15th National Conference and Global Forum on Science, Policy and the Environment

Energy & Climate Change

Conference Report

January 27-29, 2015

Hyatt Regency Crystal City at
Washington, DC National Airport

National Council for Science and the Environment
Improving the scientific basis for environmental decisionmaking

About NCSE

The National Council for Science and the Environment (NCSE) is a not-for-profit organization dedicated to *improving the scientific basis for environmental decision making*. NCSE specializes in programs that foster collaboration between the diverse institutions and individuals creating and using environmental knowledge, including research, education, environmental, and business organizations as well as governmental bodies at all levels.

EDUCATION, RESEARCH, AND CAREER DEVELOPMENT

NCSE brings members of the academic community together to improve their interdisciplinary environmental and sustainability programs and increase their value to society. Programs in this area include the:

- **University Affiliate Program** advances programs at over 150 member schools ranging from large research universities to small liberal arts colleges.
- **Council of Environmental Deans and Directors** improves the quality and effectiveness of interdisciplinary environmental programs on the nation's campuses.
- **Council of Energy Research and Education Leaders** fosters collaboration among academic energy leaders and enhances their contribution to a clean energy future.
- **Community College Affiliate Program** works to enhance environmental and sustainability efforts at member schools and in their respective communities.
- **Center for Environmental Education Research** conducts ongoing research to advance understanding of the evolving fields of interdisciplinary environmental, sustainability, and energy (IESE) education.
- **Daily Environmental News Digest** provides a compilation of 30 top environmental news and stories about issues and subjects valued by NCSE affiliates and partners.
- **EnvironMentors Program** prepares underserved high school students for college and careers in science and the environment at chapters across the United States.

NATIONAL CONFERENCE AND GLOBAL FORUM ON SCIENCE, POLICY AND THE ENVIRONMENT

The National Conference has become a signature event for the organization bringing together over 1,200 leaders from science, government, corporate and civil society to develop strategies to improve decision making on a major environmental theme. Conferences have featured such issues as water, health, energy, climate change, biodiversity and the green economy.

COMMUNICATING SCIENCE-BASED INFORMATION – THE ENCYCLODIA OF EARTH

The online Encyclopedia of Earth (EOE) provides comprehensive and accurate information on the Earth, its natural environment and their interaction with society, free to the public. Currently, over 1,400 environmental experts and 60 partnering organizations from 60 countries contribute their expertise to the EOE.

SCIENCE POLICY

NCSE builds support for environmental science and its applications, and the programs that make it possible. We present expert testimony to Congress, consult with key decision makers, and build coalitions to promote research and education.

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Conference Summary

Human energy use accounts for three quarters of greenhouse gas emissions globally and an even higher share in the United States. Transitioning to new "low carbon" and "climate resilient" energy systems lies at the core of any response to climate change. The challenges of such a transition include:

- reducing greenhouse gas emissions from current energy sources and practices;
- deployment of new low carbon energy sources at a greater scale;
- making energy systems resilient to the effects of climate change; and
- sustaining prosperity in many countries while providing additional energy services to lift many out of poverty around the world.

The 15th National Conference and Global Forum on Science, Policy and the Environment: *Enery and Climate Change* (January 27-29, 2015) brought together nine hundred leaders in science and engineering, policy and governance, businesses and civil society, and education to work across traditional boundaries and develop strategies to accelerate this needed transition.

During the two and a half day event, over 200 speakers presented in 7 keynote addresses, 6 plenary roundtable discussions, 40 symposia and 20 workshops.

The conference sessions were organized around thirteen tracks:

- COP 21
- US-China Partnerships
- Energy Sources
- Reinventing Utilities
- Smart Energy Use
- Climate-Resilient Energy
- Low Carbon Transportation
- Energy for All
- Energy-Water Nexus
- Finance, Pricing and Markets
- Communities
- Higher Education
- Advancing Science and Technology for Decisions and Solutions

Keynote speakers included:

- Gina McCarthy, Administrator, U.S. Environmental Protection Agency
- Jennifer Granholm, Distinguished Practitioner of Law and Public Policy, University of California – Berkeley and Former Governor of Michigan

- Stephen Hubbell, Distinguished Professor, University of California – Los Angeles (*Lifetime Achievement Award*)
- Amory Lovins, Chief Scientist, Rocky Mountain Institute
- Franklin Orr, Under Secretary of Science and Energy, U.S. Department of Energy
- Gerard Araud, Ambassador of France to the United States
- John Holdren, Director, Office of Science and Technology Policy, The White House

Breakout workshops were a key feature of the conference. The goal of the workshops was to generate additional action through development of improved strategies, tools, and partnerships. During the workshops participants developed strategic recommendations, committed to further collaboration and implementation, and outlined conference follow-up activities.

A list of the strategic recommendations and other outcomes from workshops follows this summary.

Please note that the workshops operated under "Chatham House Rules," whereby the outcomes were the result of group processes. They do not necessarily represent positions of NCSE, of every individual, or of the organizations which they work for.

The National Council for Science and the Environment thanks all conference session organizers, notetakers, and participants for their time, creativity, effort and commitment towards developing and advancing climate solutions.

Strategic Recommendations

Please note that the workshops operated under "Chatham House Rules," whereby the outcomes were the result of group processes. They do not necessarily represent positions of NCSE, of every individual, or of the organizations which they work for.

W1. Who is Responsible for Climate Change?

Partners: University of California, Davis; Union of Concerned Scientists Climate Accountability Institute; Concordia University

This workshop addressed key scientific, ethical, and policy dimensions of responsibility for climate loss and damage as well as adaptation and mitigation. The aim of the workshop involved developing strategies for how to better inform policy in the lead-up to COP 21 in Paris as well as broader societal debate. Discussion points included scientific challenges surrounding emissions estimates and allowances for different climate targets, political challenges involving when historical responsibility should begin, and the merits of focusing on national vs. corporate vs. individual responsibility.

Strategic Recommendations:

- Develop a coherent framework that can be used to describe the issue of who is responsible for anthropogenic climate change.
    - Capacity for action and awareness of the problem are key factors to consider.
    - Determining when we can equate responsibility to emissions is key, and science milestones might be a mechanism of determining which emissions matter.
    - Different actors (governments, corporations, individuals, etc.) carry different measures of responsibility, supply chain (extraction, production, consumption), and timing (historical, current, and future).
- Identify dimensions for this framework.
- Use the framework to determine: who is responsible for climate change, which actors bear responsibility, how to measure responsibility, how to define emissions that equate to responsibility, what parties are responsible for, and what the losses and damages are that fall under the umbrella of responsibility.
- Survey a broader audience, using the workshop as a test group, to further refine and prioritize whom and for what society should hold accountable with respect to climate mitigation, adaptation, and loss and damages.
- Present this framework in a publication that describes the dimensions and issues surrounding responsibility for anthropogenic climate change.

W2. Fostering Effective U.S.-China Nongovernmental Climate Change Partnerships

Partners: Shanghai International Studies University, Worldwatch Institute, Nova Southeastern University

The workshop brought together representatives from both countries to further U.S.-China bilateral cooperation. They engaged in a discussion on how to advance climate change diplomacy and educate their respective publics.

Strategic Recommendations:

- The U.S. and Chinese people and governments should understand each other in terms of governmental systems, economic patterns, and lifestyles.
- U.S. and Chinese nongovernmental organizations, universities, scientists and laypeople should cooperate more deeply to share their respective perspectives about climate change.
- People should be able to gather local information about startup organizations, universities, think tanks, etc., and the experts can use these analyses.
- U.S. and Chinese scholars and scientists should develop new and innovative ways to promote climate mitigation and adaptation and to give incentives to governments and residents to protect our environment.

W3. Advancing Solar Energy – Beyond Sunshot

Partners: National Renewable Energy Laboratory, U.S. Department of Energy, Stanford University

This workshop explored how to grow global photovoltaic generation capacity to a scale that is large enough to substantially reduce global carbon emissions while maintaining wholesale electricity costs that are comparable to the lowest cost fossil fuel generation sources, currently combined cycle natural gas in the U.S. The workshop focused on moving Photovoltaics (PV) to 20% of world electrical generation capacity by 2025.

Case **(All Cases based on 2014 WED, "New Policies Scenario)**	PV Generating Capacity (TW)	PV Energy Production (TWh)	Fraction of the World Electricity Generation	Carbon Emissions Reduction (Coal Displaced)
WEO Projection for PV in 2025	0.5	643	2%	Base Case
PV at 10% of Generation Capacity in 2025	1.4	3,082	10%	9%
PV at 20% of Generation Capacity in 2025	2.8	6,163	20%	19%
PV Replaces All Coal Generation by 2025	5.2	11,443	37%	35%

The discussants and experts in the audience had mixed opinions about whether a new Levelized Cost of Energy Calculator (LCOE) goal would really drive the needed behaviors. Others thought a new U.S. "SunShot-2" goal should be established 2 or 3 cents lower than the current goal of 6 cents/KWh for utility scale Photovoltaics (PV). All agreed, however, that there are still important technology developments to be completed in the area of PV modules (materials, cells and modules), development of region-specific utility business models, power demand and distributed generation power electronic technologies, lower cost energy storage technologies, and a holistic policy framework that encourages behaviors that lead to reduced carbon emissions both through more PV on the system and wiser use of PV energy when it is available.

- *Silicon PV Technology:*
  As this topic involves complex technical, manufacturing and public company financial issues, the discussion was dominated by 6 or 7 experts that were in the room. The conclusions we reached largely followed published work from both MIT and NREL that states substantial new R&D is needed to truly achieve the current DOE SunShot goal of module price of 50 cents/W. The experts in the workshop agreed that Chinese Si PV module manufacturing costs are difficult if not impossible to determine because of capital expenditure (CAPEX) and operating expenditure (OPEX) subsidies that are not fully disclosed. We also agreed that the reported gross margins from the entire Si PV supply chain (polysilicon, solar wafer, solar cell and module) are too low to justify rational re-investment of capital. The larger group could not agree if this was an actual threat to future growth of PV but did agree that opportunities still exist for large scale PV manufacturing to be developed

outside of China, specifically in the U.S. To many, Thin Film PV efficiency does not appear to be high enough (CdTe is an example; CIGS is still not relevant) to compete with Si PV over the long term. On the other hand, recent CdTe champion cell efficiency records suggest that at least this technology can be competitive with Si.

- *Thin Film PV Technology:*
  The discussion was focused on CdTe technology given the expertise that was present (First Solar CTO, experts from NREL). All agreed that this technology has demonstrated a manufacturing cost trajectory that should surpass the DOE SunShot goal before 2020. Since this technology is uniquely positioned presently for large scale utility PV and not distributed PV (rooftops), there was no agreement as to the impact that CdTe PV alone could have on moving the PV industry to the massive scaling goals discussed at the outset.

- *Grid Integration Technology:*
  The group who gathered for this workshop had only 2 or 3 experts in this area but many others had an awareness of the issues especially as they relate to challenges of incorporating massive amounts of PV on the world's existing electrical grids. The high level conclusion reached is that technical solutions, for the most part, already exist, but these have not yet been tested at the right scale or with sufficient rigor. We also agreed that the rules public utilities are given by their regulators require re-examination given the array of new technologies that exist to help manage key issues (voltage and frequency regulation being only two). The state of Hawaii was cited several times as an example of very high PV penetrations on a stable grid without massive storage.

- *Utility Business Model:*
  Here again our workshop group had several experts and a larger group with high level knowledge and opinions that were shared. We agreed that utilities around the U.S. and around the world generally develop business practices that are specific to the region they are in. For instance, what works for a west coast utility in the U.S. may not work for a U.S. mid-western utility or a utility in central Europe. We discussed the well-documented problem of the California "duck curve" and the published reports describing various ways to address this problem both with and without the adoption of energy storage. There was no agreement as to whether a future world with massive PV adoption would be best served by buildings, neighborhoods and even whole cities that were operating independently of a larger regional grid or whether a much improved, more intelligent and better interconnected grid (i.e., a "smart grid") is what the world will need. Again we came back to the conclusion that the ultimate outcome will almost certainly vary by region.

- *Finance:*
  The ability to raise the capital needed for new PV module manufacturing (the entire supply chain for all leading PV technologies) is a potential problem depending on your point of view. Current PV industry gross margins do not seem to justify rational re-investment by global capital markets yet this may continue without problems in China. Again, there are many variables to consider and the group did not conclude that availability of capital would

definitely limit the growth of PV manufacturing. We did however agree that the availability of capital was a major problem for PV project development in the world's poorest countries. Not only is the availability of capital a problem but so too is the availability of local expertise to install and maintain PV systems at the scale needed. This will remain a problem that the national governments, world bodies like the UN, and new business models will have to address going forward.

- *Energy Storage:*
  Although we had several experts present in the room, we did not spend a substantial amount of time discussing the role of storage in the 3 hours we had available. All did agree that energy storage will be needed at some point in the future and this point in time will vary with regional factors that involve local solar and wind resources, weather patterns (AC loads as a function of time of day) and local & regional government policy. Storage will add cost but whether this is truly a barrier will also vary by region and over time. We also agreed that storage is beginning to enter the PV business landscape already and will quickly play a meaningful role in markets such as California with time of day pricing that will justify the strategic use of energy storage even at today's prices.

- *Policy:*
  Over the course of our 3 hour discussion we discussed the role of government in establishing appropriate policy several times. This is a very complicated topic so the only concrete conclusions that we could reach involved the general need to have an intelligent policy framework to support the growth of PV while maintaining grid stability at energy price points that are needed to sustain economic growth. We agreed that there is substantial variability around the U.S. and states like CA and NY are leading the others. With regard to the federal Investment Tax Credit, there were several experts in the room that expressed strong opinions about how this should be handled. These opinions generally involved a more intelligent phasing out over time allowing enough time for the PV industry to mature so that regional set-backs do not emerge as a problem for PV growth at a national level.

W4. Growing the Future Bioeconomy: Breaking through Bottlenecks

Partners: University of Illinois, Urbana – Champaign; Wisconsin Energy Institute; University of California, Berkeley; and Virent

This workshop discussed the bottlenecks facing bioenergy such as logistics of biomass collection and delivery, efficient and economical cell wall destruction, and advantageous policies. Participants boiled the issues down to seven challenges that need to be addressed for bioenergy to compete with traditional petrochemical-based approaches.

Challenges to be Addressed:

- We need to better define the bioeconomy and understand that it goes beyond bioenergy production.
- We need more cross-agency collaboration to build a diverse and effective bioeconomy.
- We need to recognize the diversity of values associated with bioeconomy technologies, products and stakeholders, and use these to identify realistic applications and market needs.
- Policies to stimulate the bioeconomy need to consider industrial, health, and socio-economic issues as well as environmental ones.
- We need to consider all possible feedstock sources and waste streams.
- We need a comprehensive assessment to understand the full range of impacts of a bioeconomy in the U.S.
- Policies at the federal level must be flexible enough to accommodate differences at state and regional levels.

W5. Harnessing the Hidden Efficiency: Using Voltage and Reactive Power Management as a Compliance Mechanism for the Clean Power Plan

Partner: Environmental Defense Fund

Voltage and Reactive Power Management, specifically Conservation Voltage Reduction (CVR), has been demonstrated to be a cost-effective strategy in lowering electricity use across customer appliances and equipment while reducing associated greenhouse gas emissions. However, some planning consideration misalignments in the current system of incentives must be addressed in order to ensure broad adoption of this practice. Participants in this workshop investigated what was needed to generate additional interest and investment in this more efficient electric system.

- States will need more than a simple recommendation to pursue Conservation Voltage Reduction (CVR) – each state will need support and guidance to understand the potential for this practice and maximize its associated benefits. This practice needs to be recognized nationally as an effective method of increasing energy efficiency and reducing greenhouse gas emissions.
- The monetary, environmental, and social benefits of CVR must be quantified and be made transparent so that states, municipalities, and energy service companies can have confidence in the decision to make the necessary investments.
- Transparency in the benefits provided by each method of compliance and deployment strategy would allow each state to select a deployment strategy that maximizes its individual goals and policy objectives, based on its own priorities.
- States will need accessible, easy-to-understand information on the potential for Conservation Voltage Reduction and how this compares to other compliance options.
- Designing appropriate Evaluation, Measurement and Verification (EM&V) protocols will be critical in creating an effective compliance mechanism with the EPA's Clean Power Plan goals.
- The potential magnitude of energy reductions through this practice will vary by state and is determined by collecting baseline information on current voltage and energy consumption profiles, local electric system configurations, the local generation mix, etc.
- The existing system of electric utility compensation must be revisited and redesigned to encourage investments in strategies that encourage energy conservation.
- Next steps could include quantifying and increasing transparency in the various benefits that could be realized by deploying the technology and practice, developing consistent measurement and verification protocols to instill confidence in the investments, increasing overall awareness of the potential for CVR, providing states the tools and support to make the necessary investment decisions, and creating the right system of incentives to encourage electric system efficiency.

W6. Reinventing Utilities: Planning for the Utilities that We Want and Need

Partners: Wisconsin Energy Institute, University of Wisconsin – Madison; Midwest Energy Research Consortium; OPower; Northern Arizona University

This workshop addressed the technical, market design, and policy issues required to change the modern electrical power distribution system to efficiently and effectively integrate larger amounts of intermittent solar, wind, geothermal and biomass power. They also discussed needed changes in business models, infrastructure, public policy and systems-thinking designs that will offer a practical tested path for change.

- If you don't have the collaborative processes in place already, get the investors', financiers', and utilities' attention through the customers (engaging them in the conversation).
- Improve the cost-efficiency of the distribution agencies.
- Partner with NGO's or Universities to organize similar workshops in your state.
- Form a network of the future grid advocates that exists beyond this conference.
- We need to know our utilities' backgrounds and their motivations.
- Figure out ways to help the utilities to get past the cost of new technologies (how to not hurt their bottom line).
- Work with local utility companies to create a benefit-cost analysis for utilities and utility mapping of models, motivations and technical systems.
- When you innovate, go to consumer advocates and state energy office groups to spread the word and educate from the top down.
- With the network experts and NCSE support, have an impact through the comments on DOE Quad-Annual Energy Review (QER) and Quad- Annual Technology Review (QTR).
    - The Federal Electric Regulatory Commission (FERC) is having regional hearings starting February 19th. Get the word out and participate, especially by providing input at major processes.
- Figure out how utilities are going to act to different block scenarios.
- Create a Social Media portal for future grid/future utility information.

W7. Environmental Dashboard: Combining Displays of Real-Time Resource Use with Community Voices to Celebrate & Empower Stewardship

Partner: Oberlin College

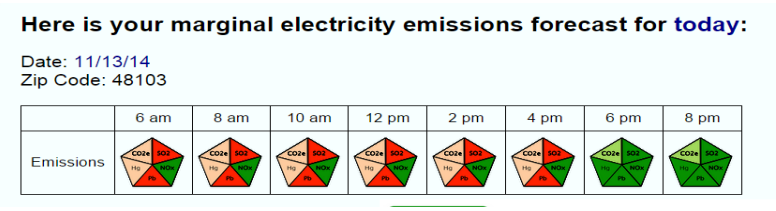
This session explored how technology can be used to engage a community and broaden perspectives on sustainability. The Environmental Dashboard monitoring and display technology was used as a case study, and the participants discussed how this approach might be adopted in other communities.

- Real-time data on resource flows (electricity/water use and water quality) can help reconnect people with the natural world and motivate them to engage in sustainable behavior.
- Strategies of community-based social marketing and other tools of social psychology should be employed to both inform and engage a diverse citizenry and promote behavior change.
- Digital signage incorporating data on resource flows and images/quotes from community members can advance citizen awareness, understanding and participation in community goals related to environmental, economic and social aspects of sustainability.
- Communities should use digital signage to feature citizens that are engaged in pro-environmental thought and behavior. This includes highlighting the thought and behavior of people who are not conventionally recognized as leaders. Reflecting the full diversity of the community should be a top priority.
- Technologies like the Environmental Dashboard can be used in the classroom to promote students' "systems thinking" skills. "Systems thinking" is an understanding of the world that emphasizes interactions, inter-dependencies and relationships.

W8. Environmentally Sensitive Electricity (ESE): Developing a National Strategy for ESE Adoption

Partners: Wayne State University, EcoWorks

This workshop identified a vision, strategy and potential barriers to National ESE adoption.



VISION

A national ESE will:

- involve a decision-making process that leads to increased societal awareness;
- include both price and environmental (emissions) signals congruently;
- generate information to inform smart energy usage and sustain societal awareness;
- provide flexibility to make value selection an attribute;
- include self-regulating, seamless integration;
- be resilient and redundant;
- be carbon-neutral and will not degrade ecosystem services or alter climate; and
- expand transmission and allow sharing of resources – optimizing transmission system environmental benefit.

STRATEGY

National adoption will require:

- environmental information accessible through technology or transparency (e.g. reported by Independent System Operators (ISOs) or generators);
- standards and measurements;
- a multi-faceted approach: top-down, bottom-up, middle-out;
- the middle-out approach has political benefits (industry-driven process may be faster);
- operational frameworks (economic, etc.);
- policy and regulatory changes; and
- cost savings, ease of application and relevance.

BARRIERS

The barriers include:

- *Political framework and policy is unsupportive*

  A middle-out approach is recommended for which industry will take the lead, with encouragement from consumers and environmental groups. Policy is another important driver. An existing framework that might provide a good example of a way forward is the Energy Star program.

- *A lack of transparent environmental metrics*

  Two approaches were identified, one top-down and the other bottom-up. The top-down approach would institute regulations to require reporting of existing information (emissions, marginal generator, etc.) through International Standardization Organizations (ISOs) or dispatching entities. The bottom-up approach involves technological innovation, such as Locational Emissions Estimation Methodology (LEEM), to provide the information. See www.herowayne.com as an example.

W9. Strategies to Advance Low Carbon Transportation

Partner: University of Maryland Energy Research Center

In this workshop, participants discussed advancing low-carbon transportation, the infrastructure and policies that are needed for this transition to occur, and tangible suggestions on putting the infrastructure and policies in place.

- *Implement a Carbon Tax*
  Financial incentives are needed to de-carbonize energy, and a carbon tax is the most effective way to do this for transportation. This carbon tax could, however, be offset by other individual tax cuts to be revenue neutral.
- *Create Critical Fueling Infrastructure*
  The electric grid does not currently have the capacity for everyone to switch to electric vehicles (EVs) and there is no significant hydrogen fueling infrastructure. Gasoline and diesel are on every major street corner, and natural gas pipelines exist over much of the U.S. but are not sufficient as a transportation infrastructure. Expand natural gas pipelines to allow for greater distributed generation of electric power (for EVs) and hydrogen production (for fuel cell vehicles) as well as the filling of natural gas vehicles. Moreover, extend the natural gas pipelines and pipeline connections and to allow the implementation of biogas resources.
- *Create Transit Integrated Charging Network*
  Use intelligent system optimized "hub and spoke" charging networks integrated with major transportation hubs around high population density locations to allow integrated use of "city" EVs, bicycles, and other short range transportation with long-range transportation, such as trains and planes.
- *Waste to Energy Fuels*
  Utilize biogas from anaerobic digestion, landfills, and other distributed waste energy resources connected through the natural gas pipeline (above) to utilize carbon neutral and even carbon negative fuels (methane released vs. CO_2).
- *Increase R&D Focus for Heavy-duty Truck, Rail, Ship and Airplane Fuel Efficiency*
  Increasing the efficiency of a smaller number of vehicles in this category will have a greater impact on U.S. energy consumption than the same number of conventional passenger vehicles because the proportional incremental cost to achieve greater efficiency on large vehicles is less proportional than on passenger vehicles. Moreover, business decisions to purchase will be made on return on investments due to fuel efficiency rather than the popularity of vehicles.
- *Consumer Behavioral Change*
  Consumers need life cycle analysis information for consumer vehicle purchase and operation decisions. Education of consumers is needed on the impact of those choices on the environment and future generations.

W10. The Water-Energy Nexus: Collaboration for Increased Impact

Partners: U.S. Department of Energy, Global Water Fund

This workshop explored work conducted by the U.S. Department of Energy, The World Bank, and Stanford University's Water in the West program to frame the integrated challenge and opportunity space around the water-energy nexus. Workshop participants then formulated an integrated and collaborative vision of the respective roles of stakeholders for maximum impact at the regional, national, and global scale.

- The government should invest in an open source integrated data platform that draws on Big Data and data analytics. This data should be made available to a broad swath of users, and government-funded researchers should be required to provide their data.
- The government should support an open source integrated modeling platform addressing water-energy nexus issues.
- The water education foundation should incorporate energy-water nexus information into its materials and disseminate them broadly.
- The National Association of Regulatory Utility Commissioners (NARUC), the American Water Works Association (AWWA), and the Alliance for Water Efficiency should convene water utilities to share best practices on sensible pricing for water.
- Nonprofits and universities should incorporate water-energy nexus concepts into next generation K-12 science education.
- NIDAS and NDMC should encourage states to learn from leading states (e.g. CA, TX, FL) in action-oriented drought and water planning for energy.
- The government should support dynamic life cycle analysis of embedded water in food and energy systems.
- DOE needs to increase its dialogue with stakeholders to inform broadening of its R&D investment into the energy-water nexus space.
- Water utilities should model energy utility efficiency programs.
- The government should support policy R&D on cross impacts between water and energy policy.

W11. The Water-Energy-Climate Nexus: New Strategies

Partner: Florida International University

This session discussed risk reduction and emergency management; water supply management and infrastructure; energy and fuel; natural ecosystem goods and services; and agriculture in the context of climate change mitigation. They identified action plans to integrate these plans across sectors of society to focus regional solutions.

Next steps include:

- Synthesis of outcomes in a white paper;
- Follow-up meeting to discuss some issues we did not have time to address, including agriculture; and
- Synthesis of these two activities to develop outputs for a review paper in a peer-reviewed journal.

W12. Carbon Pricing, Coalition Building, and International Action Towards COP 21

Partner: Citizens' Climate Lobby

This workshop explored opportunities and impacts of carbon pricing instruments and developed a working coalition to advance and implement solutions. Key points and next steps for collaboration and moving forward include:

- Feb 4, 2015 and the New York session in early January were the next direct engagement working sessions building on today's session.
- Six working groups produced reports on topics central to the global climate negotiations.
- Those insights will feed into a matrix of priorities to coordinate civil society action inside COP 21.
- Participants proposed new partners for the Pathway to Paris coalition.
- Securing a place for citizens and stakeholders as direct contributors to a more ambitious global solution.
- Creating a worldwide network for sustained direct citizen engagement on climate policy.

W13. Advancing Community Action

Partners: Enterprise Community Partners; National Environmental Education Foundation; TERC; NOAA; National Center for Science Education; University of Delaware; University of Maryland Center for Environmental Science; Student Conservation Association

Participants discussed and improved upon results-driven community strategies for sustainability action. Agreed-upon measures include:

- Work with NCSE towards an action plan to support community-based action on climate change.
- The Student Conservation Association (SCA) offers environmental internships and fellowships for work with local governments, non-profits, etc.
- Enterprise has a grant process provided to community based groups – a new granting session is coming up soon.
    - Affordable housing development and neighborhood scale – retrofitting is difficult, time consuming and costly.
- A network of networks with:
    - Common agenda
    - Shared interests
    - Mutual activities
    - Continuous communications
    - Backbone support organization
- Celebrating community engagement – building awareness and looking at ways of solutions and supporting community leaders.
    - Develop a media plan to reach out to Hispanic communities (in the Midwest) – paired with TV networks to push initiative with Univision in DC.
- Get communities to implement action for climate change:
    - Dialogue with the community and ask what it means to them
    - Work with local governments to put together resiliency policies
    - Implementation of these at the appropriate scale
- Engage Television weather casters and other local media outlets, faith based events, and boy scouts / girl scouts
- Engage students in issues with their own communities – merging schools with community decision makers.

- Bring together experts on climate and SME's on other vulnerabilities to speak to the community.
    - Data and maps
- Reach out to businesses – can profit motive by adaptation if part of their business model – tools for vulnerability and resilience.
    - Feeds innovation
    - Relationship between employer responsibility rubbing off on employees home responsibilities
    - Convening functions or organizations in communities
- Use a positive message rather than a doom and gloom type theme (self-efficacy).
- Hope – commensurate solutions to the size of the problem.
- Build trust relationships.
- Build on intergenerational views.
- Showcase success with real people on-the-ground.
- Increase school and business relationships i.e. when families invest in solar panels the business donates to the school of their choice.
- K – 12 curriculum really matters especially with respect to energy – giving kids of the 21st century skills.
- Supply values based achievement awards for teachers and volunteers.
- Prepare the future workforce for energy needs.
- Service clubs like rotary are very important in all communities.
- Reach and engage underserved and underrepresented more vulnerable audience.

W14. Higher Education, Energy, and Climate

Partners: Ball State University, SUNY-College of Environmental Science and Forestry, and Portland State University

This workshop engaged participants in a dialogue around how higher education institutions can assess and address their own carbon footprints as well as how they can effectively develop external partnerships to address climate change.

Community Partnerships:

- Understand what is already happening in the community
    - Database of best practices, community projects
    - Format for best practice
    - Develop local needs assessment/inquiry tools
- Federal university grant program to support university/community grants program (modeled on DOE's energy assessment program)
    - Survey of existing programs that might support sustainability partnerships across the federal government
    - Require grant proposals to include a community dialogue methodology
- Engage with President's Climate Challenge in implementing the President's Executive Order on Integrating Climate Change in federal education programs
- National competition for student-driven solutions
- NCSE assessment sustainability curricula
- Create project loan fund
- Funding to develop a national university agenda around sustainability curriculum development in anticipation of national and international federal dialogue in April
- Crowd funding mechanism for local community based sustainability projects (e.g., IOBY.org)
- The Council of Environmental Deans and Directors (CEDD) should continue to address tenure issue as obstacle to institutional change; make service and community partnerships part of accreditation
- NSCE should look at science standards under Common Core for the potential to integrate sustainability
- NCSE should look at how to integrate sustainability into teacher training programs (Teaching Colleges)
- NCSE conference in 2016 should have a panel that includes both Higher Education and K-12 on same panel to discuss "life cycle" approach to sustainability education.

Interdisciplinary and Cross Campus Collaboration:

- Models for different size organizations from CEDD; audience administrators such as multiple stakeholder model; leadership model; financial accounting model
- Models and case studies for integration of paths for sustainability across the campus
- Sustainability recruitment and retention metrics using income survey and literacy test tied to general education
    - NCSE/CEDD update its study of models for promotion and tenure models that recognize interdisciplinary
    - Compile organizational models for campus wide sustainability
- Models and toolkits for public private partnerships – Green fund for student projects
    - Kind of asks – donor match
    - Work with development offices
    - In-kind with communities
- Multiple semester projects for service learning
- Methodology for evaluation of interdisciplinary courses and curricula
- General education outcomes as driver to affect behavior change
- Compile Pet models that recognize interdisciplinary, extension and service work

W15. Climate Knowledge and Innovation Communities

Partners: National Center for Science Education; Climate-KIC

In this interactive workshop, attendees participated in a short simulation of a course developed by the Climate Knowledge Innovation Community (Climate KIC), where experts share insights and experiences relating to climate and energy and plan for implementing climate innovation into their organizations. Participants also reviewed the program and suggested next steps for the course.

- The audience for the Climate KIC program can be expanded through collaboration and building dynamic relationships with American institutions
- Possibility of working with European Union Centres for Excellence (based in American universities such as University of Colorado), designed to foster collaboration between institutions in U.S. and EU
- The Climate KIC program could provide a week-long water focused "Journey" type program for student such as the Tufts University Water Diplomacy Students
- A Nordic River Cruise from Amsterdam to Budapest could be the location/central activity for this water focused Climate KIC course (22-28 August, 2015)
- World Water Week in Stockholm could provide a forum/time for this program
- Possibility of students participating in a specially-designed Land and Water summer school for doctoral students

W16. Campuses as Living Laboratories

Partner: The Association of Controls Professionals

This workshop explored how leveraging campus facilities for education reduces utility expenditures, increases student retention rates through engagement, and encourages the attainment of 21st century workforce skills.

During the program, participants developed detailed action plans for implementing living laboratory pedagogy at their respective institutions. The plans were developed on a planning matrix, which included:

- Strategic objectives
- Key actions
- Time
- Lead person
- Outcomes

Participants agreed to develop and add to an existing Google drive site to share packaged living laboratory exercises. These can be adopted by any institution within the respective subject areas.

W17. Earth Observations Informing Energy Management Decision Making: Connecting Data Providers to Stakeholders

Partners: NASA Headquarters and Climate Data Solutions, LLC

The workshop enhanced the dialogue between Earth Science data producers (who develop value added products) and those who create the decision support systems that use these measurements for renewable and other energy applications. The main goal was to better understand the needs of decision-makers and stakeholders to improve the production of value-added products. Key challenges from the workshop included:

Understanding the end users:

- How do we classify end users – who are they and what are they trying to do?
- Direct interaction with end users to find out what they need and what is driving them
- Think about the whole range of end users (developers, planners, etc.)
- Everyone can't understand everything – it happens through user communities and targets user tools
- How to integrate in a user-friendly way – different cultures and levels of education
- Educate people to understand the data – better translate what the data can do
- Making data available to the Federal user community is also needed (sharing datasets amongst the science community)

Simplification of data:

- Need to improve usability and functionality (e.g., online maps that do not have legends)
- Simplify data so that you can intuitively/visually understand the relationships
- The GIS community can sometimes complicate things by adding too many layers
- Need overlaying of data and information for specific end user communities
- Need data for planning (hardening infrastructure from climate change) and cybersecurity
- Simplify products to make it relevant and simple to the community but with enough metadata and supplemental information so that it is used in the right way, with all of the limitations understood

Providing and curating data in a central location:

- Making connections between the provider and the end users
- A data portal is needed – a lot of resources are available. Which ones are the most credible, most recent, etc.?
- Define what the keystone datasets are, set up systems to get them out to the public
- Curate them by theme, resolution, etc.
- Climate Data Initiative (www.climatedata.gov) – put all of the data on one site – still needs work to be complete, and many people do not know about it

Data validation and verification:

- Formalizing a process for feedback mechanisms from end users is important
- Were errors and issues associated with the data found? E.g. data validation
- Verify the integrity of data (that they have not been modified without users knowing it)
- Metadata should be available, but it should be easy enough for specialized user communities to use without having to filter through a lot of metadata or going to multiple websites
- Work together as a community so that the uncertainties of data are understood
- Others (private sector) can work with data, validate data, and improve upon them

Connecting data to solutions:

- Responsibility and challenge of scientists to better communicate what the data is and how it can be translated to actual solutions
- Transfer of research to applications and operations
- Fund pilot projects to provide structure for projects
- Interface resource data with real issues, e.g.:
    - Water resource management
    - Land use development, permitting, and energy
    - Global climate change preparation (i.e. storm surges, etc.)
    - Avian flyways and mammalian by-ways
    - Geopolitical – population poverty, health, and local instability

Challenges for developing countries:

- Especially for projects in developing countries, lower-cost, lower-accuracy data can be used as an initial screen and then more costly, higher-accuracy data can be utilized if warranted
- Gathering/distributing ground-level data that are being gathered in developing countries is a challenge

Solutions:

- User communities where people can share best practices, etc. (community of practice) and be a forum to disseminate this information. A first step would be just to provide hyperlinks to where data can be found online.
- One-on-one conversations with private-sector users so that they can have private conversations about how they use data, etc.
- Connect with organizations (like ASHRAE, ESRI, etc.) for feedback.
- The Homeland Infrastructure Foundation-Level Data Working Group Online Community (https://www.hifldwg.org/) can be a model of how to develop a community of practice.

W18. World Energy: Creating Pathways to a Low-Carbon World with Computer Simulation-Based Role Playing Games

Partners: University of Massachusetts, Lowell; Climate Interactive

At the *World Energy* workshop, participants took on the role of leaders from key economic and energy sectors and negotiated climate and energy deals. Afterwards, they discussed identifiable priorities that would allow *World Energy* creators to make more coordinated progress. Priorities include:

- Take this experience and replicate in educational environments (classes, etc.)
- Offer Climate Interactive as a resource to those who need tools to engage people in climate and energy.
- How can we scale up good resources like interactive simulations? It takes some expertise, but we can provide the resources to run it.(Though we need to get to the word out about it.) The take-away is Climate Interactive has great resources to put on to people's radar.

W19. Integrated Science: Economy, Energy and Environment

Partner: University of Arkansas

This session focused on the nexus of issues that drive energy production, delivery, and use with environmental progress in national, regional, and state economies. Session organizers are working on a white paper encouraging federal agencies to consider co-funding cross-cutting initiatives. This paper will include the following suggestions:

- Communicate issues related to energy, economy, and environment framed in terms relevant to community values.
- Spatial aspects are important; regions can be studied for patterns. Create programs at the community/city level: challenge them to present opportunities for adaptation and plans for climate change under the assumption climate change will occur in a stepwise fashion – shock-based approach and kick-started approach. Give scenario-based outcomes demonstrating options under those different scenarios (choice-based decision making).
- Make resilience/adaptation planning an experimental process, so individual communities develop relevant programs reflecting local values in more unique ways. Learning becomes diffused in that process, and what worked at a community level can be used to come up with common goals. Also, can model across many communities and highlight successes to others.
- Having local energy production (such as a local power plant) drives resiliency and adaptation. Understand sources of energy and include in adaptive plans.
- In the current political environment, it may be easier to get money for local and regional projects than for large national-scale programs.
- Engage the commercial community, including national chains operating at a local level, which often steps in to provide stability during shock events.
- For local and regional programs, ensure an equitable distribution of resources and money spent.
- Recognize that corporations will probably come to terms that some will win and others lose. Winners are those that innovate and move. That may lead to the innovations we seek as part of the solutions.
- Knowledge is power. In this information age, communities should innovate. Know your audience and communicate to that audience in terms they will likely use to frame the issue.
- The source of the messaging determines reception. Knowledge presented in the right way and by the right folks can move mountains. Government and scientists may not be the way to get this out. Share information through conduits that have more influence, as these issues relate to values. Example: Faith leaders are a powerful conduit if used correctly.
- Search for co-benefits that relate to core values (not just for the sake of sustainability). Plan for resilience for the sake of resilience (like saving for the future); i.e., “Be prepared.”

Sustainability is not a destination but a journey that provides intermediate benefits along the way. These approaches may resonate with those who don't prioritize the environment.

- Global awareness, local action (again, focus on community and frame issues relevant to community values).
- Metrics that help illustrate competing priorities and tradeoffs, etc. should be part of the messaging.
- Technology: Necessity is the mother of invention; humanity has innovated out of a problem many times, e.g. agricultural practices.
- A systems approach to understanding complex interactions is the only reasonable way to characterize energy, environment, and economy nexus. Example: life-cycle analysis: CFC and LED lighting do not live up to durability claims.

W20. Decisions Need Information, Information Needs Data, and Data Needs a System: Putting it Together

Partners: Second Nature, National Council for Science and the Environment, Association for the Advancement of Sustainability in Higher Education (AASHE)

This session began a critical dialogue on how reporting and data systems can be major drivers of positive change and opportunities for decision-makers and those at the leading edge of institutions managing climate and energy planning and implementation. Participants brainstormed on solutions and partnerships needed to create an integrated approach for these opportunities.

- Should we instead focus on targeted data collection efforts around specific interventions? We can start with small, individual decisions that are being or have been taken; track the data that could inform them; then later scale it.
- One can measure both direct and indirect/cascading effects – measurement of the latter can be the key to determining the overall impact.
- For the Sustainability, Tracking, Assessment and Rating System (STARS), it's important to identify the prioritized points of impact. Ask if the data we're collecting is important and worthwhile for others to view and verify. Some dining services companies are prompted by this to participate and track their own sustainability.
- We've done a better job of learning from scientists than practitioners who actually use this information. We don't have a system for learning from practice.
- One fundamental tenet is getting greenhouse gas reporting finalized and shared.
- Second Nature and AASHE both are interested in figuring out how their systems can interact with one another. It is a matter of capacity. Continuous improvement of STARS is another of AASHE's priorities; it was developed by and for higher education, and feedback from users and non-users (as to motivation for non-participation) is key. B-Lab is another ratings system with similar ideas and struggles with regard to data. They're trying to make their system accessible, easy, and fun – in contrast to the data monster. The community needs to prioritize the determination of which data points are critical to drive the necessary changes on campuses.
- As much as possible, organizations must be willing and able to align our system with metrics that are being commonly used.
- STARS' original intent was to keep it simple; perhaps it's necessary to ID key indicators and go back to which data is needed to populate said key indicators. HOWEVER, individual differences across campuses impact which data are critical to drive key decisions, and this can be a motivation in deciding not to participate in STARS.
- Who are the decision makers, and what decisions are being made? This influences the data systems that are needed.

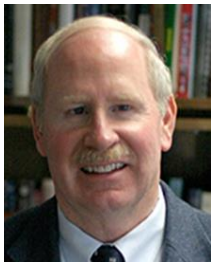
- If there is an entirely accessible "monster" of data, power is in the hands of the decision-makers while simultaneously it could be usefully tapped into by individuals. If data are organized so that users can find data that are most useful to them, this is much more useful and can lead to more coordinated systems.
- Groups should start small and focused, but think about coordination around that.
- What is the role of physical infrastructure when it comes to data? How does this fit in?
- Understanding your narrative as an entity possibly comes before collecting the data and impacts the decisions and data that are important to the user.
- NCSE could provide data on what programs are available and what these actually mean in terms of data – this is something that students might be interested in viewing. STARS has data at the course-level; NCSE has information on level of degree granting programs.
- STARS wants to connect with marketing departments for promotion.
- Engagement is critical to sustainability performance, not enrollment in groups.

Leadership Committee

Robert Dixon, Vice President, Industry Affairs, Siemens Infrastructure and Cities - Building Technologies Division

Gerald Geernaert, Division Director, Climate and Environmental Sciences Division, U.S. Department of Energy

Amy Luers, Director, Climate Change, Skoll Global Threats Fund



Alexander MacDonald, Chief Science Advisor, NOAA's Office of Oceanic and Atmospheric Research; Director, Earth Systems Research Laboratory

Anthony Michaels, CEO, Midwestern BioAg

Dian Ogilvie, former Senior Vice President, General Counsel, and Chief Environmental Officer, Toyota Motors Sales USA *(ret.)*

Governor Bill Richardson, former Governor of New Mexico, Secretary of Energy and U.S. Ambassador to the United Nations

S. Jacob Scherr, Senior Advisor, International Program, Natural Resources Defense Council

Peter Saundry, Executive Director, National Council for Science and the Environment

Eric Wachsman, Director, University of Maryland Energy Research Center

Agenda

Tuesday, January 27, 2015

7:30 a.m. Continental Breakfast, Exhibition and Scientific Poster Presentations open

8:45 a.m. Opening: **Governor Bill Richardson,** former Governor of New Mexico, Secretary of Energy and U.S. Ambassador to the United Nations

9:00 a.m. Keynote Address: **Gina McCarthy,** Administrator, Environmental Protection Agency

9:30 a.m. Plenary 1: **The Big Challenges**

Moderator: **Richard Harris**, Science Correspondent, National Public Radio

- **Dymphna van der Lans**, CEO, Clinton Climate Initiative, The Clinton Foundation
- **Veerabhadran Ramanathan**, Distinguished Professor, University of California, San Diego; UNESCO Professor of Climate and Policy, TERI University, India
- **Mohinder Gulati,** Chief Operating Officer, Sustainable Energy for All

10:30 a.m. Plenary 2: **Decarbonizing the Energy Supply**

Moderator: **Chris Joyce,** Science Correspondent, National Public Radio

- **Dan Arvizu**, Director, National Renewable Energy Laboratory
- **Julio Friedmann**, Deputy Assistant Secretary for Clean Coal, U.S. Department of Energy
- **Mark Jacobson**, Director, Atmosphere/Energy Program, Stanford University
- **Cheryl Roberto**, Associate Vice President for Clean Energy, Environmental Defense Fund
- **Ellen Williams**, Director, Advanced Research Project Agency-Energy

11:30 a.m. Plenary 3: **Smart Energy Use: Transforming our Relationship to Energy**

Moderator**: Elizabeth Shogren,** Science Journalist, National Public Radio

- **Nihar Patel**, Vice President of North American Business Strategy, Toyota Motor Sales, USA, Inc.
- **Kateri Callahan,** President, Alliance to Save Energy
- **Kathleen Hogan,** Deputy Assistant Secretary for Energy Efficiency, U.S. Department of Energy
- **Richard Caperton**, Director of National Policy & Partnerships, OPower

12:30 p.m. Lunch

2:00 p.m. Symposia A

1. Preparing for COP 21
2. US-China Nongovernmental Climate Change Partnerships That Work

3. Natural Gas: How Much Better Than Coal?
4. The Future of Bio: Beyond Ethanol
5. EPA's Clean Power Plan Part I: Status and Strategy
6. Integrating Clean Energy Across Scales: Buildings-to-Nations
7. Green Buildings
8. Coastal Energy Resiliency
9. UN's Sustainable Energy for All Initiative: Focus on Energy Efficiency
10. Financing Low Carbon Energy through Green Revolving Funds
11. Facilitating Understanding: Challenges and Opportunities for Climate Change Education in a Range of Sectors
12. Low and Net-Zero Carbon Campuses

3:45 p.m. Symposia B

13. Engaging US and Chinese Businesses, Media and Publics in a Meaningful Dialogue on Climate Change
14. Carbon Capture and Storage: The Future of Coal
15. Geothermal Energy
16. EPA's Clean Power Plan Part II: Opportunities and Obstacles
17. Smart Grid, Microgrids and Information Technology
18. Wood: The Real Green Building Material
19. From Transactions to Transformation: Large Corporate Energy Users Driving Change in the Electricity Sector
20. Population and Energy Growth beyond 2030: Can Renewable Energy Meet the Demand?
21. Carbon Markets: Lessons from Around the World
22. Academic Investment and Divestment
23. Facilitating Community Engagement
24. Climate-KIC, a Knowledge and Innovation Community

5:30 p.m. Special Viewing: **Extreme Realities**

Wednesday, January 28, 2015

7:30 a.m. Continental Breakfast, Exhibition and Scientific Poster Presentations open

9:00 a.m. Keynote Address: **Jennifer Granholm**, Distinguished Practitioner of Law and Public Policy, University of California, Berkeley; Former Governor of Michigan

9:30 a.m. Plenary 4: **Finance and Markets**

Moderator**: Jeffrey Leonard,** President and CEO, Global Environment Fund

- **Naoko Ishii,** CEO, Global Environment Facility
- **Theodore Roosevelt IV,** Chairman, Barclay's Clean Tech Initiative
- **Adele Morris,** Policy Director, Climate and Energy Economics Project, The Brookings Institution

10:45 a.m. Symposia C

25. Historic Contributions: The "Common But Differentiated Responsibility" (CBDR) Challenge
26. Massive Scale Solar Energy: 1.5 Terrawatts by 2025
27. Designing Landscapes to Deliver Energy, Economic Opportunities, and Climate Change Services
28. Nuclear Energy as a Non-Carbon Energy Option
29. Social Cost of Carbon
30. Utilities in 2050: Which Possible Futures are Likely and Desirable?
31. Enabling Climate-Smart Energy Use with Real-Time Information
32. Local & Regional Energy Resiliency
33. Electrifying Transportation
34. Public Sector Roles in Increasing Private Sector Finance for Clean Energy Access
35. The Water-Energy Nexus: Challenges and Opportunities
36. Carbon Pricing, Coalition Building, and International Action Towards COP 21
37. From Climate and Energy Literacy to Impact
38. Innovative University – Community Partnerships: Collaboration for Climate Action
39. "Reframing" Energy for the 21st Century

12:15 p.m. Lunch

2:00 p.m. Workshops

1. Who is Responsible for Climate Change?
2. Fostering Effective U.S.-China Nongovernmental Climate Change Partnerships
3. Massive Scale Solar Energy: Identifying the Barriers

4. Growing the Future "Bioeconomy": Breaking Through Bottlenecks
5. Harnessing the Hidden Efficiency: Using Voltage and Reactive Power Management as a Compliance Mechanism for the Clean Power Plan
6. Reinventing Utilities: Planning for the Utilities that We Want and Need
7. Environmental Dashboard: Combining Displays of Real-Time Resource Use with Community Voices to Celebrate & Empower Stewardship
8. Environmentally Sensitive Electricity: Developing a National Strategy for ESE Adoption
9. Strategies to Advance Low Carbon Transportation
10. The Water-Energy Nexus: Collaboration for Increased Impact
11. The Water-Energy-Climate Nexus: New Strategies
12. Carbon Pricing, Coalition Building, and International Action Towards COP 21
13. Advancing Community Action
14. High Education, Energy, and Climate
15. Climate Knowledge and Innovation Communities
16. Campuses as Living Laboratories
17. Earth Observations Informing Energy Management Decision Making: Connecting Data Providers to Stakeholders
18. World Energy: Creating Pathways to a Low-Carbon World with Computer Simulation-Based Role Playing Games
19. Integrated Science: Economy, Energy and Environment
20. Decisions Need Information, Information Needs Data, and Data Needs a System: Putting it Together
40. Additional Symposium: Nuclear Energy: Technologies for 2025 and 2050, Advancing Nuclear Energy Options

5:30 pm "Climate Change, Our Personal Challenge" Photography Presentation by **Gary Braasch**

5:45 pm Lifetime Achievement Award: **Stephen Hubbell,** Distinguished Professor, University of California, Los Angeles

Introduction: **Jim Reaves,** Deputy Chief of Research and Development, U.S. Forest Service

6:05 pm John H. Chafee Memorial Lecture: **Amory Lovins,** Chief Scientist, Rocky Mountain Institute

7:00 pm Reception
Book signing: Ripudaman Malhotra – *A Cubic Mile of Oil*

Thursday, January 29, 2015

7:30 am Continental Breakfast, Exhibition and Scientific Poster Presentations open

9:00 am Keynote Address: **Franklin Orr,** Under Secretary of Science and Energy, U.S. Department of Energy

9:30 am Plenary 5: **Sustainable Energy for All**

Moderator**: Juliet Eilperin,** White House Correspondent, The Washington Post

- **Jacob Scherr,** Senior Advisor, International Program, Natural Resources Defense Council
- **Ryan Hobert,** Senior Director, Energy and Climate, United Nations Foundation
- **Glenn A. Jones**, Professor of Marine Sciences, Texas A&M University at Galveston

10:30 am Plenary 6: **The Road to Paris**

Moderator**: Suzanne Goldenberg,** U.S. Environmental Correspondent, The Guardian

- **Robert Orr,** Dean, School of Public Policy, University of Maryland; Special Advisor, Secretary-General on Climate Change, United Nations
- **Nigel Purvis,** CEO, Climate Advisers
- **Mindy Lubber,** President, Ceres
- **Alden Meyer**, Director of Strategy and Policy, Union of Concerned Scientists

11:30 am Keynote Address: **Gérard Araud**, Ambassador of France to the United States

12:00 pm Keynote Address: **John Holdren,** Director, Office of Science and Technology Policy, The White House

12:20 pm Buffet Lunch in the Regency Ballroom

2:00 pm Exhibition and Scientific Poster Presentations close

2:15 pm Adjourn

Exhibitors

American Meteorological Society

Diesel Technology Forum

Environmental Law Institute

Johns Hopkins University

NASA Hyperwall

Union of Concerned Scientists

United Nations Environment Programme

U.S. Department of Agriculture

U.S. Environmental Protection Agency

U.S. Forest Service

U.S. Geological Survey

WebsEdge

Collaborating Organizations

American Energy Society

American Geophysical Union

Association for Environmental Studies and Sciences

Association for the Advancement of Sustainability in Higher Education

CAFÉ Foundation

Citizens' Climate Lobby

Second Nature

Security and Sustainability Forum

The Global Environmental Facility

World Alliance for Decentralized Energy

Poster Presentations

1. **A global collaborative approach to clean energy technology development: the U.S.-China Advanced Coal Technology Consortium**
   Sarah Forbes, David Sonnefeld, Xiaoliang Yang
   SUNY College of Environmental Science and Forestry, *World Resources Institute*

2. **A science-faith partnership to provide education and facilitate action on climate change and energy use**
   Jason Cervenec, Craig Foster, Greg Hitzhusen, Sara Ward, *The Ohio State University*, *Foster Energy Management Co, Ohio Interfaith Power and Light, Byrd Polar Research Center*

3. **Examining energy production and use in our changing climate**
   James A. Brey, Ira W. Geer, Chad M. Kauffman, Kira A. Nugnes
   American Meteorological Society, *California University of Pennsylvania*

4. **Ethanol-based gelfuel production from biomass for household cooking fuel**
   Biniam Taddele Maru, *Universitat Rovira I Virgili, Catalonia*

5. **Service and sustainbility learning: Inter-instituional civic engagement in a shared watershed-marine ecosystem**
   Francisco Acoba, Robert Franco, Ulla Hasager, Krista Hiser, Wendy Kuntz, Tanya Renner
   Kapi'olani Community College, University of Hawai'i at Manoa

6. **Combining technological and behavioral policy innovations to reduce GHG emissions**
   Max Kummerow, *Curtin University*

7. **Less energy and more efficient design with a pro-social framework**
   Adrienne Schwarte, *Maryville College*

8. **Blending three different models for interdisciplinary sustainability: Local partnerships, service-learning, and faculty workshops**
   Mark O'Gorman, Adrienne Schwarte, *Maryville College*

9. **Ocean renewable power company: Lessons from the first commercial, grid-connected tidal system in the U.S.**
   Mark Gallo, Vesela Veleva, *University of Massachusetts – Boston*

10. **Achieving sustainable landscapes by integrating bioenergy crops into agricultural systems**
    M. Cristina Negri, Herbert Ssegane, *Argonne National Laboratory*

11. **Mitigating impact of climate change on water quality by landscape design with best management and practices (BMPs) in biofuel production: A Midwest case study**
    Mi-Ae Ha, May Wu, *Argonne National Laboratory*

12. **WATER (Water Assessment Tool for Energy Resources)**
    Yiwen Chiu, Miae Ha, May Wu, Sashi Yalamanchili, *Argonne National Laboratory*

13. **Limiting short-lived climate pollutants in curbing climate change: An atmospheric chemistry synopsis**
    Song Gao, *Nova Southeastern University*

14. **Long-range transport and in-situ transformation of atmospheric aerosols: Tales from African dust and Shanghai smog**
    Song Gao, *Nova Southeastern University*

15. **On-line initiatives to galvanize climate mitigation in the Great Lakes Region**
    Steven Ackerman, Margaret Mooney, *University of Wisconsin, Madison*

16. **CO_2 heat pump for simultaneous heating and cooling applications**
    Supriya Dharkar, Eckhard Groll, Orkan Kurtulus, Kazuaki Yazawa, *Purdue University*

17. **Commercialization of next generation nuclear reactor for long term energy sustainability**
    Guanheng Zhang, *University of California, Berkeley*

18. **Design of photovoltaic systems for supplying electricity to natural mine water treatment facilities**
    Jinyoung Song, *Pukyong National University*

19. **Influence of climate change beliefs on support for an offshore wind farm**
    David Bidwell, *University of Rhode Island*

20. **Separate contributions of land use activities and fossil fuel burning to global climate forcing: A country-level analysis**
    Daniel S. Ward, Natalie M. Mahowald, *Cornell University*

21. **Energy planning, a tool for a sustainable campus**
    Lionel R. Orama, Uroyoan R. Walker, *University of Puerto Rico*

22. **Say goodbye to green: Taking climate change communications from margin to mainstream**
    Richard Alley, Kelly Harris, Michael Mann, Alex Novak, Denice Wardrop, *The Pennsylvania State University*

23. **A model to predict electric grid stress events under climate change**
    Lisa Bramer, James Dirks, John Hathaway, Michael Kintner-Meyer, Ian Kraucunas, Ruby Leung, Ying Liu, Jennie Rice, Trenton Pulsipher, Daniel Skorski, *Pacific Northwest National Laboratory*

24. **Numerical simulations of wind turbine power plants**
    Charles Meneveau, Claire VerHulst, *Johns Hopkins University*

25. **Climate education solutions for the U.S. corn belt**
    Marci Bird, Deana Hudgins, Kristi Lekies, Wade Miller, Richard Moore, Nsalambi Nkongolo, Morgan Schafbuch, Dennis Todey
    The Ohio State University, Iowa State University, Lincoln University, South Dakota State University

26. **Getting from here to a sustainable world - Why resource sufficiency evaluation is critical**
    Ed Barry, *Sustainable World Initiative*

27. **A sustainable solution to global warming: The North American Renewable and Neutral Energy Alliance (NARNEA)**
    Karl Edinger, Molly Fisher, José A. Rial, *University of North Carolina Chapel Hill*

28. **Opportunities for sustainable energy management and generation at water & wastewater utilities**
    Barry Liner, *Water Environment Federation*

29. **The adoption of anaerobic digestion of source separated organics as a revenue stream in large municipalities**
    Nickolas Alles, Stewart Gibson, Diana MacDonald, Katherine Rosa, Brittany Shrubb, *Fleming College*

30. **Biomimicry: What nature can teach us about energy reduction**
    Allyssa Davies, Brad Mahony, Connor Overbaugh, Olivia Prinzen, Anne-Lise Watson, *Fleming College*

31. **The Cuban energy revolution: Policy implications for conservation and accessibility in marginalized communities**
    Allan Fretz, Jennifer Greene, Jeffery McFarlane, and Daphne Paszterko, *Fleming College*

32. **Turning problems into solutions: Using hydrothermal liquefaction of microalgae to produce biofuel from harmful algal blooms**
    Joseph Broughton, Cody Hildebrant, Liam Prichard, Jonathan Shaddock, *Fleming College*

33. **High-density urban rainwater harvesting for non-potable uses in high-rise building operational systems**
    Jason Ryan Solnik, Davis Spencer, Reuben Van Zeumeren, *Fleming College*

34. **Eat the heat: Using waste heat to produce food in urban environments**
    Kaitlyn Finnegan, Laura Gerencser, Elizabeth Moore, Molly Teather, Catherine Wisniowski, *Fleming College*

35. **Quantifying the greenhouse gas benefits of agriculture and forestry management practices**
    Marlen Eve, Coeli Hoover, Stephen Ogle, Diana Pape, Wendy Powers
    Colorado State University, ICF International, Michigan State University, U.S. Department of Agriculture

36. **Biogas utilization: A regional snapshot in understanding factors that affect water resource recovery facilities – highlighting WEF Phase II biogas data collection results**
    Dan Basoli, Eloise Castillo, Barry Liner, Lisa McFadden, Shannon Ragland, Patrick Serfass
    Abt. Associates Inc., American Biogas Council, Water Environment Federation

37. **Biogeomorphodynamics of coastal ecosystems under conditions of climate change and nutrient enrichment**
    Cristina Da Lio, Massimiliano Ignaccolo, Marco Marani, Michaela Margida
    Corecomplete LLC, Duke University, Instituto di Scienze Marine, University of Toledo

38. **Tidal power: Harnessing clean, consistent currents**
    Isaac Burns, Keith Burns, Kyle Corbin, Jessica Ezzie, David Krane, Ryan Oaks, Logan Rickle
    Building Ohio's Sustainable Energy Future

39. **A data assimilation approach to differentiate and optimize biogenic and anthropogenic CO_2 sources in North and East China from 2005 to 2009**
    Zhang Bin, Archana Dayalu, J. William Munger, Thomas Nehrkorn, Chris Nielsen, Yuxuan Wang, Steven C. Wofsy
    Atmospheric and Environmental Research Inc., Harvard University, Tsinghua University

40. **Lake Erie phosphorous reduction, One CAFO at a time**
    Austin Bartos, Stephanie Clendenen, Sarah Jindra, Lauren Marshall, Joseph McVeen, Madeline Tomczak, Alex Williams, *University of Toledo*

41. **Climate communication insights from a sea level rise adaptation planning project in Beaufort County, South Carolina**
    Sean Bath, *College of Charleston*

42. **Splitting water by cheap materials, An effective solution to power future**
    Yunfei Xu, *Harvard University*

43. **Applying the learning community model to teach energy management and sustainability to graduate students**
    Randall S. Bohlman, Soizik Laguette, Haochi Zheng, *University of North Dakota*

44. **Environmental education in primary school**
    Meri Mullins, *University of Toledo*

15th National Conference and Global Forum on Science, Policy and the Environment

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