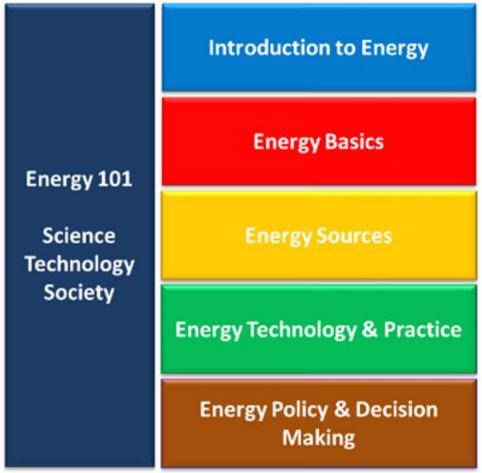
The 'Energy 101' Webinar

Goal: Support the creation of an Energy 101 course framework for an **multidisciplinary** higher education **undergraduate** course for teaching the fundamentals of energy using a **systems-based** approach that **can be individualized** by the nations universities and community colleges to create their own 'Energy 101'.



I. **Introduction of the Energy Literacy and Energy 101 Initiatives -Michelle Fox & Matt Garcia**

II. Energy 101 Curricular Framework Development - Jim Turner

III. Energy 101 Implementation: Course Development, Approval, Transferability

- University of Maryland 'Energy 101'- –Leigh Abts
- Harford Community College 'Energy 101' -Tami Imbierowicz
- Energy 101 NTER Module Concept-- Stephanie Moore

IV. Next steps - Ellen Vaughan

V. **Online Forum-Panel Q & A**

#Energy101

Energy Education & Workforce Development

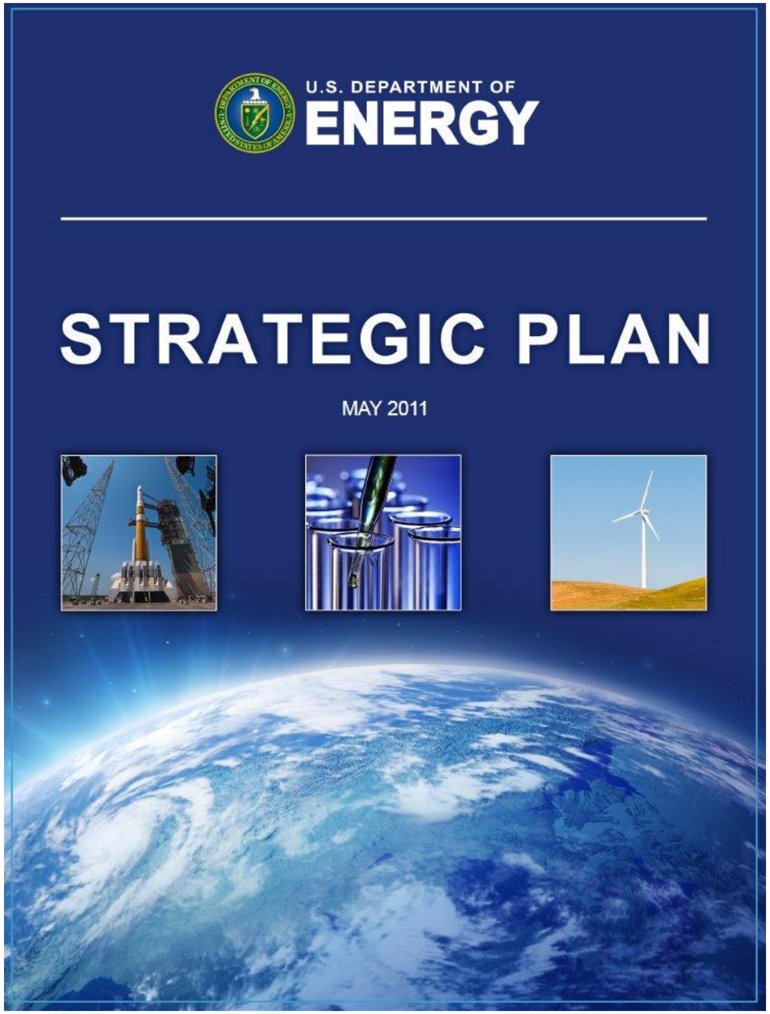
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Energy 101

Dr. Michelle Fox
Director, Energy Education & Workforce Development

Dr. Matthew Garcia
AAAS Science & Technology Policy Fellow

DOE Strategic plan & Energy Literacy



1. **Promote Energy Literacy**

- Identify by 2012 the most promising education opportunities to improve domestic energy literacy
- Provide online energy literacy content by 2013 for the National Training and Education Resource Platform

2. **Leverage Partnerships to Expand Our Impact**

- Partnerships with educational institutions (Universities, Community Colleges, Minority Serving Institutes)
- Encourage more students to explore careers in Energy & the Science, Technology, Engineering, and Mathematics (STEM) field

State of Energy Literacy in the US

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

12% passed a basic quiz on awareness of energy topics (general knowledge/ not technical or scientific)

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

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

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

Energy literacy empowers people to make informed energy decisions

Energy Literacy & Education Initiatives

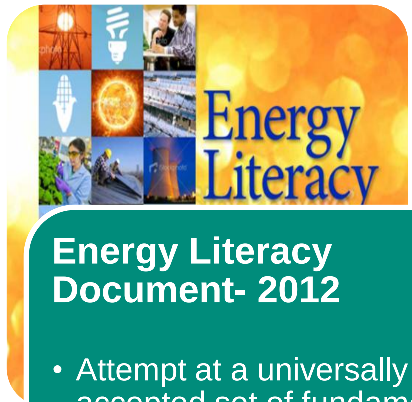
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE Strategic Plan

Promote Energy Literacy

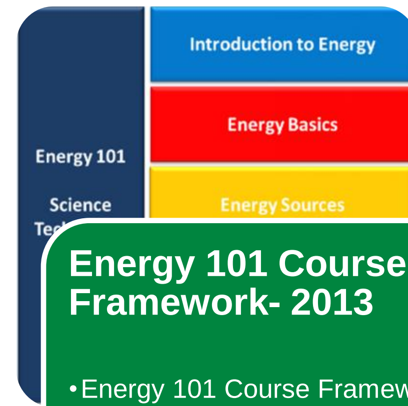
Leverage Partnerships

Support Future Energy Workforce Needs



Energy Literacy Document- 2012

- Attempt at a universally accepted set of fundamental principles & core concepts in energy literacy
- Peer Reviewed
- Widely Distributed

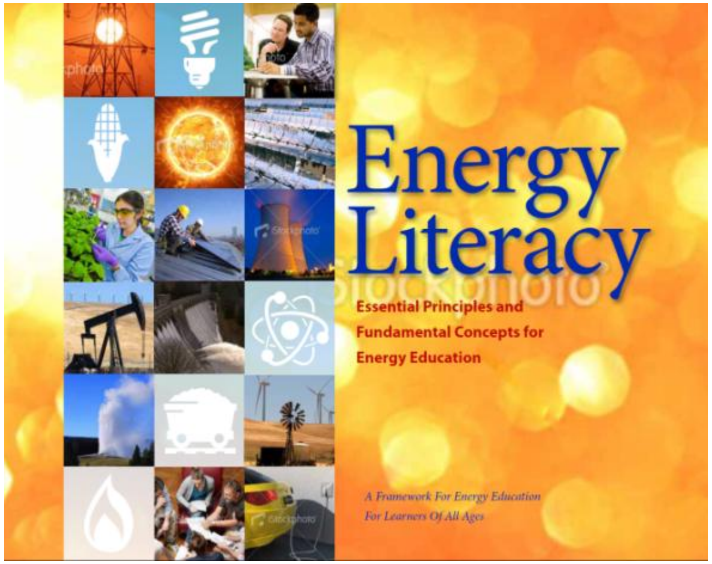


Energy 101 Course Framework- 2013

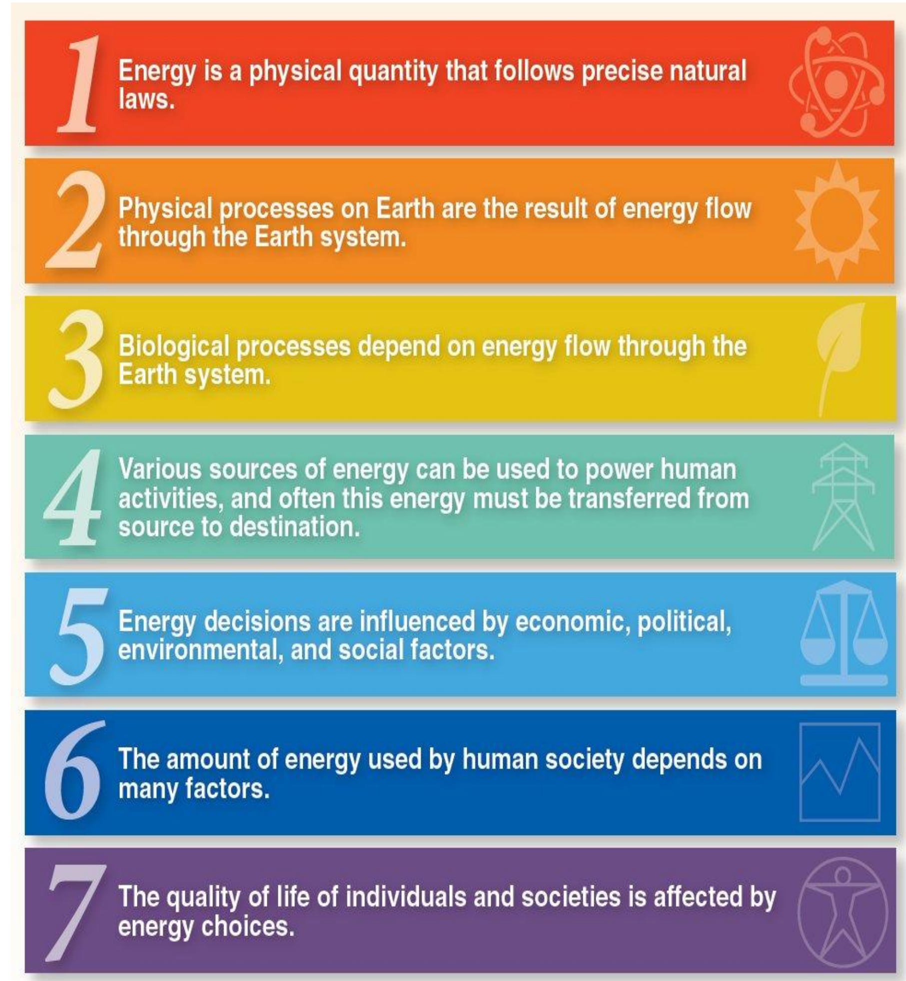
- Energy 101 Course Framework document
- Expert Peer Review
- Increase Energy & STEM degrees
- Online Content on the National Training and Education Resource (NTER)

Energy Literacy Fundamentals Document- March 2012

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



- 7 Essential Energy Principles and 49 Fundamental Core Concepts
- Derived from the engagement of an expansive and broad assortment of stakeholders
  - 250 different offices, organizations, and education partners
  - Energy Literacy Wiki of 4,587 registered users and 177,222 page views
- Accuracy review by Federal Agency content experts
- 13 USGCRP agencies approved document language (DOE, DOD, DOC, HHS, DOI, State, DOT, EPA NASA, NSF,USAID, DO Ag, Smithsonian Institute), OSTP



www1.eere.energy.gov/education/energy_literacy.html

Energy Literacy Principles and Cores example

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

5 Energy decisions are influenced by economic, political, environmental, and social factors.

5.1 Decisions concerning the use of energy resources are made at many levels. Humans make individual, community, national, and international energy decisions. Each of these levels of decision making has some common and some unique aspects. Decisions made beyond the individual level often involve a formally established process of decision-making.

5.2 Energy infrastructure has inertia. The decisions that governments, corporations, and individuals made in the past have created today's energy infrastructure. The large amount of money, time, and technology invested in these systems makes changing the infrastructure difficult, but not impossible. The decisions of one generation both provide and limit the range of possibilities open to the future generations.

5.3 Energy decisions can be made using a systems-based approach. As individuals and societies make energy decisions, they can consider the costs and benefits of each decision. Some costs and benefits are more obvious than others. Identifying all costs and benefits requires a careful and informed systems-based approach to decision making.

5.4 Energy decisions are influenced by economic factors. Monetary costs of energy affect energy decision making at all levels. Energy exhibits characteristics of both a commodity and a differentiable product. Energy costs are often subject to market fluctuations, and energy choices made by individuals and societies affect these fluctuations. Cost differences also arise as a result of differences between energy sources and as a result of tax-based incentives and rebates.

5.5 Energy decisions are influenced by political factors. Political factors play a role in energy decision making at all levels. These factors include, but are not limited to, governmental structure and power balances, actions taken by politicians, and partisan-based or self-serving actions taken by individuals and groups.

5.6 Energy decisions are influenced by environmental factors. Environmental costs of energy decisions affect energy decision making at all levels. All energy decisions have environmental consequences. These consequences can be positive or negative.

5.7 Energy decisions are influenced by social factors. Questions of ethics, morality, and social norms affect energy decision making at all levels. Social factors often involve economic, political, and environmental factors.

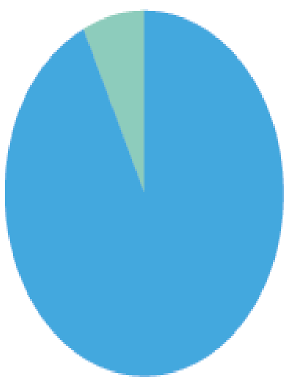
Global Energy Subsidies, 2010

Renewable Energy Subsidies – $66 billion

Fossil Fuel Subsidies – $409 billion

Source – International Energy Agency (IEA), World Energy Outlook, 2011

Decisions regarding energy subsidies have a significant effect on energy infrastructure, energy use, and on related impacts and consequences.



Energy Literacy Principle

Associated Fundamental Core Concepts

The Principles and Fundamental Concepts were intended to be unpacked and applied as appropriate for the learning audience and setting.

eere.energy.gov/education/energy_literacy.html

The Energy 101 Initiative Goals

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

Goal: Support the creation of an Energy 101 course framework for an **multidisciplinary** higher education **undergraduate** course for teaching the fundamentals of energy using a **systems-based** approach that **can be individualized** by the nations universities and community colleges to create their own 'Energy 101'.

1. **Use the Energy Literacy Principles as a starting point**
2. **Ability to individualize for specific student audience & setting**
3. **Be the result of review and public comment**
4. **Provide roadmaps for course adoption (course credit, transferability)**
5. **Leverage National Training & Education Resource (NTER) and learning technology for courses and content**
6. **Leverage Energy Literacy and Education Partnerships**

Association of Public and Land-Grant Universities

- **217 members**
- **Universities, Colleges & Orgs**
- **3.5 million Undergraduate Students**
- **Held first Energy 101 forum in April 2011**

www.aplu.org/energy101

EESI — Advancing Innovative Solutions Since 1984

- **Support the nations energy & environment organizations**
- **Outreach coordination**

www.eesi.org

ORAU — Oak Ridge Associated Universities

- **105 members, universities including HBCU's and MSIs**
- **Peer Review Model for Energy content on NTER**

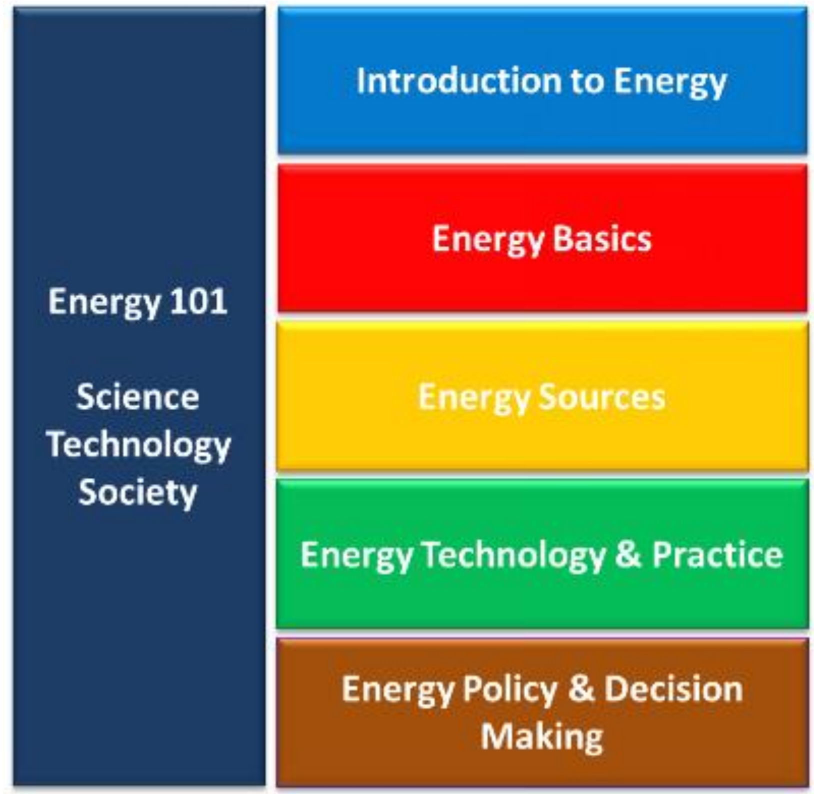
www.orau.org

University of Maryland 1856

Harford Community College, Bel Air, Maryland, 1957

Using the Energy Literacy Fundamentals as a Starting Point

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



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

5 Units of unpacked fundamentals and concepts
Following model of introductory, semester long courses

The 5 Units of the Energy 101 Course Framework

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

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

Energy 101 course framework

- 5 Units
- Composed of 1-3 sections each covering the 7 fundamental principles
- 36 supporting core concepts

National Training & Education Resource (NTER)

Free, Open Source-Online Cloud Based training and education platform for content creation, and delivery

NTER can serve as entry point for Energy 101 Courses and Content

The Energy 101 courses and content can be modified and used to fit the individual needs of each university community college, extension services, learning annex

Leverage the technical capacity embedded in NTER for authoring, assessment, and peer review

Energy 101 and NTER

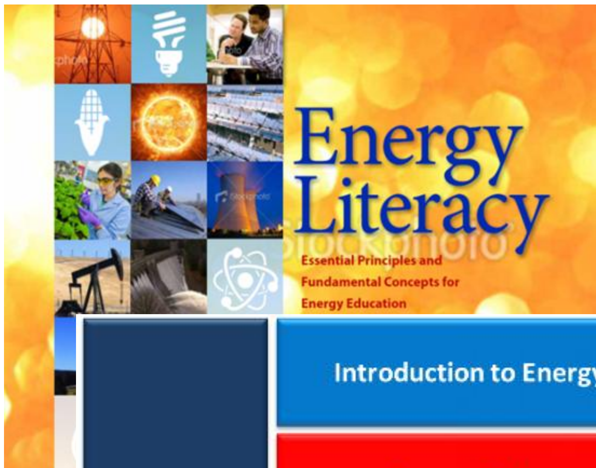
A digital community
to create and share content & Courses

Together with framework, lowers barrier to creating
Energy 101 courses and engaging content

www.nterlearning.org

The Energy 101 Framework

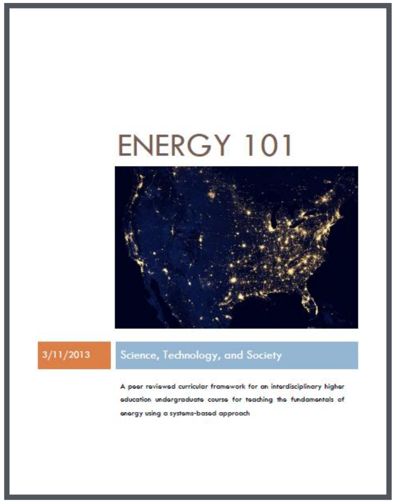
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Energy 101

Science Technology Society

- Introduction to Energy
- Energy Basics
- Energy Sources
- Energy Technology & Practice
- Energy Policy & Decision Making


ENERGY 101

3/11/2013 | Science, Technology, and Society

A peer reviewed curricular framework for an interdisciplinary higher education undergraduate course for teaching the fundamentals of energy using a systems-based approach

NTER

Energy 101's at the nations Universities & Community colleges

University of Maryland 1856

Harford Community College, Bel Air, Maryland 1957

Offering their own versions of an Energy 101 aligned with the Energy 101 Course Framework and with example content on NTER in spring or summer of 2013

Development of the Energy 101 Curricular Framework

Jim Turner, APLU

May 25th 2011 APLU Energy 101 Listening Session
32 Schools in attendance with another 58 schools on the mailing list

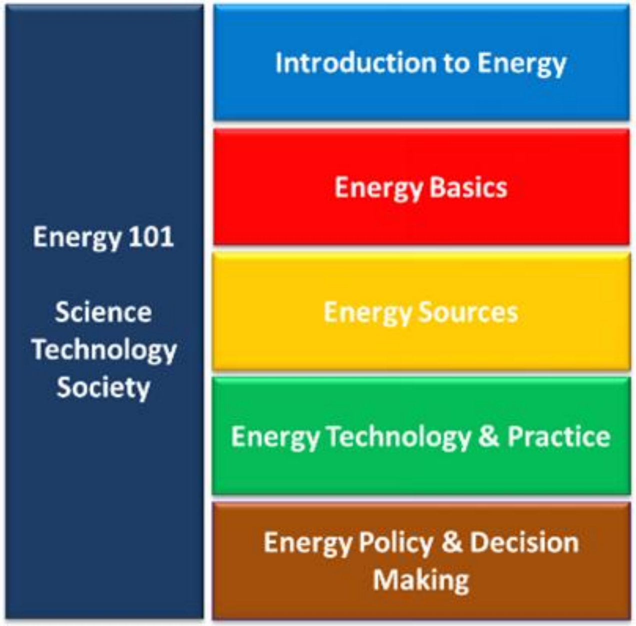
- Overwhelming support for an Energy 101 course concepts
- Identified problems and pathways towards development and implementation (adoption roadmaps)

Mapped the energy literacy principles against “Introduction to Energy” curricula from 16 universities and community colleges

- Identified the Energy Literacy Principles that repeatedly appeared in courses and those that are either too specialized or too advanced for a freshman-level introductory courses

Results were organized and several drafts of the framework were circulated widely throughout the university and energy policy communities

- Two public comment periods, producing 3 versions
- Energy 101 online forum received over 10,000 views
- Improvements were made based on the comments received both there and through emailed comments
- Final draft was circulated through the membership of additional educational associations and a group of energy-expert reviewers and this final course outline is reflective of this process



Energy 101

Association of Public and Land-grant Universities

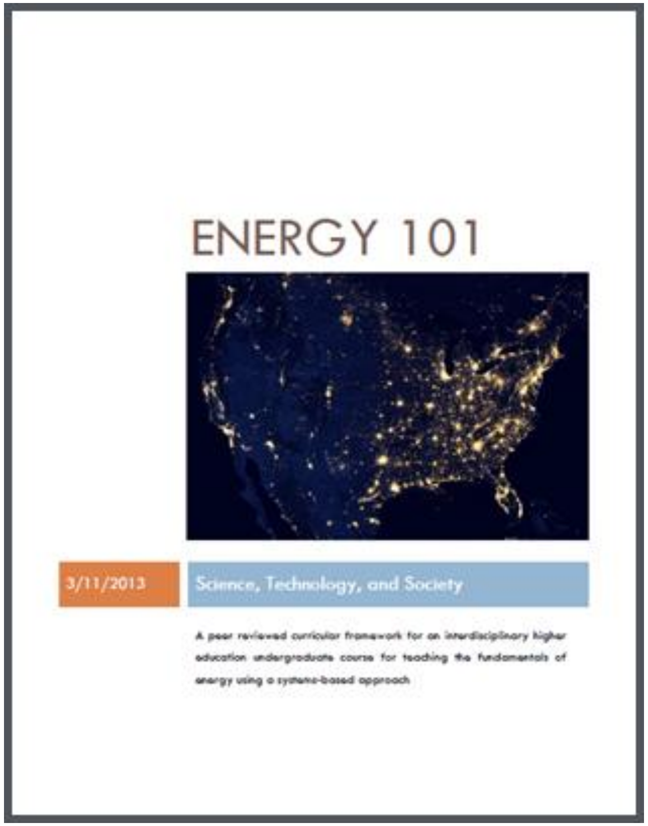
Development of the Energy 101 Framework

The approach of former Carnegie Mellon University Vice Provost of Education Indira Nair's *Intro to Environmental Science* course inspired and informed the design of Energy 101

Attracted students from numerous majors across the university who worked in teams and were encouraged to think about problems and solutions holistically, drawing on their collective knowledge bases.

Energy and environment are similarly broad, multi-disciplinary topics. Accordingly, courses based on this curricular framework should include a broad survey of energy

Go beyond knowledge of physical, biological energy processes, to the application of the economic, ethical, societal, and international factors that guide energy choices and energy decision-making


ENERGY 101

3/11/2013

Science, Technology, and Society

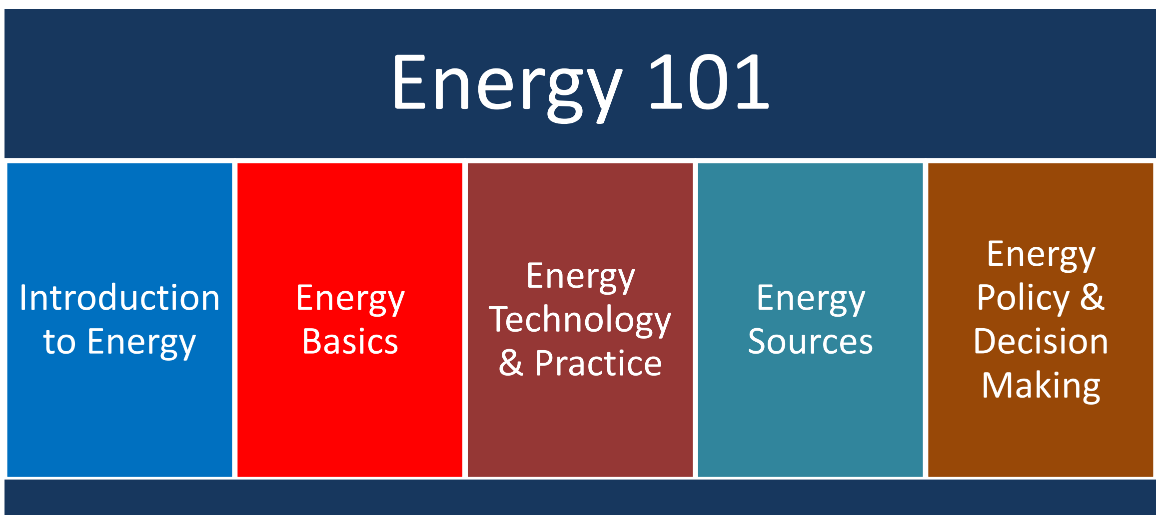
A peer reviewed curricular framework for an interdisciplinary higher education undergraduate course for teaching the fundamentals of energy using a systems-based approach

Even though the Energy 101 curricular framework is presented in the same order as the Energy Literacy Principles, professors may choose a different presentation order of the subject matter.

Some professors, for example, may wish to begin with actual applications; others may wish to teach the course as it is laid out and begin with the science of energy

Framework and future NTER based course resources useful tools to facilitate and point to in course creation, as you modify for your own individual needs

Next presenters will give examples of how they used the energy 101 course framework in their course development and how their courses were approved



Energy 101 potential use

I. **Introduction of the Energy Literacy and Energy 101 Initiatives (Michelle Fox & Matt Garcia)-15 min**

II. Energy 101 Curricular Framework Development - Jim Turner - 5 min

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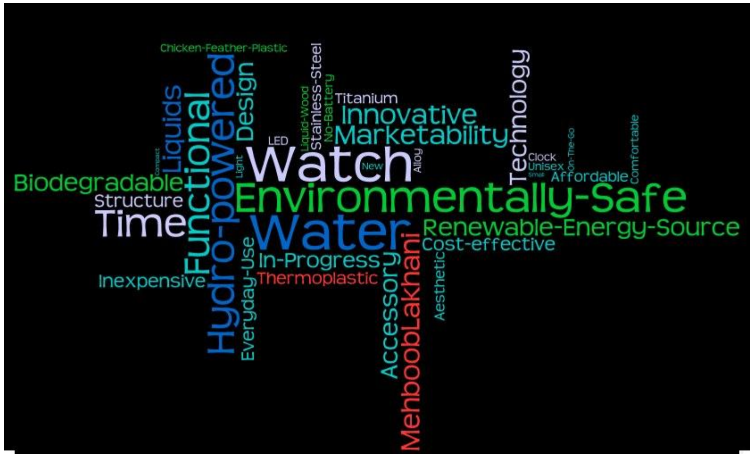
Designing a Sustainable World

Water powered watch – Recycled materials



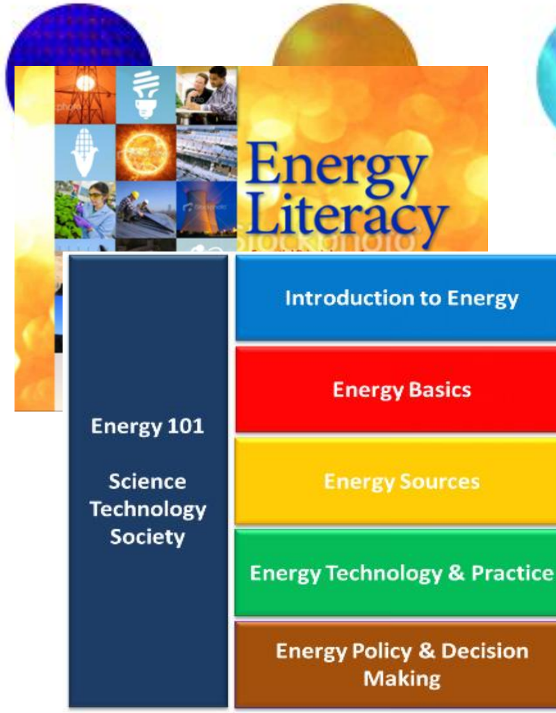
Courtesy of Ms. Angela Kang, FR LTSC

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

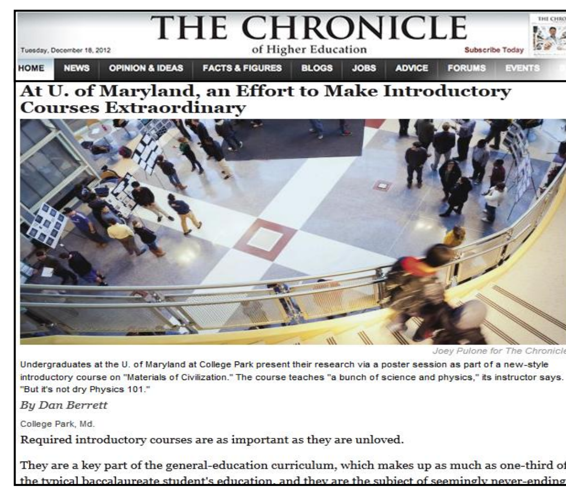
Idalis Villanueva, Ph.D
Instructor
A. James Clark School of Engineering

Designing a Sustainable World (BioE 289A) Philosophy –

- **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."



THE CHRONICLE
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At U. of Maryland, an Effort to Make Introductory Courses Extraordinary

Joey Pulone for The Chronicle

Undergraduates at the U. of Maryland at College Park present their research via a poster session as part of a new-style introductory course on "Materials of Civilization." The course teaches "a bunch of science and physics," its instructor says. "But it's not dry Physics 101."

By Dan Berrett

College Park, Md.

Required introductory courses are as important as they are unloved.

They are a key part of the general-education curriculum, which makes up as much as one-third of the typical baccalaureate student's education, and they are the subject of seemingly never-ending

1. http://www.eesi.org/energy101
2. http://www.gened.umd.edu/i-series/iseries.php

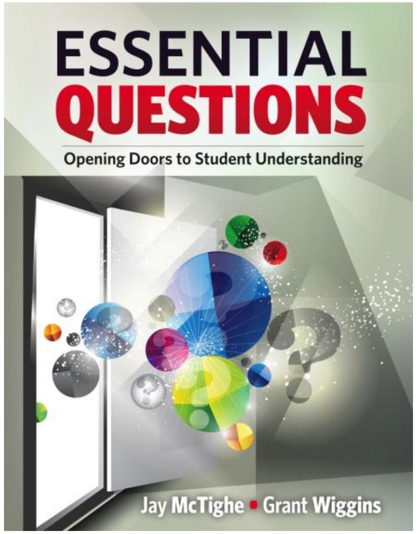
Sample of topics of UMD BioE 289A

Dates / Energy 101	Topic	Energy Principles Addressed
January 24 (**Lecture 1**) **Energy 101 – U1.Introduction to U2.Energy & Energy Basics**	**What is Energy?** The formal laws governing energy; Introduction to units	ELP #1 ELP #2
January 29 and 31 (**Lecture 2 and Lecture 3**) **Energy 101 – U1.Introduction to Energy & U2. Energy Basics**	**An Energy Medley** Various forms of energy (Chemical, Physical, Thermal, Electrical, Nuclear)	ELP #1 ELP #3
February 5 and 7 (**Lecture 4 and Lecture 5**) **Energy 101 – U5.Energy Policy and Decision U4.Making Energy Technology & Practice;**	**WORKSHOP: Design Thinking about Energy Sustainability**	
February 12 and 14 (**Lecture 6 and Lecture 7**) **Energy 101 – U3.Energy Sources**	**And it began with a source…** Energy sources (petroleum, natural gas, coal, propane, fossil fuels, water, wind, and light)	ELP #4 ELP #5 ELP #6 ELP #7

Applying *Understanding by Design* - Lecture 4
"Design Thinking"

Essential Questions – the essence of the issue :

- –EQ1: How is **the design process different from the scientific method?**
- –EQ2: **Why research is an important process embedded in design?**
- –EQ3: How can **designs be systematically developed** to solve a problem?
- –EQ4: How can **multiple design tools** be applied to a problem?



Depth of Understandings – mastery:

- –U1: Design is **a multi-step process.**
- –U2: Design applies knowledge **gained through research**.
- –U3: **Design can be used to develop solutions** for simple to complex problems.
- –U4: **The design process solve problems** related to Sustainability and Energy issues.

Energy 101-Policy & Decision Making
Core Concepts– content applied to process:

- –U5-5.1: Decisions concerning the use of energy resources are made at many levels.
- –U5-5.3: Energy decisions can be made using a systems-based approach.
- –U5-5.4: Energy decisions are influenced by economic factors.
- –U5-5.5: Energy decisions are influenced by political factors.
- –U5-5.6 Energy decisions are influenced by environmental factors.
- –U5-5.7 Energy decisions are influenced by social factors.

Courtesy Mr. Jay McTighe

5 Energy decisions are influenced by economic, political, environmental, and social factors.

5.1 Decisions concerning the use of energy resources are made at many levels. Humans make individual, community, national, and international energy decisions. Each of these levels of decision making has some common and some unique aspects. Decisions made beyond the individual level often involve a formally established process of decision-making.

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Source – International Energy Agency (IEA), World Energy Outlook, 2011

Decisions regarding energy subsidies have a signifcant effect on energy infrastructure, energy use, and on related impacts and consequences.

Wiggins, G., and McTighe, J. (2005). *Understanding by design*. 2nd Ed., Association for Supervision & Curriculum Development, Alexandria, VA: ASCD.

Energy 101 framework and Lecture 4 “Design Thinking”

- **U1. Introduction to Energy**
- **U2. Energy Basics**
- **U3. Energy Sources**
- **U4. Energy Technology & Practice**
- **U5. Energy Policy & Decision Making**
  - 5. Energy decisions are influenced by economic, political, environmental, and social factors.
    - S5. Energy decisions are influenced by economic, political, environmental, and social factors
      - 5.1 Decisions concerning the use of energy resources are made at many levels.
      - 5.2 Energy infrastructure has inertia.
      - 5.3 Energy decisions can be made using a systems-based approach.
      - 5.4 Energy decisions are influenced by economic factors.
      - 5.5 Energy decisions are influenced by political factors.
      - 5.6 Energy decisions are influenced by environmental factors.
      - 5.7 Energy decisions are influenced by social factors.
  - 6. The amount of energy used by human society depends on many factors. (6.2, 6.3, 6.4, 6.5, 6.6, 6.8)
  - 7. The quality of life of individuals and societies is affected by energy choices. (7.1)

Fundamental basis for the Essential Questions: The Design utilizes a variety of processes to make informed decisions

Problem solving

Apply Energy and Sustainability knowledge

Modeling

Teaming

Planning

Role in society

Communications

Ethics

Creative thinking

Evidence Centered Design (Mislevy, et. al; 2003) – Documenting and linking the Energy Literacy Principles to the 'chains of reasoning' that elicit evidence of learning from the students design projects.

Developing an accessible e-portfolio resource

www.innovationportal.org

Courtesy of Project Lead the Way

Portfolio Elements

Portfolio Home

A Presentation and justification of the problem
Resources EDPPSR

B Documentation and analysis of prior solution attempts
Resources EDPPSR

C Presentation and justification of solution design requirements
Resources EDPPSR

D Design concept generation, analysis, and selection
Resources EDPPSR

E Application of STEM principles and practices
Resources EDPPSR

F Consideration of design viability
Resources EDPPSR

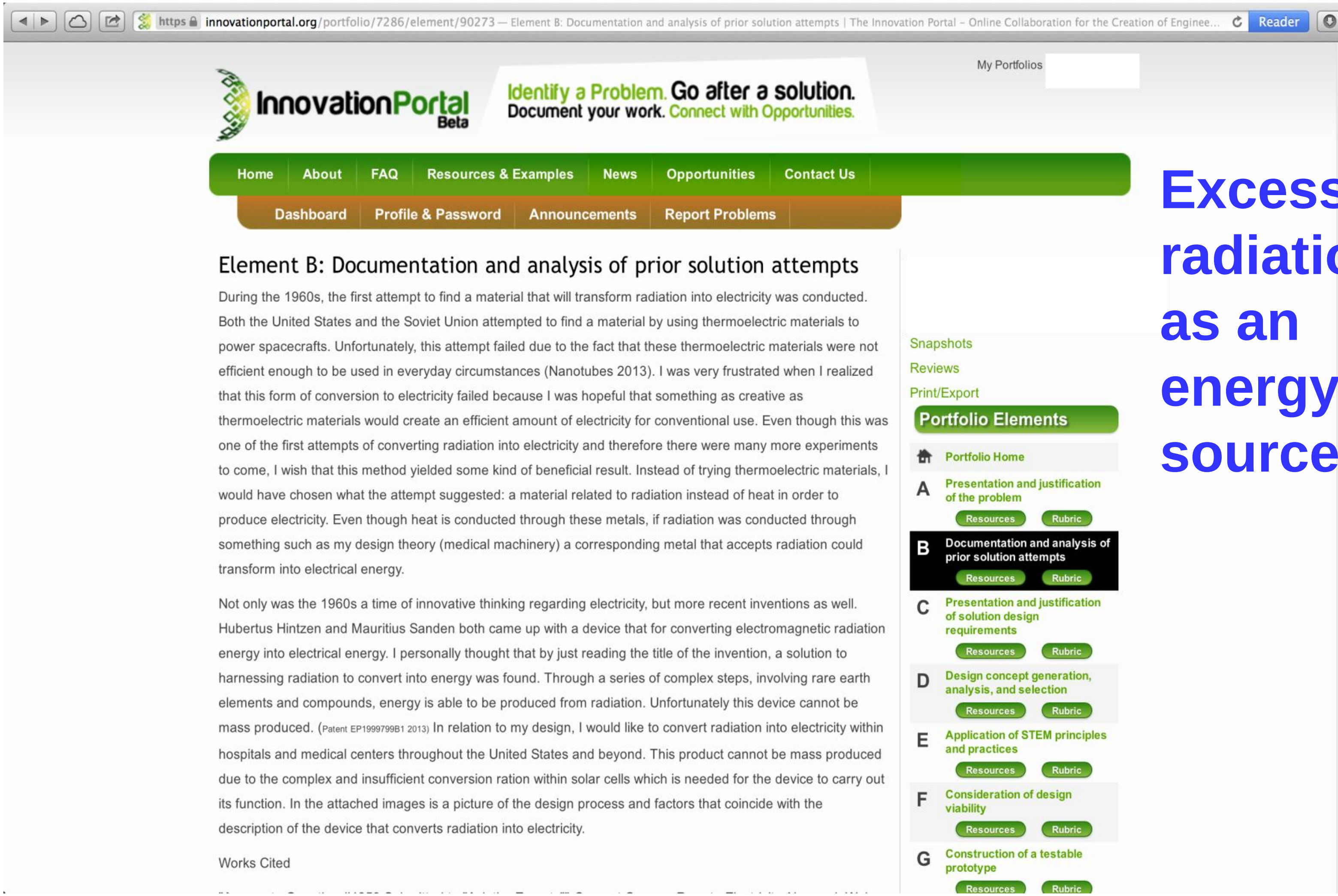
G Construction of a testable prototype
Resources EDPPSR

H Prototype testing and data collection plan

Steps in the Design Process

Mislevy, R. J., Almond, R. G., and Lukas, J. F. (2003). A Brief Introduction to Evidence-centered Design. Research Report, RR-03-16, Educational Testing Service: Princeton, 1 – 37.

Depth of knowledge – Knowledge gained through Research


https innovationportal.org/portfolio/7286/element/90273 — Element B: Documentation and analysis of prior solution attempts | The Innovation Portal – Online Collaboration for the Creation of Enginee...

My Portfolios

InnovationPortal Beta

Identify a Problem. Go after a solution. Document your work. Connect with Opportunities.

Home | About | FAQ | Resources & Examples | News | Opportunities | Contact Us

Dashboard | Profile & Password | Announcements | Report Problems

Element B: Documentation and analysis of prior solution attempts

During the 1960s, the first attempt to find a material that will transform radiation into electricity was conducted. Both the United States and the Soviet Union attempted to find a material by using thermoelectric materials to power spacecrafts. Unfortunately, this attempt failed due to the fact that these thermoelectric materials were not efficient enough to be used in everyday circumstances (Nanotubes 2013). I was very frustrated when I realized that this form of conversion to electricity failed because I was hopeful that something as creative as thermoelectric materials would create an efficient amount of electricity for conventional use. Even though this was one of the first attempts of converting radiation into electricity and therefore there were many more experiments to come, I wish that this method yielded some kind of beneficial result. Instead of trying thermoelectric materials, I would have chosen what the attempt suggested: a material related to radiation instead of heat in order to produce electricity. Even though heat is conducted through these metals, if radiation was conducted through something such as my design theory (medical machinery) a corresponding metal that accepts radiation could transform into electrical energy.

Not only was the 1960s a time of innovative thinking regarding electricity, but more recent inventions as well. Hubertus Hintzen and Mauritius Sanden both came up with a device that for converting electromagnetic radiation energy into electrical energy. I personally thought that by just reading the title of the invention, a solution to harnessing radiation to convert into energy was found. Through a series of complex steps, involving rare earth elements and compounds, energy is able to be produced from radiation. Unfortunately this device cannot be mass produced. (Patent EP1999799B1 2013) In relation to my design, I would like to convert radiation into electricity within hospitals and medical centers throughout the United States and beyond. This product cannot be mass produced due to the complex and insufficient conversion ration within solar cells which is needed for the device to carry out its function. In the attached images is a picture of the design process and factors that coincide with the description of the device that converts radiation into electricity.

Works Cited

Snapshots
Reviews
Print/Export

Portfolio Elements

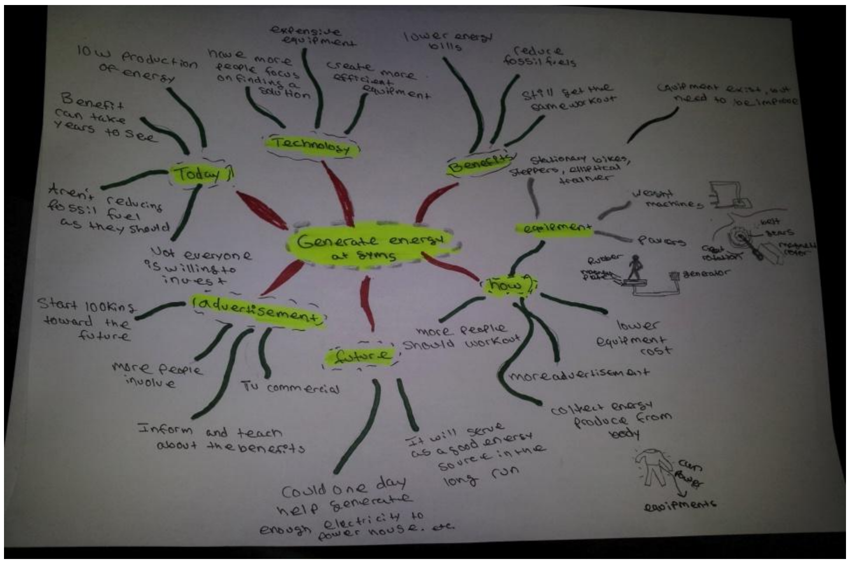
- Portfolio Home
- A Presentation and justification of the problem — Resources | Rubric
- B Documentation and analysis of prior solution attempts — Resources | Rubric
- C Presentation and justification of solution design requirements — Resources | Rubric
- D Design concept generation, analysis, and selection — Resources | Rubric
- E Application of STEM principles and practices — Resources | Rubric
- F Consideration of design viability — Resources | Rubric
- G Construction of a testable prototype — Resources | Rubric

Excess radiation as an energy source

Courtesy Ms. Ivy Obonyo, FR LTSC

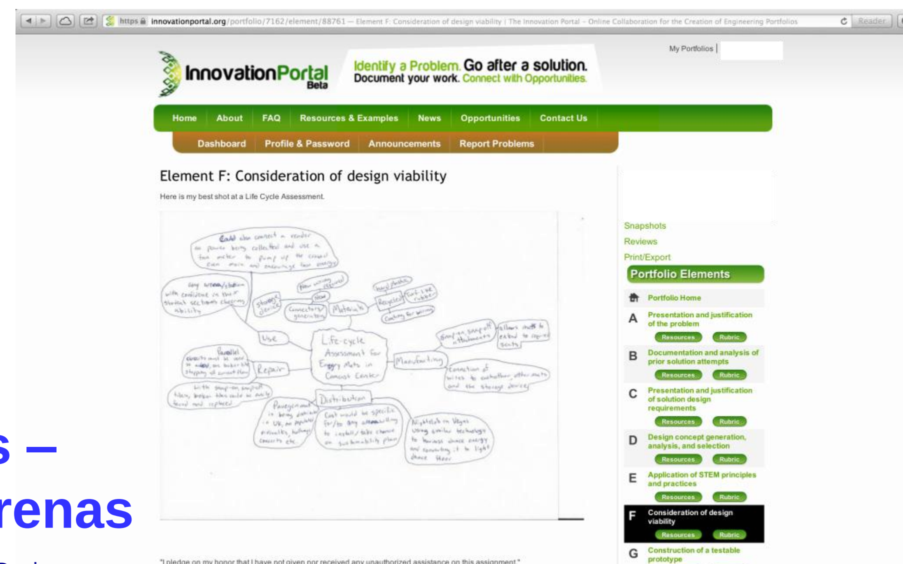
Universal Design for Learning (Rose & Meyer; 2002) – Develop their own design ideas and expressions

The Gym – Brainstorming multiple sources of energy



Courtesy of Ms. Gerson Miranda Rosales, SR LTSC IAP

Mind maps – a visual method to outline information and brainstorm



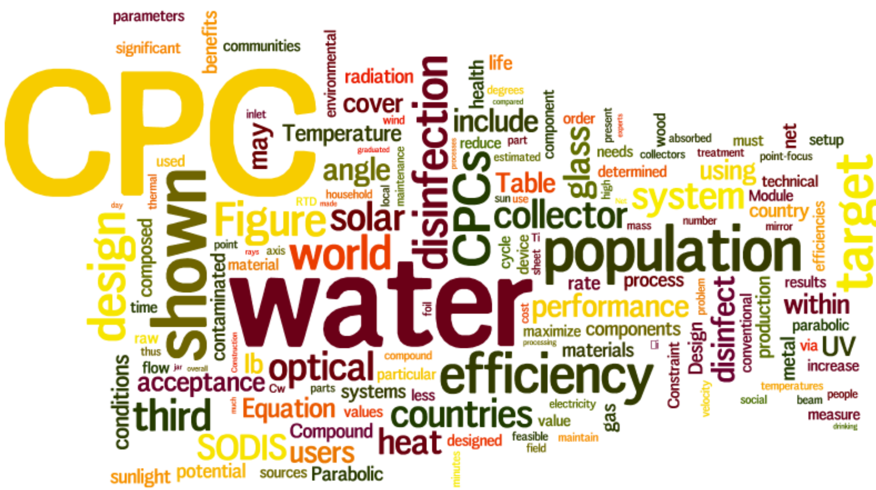
Life-cycle analysis – Energy mats for arenas

Courtesy Mr. Paul Wampler, SO LTSC

Rose, D. H. and Meyer, A. (2002). Teaching Every Student in the Digital Age: Universal Design for Learning (2002) by David H. Rose & Anne Meyer with Nicole Strangman and Gabrielle Rappolt. Alexandria, VA: Association of Supervision & Curriculum Development.

Universal Design for Learning – Develop their own design expressions

Solar disinfection of contaminated water

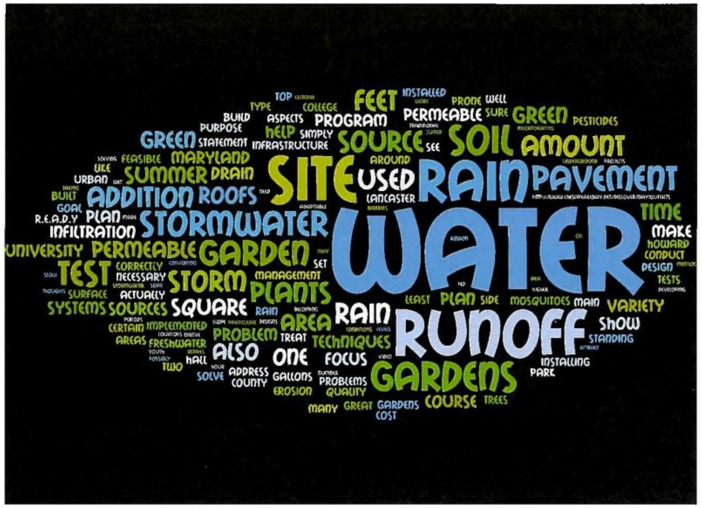


Mr. James Thomas, SR Civil Engineering

Courtesy of Mr. James Morton, FR LTSC

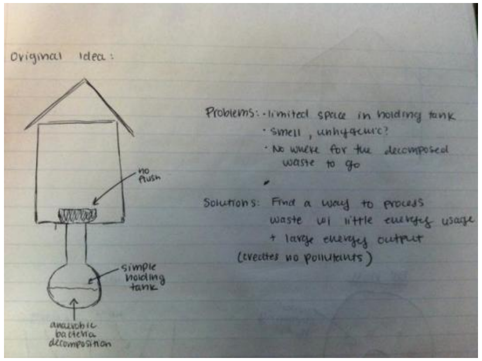
Word Clouds – is a weighted list of text Information

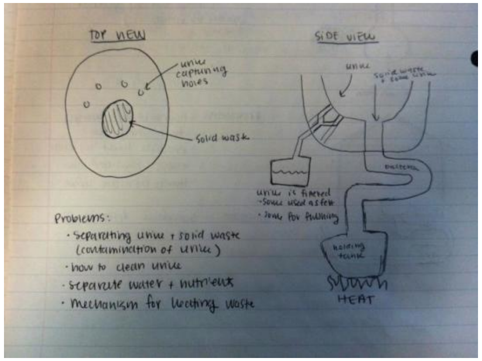
UMD Rain gardens

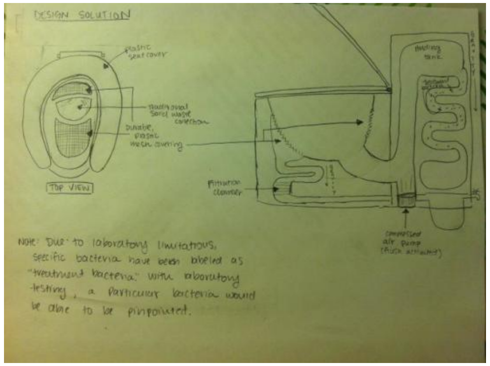


New knowledge and creative thinking evolve Designs

Resource recovery – Reinventing the toilet





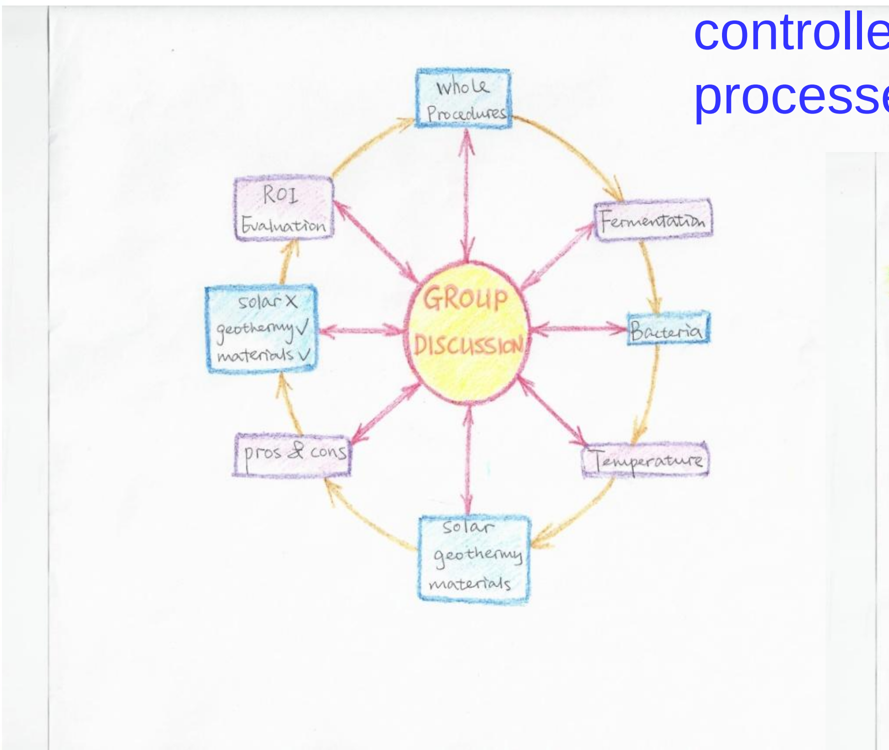


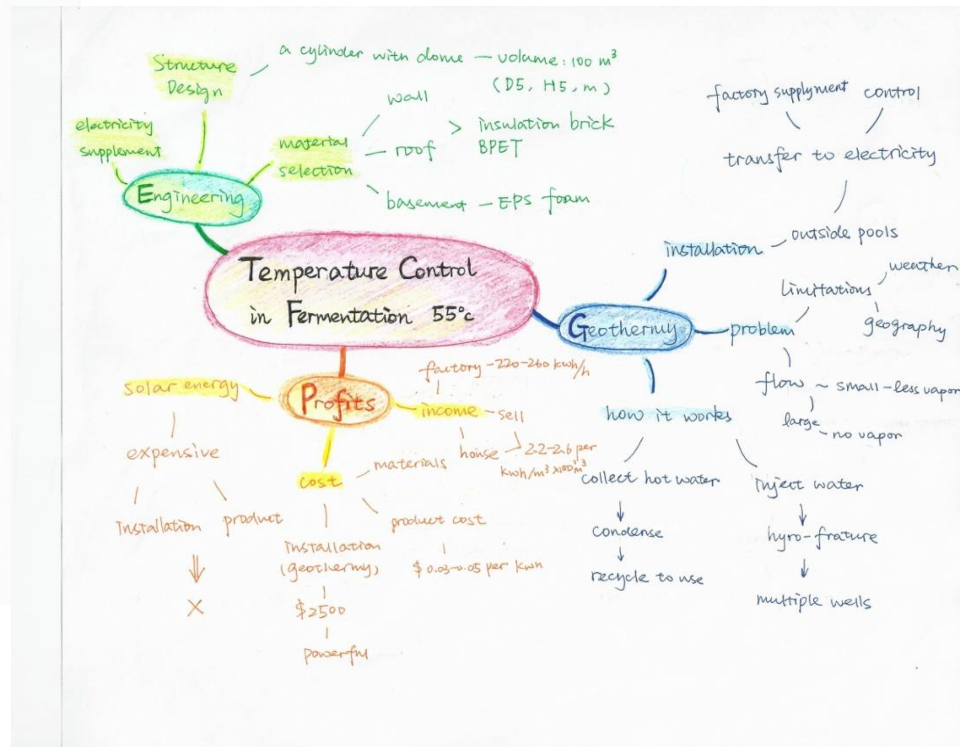
Courtesy of Ms. Natalie Tham – FR LTSC

Start of Course → Mid-Course

Teamwork – individual and collaborative

Geothermal energy for temperature controlled fermentation processes





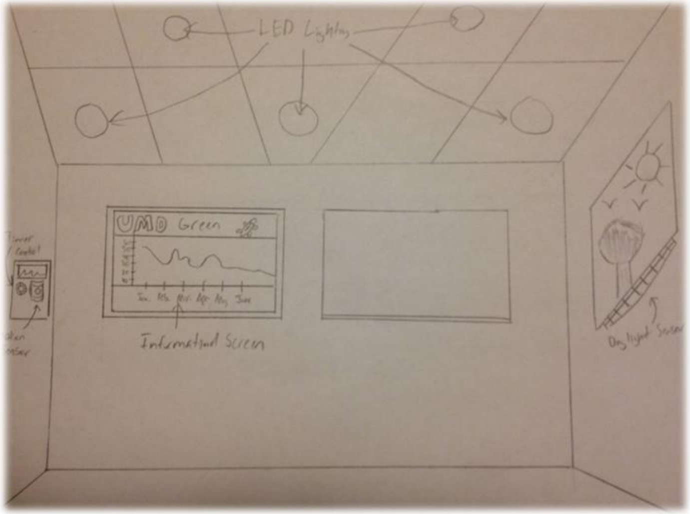
Courtesy of Ms. Dan Li, SO AGNR Food Sciences
Courtesy of Ms. Yinzhi Qu, SO AGNR Food Sciences
Courtesy of Ms. Huiqi Zhuang, JR AGNR Food Sciences

Systems Thinking

Integrated lighting control for UMD buildings –
"a multifaceted, sustainable design system"

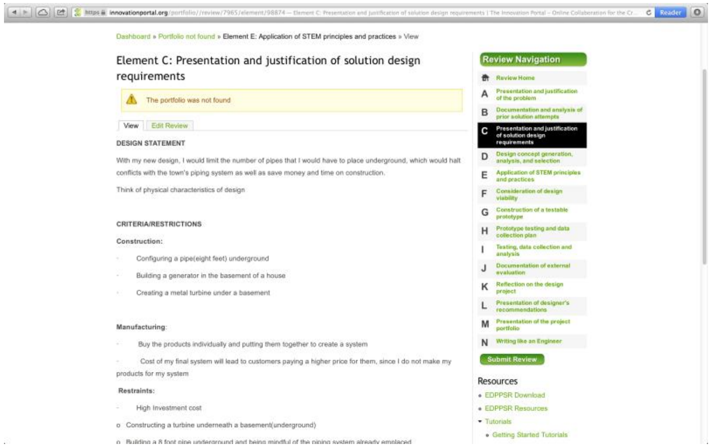
A five part plan to reduce the amount of electricity used by lights on campus:

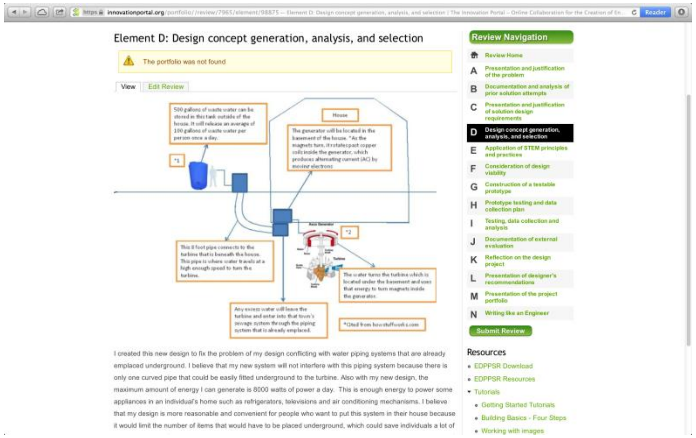
I. Occupancy Sensors
II. Light Timers
III. LED Lighting
IV. Daylight Sensors
V. Savings Monitoring System

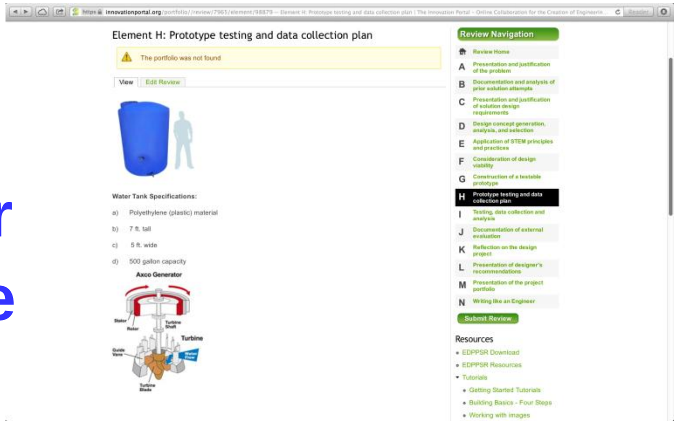


Courtesy of Mr. Jack Trimble, JR AGNR ECON DESIGN

Depth of understanding –
Design is a multi-step process







Small hydropower system for a home

Courtesy of Mr. Isaiah Bell, FR Community Health

Engineering Sustainability Workshop-ESW-Focus on Energy

- **Sustainability does not happen by chance. It must be engineered.**
- **BioE 289A will participate in Earth Day** on April 22 to present the students' work to the Clark School faculty members and students, interested people from other University of Maryland schools, and guest speakers from industry and government, to come together for the Clark School's Engineering Sustainability Workshop.
- **Several BioE 289A student projects** related to the Sustainability Studies Minor will have their projects highlighted.
- **At the conclusion of the workshop, a list will be made of new ideas for sustainability initiatives proposed by attendees;** this list will be posted on this website for future reference and possible development and execution.

Special Thanks to the Contributors

- The students!
- The Department of Energy
- The National Science Foundation
- James Turner, Senior Counsel and Director of Energy Programs, Association of Public and Land Grant Universities
- Ellen Larson Vaughan, Policy Director, High Performance Green Buildings, Environmental and Energy Study Institute
- Indira Nair, Ph.D. Professor and Vice Provost Emeritus, Carnegie Mellon
- Matthew Garcia, Ph.D., AAAS Science & Technology Policy Fellow, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy
- DaNel Hogan, Albert Einstein Distinguished Educator Fellow, Energy Efficiency & Renewable Energy, U.S. Department of Energy
- Mark Schroll, *Senior Director of Strategic Partnerships,* Project Lead the Way
- Rosemary Reshetar, Ed.D. Executive Director at The College Board
- Margaret McLaughlin, Ph.D. (Associate Dean for Research and Graduate Education, UMD College Park)
- Isabel Llyod, Ph.D., Associate Professor, UMD College Park
- Tami Imbierowicz, Associate Professor, Harford Community College
- Gail Wyant, Professor, Cecil Community College

Welcome to the Energy 101 Webinar

I. Introduction of the Energy Literacy and Energy 101 Initiatives -Michelle Fox & Matt Garcia

II. Energy 101 Curricular Framework Development - Jim Turner

III. Energy 101 Implementation: Course Development, Approval, Transferability

- University of Maryland 'Energy 101'-–Leigh Abts
- Harford Community College 'Energy 101' -Tami Imbierowicz
- Energy 101 NTER Module Concept- - Stephanie Moore

IV. Next steps - Ellen Vaughan

V. Online Forum-Panel Q & A

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HARFORD COMMUNITY COLLEGE

Tami Imbierowicz, Associate Professor, STEM Division, Harford Community College, Bel Air, MD

- Designed a new course to align with the DOE *Energy Literacy* fundamentals and ‘Energy 101’ curricular framework:
  - **SCI 109 –Introduction to Energy & Sustainability**
  - To be offered in fall 2013
- HCC approved course as a GS elective in February 2013
  - Discussion by CWG regarding general education category – interdisciplinary (GI) or science (GS)
- Transferability:
  - UMD approved SCI 109 as a transfer equivalent to BIOE-289A
  - SCI 109 transfers as a GS to all transfer institutions in Maryland
  - Community colleges use SCI 109 as an equivalent for transfer

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HARFORD COMMUNITY COLLEGE

SCI 109 – Introduction to Energy & Sustainability

Course Description:

This course introduces students to the essential principles and fundamental concepts of energy necessary to build an energy literate society. Topics include the history of energy use, energy science and mechanics, electricity, sources of energy and use of energy, energy conservation and efficiency, environmental impacts, health effects, economics, policy, and future technology. Field experiences may be required; a reasonable alternative to the field trips will be available.

SCI 109 – Course Learning Objectives

Upon satisfactory completion of this course, the student will be able to:

1. Explain the basic principles of energy science and mechanics.
2. Describe how electricity works to transfer energy from an energy source to homes and businesses.
3. Analyze various energy sources and evaluate their advantages and disadvantages.
4. Calculate energy use, cost, and rate of depletion of energy sources under varying scenarios.
5. Discuss the U.S. and global trends on energy and sustainability related to policies, ethics, economics, politics, environment and society.
6. Design a sustainability plan for school, work, and/or home.
7. Identify and locate appropriate types of information for review, evaluate the information, and use the information effectively, ethically, and legally.

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V. **Online Forum-Panel Q & A**

Online Energy Modules

- Stephanie Moore, Director of Engineering Instructional Design, Dept. of Engineering & Society
- Currently teaching course on sustainability designed around systems thinking and design
- Background in online learning and evidence-based pedagogy

- Working with a team of experts and developers here at UVa to develop online modules – "learning objects" – that are tied to the Energy 101 course and energy literacy standards and made available through the NTER platform

Module Design

- First set of modules is focused on heat transfer capped with systems design and system data analysis
- Design reflects evidence-based approaches to developing multimedia learning materials and interactive online learning

Thermal Energy basics

Conduction

Convection

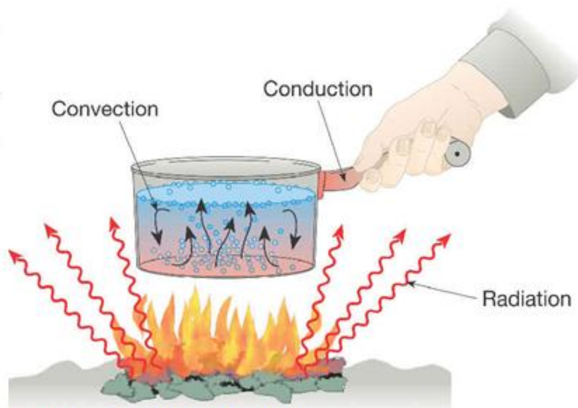
Radiation

- Explicit instruction using narrated images and animations
- Periodic quizzes on basic concepts
- Individual and Group activities focused on application
- Multiple examples for each concept to facilitate transfer and UDL
- Accessibility

Systems Example, Design, & Data Analysis

- Examples of systems including WaterShed house and other examples around the home
- Design activity
- Modeling of design and use of data

Storyboard and Prototype

Module: Thermal Energy – Heat Transfer	
Introduction – Heat Transfer: Three Processes	Three Processes of Heat Transfer Animated narration – boiling water over a campfire  (do we have permission for use?)
Menu / Navigation Format	

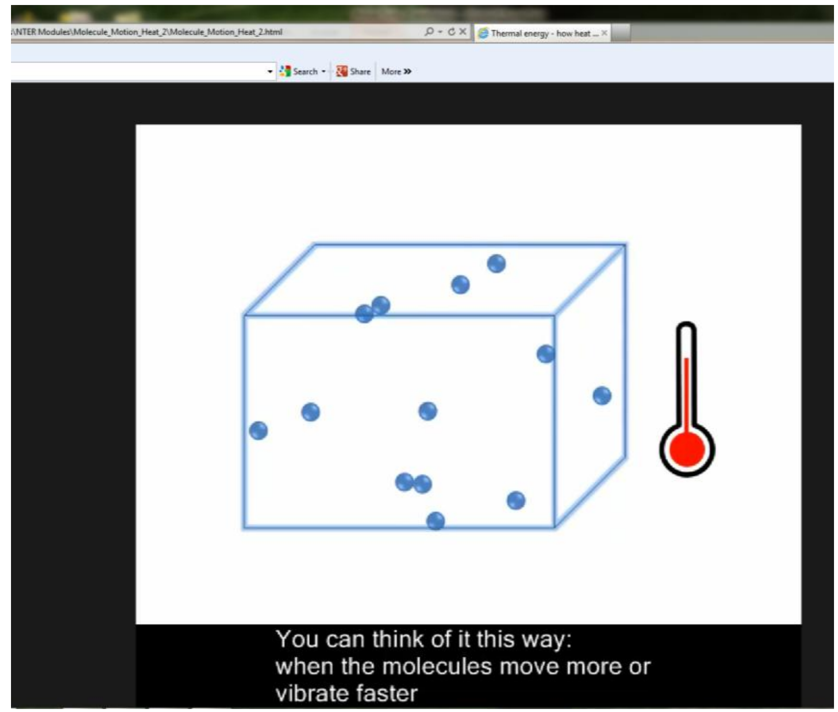
Graphics:
Image of cooking over an open fire:

Static image: Flame in a fire pit, pot with water inside and a metal handle, hand holding the pot

Gray out entire image; then color in conduction (warm moving along the metal handle towards the hand holding the handle); gray that back out and color in convection process (water molecules moving around as they heat up); gray that out and color in radiation (fire with warm arrows radiating out from the fire to heat up the pot and other objects around) – label for each appears with each during its individual animation (e.g. "Convection" appears when water is highlighted)

For final sentence, when each principle is stated, label appears again next to that portion of the image.

Narration:
Now that we understand the idea of heat transfer, let's look at how it occurs so you can start to imagine different types of solutions.



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Ellen Vaughan

Policy Director

Environmental and Energy Studies Institute

Energy 101-Next Steps

Ellen Larson Vaughan
evaughan@eesi.org www.eesi.org
202-662-1893

Next Steps

- Continue outreach
  - Provide information about Energy 101 to Ag/Energy Cooperative Extension Service offices and others
  - Encourage Energy 101 champions to start or join a discussion on NTER Forum about Energy 101 courses, textbooks, NTER modules and other topics
  - Encourage champions to tell additional educators and students about Energy 101!

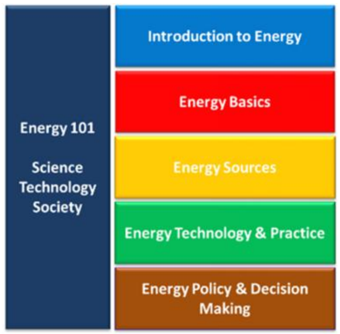
- Implement – Promote Energy 101 Course Development
  - Follow up with interested schools to gauge interest, needs
  - Pursue funding to offer targeted education and training and/or additional curricula such as AP, adult continuing education

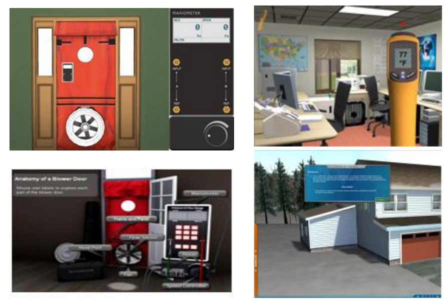
Next Steps

- Work with Key Organizations to Survey Members
- Bentley University Survey

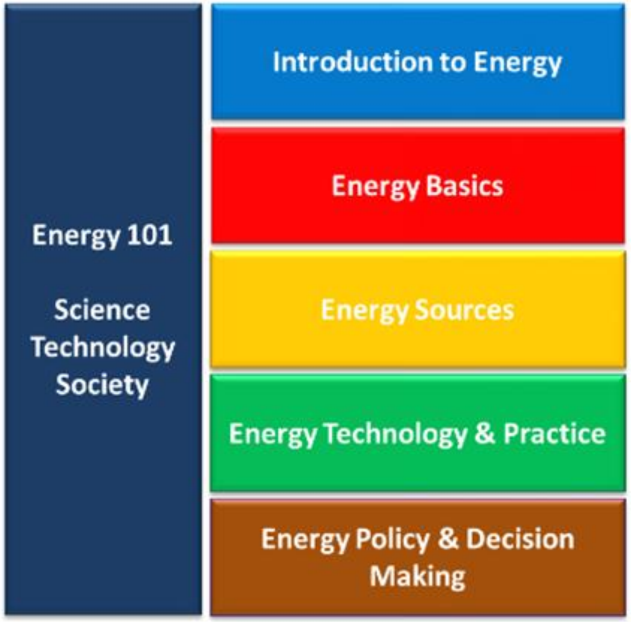
  - For example: **Second Nature / ACUPCC Signatories** (American College and University Presidents' Climate Commitment)
  - **American Association of Community Colleges (AACC)** and the **SEED Center (Sustainability in Education and Economic Development)**

Next Steps





- **Energy 101** - Teaching materials related to lectures are currently being developed for each course and could be posted on NTER for easy access and sharing.
- **Trade Adjustment Assistance Community College and Career Training initiative** (TAACCCT) NTER and energy related content included in the Round Two TAA Grants- 500 Million total
- **Grid Engineering for Accelerated Renewable Energy Deployment (GEARED)** One of the two supported activities include training consortia that focus on quickly bringing their findings into training and educational initiatives (Concept paper 4/12/13-Full application 4/19/13)



Support the creation of an Energy 101 course framework for an **multidisciplinary** higher education **undergraduate** course for teaching the fundamentals of energy using a **systems-based** approach that **can be individualized** by the nations universities and community colleges to create their own ‘Energy 101’.

1. **Use the Energy Literacy Principles as a starting point**
2. **Ability to individualize for specific student audience & setting**
3. **Be the result of review and public comment**
4. **Provide roadmaps for course adoption (course credit, transferability)**
5. **Leverage National Training & Education Resource (NTER) and learning technology for courses and content**
6. **Leverage Energy Literacy and Education Partnerships**

APLU Energyy 101- energy101@aplu.org
www.aplu.org/energy101
EESI Energy 101- energy101@eesi.org
www.eesi.org/energy101
DOE EERE Energy 101 –energy101@ee.doe.gov
www.eere.energy.gov/education/energy_101.html

Energy 101 Forum
www.nterlearning.org/forum/energy101

NTER