K-12 Energy Education

NEED
National Energy Education Development Project

What is NEED?

National Energy Education Development

The mission of the NEED Project is to promote an energy conscious and educated society by creating networks of students, educators, and business, government, and community leaders to design and deliver objective, multi-sided energy education programs.

In 2012-2013:

- 600 workshops
- 65,000 classrooms
- 50 states, Washington, D.C. and U.S. territories

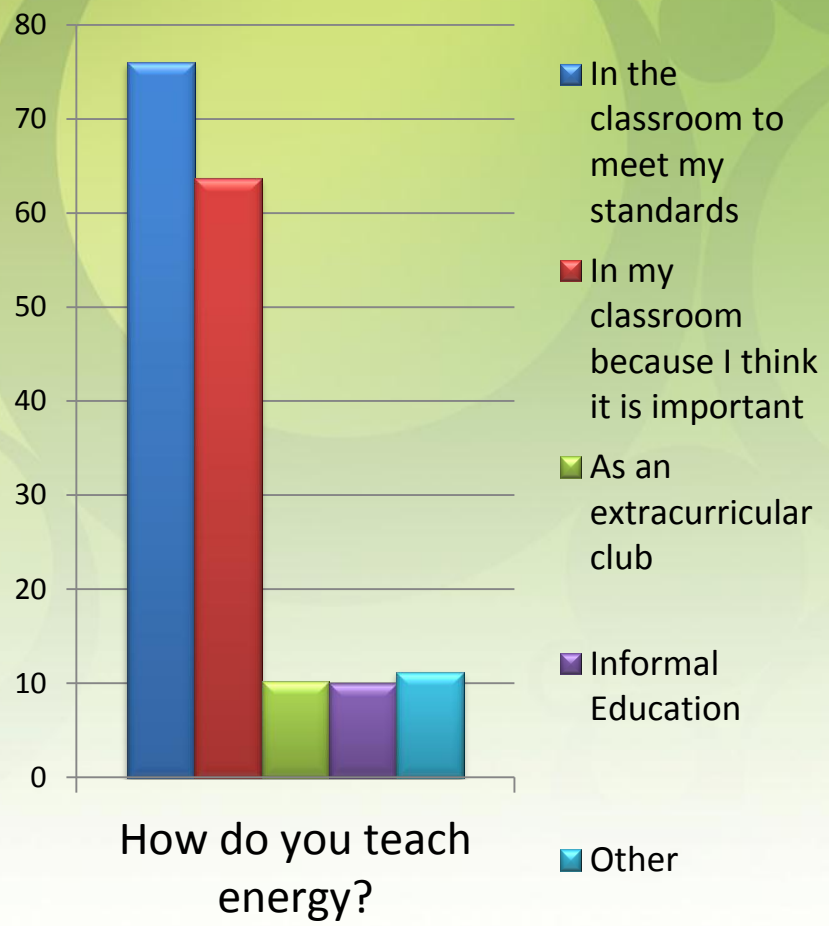
Goals and Philosophy

NEED exists to:

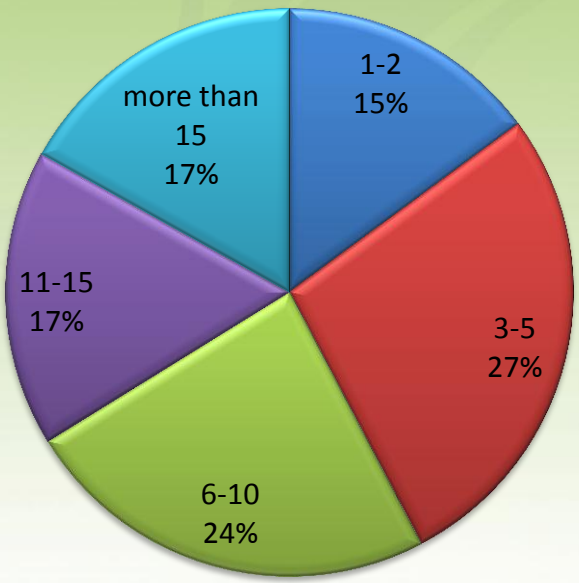
- prepare future leaders
- train teachers to teach energy from a balanced perspective
- reach parents and community decision makers through energy outreach and education.

Materials are updated annually and reviewed by NEED's Teacher Advisory Board and an Energy Advisory Board in an effort to remain current – in both education philosophy and energy technologies and issues.

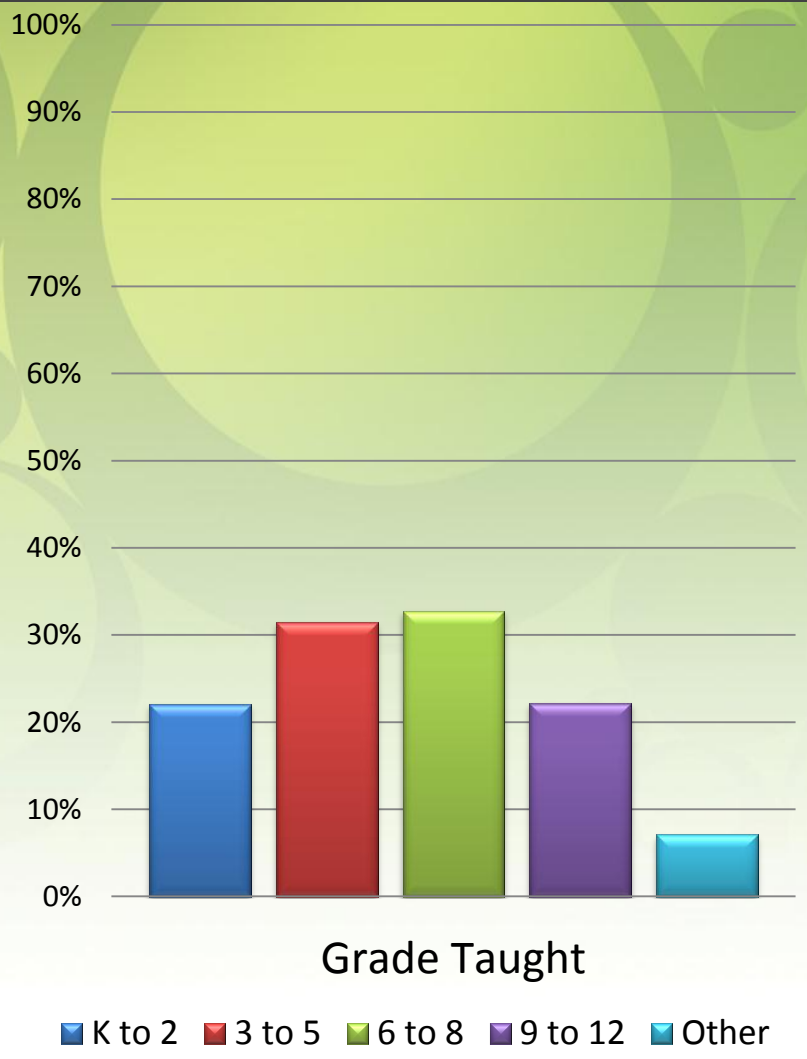
How Energy is Taught

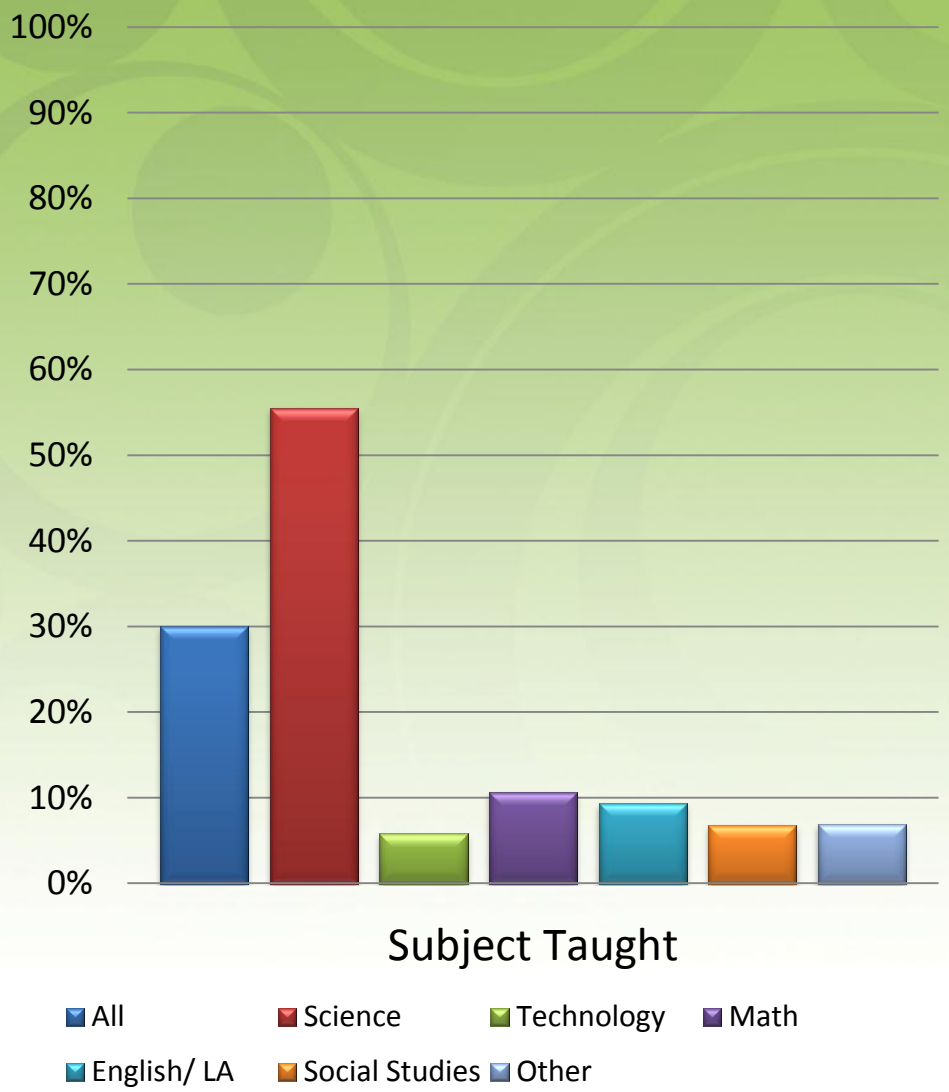


How many class periods do you focus, or plan to focus, on energy this school year?



Grade & Subject



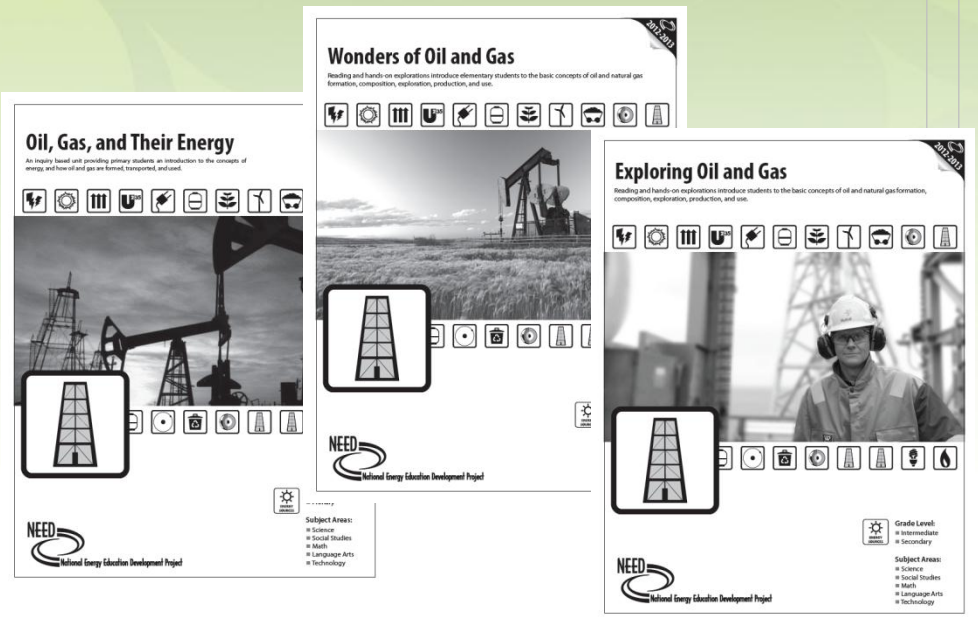


- Science of Energy
- Sources of Energy
- Electricity
- Transportation Options
- Efficiency & Conservation
- Career & Technical Education

NEED Curriculum and Materials

NEED Oil and Gas curriculum

- Oil, Gas, and Their Energy (grades K-2)
- Wonders of Oil and Gas (grades 3-5)
- Exploring Oil and Natural Gas (grades 6-12)



Activities Include

- Where is the Oil and Gas?
- Illustrating Stories
- Formation of Petroleum and Natural Gas
- Exploring Core Sampling
- Exploring Density
- Exploring Porosity
- Exploring Polarity
- Drilling for Oil in the Ocean
- Mapping the Ocean Floor
- Perforated Well Casing
- Visualizing Hydraulic Fracturing
- Fracking with Jello
- Fracking a Cake
- Using Density to Extract Petroleum
- Polymers
- Hydrocarbon Properties
- I'm Made from Oil and Gas
- Oil and Gas Career Game
- Peak Oil Game

MICHIGAN
M
CAROLINA

Incorporating Language Arts

- Nonfiction reading and career interviews for older students
- Fiction and nonfiction reading for younger students
- Bibliography of current press publications related to energy

Have the students read the background information on light in the EnergyWorks Student Guide.

Have the students conduct the experiments you have chosen for light.

Have the students read the myth of Narcissus and write a paragraph about how the myth tries to explain a natural phenomena pertaining to light.

Have the students make a time line of the ways people have used and produced light over the years.

KWL What have you learned about light?

Lesson 4: Heat - Prometheus (giver of fire)
KWL What do you know about heat?
KWL What do you want to know about heat?

Have the students read the background information on heat in the EnergyWorks Student Guide.

Greek Mythology and the Forms of Energy

developed by

Donna Quillen
Prospect Elementary School
Monroe, NC

Background:
Greek Mythology is a wonderful literary vehicle with which
ergy. The ancient Greeks did not have the scientific tools w
natural phenomena affecting them, so they used myths to
world.

Objective:
To integrate literature and science and capture student int
logical explanations for phenomena we recognize as forms

Materials:
NEED EnergyWorks Kit (or Teacher and Student Guides witl
rials to demonstrate the forms of energy)

Greek mythology materials from the NEED website and the

Lessons:

Lesson 1: Meet the Gods & Introduction to the Form
Lesson 2: Sound - Echo
Lesson 3: Light - Narcissus (reflection)
Lesson 4: Heat - Prometheus (fire)
Lesson 5: Growth - Demeter and Persephone
Lesson 6: Electricity - Zeus
Lesson 7: Motion - Hermes
Lesson 8: Review

Reinforcement Activities: Nine Kinds of Smart

Using and Saving Energy in the House System

Building Envelope
The transfer of heat, air, and moisture into and out of the home is largely governed by the building envelope, which is made up of all the components that separate the inside of the home from outdoors. Siding, windows, doors, and roofs have an important role to play, as does how tightly the various parts of the building are sealed to one another.

- **Insulation**
Insulation in the walls and attics plays a very important role in controlling heat transfer. Insulation is effective because it contains many, tiny air pockets. When heat has to move through trapped air it is slowed down because air does not conduct heat very well compared to most materials. This is because air molecules are farther apart from one another than the molecules in solids or liquids. Materials used for insulation are effective because they create these air pockets. Most types of insulation only slow heat transfer via conduction. In these materials, heat can still transfer through via convection.

The type of insulation used is determined by both where it will be used and how much it costs. There are many types of insulation used in buildings today.

- Cellulose is made from ground up newspaper that is treated with a flame retardant to minimize risk from fire. It comes in large bales and is installed using a machine that blows the insulation through a hose.

  It is common to see this type of insulation in attics as loose fill. It is also used to insulate walls in homes that have no insulation in these locations. In walls, cellulose is packed tightly enough into the cavity that it also stops air movement preventing heat transfer via convection.
- Fiberglass insulation is made of tiny threads of glass that are meshed together. Fiberglass insulation is most used in long rolls called batts. Sometimes there is a paper or foil facing on one or both sides of the roll. The rolls are sized so that batts fit snugly between the rafters or wall studs of most homes. Some forms of fiberglass insulation can also be blown into an attic or a wall just like cellulose.
- Foam insulation comes in many forms. Some foam insulation comes as a liquid and is blown like cellulose. However, it can't be used in enclosed walls the way cellulose and fiberglass can. Other types of foam insulation are provided as solid boards. These are useful for attaching to walls and ceilings. Some types of foam insulation can stop air movement, preventing heat transfer via

CELLULOSE INSULATION

Image courtesy of Community Services Consortium

FIBERGLASS INSULATION

Image courtesy of Owens Corning

Insulation R-Value

Insulation	R-Value Per Inch of	Typical Applications
		Attic Floor
		Walls, Enclosed Cavities, Framing Transitions
		Basement Ceiling, Open Stud Walls, Attic Floor
		Foundation Walls, Attic Access Doors

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ENERGY DICTIONARY

Image courtesy Louisiana Department of Transportation

PILE DRIVER

If the first thing that comes to mind when you hear "pile driving" is a wrestling move, you are not alone. Pile driving is the process of driving large support columns or beams into the ground to support large structures. Stadiums, bridges, parking garages, office tower foundations, wind turbines, cooling towers for power plants, oil rigs, gas pipelines and countless other large structures have to be supported by steel or concrete. This is where pile drivers come into play. As Dave Borrus, a business agent for pile drivers and Divers Local 56, the marine construction division of the New England Carpenters union in Boston, MA says, "Our best work gets covered up."

A pile driver is a person of numerous trades. Welding, rigging, diving, precision cutting, measuring, and pouring concrete are just a few of the many skills that are required. Some of the time these skills are done underwater in limited visibility, and most of the time in muddy, most unfavorable conditions. For the past ten years Dave has been one of the managers of the trade union. This requires him to work with a collective bargaining agreement between independent contractors and the skilled tradesmen who perform the work. He essentially finds tradesmen with the skill set best suited for the contractor's needs. With close to 325 tradesmen and 25 contractors part of the Local 56, Dave makes sure each worker is qualified, capable, and receives a fair wage for their work. Dave's favorite part of his job is finding someone a job and moving production forward. He has helped workers find close to 70,000 hours of work in the energy sector over the past 4-5 years.

Keeping up with technology in the industry is one of the largest obstacles that Dave faces. "If you can stay ahead of technology and know how to use it, you can gain a lot of jobs." Through grants and other funding Dave is able to keep the tradesman up-to-date and qualified to perform these jobs. Pile Drivers Local 56 will train qualified persons to become pile drivers through the Carpenters Union, specifically focusing on skills like precision cutting, welding, and rigging. Apprenticeships lasting three to four years are available to nearly anyone over the age of 18 that applies. Of course, any previous skills or training helps significantly. The types of knowledge and training most helpful are welding skills, carpentry skills, various aquatic or boating experience, metal working, commercial fishing, and technical programs available at the high school level. These will all contribute toward a good pre-apprenticeship background.

There are apprenticeship programs available in the Midwest, New England, Seattle, Pennsylvania, San Francisco, and Los Angeles. With a large market share in the Northeast, Dave has seen some of the highest wages for first year apprentices. Many begin making $22 per hour and also receive a generous benefit package that is worth an additional $27 per hour. A fully fledged Journeyman can make approximately $36 per hour, before the benefits package. With that being said, work for these skilled people can be scarce at times. Work may consist of three weeks straight, off for three weeks, or work for three months, and off for three months. This is where Dave comes in. He finds work for these tradesman and contractors. It may take up to two years to break into the industry and get around 2,000 hours a year, so many of these apprentices and tradesman work other jobs while they are breaking into the industry. While the wage is very attractive, the work is almost the complete opposite. Working in the most unfavorable conditions is a staple of the job, whether it is muddy and wet, cold or hot, this is not a job for those who like to stay clean.

Dave has worked in the commercial diving industry for close to 30 years and has held numerous skilled positions. He has worked in agriculture, welding, construction, marine biology, and even the oil business in many different places around the world.

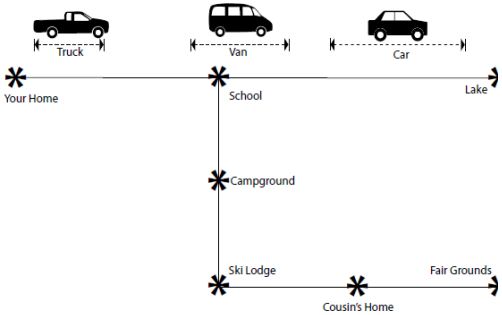
4 | CAREER CURRENTS FEBRUARY/MARCH 2012

Incorporating Math

- Basic math skills continue to be an important attribute for employers at all levels of employment and skill level.
- Math activities begin at the primary level and continue through high school
- Activities include real world data and current figures

Problem 4: All Around the County

Below is a map of your county and three vehicles that can travel the distance shown o
gallon of gas.



1. How many gallons of gas will the truck use to go from the school to the ski lodge?
2. How many gallons of gas will the car use to go from the ski lodge to your home?
3. How many gallons of gas will the van use to go from your home to the campground?
4. Can a truck go from your home to your cousin's home on six gallons of gas?
5. How m back to

BONUS: Ho

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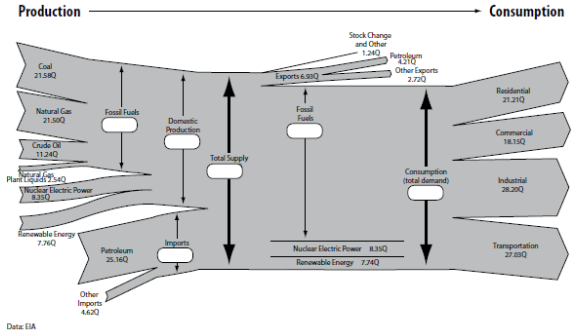
U.S. Energy Flow, 2009

1. Fill in the blank boxes on the 2009 Energy Flow diagram.
2. Draw and label a pie chart of 2009 Domestic Energy Production by Source.
3. Draw and label a pie chart of 2009 Energy Consumption by Sector of the Economy.



2009 Domestic Energy Production by Source

2009 Energy Consumption by Sector of the Economy

ing Hydroelectricity

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Plug Load Spreadsheets

In addition to the School Plug Load Model and Phantom Load Excel worksheets, two additional spreadsheets calculating savings area also available. Download the spreadsheets online at **www.NEED.org/curriculum-guides.**

Plug Load Savings Model

Average Electricity Cost= $ 0.10 per kWh Average CO2 Emitted per kWh= 1.6 lbs

1	2	3	4	5	6	7	8	9	10	11	Savings Analysis						
Equipment	Quantity In Use[1]	Typical Use, Hours/Day	Wattage	Cycle Time[2]	Monthly kWh	Months/ Year	Yearly kWh	Annual Cost Each	Total Annual Cost	Annual CO2 Emissions (lbs)	Existing Yearly kWh	kWh Savings	Existing Annual Cost	$$ Savings	Existing CO2	CO2 Savings	Action Taken to Achieve Savings
Coffee Maker	25	3	900	33%	440	9	4,010	$16.04	$401	6,415	4,010	-	$401	$0	6,415	0	
Computer/Monitor	182	7	125	100%	3,185	9	28,665	$15.75	$2,867	45,864	28,665	-	$2,867	$0	45,864	0	
Fan	10	3	115	100%	69	9	621	$6.21	$62	994	621	-	$62	$0	994	0	
Desk Lamp	30	5	75	100%	225	9	2,025	$6.75	$203	3,240	2,025	-	$203	$0	3,240	0	
Microwave	15	0.5	1000	100%	150	9	1,350	$9.00	$135	2,160	1,350	-	$135	$0	2,160	0	
Tabletop Fridge (<2.5 cu.ft.)	5	24	100	33%	120	9	1,083	$21.67	$108	1,734	1,083	-	$108	$0	1,734	0	
Small Fridge (2.5-6.4 cu.ft.)	20	24	125	33%	602	9	5,417	$27.09	$542	8,668	5,417	-	$542	$0	8,668	0	
Television	25	1	80	100%	40	9	360	$1.44	$36	576	360	-	$36	$0	576	0	
VCR	25	1	40	100%	20	9	180	$0.72	$18	288	180	-	$18	$0	288	0	
Space Heater	20	7	1500	20%	840	4	3,360	$16.80	$336	5,376	3,360	-	$336	$0	5,376	0	
Window AC (9,000 Btu/hr)	3	8	1000	50%	240	4	960	$32.00	$96	1,536	960	-	$96	$0	1,536	0	
Window AC (12,000 Btu/hr)	3	8	1300	50%	312	4	1,248	$41.60	$125	1,997	1,248	-	$125	$0	1,997	0	
Cold Drink Vending Machine	6	24	800	50%	1,751	12	21,012	$350.21	$2,101	33,620	21,012	-	$2,101	$0	33,620	0	
Other?	0	0	0	0%	-							-	$0	$0	0	0	
TOTAL					8,000		70,292		$7,029	112,467	70,292	0	7,029	0	112,467	0	

Notes:
1. Quantities shown are for a typical, 25-classroom, 100,000 sq.ft., K-12 school.
2. Amount of time the appliance actually runs (ex. a coffee maker burner is only on ~33% of the time).
3. If necessary, change input in yellow for equipment you are analyzing. You can change other numbers if needed.

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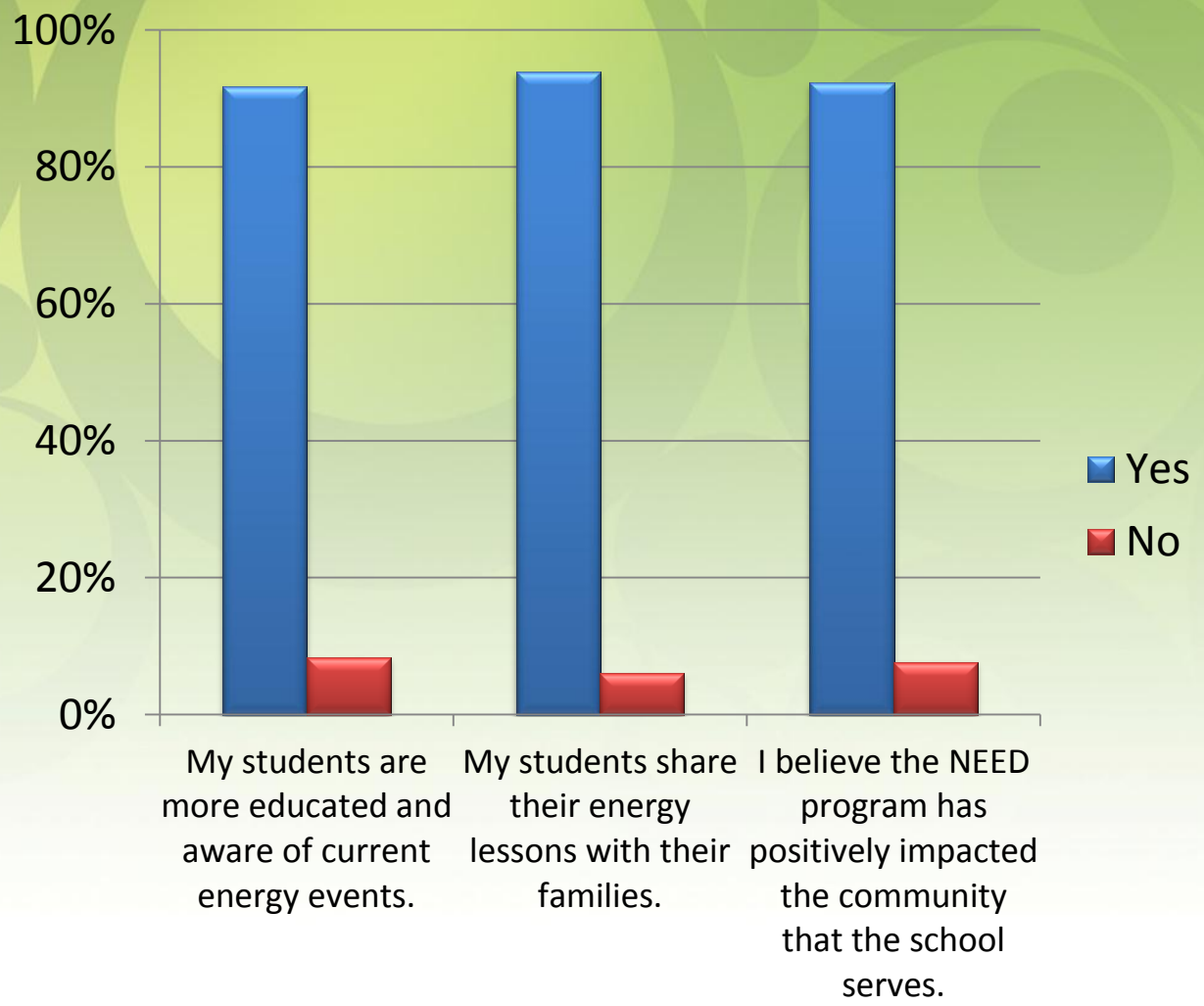
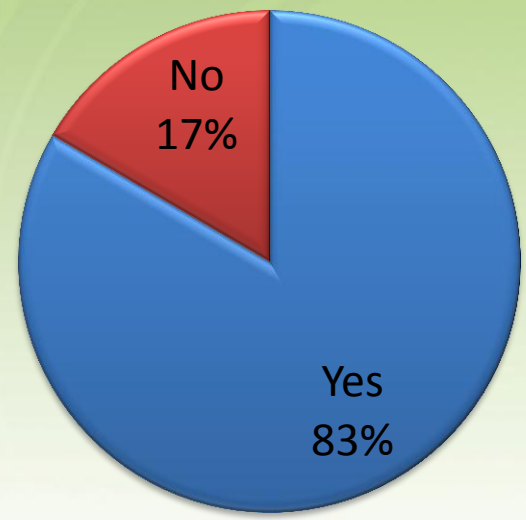
Evaluation and Curriculum Connections

- All NEED activities are correlated to the National Science Education Standards and state science standards, common core standards in math and language arts. Soon: Next Generation Science Standards.

NEED students and the community



Do the materials help students succeed on state testing?



NEED offers a variety of training opportunities for teacher and students.

During the school year, training programs are offered for teachers, students, and the community. Professional development or graduate credit can be earned.

NEED is also working to create materials for teachers to use as they discuss energy careers with their students.

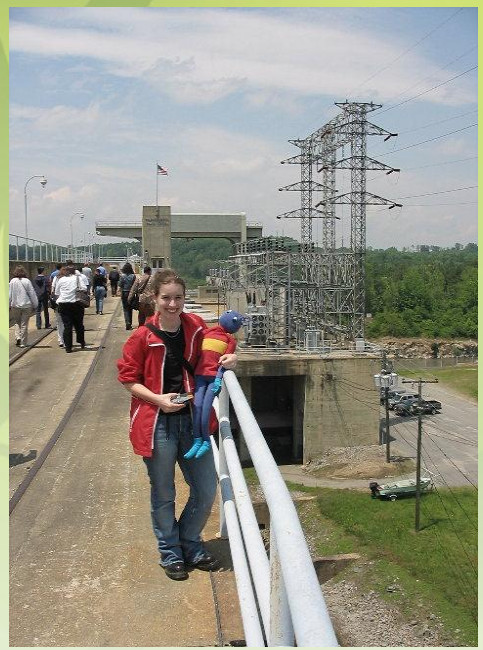
Training and Professional Development

Teacher Networking and Support

- NEED provides a support system for educators, helping them plan individual energy units, connecting them with each other and with resources in their area.

- The **NEED Network** connects educators, students, directors, coordinators, sponsors and community partners.

Students and Teachers Learn By Doing



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