

Performance Expectations		F	W	AM	AN	AQ	AR	AT
Energy								
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.								
Practices								
Planning and Carrying Out Investigations								
Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.								
Disciplinary Core Practices								
Crosscutting Concepts								
Science Practices								
Informational Text Activities								
On Contract								



NGSS AND NEED



TEACHER INFORMATION

The Next Generation Science Standards (NGSS) can be daunting. As educators, we're accustomed to seeing curriculum standards as single statements dictating information a student is expected to know upon completing a lesson, class, or grade. Looking at a page of NGSS expectations can be confusing unless you understand how everything on that page is designed to work together. This guide is designed to help you design an energy unit under the framework of the NGSS energy related standards.

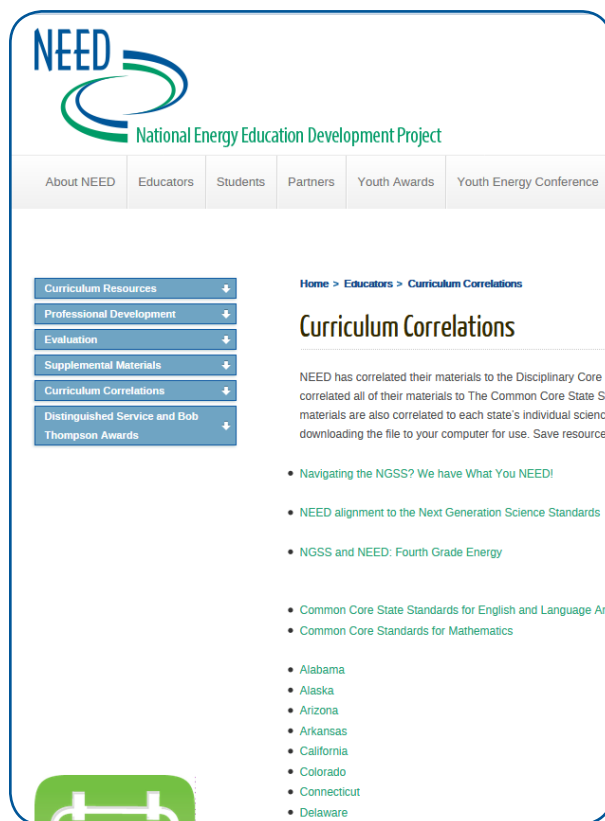
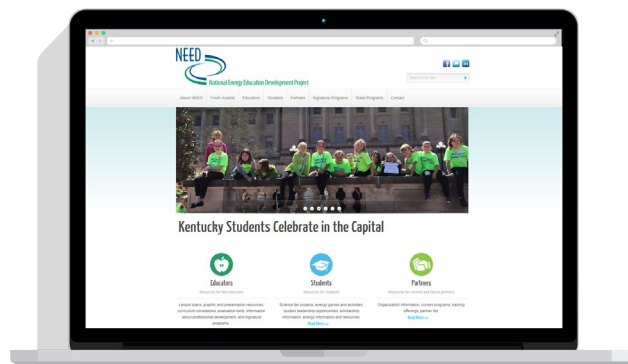
Before you begin, you may want to make multiple copies of the worksheet before writing on it. Additionally, you can obtain a pdf of this entire guide by navigating to <http://www.need.org/curriculumcorrelations>.

To complete these exercises, you will need:

- this sampler guide;
- a computer with internet access;
- scrap paper or a printer; and
- patience.

The amount of time you will need depends heavily on the familiarity you have with the NGSS and NEED curriculum guides. One of the most important guidelines is to be patient with yourself. As the information comes together, you will see how all of the parts of one NGSS page are designed to fit together. After completing everything in this guide, you will be able to apply the principles to all the NGSS expectations you are required to teach, and you will be able to apply the concepts to other curriculum materials outside of energy education.

Ok. Here we go!





PART 1 – GET THE STANDARD

They say the best place to start is the beginning, so let's begin by obtaining the standards themselves.

1. Access the NGSS by navigating to <http://www.nextgenscience.org/>.
2. Choose "Search the Standards."
3. For simplicity, choose one grade level you teach, and click "submit."

NGSS Search the Standards

KEYWORD SEARCH

DISPLAY ONLY SELECT THE APPROPRIATE CHECKBOX(ES) TO RESTRICT RESULTS.
☐ DCI ARRANGEMENTS ☐ TOPIC ARRANGEMENTS ☐ PERFORMANCE EXPECTATIONS

FILTER BY

GRADE
4

PRACTICE
Select

DISCIPLINARY CORE IDEA
Select

DISCIPLINE
Select

CROSSCUTTING CONCEPT
Select

SUBMIT

RESET

SEE ALL STANDARDS
ARRANGED BY DCI

DOWNLOAD A PDF OF DCI
ARRANGEMENTS (4 MB)

SEE ALL STANDARDS
ARRANGED BY TOPIC

DOWNLOAD A PDF OF TOPIC

4. Your results will return as a list of Performance Expectations. Choose the first one for your grade level that focuses on energy, and click on the number.
5. You will see a page with the Performance Expectation (PE) at the top in a white box. There may be a red, italicized clarification statement and/or assessment boundary. Beneath the Performance Expectation is a blue Science and Engineering Practices (SEP) box, an orange Disciplinary Core Ideas (DCI) box, and a green Cross-Cutting Concepts (CCC) box. You will build a lesson surrounding the contents of these three boxes.

4-PS3-2 Energy

Students who demonstrate understanding can:

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. *[Assessment Boundary: Assessment does not include quantitative measurements of energy.]*

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects.

Viewing Options

- Hide Popup
- Black and White
- Practices and Core Ideas
- Practices and Crosscutting Concepts

Use browser zoom to increase text size (ctrl + on PC, command + on Mac)

Related Evidence Statements

6. At this point, it may be helpful to bookmark this page, or print it, so you can go back to it as needed.
7. Write the Performance Expectation in the space provided on the worksheet on page 8. Abbreviate as much as desired. Do the same with the SEP, DCI, and CCC statements, writing in shorthand, abbreviations, or other notation you can understand.



4. Across the top of the spreadsheet, the Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Cross-Cutting Concepts, have been listed. Scroll to the left or right to locate the correct standards or expectations. The SEPs, DCIs, and CCCs in the spreadsheet have been color coded to match the NGSS labeling. Row headings down the left side are the titles of the NEED curriculum guides pertinent to that grade level. In some cases, the activities in each title are itemized, or the activities and student text are separated.

[illegible]



1. Using the single Performance Expectation page obtained in Part 1, find the Performance Expectation, Science and Engineering Practices, Disciplinary Core Ideas, and Cross-Cutting Concepts that are listed together on the NGSS correlations spreadsheet. Write the column letters in the appropriate space on the worksheet (see pages 8-9).
2. "Hide" all of the columns you do not need. For example, if you only need column H, hide columns C-G, keeping column A visible with the curriculum guide titles. Left-click and hold down the mouse button while sliding over the column letters at the top for the columns you don't need. The unnecessary columns will be shaded.
3. Pointing with your mouse to any of the columns that are selected, right-click and choose "hide." You can also choose "hide" from the View menu at the top of Excel.
4. The spreadsheet will condense, removing from view the columns you do not need.
5. Repeat steps 2 and 3 to hide all the other unnecessary columns on the spreadsheet. You should only have approximately 4 to 12 columns of statements showing (not counting headings), pertaining to the exact PE, SEP, DCI, and CCC statements you need.

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PART 4 – IDENTIFY THE NEED CURRICULUM GUIDES THAT MEET YOUR CLASSROOM GOALS

All NEED teachers would probably like to teach everything that NEED offers, but that just is not practical. This step helps you determine which NEED units are most closely correlated to the statements in the NGSS you need to teach. Keep in mind, if you have a favorite NEED guide that gets excluded during this process, you should aim to include it where time allows. The best teachers are those who are enthusiastic about what they teach. Even if your favorites are not a direct match for the standards you are building lessons around, you can be creative in bringing those favorites into your lesson and still make them meaningful while teaching the content you need to teach.

1. NEED curriculum guides are correlated to educational standards using a two-dot system in the correlations spreadsheet. Solid dots (●) in a cell indicate that the curriculum guide (or parts of a guide) from the left will be sufficient for a teacher to teach the listed statement at the top of the column. Hollow dots (○) indicate books or parts of books that are excellent choices for supplemental materials, but do not carry the statement on their own.
2. Find curriculum guides with a large number of solid dots underneath your SEP, DCI, or CCC statements. Note: It is not necessary for one book to have solid dots for all of these statements. It is only necessary for a curriculum guide to have solid dots for some, or even one, of them.
3. Curriculum guides with more solid dots will provide the most direct correlation and therefore the most thorough content coverage for the lesson you are building. List the curriculum guides that best meet the standard statements in the space provided on the worksheet.
4. Make sure every SEP, DCI, and CCC statement has at least one curriculum guide, or activity from a guide, listed beneath it.
5. The guides listed most often will be the core of the material you will use to teach your students to meet that Performance Expectation. In other words, if you use the most often listed books to teach the things in the SEP, DCI, and CCC statements, your students will be well-equipped to do the thing(s) listed in the PE.





PART 5 — WRAP IT UP AND GET ENERGIZED!

At this point, a core of 2 or 3 curriculum guides should have stuck out on your list. These NEED materials will provide the best fit for you to teach your energy NGSS. Keep in mind that many of the NEED curriculum guides can also be used to support non-energy NGSS. These items can be determined using the same process.

1. Open your computer's browser, and navigate to www.need.org/curriculum.
2. Use the graphic icons, or the menu list on the left, to go to the page of curriculum with the book(s) desired. For example, if you would like to open *EnergyWorks*, click on "Science of Energy". If you want to look at *Exploring Oil and Natural Gas*, click on "Petroleum."
3. Each title has three important parts. The title itself is a link to the PDF of the guide. There is a short description, and then at the end of the description are links to any supplemental materials that might be useful.
4. Click the title of the book you want to open. We recommend you begin with the Teacher Guide if the title is in two parts, but have the Student Guide readily available for cross-referencing.
5. Use the Teacher Guide to determine how much time you will need to adequately teach the contents of the book or to select the activities you will use. You can also use this part of the guide to help you determine your daily lesson plan as you teach the lesson beginning-to-end. Pages 10-11 include a space for you to develop your plan. Before you write on it, you may want to make copies for other lessons you develop.
6. Lastly, we don't want you to feel as though you cannot use other things you have acquired along the way with NEED curriculum guides. If you have an activity you already use from your own library that works really well with one of our activities, by all means use it! And, if you feel as though other teachers would like it, send that activity to us! We love to get feedback and suggestions from the teachers who use our materials.

The screenshot shows the NEED.org curriculum page. On the left is a vertical menu with categories like Progress, Solar, Uranium, Wind, Science of Energy, Electricity, Transportation, Energy Efficiency & Energy Management, Climate Change, Energy in Society, Science, Language Arts, Math, Social Studies, Technology, Careers, Creative Arts, Public Speaking, and After-school Program. Below this are expandable sections for Professional Development, Evaluation, Supplemental Materials, Curriculum Correlations, and Distinguished Service and Bob Thompson Awards. The main content area is titled 'Curriculum by Grade Level' and features four circular icons for Primary (Pri), Elementary (Elem), Intermediate (Int), and Secondary (Sec). Below this is 'Curriculum by Topic' with eight square icons representing Energy Sources, Science of Energy, Biomass, Coal, Geothermal, Hydropower, Natural Gas, and Petroleum.

This section displays three specific curriculum materials. 'Energy Enigma (e-publication)' is described as a detective-themed activity where students use research clues to uncover energy facts. It includes icons for Intermediate and Secondary levels, a magnifying glass, a book, a puzzle, and a 'NEW!' badge. 'Energy Expos and Exhibit Question Sheets (e-publication)' are for group work on developing hands-on exhibits. It includes icons for Elementary, Intermediate, and Secondary levels, a magnifying glass, a book, a puzzle, a person at a computer, and a person at a podium. 'Energy Games and Icebreakers (e-publication)' offers entertaining activities to introduce energy concepts. It includes a 'NEW!' badge and icons for a magnifying glass, a book, a puzzle, a person at a computer, and a person at a podium.

**Some Final Thoughts

Some of you may find that having all of the energy PE statements and their supporting three strands of SEP, DCI, and CCC statements on one spreadsheet is the best route for planning an energy lesson. That is fine, but remember that you will not be able to distinguish which of the three strands is meant to direct toward a specific PE. In other words, it will look as though your lesson has to do all of the SEPs, DCIs, and CCCs in one. It might be easier to stick to one PE and its supporting statements at a time, unless you're very familiar with the NGSS and can tackle the whole thing at once.

High school teachers may find they need to be a little more picky and choose more specifically which curriculum guides, or parts of guides, they need to use in their content area classes. Many of our high school teachers use NEED materials this way, with the possible exception of Environmental Science teachers. Our energy source and climate change curriculum guides work very well to support Environmental Science content.

Lastly, if you run into any difficulty, or if you require further assistance, send an email to info@need.org. We will help to provide you more insight.

Happy planning!



WORKSHEET

Performance Expectation:				
	Science and Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts	
NGSS Statements:				
NEED Curriculum Correlations File – column letters	PE	SEP	DCI	CCC
NEED Curriculum Guides that are closely correlated to these statements:				
NEED Curriculum Guides listed most often above:				
Other favorite NEED activities not listed:				
Think: How can your favorite NEED activities fit into teaching this particular standard?				



WORKSHEET EXAMPLE

Performance Expectation:	4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [Assessment Boundary: Assessment does not include quantitative measurements of energy.]			
	Science and Engineering Practices		Disciplinary Core Ideas	Cross-Cutting Concepts
NGSS Statements:	Planning and Carrying Out Investigations: Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.		Definitions of Energy: Energy can be moved from place to place by moving objects or through sound, light, or electric currents Conservation of Energy and Energy Transfer: ▪Energy present whenever moving objects, sound, light, or heat. When objects collide, energy transferred one object to another, changing their motion. In collisions, some energy also transferred to air; air gets heated and sound is produced. ▪Light also transfers energy from place to place. ▪Energy can also be transferred from place to place by electric currents, which can be used to produce motion, sound, heat, or light. The currents may be produced by transforming motion into electrical energy.	Energy and Matter: Energy can be transferred in various ways and between objects.
NEED Curriculum Correlations File – column letters	PE F	SEP AN	DCI AT, AV, AW, AX	CCC CH
NEED Curriculum Guides that are closely correlated to these statements:	All About Coal – Activities ElectroWorks – Activities Elementary Science of Energy EnergyWorks Wonders of Magnets Wonders of Oil and Natural Gas – Activities Wonders of the Sun – Activities Wonders of Water – Activities Wonders of the Wind – Blade Activities Wonders of the Wind – Blade Activities		ElectroWorks – Activities Elementary Energy Infobook Elementary Science of Energy Elementary Transportation Fuels Infobook Energy Expos EnergyWorks Hybrid Buses – Activities Monitoring and Mentoring – Activities (all) Wonders of Oil and Natural Gas – Activities Wonders of the Sun – Activities Wonders of the Wind – Activities Wonders of Water – Activities	All About Coal Activities ElectroWorks Activities Elementary Energy Infobook Elementary Science of Energy Elementary Transportation Fuels Infobook Energy Expos EnergyWorks Hybrid Buses Activities Monitoring and Mentoring – Activities (all) Wonders of Oil and Natural Gas – Activities Wonders of the Sun – Activities Wonders of Water – Activities Wonders of the Wind – Activities
NEED Curriculum Guides listed most often above:	Elementary Science of Energy EnergyWorks Wonders of Oil and Natural Gas		Wonders of the Sun Wonders of Water Wonders of the Wind	
Other favorite NEED activities not listed:	Digital Energy Energy Carnival			
Think: How can your favorite NEED activities fit into teaching this particular standard?	Digital Energy – can pull topics that pertain specifically to energy transfer or an energy source and how it transfers energy, to reinforce that topic Energy Carnival – can re-write games to focus specifically on how energy is transferred or transformed			



ENERGY UNIT PLANNING GUIDE

Grade / Class:			
Learning Targets or Objectives			
Standard(s) Being Taught:			
Start Date:		Number of Days:	
NEED Curriculum Guides Being Used:			
Supplies Already On-Hand:			
Supplies to Acquire:			
Check when:	<input type="checkbox"/> Curriculum Guides Downloaded	<input type="checkbox"/> All Supplies Gathered	

Daily Schedule				
Monday	Tuesday	Wednesday	Thursday	Friday



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Chugach Electric Association, Inc.	Mojave Unified School District	C.T. Seaver Trust
CITGO	Montana Energy Education Council	Secure Futures, LLC
Clean Energy Collective	The Mountain Institute	Shell
Colonial Pipeline	National Fuel	Shell Chemicals
Columbia Gas of Massachusetts	National Grid	Sigora Solar
ComEd	National Hydropower Association	Singapore Ministry of Education
ConEdison Solutions	National Ocean Industries Association	Society of Petroleum Engineers
ConocoPhillips	National Renewable Energy Laboratory	Society of Petroleum Engineers – Middle East, North Africa and South Asia
Constellation	NC Green Power	Solar City
Cuesta College	New Mexico Oil Corporation	David Sorenson
David Petroleum Corporation	New Mexico Landman’s Association	South Orange County Community College District
Desk and Derrick of Roswell, NM	NextEra Energy Resources	Tennessee Department of Economic and Community Development–Energy Division
Direct Energy	NEXTracker	Tesla
Dominion Energy	Nicor Gas	Tesoro Foundation
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Exelon Foundation	Offshore Technology Conference	University of Tennessee
Foundation for Environmental Education	Ohio Energy Project	U.S. Department of Energy
FPL	Opterra Energy	U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy
The Franklin Institute	Pacific Gas and Electric Company	U.S. Department of Energy–Wind for Schools
George Mason University – Environmental Science and Policy	PECO	U.S. Energy Information Administration
Gerald Harrington, Geologist	Pecos Valley Energy Committee	United States Virgin Islands Energy Office
Government of Thailand–Energy Ministry	Peoples Gas	Wayne County Sustainable Energy
Green Power EMC	Pepco	Western Massachusetts Electric Company
Guilford County Schools – North Carolina	Performance Services, Inc.	Yates Petroleum Corporation
Gulf Power	Petroleum Equipment and Services Association	
Hawaii Energy		
Idaho National Laboratory		
Illinois Clean Energy Community Foundation		