



# The Energy Literacy Feedstock

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## Introduction

The NARA Education Team has spent the last year examining, defining, and developing an assessment strategy for participants in K-Teacher educational programing. Over the past several years many lessons, workshops, and energy-based learning opportunities have been offered for a wide audience in the Pacific Northwest. The NARA Education Team aims to increase energy literacy of students and adults, thus the need for creating a tool to quantify change in energy literacy as a result of NARA related education and to understand current gaps in energy concepts.

## Defining Energy Literacy

The desired outcome of many energy education programs is not necessarily to produce energy experts, but to foster energy literate citizens who are able to understand and make informed decisions about local and global energy issues. While defining energy literacy and developing an energy literacy survey tool, DeWaters, Powers, and Graham found that: “*Literacy* implies not only the understanding of a particular, relevant body of knowledge and set of relationships, but moreover, the ability and willingness to *use* that knowledge in a functional manner - to read and write, to communicate, to participate in society.” In order to assess energy literacy in students and adults alike, the NARA Education Team focuses on content knowledge as well as system thinking pertaining to energy topics in general and biofuel topics specifically.

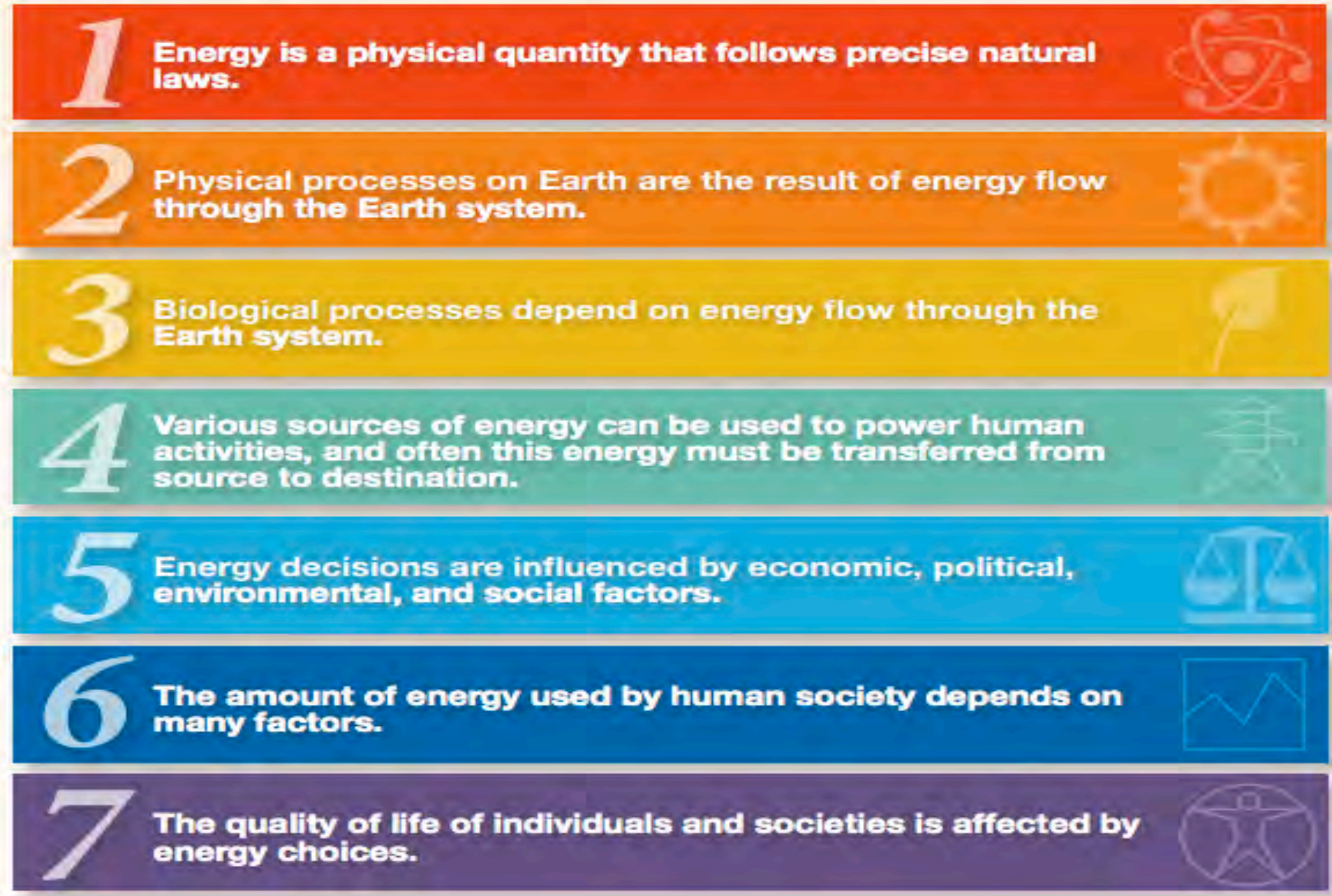
The Department of Energy created the Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education (2013). Energy literacy, as defined by DOE, “is an understanding of nature and role of energy in the universe and in our lives” and “energy literacy is also the ability to apply this understanding to answer questions and solve problems.” The framework created by DOE, breaks down energy concepts into seven principles that hope to empower individuals and communities to make informed energy decisions.

## Methods

With the foundation of the DOE Energy Literacy document and guidance from WSU’s Professional Educational Assessment Chad Gotch, the Education Team created assessment questions using a multiple-choice format for high school students. The NARA Education Team went through many iterations to create questions that evaluated basic energy knowledge and understanding but also incorporated elements of biofuel education specifically. The process took several months and much examination into the goals of NARA and energy literacy education. Overall, the questions are written at a tenth grade reading level.



## DOE Energy Literacy Principles



## Pilot Testing

This first version of assessment includes 22 questions with three answer options per question. The questions were piloted over the summer 2014 at the University of Idaho’s McCall Outdoor Science School (MOSS). The test was piloted with teachers attending a workshop (n=21), and middle and high school students attending MOSS summer programs (n=113).

## Sample Question

1. Why do greenhouse gases impact temperatures on Earth?	a. greenhouse gases in Earth’s atmosphere trap infrared light from the surface of Earth
	b. greenhouse gases are not transparent to incoming sunlight
	c. greenhouse gases create holes within Earth’s ozone layer and allow more sunlight in
2. Which of the following answers best describes the greatest impact that humans have on the energy flow in earth’s ecosystem:	a. genetically engineering crops
	b. harvesting and removing tree from forests
	c. causing environmental accidents such as oil spills
3. Which of the following statements describes the largest constraint typically associated with the transportation of woody biomass?	a. distance from the source of feedstock to the refinery
	b. distance from the distributor to the user
	c. distance from the refinery to the distributor
4. Which of the following best represents the physical law of energy conservation.	a. using less gasoline can save you money
	b. energy can neither be created nor destroyed
	c. turning off your lights saves energy



## Results

The objective in the pilot test from the summer was to see if any of the questions proved to be too difficult for students and/or if some answer choices were too tricky or misleading for students. After examining the results from the pre and post test to look for trends in commonly missed questions and commonly chosen incorrect answer choices, several questions emerged as being problematic for students. Questions 10, 14, 16 and 20 were missed more than 60% of the time with one predominant incorrect answer (10:c, 14:c, 16:b, 20:c). This indicates prevailing misconceptions or lack of understanding that NARA Education Team members need to address in curriculum creation. Although the objective was to determine if any questions were misleading or confusing, we realized we’d come across questions that represent current gaps in energy education. From this assessment tool we can continue to define and target key areas to focus on for future education literacy education.

Misconceptions:

- The nature of greenhouse gases
- Oil spills cause a greater impact on a daily basis than harvesting of trees
- The constraints/challenges of transporting woody biomass
- The difference between conservation and the law of conservation

## Next Steps:

- Develop and implement lessons to target common misconceptions
- Create an assessment tool for middle school students
- Create a version for elementary school students
- Pilot test both middle and elementary versions
- Proceed with testing participants using a pre, post-test model looking for significant change from the pre test to the post test

References:  
DeWaters, J. & Powers, S. (2012). Establishing measurement criteria for an energy literacy questionnaire. *The Journal of Environmental Education*, 44(1), 38-55.

United States Department of Energy. (2013) Energy literacy: Essential Principles and Fundamental Concepts for Energy Education.