Welcome to the Energy 101 Online Dialogue 1#

Energy in the Classroom

Today's Agenda

1) Introduction
Energy 101 Initiative: Framing the Issue - Matt Garcia **(3-3:10)**
2) Instructors in Energy Education Series
Energy in the Classroom presentations (**3:10-4:00)**
3) Online Energy Education Discussion Forum (4:00-4:30)
Interactive and pre-populated discussion points and comments
4) Resources Discussion 4:30-5:15
5) Conclusion (5:15)
Summary, take-aways, action items, and next steps

We encourage you to bring up topics of discussion using question function on your gotowebinar panel for the online virtual panel we will have following the Instructors in Energy Presentations.

#Energy101

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

The Energy 101 Initiative
Framing the Issue
#Energy101

Dr. Matthew Garcia[1]

Science & Technology Policy Fellow
Department of Energy

September 20th, 2013

[1]All opinion presented are my own
All image rights and credits to original creators

Energy 101: Framing the Issue

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Launch of the Energy 101 Dialogue Series

energy.gov/eere/education/energy-101-dialogue

Background on the Energy 101 Initiative

energy.gov/eere/education/energy101

What is the Energy 101 Initiative?

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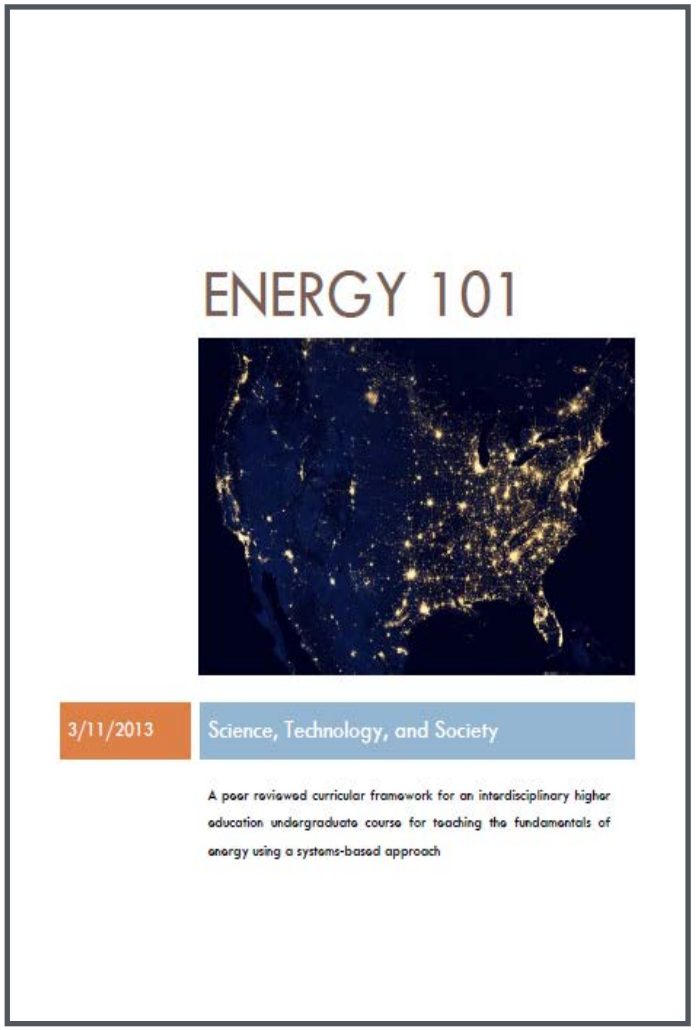

Promoting Energy Education in the Nation's Colleges and Universities

- A recognition of ongoing post-secondary energy education efforts in the Nation's colleges and universities.
- Effort to further support and amplify those efforts
  - Encouraging the creation of energy courses, by lowering thresholds toward course creation and adoption
  - Facilitate and foster a coordinated national discussion on energy education at the post-secondary level

Overall Goals

- Increasing the pathways available to students towards training, degrees and careers in energy and related fields (Energy STEM)
- Increase the Nation's Energy Literacy

The Energy Literacy Principles and the Energy 101 Framework

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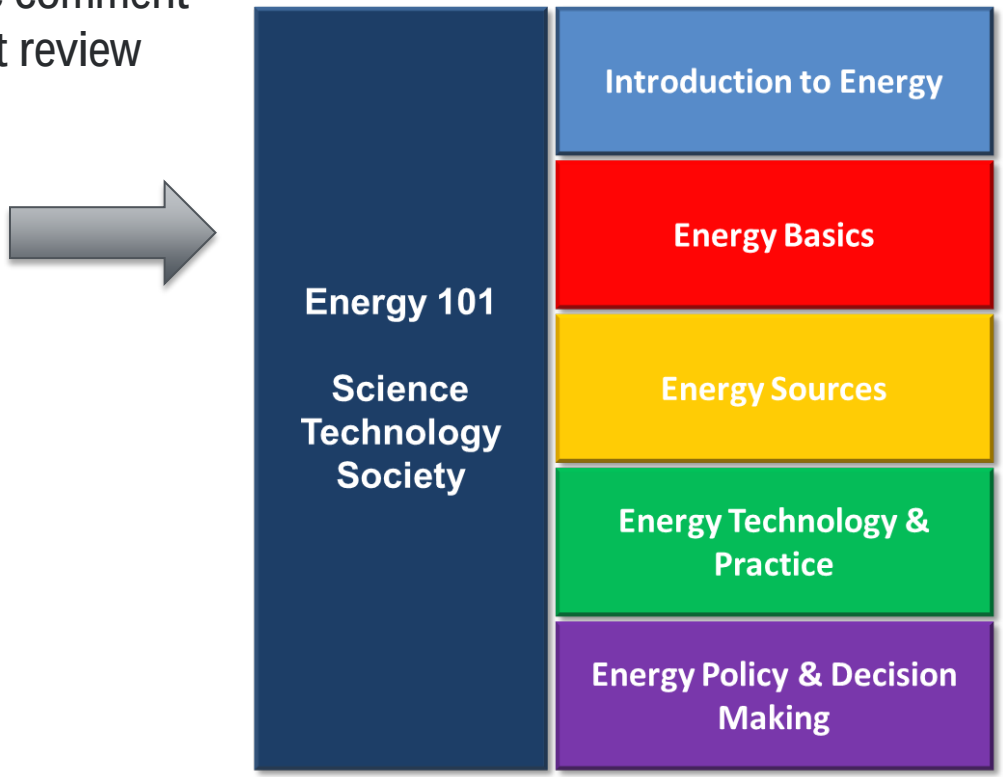
A peer reviewed and agreed upon set of principles and concepts that define energy literacy

1. Intro to Energy Course models
2. Public comment
3. Expert review



Course outline consisting of 5 Units of fundamentals and 36 core concepts in the format of a semester long course

The 5 Units of the Energy 101 Course Framework- 36 core concepts

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Units

U1. Introduction to Energy

1. Energy is a physical quality that follows precise natural laws (Core 1.1)
2. Physical processes on Earth are the result of energy flow through the Earth system. (Core 2.6)
3. Biological processes depend on energy flow through the Earth system. (Core 3.6)

U2. Energy Basics

1. Energy is a physical quantity that follows precise natural laws (Cores 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8)

U3. Energy Sources

2. Physical processes on Earth are the result of energy flow through the Earth system. (Core 2.2)
4. Various sources of energy can be used to power human activities, and often this energy must be transferred from source to destination. (Core 4.1, 4.3, 4.5 , 4.7)
6. The amount of energy used by human society depends on many factors. (Core 6.1)
7. The quality of life of individuals and societies is affected by energy choices.(Core 7.3)

U4. Energy Technology & Practice

4. Various sources of energy can be used to power human activities, often this energy must be transferred from source to destination. (Cores 4.2, 4.3, 4.4, 4.5, 4.6, 4.7)

U5. Energy Policy & Decision Making

5.Energy decisions are influenced by economic, political, environmental, and social factors. (Cores 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)

6. The amount of energy used by human society depends on many factors. (Cores 6.3, 6.4, 6.5, 6.6, 6.8)

7. The amount of energy used by human society depends on many factors. (Core 7.1)

Sections (Cores)

- **5 Units**
- **1-3 sections**
- **36 supporting core concepts**

Energy 101 Course Framework Unpacked Example

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U1. Introduction to Energy — UNIT

Sections

1. Energy is a physical quality that follows precise natural laws (Core 1.1)
2. Physical processes on Earth are the result of energy flow through the Earth system. (Core 2.6)
3. Biological processes depend on energy flow through the Earth system. (Core 3.6)

Cores

1.1 - Energy is a quantity that is transferred from system to system.

2.6- Greenhouse gases affect energy flow through the Earth system.

3.6 Humans are part of Earth's ecosystems and influence energy flow through these systems.

U2. Energy Basics

U3. Energy Sources

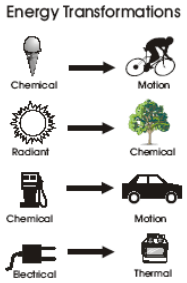
U4. Energy Technology & Practice

U5. Energy Policy & Decision Making

Cores Unpacked

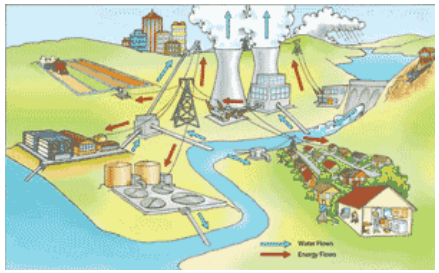
1. Energy is a physical quality that follows precise natural laws (Core 1.1)

1.1 Energy is a quantity that is transferred from system to system. Energy is the ability of a system to do work. A system has done work if it has exerted a force on another system over some distance. When this happens, energy is transferred from one system to another. At least some of the energy is also transformed from one type into another during this process. One can keep track of how much energy transfers into or out of a system.



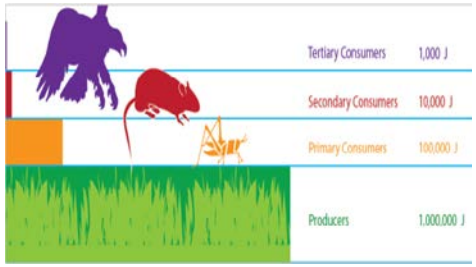
2. Physical processes on Earth are the result of energy flow through the Earth system. (Core 2.6)

2.6 Greenhouse gases affect energy flow through the Earth system. Greenhouse gases in the atmosphere, such as carbon dioxide and water vapor, are transparent to much of the incoming sunlight but not to the infrared light from the warmed surface of Earth. These gases play a major role in determining average global surface temperatures. When Earth emits the same amount of energy as it absorbs, its average temperature remains stable.



3. Biological processes depend on energy flow through the Earth system. (Core 3.6)

3.6 Humans are part of Earth's ecosystems and influence energy flow through these systems. Humans are modifying the energy balance of Earth's ecosystems at an increasing rate. The changes happen, for example, as a result of changes in agricultural and food processing technology, consumer habits, and human population size.



Framework Summary Document

Energy 101 Framework Use

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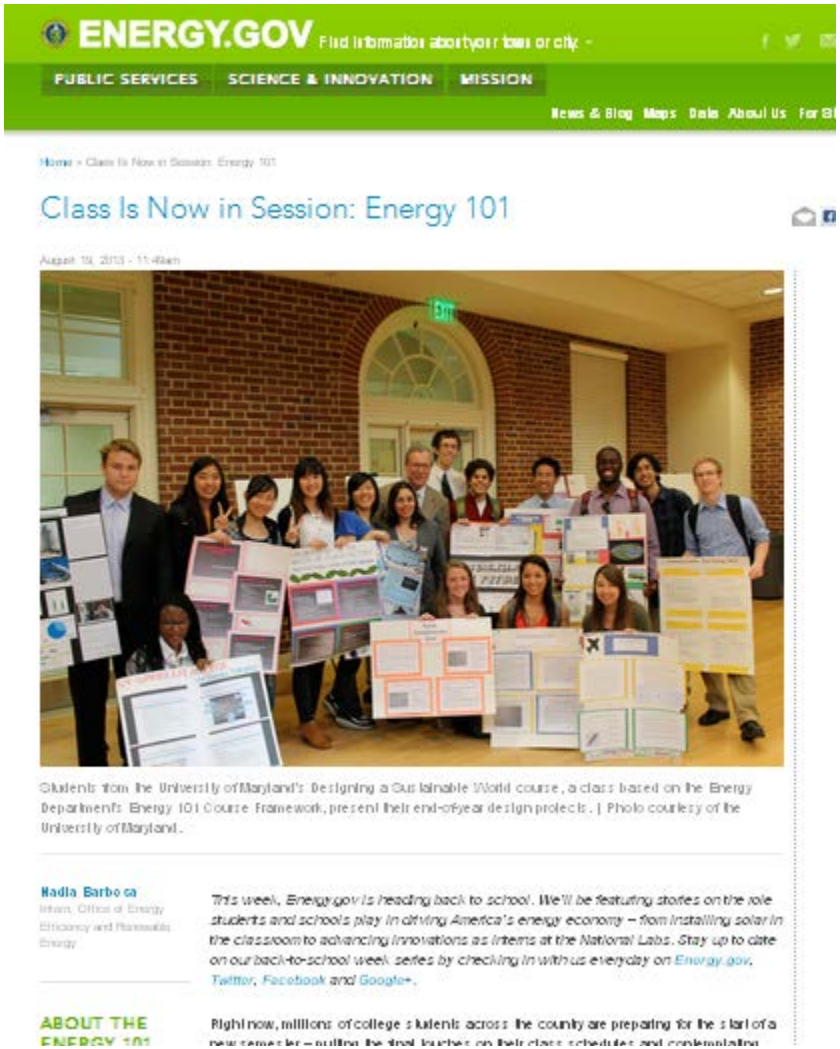

http://energy.gov/articles/class-now-session-energy-101

Spring 2013, Pilot course at University of Maryland was offered

- Resulted in a general Education Course Credit
- More than 90 percent of the students who took the pilot indicated it helped them think about the complex issues or problems surrounding energy

February 2013, Harford Community College in Bel Air, Maryland, received approval to teach a course based on the Framework, *Introduction to Energy & Sustainability* (SCI 109)

- General Science Course
- Transferrable to All State Higher Education Institutions in Maryland

In May of 2013, Cecil Community College received approval for Introduction to Energy & Sustainability

- 4 hour credit courses: ENV 150

Why are Energy Education and Energy literacy important topics to the Department of Energy?

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DOE Mission Goals: Energy Workforce

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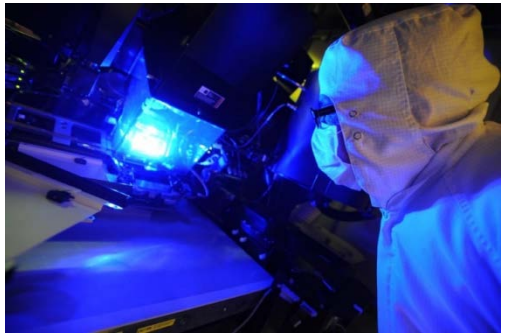

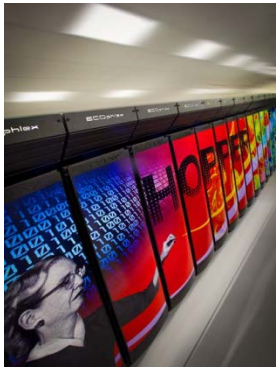

Sustain a World-Leading Technical Workforce

http://www.pinterest.com/energy/

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Increase Energy Literacy in the U.S.

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National Environmental Education and Training Foundation "Energy Literacy in America[1]" 2002

12% passed a basic quiz on awareness of energy topics

75% believe they have a lot or fair amount of knowledge of energy

Similar studies done since 2002 have shown little energy literacy improvement (2012)

http://www.clarkson.edu/cses/research/energylitproj.html

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Results of increased Energy Literacy

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- A better understanding of energy can:
  - Lead to more informed decision
  - Promote economic development
  - Lead to efficient energy use
  - Reduce environmental risks and negative impacts
  - Help individual and organizations save money

Energy 101 Dialogue Series

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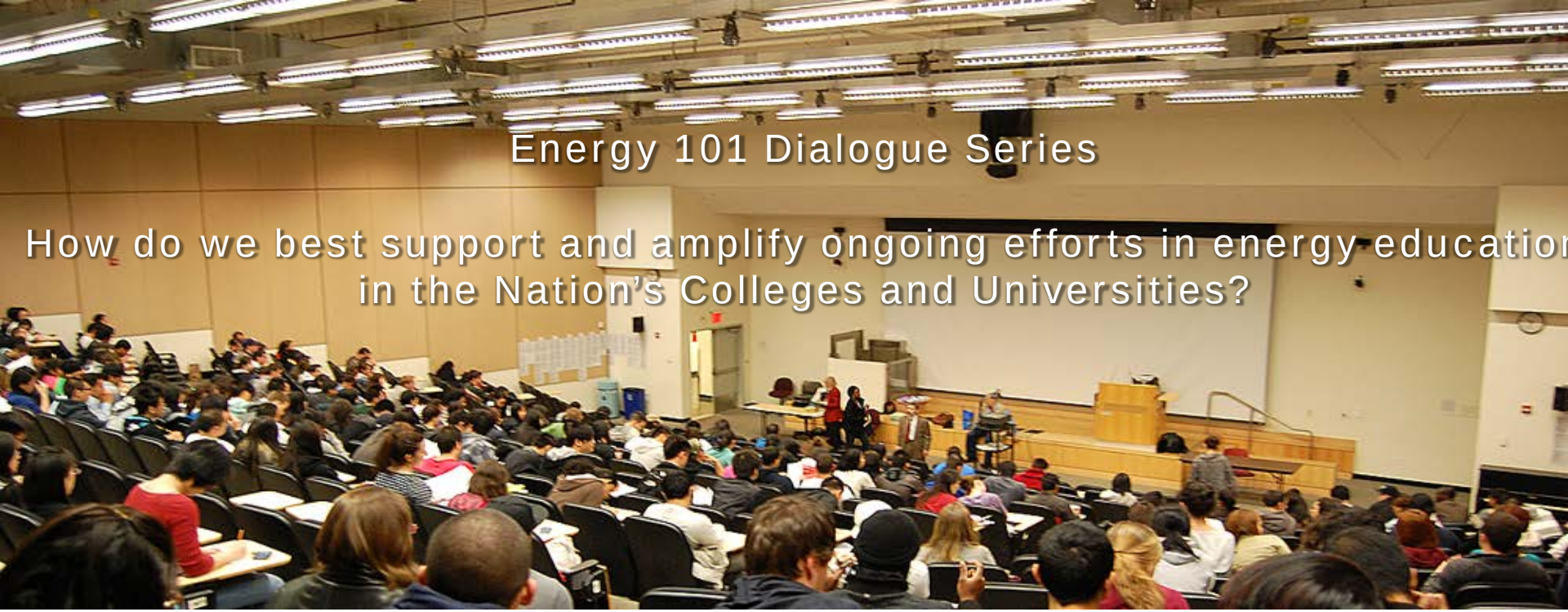
- In the process of creating the energy 101 initiative and creation of the framework, we uncovered a growing ecosystem of energy education in the post secondary setting



Energy 101 Dialogue Series

How do we best support and amplify ongoing efforts in energy education in the Nation's Colleges and Universities?

Energy Dialogue Series Activies / Goals

- Identify issues surrounding increasing energy education opportunities and courses
- Identify and share components of DOE and the federal training & workforce infrastructure to leverage
- Report out best practices and Energy 101/Energy literacy efforts
- Communities of practice around post secondary energy education

Dialogue #1: Energy in the Classroom

- Sharing best practices in the teaching of fundamentals of energy and energy related courses
- Sharing of resources for educators in energy education

2. Instructors in Energy Education Panel

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Energy Educators Panel Speakers

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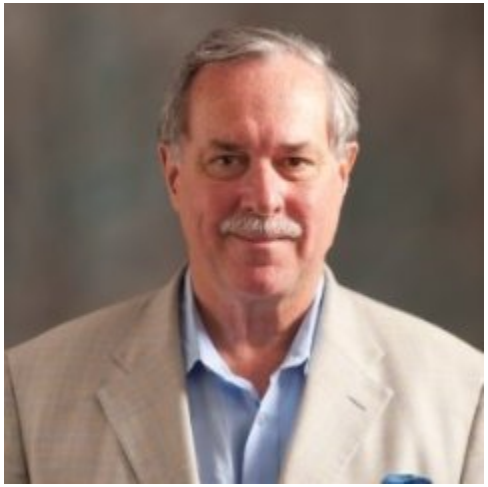
Professor Leigh Abts - Research Associate Professor, University of Maryland
Professor Daniel Kammen - Professor, Energy and Resources Group, University of California, Berkley; Director, Renewable and Appropriate Energy Laboratory
Professor Andy Bunn - Associate Professor, Western Washington University; Director, Institute for Energy Studies
Professor Douglas J. Reinemann - Professor, University of Wisconsin-Madison; Department Chair, Biological Systems Engineering
Professor Kenneth Klemow - Professor, Wilkes University; Associate Director, Institute for Energy and Environmental Research

All panelists views are their own



Professor Leigh Abts - Research Associate Professor, University of Maryland

Energy 101 by Design:

Designing a Sustainable World

Designing Quantitative Solutions for Energy

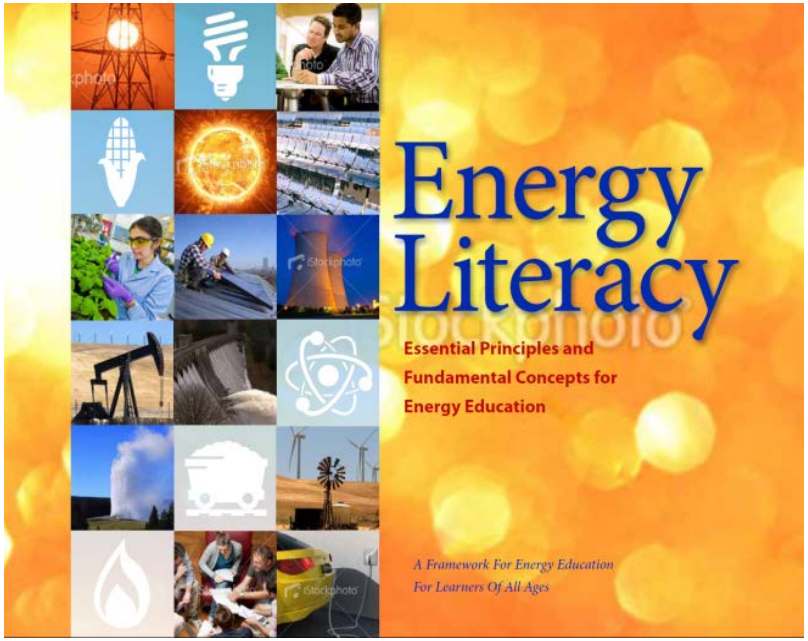
Leigh Abts, Ph.D.
Research Associate Professor
A. James Clark School of Engineering
&
College of Education
University of Maryland, College Park

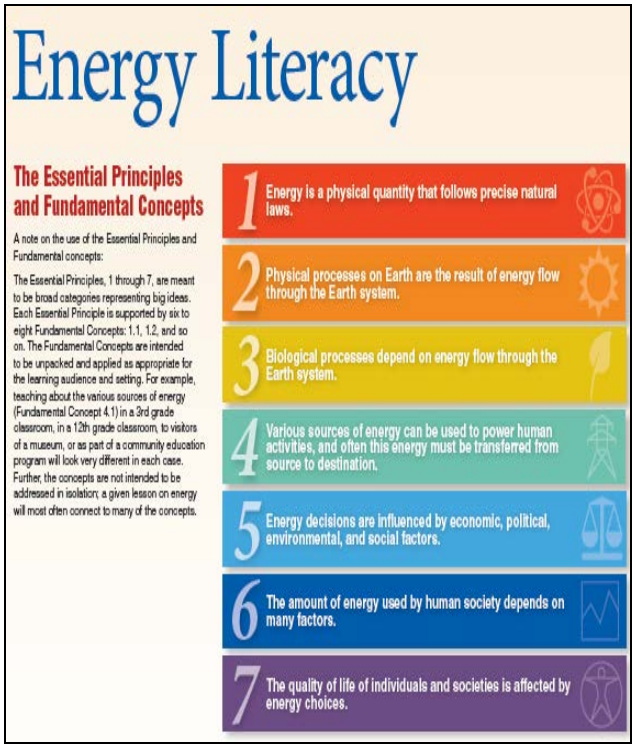
June 26, 2014

Creating the Framework to Align the Energy Literacy Principles to 21St Century Skills through Design

Initial Project Funded by DOE to APLU with James Turner as PI

Energy Literacy Principles form the Foundation





Energy Literacy

The Essential Principles and Fundamental Concepts

A note on the use of the Essential Principles and Fundamental concepts:

The Essential Principles, 1 through 7, are meant to be broad categories representing big ideas. Each Essential Principle is supported by six to eight Fundamental Concepts: 1.1, 1.2, and so on. The Fundamental Concepts are intended to be unpacked and applied as appropriate for the learning audience and setting. For example, teaching about the various sources of energy (Fundamental Concept 4.1) in a 3rd grade classroom, in a 12th grade classroom, to visitors of a museum, or as part of a community education program will look very different in each case. Further, the concepts are not intended to be addressed in isolation; a given lesson on energy will most often connect to many of the concepts.

1. Energy is a physical quantity that follows precise natural laws.
2. Physical processes on Earth are the result of energy flow through the Earth system.
3. Biological processes depend on energy flow through the Earth system.
4. Various sources of energy can be used to power human activities, and often this energy must be transferred from source to destination.
5. Energy decisions are influenced by economic, political, environmental, and social factors.
6. The amount of energy used by human society depends on many factors.
7. The quality of life of individuals and societies is affected by energy choices.

Courtesy Department of Energy (DOE)

The 21St Century Academic and Workforce Skills Frame the Competencies[1]

Problem solving

Modeling

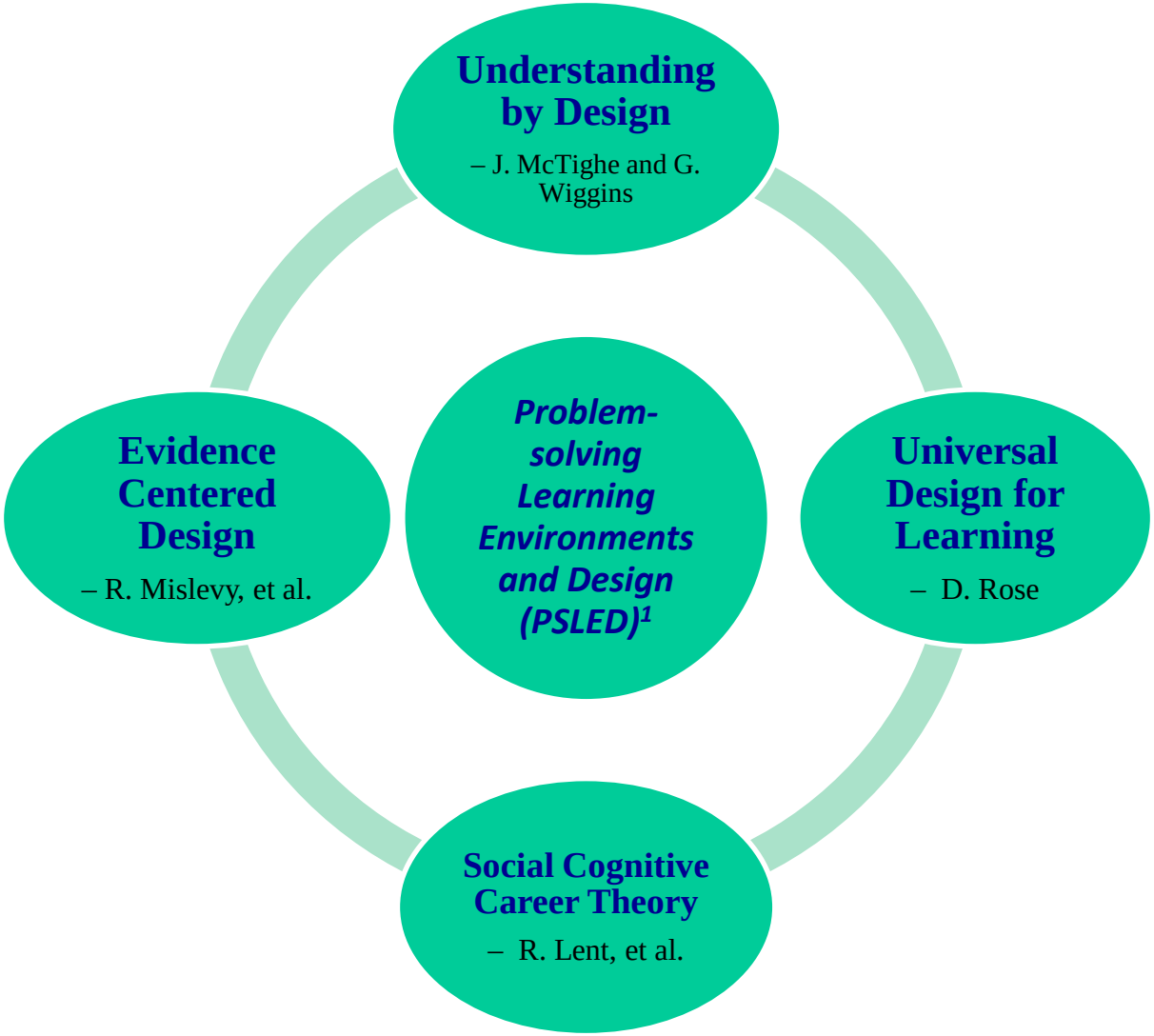
Collaboration

Creative thinking

Communications

1. NSF RET, PRIME and Inspire Awards

Align the Educational Design Theories Establish the Model[1,2,3]



1. NSF RET and Inspire Awards
2. Building and expanding upon the concepts outlined by D. H. Johansen and others
3. Graphic developed by Dr. Laura Adolfie

The Pilot Courses

A general curriculum classroom course for UMD Students:
BioE 289A: Designing a Sustainable World

An online course for Active Duty and Veterans:
BioE 110: Designing Quantitative Solutions for Energy

Designing a Sustainable World[3]

Dr. Leigh Abts (Spring 2013 and 2014) and Dr. Idalis Villanueva (2013)

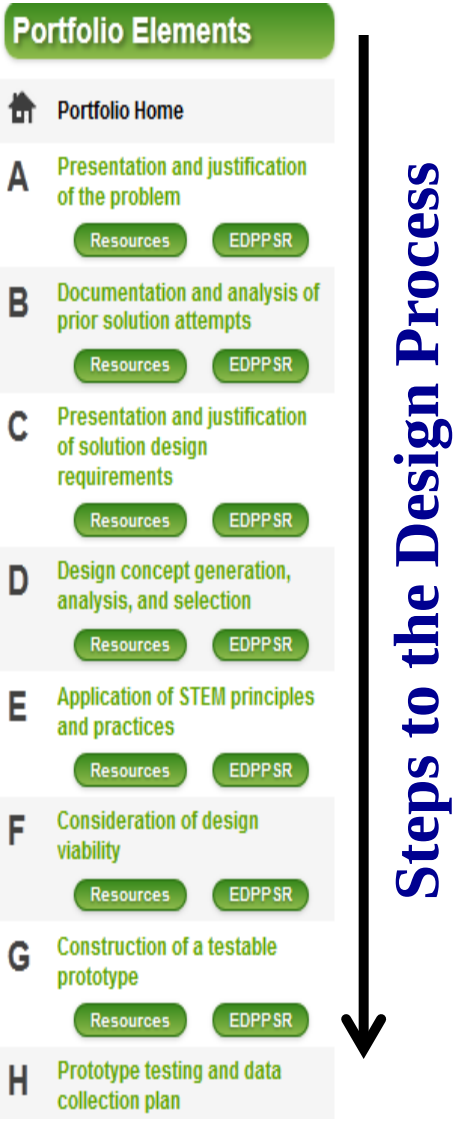
- **Philosophy of Energy 101[1] -** "Solid understanding of basic energy principles … develop critical thinking skills … making informed decisions about energy production, energy use, sustainable development and other issues."

- **Philosophy of a UMD I-course[2] -** "Spark the imagination, demand intellect, and inspire innovation … challenge students to wrestle with big questions … examine the ways that different disciplines address them."

Courtesy of Ms. Angela Kang, FR LTSC

1. http://www.eesi.org/energy101
2. http://www.gened.umd.edu/i-series/iseries.php
3. Course developed through funding provided by DOE and NSF SITE RET

Utilize the PLTW Innovation Portal™



Steps to the Design Process

Courtesy Project Lead the Way

Online, Asynchronous Course for Active Duty and Veterans[1,2]

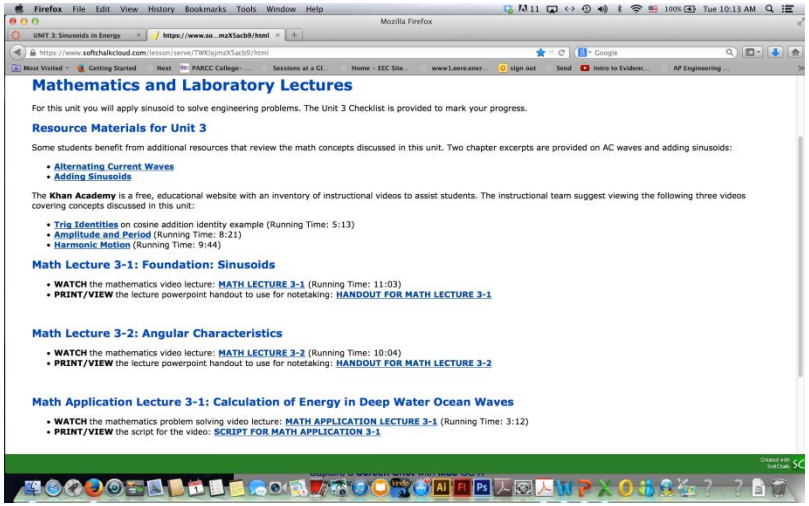
Designing Quantitative Solutions for Energy

UMD Faculty – Dr. Leigh Abts and Dr. Ian White

- **24 mathematics videos** (Dr. Danny Barnes)[3] based on the Wright State Engineering Math
- **4 virtual laboratory videos** (Ms. Emily Hauser and Ms. Gail Wyant)[4] filmed at Cecil Community College
- **12 energy-based application videos** (Ms. Toby Ratcliffe)[4] studio filmed
- **7 design videos** to guide student projects submitted to Innovation Portal (Dr. Leigh Abts)[4] studio filmed aligned to the PLTW Innovation Portal™
- **11 Career mentoring videos** (Center for Energy Workforce Development)[5]
- **4-credits from UMD[6]**

Authored:
SoftChalk™

Delivered:
CANVAS™ LMS



1. Funded by Advanced Distributed Learning Initiative and National Science Foundation.
2. Building upon concepts originally proposed by Dr. Ian White and Dr. Jennifer Wolk derived from Dr. Nathan Klingbeil's Wright State Course.
3. Videos production by the UMD Seigel Learning Center.
4. Video production by Vanderpool Films.
5. Videos by the Center for Workforce Development.
6. Credits offered through the UMD Office of Extended Studies.

A Unit-level PSLED

UNIT 3: Sinusoids in Energy Theme: TECHNOLOGY and POWER TRANSMISSION WEEK 3: Feb. 24-Mar. 2, 2014 - WEEK 4: Mar. 3-9, 2014 - WEEK 4: Mar. 10-16, 2014	
	Date Completed
MATH LECTURES:	
Pre-assessment: Self-efficacy Assessment – DUE: 2/27	
Math Lecture 3-1: Foundations: Sinusoids Math Lecture 3-2: Angular Characteristics	
Application Lecture 3-1: Calculation of Energy in Deep Water Ocean Waves	
Math Homework 5 – DUE: 2/28	
Math Lecture 3-3: Sinusoid Shifts	
Math Lecture 3-4: Addition of Sinusoids Application Lecture 3-2: Analysis of Current and Voltage in a Resistor-Inductor	
Math Homework 6– DUE: 3/7	
Post Assessment: Self-efficacy Assessment – DUE: 3/9	
UNIT 3 QUIZ – DUE: 3/12	
DESIGN PROJECT:	
Design Project Video: Design Step 3: Generate and Select Design Solutions	
Design Assignment: Design Element B: Documentation and Analysis of Prior Solution Attempts – DUE 3/2	
Design Assignment: Initial Design Review for Elements A and B – DUE: 3/9	
Design Assignment: UPLOAD Design Element C: Presentation and Justification of Solution Design to Innovation Portal - Due 3/10	
Design Assignment: Elements A through C for Review - DUE: 3/15	
TROOPS TO ENERGY JOBS:	
Troops to Energy Videos: Translate Skills and Education	
UNIT EVALUATION:	
Unit 3 Instructional Feedback Survey – DUE: 3/21	

Updated 2-11-2014 by TJI

Template developed by Ms. Tami Imbierowicz

UbD – UDL – ECD – SSCT Template Sample

Draft Unit 4: Stage 1 – Desired Results	
	d reasonable solutions to the problem.

Template Design and Content: Dr. Stephanie Moore, Dr. Rosemary Reshetar, Ms. Toby Ratcliffe, Ms. Emily Hauser, Ms. Gail Wyant, Dr. Laura Adolfie and Dr. Leigh Abts

?

Course: http://ter.ps/bioe110

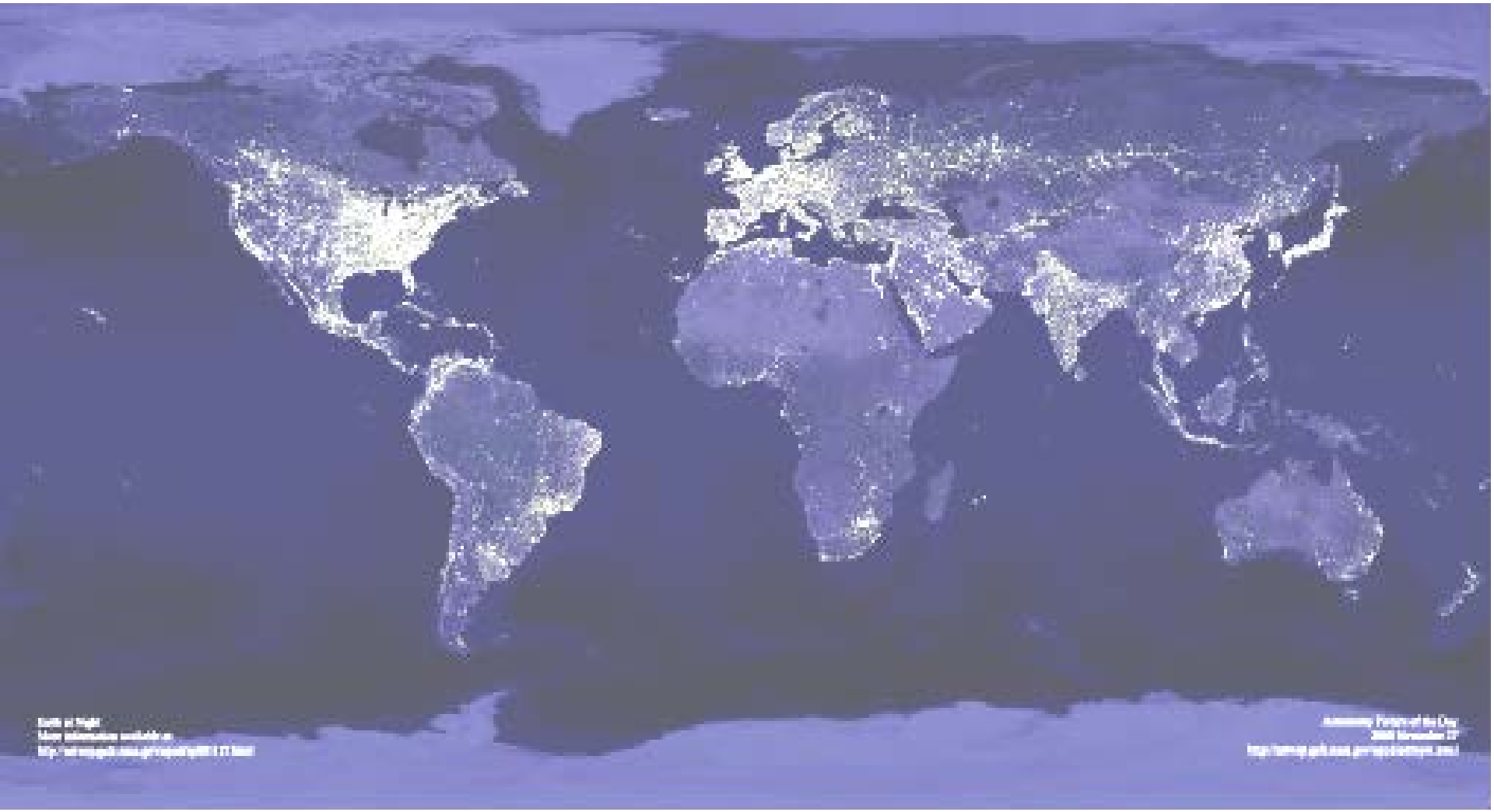
Contact: labts@umd.edu

Professor Daniel M. Kammen
Energy and Resources Group, University of California, Berkley

Director, Renewable and Appropriate Energy Laboratory

Prof. Kammen has taught Energy and Society for 15 years; the course is the combined undergraduate and graduate gateway course to interdisciplinary energy science, engineering, financial and policy studies at UC Berkeley. It has been a mOOC for over a decade at http://er100200.berkeley.edu

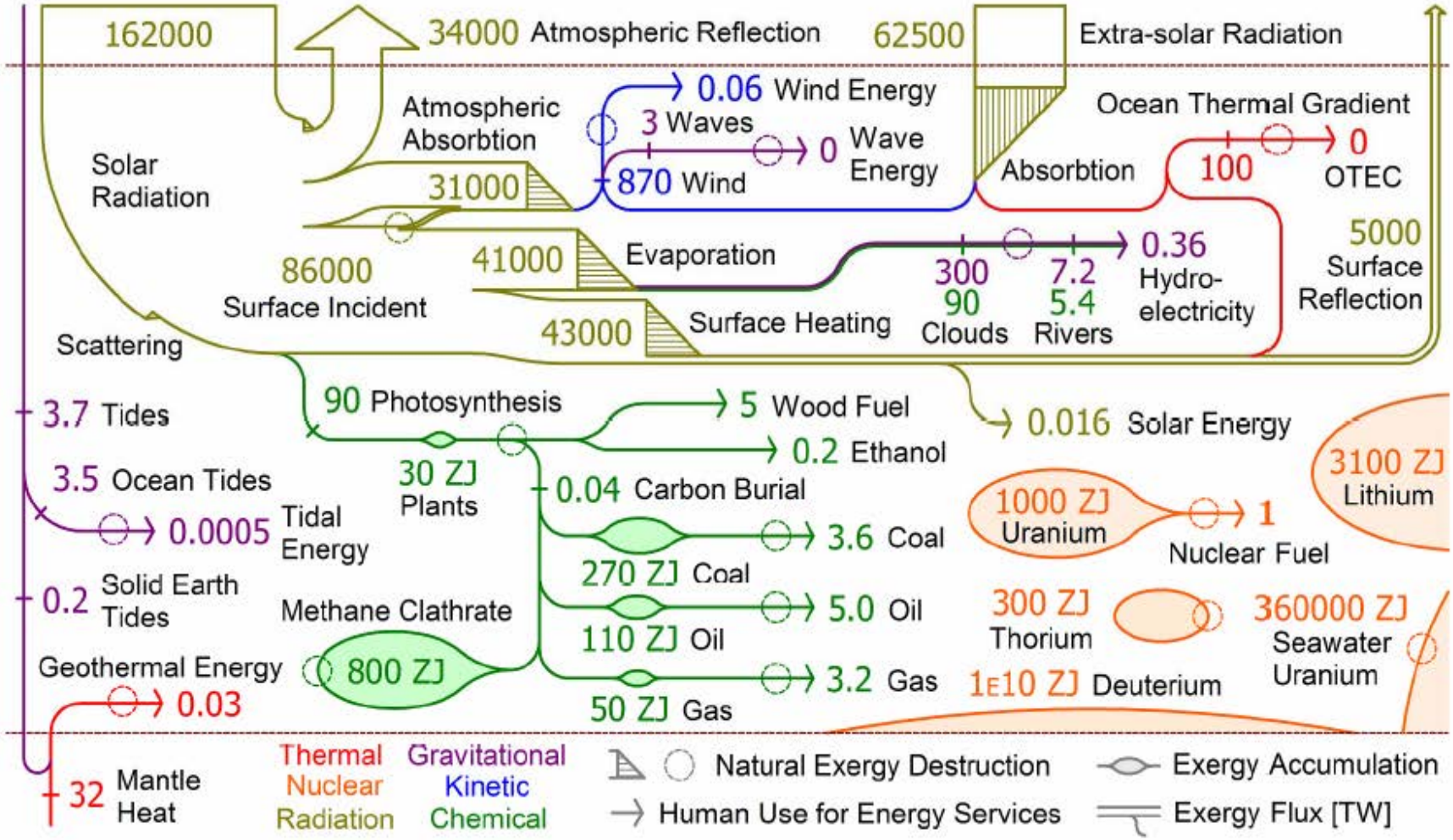
Energy and Society in two slides: *slide 1*



Scales of analysis

Energy Stocks & Flows for the Earth

Energy and Society in two slides: *slide 2*



Current Global Exergy Usage Rate ~ 15 TW (0.5 ZJ per year)

86000/15 = 5733

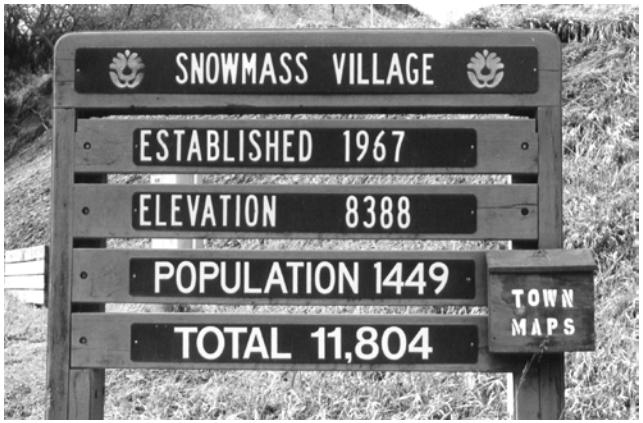
(1 ZJ = 10^{21}J)

A mOOC (managed Online Open Course - http://er100200.berkeley.edu)

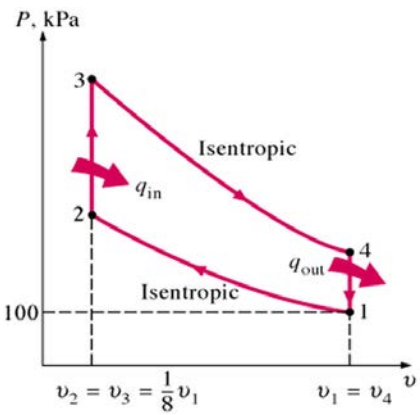
Wk	Date	Lecturer	Lecture #/Topic
1	8-29	Kammen	1. Introduction to Energy and Society & How energy use shapes society, and how society drives energy choices
2	9-3	Kammen	2. Energy Toolkit I: Units, Forecasts, and the Back-of-the-Envelope
	9-5	Kammen	3. Energy Toolkit II: Fuels, Energy Content & Basics of Combustion
3	9-10	Kammen	4. Energy for 'the South' I: Energy Transitions and Development
	9-12	Kammen	5. Energy for 'the South' II: Biomass, Households and Gender
4	9-17	Lucas	6. Energy Toolkit III: Energy Thermodynamics
	9-19	Lucas	7. Energy Toolkit IV: Thermodynamics of Modern Power Plants
5	9-24	Kammen	8. 'Hydrocarbon Man'
	9-26	Kammen	9. Evolution of the Modern Energy Economy
6	10-1	Kammen	10. Energy Toolkit VI: Economic Analysis of Energy Systems
	10-3	Horvath	11. Energy Toolkit VII: Life-Cycle and Cost-Benefit Analysis
7	10-8	Kammen	12. Energy Efficiency I
	10-10	Kammen	13. Energy Efficiency II
8	10-15	Kammen	14. The Grid
	10-17	GSIs	**In class mid-term review**
9	10-22	Kammen	15. The Promise and Perils of Natural Gas and Fracking
	10-24	You!	**Midterm Exam, In class**
10	10-29	Peterson	16. Nuclear Energy I: Physics and Engineering – Fission/Fusion
	10-31	Budnitz	17. Nuclear Energy II: Waste, Risk & Economics
11	11-5	Kammen	18. Energy and Environmental Justice
	11-7	Kammen	19. Renewable Energy I: Solar Energy
12	11-12	Kammen	20. Renewable Energy II: Wind and Water Power
	11-14	Lipman	21. Renewable Energy III: Hydrogen and Fuel Cells
13	11-19	Kammen	22. Underground Energy: Carbon Capture and Storage & Geothermal
	11-21	Kammen	23. Innovations in R&D, Novel Energy Policies and Market Approaches
14	11-26	Guest	24. Biofuels and new transportation policies
	11-28		**THANKSGIVING HOLIDAY**
15	12-3	Kammen	25. Climate Change I: Energy and Climate
	12-5	Kammen	26. Climate Change II: Energy Policy

Goal: build and use toolkits for energy studies

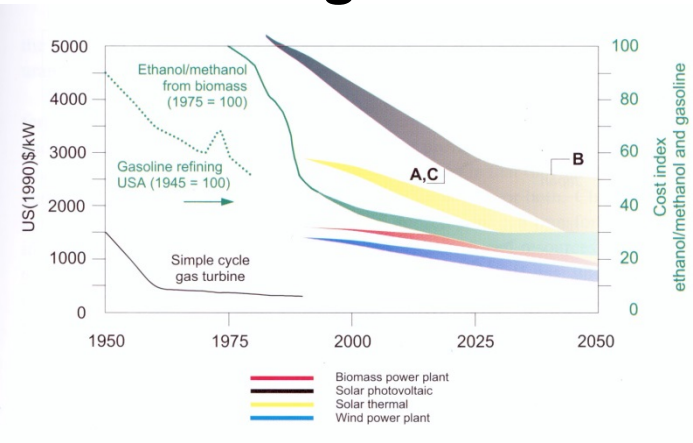
Analytic methods



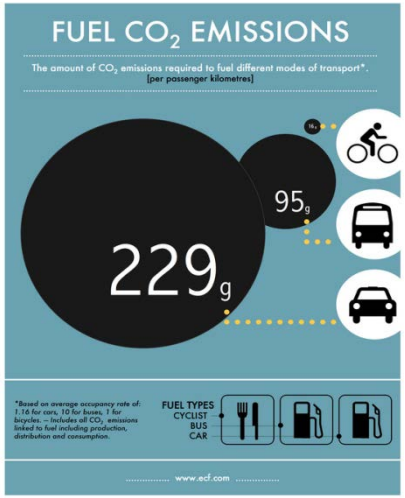
Systems methods



Forecasting methods

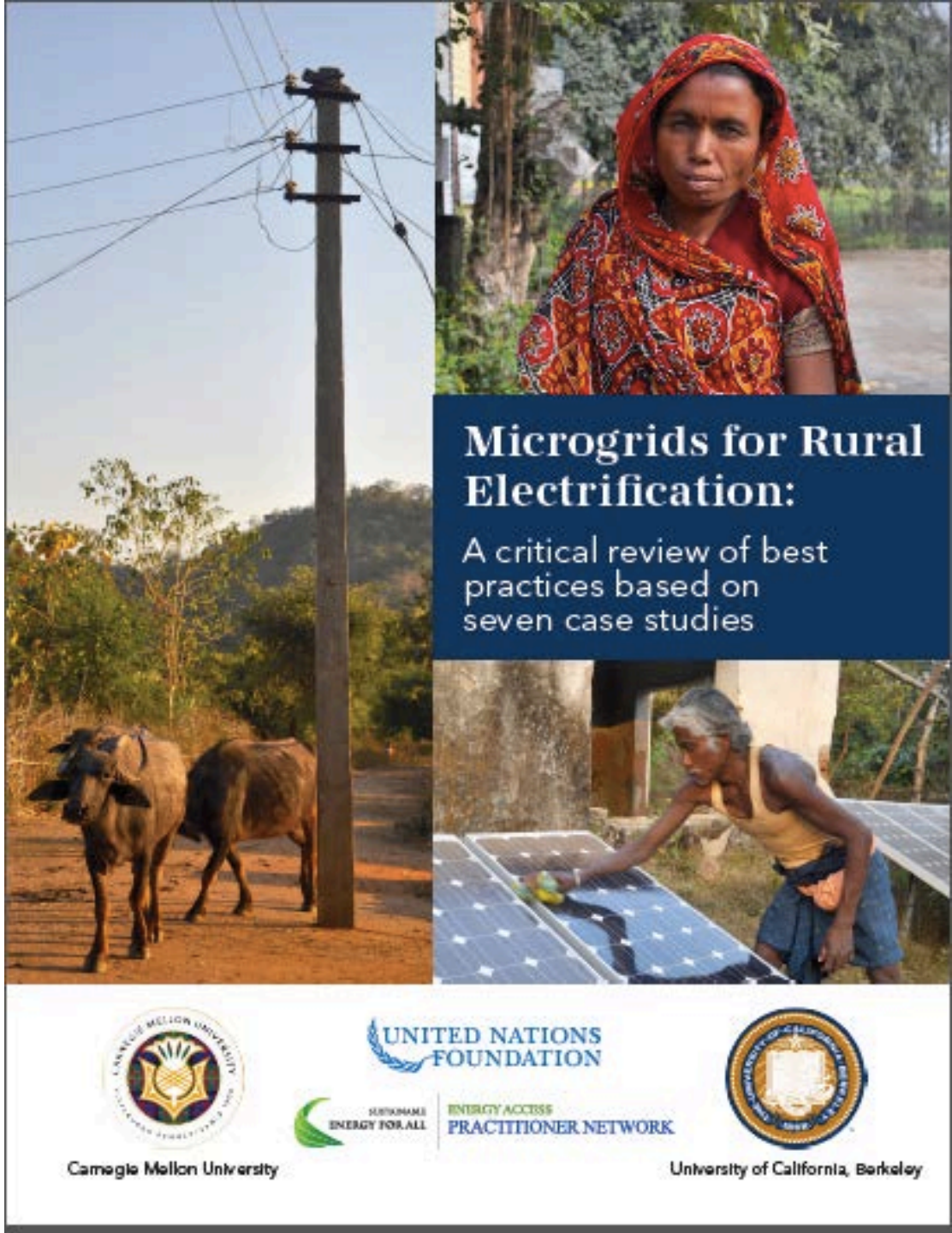


Life-cycle methods

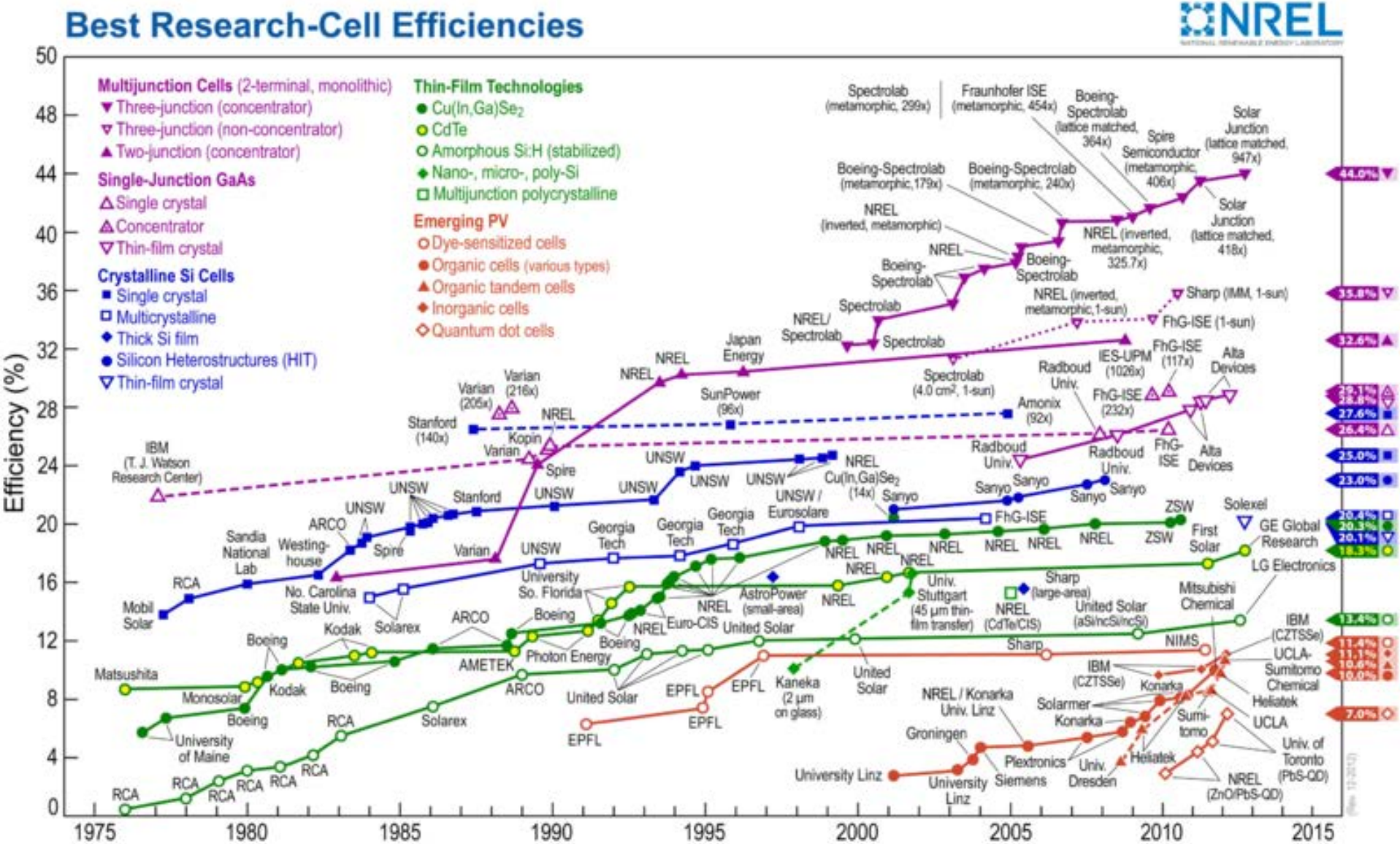


Policy analysis and action methods

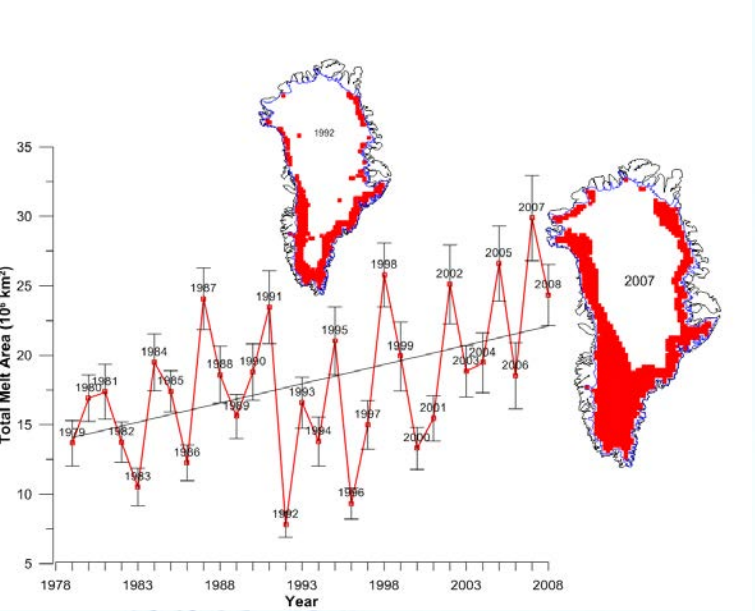
Access narratives of energy



Science and engineering narratives of energy

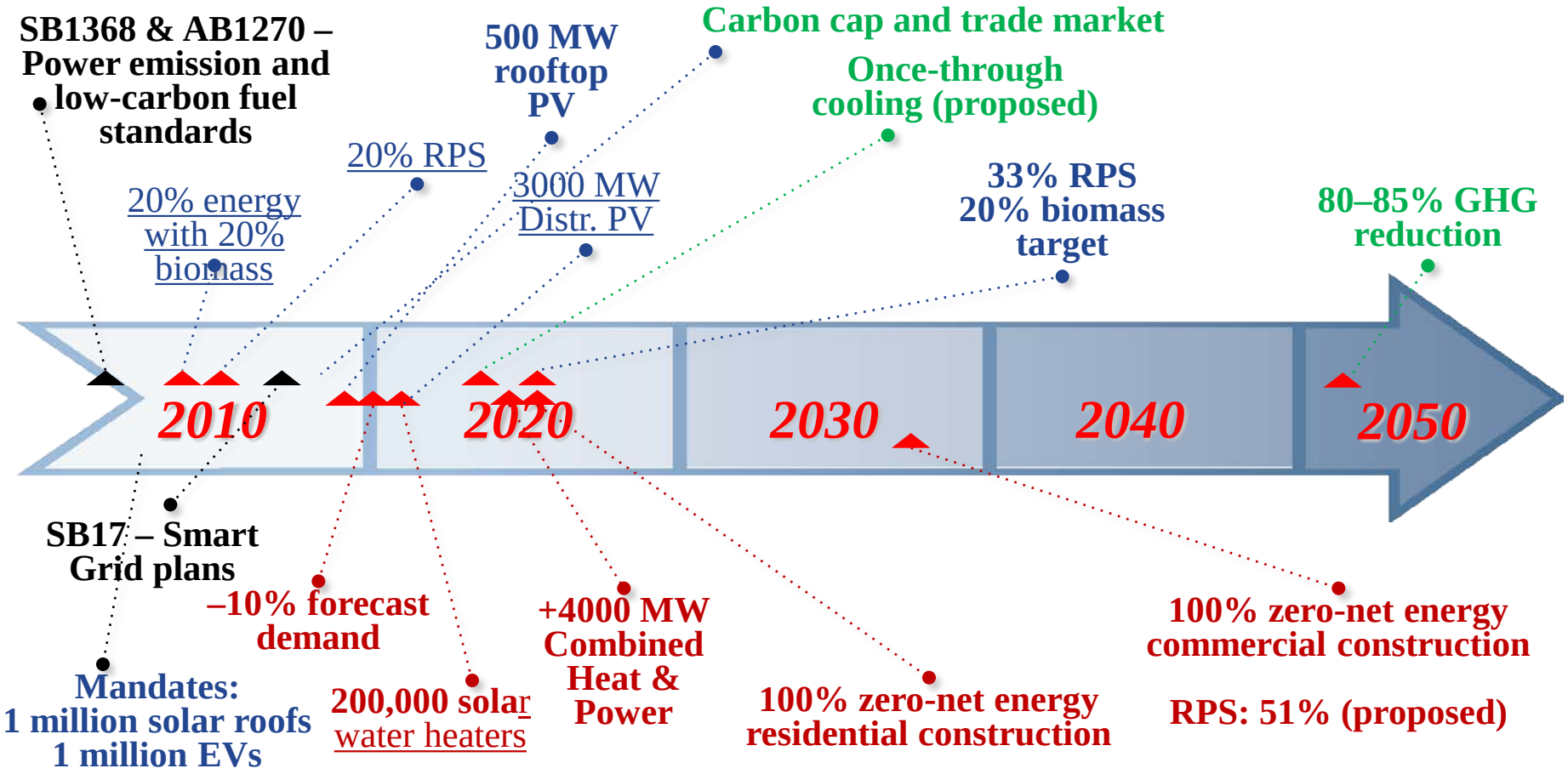


Climate narratives of energy



D Kammen: Svalbard, Norway

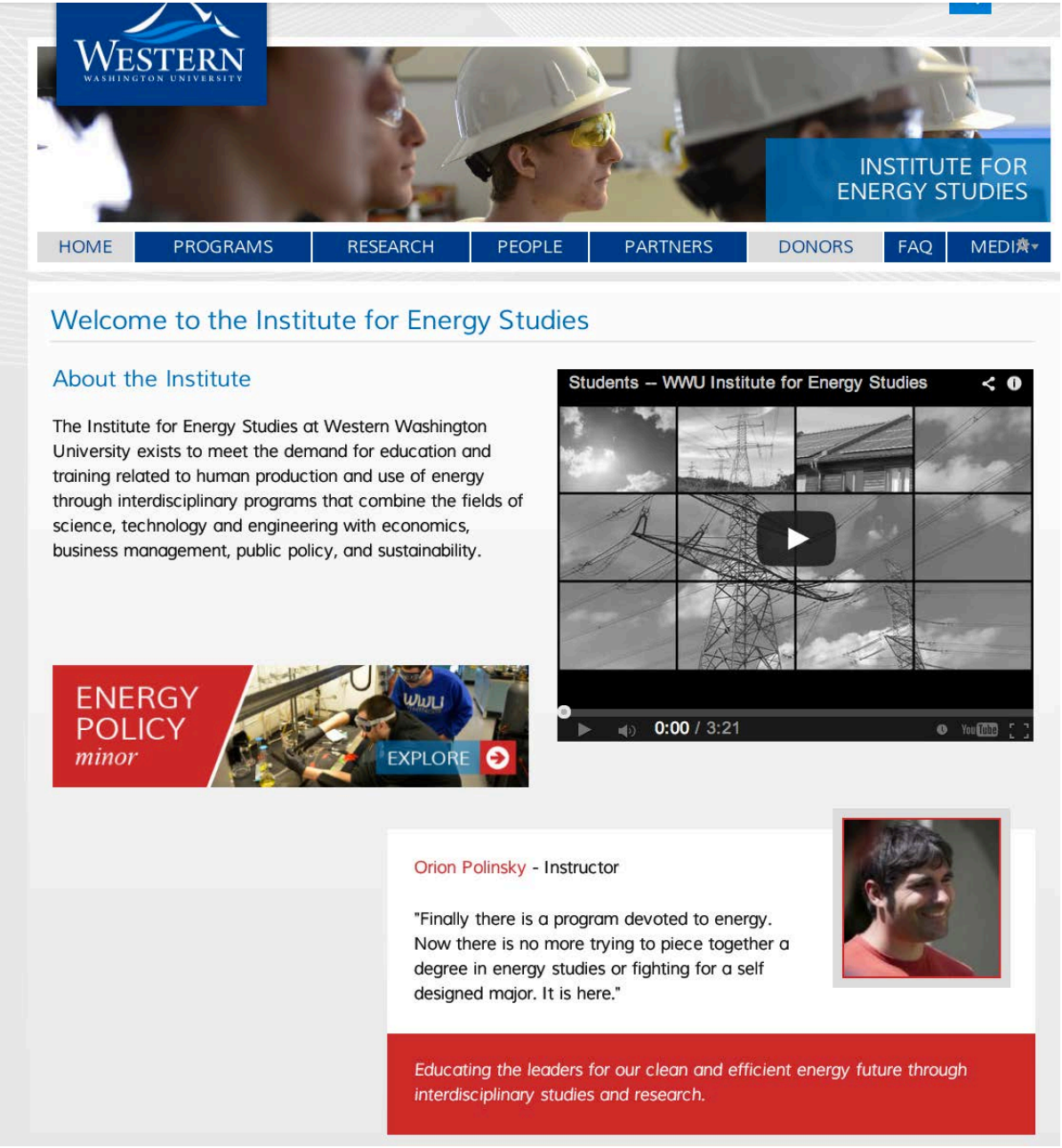
Policy narratives of energy



Pipeline of innovations: scientific, technical, market, managerial and environmental

Professor Andy Bunn
Associate Professor, Western Washington University
Director, Institute for Energy Studies, Western Washington University

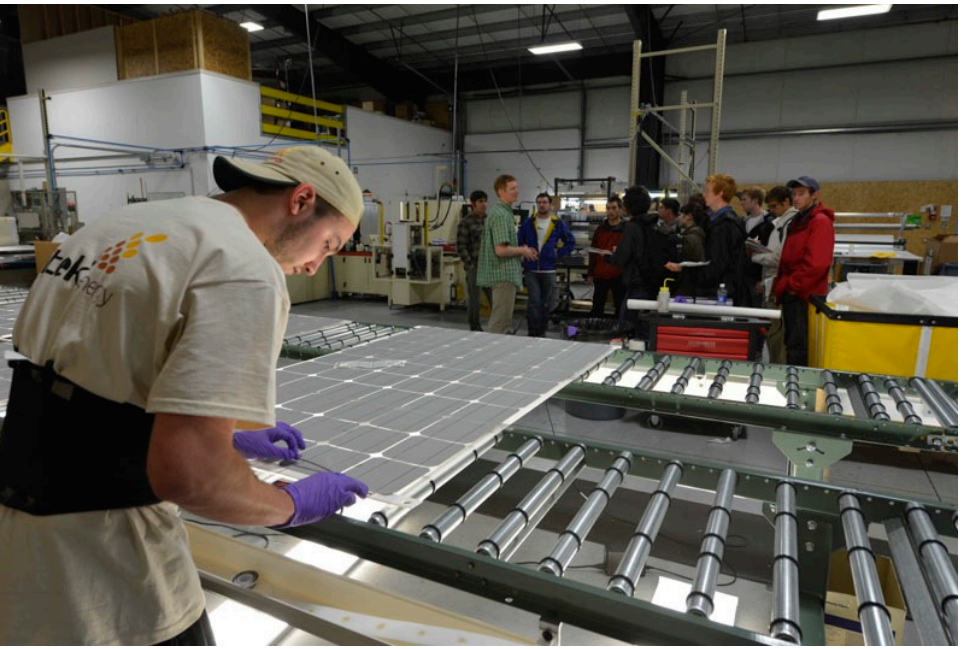
Andy Bunn is the director of the institute for energy studies at Western Washington University. The institute is a cross-college venture designed to meet the demand for education and training related to human production and use of energy through interdisciplinary programs that combine science, technology and engineering with economics, business management, public policy, and sustainability



https://energy.wwu.edu/

Lessons learned while teaching energy without a license

- Getting into the field
- Local issues
- History
- Units
- Thermodynamics
- Working with data



Property of Museum of History & Industry, Seattle

Locomotive hauling coal from Lake Union, Seattle, ca. 1871

Units

- Units are like language
- The beauty of units are hard to describe to nonscientists

$$\frac{3.25in}{hr} \times \frac{ft}{12in} \times \frac{m}{3.28ft} \times \frac{10^3 mm}{m} \times \frac{hr}{60\,\text{min}} = \frac{1.37mm}{\text{min}}$$

Units

- The units are ugly – just the way it is
  - Tons of oil equivalent, terawatt-hours, Quads
  - Horsepower?!?! (550 foot pounds per second)
- We typically use kilowatt hours (kWh)
  - Unit on our electric bill, costs less than dime
  - A 40 W bulb left on all day, or the work a servant can do
  - US: ~239kWh per person per day

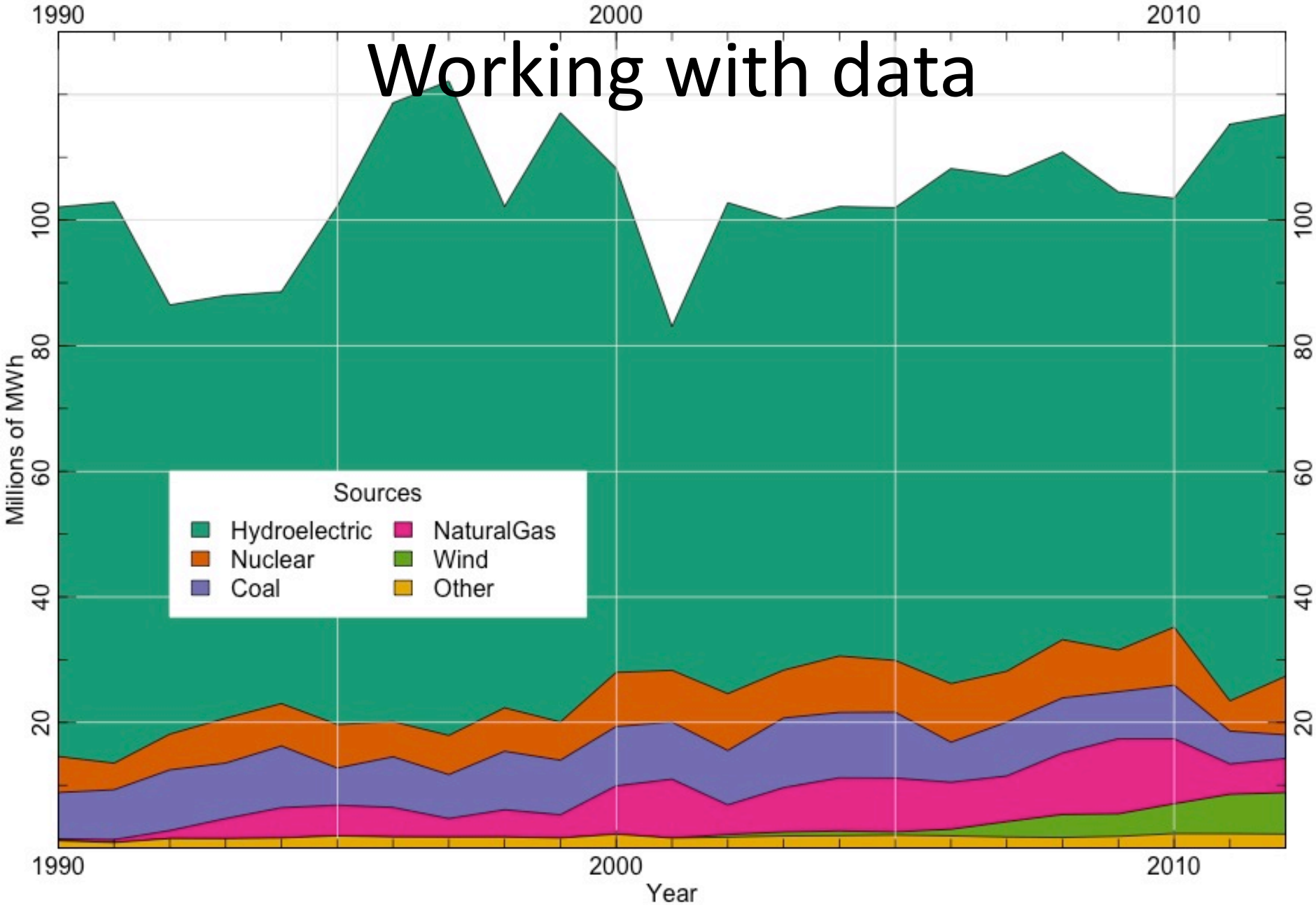
$$\frac{97.3\ Quad}{year} \times \frac{10^{15} Btu}{Quad} \times \frac{10^{3} J}{Btu} \times \frac{kWh}{3.6 \times 10^{6} J} \times \frac{year}{365\ day} \times \frac{1}{3.1 \times 10^{8} ppl} = \frac{239\ kWh}{person\ day}$$

Thermodynamics

- Class discussion about first and second laws
  - Where did the energy go when I biked up the hill to campus today?
  - What's the difference between energy conservation in physics and in policy?

  - Give an example of the second law in your every day life
  - Does evolution disprove the second law?

Working with data



Electric Power Industry Generation by Primary Energy Source, 1990-2012, Washington
http://www.eia.gov/electricity/state/washington/

Professor Douglas J. Reinemann, University of Wisconsin-Madison; Department Chair, Biological Systems Engineering

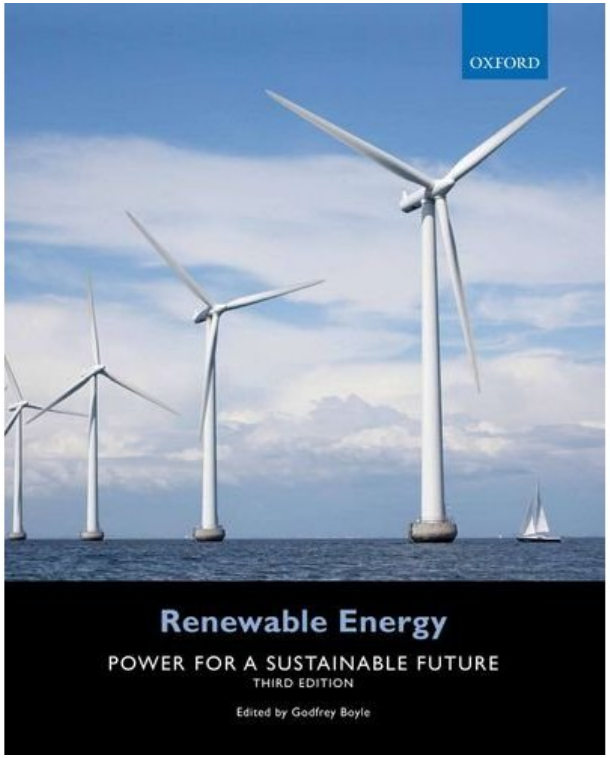
Renewable Energy Systems

University of Wisconsin – Madison
Biological Systems Engineering 367
Cross Listed with the
Nelson Institute for Environmental Studies

Texts and Web Resources

RETScreen® International
Clean Energy Decision Support Centre

- RETScreen International
  - Design Software
  - E-textbook
- Required text
  - Renewable Energy for a Sustainabl Future 3rd Edition
  - Godfrey Boyle
  - Pre-order for 1 Nov release



Design Projects

- Renewable Energy System (RES) design projects
- We recommend you use RETscreen to do the analysis
- Making a pitch to ‘sell’ this RES project to:
  - A Company or group of Investors
  - A Homeowner (Your Uncle Vince)
  - A Governmental or Non-Profit organization

Each technology module

- Overview of the state of the art and application
- Review of collection, processing and conversion systems
- Engineering calculations of energy and power
- Special issues relating to limitations, scale, economics and policy
- Overview of environmental impact/implications

Professor Ken Klemow, Wilkes University; Associate Director, Institute for Energy and Environmental Research

Ken Klemow has served on the Wilkes University faculty for over thirty years, where he teaches courses in botany, ecology, and energy. His research focuses on restoration of lands and waters damaged by anthracite coal mining in northeastern Pennsylvania. For the past four years, Ken has led Wilkes's Energy Institute, where he is a PI for a DOE contract involving assessing Marcellus Shale impacts on surface waters. Ken has also been active with the Ecological Society of America's education initiatives for over 20 years, and will lead several sessions exploring the interface between ecology, energy, and education at their annual meeting later this summer.

Wilkes University "Energy in Our World" BIO / EES 105

Kenneth M. Klemow, Ph.D.
Professor of Biology and Environmental Science
Associate Director, Institute for Energy and Environmental Research

WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

Purposes of Course

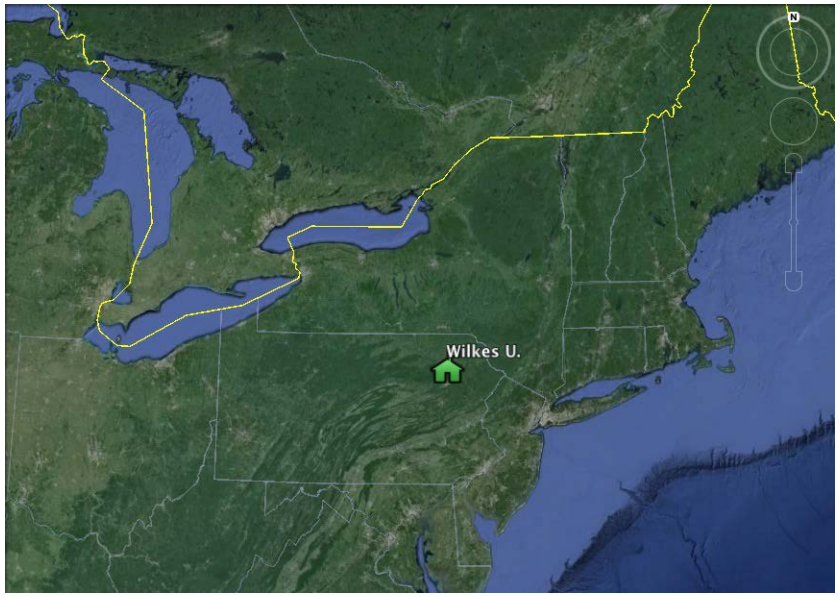
- Provide a broad overview of energy topics for Wilkes students
  - Energy-related concepts discussed within >20 courses at Wilkes, but no single course focuses on energy
- Gateway to interdisciplinary energy minor under development

WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

About Wilkes

- "Small", private, non-sectarian, comprehensive university in northeastern PA.
  - Liberal arts tradition
  - 2,100 undergrads
  - Popular majors include biology, engineering, business, psychology, education, communications
  - Most students from PA, NY, NJ



WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

Local energy issues

http://www.marcellus-shale.us

http://www.communitywalk.com

http://pashto.wunderground.com

Course information

- Fall 2013
- 40 enrolled, 34 finished
- Mostly non-majors
  - Students took class as "Science" Elective
- Class level:
  - Mostly sophomores and juniors
- Course website:
  - http://klemow.wilkes.edu/BIO-EES-105.html
- Meetings: Weekly, 3-hour lectures

WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

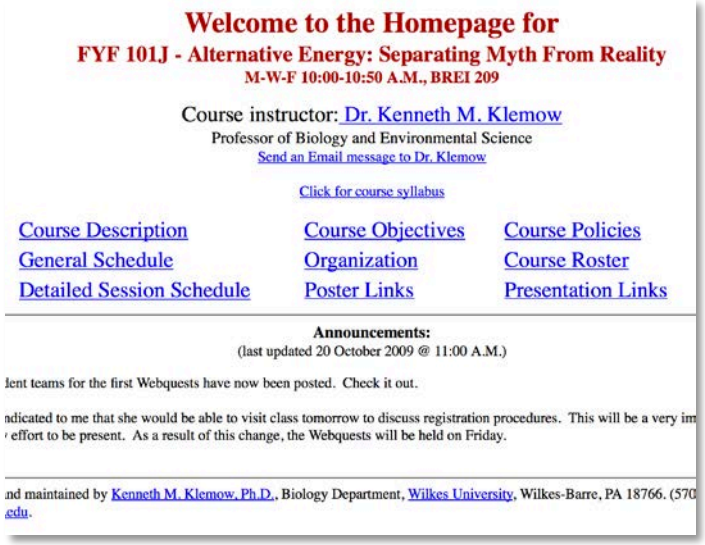
Course instructor

- Kenneth M. Klemow, Ph.D.
  - Plant ecologist
    - Policy, communicating science
  - Wilkes faculty since 1982
  - Energy credentials
    - Restoration of ecosystems damaged by anthracite mining
    - Consults on windfarm projects
    - Twice taught courses on Alternative Energy
    - Leads Wilkes Energy Institute
      - PI of $880K contract with DOE

WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

Course influences



Welcome to the Homepage for

FYF 101J - Alternative Energy: Separating Myth From Reality

M-W-F 10:00-10:50 A.M., BREI 209

Course instructor: Dr. Kenneth M. Klemow
Professor of Biology and Environmental Science
Send an Email message to Dr. Klemow

Click for course syllabus

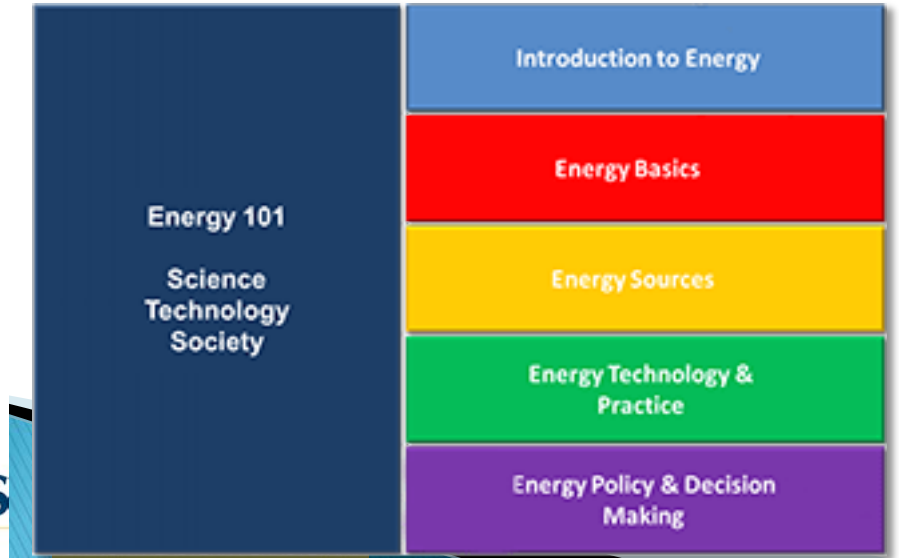
Course Description	Course Objectives	Course Policies
General Schedule	Organization	Course Roster
Detailed Session Schedule	Poster Links	Presentation Links

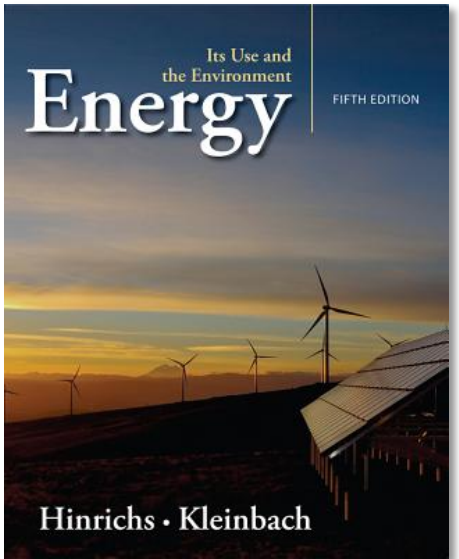
Announcements:
(last updated 20 October 2009 @ 11:00 A.M.)

dent teams for the first Webquests have now been posted. Check it out.

ndicated to me that she would be able to visit class tomorrow to discuss registration procedures. This will be a very im
effort to be present. As a result of this change, the Webquests will be held on Friday.

nd maintained by Kenneth M. Klemow, Ph.D., Biology Department, Wilkes University, Wilkes-Barre, PA 18766. (570
edu.





WILKES UNIVERSITY

Main features of course

- Sessions 1 – 4: Intro, physical and biological basis for energy
- Session 5: Webquests
- Sessions 6–13: Presentations on energy types:
  - Cluster 1: coal, petroleum, Hubbert curve, natural gas, nuclear,
  - Cluster 2: hydropower, solar, geothermal, wind, hydrogen, biomass/biodiesel, ethanol
  - Faculty overview, then student teams
- Session 14: Guest lecture on Smart Grid

Philosophy

- Consider holistically
  - All energy types
  - Supply, demand, technological, environmental, social, economic
- Try to not advocate one option over another
- Climate change as a scientific consensus

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Student presentations

- Students organized into teams of 3-4, ensuring diversity of majors and academic achievement
- Each team focused on one energy type
  - Based on WebQuest
    - Prompting questions
    - Posted websites
  - Each presentation lasted 20 minutes

Other student assessments

- Exams (students permitted “cheat sheet”)
  - Gave one retest on problem set
- Beginning and ending surveys
- Website-evaluation rubric

Findings:

- Students diverse in aptitude, attitude
- Math phobia was a big issue, especially at beginning.
  - 1/3 class struggled but mastered expected concepts
  - 1/3 of class struggled and largely gave up.
  - 1/3 of class had no problem; often resented students with math issues
- Weekly meeting time prevented continuity.
- Students desired more hands-on experience.
- Evaluations positive, but diverse (ranged from “I want to take energy minor” to “worst course ever”).
- Many found textbook overwhelming.

WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

Lessons learned…

- Will retain
  - Webquests / student presentations
  - Diverse perspective (all energy forms, multiple aspects)
- Will change
  - Adopt three one-hour meetings per week for continuity
  - More guest speakers
  - More hands on / demonstrations
  - Try even harder to explain quantitative concepts
  - Perhaps adopt another text

WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

Contact information:

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Wilkes-Barre, PA 18766

Kenneth.klemow@wilkes.edu

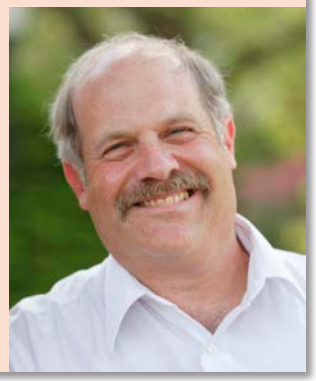
570-408-4758

Facebook: DrKlemow

Websites:

Klemow.wilkes.edu

Energy.wilkes.edu



WILKES UNIVERSITY

THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH FOR NORTHEASTERN PENNSYLVANIA

3. Online Discussion Forum

#Energy101

Topics for Discussion

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

How do we promote Energy Education in the Nation's Colleges and Universities?

- Recommended Course Content (textbooks, multimedia, simulations)
- Best practices in communicating complicated energy concepts
- Useful interdisciplinary examples
- Digital resources and Digital tagging of resources

4. Energy Education Resources

#Energy101

Resources- Speakers

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Professor Justin Hougham – **Northwest Advanced Renewables Alliance** - Assistant Professor, University of Wisconsin-Extension; Director, Upham Woods Outdoor Learning Centers

Todd Cohen **SEED Center** - American Association of Community Colleges; Director, Sustainability Education and Economic Development Centers

Dr. David Blockstein **National Energy Education Summit** - National Council for Science and the Environment; Senior Scientist and Director of Education

Professor Justin Hougham
Assistant Professor, University of Wisconsin-Extension; Director, Upham Woods Outdoor Learning Centers

Todd Cohen (SEED Center) - American Association of Community Colleges; Director, Sustainability Education and Economic Development Centers

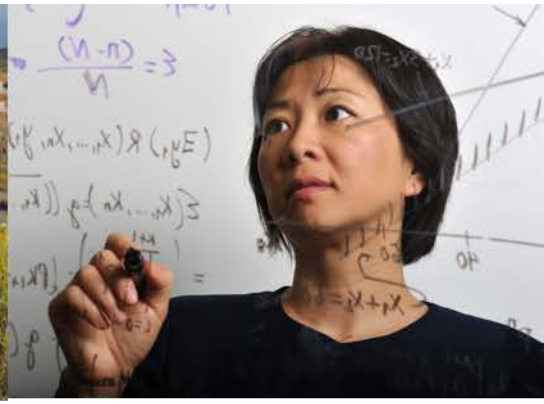
Todd Cohen directs the American Association of Community College's (AACC) Sustainability Education and Economic Development (SEED) Center, a multi-million dollar initiative designed to support the community college sector in ramping-up programs to educate America's 21st century environmental and energy sector workforce. Through his leadership, SEED has become, in less than three years, a 485-member formal community of colleges sharing and implementing promising sustainability and clean technology education and workforce practices. Todd has over 15 years experience leading large-scale strategic planning and evaluation initiatives around the country aimed at enhancing the competitiveness of regions through post-secondary, workforce and economic development collaboration.

SEED
Sustainability Education & Economic Development

AMERICAN ASSOCIATION OF COMMUNITY COLLEGES

The SEED Center and Energy 101

June 2014



center SEED
Sustainability Education & Economic Development

AMERICAN ASSOCIATION OF COMMUNITY COLLEGES

center SEED
Sustainability Education & Economic Development

Community Colleges in the U.S.

1,132 community colleges

45%

...of all U.S. undergraduates

13 million students

AMERICAN ASSOCIATION OF COMMUNITY COLLEGES

center

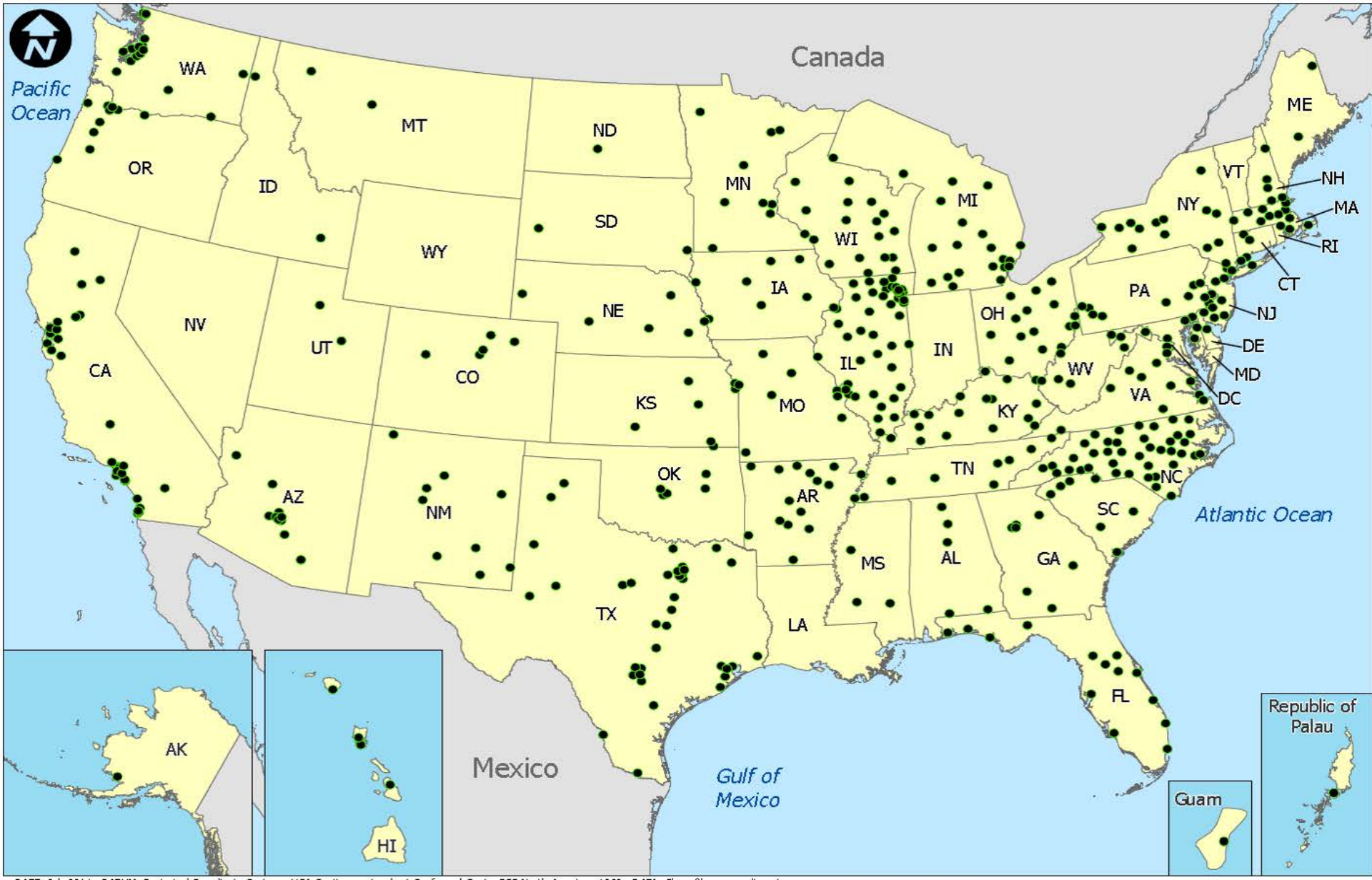
SEED

Sustainability Education & Economic Development

Supporting community colleges in educating for and building a clean economy

Supported by the Kresge Foundation

482 SEED Colleges

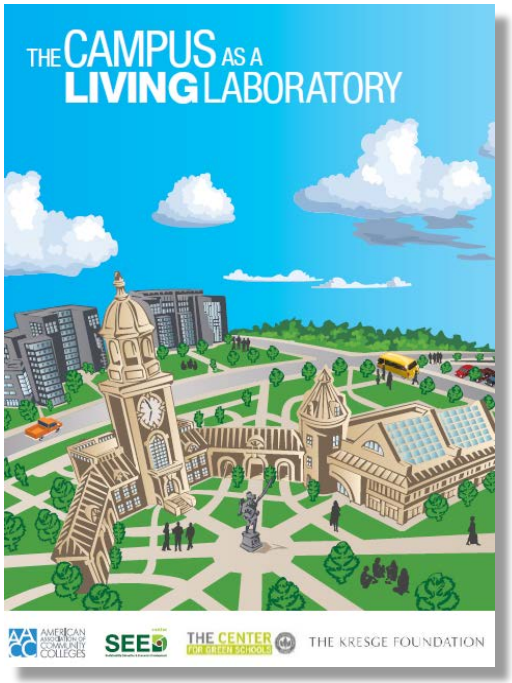


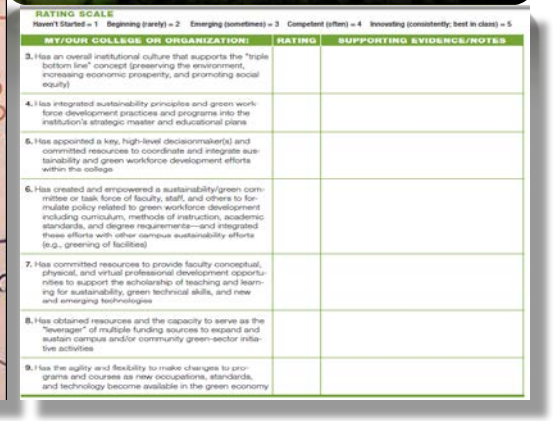
All the tools your college needs: theseedcenter.org

- ✓ **LEADERSHIP DEVELOPMENT**
  (senior-admin peer mentoring; sustainability messaging)

- ✓ **EDUCATION & TRAINING RESOURCES**
  (750+ online curricular resources and best practices, tools)

- ✓ **SHARING NETWORK**
  (Peer-to-peer faculty mentoring, networking, professional development opportunities)





RATING SCALE

Haven't Started = 1 Beginning (rarely) = 2 Emerging (sometimes) = 3 Competent (often) = 4 Innovating (consistently; best in class) = 5

MY/OUR COLLEGE OR ORGANIZATION:	RATING	SUPPORTING EVIDENCE/NOTES
3. Has an overall institutional culture that supports the "triple bottom line" concept (preserving the environment, increasing economic prosperity, and promoting social equity)		
4. Has integrated sustainability principles and green workforce development practices and programs into the institution's strategic master and educational plans		
5. Has appointed a key, high-level decisionmaker(s) and committed resources to coordinate and integrate sustainability and green workforce development efforts within the college		
6. Has created and empowered a sustainability/green committee or task force of faculty, staff, and others to formulate policy related to green workforce development including curriculum, methods of instruction, academic standards, and degree requirements—and integrated these efforts with other campus sustainability efforts (e.g., greening of facilities)		
7. Has committed resources to provide faculty conceptual, physical, and virtual professional development opportunities to support the scholarship of teaching and learning for sustainability, green technical skills, and new and emerging technologies		
8. Has obtained resources and the capacity to serve as the "leverager" of multiple funding sources to expand and sustain campus and/or community green-sector initiative activities		
9. Has the agility and flexibility to make changes to programs and courses as new occupations, standards, and technology become available in the green economy		

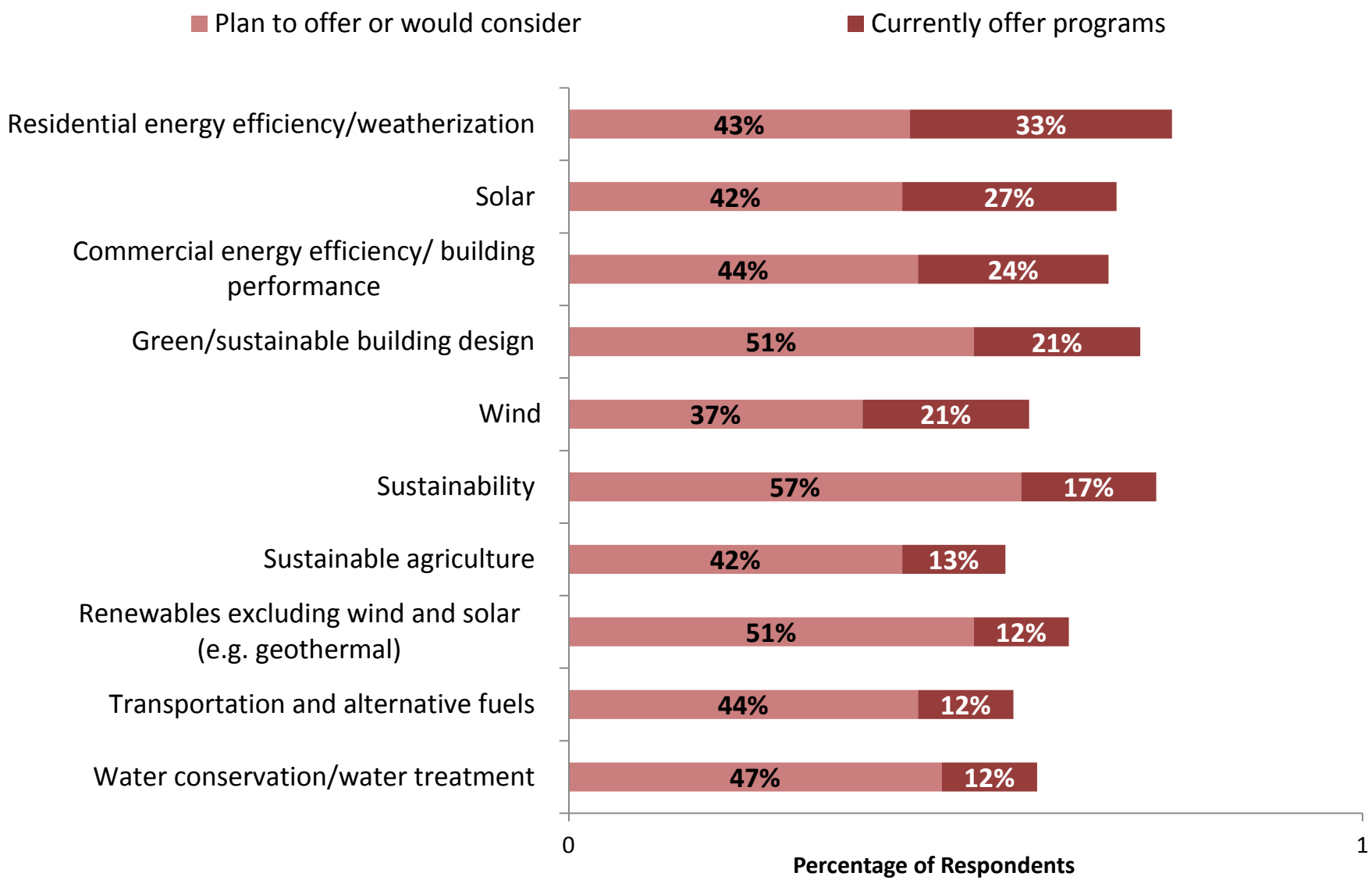
center SEED Sustainability Education & Economic Development

2013 AACC Survey

- **80+%** of colleges offer at least one clean technology- or sustainability-focused course
- **~400** clean tech or sustainability-related programs
- College commitment to sustainability education (as either a core institutional function or important to education process): **85%**

AMERICAN ASSOCIATION OF COMMUNITY COLLEGES

Energy-Related Programs



Community Colleges & Energy 101

- **Capacity** exists at community colleges to adapt Energy 101 curriculum
- **Interest** is strong and growing
- **Suggestions**:
  - Enhance awareness of the framework
  - Provide light TA/tools to increase adaptation
  - Connect with TAACCCT energy-related grantees (SEED has segmented those at): http://www.theseedcenter.org/Special-Pages/TAACCCT-Resources-and-Support.aspx

Contact Info

Todd Cohen

Director, SEED Center, AACC

Sustainability@aacc.nche.edu

Dr. David Blockstein (National Energy Education Summit) - National Council for Science and the Environment; Senior Scientist and Director of Education

SAVE THE DATE

National Energy Education Summit

January 26, 2015

Hyatt Regency Crystal City
near
Washington, DC

Organized by the Council of Energy Research and Education Leaders (CEREL)

ncseonline.org/2015-national-energy-education-summit

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Federal Resources for students and post secondary energy education

#Energy101

Dr. Matthew Garcia[1]

Science & Technology Policy Fellow
Department of Energy

September 20th, 2013

[1]All opinion presented are my own

All image rights and credits to original creators

Opportunities for Student Engagement

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

1. Competitions
2. Internships
3. Federal partners in education & Workforce training

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

EERE RESOURCES FOR UNDERGRADUATE STUDENTS

Looking to expand your experience outside of the classroom? The Office of Energy Efficiency and Renewable Energy (EERE) at the U.S. Department of Energy (DOE) has a number of resources available for undergraduate students, including competitions, internships, and career-planning information to help you navigate the education-to-employment pathway in energy. The following is a partial list of the undergraduate activities and programs that are offered. For a complete listing, visit our Energy Education and Workforce Development website:
energy.gov/eere/education

Competitions

Better Buildings Case Competition

Gain practical experience and critical skills while working to solve real-world issues affecting energy efficiency in buildings. In this annual competition, interdisciplinary teams of university students develop creative solutions and showcase their ideas to a panel of judges, allowing the teams to interact directly with industry and government leaders. Become a part of the next generation of engineers, entrepreneurs, and policymakers in clean energy.
eere.energy.gov/buildings/betterbuildings/casecompetition

National Clean Energy Business Plan

The National Clean Energy Business Plan Competition is designed to build regional networks of student-focused business creation contests across the country. Six regional organizations were funded under the competition to hold clean energy business plan competitions, which are open to currently enrolled undergraduate and graduate students. Winners of the regional contests will receive $100,000 to fund their business plans and a chance to compete in the national contest.
eere.energy.gov/commercialization/natibizplan.html

Internships

Science Undergraduate Laboratory Internships (SULI) Program

Are you interested in a Science, Technology, Engineering, and Mathematics career? The Office of Science offers research experiences for undergraduate students at the DOE National Laboratories. Interns in the SULI Program will perform research under the guidance of laboratory staff scientists or engineers, assisting on projects related to ongoing programs. There are internship openings at most of the U.S. national laboratories.
science.energy.gov/wdts/suli

DISTANCE-Solar Program

The DISTANCE-Solar Program encourages minority students to pursue careers in science and technology by supporting research associates and professors/principal investigators from selected schools as they perform renewable energy research projects during the academic year. The program is funded by the Solar Energy Technologies Office and has the dual goal of placing underrepresented minorities in Science, Technology, Engineering, and Mathematics programs, while helping to make solar cost competitive.
go.usa.gov/WKUm

Clean Cities Internships

Each year, students are able to work with the Clean Cities coalitions to increase awareness of alternative fuels and advanced vehicle technologies and their potential for petroleum reduction. Interns work with coordinators and stakeholders in the community to plan events, analyze data, research markets, design websites, and promote initiatives through social media and public relations.
eere.energy.gov/cleancities/toolbox/internship_program.html

EERE Student Internships

EERE offers exciting student volunteer internships throughout the year in its Washington, D.C., headquarters. These volunteer internships provide students with the opportunity to learn through direct experience about the field of energy efficiency and renewable energy.
eere.energy.gov/office_eere/oe_internships.html

Tribal Energy Program Internships

Looking for a summer internship? The Tribal Energy Program offers technical project internships at Sandia National Laboratories (SNL). There, interns will immerse themselves in collaborative work with SNL's renewable energy staff, Native American tribes interested in renewable systems, and SNL's American Indian Outreach Committee.
eere.energy.gov/tribalenergy/internships.cfm

Industrial Assessment Centers

Engineering students can receive hands-on training and real-world experience in energy engineering and management by participating in DOE's Industrial Assessment Centers. Teams located at 24 universities around the country conduct cost-free energy assessments of small- and medium-sized manufacturers to identify opportunities to reduce waste, improve productivity, and save energy.
eere.energy.gov/manufacturing/tech_assistance/iacs.html

Photos: (front, top to bottom) NREL, energy.gov; (back, top to bottom) energy.gov, DOE Pinterest, NREL

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

For more information, visit:
energy.gov/eere/education

DOE/EE-1087 • April 2014
Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.

National Clean Energy Business Plan Competition – National Competition

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

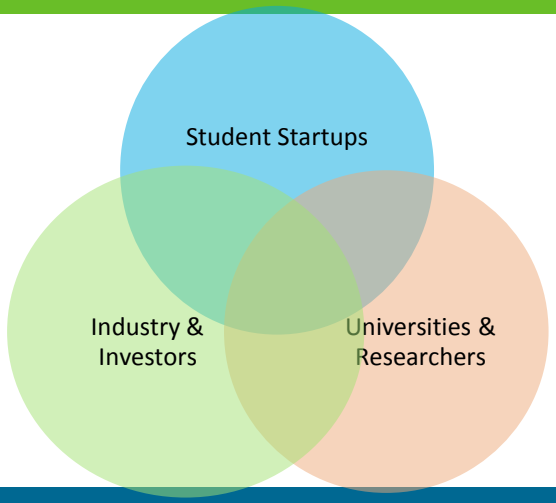
NATIONAL CLEAN ENERGY BUSINESS PLAN COMPETITION
U.S. DEPARTMENT OF ENERGY

The National Clean Energy Business Plan Competition is a student-led competition comprised of six regional competitions, culminating in a National Competition in June.

- Western Southwest Region (deadline: February 21, 2014) – Rice Business Plan Competition run by Rice University
- Southeastern Region (deadline: February 14, 2014) – ACC Clean Energy Challenge run by University of Maryland
- Eastern Midwest Region (deadline: varies by state, check here for more information) – Clean Energy Trust Clean Energy Challenge run by Clean Energy Trust
- Western Midwest Region (deadline: February 24, 2014) – CU Cleantech New Ventures Challenge run by University of Colorado-Boulder
- Northeast Region (deadline: February 28, 2014) – MIT Clean Energy Prize run by Massachusetts Institute of Technology
- Western Region (deadline: March 4, 2014) – First Look West run by California Institute of Technology

About the NCEBPC

- **600 teams** involved in 2012-2013 NCEBPC
  - More than **55 startups** incorporated
  - **55 patents and disclosures** have been filed
  - **89+ jobs** created
  - More than **$19M** in follow-on funding
- Over **$700k in prizes** across the country for participants



Internships

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Science Undergraduate Laboratory Internships (SULI) Program

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Federal Energy and Manufacturing Education and Workforce Training

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Listings of Energy and Manufacturing education and workforce related programs across the federal government including DOE programs and activities.

Energy.gov/eere/education/federal-energy-and-manufacturing-workforce-training-programs

Resources and Useful Links

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Education and Workforce Homepage

Energy.gov/eere/education/education

Competitions

Energy.gov/eere/education/competitions

Internships

Energy.gov/eere/education/find-internships

Federal Energy and Manufacturing Workforce Training Programs

Energy.gov/eere/education/federal-energy-and-manufacturing-workforce-training-programs

5. Conclusions and Next Steps

#Energy101

Energy 101 Dialogue 1# Conclusion

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The ask: What do we need to increase efforts and access to energy education in the nations universities and community colleges?

The takeaway: The answers, and best practices reside with the energy education community.

#Energy101

Energy 101 Dialogue 1# Next Steps

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Next Steps: Finding ways to engage with you and get your input!

Energy 101 Initiative website
Energy.gov/eere/energy101

Energy 101 Inbox: Energy101@ee.doe.gov

Energy 101 Dialogue Series (Fall 2014):

Next Dialogue will concentrate on institutional issues surrounding the creation of energy minors and majors

Energy Literacy Virtual Town Hall- August 5th

Energy.gov/eere/education/events/power-collaboration-national-energy-literacy-virtual-meet