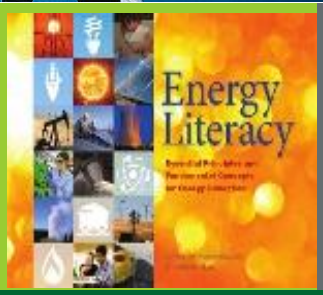
Biomass 2014 Conference

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

Energy Literacy

July 30, 2014



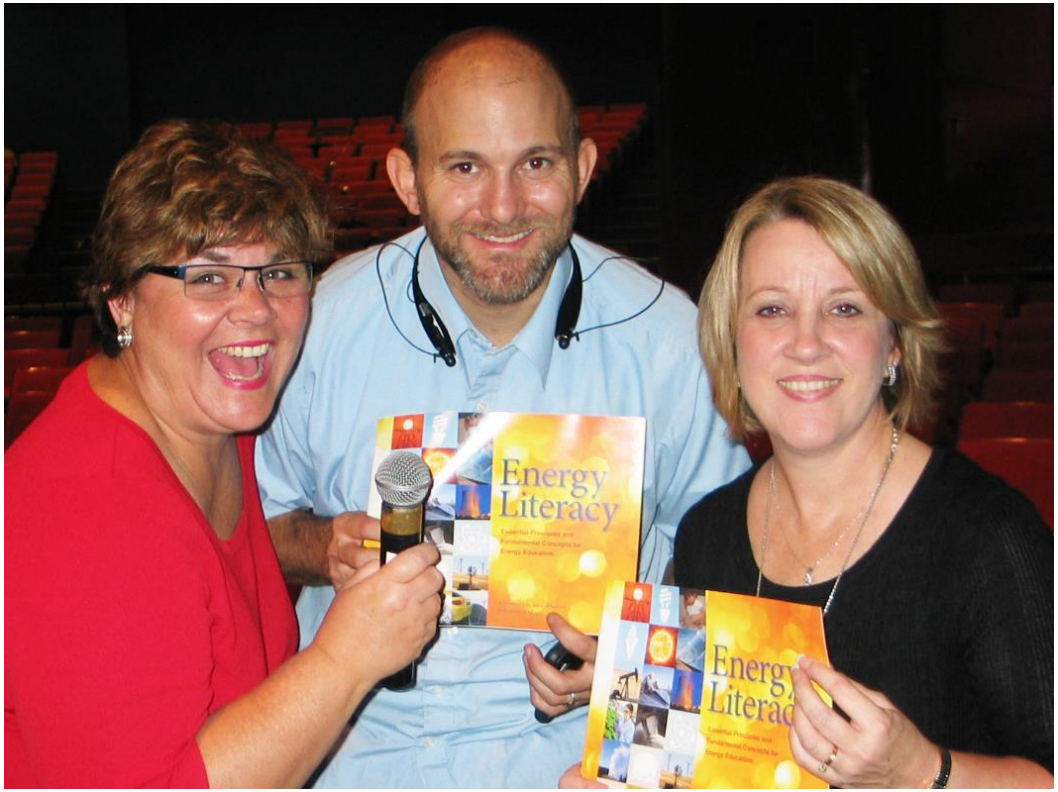
Linda Silverman

Education and Workforce Development

Department of Energy

Agenda

- Setting the Context: Global Energy Challenge
- Energy Literacy Principles
- Energy 101
- Possible Uses



Global Energy Challenge

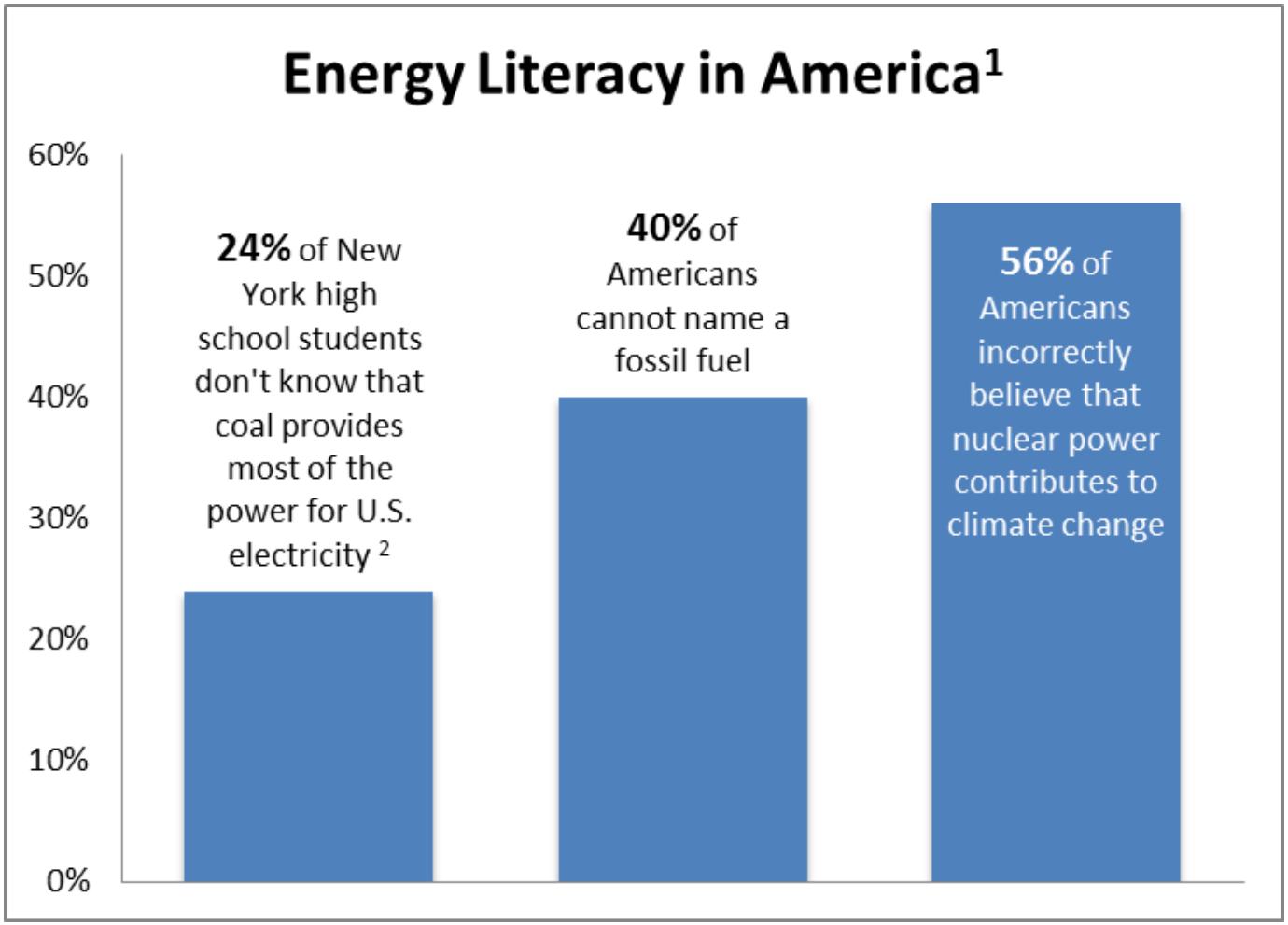
Today's U.S. Energy System	Sustainable Energy System

TRANSFORMATION

- Produces 25% of the world's carbon emissions;
- Dependent on foreign sources; subject to price volatility;
- Increasingly vulnerable energy delivery systems; and
- 2/3 of source energy is wasted.

- Carbon neutral;
- Diverse, homegrown supply options;
- Sustainable use of natural resources;
- Creates American jobs;
- Accessible, affordable and secure; and
- 20% more efficient by 2020.

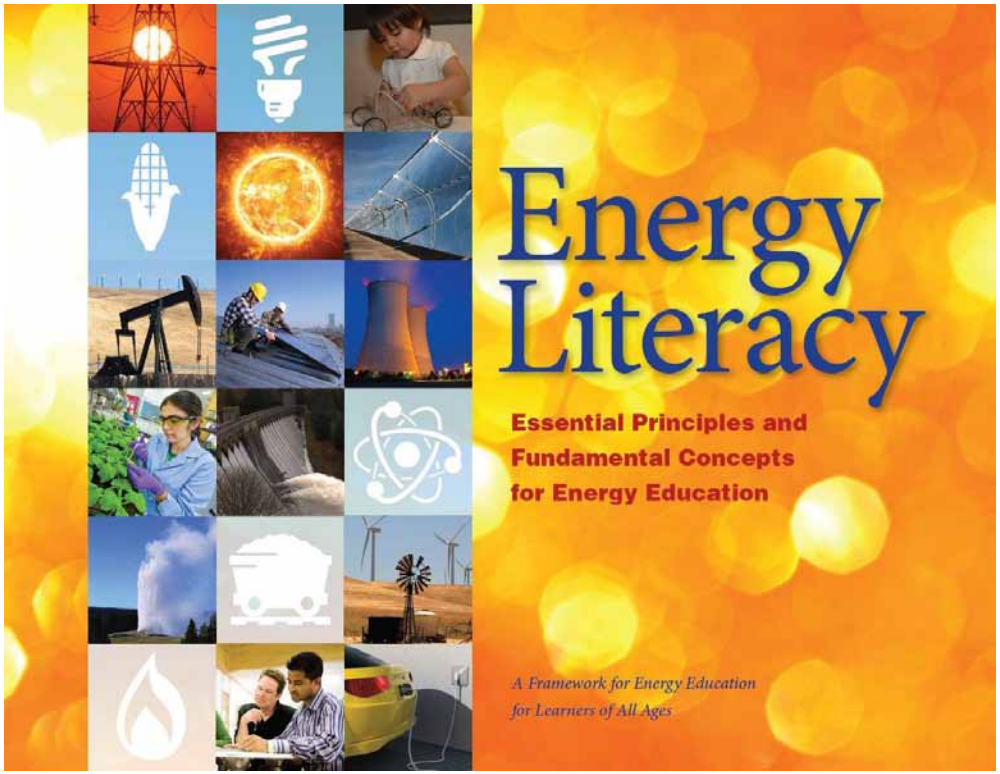
Why Energy Literacy?

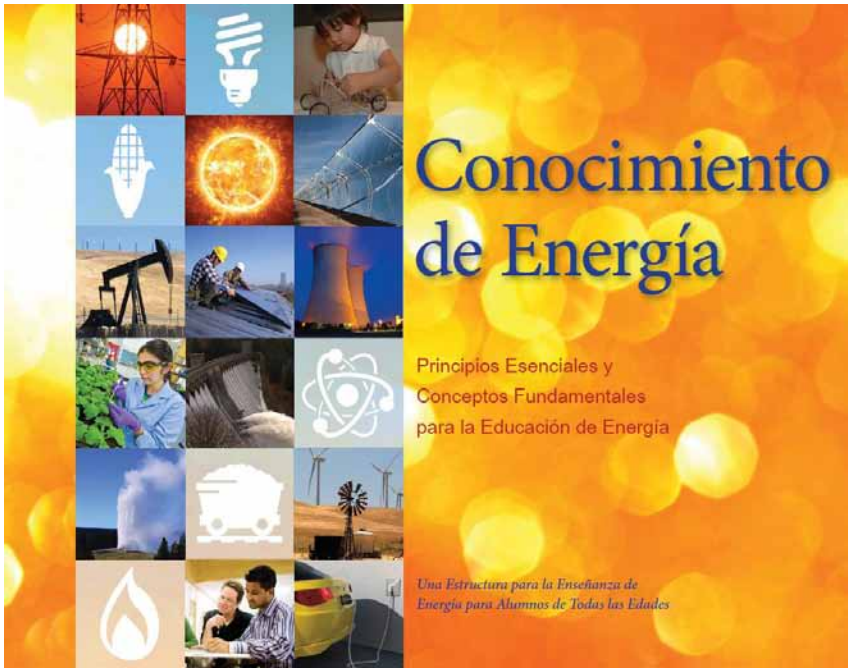


[1]DeWaters, J.E., & Powers, S.E. (2011). Energy literacy of secondary students in New York State (USA): A measure of knowledge, affect, and behavior. *Energy Policy, 39*(3), 1699-1710.
[2]Bittle, S., Rochkind, J., & Ott, A. (2009). The energy learning curve. Public agenda. As cited in DeWaters & Powers, 2011, page 1699.

Energy Literacy

A Framework for Energy Education for Learners of All Ages





Energy Literacy

Back Cover:

U.S. Global Change Research Program Partner Agencies:

- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Energy
- Department of Health and Human Services
- Department of the Interior
- Department of State
- Department of Transportation
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Science Foundation
- The Smithsonian Institution
- US Agency for International Development

Education Partners:

- Alliance to Save Energy
- American Association for the Advancement of Science, Project 2061
- American Association of Blacks in Energy
- American Nuclear Society
- Association of Public and Land-Grant Universities
- Center of Science and Mathematics in Context, University of Massachusetts, Boston
- Chabot Space & Science Center
- Climate Literacy and Energy Awareness Network
- Cooperative Institute for Research in the Environmental Sciences, University of Colorado, Boulder
- Energy Bridge
- KQED San Francisco, QUEST
- National Center for Science Education
- National Council for Science and the Environment
- National Energy Education Development Project
- National Energy Foundation
- National Science Teachers Association
- North American Association for Environmental Education
- Otherlab
- Science Museum of Minnesota
- TERC
- WestEd
- Wisconsin K-12 Energy Education Program
- Women Impacting Public Policy

U.S. Department of Energy
1000 Independence Ave SW
Washington, DC 20585
202-586-5000
http://www.globalchange.gov

Version 1.0: March 2012

Implications of Clean Energy Transformation

- Need an Energy Literate society to change behavior and reduce energy use and climate emissions
- Need workforce to operate in clean energy system

BOTH REQUIRE INSPIRING STUDENTS

Energy Literacy – A holistic interdisciplinary approach to Energy

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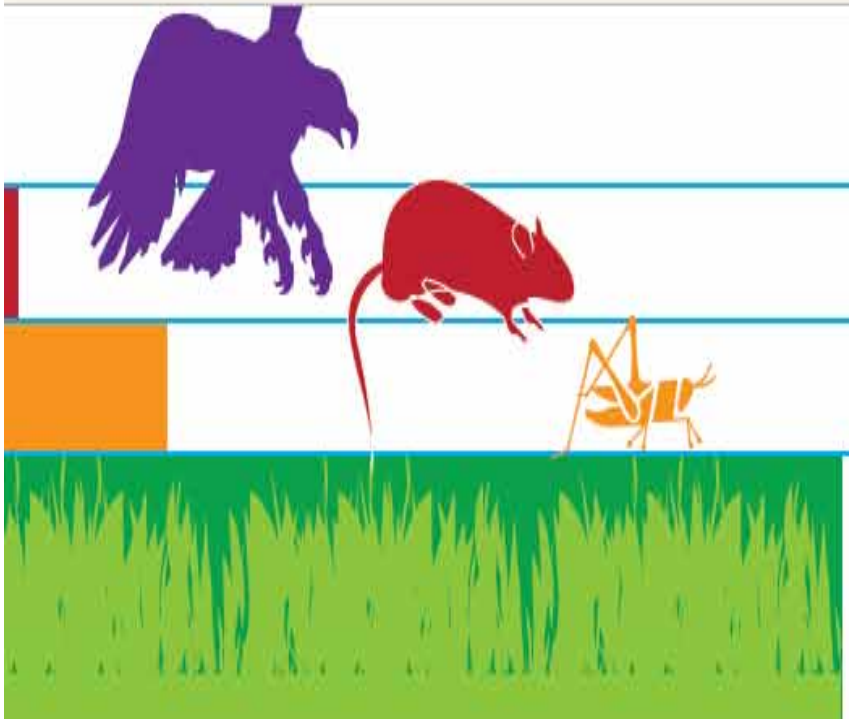
Natural Sciences
- Physics
- Chemistry
- Earth Science
- Biology

Engineering/ Technology

Social Sciences
- Civics
- Economics
- Psychology

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.

3 Biological processes depend on energy flow through the Earth system.



Tertiary Consumers	1,000 J
Secondary Consumers	10,000 J
Primary Consumers	100,000 J
Producers	1,000,000 J

Imagine 25,000,000 joules (J) of energy falling on a population of plants. The plants will make use of about 1,000,000 J of this energy. As the plants are eaten by primary consumers, only about 10% of that energy will be passed on. This process of loss continues as primary consumers are eaten by secondary, and secondary by tertiary. Only about 10% of the energy available at one level will be passed on to the next.

Essential Principle 6:

6 The amount of energy used by human society depends on many factors.

6.1 Conservation of energy has two very different meanings. There is the physical law of conservation of energy. This law says that the total amount of energy in the universe is constant. Conserving energy is also commonly used to mean the decreased use of societal energy resources. When speaking of people conserving energy, this second meaning is always intended.

6.2 One way to manage energy resources is through conservation. Conservation includes reducing wasteful energy use, using energy for a given purpose more efficiently, making strategic choices as to sources of energy, and reducing energy use altogether.

6.3 Human demand for energy is increasing. Population growth, industrialization, and socioeconomic development result in increased demand for energy. Societies have choices with regard to how they respond to this increase. Each of these choices has consequences.

6.4 Earth has limited energy resources. Increasing human energy consumption places stress on the natural processes that renew some energy resources and it depletes those that cannot be renewed.

6.5 Social and technological innovation affects the amount of energy used by human society. The amount of energy society uses per capita or in total can be decreased. Decreases can happen as a result of tech nological or social innovation and change. Decreased use of energy does not necessarily equate to decreased quality of life. In many cases it will be associated with increased quality of life in the form of increased economic and national security, reduced environmental risks, and monetary savings.

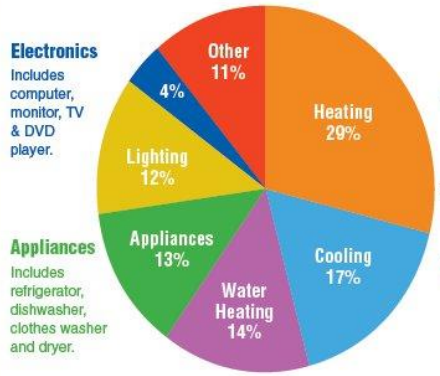
6.6 Behavior and design affect the amount of energy used by human society. There are actions individuals and society can take to conserve energy. These actions might come in the form of changes in behavior or in changes to the design of technology and infrastructure. Some of these actions have more impact than others.

6.7 Products and services carry with them embedded energy. The energy needed for the entire lifecycle of a product or service is called the "embedded" or "embodied" energy. An accounting of the embedded energy in a product or service, along with knowledge of the source(s) of the energy, is essential when calculating the amount of energy used and in assessing impacts and consequences.

6.8 Amount of energy used can be calculated and monitored. An individual, organization, or government can monitor, measure, and control energy use in many ways. Understanding utility costs, knowing where consumer goods and food come from, and understanding energy efficiency as it relates to home, work, and transportation are essential to this process.

Where Does My Money Go?

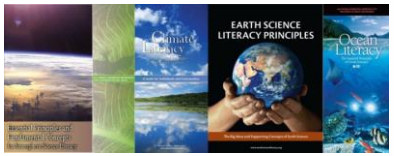
Annual Energy Bill for a typical U.S. Single Family Home is approximately $2,200.



Source: Typical House memo, Lawrence Berkeley National Laboratory, 2009 and Typical house_2009_Reference.xls spreadsheet.
Average price of electricity is 11.3 cents per kilo-watt hour. Average price of natural gas is $13.29 per million Btu.

The Energy Star program is run jointly by the U.S. Department of Energy and the Environmental Protection Agency. The Energy Star logo designates products as highly energy efficient.

Others Implementing Energy Literacy Principles



Just to name a few:

- Next Generation Science Standards K-12
- Cited in EPA RFPs
- AP Energy Course (in discussion)
- Discovery Education
  - Energy STEM Camp
- CLEAN Collection and Community
- National Geographic Education
  - *Connect! Transform the Future* Documentary
- iBook on Renewable Energy by Ecodads
- Paleontological Research Institution
  - Earth Science Rainbow Charts
- Sustainability in Prisons Project
- Realtors
- American Geosciences Institute
  - *Watt's Up? The Lowdown on Energy*
- Will Segar Foundation – Energy Institute for teachers
- Smithsonian – Teacher Energy Institute for teachers

B.I.T.E.S. SCENARIOS

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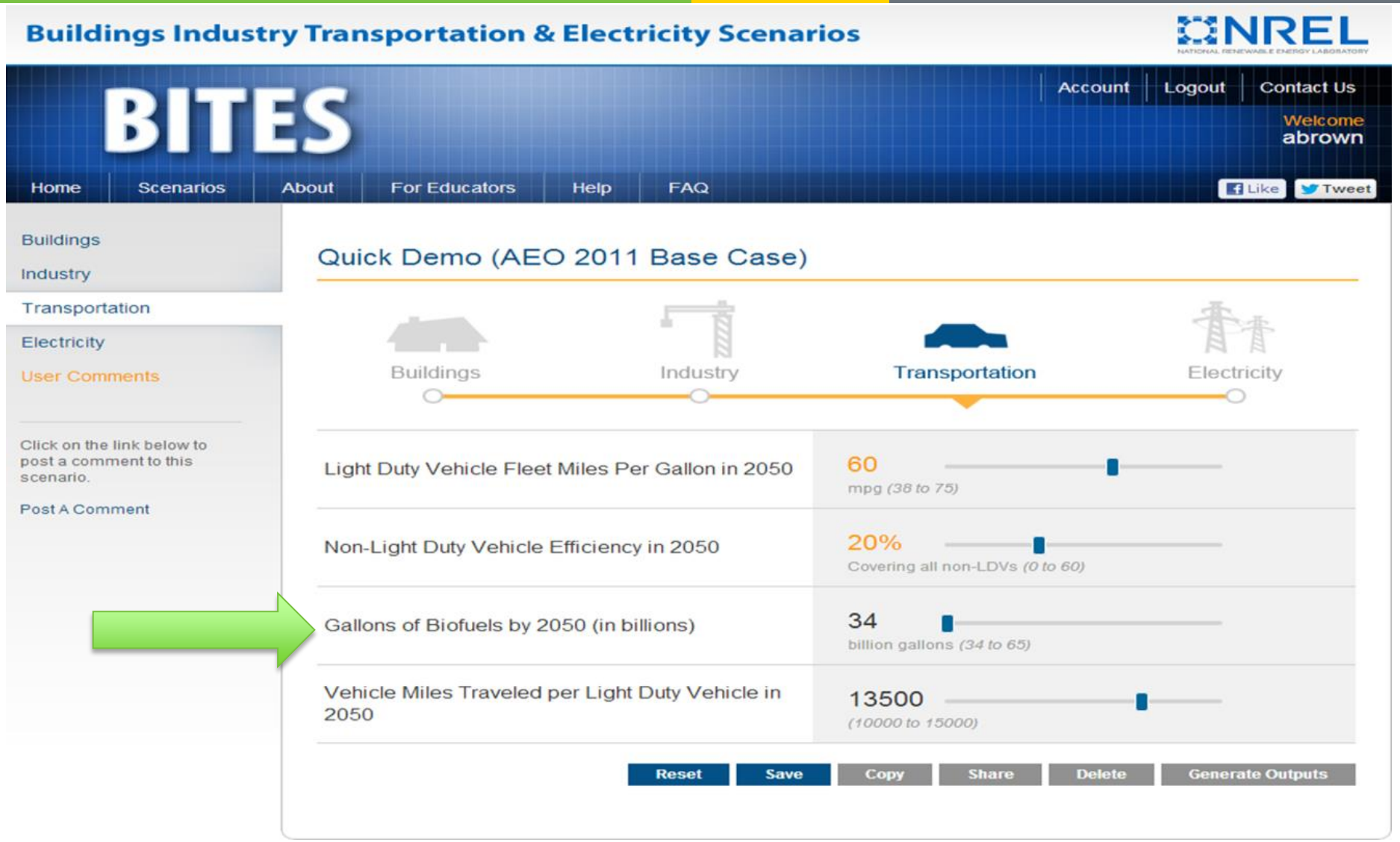
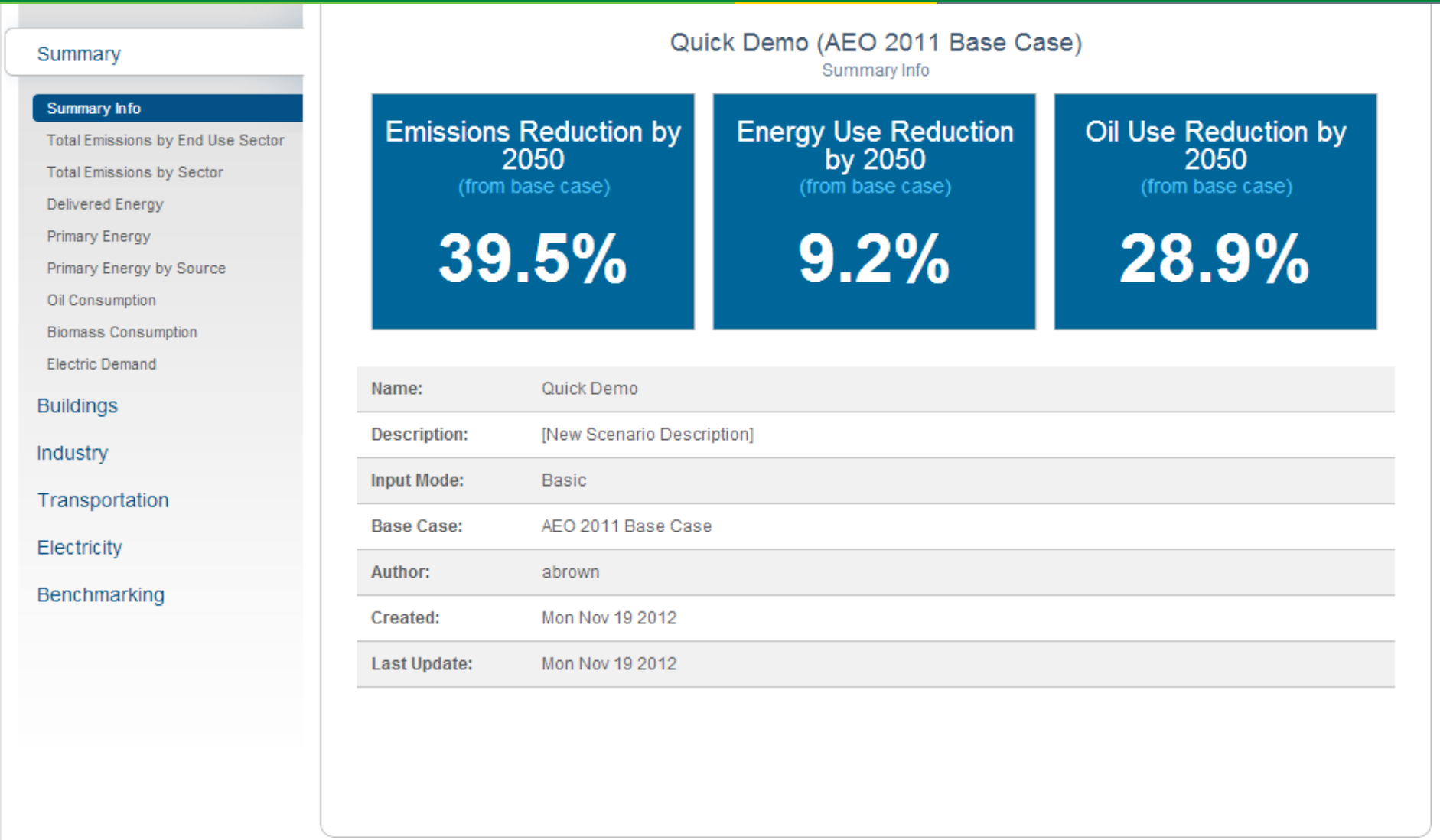

Buildings Industry Transportation & Electricity Scenarios
NREL
BITES
Account
Logout
Contact Us
Welcome
abrown
Home
Scenarios
About
For Educators
Help
FAQ
Like
Tweet
Buildings
Industry
Transportation
Electricity
User Comments
Click on the link below to post a comment to this scenario.
Post A Comment
Quick Demo (AEO 2011 Base Case)
Buildings
Industry
Transportation
Electricity
Light Duty Vehicle Fleet Miles Per Gallon in 2050
60
mpg (38 to 75)
Non-Light Duty Vehicle Efficiency in 2050
20%
Covering all non-LDVs (0 to 60)
Gallons of Biofuels by 2050 (in billions)
34
billion gallons (34 to 65)
Vehicle Miles Traveled per Light Duty Vehicle in 2050
13500
(10000 to 15000)
Reset
Save
Copy
Share
Delete
Generate Outputs


Summary
Summary Info
Total Emissions by End Use Sector
Total Emissions by Sector
Delivered Energy
Primary Energy
Primary Energy by Source
Oil Consumption
Biomass Consumption
Electric Demand
Buildings
Industry
Transportation
Electricity
Benchmarking
Quick Demo (AEO 2011 Base Case)
Summary Info
Emissions Reduction by 2050
(from base case)
39.5%
Energy Use Reduction by 2050
(from base case)
9.2%
Oil Use Reduction by 2050
(from base case)
28.9%
Name: Quick Demo
Description: [New Scenario Description]
Input Mode: Basic
Base Case: AEO 2011 Base Case
Author: abrown
Created: Mon Nov 19 2012
Last Update: Mon Nov 19 2012
Close

Energy's Elevated Role in K-12:

Energy is one of the seven NGSS **cross-cutting concepts** that **bridge disciplinary boundaries, uniting core ideas** throughout the fields of science engineering. The purpose is to help students **deepen their understanding** of the disciplinary core ideas and **develop a coherent and scientifically based view of the world**. (NGSS, 2013, p79)

Virtual Energy Literacy Town Hall

The Energy Literacy Framework

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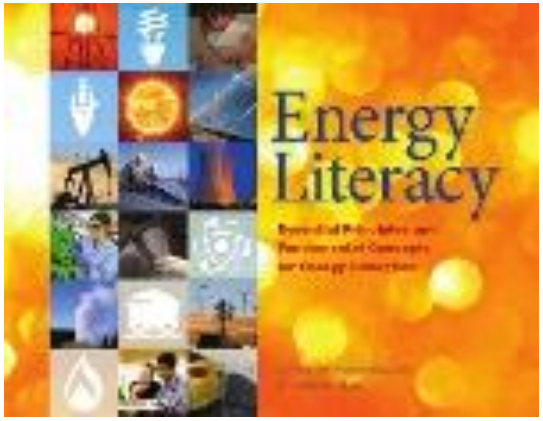
www.gotomeeting.com/register/973763169



August 5, 2014

3 -5 pm EST

Who, What, Where, Why and How of Energy Literacy

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Energy 101 Course Framework

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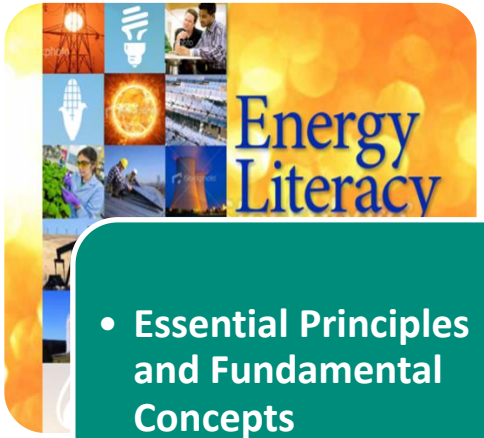
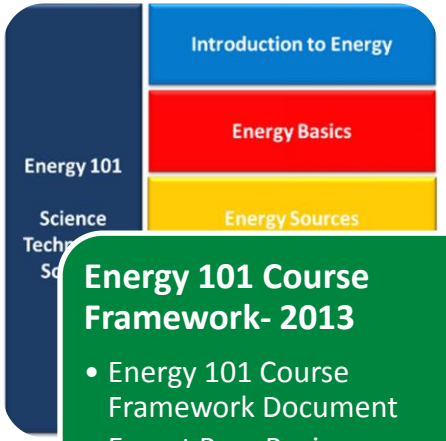
Promote Energy Literacy

Leverage Educational Partnerships

Support Future Energy Workforce Needs



- **Essential Principles and Fundamental Concepts**
- **Peer Reviewed**
- **Interdisciplinary**
- **Widely Distributed**

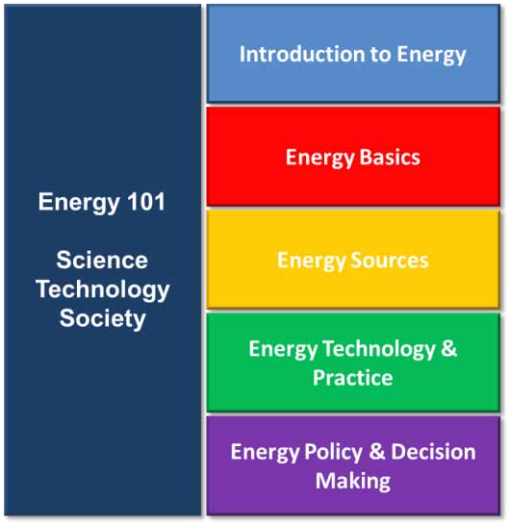


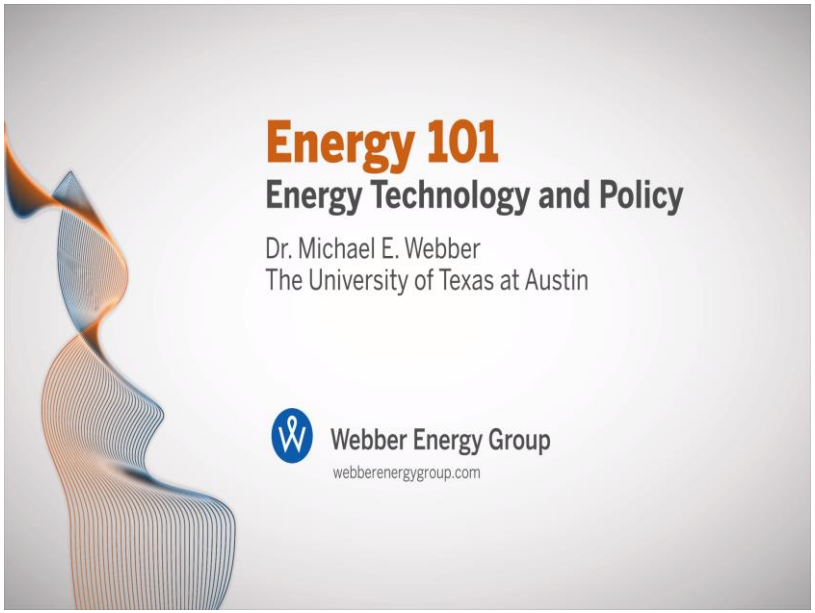
Energy 101 Course Framework- 2013

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

The Energy 101 Course Framework

- Aims to increase energy-related degree & career pathways
- Provides roadmap for course adoption, credit, and transferability
- Multidisciplinary systems- based approach





Possible Applications

- Adding energy-related Quests to Smithsonian Badges
- Incorporating videos into activities
- Including Energy Literacy in RFP or FOA
- Museum exhibits
- Creating energy-related apps
- Career visualization tools

WE WELCOME YOUR FEEDBACK!

Contact energyliteracy@ee.doe.gov