• Somewhat as a quip, the idea of “ESL” made sense. ESL usually means “English as a Second Language,” but “Energy as a Second Language” has parallels. For students, energy studies involves a new vocabulary, new conceptual relations, and a new logic. It’s a foreign language to newcomers.
• Economics and costs, and the 2nd Law of Thermodynamics, pose serious challenges for developing new energy systems.
• Energy studies require (a) integration of multiple topics, and (b) experiential learning through projects and field trips.
• Energy sources have important scale dimensions: (a) personal, (b) state-regional, (c) national, and (d) global.
• To emphasize energy efficiency, students need to learn the concepts and methods of (a) energy audits and (b) demand management.
• Energy is not just a casual concern; safe and adequate energy is literally a matter of life and death for people.
• Energy studies must include theories and concepts about (a) behavior, (b) ethics, and (c) culture.
Workshop G. Developing, Educating, and Expanding the Energy Bar…No, No That Kind of Bar!

Organizer and Moderator:
Donna Attanasio, Senior Advisor for Energy Law Programs, The George Washington University Law School

Speakers:
Carla Santos, Global Energy Fellow, Institute for Energy and the Environment, Vermont Law School
Overview of Vermont Law School Energy Program
Nancy J. Skancke, Founder & Owner, NJS Law PLC

The Energy Bar Association’s Committee on Energy Law Education is working on energy law curricula and seeks input on how energy law should be taught and integrated into curricula within and outside of law schools.

Because energy is so critical to our lives, economy, health and national security, it is no surprise that energy systems are heavily regulated, often including, for example, with respect to rates, competition, safety, operations, accessibility, environmental impact and siting. Those laws and regulations therefore affect everyone.

The Committee has been engaged since last February in an exploration of how energy law is taught, and could be better taught, in the U.S. Our primary focus has been on how to teach lawyers the broad array of skills and knowledge required to be effective advocates for sustainable, affordable, reliable and accessible energy systems, and attracting into the field of energy law undergraduates who reflect the multidisciplinary nature of energy systems, including scientists, engineers, environmentalists, economists, and finance, accounting and business majors. But there also exists a need to educate non-lawyers in the basics of energy law, to help them better understand the laws and policies that affect its accessibility, affordability, reliability and impact on our environment and health. Our work focuses primarily on the education of lawyers, but we are interested in intersections with other disciplines as well.

Session cancelled

Workshop H. Connecting Campus and Community as Living Laboratories

Session Organizers:
Karen Berger, Lecturer, Earth and Environmental Sciences, University of Rochester
Karin Warren, Herzog Family Chair of Environmental Studies & Science, Randolph College (Virginia)
Brian Lovell, Automation & Education Consultant/ Co-Principal Investigator for the NSF Best Center Project/ Founder of the Association of Controls Professionals, Georgia Piedmont Technical College
Amanda C. Graham, Education Director, MIT Energy Initiative, Massachusetts Institute of Technology - Energy and Climate Literacy for Civic Education
Jennie C. Stephens, Associate Professor, Blittersdorf Professor of Sustainability Science and Policy, Fellow, Gund Institute of Ecological Economics, Rubenstein School of Environment and Natural Resources, College of Engineering and Mathematical Sciences, University of Vermont
**Symposium**
Session overview and goals: **Karen Berger**, University of Rochester and **Karin Warren**, Randolph College (Virginia) - Engaged learning or practical learning about energy – more tangible connections, beyond classroom teaching. The common approach pedagogically is learning by doing, whether on own campus or in community; out of classroom, engaged in experiential learning. This is the touchstone. Then learn skills for how to make that happen on campus and in community.

**Brian Lovell**, Georgia Piedmont Technical College - The Campus as a Living Laboratory: Using the Built Environment to Revitalize College Education. (Living laboratory, industry connections)

**Karen Berger** and **Karin Warren** - Bringing the Campus and Community together for Energy Education (Community engagement through coursework and projects)

**Amanda C. Graham**, Massachusetts Institute of Technology and **Jennie C. Stephens**, University of Vermont - Energy and Climate Literacy for Civic Education (Programs to increase public education and awareness of energy and climate)

Responses by community members A service learning professional discussed best practices in civic engagement and education and/or financial resources available, which provided a framework for the workshop discussion.

A discussion with those present helped set the stage for the afternoon workshop

Energy education provides a simple avenue for students to become involved in a hands-on way in conservation; they can see and often measure a direct link between their actions and energy consumption. Many institutions have programs that use students’ knowledge about energy to help campuses and communities become more efficient. Some initiatives are purely extracurricular (i.e., energy-saving competitions between residence halls), while others arise out of the curriculum in energy-focused courses and may be part of a student’s academic expectations (i.e., an energy audit of a campus building as a course assignment). The goal of this session was to look at engaged learning about energy.

We explored the connection between doing and learning, campus and community. Presentation and discussion focused on how to make these goals happen on campus and in the community. We considered how campus activities can advance a broader conversation about energy in society.

The workshop focused on three general areas:

1. Living laboratory, industry connections
2. Community engagement through coursework and projects
3. Programs to increase public education and awareness of energy and climate

**Workshop**

The goal was three-fold: first, to collect as many examples as possible of campus and civic engagement units that have been designed and/or implemented; second, to evaluate the provided examples and brainstorm more, given the information from the symposium; and third, to identify
educational and financial resources that would help encourage broader implementation of campus and civic engagement in energy education. While the symposium speakers focused on the higher education community, the projects and resources likely are relevant for secondary schools as well.

The discussion considered the essentials of living labs (hands on research, course content connecting to tangible projects), engagement with industry and community, introducing students to skill-based learning on campus and in their communities, how to make projects happen (this is hard for small liberal arts college to afford – partnerships with industry for equipment would be a great help); how to be of service to community, how to get students engaged in real world – projects that contribute to the campus and community. Attendees shared their own experiences and formulate a strategy for taking measureable steps for implementation at their home institution. Planning guides were provided, which include a range of options for first steps.

Participants considered needs for follow-up opportunities including mutual- mentoring, webinars and even site visits.

The session concluded with 3 theme report outs, plus 1 minute report out of what each participant is planning to do on their campus.

Report
• Know yourself.
  - Why are you initiating a project? What resources do you bring to the project?
  - What are your impact criteria? Clarify and prioritize. Define them so they can be quantified.
• Know your campus.
  - What do they want to know? How does it line up with what you’re able to provide?
  - What efforts are already happening? What opportunities exist?
  - With whom should you partner?
  - What are opportunities for integrating into curriculum?
  - Identify your allies and resisters and why they have the attitudes that they do.
  - Identify the challenges and values for different departments on campus.
  - Be patient; accept academic time scales.
• Know your community.
  - What do they want to know and why? How does it line up with what you’re able to provide?
  - What efforts are already happening? With whom should you partner?
  - What is the political and social climate? (Choose appropriate language.)
  - What funding opportunities exist in the local community?
• Communicate with your audience.
  - Who would benefit from your results?
  - Use language that meets them where they are.
  - Clarify expectations.
• Design programs for continuity.
  - Build supportive relationships with facilities staff from the beginning.
  - Build in feasibility and follow-up into project design.
- Provide infrastructure to support partnership.
  - Human resources support
  - Data collection and accessible data management
  - Organizational infrastructure
    - Establish mechanisms for assessment that includes evolving needs and evaluating project life-cycle.

ACTION ITEMS
- CAMPUS-BASED ACTIONS
  - Learn about your campus and community.
  - Who are the players? What’s driving them?
  - What internal and external funding is available?
    - Based on actions in key findings, develop and implement programs that address campus-community connections.
    - Develop campus-based repositories of information
- Operational (energy use, etc.)
- Internships
- Projects or programs (student research, paper)

COLLECTIVE ACTION
- Create a database of assignments or case studies that demonstrate language people are using to communicate energy issues.
- Create a set of standard questions and distribute.
- How have you ensured continuity?
- Identify a location to host the database. (CLEAN/CAMEL?)
- Use diverse platforms to share information and contacts.
  - Create a database / listserve of people working on college-community partnerships. (CLEAN/CAMEL?)
  - Write a white paper looking at continuity in active-learning projects.
- Evaluate survey results.
- Propose workshop at 2016 National Energy Education Summit or NCSE Conference.
  - Identify or develop assessment tools.
- Request support from NCSE for next survey
- Consider both quantitative (years to completion, jobs) and qualitative (learning, attitudes) outcomes
  - Find and share models for advisory boards that campuses can create for energy initiatives/programs to provide oversight and (potential) funding
  - Find and share models for recognition of active learning projects in faculty/staff evaluation.

Resources:
- Cooperative Extension, works on translating science into layperson’s terms
- E3A (fact-sheets on energy topics)
- Local Chambers of Commerce, faith institutions, local government
- EPA P3 program (source of funding)
- Oak Ridge National Labs (summer fellowships for faculty)
Workshop I. Energy in Higher Education: Increasing Opportunities for Energy Studies and Capacity Building

Organizer and Moderator:

Speakers:
Leigh Abts, University of Maryland; Research Associate Professor; Fischell Department of Bioengineering; Department of Teaching and Learning, Policy and Leadership.
Sam Shelton, Georgia Tech University, Founding Director, Georgia Tech Strategic Energy Institute
John Crockett, San Diego State University, Program Director, Center for Energy Sustainability
Todd Cohen, Director, Sustainability Education Economic Development (SEED) Center,
Kenneth Klemow, Wilkes University; Professor and Associate Director, Institute for Energy and Environmental Research
Joel N. Swisher, Western Washington University, Director, Institute for Energy Studies; Professor, Huxley College of the Environment,

Session 1. Charting a course for the future of Energy Education in Post-Secondary Higher Education
The previous 5 years has seen tremendous growth and interest in energy education in the nation’s community colleges and universities. In part, this growth has mirrored the Nation’s own economic and job growth in the energy and advanced manufacturing sectors as well growing interest and discussion in the societal role energy plays in everyday life. All of this has lead to growing demand from students in energy studies. This portion of the workshop concentrated on creating a 5 year plan of action for increasing opportunities for energy education in the post-secondary setting with milestones and goals articulated, and the opportunity for collaborative opportunities and community building by governmental, academic, and organizational participants and panelists including Department of Energy staff.

PROGRAM LEADERSHIP

1. Institution-specific based on administrative structure; wanting longevity of curriculum
2. Support of leadership program by institutions
3. Know your audience
4. Tailor to resources
5. NCSE should put together a list of funders - foundation funding versus external donors
6. Template for case studies to identify different approaches by different institutions
7. Develop a support list serve

Session 2. Designing a platform and mechanism for energy education content and knowledge sharing

Through institutional, organizational and government investments, the landscape of energy education resources and content has grown exponentially. This section of the workshop concentrated on how to build a platform or mechanism for sharing of resources related to energy and advanced manufacturing. The Department of Labor’s $1.95 billion, four-year Trade Adjustment Assistance Community College Career Training (TAACCCT) program will create over 1 billion dollars of Energy and Manufacturing related content, digital media, courses, curriculum and career pathways identification, that will be free, open source, creative commons; modifiable by colleges and universities. This is in addition to other resources created by the Department of Energy and other agencies that are re-usable and sharable. Workshop participants worked on a roadmap for the utilization of energy education resources located within and outside the federal government as well as suggest the development of other tools and content that would be beneficial for the post-secondary energy education ecosystem and panelists will include academic, governmental and organizational subject matter experts.

• CURRICULUM DESIGN
  1. NCSE market research on demand for energy knowledge, skills and degrees in private sector, government, academia, civil society
  2. NCSE survey of supply of current programs and how they align with market demand
  3. NCSE assess what is happening at K-12 level that will increase demand for these kinds of programs in the future
  4. NCSE recommendation for next year’s conference: Food, Energy and Water – include an interdisciplinary focus – “Designing the Future Professionals,” teaching systems thinking is needed
  5. CEREL support a collaboration platform for communicating around interdisciplinary energy curriculum design; particularly important as move from minors to majors
  6. CEREL promote development of general energy education curriculum and content for different audiences, beyond just Energy 101
  7. Energy jobs market development programs through student internships (DOE model for energy assessments)

• ISSUES but no specific recommendation
  o Metrics for assessing programs
  o Systems thinking in energy programs—teachers don’t have it
  o Connection to innovation and entrepreneurship programs
  o Seems to be a gap in energy finance

• PARTNERS AND RESOURCES
  1. DOE determine how they can provide resources for program development; if not, can they partner with NSF or DOE that might be able to
  2. Education award for junior faculty that engage in innovative interdisciplinary subjects or pedagogies (fund education, not just research)
3. Student engagement has to be early and as “sticky” as possible, whether coursework maps at community colleges, associates degrees, learning pedagogies that are student focused, such as project based learning.

4. What is the appropriate mechanism to influence utilities in terms of their workforce needs and how they are changing?

Workshop J. Degrees, Minors, Certificates and Concentrations

Session Organizer:
Scott Williams, Research and Education Coordinator, Wisconsin Energy Institute, University of Wisconsin-Madison, Certificate in Engineering for Energy Sustainability

Speakers:
Shirley Vincent, Director, Center for Environmental Education Research (CEER), National Council for Science and the Environment Energy Education: Results from 2012 Census
Ann Greaney-Williams, Academic Coordinator, and Priyanka Chatterjee, Student in Mechanical and Ocean Engineering, Massachusetts Institute of Technology Energy Initiative (MITei), MIT Energy Minor Program
Dan Kammen, Director, Renewable and Appropriate Energy Laboratory (RAEL), University of California at Berkeley
Kimi Grzyb, Oregon State University, Bioenergy Minor

Energy Education at colleges and universities is likely on the verge of a major expansion. A 2012 census identified 37 non-traditional or broad energy (NTBE) degree programs offered at 25 US colleges and universities, 164 disciplinary or professional degree programs with formal NTBE specializations, and 109 NTBE minors and certificate programs. About half of the degrees and two-thirds of the minors and certificates are undergraduate programs. A survey of institutes and centers at research universities completed in 2014 identified 294 focused on energy. Most include education as a primary goal and over a quarter administer academic programs, mostly minors and certificates.

The goal of this session was to facilitate the creation, advancement and improvement of Degrees, Minors, Certificates and Concentrations in the energy field. After an overview by Dr. Shirley Vincent, Director of NCSE’s Center for Environmental Education Research (CEER), leaders of current programs shared the stories of the creation and operation of their programs. They discussed the challenges of creating and sustaining non-traditional, cross-disciplinary programs and how they overcame the challenges.

The afternoon workshop enabled all participants to share their situations, challenges and successes. The group identified sets of common and institution-specific challenges and catalog approaches to meet these challenges. Each participant identified several actions they will take upon returning to their institution. The workshop participants were invited to continue after the Summit in a mutual-mentoring support group that may also develop a guidance document for interdisciplinary and NTBE programs.
Workshop K. READ for the EARTH: Bringing Energy and Climate Education to College Students

Session Organizers:
Geoff Haines-Stiles, Co-Founder and CEO, Passport to Knowledge (P2K)
David Blockstein, Energy Education Summit Chair, CEREL Executive Secretary, National Council for Science and the Environment (NCSE)

Additional Speakers:
Richard B. Alley, Evan Pugh Professor of Geosciences, Penn State University (by conference call)
Russanne Low, University of Nebraska-Lincoln - *Use of Earth: The Operators’ Manual in an online course*
Andy Jorgensen, Department of Chemistry, University of Toledo, Introduction to the Climate Adaptation and Mitigation E-Learning (CAMEL) web resource [www.CAMELclimatechange.org](http://www.CAMELclimatechange.org)

The session was primarily directed towards those who may want to improve student learning about energy and climate by use of a [package of curricular resources centered on the PBS series “EARTH: The Operators’ Manual” (ETOM)](http://earththeoperatorsmanual.com/feature-video/earth-the-operators-manual) and the accompanying book by award-winning geoscientist and communicator, Richard Alley. See [http://earththeoperatorsmanual.com/landing/watch-share](http://earththeoperatorsmanual.com/landing/watch-share)

Each of the three programs has its own page:


A NSF-funded project, [www.CAMELclimatechange.org](http://www.CAMELclimatechange.org), with National Counsel for Science and the Environment and Passport 2 Knowledge (P2K) is piloting the use of these resources for First Year Reading programs or in the classroom.

Our goal is to deliver a suite of materials that can be used by schools that require all first year students to read a single book on critically important topics to promote interaction and engagement among and between their first-year cohorts.

The content is also suitable for subsets of students such as students in honors programs and in interdisciplinary courses.

Our package of climate change education resources and materials includes:

1. The book “EARTH: The Operators’ Manual” (ETOM), provided at a discount by the publisher, to be used as either a required text or optional reading for first year students.
2. Segments and clips from the PBS ETOM series (hosted by Richard Alley), available through both the ETOM and CAMEL websites
3. Special opportunities for cyber-enabled interactions with ETOM author Richard Alley via webinar, Google Hangout on Air, or other emerging technologies. Dr. Alley may be available to visit some campuses.
4. Option to take the Penn State/Coursera Massive Open Online Course (MOOC), “Energy, The Environment, and Our Future”, taught by Dr. Alley and offered through Penn State
5. Access to thousands of high quality encyclopedia style articles and other information about a wide range of climate change science and solutions through the Climate
Adaptation and Mitigation E-Learning (CAMEL) web resource www.CAMELclimatechange.org

6. Additional digital content such as an e-book version of ETOM, energy-saving apps and podcasts available through both CAMEL and P2K/GHSPi
7. Interaction between students at different schools through the ETOM Facebook site and other social media. The ETOM FB site has well over 50,000 participants and a very high level of engagement.

The morning symposium introduced the Read for the Earth materials (including video clips), included presentations from faculty who have used them in their classes and from one of the CAMEL PIs. The afternoon workshop enable faculty members to discuss strategies for use of the ETOM and CAMEL materials, either for First Year Reading programs or in the classroom. It will also provide an opportunity for discussion of other approaches to energy and climate change education.

Workshop I. Advancing Social Capacity to Mitigate Linked Energy-Environmental Problems through Sustainability Education

Session Organizers:
Elisabeth Graffy, Professor of Practice, Consortium for Science, Policy and Outcomes, Arizona State University
Walter A. Rosenbaum, Director Emeritus, Bob Graham Center for Public Service, University of Florida

Additional Speakers:
John Silkey, Director, Milepost Consulting
David Hassenzahl, Dean, College of Natural Sciences, Chico State University
Mike Shriberg, Education Director, Graham Sustainability Institute, University of Michigan

A growing trend in higher education is the introduction of sustainability paradigms, curricula and degrees which include a discussion about energy systems and their connection to larger societal sustainability goals. This energy component is especially important and challenging because “sustainable” energy” connotes a shift from the narrowly technical or technocratic perspectives common in traditional energy education to an appreciation for systems approaches that include social and ecological dimensions. The content and approaches related to such a shift are still emerging. At the same time, growing national concern about climate change is advancing in importance in campus sustainability discourse. Given this dual concern with energy and climate, an essential aspect of campus sustainability education should involve attention to linked energy-environment issues, such as climate problems, and to the social management, as well as the technological basis, of these challenges.

This symposium concerns the extent to which energy issues, their successful management, and the social aspects of the energy problem—matters such as public preferences, community stability, social equity and public policy -- are significant aspects of sustainability education. The discussion included attention to the quality and extent of the education’s on- and off-campus impact. The major issues discussed include:
• The importance—or absence—of discourse about the climate-energy-social linkage in the design of sustainability curricula;
• Innovations in sustainability education involving discussion about the social and political implications of energy development, including-climate change;
• How universities should address climate and other contentious issues (such as fracking, renewables, and carbon emission regulation) in sustainability curricula;
• Evaluating the on- and off-campus impact of energy-related sustainability education;
• The challenges and opportunities in designing relevant energy classes in sustainability curricula for mixed-background students at undergraduate and graduate levels.

Recommendations

• The campus should become a living learning lab in which discussion of energy and sustainability issues should regularly occur between facility manager, students, administrators and faculty.

• The administrative influence of students in campus sustainability decisions is often underestimated. Student influence and power on campus should be leveraged to achieve institutional sustainability goals. Enlisting student engagement means that sustainability issues should be engaging for students and interpreted in terms relevant to themselves and to the campus—including discourse about the risks and rewards implied by alternative future scenarios of national and international energy consumption.

• A common core curriculum for the campus should include attention to the relationship of energy and sustainability as major component. The objective is to assure that all students graduate with a foundation of energy-and-sustainability literacy. Require sustainability and energy training for staff.

• Development of a vital campus sustainability culture requires time and a long-term strategic vision nurtured and maintained through institutional creativity.

• Campus energy education relevant to sustainability should link knowledge about social objectives with information about practical strategies for achieving civic sustainability. This implies a robust discourse about effective civic activism in the energy curriculum.

• Campus energy education focused on sustainability should encourage collaboration with local communities to share research, best-practices, student internships and related activities linking campus and civic cultures.

• Replicating on other campuses the University of Michigan’s online dashboard energy education platform can be an entertaining and informative means for informing an entire campus community about its own patterns of energy consumption.

• Campus energy education for sustainability requires discovering the right digital language and media in both classroom and related communities.

• Preparing students for jobs and focusing upon their future opportunities in a green economy can enhance student interest and commitment to energy education for sustainability.

Thanks to our cosponsors:
US Department of Energy,
National Science Foundation,
National Energy Education Development Project (NEED),
Poster Session

Note: Posters will be up for the duration of the summit on Monday in Regency A & B.

1. **Blending Lecture, Problem-Solving, and Discussions for Introductory Energy Coursework at a Liberal Arts College**  
   Anna Goldstein, *Visiting Instructor, Mount Holyoke College*

2. **From Sunlight to Music: Integrating Stem and the Arts**  
   Michael Duffey, *Associate Professor, George Washington University*

3. **Education at the Speed of Research: An Overview of the NARA Approach to Bioenergy Literacy**  
   R. Justin Hougham, *Assistant Professor, Environmental Education Specialist, Department of Youth Development, University of Wisconsin-Extension*

4. **Ethanol-Based Gelfuel Production From Biomass for Household Cooking Fuel**  
   Biniam Taddele Maru, *Postdoctoral Candidate, Rovira i Virgili University, Spain*

5. **Bioenergy Related Student Learning, Classroom Materials, and Teacher Development at the Great Lakes Bioenergy Research Center**  
   John Greenler, *Director of Education, Wisconsin Energy Institute of University of Wisconsin-Madison*

6. **Determining Essential Components of a College-Level Bioenergy Curriculum Using the Delphi Technique**  
   Kimi Grzyb, *Bioenergy Education Initiative, Oregon State University*

7. **EmPOWER Rangers**  
   Larissa Johnson, *Climate Change Outreach and Communications Coordinator, University of Maryland Center for Environmental Science*

8. **Beyond Conservation – Reimagining the Purpose of Energy Education: An interactive issue of the Journal of Sustainability Education**  
   Larry M. Frolich, *Associate Professor, Natural Sciences, Miami Dade College, Wolfson Campus*

9. **Launching a Campaign for Building Science Education**  
   Cheryn Metzger, *Pacific Northwest National Laboratory*

10. **Involving Students and Parents in Climate Education and Action**  
    Dave Finnigan, *Founder, Climate Change is Elementary*

11. **Fabulous Resources for Energy Education**  
    Patricia Higby, *Energy Education and Outreach Coordinator, University of Northern Iowa*

12. **Creating Experiential Learning Opportunities within a Large General Education Class for Non-STEM College Students to Explore the Science of Energy/Environmental Sustainability**  
    Paul Goodall, *Associate Professor, James Madison University*

13. **High School Educators and their Students’ Perception of Climate Change and Renewable Energy**  
    Nirav Patel, *Research Fellow and PhD Candidate, Cornell University*
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Goals

- Strengthen the links among energy sciences and engineering in academia, government, and industry
- Advance university-based energy education and research
- Promote the role of energy research and education in society

Activities

- Research—advocating funding for university-based energy research, advancing and elevating the national dialogue about energy
- Education—developing sharing approaches and best-practices to prepare the future workforce
- Collaborating—bringing together research and education leaders from all fields of energy

Member Benefits

- Academic-Federal Dialogue on Energy Research and Education & Congressional Visit Day—April 13-14, 2015. One complimentary registration to an exclusive annual workshop with federal agency funders followed by visits to key congressional offices.
- Weekly Newsletter for Energy Educators and Researchers—weekly email updates on funding opportunities, federal actions, significant reports, meetings, jobs, etc.
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To Join Contact

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