Project GLAD
New Mexico Unit
Energy: Forms, Transfer and Economics
by Darla Boswell and Margaret Wattman-Turner
(Level 4)

Adjusted to fit New Mexico standards
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(Incoporates SRA Imagine It Grade 4, Unit 4)

IDEA PAGES

I UNIT THEME

- Energy is all around us and is involved in everything we do.
- Our needs and wants influence our use of energy and the type of energy we use.
- Individual and national choices impact our natural resources and environment.
- Some sources of energy are limited so we need to use them wisely.
- Energy use and availability varies in different cultures and countries. (Cross-cultural sensitivity theme)
- International supply, demand and trade impact the use of the world's Energy.

II FOCUS/MOTIVATION

- Literacy Awards
- Big Book
- Super Scientist (Physicist) awards
- Poems, chants, raps
- Observation Charts
- Inquiry Chart
- Picture Files
- Exploration Stations (Experiments)

III CLOSURE/ ASSESSMENT

- Process all charts, especially inquiry
- Energy Convention
- Class Energy Conservation Newsletter and Student Big Book
- Student or Teacher Generated Test
- Personal exploration with rubric
- Action Plan
- Expository, narrative and poetry piece of writing
- Graffiti Wall
- Student Portfolio
- Class exposition to parents or younger class

IV NM SCIENCE and SOCIAL SCIENCE STANDARDS

Science

Strand I Standard I Benchmark 1

2. Differentiate observation from interpretation and understand that a scientific explanation comes in part from what is observed and in part from how observation is interpreted.

Strand I Standard I Benchmark II

1. Communicate ideas and present findings about scientific investigations that are open to critique from others.
2. Describe how scientific investigations may differ from one another (e.g., observations of nature, measurements of things changing over time).
3. Understand how data are used to explain how a simple system functions (e.g., a thermometer to measure heat loss as water cools).

Strand II Standard I Benchmark II

1. Identify the characteristics of several different forms of energy and describe how energy can be converted from one form to another (e.g., light to heat, motion to heat, electricity to heat, light, or motion).
2. Recognize that energy can be stored in many ways (e.g., potential energy in gravity or springs, chemical energy in batteries).
3. Describe how some waves move through materials (e.g., water, sound) and how others can move through a vacuum (e.g., x-ray, television, radio).
4. Demonstrate how electricity flows through a simple circuit (e.g., by constructing one).

Strand II Standard I Benchmark III

1. Know that energy can be carried from one place to another by waves (e.g., water waves, sound waves), by electric currents, and by moving objects.
2. Describe the motion of an object by measuring its change of position over a period of time.
3. Describe that gravity exerts more force on objects with greater mass (e.g., it takes more force to hold up a heavy object than a lighter one).
4. Describe how some forces act on contact and other forces act at a distance (e.g., a person pushing a rock versus gravity acting on a rock).

Strand III Standard I Benchmark I

1. Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.
4. Know that both men and women of all races and social backgrounds choose science as a career.

Social Studies

II C 2 Describe how environments, both natural and man-made, have influenced people and events over time, and describe how places change.
II C 2.3Understand how visual data (e.g., maps, graphs, diagrams, tables, charts) organizes and presents geographic information.
II F 1 Identify the distributions of natural and man-made resources in New Mexico, the Southwest, and the United States.
III D 1 Explain the difference between rights and responsibilities, why we have rules and laws, and the role of citizenship in promoting them.
III D 2 Examine issues of human rights.
IV A 1 Understand when choices are made that those choices impose "opportunity costs."
IV A 3 Illustrate how resources can be used in alternative ways and, sometimes, allocated to different users.

IV A 4 Explain why there may be unequal distribution of resources (e.g., among people, communities, states, nations).
IV C 1 Identify patterns of work and economic activity in New Mexico and their sustainability over time (e.g., farming, ranching, mining, retail, transportation, manufacturing, tourism, high tech).
IV C 2 Explain how New Mexico, the United States, and other parts of the world are economically interdependent.
IV C 4 Explain that money can be used to express the "market value" of goods and services in the form of prices.
IV C 5 Use data to explain an economic pattern.

V. 4th GRADE COMMON CORE STANDARDS: ENGLISH LANGUAGE ARTS

http://www.corestandards.org

Note: The depth to which you address these standards will vary depending on your unit plan and what type of texts, writing pieces and research that you are including.

Reading: Literature

Key Ideas and Details

- RL.4.1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RL.4.2. Determine a theme of a story, drama, or poem from details in the text; summarize the text.
- RL.4.3. Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text (e.g., a character's thoughts, words, or actions).

Craft and Structure

- RL.4.4. Determine the meaning of words and phrases as they are used in a text, including those that allude to significant characters found in mythology (e.g., Herculean).
- RL.4.5. Explain major differences between poems, drama, and prose, and refer to the structural elements of poems (e.g., verse, rhythm, meter) and drama (e.g., casts of characters, settings, descriptions, dialogue, stage directions) when writing or speaking about a text.
- RL.4.6. Compare and contrast the point of view from which different stories are narrated, including the difference between first- and third-person narrations.

Integration of Knowledge and Ideas

- RL.4.7. Make connections between the text of a story or drama and a visual or oral presentation of the text, identifying where each version reflects specific descriptions and directions in the text.
- RL.4.9. Compare and contrast the treatment of similar themes and topics (e.g., opposition of good and evil) and patterns of events (e.g., the quest) in stories, myths, and traditional literature from different cultures.

Range of Reading and Complexity of Text

RL.4.10. By the end of the year, read and comprehend literature, including stories, dramas, and poetry, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Reading: Informational Text

Key Ideas and Details

- RI.4.1. Refer to details and examples in a text when explaining what the text says

explicitly and when drawing inferences from the text.
- RI.4.2. Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- RI.4.3. Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Craft and Structure
- RI.4.4. Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.
- RI.4.5. Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.
- RI.4.6. Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.

Integration of Knowledge and Ideas
- RI.4.7. Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
- RI.4.8. Explain how an author uses reasons and evidence to support particular points in a text.
- RI.4.9. Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

Reading: Foundational Skills

Range of Reading and Level of Text Complexity

RI.4.10. By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Phonics and Word Recognition
- RF.4.3. Know and apply grade-level phonics and word analysis skills in decoding words.
  Use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.

Fluency
- RF.4.4. Read with sufficient accuracy and fluency to support comprehension.
  Read grade-level text with purpose and understanding.
  Read grade-level prose and poetry orally with accuracy, appropriate rate, and expression.

Use context to confirm or self-correct word recognition and understanding, rereading as necessary.

Writing

Text Types and Purposes
- W.4.1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

Introduce a topic or text clearly, state an opinion, and create an organizational structure in which related ideas are grouped to support the writer's purpose.
Provide reasons that are supported by facts and details.
Link opinion and reasons using words and phrases (e.g., f*or instance*, *in order to*, *in addition*).
Provide a concluding statement or section related to the opinion presented.

- W.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
  Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
  Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
  Link ideas within categories of information using words and phrases (e.g., *another*, *for example*, *also*, *because*).
  Use precise language and domain-specific vocabulary to inform about or explain the topic.
  Provide a concluding statement or section related to the information or explanation presented.
- W.4.3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
  Orient the reader by establishing a situation and introducing a narrator and/or characters; organize an event sequence that unfolds naturally.
  Use dialogue and description to develop experiences and events or show the responses of characters to situations.
  Use a variety of transitional words and phrases to manage the sequence of events.
  Use concrete words and phrases and sensory details to convey experiences and events precisely.
  Provide a conclusion that follows from the narrated experiences or events.

Production and Distribution of Writing

- W.4.4. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
- W.4.5. With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.
- W.4.6. With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.

Research to Build and Present Knowledge

- W.4.7. Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- W.4.8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- W.4.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Apply *grade 4 Reading standards* to literature (e.g., "Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text [e.g., a character's thoughts, words, or actions].").

Apply *grade 4 Reading standards* to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text").

Range of Writing

W.4.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Speaking and Listening

Comprehension and Collaboration

- SL.4.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.
  - Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
  - Follow agreed-upon rules for discussions and carry out assigned roles.
  - Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
  - Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
- SL.4.2. Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL.4.3. Identify the reasons and evidence a speaker provides to support particular points.

Presentation of Knowledge and Ideas

- SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- SL.4.5. Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.
- SL.4.6. Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation.

Language

Conventions of Standard English

- L.4.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
  - Use relative pronouns (*who, whose, whom, which, that*) and relative adverbs (*where, when, why*).
  - Form and use the progressive (e.g., *I was walking; I am walking; I will be walking*) verb tenses.
  - Use modal auxiliaries (e.g., *can, may, must*) to convey various conditions.
  - Order adjectives within sentences according to conventional patterns (e.g., *a small*

red bag rather than *a red small bag*).
Form and use prepositional phrases.
Produce complete sentences, recognizing and correcting inappropriate fragments and run-ons.*
Correctly use frequently confused words (e.g., *to, too, two; there, their*).*

- L.4.2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
  Use correct capitalization.
  Use commas and quotation marks to mark direct speech and quotations from a text.
  Use a comma before a coordinating conjunction in a compound sentence.
  Spell grade-appropriate words correctly, consulting references as needed.

Knowledge of Language

- L.4.3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.
  Choose words and phrases to convey ideas precisely.*
  Choose punctuation for effect.*
  Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion).

Vocabulary Acquisition and Use

- L.4.4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.
  Use context (e.g., definitions, examples, or restatements in text) as a clue to the meaning of a word or phrase.
  Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., *telegraph, photograph, autograph*).
  Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.
- L.4.5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
  Explain the meaning of simple similes and metaphors (e.g., *as pretty as a picture*) in context.
  Recognize and explain the meaning of common idioms, adages, and proverbs.
  Demonstrate understanding of words by relating them to their opposites (antonyms) and to words with similar but not identical meanings (synonyms).
- L.4.6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., *wildlife, conservation,* and *endangered* when discussing animal preservation).

WIDA Can Do Descriptors for third-fifth grade

Supporting language learners – Below are the WIDA Can Do Descriptors. These are a wonderful tool to support the NM ELD Standards. These describe what students can do at various language levels within the different language domains **with support.**

Domain	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reading
Listening	• Point to stated pictures, words, or phrases • Follow one-step oral directions (e.g., physically or through drawings) • Identify objects, figures, people from oral statements or questions (e.g., "Which one is a rock?") • Match classroom oral language to daily routines	• Categorize content-based pictures or objects from oral descriptions • Arrange pictures or objects per oral information • Follow two-step oral directions • Draw in response to oral descriptions • Evaluate oral information (e.g., about lunch options)	• Follow multi-step oral directions • Identify illustrated main ideas from paragraph-level oral discourse • Match literal meanings of oral descriptions or oral reading to illustrations • Sequence pictures from oral stories, processes, or procedures	• Interpret oral information and apply to new situations • Identify illustrated main ideas and supporting details from oral discourse • Infer from and act on oral information • Role play the work of authors, mathematicians, scientists, historians from oral readings, videos, or multi-media	• Carry out oral instructions containing grade-level, content-based language • Construct models or use manipulatives to problemsolve based on oral discourse • Distinguish between literal and figurative language in oral discourse • Form opinions of people, places, or ideas	

Domain	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reading
	• Express basic needs or conditions • Name pre-taught objects, people, diagrams, or pictures • Recite words	• Ask simple, everyday questions (e.g., "Who is absent?") • Restate content-based facts • Describe pictures, events, objects, or people	• Answer simple content based questions • Re/tell short stories or events • Make predictions or hypotheses from discourse	• Answer opinion questions with supporting details • Discuss stories, issues, and concepts • Give content-	• Justify/defend opinions or explanations with evidence • Give content-based presentations using technical vocabulary	

"Energy: Forms, Transfer and Economics", by Darla Boswell and Margaret Wattman-Turner adapted by R. Lopez, E. Mayer and L. Meyer, GLAD Grade 4, DLeNM (July, 2013)

WIDA Can Do Descriptors for third-fifth grade
Download WIDA Can Do Descriptors at:
http://www.wida.us/standards/CAN_DOs/index.aspx

Domain	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reading
Reading	• Match icons or diagrams with words/concepts • Identify cognates from first language, as applicable • Make sound/symbol/word relations • Match illustrated words/ phrases in differing contexts (e.g., on the board, in a book)	• Identify facts and explicit messages from illustrated text • Find changes to root words in context • Identify elements of story grammar (e.g., characters, setting) • Follow visually supported written directions (e.g., "Draw a star in the sky.")	• Interpret information or data from charts and graphs • Identify main ideas and some details • Sequence events in stories or content-based processes • Use context clues and illustrations to determine meaning of words/phrases	• Classify features of various genres of text (e.g., "and they lived happily ever after"— fairy tales) • Match graphic organizers to different texts (e.g., compare/ contrast with Venn diagram) • Find details that support main ideas • Differentiate between fact and opinion in narrative and expository text	• Summarize information from multiple related sources • Answer analytical questions about grade-level text • Identify, explain, and give examples of figures of speech • Draw conclusions from explicit and implicit text at or near grade level	

Domain	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reading

Writing	• Label objects, pictures, or diagrams from word/phrase banks • Communicate ideas by drawing • Copy words, phrases, and short sentences • Answer oral questions with single words	• Make lists from labels or with peers • Complete/produce sentences from word/ phrase banks or walls • Fill in graphic organizers, charts, and tables • Make comparisons using real-life or visually supported materials	• Produce simple expository or narrative text • String related sentences together • Compare/contrast content based information • Describe events, people, processes, procedures	• Take notes using graphic organizers • Summarize content-based information • Author multiple forms of writing (e.g., expository, narrative, persuasive) from models • Explain strategies or use of information in solving problems	• Produce extended responses of original text approaching grade level • Apply content-based information to new contexts • Connect or integrate personal experiences with literature/ content • Create grade-level stories or reports	

ELD Standard 2: The Language of Language Arts, Formative Framework							
	Topic/ Strategy	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reaching
Listening	Sequence of story (e.g., narrative input chart)	Match pictures to sentence read aloud	Order pictures of related sentences read aloud that use sequential language (e.g., first, second, last; first, then next)	Sequence pictures of stories read aloud by beginning, middle and end	Match story sequence read aloud to a series of pictures	Select logical outcomes or endings to stories read aloud	
Speaking	Story elements (e.g., narrative input chart)	Name persons (characters) or settings for story from pictures and background	Describe characters or settings of story from picture and background	State main ideas or theme of story, including character or setting, from pictures	Narrate main events of plot sequence using pictures	Retell story using story elements from pictures	
Reading	Sequence of story (e.g., narrative input chart)	Sequence a series of pictures to tell a story	Match a series of pictures that tell a story with sequence words (e.g., “first”, “then”, “last”)	Sequence a series of words or phrases to related pictures	Sequence a series of sentences to related pictures	Sequence short paragraphs to tell stories	

Writing	Fiction (e.g., narrative input chart)	Copy words related to settings or character from review word cards or dialogue bubbles	Describe setting or characters in story from illustrations and word cards or dialogue bubbles (oral scaffold - do ELL retell first)	Identify beginning, middle and end using graphic organizer with a partner (e.g., story map)	Relate sequence of events to characters and settings in story using graphic organizer with a partner	Connect events, characters or morals in story to self	
Reading	Phonics (ex., chants)	Demonstrate awareness of unique sounds by pointing or through gestures	Match voice to print by pointing to icons, letters or illustrated words	Cross-check pictures with phonics clues	Use phonic clues to sound out illustrated words in context	Predict words or phrases based on context clues in grade-level text	

NM ELD Standards can be downloaded at:
http://www.ped.state.nm.us/BilingualMulticultural/dl08/NMEnglishLanguageDevStandards.pdf

Sample standards that could be used with this unit

ELD Standard 4: The Language of Science, Summative Framework							
	Topic/ Strategy	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reaching
Reading	**Ecology & conservation**	Sort real-life objects according to labels (e.g., recyclable and not recyclable)	Identify ways to conserve from pictures and written text	Sequence descriptive sentences and pictures to illustrate forms of conservation (e.g., recycling process)	Find solutions to conservation issues presented in illustrated texts or Web sites	Research better or new ways to conserve using grade-level materials	
Writing	**Energy Technlogies**	Label different energy technologies based on pictures, diagrams or models (e.g., wind turbine)	Classify energy technologies from pictures, diagrams or graphic organizers using phrases or short sentences (e.g., these two are renewable)	Describe energy technologies from pictures, diagrams or graphic organizers using related sentences	Differentiate energy technologies from pictures, diagrams or graphic organizers using paragraphs	Compose expository multi-paragraph pieces about energy technologies	

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http://www.ped.state.nm.us/BilingualMulticultural/dl08/NMEnglishLanguageDevStandards.pdf

V. VOCABULARY

Energy	Heat	Light	Sound	Electricity	Chemical
Renewable	Radiation	Electromagnetic	Acoustic	Electrons	Fossil fuel
Nonrenewable	Conduction	Radiation	Audible	Current	Bond
Kinetic	Convection	Particle	Amplify	Circuit	Carbon
Potential	Friction	Light Waves	Eardrum	Static	Food chain
Atoms	Solar	Visible	Vibration	Power	Batteries
Molecules	Infrared	Invisible	Pitch	Solar	Biomass
Matter	Thermometer	Reflect	Decibel	Hydro	Calories
Change	Temperature	Refract	Sound waves	Nuclear	Therms
Transform	BTU	Angle	Sonar	Uranium	
Transfer	Thermal	Ray	Ultrasound	Negative	
Conserve	Liquid	Lumens	Frequency	Charge	
Work	Solid	Polarized	Echo	Turbine	
Gravity	Gas	Transparent	Reflect	Generator	
Position	Steam	Opaque	Absorb	Joules	
Geothermal	Evaporate	Infrared		Watts	
Primary	Celsius	Ultraviolet		Shock	
Secondary	Fahrenheit	Xray,microwave		Charge	
Economics					
Limited	Resources	Supply	Demand	Wants	Needs
Import	Export	Unlimited	Benefit	Drawback	Cost
Related Imagine It Vocabulary					
Inventions	Observations	Examine	Certain	Results	React
Findings	Techniques	Randomly	Force	Rarely	Attract
Hypothesis	Pure	Core	Forcasts	Apparatus	

VI. RESOURCES AND MATERIALS

NON-FICTION BOOKS and MAGAZINES:
Use your school and local library as a reference. These are just a few possible titles.
Electricity:
Royston, Angela. Using Electricity. Chicago: Heinemann Library, 2002.
Tomecek, Stephen M. Understanding Electricity. San Francisco: National Geographic, 2002.
Whyman, Kathryn. Electricity and Magnetism, Science World. Minnesota: Aladdin, 2005
Energy:
Hewitt, Sally. Why Can't I...Jump Up to the Moon? and other questions about energy. Minnesota: Thameside Press, 2002.
Jerome, Kate Boehm. Using Energy. Washington, DC: National Geographic, 2003.
Tomecek , Stephen M.. Matter, Matter Everywhere. San Francisco: National Geographic, 2002.
"Future Power." Odyssey, Adventures in Science April 2204: 6-39.

Javna, John, et al - 50 Simple Things Kids Can Do to Save the Earth
Thaddeus, Eva. Powering the Future: New Energy Technologies. Albuquerque: UNM Press, 2010.

Light:

Royston, Angela. Light and Dark. Chicago: Heinemann Library, 2002.
Whyman, Kathryn. Light and Lasers, Science World. Minnesota: Aladdin, 2005.

Heat:

Johnson, Rebecca, L. Global Warming. Washington, DC: National Geographic, 2002.

Sound:

Johnson, Rebecca L. The Magic of Light and Sound. San Francisco: National Geographic, 2002.
Pettigrew, Mark. Music and Sound, Science World. Minnesota: Aladdin, 2005.
Royston, Angela. Sound and Hearing. Chicago: Heinemann Library, 2002.
"Shhhhh! The Science of Sound." Odyssey Magazine, Adventures in Science March 2006: 6-38.

ON-LINE RESOURCES FOR STUDENTS:

www.brainpop.com (Spanish and English)
www.sciencebob.com (short videos of experiments,
http://library.thinkquest.org/20331/game Energy Matters. Energy Crisis Game
http://www.energyhog.org/childrens.htm Energy Hogs. Interactive Kid's site on conserving energy.
http://www.sciencenewsforkids.org Science News for Kids
http://www.energy.gov/forstudentsandkids.htm US Department of Energy, for students and kids (links to other great websites at right)
http://www.epa.gov/kids United States Environmental Protection Agency Global Warming for Kids
http://www.seco.cpa.state.tx.us/seco_links-kids.htm WattsNew, Interactive site about Conserving Energy
http://energyquest.ca.gov Energy Quest: California Energy Commission Games, Energy Story
http://www.eia.doe.gov/kids/ Energy Information Administration, Kid's Energy Page Energy Facts, Timeline,
http://www1.eere.energy.gov/kids/ US Department of Energy, Energy Efficiency and Renewable Energy. Dr. Es Energy Lab, online activity.
http://environment.nationalgeographic.com/environment/energy/great-energy-challenge/
http://www.pbs.org/wgbh/warming/carbon/ PBS online activity, Your Carbon Diet
http://old.rmi.org/sitepages/pid304.php Rocky Mountain Institute for Kids, Energy,
http://go.ucsusa.org/game/ The Great Green Game, How our choices impact the environment.
Simple ideas for environmentally friendly living.
NASA's Sound Activities:
NASA's Light Activities:
NASA's Electricity Activities:
Energy Overview, Kid language
Wondernet, Energy

ON-LINE RESOURCES FOR TEACHERS:
(Google these topics to get link)
Materials **S**cience and **T**echnology
Teacher's Workshop
The Secret Lives of Energy The Franklin Institute Science Museum
Academy of Energy Education, List of Outstanding Website Resources
National Energy Foundation, Resources for teachers
Fact Monster: Energy
Renewable Energy Teaching Resources
Rebuild America, Helping kids make smart choices about energy
Alliance to Save Energy
Solar Matters, Florida Solar Energy Center
Wisconsin K-12 Energy Education Program, KEEP, K-4 Materials, Know the Flow of Energy in your school
Energy Information Administration,
http://www.eia.doe.gov/bookshelf/eer/kiddietoc.html
Energy Organization Links:
http://www.energyquest.ca.gov/teachers_resources/organizations.html
NEED, **National Energy Education Development Project**
Energy and the Environment, University of Oregon Electronic Universe Project,
Teacher resources, Physics, Simply Science (Oregon Adoption)
Kid links: http://www.simplyscience.com/physicalslinks.html#physicalfifth

Project GLAD
UNIT PLANNING PAGES
ENERGY: Forms, Transfer, and Economics: Grades 4 NM

I. FOCUS/MOTIVATION

- Cognitive Content Dictionary with Signal Word
- Inquiry chart: What do you already know about energy? What do you want to know about energy?
- Literacy Awards
- Observation Charts
- Prediction Reaction Guide
- Important Book About Energy
- Realia (Flashlight, batteries, canned food, oil, pinwheel, prism, candle, ball, rubberbands, etc.)
- Picture File Cards

II. INPUT

- Pictorial Input- Forms and Transfer of Energy
- Pictorial Input- Heat
- Map – Energy Production in New Mexico
- Narrative Input- A Day in the Life… or The Case of the Gasping Garbage
- Read Alouds

III. GUIDED ORAL PRACTICE

- T-graph for Social Skills/Team Points
- Picture files-observe, classify, categorize
- Exploration Report
- Poetry/Chants
    - Energy Sound Off
    - Energy Here, Energy There
    - Heat Transfer Bugaloo
    - Potential and Kinetic Energy Yes Ma'am
    - Energía por aquí, energía por allá
    - Energía potencial y energía cinética, ¡si señora!

- Sentence Patterning Chant (and Games)
- Expert Groups- Forms and Transfer of Energy
- Mind Map
- Process Grid
- Team Tasks
- Personal Interaction
- 10/2

UNIT PLANNING PAGES cont.

IV. READING/WRITING

A. Whole Group Activities/ Modeling

- Listen and Sketch
- Cooperative Strip Paragraph
- Poetry Frame and Flip Chant
- Narrative Story Map
- Found Poetry- Time for Kids Articles (online archive http://www.timeforkids.com/TFK/), a descriptive National Geographic text, or other text
- Highlighting and sketching on chants

B. Small Group Practice – anything modeled by teacher

- Ear-to-ear reading
- 10-2
- Expert Groups
- Team tasks
  - Found Poetry
  - Cooperative Paragraph
  - Sentence Patterning Chart
  - Strip books
  - Picture file card activities
  - Action Plans
- Flexible group reading – leveled
  - SQ3R
  - Clunkers and Links
  - ELD Group Frame
  - Struggling and Emergent Readers (rebuilding the cooperative strip paragraph)

C. Individual

- Learning logs
- Interactive journals
- Personal response
- Personal narrative- How I Use Energy
- Expository: Renewable Energy
- Focused Reading- Personal Content Dictionary
- Individual tasks- (anything practiced as a team task)
- Home/School connections

D. Writer's Workshop

- Mini-lesson
- Plan, share, write, revise, edit
- Conferences
- Author's Chair
- Publishing

V. EXTENSIONS/ACTIVITIES FOR INTERGRATION

- Energy Experiments
- Write a letter to the editor or political leader
- Math: Graphs of Energy Use overtime, Energy resources
- Public Service Announcement Commercials
- Personal Conservation Log
- Guest Speaker: Electric Energy Alternatives and Conservation

IV. CLOSURE/EVALUATION/ASSESSMENT

- Student made Big Book (How to Conserve Energy, or Types of Energy)
- Processing Charts
- Conservation Newsletter for parents and school community
- Energy Convention- Reports/brochures and presentations on renewable energy
- Assess individual work
- Student Generated Test

Project GLAD
SAMPLE DAILY LESSON PLAN
ENERGY: Forms, Transfer, and Economics: Grade 4 NM

Note: *Italicized* strategies are done frequently. Day 1 is the equivalent of 1 to 1½ weeks of instruction.

DAY 1 (week 1 normal time):

FOCUS/MOTIVATION

- *Three Personal Standards and Literacy Awards*
- *Cognitive Content Dictionary with Signal Word*
- Observation Charts
- Prediction Reaction Guide
- Inquiry Chart
- Big Book- The Important Book About Energy
- Portfolio

INPUT

- Graphic Organizer- Forms and Transfer of Energy
    - 10/2
    - Learning Logs- Write and sketch about the different forms of energy
    - ELD Review

GUIDED ORAL PRACTICE

- T-graph for Social Skills-Team points
- Picture file
    - Free Exploration
    - Classify/categorize
    - Exploration Report
- *Chants*

INPUT

- Pictorial Input – Heat Energy
    - 10/2
    - Learning Log
    - ELD Review
- Read Aloud

READING/WRITING

- Writer's Workshop
    - Mini-lesson
    - Model planning and sharing
    - Writing Choices
    - Author's Chair

CLOSURE

- Home/School Connection #1: Look around your home. Where do you find energy? Sketch and write.

SAMPLE DAILY LESSON PLAN cont.
<u>DAY 2:</u>

FOCUS/MOTIVATION
- *Cognitive Content Dictionary with Signal Word*
- Process Home/School Connection
- *Three Personal Standards and Literacy Awards*
- Review Input Chart with Word Cards
    - Forms of Energy
    - Heat Energy
- *Process Chants/Poetry: highlight, sketch, add picture file cards*

INPUT
- Narrative Input- A Day in the Life… or The Case of the Gasping Garbage
    - Learning Log
    - ELD Review

READING/WRITING
- *Flexible Reading Groups*
    - *E*xpert Groups
    - *Heterogeneous, ELD, Homogeneous, Skill, Leveled, Guided, etc.*

GUIDED ORAL PRACTICE
- *Team Tasks*
    - Process T-graph for social skills

CLOSURE
- Process Inquiry Chart
- Interactive Journal Writing
- Home/School Connection #2: How do you and your family use energy throughout your day? Sketch and write your typical schedule and how you use energy.

SAMPLE DAILY LESSON PLAN cont.

DAY 3:

FOCUS/MOTIVATION

- *Cognitive Content Dictionary with Signal Word*
- Process Home/School Connection
- *Three Personal Standards and Literacy Awards*
- Big Book Review
- Review Narrative Input Chart with word card and conversation bubbles

INPUT

- Read Aloud
- Map – Energy Production in New Mexico
- Personal Interaction- What can I do to conserve energy?

GUIDED ORAL PRACTICE

- *Process Chants/Poetry: highlight, sketch, add picture file cards*
- Sentence Patterning Chart (SPC)
    - Reading/Trading Games
    - Flip Chant

READING/WRITING

- *Flexible Reading Groups*
    - *E*xpert Groups
    - *Heterogeneous, ELD, Homogeneous, Skill, Leveled, Guided, etc.*

GUIDED ORAL PRACTICE

- *Team Tasks*
    - Oral Team Evaluations

GUIDED ORAL PRACTICE

- Mind Map
- Process Grid

READING/WRITING

- Cooperative Strip Paragraph
    - read
    - respond
    - revise
    - edit

CLOSURE

- Process Inquiry Chart
- Journals
- Home/School Connection #3: Tell your family about two different forms of energy. Sketch and write what you shared with your family.

SAMPLE DAILY LESSON PLAN cont.

DAY 4:

FOCUS/MOTIVATION

- *Cognitive Content Dictionary with student selected vocabulary "stumper"*
- Process Home/School Connection
- *Three Personal Standards and Literacy Awards*
- Review Narrative with story map

READING/WRITING

- Strip Book with SPC
- *Flexible Group Reading*
    - Clunkers and Links with SQ3R (at or above grade level)
    - ELD Group Frame (often with Narrative)
    - Rebuilding the Cooperative Strip Paragraph (Struggling or emergent readers*)*
- Team Tasks
    -Team Presentations
- Listen and Sketch
- Add to the walls
- Writer's Workshop
    - Mini-lesson
    - Model planning and sharing
    - Writing Choices
    - Author's Chair

INPUT

- Read Alouds
- Graphic Organizer of Action Plan

CLOSURE

- Process Inquiry
- Interactive Journals

SAMPLE DAILY LESSON PLAN cont.

DAY 5:

FOCUS/MOTIVATION

- *Cognitive Content Dictionary with student selected vocabulary "stumper"*
- *Three Personal Standards and Literacy Awards*
- *Chants/Poetry*

READING/WRITING

- Social Action Plan
- Team Tasks: Evaluation and Presentation
- Focused Reading-Personal Cognitive Content Dictionary
- Ear-to-Ear reading with Poetry Booklet
- Listen and Sketch
- Graffiti Wall
- Found Poetry
- Poetry Frame

CLOSURE

- Presentations/publishing
- Letter Home
- Process Inquiry Chart, Process Week- What have we learned?

Literacy Awards

Add pictures to the text and print on colored paper. (Pictures are not included here because of copyright.)

Solar Panels absorb light energy. Light energy can be converted into electrical energy and used to power the light bulbs and other electrical devices in your home or office.
On the back of this award write 3 benefits to using solar energy to power our homes. Why might it be better for our environment than burning coal or fossil fuels to create electricity?

Energy is a precious resource we all need.
Write on the back of this award ways in which YOU can become more responsible for saving energy in your home or school.

Static electricity is produced when negatively charged particles JUMP from one object to another. This can even create a small visible shock of energy!
Conduct your own experiment with a balloon. Rub a balloon with a piece of clean cloth. Observe the reaction. Write your observations on the back of this award.

Kinetic energy is MOVING energy. Potential energy is STORED energy.
Create a t-graph on the back of this award. Make two headings, kinetic energy and potential energy. Find at least 3 examples of each and write them on the t-graph.

Gravity is the force that comes from the Earth that pulls objects towards the earth's center. Gravity is the reason that our Earth has an atmosphere and we do not float off into outer space.
Imagine what life would be like on Earth if our gravity was not as strong. Write a paragraph describing life on Earth with weaker gravity. What would it be like to play soccer, do gymnastics, or play catch?

A skateboarder at the top of a ramp has lots of potential energy, energy that will transfer to kinetic energy as he or she moves back down the ramp. *What do you do that moves from potential to kinetic energy? Write and sketch on the back.*

The hotter the object, the more heat will radiate off of it. A cat's nose radiates a lot of heat energy. *What are other living and non-living things that radiate heat?*

When something is hot, it radiates heat into cooler areas. This cat's warm tongue is radiating lots of heat into the cool air around it. *What are other living and non-living things that radiate heat?*

Electricity is a form of energy. People use energy to power many kinds of technology. Human-generated electricity is carried through transmission lines from generating stations to communities where it is used. *Sketch where you see transmission lines near your school or home.*

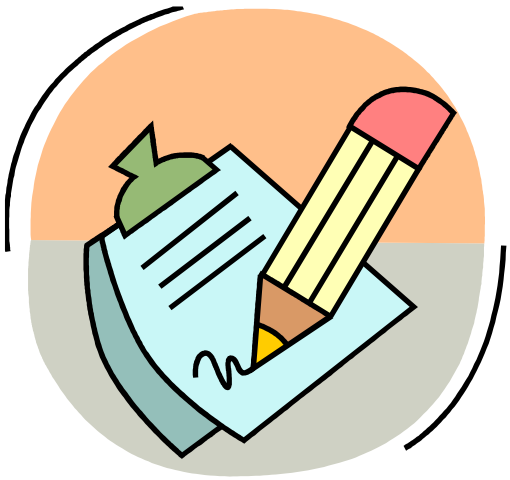
Oil rigs extract petroleum from the ground. Petroleum is a fossil fuel which people burn for energy. It is also called oil. Gasoline, asphalt, and plastic are petroleum products. *Use the Internet to research and list other products made out of petroleum.*

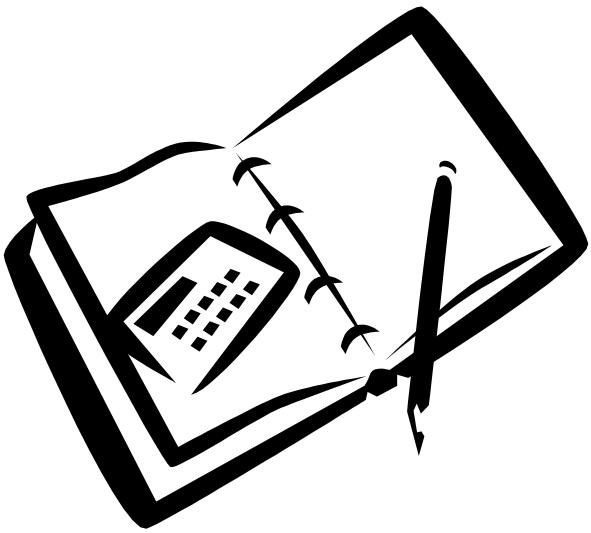
Sir Issac Newton, 1642-1727 one of the most influential thinkers of all time, proved and formulated the laws of motion and gravitation. *Using the Internet, research other important facts about Sir Isaac Newton.*

Anton Leeuwenhoek, born in Holland in 1632, used his understanding of light energy to improve the microscope. He is considered the father of "microbiology." *Using the Internet, research other important facts about Sir Isaac Newton.*

The awards on the following page are for notebooks. Copy, add blank sheets and staple.

I love to write!





Big Book: The Important Book About Energy

By D. Boswell and M. Wattman-Turner

Adapted by Rhonda Lopez

The important thing about energy is that it exists in many forms and can change from one form to another.

- Energy isn't something you can touch, but it is everywhere.
- People need energy to live, move, and have comfortable lives.
- Energy is not easy to describe, but scientists define it as the power to do work because energy causes change and makes things happen.
- Different forms of energy are HEAT, LIGHT, SOUND, ELECTRICIY and CHEMICAL energy.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

- All energy is either KINETIC ENERGY or POTENTIAL ENERGY.
- Kinetic energy is when something moves, like a person running, a clock ticking, a plane flying, or ELECTRONS moving.
- Potential energy is stored or waiting to be used like in food, batteries, gasoline and other chemicals. Energy can also be stored from GRAVITY like a book on top of a shelf.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

- Heat is the movement of MOLECULES so it is a form of kinetic energy.
- All things hot and cold have heat energy.
- When things are hot, the molecules move faster. When things are cold, the molecules move slower.
- The sun is our PRIMARY SOURCE of heat energy as ELECTROMAGNETIC INFARED WAVES we can feel but not see. We also get heat from machines and burning.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

- Light is energy that travels in PARTICLES AND WAVES of different lengths.
- Light is a form of kinetic energy because it moves.
- Light is ELECTROMAGNETIC WAVES we can see with our eyes.
- Anything that gives off light is a light source. Stars are our primary source of light, especially the Sun.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

- Sound is energy that travels in waves. Sound is a form of kinetic energy because it moves.
- Whenever something VIBRATES, these sound waves travel to our ears so we can hear it.
- Sound needs air, water, or solids in order to travel. Sound cannot travel in space.
- Sound comes from other forms of energy like when two objects hit together or as air moves.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

- Electrical energy involves moving ELECTRONS, which have a negative charge. Electrical energy is a form of kinetic energy because it moves.
- STATIC ELECTRICITY occurs when electrons jump from one object to another like in lightening. Rub a balloon on your hair or socks on the carpet and you also get electrons jumping.
- CURRENT ELECTRICITY happens when electrons move along a wire, flowing in a circular pattern called a CIRCUIT.
- Electricity always comes from other forms of energy. These sources can be NONRENEWABLE, like oil and natural gas, or RENEWABLE, like wind and solar.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

CHEMICAL ENERGY is in all matter in the bonds between molecules.

- Chemical energy is a form of potential energy because it is something waiting to happen when burning or other reactions break the bonds.
- Chemical energy can be stored in FOSSIL FUELS like coal, oil, and natural gas.
- Chemical energy can also be stored in food.
- BATTERIES also store chemical energy that can then be turned into electricity.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

The important thing about energy is that it exists in many forms and can change from one form to another.

There are many important inventors that have contributed to human's understanding and use of energy.

- Sir Issac Newton, 1642-1727 one of the most influential thinkers of all time, proved and formulated the laws of motion and gravitation. These laws are math formulas that explain how objects move when a force acts on them. His work helped us understand energy.

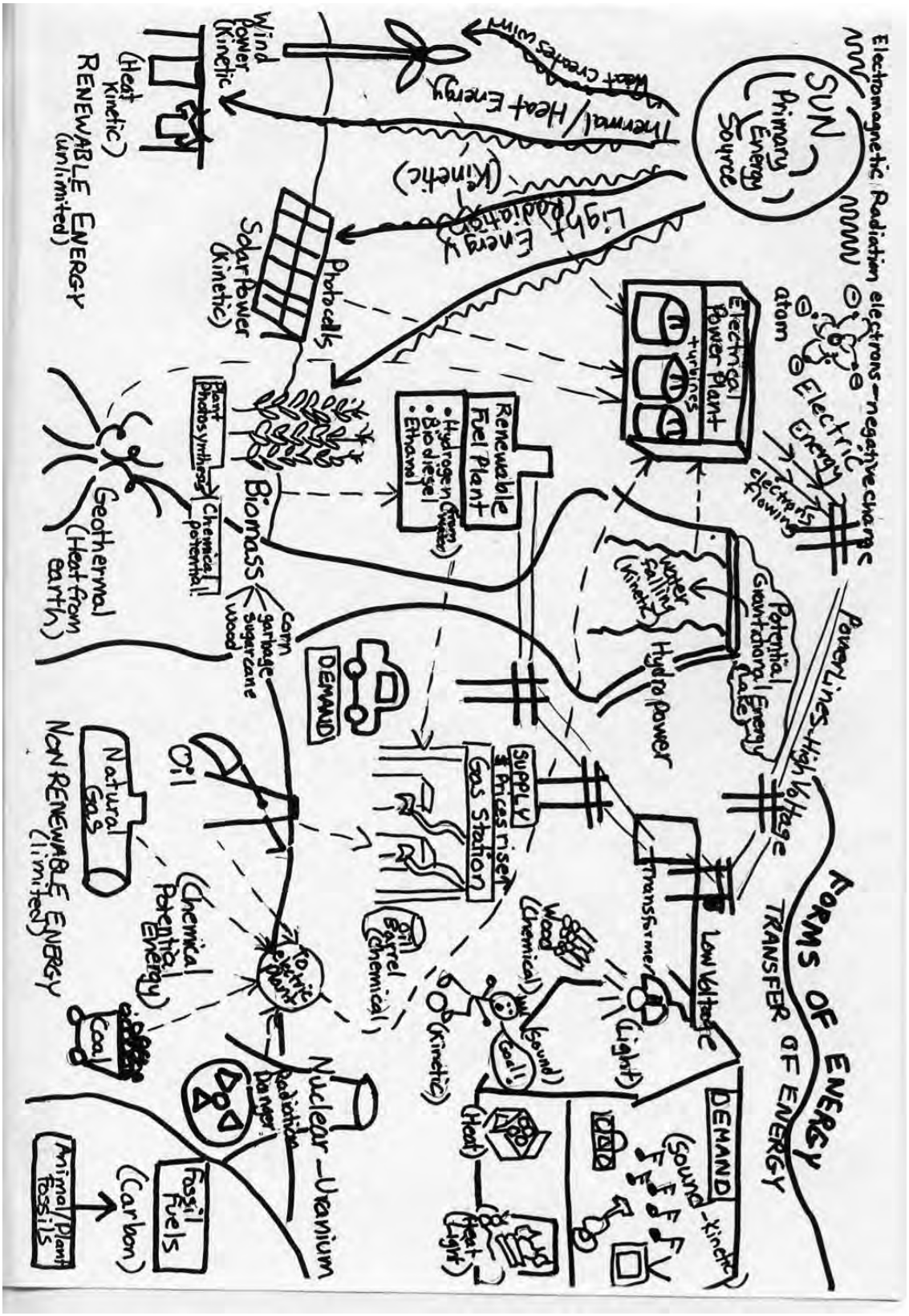
- Anton Leeuwenhoek, born in Holland in 1632, used his understanding of light energy to improve the microscope. He is considered the father of "microbiology." Before his invention, no one really knew that microscopic organisms existed.

- Benjamin Franklin lived from 1706-1790 and is considered one of the most important Americans of all time.His inventions include, electricity, the Franklin Stove, Bifocal lenses, and the lightening rod. He did not patent any of his inventions or use them for profit, preferring to give them to the world for everyone's comfort and convenience.

- Thomas Edison, 1847-1931, was an American inventor who developed many devices that greatly influenced life around the world, including the phonograph, the motion picture camera, and the light bulb. He also came up with a battery for an electric car, electrical power, recorded music and motion pictures. He opened the first power station in New York.

But, the most important thing about energy is that it exists in many forms and can change from one form to another.

Big Picture Pictorial :OPTION 1



Talking Points: Pictorial Input
Forms and Transfer of Energy

Orange: Primary Sources(Light, Heat) Green: Renewable energy, Red: Secondary (Electric energy), Blue Nonrenewable energy, Purple: Demand/Sound

By D. Boswell and M. Wattman-Turner

- Energy is everywhere around us and is constantly changing from one form to another.
- Water/pitcher/cup demonstration: Energy transfers but total amount stays same.
- Energy makes things change and makes things happen. We call this work. It can be moving, which we call kinetic energy, or stored as potential energy which is energy waiting to make things happen. Whenever there is motion, there is kinetic energy.
- Realia examples. Hold ball up and drop it: Positional/Gravity (potential to kinetic). Stretch rubber band (potential), zing it (kinetic). Battery in flashlight (potential), switch on (kinetic).
- The Sun is the primary source of energy. (Orange)
- The Sun's energy: from nuclear reaction(fusion). It travels to Earth as two forms of electromagnetic radiation: Light energy and heat/thermal energy. Light and heat travel in the vacuum of space by radiation.
- Light is energy we can see and heat is invisible energy we can feel through our skin as hot or cold. Both are electromagnetic radiation, which are waves of different lengths.
- Light travels very fast in a straight line by waves. (Flashlight) It takes 8 1/2 second from the Sun. Heat also involves motion. When things move, they get hot. (Rub hands together.)

- **10-2 What is kinetic energy? What is potential energy?**

- The Sun's energy transfers to different forms on Earth: (Green)
    - Heat forms wind in the air. This is a **windmill** with blades that move with the wind (like a pinwheel). Wind power is used to create electric energy. (Pinwheel)
    - Heat can also **dry clothes** or cook food. Heat involves motion so it is kinetic energy. The molecules in the clothes wiggle and evaporate so clothes dry on **clothesline.**
    - Light is captured by photocells in **solar panels**. (Like our solar calculators in school) This solar power heats up steam to run the turbines and creates electric energy.
    - Light helps plants grow. Photosynthesis.
    - Heat evaporates water in water cycle that provides us with precipitation and rivers. Moving water is mechanical energy because it involves force and motion. This energy from the river can or the ocean be used to run turbines which create electricity. (Hydro Power) A **hydroelectric dam** creates a lake. The lake behind the dam is energy waiting to happen (Potential) because of its gravitational position. (Like the ball) When the water falls over the dam, it is kinetic energy that runs the turbines.
    - This is an **electric power plant**. Turbines generate electricity. (Red)

- **10-2 What are different ways that the Sun's energy transfers to electric energy?**

- People use a lot of electricity everyday. In our **homes** we use electricity to run machines like stoves and radios. We turn on our lamps and lights so that we can see. Electricity is kinetic energy because it involves the flow of electrons along a circuit or jumping electrons like in **lightening**.
- Atoms Because the electrons are moving, electricity is a form of kinetic energy.
- Tiny electrons leave the electric power plant and travel along the lines in a current.
- The electrons travel along **power lines**. These lines are dangerous because they are high voltage so they can travel so far along the wires. These wires go into an electric **transformer** to change to a low voltage before it goes into our homes.
- Electric energy changes into light and heat energy when we turn on a lamp. The light bulb shines bright and also gets hot to the touch.
- Another form of kinetic energy is **sound energy** (purple), which we can hear with our ears and feel with our touch. Sound happens when objects vibrate. Sound energy comes from motion energy. If two things are struck together (hands clap) sound waves are formed which travel to our ears in waves. Our throats vibrate to form sounds when we talk (draw person kicking the ball and shouting "Goal"). The strings on a **guitar** vibrate when plucked to create music, a sound we like, just like the sounds we hear with a **radio** and **TV** (light too). Many machines in our homes make sounds when they operate, which we call noise.

- **10/2 What type of energy is the most important to you? Light, Heat, Sound, or Electric?**

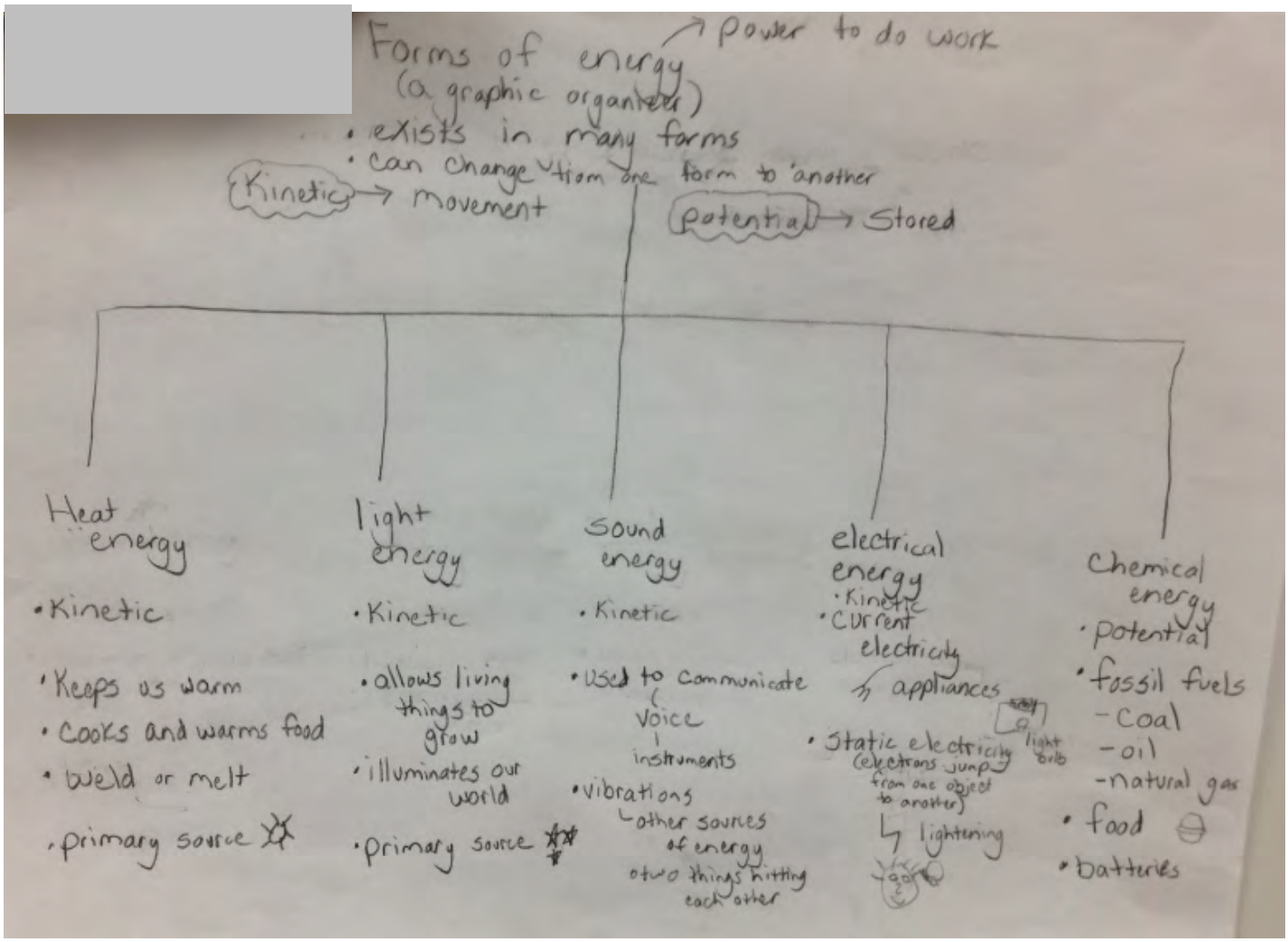
- When energy is waiting to make things happen, it is called potential energy or stored energy. An important form of potential energy is **chemical energy**. (Blue) Chemical energy is found in the bonds (like glue) between the molecules or building blocks of all things. When the bonds are broken during chemical reactions, energy can be released.
- Light makes chemical energy as food in **plants** through photosynthesis. People and animals then burn the plant's food during digestion so they have energy to live. You have energy to play because of the chemical energy in food. (Child playing soccer.)
- More of the world's chemical energy comes from the Sun in another way because it was made from the **fossils** of dead plants and animals millions of years ago. These fossils became fossil fuels, which are stored inside of the earth.
- **Coal** is a solid fossil fuel that is mined or taken out of the earth and used to burn to heat our homes and make electricity.
- **Natural gas** is a fossil fuel that is a colorless gas (like air) that we burn in our furnaces, stoves and dryers to create heat.
- **Oil** is a liquid fossil fuel that we drill out of the earth and use to create petroleum, gasoline, diesel and oil. We burn these fuels in our homes for heat or to make our cars and trucks run.
- Another form of chemical energy is the radioactive mineral from the earth called uranium. It can release the energy when the bonds in the uranium break. This

energy can be used to create electric energy in a **Nuclear Power Plant**. All of these fossil fuels can be burned in an electric power plant to create electricity. Unfortunately, pollution that causes global warming is produced when we burn fossil fuels and dangerous radioactive material is left over from a nuclear reaction.

- Because these fuels took so long to create, they are limited or will run out. It would take too long for the earth to create more fossil fuels for people to use for all their wants and needs. We call fossil fuels **nonrenewable resources** because the **supply is limited**.
- **Car and Gas Station:** When the supply of fossil fuels goes down, and the demand (want or need) for fuel is high, the prices go up which is what is happening today with the price of gasoline. The United States gets the majority of its oil from other countries around the world.
- Other sources of energy can be used again and again to create electricity or make fuels, so we call these **renewable or an unlimited supply**. Light, Wind, Solar and Hydropower are examples. Another form of renewable energy is to use the heat inside of the earth, like steam and geysers. This is called **geothermal energy**.
- Plants can be used as **Biomass** to create electricity and make chemical fuels to run our cars. Examples: Corn, wood, sugar cane, garbage, vegetable oil
    - A renewable fuel plant uses biomass to create Ethanol, bio-diesel,
    - Hydrogen fuel from splitting water.
- All sources for energy have their benefits and their drawbacks.
- Chemical energy can also be burned like wood in a fireplace to get heat energy.

10/2 What is one type of renewable source of energy?

Big Picture Forms of Energy (Option 2 – Only do one of the big picture charts)
This chart needs multiple pictures for each form of energy for it to be comprehensible to students.



Talking Points for Heat Pictorial

- Heat is a form of energy. Also called thermal energy.
- It is everywhere, working and moving.
- Heat is atomic motion. Atoms are tiny particles that make up everything around us. (All things hot and cold have energy as their molecules are wiggling. If atoms move slow things are cold, if they move fast, things are fast.)
- Primary source of heat: Sun, nuclear reactions.(Red)
- **CHARACTERISTICS: Orange**
    - **Electromagnetic radiation, invisible, infrared waves.**
    - These **waves travel** to and heat the earth. Heat energy moves so it is **kinetic energy**
    - Feel heat by **touch,** like when you lay out in the sun and your skin gets hot.

- There are other sources of heat. **SOURCES are RED**
- Warm-blooded **organisms** radiate heat. Heat comes off the skin of our bodies, and from the nose of this dog.
- When we use machines to do work, like this **lawnmower**, the mechanical motion generates heat energy. When machines run, they feel warm or hot to the touch.
- We burn chemicals like the charcoal in a BBQ, they radiate heat into the air.
- Inside our house, we can see more sources. When we burn wood in a **fireplace**, this is a chemical reaction. The same with a **candle**.
- When we **rub our feet on the carpet**, or our two hands together, the **friction** from mechanical action generates heat. Let's try rubbing our **hands** together and see.
- **Stoves** in the kitchen and **heaters** in the basement are an example of another machine generating heat.
- **Electric Lamps** also are a source of heat energy. (They have light energy too.)
- Nuclear Reactors generate heat by releasing energy from a mineral called uranium and nuclear reactions in the sun are sources of the infrared thermal energy in the Sun.

MOVEMENT: Green

- Our homes are a good place to see the **three ways heat moves**. Heat moves hot to cold. Warmer objects give their heat away to cooler objects. Heat energy
- Sometimes we use a **convection heater** to heat our homes. Warm air rises, and cool air sinks. The warm air goes up into the vents. Heat moving in the air is called convection.
- From the fire, the heat rises out the chimney to the cooler air outside.
- A stovetop radiates heat into the air. On top of the stove, we use a pot (blue) to cook our food.
- Heat energy **moves through solids through conduction** The atoms and molecules in the solid wiggle and giggle and bump into each other like a bunch of marbles or balls on a pool table. The atoms pick up some of the motion of the molecules that bumped into it. Heat is transferred by these collisions. Heat moves through some materials better than others. If you place a metal spoon and a plastic spoon is a pan

full of boiling water, the metal spoon will heat up faster. Metal is a good conductor of heat. That is why our pots and pans are usually metal to conduct the heat of the burner to cook our food. Usually the handles are plastic because they don't conduct heat well. Glass, wood and plastic are examples of insulators.

- When heat moves through a liquid or a gas it is called convection. The molecules move around and begin to vibrate faster. As this happens they move apart. The warmer gas or liquid rises and the cooler sinks. A convection heater works this way. The warmer gas moves to the top of the heater and out into the air warming it up as the cooler air enters down at the base. When water is boiling in a pan, heat is traveling in the water by convection. Hot water in the pan rises, cools,
- Heat can also move by radiation. Radiation is heat that travels in rays like light. Heat rays are not hot, but they warm things up as the rays reach them Thermal waves from the Sun radiate through space and warm up the earth. Heat can also radiate in the air on earth. Hot objects like fire, electric heaters, candles, light bulbs and even people and animals also give off heat through radiation. Outside in the BBQ, the metal stick we are using to roast the marshmallow conducts heat so we have to be careful not to burn our hands. The charcoal also is radiating heat in the air to toast the marshmallow. When the marshmallow browns, heat moves inside the marshmallow by conduction to melt the middle.

USES/WORK: BLUE

There are many ways that heat energy makes things happen or does work.

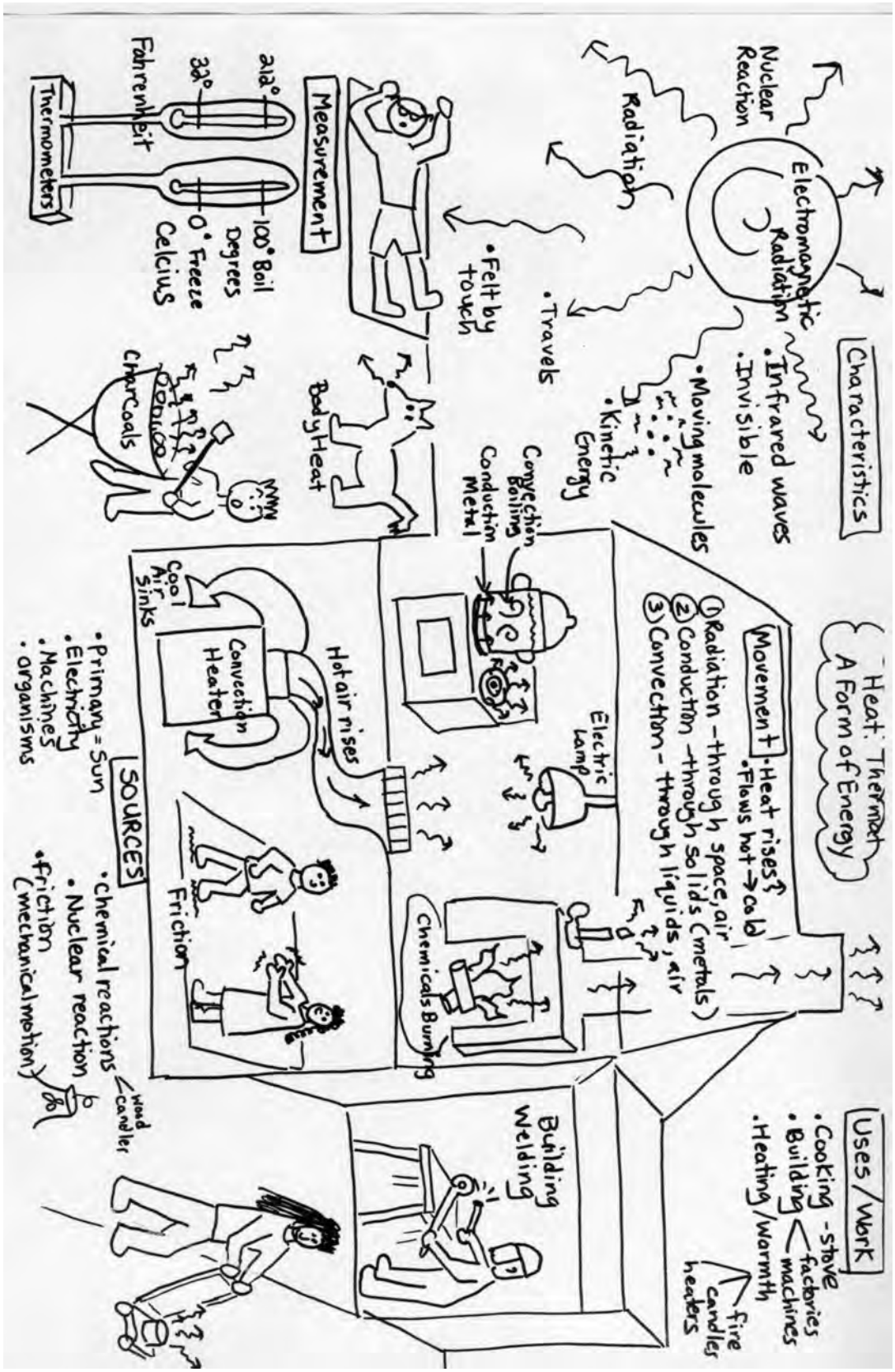
- Uses for heat energy include **building**. Here in the garage, this person is using heat energy to weld or change the shape of the metal using heat energy. Heat energy is used to make things in factories by melting plastics and metals.
- The most common use of heat energy is for **warmth**, to keep our homes warm during cold weather.
- We also use heat energy to **cook** our food.

MEASUREMENT: PURPLE

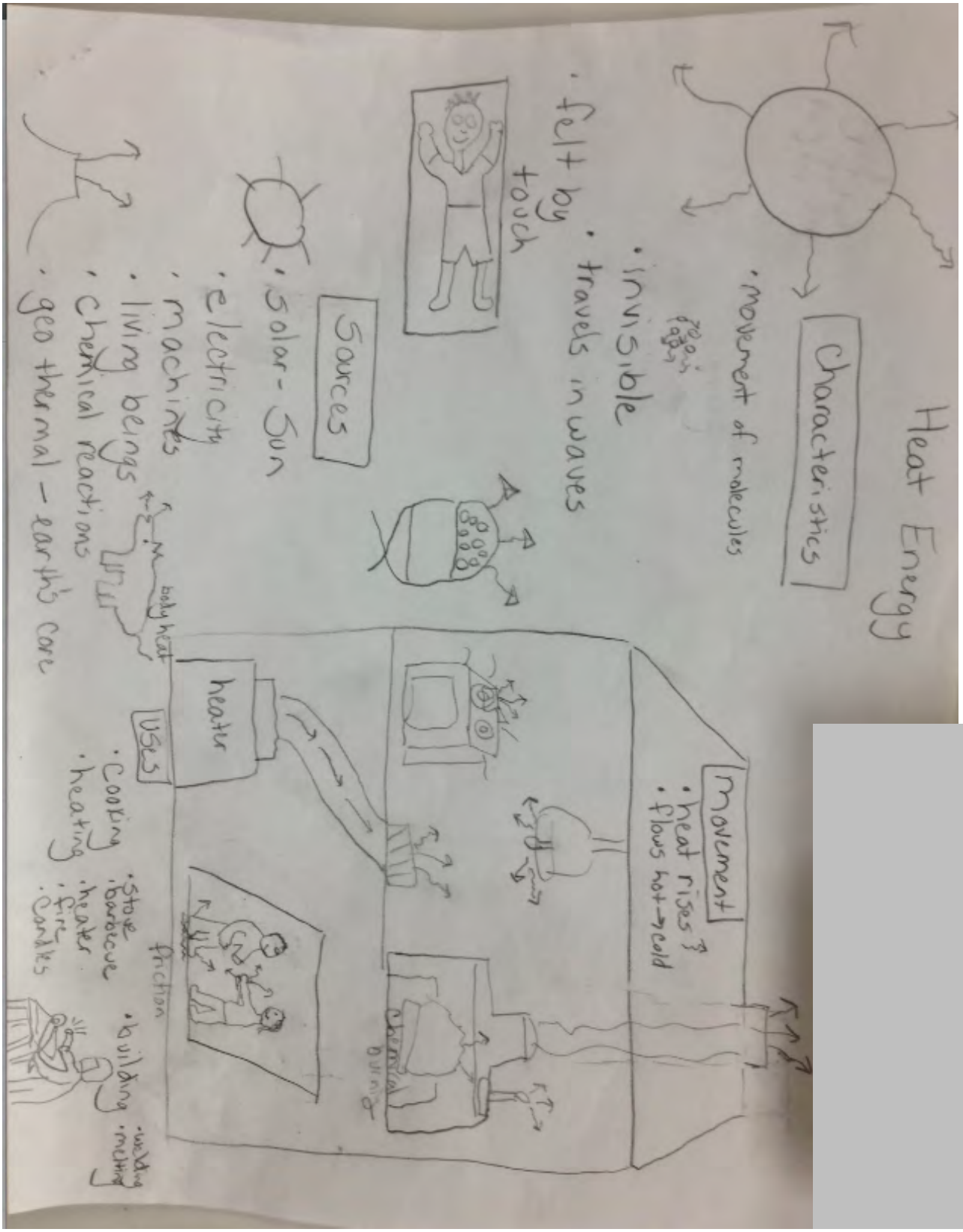
People like to know how hot or cold it is outside or in our homes. We have weather reports everyday to let us know this information.

Heat is measured in degrees using a thermometer. In the United States heat is measured using degrees Fahrenheit. In science and in most of the world, heat is measured in degrees Celsius. We measure degrees using a thermometer. The freezing point is 32 degrees Fahrenheit or 0 degrees Celsius. The boiling point of water is 212 degrees Fahrenheit or 100 degrees Celsius. Even at extreme cold temperatures, atoms are still moving. Scientists call no movement Absolute Zero, but it cannot really happen.

Heat is a form of energy that is always working and moving and is everywhere in our lives.


Heat: Thermal Energy A Form of Energy
Characteristics
Electromagnetic Radiation
Nuclear Reaction
•Infrared waves
•Invisible
Radiation
•Moving molecules
•Kinetic Energy
•Travels
•Felt by touch
Measurement
212° 100° Boil Degrees
32° 0° Freeze Celcius
Fahrenheit
Thermometers
Body Heat
Charcoals
Movement
•Heat rises
•Flows hot→cold
(1) Radiation - through space, air
(2) Conduction - through solids (metals)
(3) Convection - through liquids, air
Convection Boiling
Conduction Metal
Electric Lamp
Chemicals Burning
Uses/Work
•Cooking - stove
•Building - factories, machines
•Heating/Warmth - fire, candles, heaters
Building Welding
Cool Air Sinks
Convection Heater
Hot air rises
Friction
SOURCES
•Primary = Sun
•Electricity
•Machines
•organisms
•Chemical reactions
•Nuclear reaction
•Friction (mechanical motion)
wood candles

Simplified version of heat energy pictorial input



ELD Review Questions

Heat Energy

Pictures should be used to support comprehensibility as well as to support higher level thinking questions.

Point to (targets preproduction):

1) Point to the sun which is one of the primary sources of energy. (knowledge)
2) Point to the picture that shows feet creating friction or heat . (knowledge)
3) Locate the heater which heats the house or makes it warmer. (knowledge, comprehension)
4) Identify the category that tells how heat moves. (knowledge, comprehension, application)
5) (Showing three different pictures) Identify two pictures that show sources of heat energy. (comprehension, application)
6) (Show two pictures) Looking at these pictures, which shows heat rising. (application)
7) Which use of heat (cooking, heating or building) do you use most often? (application)
8) Where are the vents where heat enters the classroom? (application)

Yes/ no (targets early production):

1) Is cooking a use of heat energy? (comprehension)
2) Can living beings such as animals or humans give off heat? (comprehension)
3) Does heat fall down towards the floor? (comprehension)
4) Can people feel heat energy? (comprehension)
5) Do the sources of heat energy tell how heat energy moves? (comprehension)
6) Have you ever touched a machine that gives off heat? (application)

Either/ or (targets early production):

1) Is rubbing your hands together an example of friction or geothermal energy? (comprehension)
2) Does heat rise up in the air or fall down towards the floor? (comprehension)
3) Do you think a fire or a candle would give off more heat? (application)
4) (Showing pictures) Which of these appliances gives off heat energy ? (application)

Open- ended questions: (need to adjust expectations for answers based on students' language levels)

1) What are the sources of heat energy? Which are the most important? Why? (comprehension, evaluation)
2) (Showing pictures) Which of these appliances gives off heat energy ? (application) How do you know?
3) Which room in a house has the most appliances that give off heat energy? (analysis)
4) Do you think a heater or a stove gives produces more heat? Why? (analysis)

A Day in the Life….

(Narrative option #1) By D. Boswell and M. Wattman-Turner

1. How do people use energy around the world? How is energy used for their needs, and how do they use it for the things they want? Let's find out.

This is Mario. He is a 10-year-old boy living in a small town in northeast Brazil. He lives on a farm called a situ. His house is made of brick and tile and does not have electricity or running water. His family gets water from the pond that is located outside of their house.

2. This is Miranda. She is an 11-year-old girl living in a small town in Oregon. She also lives on a farm. Her house is made of wood and has electricity and running water.

---How do these two kids use energy differently? Let's take a closer look.

3.When Mario wakes up in the morning, he has to carry the water into the house in five-gallon cans on his head or shoulder. The sun comes up at 5 am on Mario's farm, and he tries to get his chores done early before the day gets too hot. Outside, his mother makes coffee and starts making the rice and beans they will eat for lunch. Since Mario's family does not have the resources to have a stove, his mother cooks food over a fire using charcoal made from wood for fuel. Mario's family does not need to heat their home because they live in a warm tropical climate. His family washes clothes in the stream nearby and lays them out in the sun to dry.

4. When Miranda wakes up in the morning, it is still dark and cold outside. Her family has resources like a furnace to heat their home so it will be warm when she first wakes up. Miranda turns her light on and takes a hot shower heated up by a water heater. Miranda dries her hair with a hair dryer. Downstairs, her mother prepares eggs on their gas stove and toast in their toaster using electricity. In the summer, Miranda's family turns on their air conditioning to keep the house cool. Her family cleans their clothes using a washing machine and dryer.

5. It is time for Mario to walk to school. Mario's family walks everywhere, and his dad has a bike to ride to work in the battery factory. Most people in Brazil walk or take public transportation, either by bus or a minibus. Most people cannot afford to buy gas or cars. Gas in Brazil is made from sugar cane and is called ethanol.

6. It is time for Miranda to go to school. Miranda rides a bus to school. Her family has three cars, including a mini van. Her dad drives to work each day. They use gas for their riding lawn mover and all their farming equipment. Most people in Oregon drive everywhere they need to go. Gas is expensive, but most families can still afford to buy gas. Their gas comes from oil drilled deep from the ground.

7. When Mario arrives at school he sits down at his desk. Mario's school does not have electricity. It has open windows so the room will stay cool. Mario's teacher uses the chalkboard to teach the children how to read, write, and do math. He copies things off the chalkboard on a slate or into a small notebook.

8. When Miranda arrives at school, she sits down at her desk. Miranda's school has electric heat and air conditioning to heat and cool the building. Miranda's teacher uses books, textbooks, movies, and other materials, including computers, to teach the children how to read, write, and do math. Miranda writes on paper, uses a calculator and computers to do her work.

9. When school is over, Mario has work to do. He has a part time job selling tomatoes at the street market. He also helps haul water and work in the family garden. Afterwards, he likes to play soccer or rocks, which is a game like marbles. Mario does not have a computer or a television, but he still has fun.

10. When school is over for Miranda, she has work to do. First she has to do her homework, sometimes while listening to music. She has chores to do like vacuuming and doing the dishes. Afterwards, she likes to play basketball and ride her scooter. Inside she likes to play games on the computer and watch television.

11. It is getting dark outside so Mario's family lights the lamp oil in their lamp to light their home. After a family soup supper they hand wash their dishes. His family sits together to listen to their radio and tell stories. They don't use their radio a lot so they can make the batteries last as long as they can.

12. After a family dinner together, Miranda's family spends time watching the television or a movie on their DVD player while the dishwasher runs. Sometimes they play CD's on their stereo or listen to their father play his electric guitar. Miranda also talks to her friends on the telephone, pops popcorn in a microwave oven, and play her Game Cube before she goes to sleep. They turn off lights when they leave the room to save energy.

Mario's and Miranda's lives are not better or worse than each other's. All people use energy for their needs and for their wants, only they use it differently depending on their resources and where they live. All choices about energy have benefits and trade offs that can shape our decisions.

VICTOR'S FIRST PINEWOOD DERBY (Narrative option #2)

By Rhonda López

1. The day that Victor received the assignment to build a pinewood derby car to compete against the other 4th graders at his school was one of the best days of his life. His teacher Ms. Girón handed him a plastic bag holding a block of wood, four metal pins, and 4 black plastic wheels.

2. Ms. Girón said, "You will have one week to use these materials to design and create the fastest moving car that you can. Remember that the Earth's gravity will provide the energy that your car needs to go down the sloped track. Your job is to design your car so that it has the least amount of friction pushing against it to slow it down, and the maximum amount of momentum working with the gravity to pull it down the track. You will have to research how these different forces will affect the velocity or speed of your car. You are also allowed to ask for help from an adult."

3. Victor was very nervous because he had never built anything before in his life. He didn't have any tools at his house, and he didn't know anything about how to build a fast moving car. He did have a very nice neighbor named Mr. Luna who he had seen working in his garage with wood and tools. He decided to ask him for some help and advice.

4. That afternoon Victor asked his mom for permission to visit with Mr. Luna. Then he went to Mr. Luna's house and rang the door bell. "Mr. Luna, I have a very important science homework assignment that I really do not know how to do. I have seen you working with wood and tools, and I was wondering if you would help me to build a pinewood derby car. Mr. Luna smiled and said, "I would love to help you with your assignment Victor. I am a former Cub Scout who has many fond memories of building pinewood derby cars with my father. This is a photo of me with my first car! I have some ideas that may help." (picture 5)

6. "Let's start with the basic fact that pinewood derby cars roll down a track under the influence of gravity. We know from scientific research that in air, a heavy steel ball falls much faster than a feather. So you want the car to be as heavy as possible. Here's why: The force acting on the car is calculated by the formula **Force = Mass x Acceleration**. How fast the car goes is called the acceleration. The acceleration due to gravity is a constant. So the more mass, the greater the gravitational force acting on the car.

7. This force is competing against the force of friction caused by air rubbing against the car. To decrease the air friction pushing against your car, we will need to design the car as sleek and arrow shaped as possible. This shape is called aerodynamic. This way the air will flow around the car and not push so much against it. We will also have to add some mass by inserting some heavy metal weights into holes that we drill into the bottom side of the car. This will increase the gravitational pull on the car, and make it go faster."

8. Mr. Luna continued, “One thing I do know is that the axles, where the car and the wheels are attached, also can generate a LOT of friction. What you want to do is polish them with steel wool to smooth them as much as possible. Then, oil them to lubricate them and to reduce friction. You also want to make sure that the wheels are perfectly round and balanced, with the axle hole dead center in of each wheel, so the car will be balanced.”

9. That afternoon, Mr. Luna and Victor sketched the design of the car. They made it the aerodynamic shape of a fancy race car to reduce the air friction pushing on the car. They then put on goggles to protect their eyes and used Mr. Luna’s jigsaw to cut the shape out of the block of wood. Victor spent the evening sanding the wood smooth with sand paper so it would be ready for painting.

10. Victor painted the car as carefully as he could, and Mr. Luna helped him to prepare the wheels and axles and attached them to the bottom of the car. They glued the metal weights onto the bottom of the car so that the car would have maximum mass and more momentum. The car looked fantastic!

11. The day of the race arrived and Mr. Luna came to the school playground to cheer Victor and his car on. The race track was already set up for the event. Everyone was there to see the race. Victor placed his racecar on the top of the sloped track. There was a wooden gate set up to hold all the cars on the track with a lever attached to release them at the same time. The race official blew his whistle, and pulled the lever down releasing the cars. Victor’s car sped down the track, passing all the other cars at first, but then was passed by one of the other cars. Darn! Maria Ortiz’s car had won!

12. The cheers died down, and Victor ran to congratulate his friend Maria. He also searched the crowd for Mr. Luna, his racing partner. Mr. Luna waved and smiled. Victor ran over to him. Mr. Luna hugged Victor and said, “Thanks so much for letting me help you with your car. This was the most fun I have had in years! Next year, let’s make the car even more aerodynamic, and add even more mass to the car so it will go faster!” Victor couldn’t wait to begin his next design.

Narrative option #3
Imagine It – *The Case of the Gasping Garbage* (Unit 4 student text page 390)

ELD Review Questions for *The Case of the Gasping Garbage*

The Case of the Gasping Garbage (Imagine It Unit 4)
Pictures should be used to support comprehensibility as well as to support higher level thinking questions. Many are based on the comprehension questions in the teachers’ guide.

Entering/ Beginning

1) Does the story begin in a gas station or in a laboratory in a house? (comprehension)
2) Point to the notes that Drake wrote in his science notebook. (comprehension)
3) Looking at the picture on page 395, is Gabby calm, scared or happy? (analysis)
4) Do you think there is a monster in the trashcan? (prediction)
5) Do you think the author meant to write a sad or a funny story? (analysis)
6) Point (p. 402) to why Gabby’s thinks there is something inside the trash can.

7) Point to the things that make you think Drake and Nell are scientists. (p. 406-407, application)
8) Was there a monster in the trashcan? (comprehension)
9) Do Drake and Nell solve the mystery and find out what was in the trashcan? (comprehension)
10) Did a chemical reaction happen in the trashcan? (comprehension)
11) Do you think Drake or Nell is more intelligent? Explain. (evaluation)

Developing/ Expanding
If students at this level have difficulty answering questions, consider giving them two possible answers and seeing if they can identify the correct/ plausible answer.

Focus students on specific situations or examples to help them understand questions. For example, on page 403, "Drake writes notes and asks questions about the garbage can. What does this tell us about his work?"

Where do you see examples of potential and kinetic energy in the story?

The author includes a lot of humor in the story that makes it funny. What was funny in the story? (p. 413)

Prediction Reaction Guide

1) What are different ways you use energy each day?

2) List examples of renewable energy sources.

3) List examples of non-renewable energy sources.

Mark true or false next to the statement and then write how you know that.

True	False	How do you know?	Statement
			4) All things hot or cold have light energy.
			5) The sun is our primary source of heat and light energy.
			6) Current electricity happens when electrons move along a wire, flowing in a circular pattern called static.
			7) Some sources of energy are limited so we need to use them wisely.
			8) Chemical energy is a form of kinetic energy because it is something waiting to happen when burning or other reaction break the bonds between the molecules.
			9) Sound cannot travel in space.
			10) Energy exists in many forms and can change from one form to another.

Energy Poetry Booklet

Name _____

Energy: Forms, Transfer and Economics , by Darla Boswell and Margaret Wattman-Turner adapted by R. Lopez, E. Mayer and L. Meyer, GLAD Grade 4, DLeNM (July, 2013)

Energy Sound Off

(Marine Cadence)

We just know cause we've been told
Energy's worth its weight in gold
People use it everyday
Its sources help us work and play

Sound off- Electricity
Sound off- Light
Sound off- 1, 2, 3, 4, Heat and Sound!

Chemical energy's all around
Some of it lies underground
Once we use it, it is gone
If we don't conserve, it won't be long.

Sound off- Oil
Sound off- Coal
Sound off- 1, 2, 3, 4, Non-renewable!

Other sources do abound
We just need to look around
Water, wind, and yes, the Sun
Generate energy by the ton.

Sound off- Wind turbines
Sound off- Hydropower
Sound off- 1, 2, 3, 4, Renewable!

-M. Wattman-Turner

Energy, Here There, Everywhere

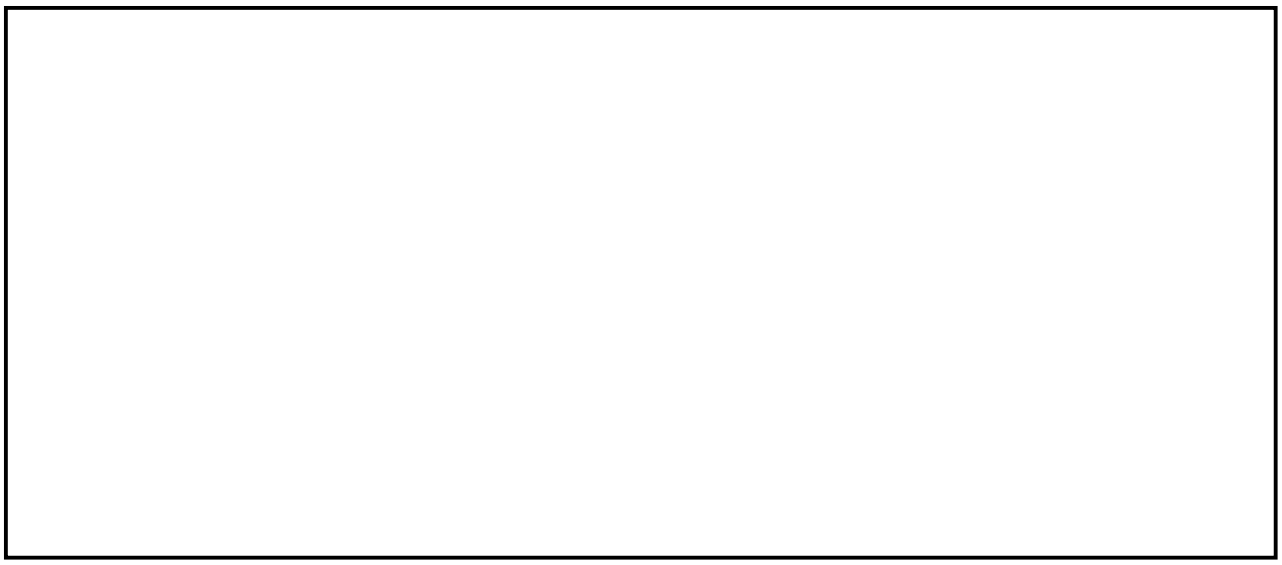
Energy here, energy there
Energy, energy everywhere

Heat energy jiggling rapidly
Sound energy traveling noisily
Light energy reflecting quickly
And electrical energy zapping shockingly

Solar energy throughout the universe
Geothermal energy deep within the earth
Electrical energy on a kitchen stove
And Chemical energy in a car's gas tank

Energy here, energy there
Energy, energy everywhere
Energy, energy, energy!

-M. Wattman-Turner



Scientists Here, Scientists There

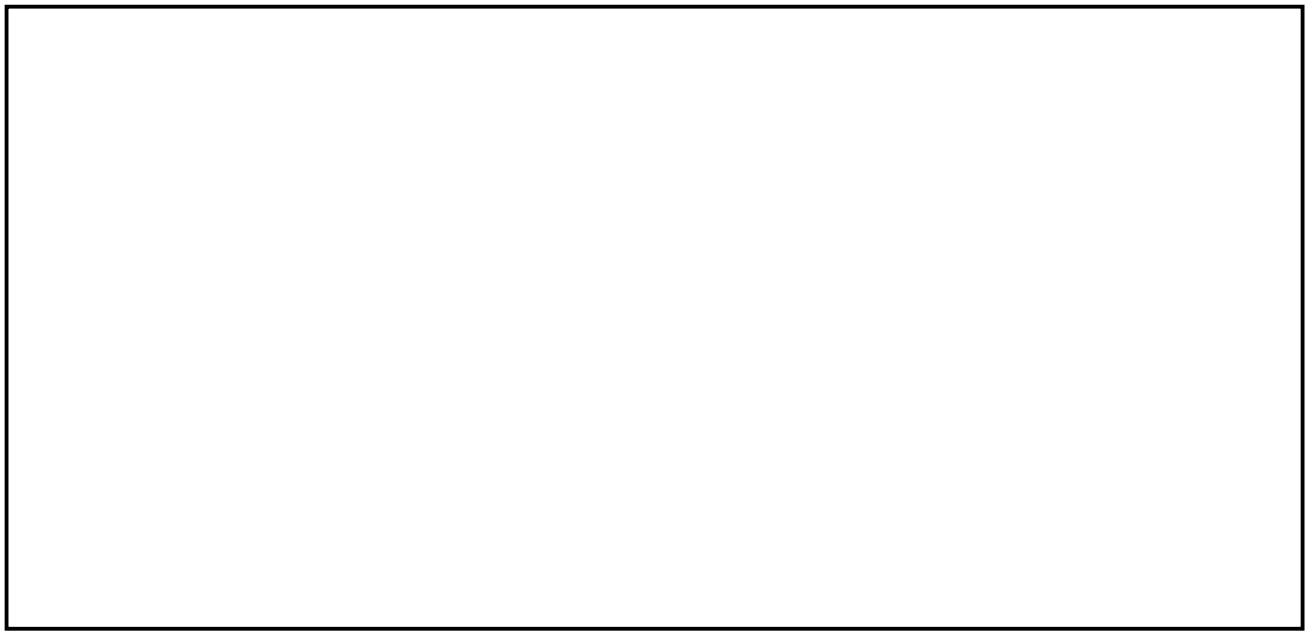
Scientists here, scientists there
Scientists, scientists everywhere

Smart scientists studying seriously
Focused scientists investigating diligently
Mad scientists calculating endlessly
And, brainy scientists hypothesizing carefully

Scientists in the lab
Scientists with a microscope
Scientists on a mission
And, scientists around the world

Scientists here, scientists there
Scientists, scientists everywhere
Scientists! Scientists! Scientists!

By Ruth Kriteman



Heat Transfer Bugaloo

I'm a physicist and here to say,
I study how heat works everyday.
Sometimes I write a paper, sometimes I read a book,
But usually I go and take a look.

Conduction, convection, radiation, too
Doin' the heat transfer bugaloo.

Conduction is the transfer of heat through solid material,
Like when you use a metal pot to heat up your cereal.
Metal is a good conductor, air is not,
If you leave a spoon in boiling water, it'll get hot.

Conduction, convection, radiation, too.
Doin' the heat transfer bugaloo.

Convection is the transfer of heat through liquid or gas,
Into the colder objects, the warmer will pass.
When you boil a lot of water in a very hot pan,
The hottest part of the water rises as fast as it can.

Conduction, convection, radiation, too.
Doin' the heat transfer bugaloo.

Radiation is the transfer of heat through air and space,
Like when the sun heats the earth, it makes a great place.
You can feel the heat when it reaches your skin,
But no solid, liquid or gas is needed for it to move in.

-D. Boswell

Potential and Kinetic Energy Yes, Ma'am

Is this kinetic energy?	Yes, ma'am!
Is this kinetic energy?	Yes, ma'am!
Well, how do you know?	It's changing and moving.
Well, how do you know?	It lets us work.
Give me some examples.	Heat and light.
Give me some examples.	Sound and electricity.
Is this kinetic energy?	Yes, ma'am!
Is this kinetic energy?	Yes, ma'am!
Well, how do you know?	Things are wiggli'n 'n a jiggli'n
Well, how do you know?	Things are a happen'n
Give me some examples	Machines and talking
Give me some examples	Lasers and playing
Is this potential energy?	Yes, ma'am!
Is this potential energy?	Yes, ma'am!
Well, how do you know?	It's waiting to happen.
Well, how do you know?	It has stored energy.
Give me some examples.	Wood and food.
Give me some examples.	Rubber bands and batteries.
Is this potential energy?	Yes, ma'am!
Is this potential energy?	Yes, ma'am!
Well, how do you know?	It's waiting to be used.
Well, how do you know?	It has stored energy.
Give me some examples.	Fossil fuels and uranium
Give me some examples.	A rock a top a hill.
<u>Now</u> it's kinetic energy?	Yes, ma'am!
<u>Now</u> it's kinetic energy?	Yes, ma'am!
Well, how do you know?	Burning fuel gets moving.
Well, how do you know?	Gravity pulls it down.
Give me some examples.	Cars move and fire heats.
Give me some examples.	A rock falling down.
And are you through?	Yes, ma'am!
Did you tell me true?	Yes, ma'am!
What did you chant?	Energy!
What did you chant?	Energy!

-M. Brechtel, adapted by D. Boswell and M. Wattman-Turner

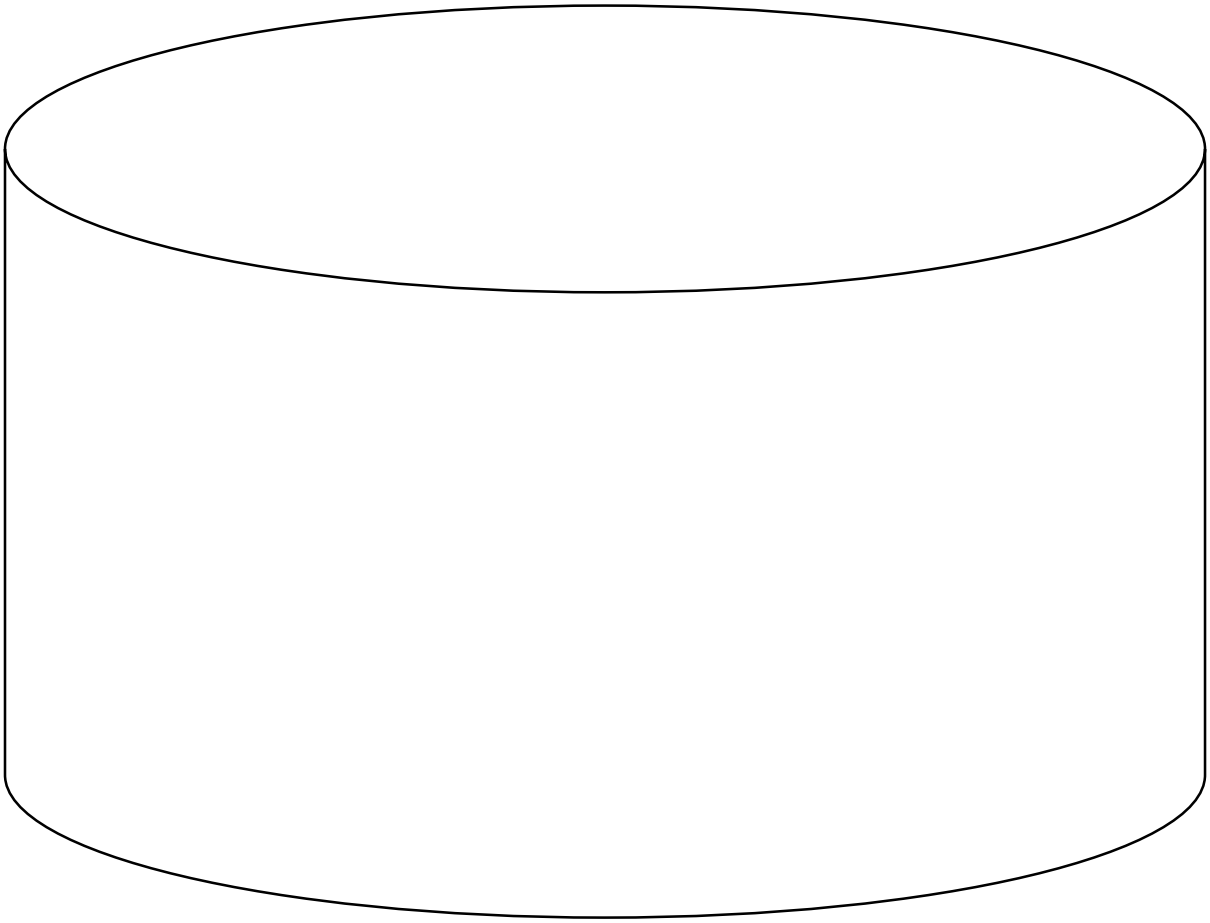
Science Detective Bugaloo
by Rhonda Lopez and Erin Mayer

We're detectives and we're here to say,
We use scientific techniques everyday.
The environment holds the key to our pursuit
The evidence we need to find the truth

Proving our finding
Working with rigor, too.
Doing the detective bugaloo.

In the garbage can, a mystery growled.
A drizzly mess, a possible monster prowled.
We had to solve the case, before our competitor
The creature in the can wasn't a true predator.

We peered in the can,
Found yeast's chemical reaction from the baker man,
It gurgled, popped, and burped, too.
Doing the detective bugaloo.



Energía por aquí, energía por allá
por Eva Thaddeus

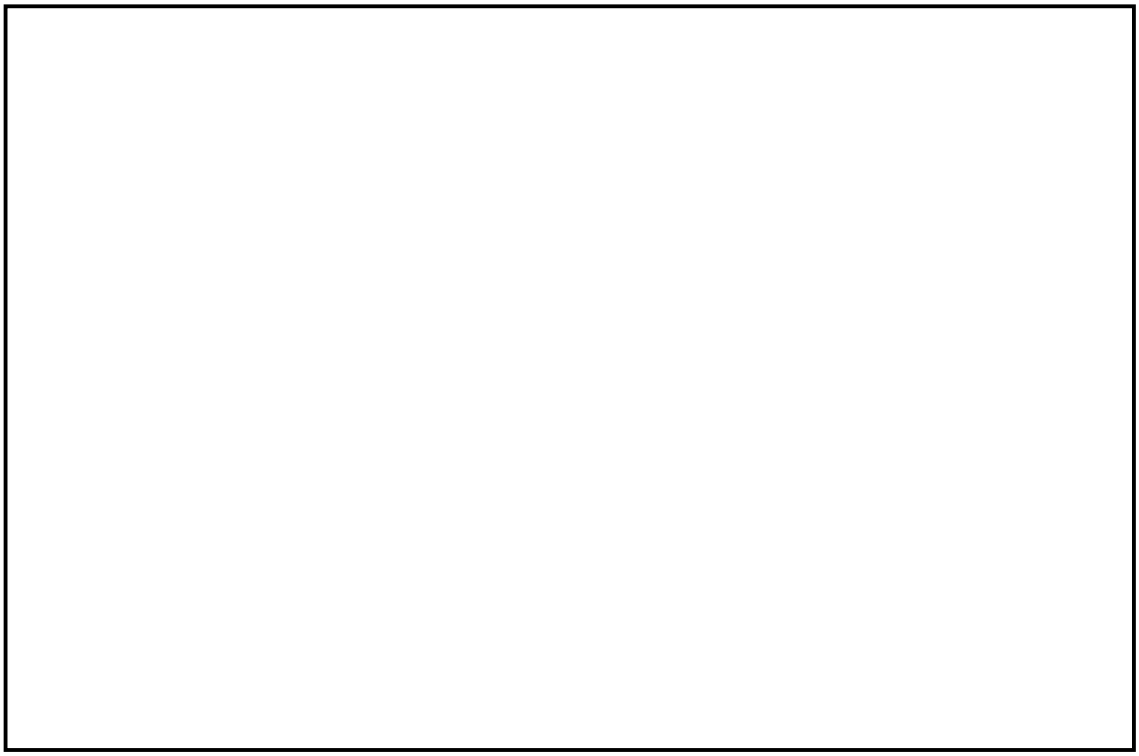
Energía por aquí, energía por allá
Energía en todas partes.

La luz reflejando energía,
El sonido haciéndole eco a la energía,
El calor irradiando energía,
y la energía eléctrica fluyendo, fluyendo.

Energía por aquí, energía por allá
Energía en todas partes.

Energía en mis músculos,
Energía en mi comida,
Energía en mi autobús escolar,
y energía alrededor de todo el mundo.

Energía por aquí, energía por allá
Energía en todas partes.
¡Energía, energía, energía

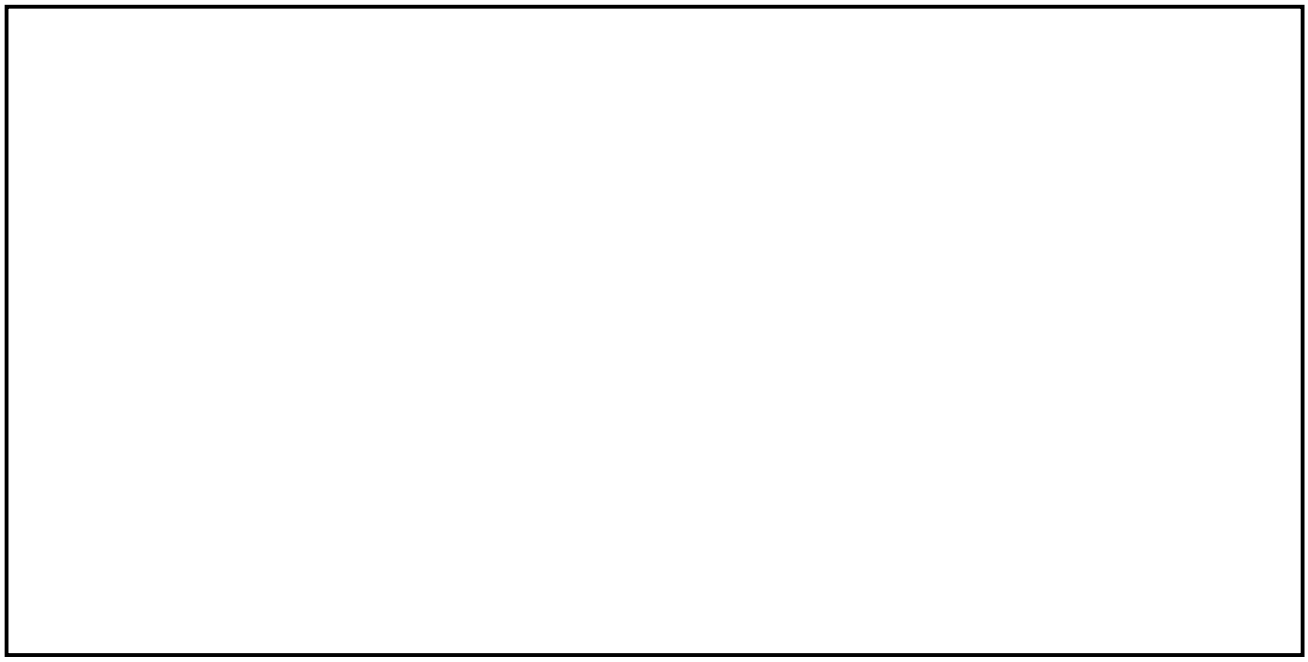


Energía potencial y energía cinética, ¡si señora!

¿Es esto energía cinética? ¡Si, señora!
¿Es esto energía cinética? ¡Si, señora!
Bueno, y ¿cómo lo sabes? Está cambiando y moviéndose.
Bueno, y ¿cómo lo sabes? Nos permite trabajar.
Dame algunos ejemplos. Calor y luz.
Dame algunos ejemplos. Sonido y electricidad.

¿Es esto energía cinética? ¡Si, señora!
¿Es esto energía cinética? ¡Si, señora!
Bueno, y ¿cómo lo sabes? Cosas moviéndose y riéndose.
Bueno, y ¿cómo lo sabes? Muchas cosas pasando.
Dame algunos ejemplos. Máquinas parloteando.
Dame algunos ejemplos. Rayos láser y niños jugando.

¿Es esto energía potencial? ¡Si, señora!
¿Es esto energía potencial? ¡Si, señora!
Bueno, y ¿cómo lo sabes? Está esperando para funcionar.
Bueno, y ¿cómo lo sabes? Tiene energía almacenada.
Dame algunos ejemplos. Madera y comida.
Dame algunos ejemplos. Goma elásticas y baterías.



¿Es esto energía potencial?	¡Si, señora!
¿Es esto energía potencial?	¡Si, señora!
Bueno, y ¿cómo lo sabes?	Está esperando ser usada.
Bueno, y ¿cómo lo sabes?	Tiene energía almacenada.
Dame algunos ejemplos.	Combustibles fósiles y uranio.
Dame algunos ejemplos.	Una roca en la cima de una colina.
¿Y ahora es energía cinética?	¡Si, señora!
¿Y ahora es energía cinética?	¡Si, señora!
Bueno, y ¿cómo lo sabes?	Al quemar combustible se pone en movimiento.
Bueno, y ¿cómo lo sabes?	La gravedad la hala hacia el centro
Dame algunos ejemplos.	Los carros se mueven y el fuego calienta.
Dame algunos ejemplos.	La roca se cae y rueda hacia abajo.
¿Y has terminado?	¡Si, señora!
¿Me dijiste la verdad?	¡Si, señora!
¿Cuál es tu cántico?	¡Energía!
¿Cuál es tu cántico?	¡Energía!

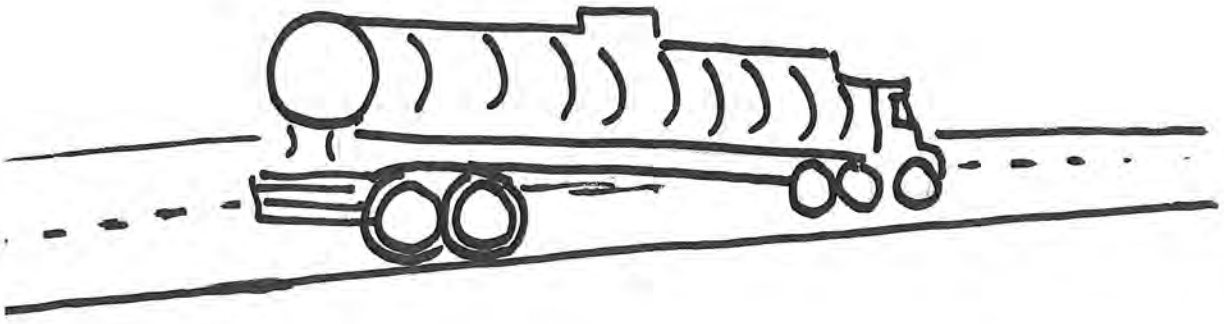
-M. Brechtel, adapted by D. Boswell and M. Wattman-Turner

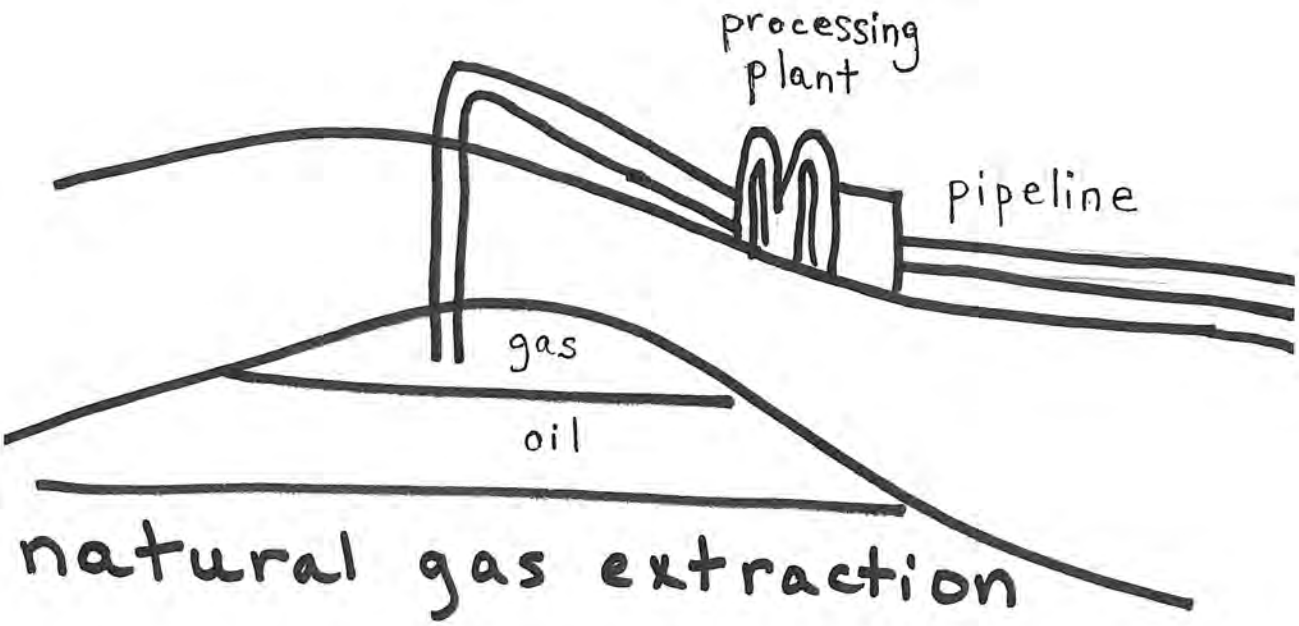
Energy Production in New Mexico
(See following pictures.)
From Eva Thaddeus

These pictures were designed to be placed on an input chart (map of New Mexico) or on a wall map of New Mexico. They connect to New Mexico's economic standards.

oil rig

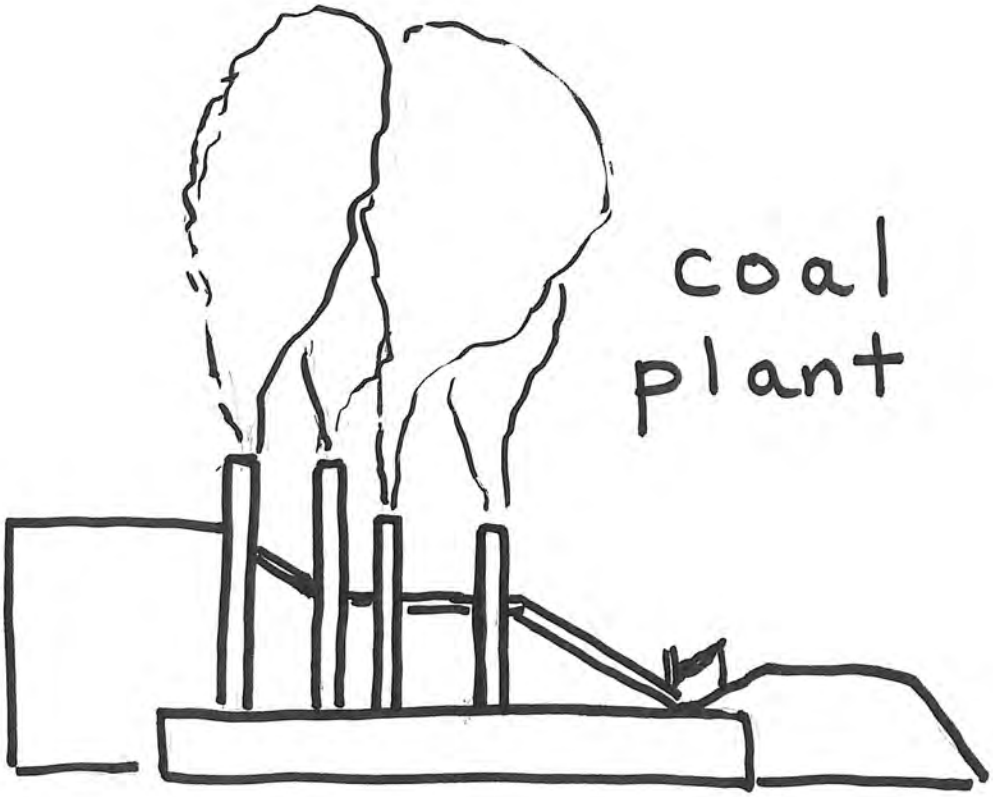
oil tanker truck





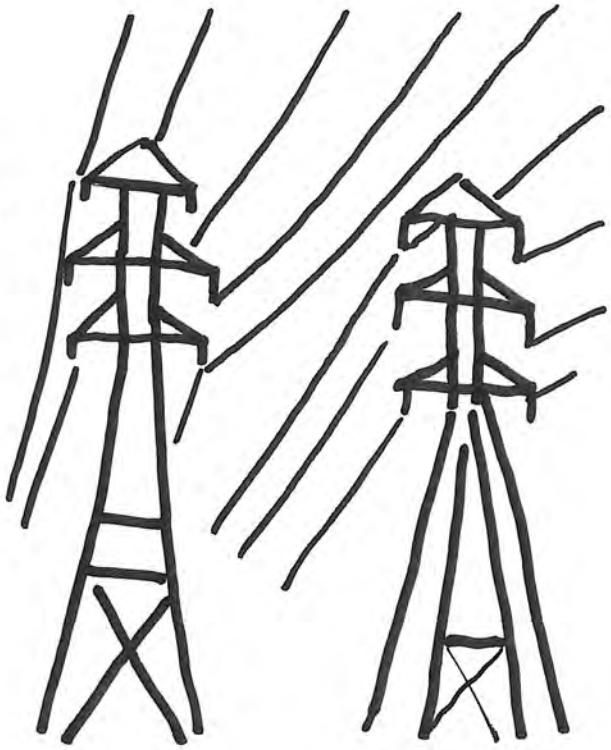
natural gas extraction

wind farm

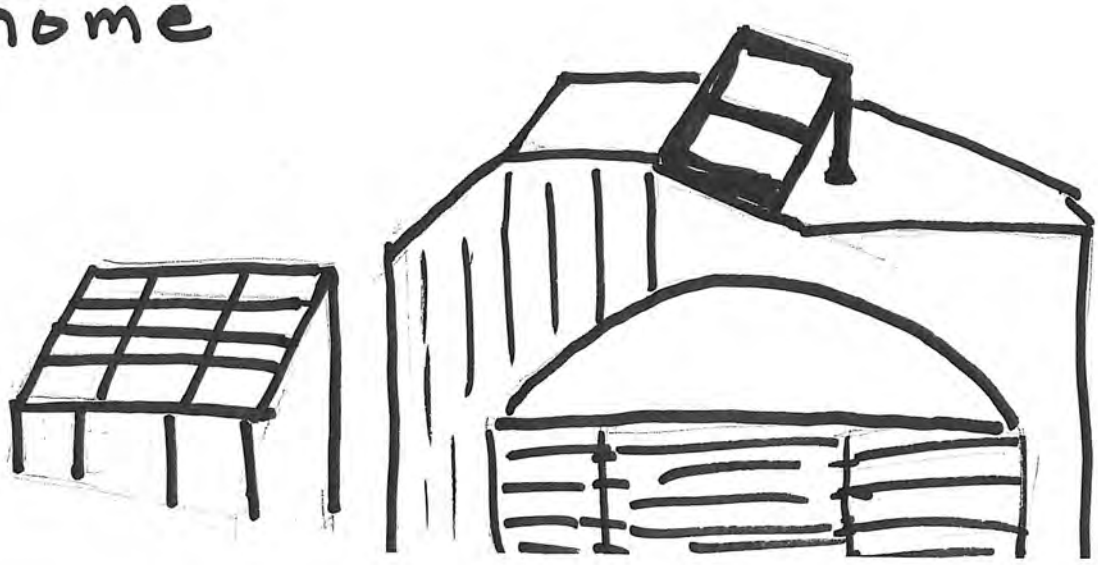

coal
plant


transmission
lines

transmission lines



solar home



Date:_____

Energy Unit

Home/School Connection #1

Look around your home. Where do you find energy? Sketch and write about the places you find energy. Share what you discovered with your family.

Parent: _____ Student:_____

Fecha: _____

Unidad de Estudio sobre Energía

Conexión del Hogar/Escuela #1

Busca alrededor de tu casa. ¿Dónde encuentras energía? Dibuja y escribe sobre estas fuentes de energía. Comparte con tu familia lo que tú descubres.

Adulto: _____ Estudiante: _____

Date:_____

Energy Unit

Home/School Connection #2

How do you and your family use energy throughout your day? Sketch and write your typical schedule and how you use energy.

Parent: _____ Student:_____

Fecha: _____

Unidad de Estudio sobre Energía

Conexión del Hogar/Escuela #2

¿Cómo utilizan energía tú y tú familia durante el día? Dibuja y escribe tu horario típico y cómo tú usas energía.

Adulto: _____ Estudiante: _____

Date:_____

Energy Unit

Home/School Connection #3

Tell your family about two of the different forms of energy that we are studying (heat, light, sound, electric, and chemical). Sketch and write what you shared with your family.

Parent: _____ Student:_____

Fecha: _____

Unidad de Estudio sobre Energía

Conexión del Hogar/Escuela #3

Cuéntale a tú familia sobre dos formas diferentes de energía que estamos esudiando (calor, luz, sonido, energía eléctrica, y energía química). Dibuja y escribe sobre lo que le comentaste a tú familia.

Adulto: _____ Estudiante: _____

LIGHT ENERGY EXPERT GROUP

Characteristics: Light is a form of energy with certain characteristics. Light acts in two ways, like a stream of tiny particles or like a wave. Because light energy moves, it is a form of kinetic energy.

Light is a form of electromagnetic radiation called visible light because we can see it. Sunlight is called white light that is made up of all the colors of light together. A piece of glass called a prism, or water droplets, break out the different bands of light into many colors to form a rainbow. Each color of light has a different wavelength.

Sources: Light is everywhere around us. The primary source of light is the Sun. Light also comes from secondary sources like electrical energy in lamps or flashlights. Fire, fireworks, oil lamps, and candles are sources of light from chemical reactions when fuels are burned. Some types of rocks, fish and glow-sticks are sources of light because they glow which is called phosphorescence.

Movement: Light energy moves. It always travels in a straight line called a ray. Light travels straight like an arrow until it hits an object. When light hits a shiny, solid surface like a mirror or lake, it bounces off. This is called reflection. Light always reflects with the same angle it strikes the object with.

When light travels from one substance and through another, like from air and into water, it changes direction. This is called refraction when light bends. If a pencil is sticking out of a glass of water, it looks like it is bent because of refraction.

Light travels very fast. It goes about 186,000 miles per second. The sun is 93 million miles away, but it only takes 8 ½ minutes for sunlight to reach the earth. Light is the fastest thing in the universe.

Uses and Examples: There are many ways we use light. Like all energy, light makes things happen. Light does work. Most importantly, we need light to see. Light carries information to our eyes. Our eyes then send messages to our brains so we can see colors, shapes and understand things. Light also gives us plants to eat. Plants make food from light in the process of photosynthesis. Without light, plants do not grow, and all animals, including people, need plants to survive as part of the food chain.

There are many other ways people use light. Light creates electricity in solar cells to heat homes or run machines, like a solar calculator. Laser lights cut metal in factories, perform surgery in hospitals, or scan items at the store or library. Lights entertain people in light shows, fireworks, and on our televisions. We also decorate our world with lights, especially during the winter holidays.

Measurement: We measure light by its brightness with a unit called lumens. We can also measure the wavelengths of light. Each color has a different wavelength of light, red being longest and blue the shortest. We also measure light by the angle it travels when it hits objects. We can also use light to measure how far away something is in space in light years. A light year is over 5 trillion miles.

SOUND ENERGY EXPERT GROUP

Characteristics: Sound is a form of energy with certain characteristics. Sound is the vibration of molecules. When molecules vibrate, they move, wiggle, and jiggle, and transfer their energy to other molecules. Sound travels in waves. Because sound moves it is a form of kinetic energy. Some sounds are too high or too low for the human ear to hear, but animals can hear them. Humans hear some sounds with their ears and some sounds by feeling solids that are vibrating.

Sources: Sound is everywhere around us. Sound is produced when forces cause objects or substances to move and vibrate. Sound can be made by hitting two solids together like a hammer on a nail, from the friction of a moving bow on a violin, or when animal hooves strike on the ground. Air vibrates in musical instruments to make music or in our vocal cords so we can speak. This sound energy then reaches our ears as vibrating air. This air hits our eardrums, which carry messages to our brains.

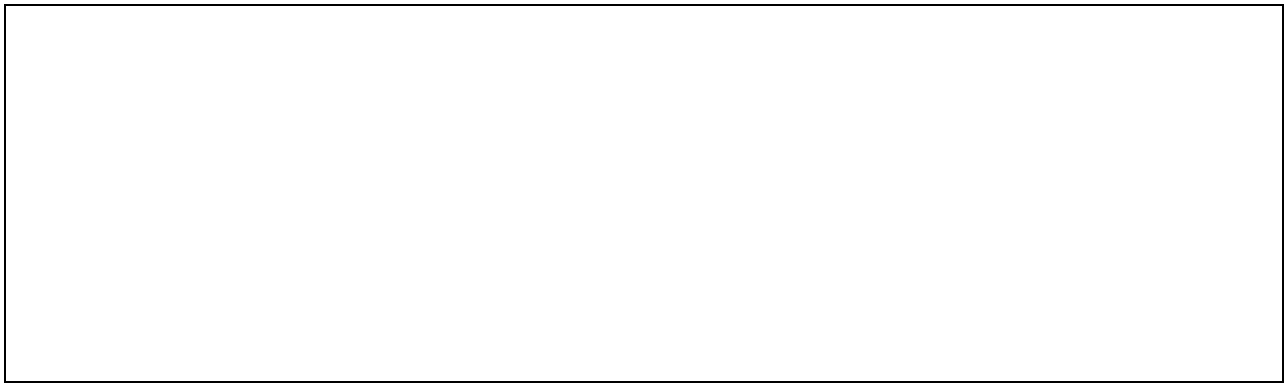
Movement: Sound energy moves in waves. We cannot see these waves, but they can be heard. If we could see sound waves, they would look like the rings made in water when a pebble is dropped into it or like the wave created by a snapping a stretched Slinky or coiled wire.

Sound travels through air, water, and solids, however, sound cannot travel through space. Space is a vacuum. There is nothing in a vacuum that can vibrate to make sound. Most of the distance between the Earth and the Sun is a vacuum, so there is no sound in space.

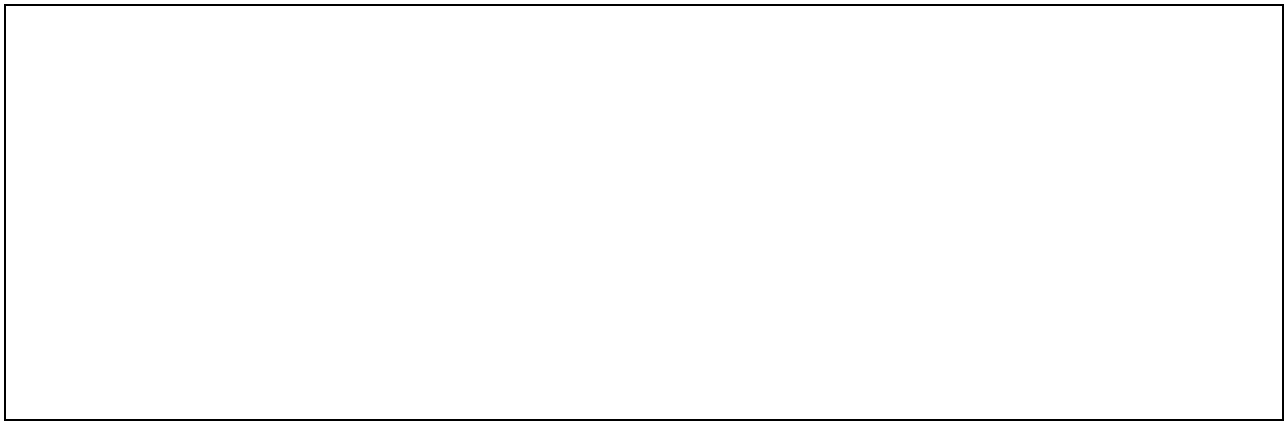
Sound travels slowly. It takes about five seconds to travel a mile. Echoes occur when sound waves reflect off a solid object. The sound waves bounce right off the object and come back to our ears so we hear them again. Some materials like carpet absorb or soak in sound when the sound waves hit the object.

Uses and Examples: There are many ways we use sound. Like all energy, sound makes things happen. Sound does work. Most importantly, we use sound to communicate with others while talking or through music. Sound entertains us in film, on the radio, or while we dance. Sounds we don't enjoy we call noise and often come from machines.

We also use sound to locate things in the environment around us. When we hear sounds from traffic, people, animals, or other objects, we can tell where these objects are. Blind people also use sound to find their way. Animals like bats and whales use sound to help them locate their food or so they can move without hitting things. This is called echolocation. Submarines and ships use sound to navigate on the ocean. This is called SONAR.



Measurement: Sound is measured by pitch and intensity of loudness. Pitch is measured by how fast the waves vibrate. Objects that vibrate quickly and have a short wave produce a higher sound or pitch. Slower vibrating objects with a long wave produce a lower pitch or tone. Loudness is measured in decibels (dB). Humans can damage their hearing if they listen to sounds that are too loud.



ELECTRICAL ENERGY EXPERT GROUP

Characteristics: Electricity is a form of energy that has certain characteristics. Electricity involves the flow of a negative charge found in atoms. All matter is made up of atoms, which are the building blocks of molecules. An atom has a center called a nucleus made of protons and neutrons. An atom also has lots of empty space where tiny electrons spin. Electrons have a negative charge. When these electrons move, there is electrical energy. Because electricity moves, it is a form of kinetic energy.

There are two types of electricity. Current electricity happens when electrons flow in a circuit or a loop. Static electricity happens when electrons jump from one place to another.

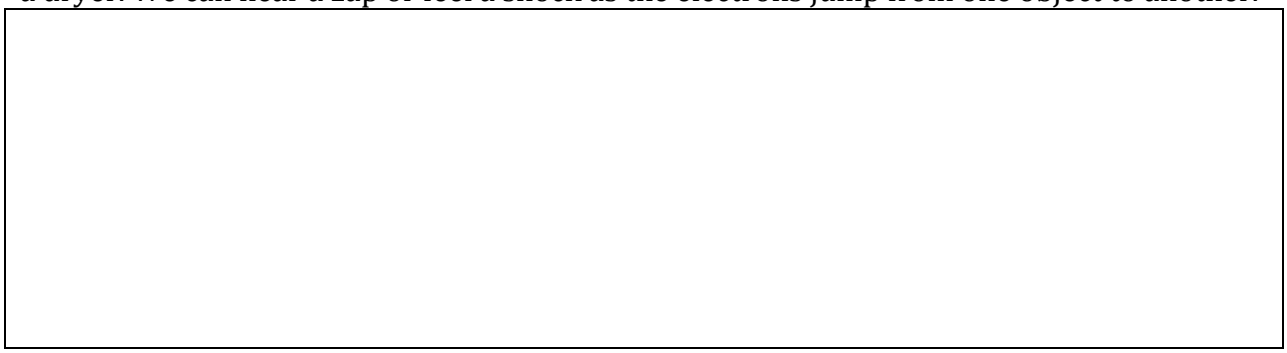
Sources: Electricity is all around us. Electricity is generated in a power plant from spinning machines called turbines that create an electrical charge. We can run the turbines using renewable sources like wind, water and solar power. Other renewable sources of electricity are biomass which comes from plants, wood and garbage, and steam from inside the Earth which is called a geothermal source.

Some sources of electricity are nonrenewable, like the stored chemical energy in batteries, fossil fuels, or in a mineral called uranium. We burn fossil fuels like coal, natural gas, and oil to run the electrical turbines in power plants. Fossil fuels are made from plant and animal fossils in a process that takes millions of years. When the atoms of uranium are broken apart in nuclear fission in a nuclear plant, energy is released.

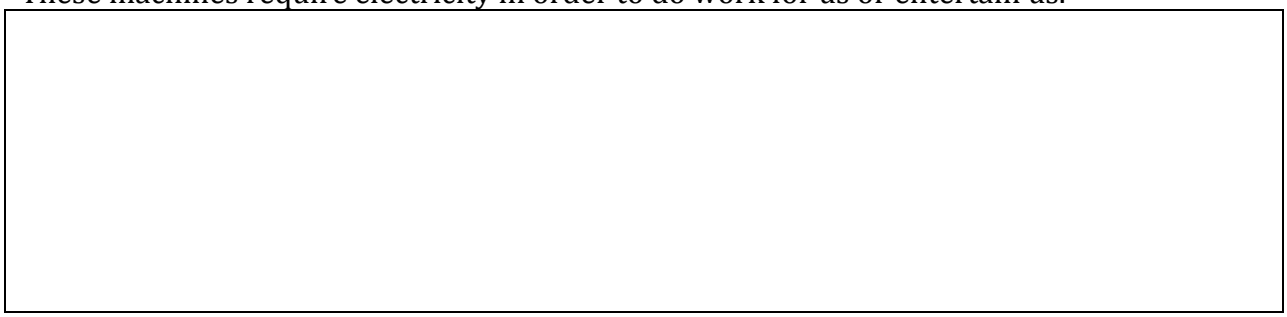
Movement: Electric energy moves. Most electricity travels in a loop called a circuit. Electricity travels long distances from the power plant through power lines and into buildings. Electric current travels through wires in these buildings. The energy flows or conducts along metal wires because metal is a good conductor of electrons. Electrons do not travel well through plastic insulators. Plastic shields the wires inside of electric cords so people don't get shocked. The circuit is completed when we turn on a light switch or use the on and off buttons on appliances.

Not all electricity flows through a circuit. Static electricity occurs when an electric charge builds up and sits on an object until it jumps to an object with a positive charge. Lightening is a natural form of static electricity. During an electric storm negative charges

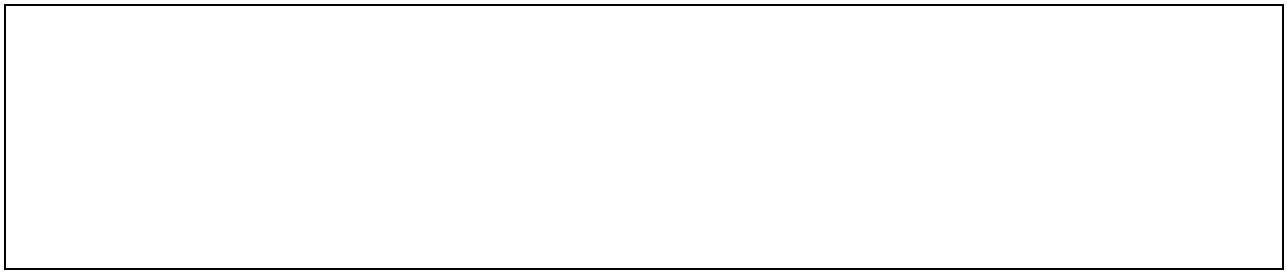
build up in the cloud and then zap down to the earth. A negative charge also builds up when certain materials rub together, like a balloon on hair, socks on a carpet, or clothing in a dryer. We can hear a zap or feel a shock as the electrons jump from one object to another.



Uses and Examples: There are many ways we use electricity. Like all energy, electricity makes things happen. Electricity does work. Electricity gives us light and heats and cools our homes. Electricity runs many of our appliances like refrigerators, washers, dryers, and vacuum cleaners as well as technology like televisions, computers, and radios. These machines require electricity in order to do work for us or entertain us.



Measurement: We measure electricity by a unit of power called watts. It is named after James Watt who invented the steam turbine. A watt is a very small amount of electrical energy, so we often use kilowatts to measure the amount of energy used. 1,000 watts is a kilowatt.



CHEMICAL ENERGY EXPERT GROUP

Characteristics: Chemical energy is a form of energy with certain characteristics. Chemical energy is something waiting to happen, so we call it stored energy, or potential energy. Chemical energy is found in the chemical bonds of everything. All living and nonliving things are made of molecules and atoms. A bond is a force, kind of like glue, that keeps these atoms and molecules together. Energy can be released when these bonds are broken. This energy is changed into other forms of energy, but then it isn't called chemical energy anymore.

Sources: Chemical energy is everywhere around us. Fuels are chemical energy. One common fuel is food. Plants take the energy of the Sun and use it to grow. People and other animals in the food chain eat and digest this food and turn its stored chemical energy into kinetic energy to live and move.

There are other chemical fuels. Plants can be made into biofuels used in vehicles and machines. Examples of bio-fuels are bio-diesel, which is made vegetable oil, or ethanol made from sugar cane, straw, corn or wood, all which are called biomass. Fossil fuels include oil, coal and natural gas made which are made from the fossils of plants and animals. Fossil fuels take millions of years to make and are a limited resource. Uranium is a mineral that has chemical energy and can be used to create electricity in a nuclear power plant. By using these fuels, there can be consequences. When fossil fuels burn, they pollute the air and contribute to global warming and uranium creates radiation. Bio-fuels don't put pollutants in the air that contribute to global warming.

Chemical energy can also be stored in batteries. We use the stored energy in batteries to create electricity from chemical reactions inside them. When a battery is dead it has no more stored energy. Some batteries are rechargeable and can be used again.

Movement: Chemical energy does not move. It is stored energy. Chemical energy is a type of potential energy. Potential energy is stored energy because it is something waiting to happen.

Uses and Examples: There are many ways we use chemical energy, but we can only use it after it is transformed or changed in chemical reactions. Once it transforms to another type of energy like heat, sound, light, electricity or mechanical energy, it is no longer chemical energy. People need chemical energy to make things happen.

Whenever we burn fuels, use batteries, eat food or watch a fireworks show, we have used chemical energy. We burn chemical fuels to run our cars and trucks and to make electricity. We use stored chemical energy from batteries to run our radios, flashlights and game boys. When we eat food we burn chemical energy to work and play. The chemical energy in fireworks or dynamite changes to light and sound energy to entertain us and do work. By breaking the bonds in uranium, we generate electricity.

Measurement: There are many ways we measure chemical energy. Most energy is measured in units of joules. One joule is the power it takes to lift one pound off the ground nine inches. We measure chemical energy in food as calories. For natural gas we measure the energy as therms.

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Mind Map
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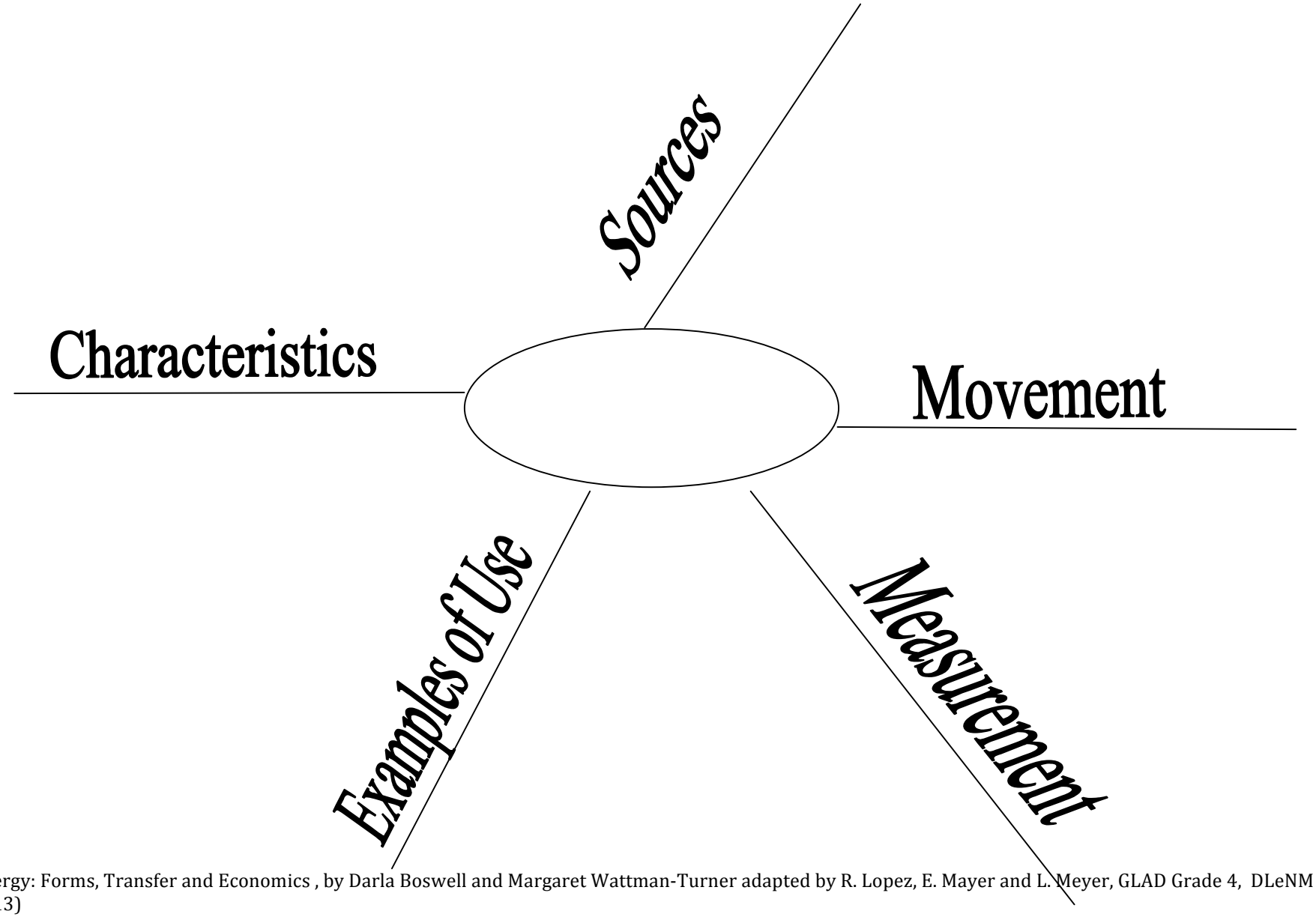

Process Grid
Process Grid Page 1

Forms of Energy	Characteristics	Sources	Movement	Use Examples	Measurement

Heat (Thermal)	Infrared radiation Hot and cold Invisible Kinetic Energy Moving Molecules	-Primary, SUN Other Sources of energy: -Electricity (heaters) -Chemical Reactions (burning of fuel, food) -Friction (mechanical movement, machines) -Nuclear	-Heat flows from hot to cold -Radiation: (through empty air and space) -Convection (through fluids & gases) -Conduction (through solids) Metals good conductors.	Cooking (stoves) Building , factories and machines Warmth: Candles, coal, oil, wood ,	Temperature (Degrees Fahrenheit or Celsius)
Light (Radiant)	Electromagnetic radiation Visible: SIGHT Waves and particles Different colors, different wave lengths Kinetic Energy	-SUN Primary Secondary Sources -Light bulbs (Chemical) -Fire (Chemical) Phosphorescence -Chemical Reactions	-Travels in straight line (Rays) -Reflection (bounce, some is curved, distorted) -Refraction (bends changes direction) -very fast	Help us see (lamps, fire) Make food in plants Lasers-cut metal, Surgery, Scanning Entertainment (T.V, light shows, fireworks) Decorations	Brightness -- Lumens Color (frequency and wavelength) Angle of movement Distance- Light years
Sound	Vibration molecules in all matter can be heard and not heard, Some can be felt Kinetic Energy	Secondary Energy: mechanical force (air, striking, motion) causes an object or substance to	-Travels in Waves -slower than light -waves of alternating	Speech (voice) Entertainment (Music film) SONAR (ships, submarines) Echolocation (bats)	Intensity of loudness - Decibels Pitch- Tone (wave length)

Process Grid Page 2

Forms of Energy	Characteristics	Sources	Movement	Use /Examples	Measurement
Electricity	Movement of electrical charge electrons, a (-) charge -Electrons flow through conductor. -Static electricity is a stationary electric charge that is built up on a material Kinetic Energy	Secondary Energy: negative charge generated from other energy Turbines make electrons from heat, wind, solar, fuels Nonrenewable: coal, natural gas, oil, nuclear power Renewable: geothermal biomass solar wind water Batteries	Static- electrons jumping, Lightening, balloons, socks Charge flows along conductor (electrons travel in closed loops or circuits)	Heat/ cool homes Light Appliances (Work) Technology Entertainment	Joules <u>Units of Power:</u> Watts (in honor of James Watt, inventor of steam engine), converts 1 joule per second Voltage-pressure on power lines
Chemical	Bonds that hold atoms together Potential energy, (Stored) waiting to happen	SUN Food Chain Fossil Fuels Bio-fuels, Biomass Uranium	Doesn't move Transfers to electrical, mechanical, sound, and light.	Food Fuel: Oil, natural gas, coal biomass, (heat, transportation, electricity) Batteries	Calories Therms

Graffiti Wall Questions

These are example questions. Adjust or write new questions based on your instruction and standards.

1) What are the characteristics of heat energy?

2) What is the difference between potential and kinetic energy?

3) Give an example of how energy changes from one form to another.

4) Where in New Mexico do you find oil wells?

5) List different forms of energy.

6) What types of energy travel in waves?

Name _____

Energy: Forms, Transfer and Economics
Unit Test