Curriculum to Accompany Energy Detectives

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in collaboration with Meet Me on Planet 3
Click HERE to learn more about the Curriculum Team

Rationale

Heating and cooling of buildings is one of the main sources of greenhouse gas emissions in U.S. cities and towns. Burning of fossil fuels for energy results in high costs to residents as well as pollution that leads to environmental and health concerns.

Illnesses associated with fossil fuel pollution include chronic cough, asthma, lung cancer, bronchitis, and other respiratory ailments. Energy efficiency measures can support good physical and mental health by creating healthier indoor living environments, which include improved air temperatures, noise levels, humidity levels and air quality.

The book *Energy Detectives* was written by Madelyn Rosenberg, illustrated by Paul Meisel, and funded by Cooler Communities to help children better understand how to conserve energy at home. Our hope is that educators will read the book with students in the classroom and incorporate some or all of our accompanying solutions- and project-based curriculum into their instruction.

Additionally, we hope children will learn to understand and advocate for changes to energy consumption in their communities. This starts with encouraging their adult family members to make changes to more efficiently insulate and power their homes.

Planning Ahead: Teacher Preparation & Notes

About the Curriculum

- **Everything in this curriculum is *optional***.
- While the curriculum was designed as a unit plan to gradually build knowledge and guide your students to deeper understandings about energy transfer and efficiency, each lesson or activity can serve as a stand alone lesson.
- You are the expert on your students and your bandwidth. It is up to you to decide if you want to do every lesson exactly as written, complete only one or two lessons, and/or modify lessons.
- If you have an existing science curriculum, please select the lessons or lesson components that would best supplement your current instructional plan.

Schedule

- Keep in mind that some classes may need more time than others. An activity that claims to take 30 minutes realistically may last 45 minutes.
- Be flexible. Because class schedules and blocks of time vary, **one lesson may take several days to finish**.

Supplies

- Request *Energy Detective* books for you and each of your students. To order, visit energydetectives.org.
- We highly recommend you sign up for a free educator account with Canva. With an account, you can save and make changes to any of our canva templates.
- Gather materials and make photocopies for each lesson. ***Click* HERE for a complete list of supplies**. (PDF)

Anticipating Student Needs

- Read the *Energy Detectives* book on your own.
- Look over the list of Key Vocabulary Terms.
- Preview lessons and handouts, and scaffold for your students as needed.
- Some students may enter with a better foundational understanding of energy than others.

Inviting Guests

- If you plan to invite a guest speaker (Lesson 5), make those arrangements in advance. (sample email to potential guest speakers provided in lesson plan that follows)
- If you plan to invite families or other school community members to hear the guest speaker (Lesson 5) or view student presentations (Lesson 8), choose dates early, and send out "save the dates." (sample invitations provided in lesson plans that follow)

Curriculum Summary

Lesson	Time	Relevant Frameworks	Summary
Lesson 1: Launch	1 hour	SL4.1, SS & STE practices	Students are informed of their roles as "Energy Detectives," why conserving energy is important, and the challenges they have to look forward to.

Lesson 2: Building Knowledge	1 ½ hours	RI4.3, SL4.1, SL4.4, L4.4, 4-ESS3-1, 4-PS3-2, STE practices	Students participate in vocabulary-building activities and choose their own paths for learning about types of energy and energy transfer.
Lesson 3: Story Time	1 hour	RI4.1, RI4.3, L4.4, ELA & STE practices	The class reads *Energy Detectives*, and students engage in corresponding literacy activities.
Lesson 4: Energy Efficiency	1 ½ hours	L4.4, SL4.1, SS & STE practices	Students review important concepts pertaining to energy conservation and go on a scavenger hunt in search of examples of energy efficiency in their school building.
Lesson 5: Guest Speaker	1 ½ hours	SS, STE & ELA practices	The teacher invites a community member to speak about energy efficiency.
Lesson 6: Model Home	2 ½ - 3 ½ hours	SL4.1, 4-ESS3-1, 4-PS3-2, 3-5-ETS1-1, 3-5-ETS1-2, 4.3-5-ETS1-5(MA)	Students design and build energy-efficient model homes.
Lesson 7: Creative Writing	1 - 1 ½ hours	RI4.1, RW4.2, SL4.1, ELA practices	Students author a real estate listing for their model homes with a focus on energy efficiency and sustainability.
Lesson 8: Presentations & Reflections	1 hour	SL4.4, 4-ESS3-1, 4-PS3-2, SS, ELA & STE practices	Students present their energy-efficient model homes and real estate listings to a live audience. They then reflect on the curriculum and what they learned.

Practices		
STE	ELA	SS
✓ Asking questions (for science) and defining problems (for engineering)	✓ Participate in an interactive read aloud by sharing ideas with peers through a turn and talk or think - pair - share	✓ Demonstrate civic knowledge, skills, and dispositions. ✓ Develop focused questions or problem

✓ Developing and using models ✓ Constructing explanations (for science) and designing solutions (for engineering) ✓ Engaging in an argument from evidence ✓ Obtaining, evaluating, and communicating information	✓ Answer questions about the ideas presented in a text ✓ Make text-to-self and text-to-world connections ✓ Determine the meaning of a multiple meaning word as it used within a specific context ✓ Compose a well organized informational piece of writing that includes domain specific vocabulary and specific examples	statements and conduct inquiries. ✓ Argue or explain conclusions, using valid reasoning and evidence. ✓ Determine next steps and take informed action, as appropriate.

Relevant STE Frameworks

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

4.3-5-ETS1-5(MA). Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.

Relevant ELA Frameworks

RI4.1: Refer to details and examples in a text when explaining what the text states explicitly and when drawing inferences from the text.

RI4.3: Explain events, procedures, ideas, or concepts in a historical, scientific, mathematical, or technical text, including what happened and why, based on specific information in the text

RW4.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

RW4.2a: Introduce a topic clearly and group related information in paragraphs and sections; include text features (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.

RW4.2b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.

RW4.2c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because).

RW4.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

RW4.2e. Provide a concluding statement or section related to the information or explanation presented.

SL4.1: 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

SL4.4: Report on a topic, text, procedure, or solution to a mathematical problem, 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 and use appropriate vocabulary.

L4.4: 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

Key Vocabulary Terms		
Tier 1 ● Attic ● Detective ● Freezer ● Refrigerator ● Roof ● Snow	Tier 2 ● Conservation / Conserve ● Efficiency / Efficient ● Energy ● Environment ● Hack ● Leak ● Loss ● Nonrenewable ● Pollute / Pollution ● Power ● Renewable ● Save ● Sustainable ● Transfer ● Waste	Tier 3 ● Fossil fuel ● Heat pump ● Insulation ● Natural resource ● Thermal energy

Lesson 1: Launch (1 hour)

Learning Objectives: Students will be able to…

1. Explain reasons it is important to reduce energy consumption.
2. Create a model that illustrates their current understanding of a phenomenon.
3. Generate ways of doing and thinking that are not so detrimental to the Earth.

Language Objective: Students will be able to…

Describe a model that illustrates their current understanding of a phenomenon.

Lesson 1 Slides

Duration	Activity	Materials & Prep
5 minutes	Introduce students to their roles as "Energy Detectives", and generate excitement about the challenges they have to look forward to. Share "The Why" with students, so they understand the rationale behind what they are learning. Use the Lesson 1 Slides as a guide.	Lesson 1 Slides ➢ PDF ➢ Google slides ➢ Canva template
20 minutes	Students connect the concept of energy efficiency to healthier air and the environment. ● Read together the front page of 'Energy: Why does it matter?' and check for understanding. ● Read together the examples of individual, collective, and systemic changes in a community, and check for understanding. ● Students respond to questions on the handout or in their science notebooks: 1. Which change is the easiest to make and why? 2. Which change would result in the greatest	☐ Science Notebooks *or* ☐ Energy: Why does it matter? ➢ PDF ➢ Canva template

	improvement to air quality and why? 3. What can YOU do to encourage collective and systemic changes in your community? ● Tell students to share their thinking with a classmate (e.g. elbow partner), and then select a few students to share with the class. ● After sharing, make sure students understand that *systemic* change would result in the greatest improvement on air quality. These changes affect a larger population and are typically longer lasting because they are mandated by a government entity. For example, an ordinance banning plastic bags is going to have a bigger impact than a few stores deciding to stop using them. One way a student could encourage systemic change is by writing a letter to the city council in support of an ordinance. That said, collective change typically comes before systemic and is also impactful. Students can encourage collective change by encouraging family and friends to make changes or by creating awareness such as with posters. All this said, keep in mind that every change starts with an individual!	
20 minutes	Uncover what students already know about energy, energy transfer, and energy sources. ● Students preview a picture of Charlie & Annabeth's homes from *Energy Detectives*, and complete a "See Think Wonder." Elicit volunteers to share a "see", "think", or "wonder" with the class. ● Students draw initial models (diagrams) of their current understandings of the **cause**(s) of differences observed between the two rooftops, including how *energy* fits into the equation. Give students the opportunity to share their models in pairs and then with the class. ● In Lesson 8, students will draw a *final* energy model. For the teacher: Link to a *final* energy	☐ Science Notebooks *or* ☐ See Think Wonder & Initial Model ➢ PDF ➢ Canva template

	model exemplar. • Important Note: It is okay if students have misinformation at this time. In fact, it will help you to understand any preconceptions they may have. Instead of commenting on "right" and "wrong" ideas, you can say to any student things like, "Thank you for sharing," "We'll see how this all turns out," "We will create new models as we learn new information," "It's great to hear so many different ideas," and "I love that so many students are taking risks," etc.	

Lesson 2: Knowledge Building (1 ½ hours)

Learning Objectives: Students will be able to…

1. Demonstrate an understanding of energy.
2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4. Generate ways of doing and thinking that are not so detrimental to the Earth.

Language Objective: Students will be able to…

Describe different types and examples of energy transfer.

Lesson 2 Slides

Duration	Activity	Materials & Prep
20 minuters	Preview vocabulary. • Students copy the word and definition for both 'energy' and 'transfer' onto their "Frayer models." They work on the remaining 3 boxes on their own. Select a few students to share their ideas with the class. • Students work on "Exploring the Root 'Therm'" individually or in pairs. Select a few students to share out.	Lesson 2 Slides ➢ PDF ➢ Google slides ➢ Canva template ☐ Frayer Model ➢ PDF ➢ Google slide ☐ Exploring the Root "Therm"

		➢ PDF ➢ Canva template
30 minutes	Build knowledge about types of energy and energy transfer in a UDL-inspired format. ● Students may choose to work alone, with others (recommend 2-3 students), or with a teacher in a small group. ● They have 6 options for knowledge building, including challenge level options (for students interested in content that is above grade level): Option 1: Video, "Energy is always changing," courtesy of Mighty Owl Science and YouTube. Notes: (1) Tell students to pause the video to allow ample time to discuss concepts and record responses. (2) Students choosing this option also can complete the provided "Energy Video Questions" worksheet, which reviews information specifically from the video. Option 2: Grade Level Article, "Electricity & Energy," courtesy of ReadWorks Option 3: Challenge Level Article, "There are three ways heat, or thermal energy, can be transferred," courtesy of Newsela. Note: Five Lexile reading levels are available in Newsela. Option 4: Podcast Episode, "The Electric Detectives with Mike Legatt", courtesy of the children's podcast, Tumble. Note: Relevant content begins at minute 2:13, with 13 minutes remaining. Option 5: Challenge Level Virtual Simulation, "Thermal energy transfer," courtesy of PBS Learning Option 6: My Own Resource Idea - Students choose another way to build their energy knowledge (with teacher approval). ● Questions for all options, to be answered in	☐ Science Notebooks *or* ☐ Universal Handout for Energy Knowledge Building ➢ PDF ➢ Canva template ➢ Google doc (for use with Google Classroom) Option 1: Video LINK Video-specific Questions ➢ PDF ➢ Canva template Option 2: ReadWorks LINK Article PDF Option 3: Newsela LINK Article PDF 940L Article PDF 410L Option 4: Podcast LINK Option 5: Simulation LINK

	science notebooks or the provided "Universal Handout for Energy Knowledge Building": 1. Describe one piece of information from your resource that **confirmed** what you already knew about energy. 2. Describe one **new fact** that you learned about energy or something that surprised you. 3. List at least one **question** that you now have about energy or one energy topic you would like to learn more about. ● Note: Please give space and opportunity for growth. If students are having difficulty writing, they might draw or demonstrate their thinking. If they are having difficulty drawing, they might demonstrate or write their ideas.	
10 minutes	Jigsaw. ● Students pair up with a partner, preferably one that chose a *different* knowledge-building activity. They each spend a few minutes sharing what they learned. and/or ● Invite students to share what they learned with the entire class.	
20 minutes	Review what students have learned about energy so far. ● Review vocabulary: Energy, transfer, energy transfer, heat transfer (extension terms: conduction, radiation, and convection). ● Give students time to understand, discuss, and ask questions to assess their learning thus far.	
20 minutes	Natural resources & the environment activity ● First make sure students understand what a **natural resource** is, and why some are	☐ Video on Natural Resources, courtesy of Cartoons for Kids!,

	considered **renewable** and others **nonrenewable**. Use the Lesson 2 Slides to help you. Option 1: Sorting Cards in Teams ● Give each team a set of energy sources cards. ● Tell each team to read the cards out loud to each other, and then place the cards in order of environmental impact, from least harmful to the environment to most harmful. ● Tell them to defend their choices by using evidence and reasoning to support their claims (a.k.a. position in line). ● Have groups share their orders, and try to come to a consensus on the order. ● It's okay if students have different responses and not everyone agrees; however, in general, the nonrenewable resources should be ranked as having a greater, more harmful impact. Option 2: Sorting Posters as a Class ● Give 9 students a poster with a type of natural resource and its description to hold. ● One at a time, tell each student to read their sign out loud, and then place themselves in front of the class in order of environmental impact, from least harmful to the environment to most harmful. ● Tell them to defend their choices by using evidence and reasoning to support their claims (a.k.a. position in line). ● Other students can make suggestions about where they should stand as well. The class should come to a consensus at the end. ● It's okay if students have different responses; however, in general, the nonrenewable resources should be ranked as having a greater, more	Sandra Stoiber and YouTube. ☐ Option 1: Energy source cards to sort in teams (recommend cardstock if reusing) ☐ PDF ☐ Canva template ☐ Option 2: Energy Sources posters for full class stand in order activity (recommend cardstock if reusing) ➢ PDF ➢ Canva template

	harmful impact. ● **Teacher Note**: Much of the 'air pollution' is in the form of **greenhouse gases**, such as carbon dioxide. Greenhouse gases trap heat in Earth's atmosphere, which is a *good* thing, or our planet would be too cold for most living things to survive. However, when *too* much of these gases are trapping heat, such as due to the amount released from burning fossil fuels, it leads to climate change. Students will learn more about greenhouse gases and **climate change** in future grades. However, if you feel they are ready for it now, go ahead and discuss it with them.	
15 minutes	Exit Ticket ● Tell students to complete the exit tickets in their science notebooks or on the provided "Lesson 1 Exit Ticket" handout. 3 new facts 2 new vocabulary terms 1 question ● Use exit ticket information as data to inform next steps. ● Teachers also should check student exit ticket **questions**, and use those to help guide upcoming lessons. One technique is to post the student questions on chart paper (either re-write them, or paste on the actual exit ticket), and refer back to them at the end of each lesson to see if any have been answered. Some teachers like to categorize student questions. E.g. Questions about "energy conservation" in one category, questions about "energy transfer" in another, etc.	☐ Science Notebooks *or* ☐ Exit Ticket ➢ PDF ➢ Canva template

* Energy **wasted** refers to energy *leaked, lost* or *transferred* unnecessarily.

** Energy **saved** refers to energy *conserved*, *hacked* or used to its *greatest potential*. Energy leaks are absent or greatly reduced.

Lesson 3: Story Time (1 hour)

Learning Objectives: Students will be able to…

1. Identify ways that energy is conserved and wasted within our homes.
2. Identify key details in a text that help them gain understanding of a scientific concept.

Language Objectives: Students will be able to…

1. Describe ideas about a text using complete sentences.
2. Generate questions using the 5Ws and H, and compose complete sentences in order to discuss and write their ideas about concepts in a text.

Lesson 3 Slides

Duration	Activity	Materials & Prep
10 minutes	Students generate ideas about what they *think* they know about energy use in their homes. • Students place their ideas into the first column of the class's RAN chart using sticky notes. • *If this is the first time using a RAN Chart as a class, briefly introduce this as a way for us to record our ideas about a topic, clear up misconceptions, and capture new learning and questions. RAN is an acronym for Reading and Analyzing Nonfiction.*	Lesson 3 Slides ☐ PDF ☐ Google slides ☐ Canva template ☐ RAN Chart (per class / recreate this on chart paper) ☐ Sticky notes (Start with 3 per student, more as needed)
20 minutes	Interactively read aloud *Energy Detectives*. See accompanying "Read Aloud Guide" with guiding questions.	☐ *Energy Detectives* books. (To order, visit energydetectives.org.) ☐ Read Aloud Guide ➢ PDF ➢ Google doc
15 minutes	Revisit the class RAN chart. • Read over the ideas in the first column and move	☐ RAN Chart on chart paper

	any accurate understandings into the 'Confirmed' column and any inaccurate understandings into the 'Misconceptions' column. ● Have students record their new learning and any lingering questions onto sticky notes and post them in the remaining columns.	
	Homework: Read and discuss *Energy Detectives* with family members. ● Send home a letter to families with the book and bookmark. The letter should explain the rationale behind reading *Energy Detectives* with their children. See sample letter. ● Students can read the book independently, read it aloud to family member(s) or if the text is above their independent reading level, a family member can read aloud the text to the student. ● After reading, students and caregivers will participate in a brief discussion about what was read using the accompanying bookmark with discussion prompts. ● **Teacher Note**: Homework discussion prompts are available at the beginning of Lesson 4.	☐ *Energy Detectives* books for students to bring home (per student, to request books, visit energydetectives.org) ☐ Sample Letter to Families ➢ PDF ➢ Canva template ☐ *Energy Detectives* bookmark with discussion prompts (recommend printing 3 per page, so one page per 3 students) ➢ PDF ➢ Google slide ➢ Canva template

* Energy **wasted** refers to energy *leaked* or energy *transferred* unnecessarily.

** Energy **saved** refers to energy *conserved*, *hacked* or used to its *greatest potential*. (i.e. energy leaks are absent or greatly reduced)

Lesson 4: Energy Efficiency (1 ½ hours)

Learning Objectives: Students will be able to…

1. Identify and categorize examples of home and school practices as energy *conserved* or energy *wasted* as well as changes to energy consumption as *behavioral* or *structural*.
2. Obtain, evaluate, and communicate information about energy efficiency within a building.
3. Analyze the results of an energy-efficiency scavenger hunt, and identify changes that can be made to make a building more energy-efficient.
4. Recount that energy and fuels are derived from natural resources, explain why an energy source is labeled as *renewable* or *nonrenewable*, and describe how their uses affect the environment.

Language Objective: Students will be able to…

Make a claim and support it with evidence and reasoning.

Lesson 4 Slides

Duration	Activity	Materials & Prep
10 minutes	Share about reading the book with families. **Teacher Note**: Invite students to respond to questions about their homework. It's okay if a student has not read with their families; do not single them out or penalize them in any way. • What did your family think of the book, *Energy Detectives*? • How are the homes in the book similar to and different from where you live? What are some different kinds of homes in your neighborhood? • How do city homes differ from country homes? What other types of homes can you describe? • Did the book inspire you or your family to do anything to conserve more energy at home? • Do any of your family members work in the field of energy (e.g. electrician, engineer, energy consultant, technician, gas station attendant, etc.) Use the Lesson 4 Slides as a guide.	Lesson 4 Slides ➢ PDF ➢ Google slides ➢ Canva template

10 minutes	Make sure students understand what a heat pump is, how it works, and why it is more energy efficient than a traditional HVAC. • What is a heat pump? ◦ A heat pump is a more energy efficient means of heating and cooling buildings. A heat pump *moves* warm air rather than changing its temperature. This requires less energy and also is electric, thus it does not rely on fossil fuels to function. • Optional: Show students the video about heat pumps, courtesy of PBS NewsHour and YouTube (about 8 minutes).	Video about Heat Pumps, courtesy of PBS NewsHour and YouTube
20 minutes	Students develop a better understanding of energy efficiency with a sorting activity. • Place examples of home and school practices into "**energy conserved****" and "**energy wasted***" buckets. Option 1: Class of 20 or fewer students. Print and cut one set of cards for the class. Each student gets one or two cards (depending on class size). One at a time, they place their card(s) in a bucket (2 buckets per class) and give a reason for their bucket choice. Option 2: Print card sheets, one per pair or small team. Each team of students can cut their own cards (or the teacher can cut in advance). Students work together as a team to place each card in a bucket (2 buckets per team). Then reconvene as a class to go over which cards go in each bucket. • Discuss each card as a class so students understand why the card represents energy conserved or energy wasted. If a student places their card in the wrong bucket, help them to understand why. • Optional: Further classify the "energy conserved"	Per Team: ☐ Buckets (2 if doing as an entire class or 2 per group if working in teams) / A bucket can be a recycled box or even just a labeled pile on the floor / You also could put tape on the cards, and students could stick them on the white board ☐ Bucket Labels ➢ PDF ➢ Canva template ☐ Sorting Cards (cardstock recommended if reusing) ➢ PDF ➢ Canva template

	cards into “behavioral” or “structural” changes. ○ **Behavioral** changes are changes people make to their *actions and habits*. ○ **Structural** changes are changes people make to the actual *home or building*. ● Discuss: Which type of change will last longer? Explain your reasoning. ○ Students may argue a claim for either behavioral or structural changes lasting longer, as long as they support their claims with evidence and reasoning. That said, structural changes are changed one time, and the change is permanent and remains in place regardless of who occupies the building. On the other hand, behavioral changes rely on a human to remember and continue to change the habit again and again. Also, if the people in the building change, the habit may disappear. * Energy **wasted** refers to energy *leaked, lost* or *transferred* unnecessarily. ** Energy **saved** refers to energy *conserved*, *hacked* or used to its *greatest potential*. (i.e. energy loss is absent or greatly reduced)	
15 minutes	Review energy sources with a “Stand by your Choice” activity. ● The teacher hangs up signs that say “Renewable Energy Source” and “Nonrenewable Energy Source” on two different sides of the classroom. ● Ask students to turn & talk to review what is meant by the terms “renewable” and “nonrenewable” as well as their meaning for energy sources specifically. ● In addition to the ability to renew, ask students for a reminder about why else renewable sources of energy are better for our environment.	☐ Energy Sources “Stand by Your Choice” Signs (recommend printing one set on cardstock and/or using slides to project the different types of energy sources) (one set) ➢ PDF ➢ Canva template

	○ Geothermal, solar water, and wind are also considered *cleaner* energies because they do not produce pollution, such as dangerous waste products (nuclear) or excessive amounts of air pollution (coal, natural gas & oil). ○ **Teacher Note**: Much of the 'air pollution' is in the form of **greenhouse gases**, such as carbon dioxide. Greenhouse gases trap heat in Earth's atmosphere, which is a *good* thing, or our planet would be too cold for most living things to survive. However, when *too* much of these gases are trapping heat, such as due to the amount released from burning fossil fuels, it leads to climate change. Students will learn more about greenhouse gases and **climate change** in future grades. However, if you feel they are ready for it now, go ahead and discuss it with them! ● The teacher holds up a sign for each type of energy source (or use the slideshow), one at a time: coal, geothermal, natural gas, nuclear, oil, solar, water, and wind. ● Students stand by their choice. For example, if the teacher shows them the sign for "geothermal", and they believe it to be a renewable source of energy, they walk to the side of the room that says "Renewable." ● Tell students to turn and talk to a partner to share evidence to support their claim. Then call on a student from each side to share with the class. Challenge them to make an argument persuasive enough to change the minds of students on the other side! ● Go over correct answers with students: ○ Renewable: Geothermal, Solar, Water, Wind ○ Non-renewable: Coal, Natural Gas, Nuclear, Oil	

10 minutes	Discussion points prior to students starting the school energy scavenger hunt: ● What does a sealed door look like? Weather stripping or caulking found along the edges, draft guard along door bottom ● What else can you do to find out if a door is sealed? Feel for drafts! ● How can you read a light bulb label to know if it's LED? The easiest way to tell if a bulb is an LED is by looking at the wattage – an LED should be under 10W (but sometimes on the packaging it'll be confusing and say something like "equivalent to 80W"). You can also test by touching the bulb after it's been on – an LED may be warm, but an incandescent bulb is likely too hot to touch. CFLs may be fairly low as well, but they'll have the skinny tubes rather than the bulb shape. ● Insulation will be hard to find even if it is there. Who can you ask about where insulation is located in our school? Typically a custodian or facilities manager is good to ask.	
20 minutes	Hunt for energy efficiency in the school building(s). ● Each student team receives a "School Energy Scavenger Hunt" sheet and a pencil. ● Review safety guidelines (e.g. where they are and are not allowed to go in the building) ● Students are told to return to the classroom in 20 minutes (or whatever time you feel makes sense for your students and your school).	Per Team: ☐ School Energy Scavenger Hunt ➢ PDF ➢ Canva template ☐ Pencil ☐ Clipboard (optional) ☐ Magnifying glasses (optional) ☐ Timer (optional)
10 minutes	Analyze energy scavenger hunt results. ● Students share the results of their energy scavenger hunts with each other and suggest solutions for energy being wasted. ○ Prompts to write on the board: How is our school conserving energy? Where is our school wasting energy? What can our school	☐ Science Notebooks

	do to improve its energy efficiency? ○ Suggestions to increase participation and equity of voice - Turn & Talk with a partner and/or provide time for students to jot down some ideas (in science notebooks or on scrap paper) before sharing as a class. You also can let them know ahead of time that you will call on them randomly (using popsicle sticks or another method), so they should make sure they are prepared to share their responses. ○ Tell students they will be doing a second energy efficiency scavenger hunt at home with their families	
10 minutes	Exit Ticket ● Tell students to complete the exit ticket in their science notebooks or on the provided handout. 1. One example of energy conserved is… 2. One example of energy wasted is… 3. One question I have about energy is… ● Teachers should check exit tickets for student understanding, and use this information as data to inform next steps. ● Teachers also should check student exit ticket **questions**, and use those to help guide upcoming lessons. One technique is to post the student questions on chart paper (either re-write them, or paste on the actual exit ticket), and refer back to them at the end of each lesson to see if any have been answered. Some teachers like to categorize student questions. E.g. Questions about "energy conservation" in one category, questions about "energy transfer" in another, etc.	☐ Science notebooks *or* ☐ Exit Ticket ➢ PDF ➢ Canva template
10 minutes	Revisit the class RAN chart. ● Read over the ideas in the first column and move any accurate understandings into the 'Confirmed'	☐ RAN Chart (on chart paper)

	column and any inaccurate understandings into the 'Misconceptions' column. ● Have students record their new learning and any lingering questions onto sticky notes and post them in the remaining columns.	
	Homework: "Home Energy Scavenger Hunt" with families. ● Recommendation: Photocopy information about heat pumps on the back of the scavenger hunts going home. ● **Teacher Note**: Homework discussion prompts are available at the beginning of Lesson 5.	☐ Home Energy Scavenger Hunt & Heat Pump info ➢ PDF ➢ Canva template

Lesson 5: Guest Speaker (1 ½ hours over one to two days)

Learning Objective: Students will be able to…

Ask an energy expert questions related to energy and/or energy conservation.

Language Objective: Students will be able to…

Generate questions using the 5Ws and H, and share them verbally.

Lesson 5 Slides

Duration	Activity	Materials & Prep
10 minutes	Share about the Home Energy-Efficient Scavenger Hunt. **Teacher Note**: Invite students to respond to questions about their homework. It's okay if a student has not completed the home scavenger hunt; do not single them out or penalize them in any way. ● What did your family think of the energy-efficiency scavenger hunt? ● Where is your family already conserving energy? ● Does your home use any renewable energy	Lesson 5 Slides ➢ PDF ➢ Google slides ➢ Canva template Completed Home Energy Scavenger Hunt, students have from earlier

	sources (e.g. solar, geothermal?) ● Where did you find energy wasted in your home? ● Did the energy transfers in your home look similar at all to Annabeth or Charlie's homes? Why or why not? ● Did the energy scavenger hunt inspire you or your family to do anything to conserve more energy at home? ● Are the changes your family plans to make behavioral or structural changes (or both)? ● How does conserving energy in an apartment look similar to and different from conserving energy in a single house?	
15 minutes	Students generate questions for the speaker. ● Students prepare questions beforehand to ask the speaker, either in their science notebooks or the provided handout. ● Encourage students to think of at least 2 questions. ● Provide students with a sample question. ● Read their questions prior to the speaker, and choose one question from each student (or have them choose) to place in a hat.	☐ Science Notebooks *or* ☐ Guest Speaker handout (page 1) ➢ PDF ➢ Canva template
35 minutes	Guest speaker ● An energy professional, invited by the teacher, speaks to students about energy efficiency. ● Leave time at the end for student questions. They can read them from their list of questions that they wrote, or you can pick them out of a hat for the speaker to answer.	Suggested guest speakers: energy coach, environmental advocate, Mass Save representative, renewable energy consultant, etc. Reach out to adult family members first to see if any of them might be a good fit or know someone who is! Tell the speaker what your students are learning about and what types of things you'd like them to

		share. For example, tell them to share what they were doing when they were in 4th grade and their path to their role/interest in energy conservation. ***Click* HERE** to make a copy of an email template for inviting a guest speaker to your class. Invite parents and caretakers to come to school or zoom in to listen to the speaker along with your students. ***Click* HERE** for a sample invitation, editable in canva. (Note: A photo of your guest can also be pasted over the center image.)
10 minutes	Exit Ticket ● Students complete the "What I learned from our guest speaker" side of the handout, write what they learned in their science notebooks, or write thank you letters to the guest speaker (handout available for that as well).	☐ Science Notebooks *or* ☐ Guest Speaker handout (page 2) ➢ PDF ➢ Canva template ☐ Thank You Letter ➢ PDF ➢ Canva template
10 minutes	Revisit the class RAN chart. ● Read over the ideas in the first column and move any accurate understandings into the 'Confirmed' column and any inaccurate understandings into the 'Misconceptions' column. ● Have students record their new learning and any lingering questions onto sticky notes and post	☐ RAN Chart (on chart paper)

	them in the remaining columns.	

Lesson 6: Energy-Efficient Model Home (2 ½ to 3 ½ hours over several days)

Learning Objectives: Students will be able to…

1. Define a problem related to energy efficiency, and design an energy-efficient model home to demonstrate a solution.
2. Think critically and apply what they learned about energy transfer, energy conservation, and sustainability to their model home design.
3. Evaluate relevant design features that must be considered in building an energy-efficient model home as a solution to a given design problem.
4. Generate and compare multiple possible solutions to a problem of energy-efficiency based on how well each is likely to meet the criteria and constraints of the problem.

Language Objectives: Students will be able to…

1. Provide feedback that contains content specific vocabulary through a conversation with a peer.
2. Support a claim with evidence and reasoning.

Lesson 6 Slides

Duration	Activity	Materials & Prep
30 minutes	**Activity 1**: Introduce the energy-efficient model home engineering challenge. ● Teacher Script: "For Charlie and Annabeth's next science assignment, Mrs. Gagnon has invited the students to design an energy efficient home. This time, you're included in the challenge! Join Charlie and Annabeth as they set out to design the most energy efficient home. Your home must have the following requirements…" ● Share model home requirements with students, either in the slideshow or on the board:	Lesson 6 Slides ☐ PDF ☐ Google slides ☐ Canva template ☐ Science Notebooks *or* ☐ Energy Efficient Model Home Design ➢ PDF ➢ Canva template ☐ Minecraft or Minecraft for Education - if this is

	○ Door that opens & closes ○ Two see-through windows ○ Insulation, siding, etc. that limits energy transfer ○ Upgraded energy-efficient appliances and heating/cooling ○ Natural resource for energy ○ Name & decorate your model home • Assign student teams. We recommend **teams of 2-3 students**, 4 students max. However, this will also depend on availability of materials and teacher discretion. • Student teams brainstorm and plan their energy efficient model home designs in science notebooks or on the provided handout (or virtually using a program like Minecraft).	something you are comfortable with, you can offer students virtual energy-efficient model home design as an option
20 minutes	**Activity 2**: Peer Feedback • Pair up groups to share design plans and give feedback on each others' ideas. • Students can write feedback for *themselves* in their science notebooks and/or students can write feedback for *others* on the provided "TAG Peer Feedback" handout. • About 5 to 10 minutes per group pairing.	☐ Science Notebooks *or* ☐ TAG Peer Feedback ➢ PDF ➢ Canva template
10 minutes	**Activity 3**: Redesign. • Give time for students to modify their designs based on peer feedback.	
1 to 2 hours	**Activity 4**: Build energy-efficient model homes. • Students build using cardboard boxes and other available materials. • To save time, standardize sizes, and prioritize	Per Team: ☐ Model Home Requirements ➢ PDF ➢ Canva template

	safety, we recommend the **teacher** use a box cutter to cut windows (10 cm x 10 cm) and doors (10 x 20 cm) into the boxes *prior* to giving boxes to students. If you prefer students cut their own, scissors are more difficult but should be fine as well. See this video from the NEED project for suggestions. • Stress to students the importance of **measuring** and using only what they need. One of their goals should be to *waste as little materials* as possible. Contractors and builders do this both for cost-savings and **sustainability** purposes. • Create a system for students to return materials that still can be used, and show them what to do with items that no longer can be used (trash or recycle).	☐ Cardboard box (recommended size: 9" x 9" x 9" or similar) ☐ Scissors (sharp) ☐ Permanent marker ☐ Ruler ☐ Weather strips ☐ Plastic film ☐ Tape (masking, clear, electrical, duct, decorative, etc.) ☐ Cotton batting or old clothing ☐ Other **Important note**: The best materials are upcycled, free or cheap! Send a request out to families for supplies. For example, old jeans and t-shirts can be used for insulation, and single-use plastic water bottles can be cut and used for siding! Many delivery boxes usually are a good size. **The NEED House Energy project**: If your school has funding available, you can purchase kits for $35 per kit plus shipping.
20 minutes	**Activity 5**: Conclusion Students respond to conclusion questions in their science notebooks or on the provided "Model Home Conclusion" handout. 1. Is your model home energy-efficient? Explain why or why not by supporting your claim with evidence. 2. What can you change to make your model home more energy-efficient? Encourage students to inspect the model homes of other teams in order to get ideas for	☐ Completed model home (per team) ☐ Science Notebooks *or* Model Home Conclusion ➢ PDF ➢ Canva template ☐ Model Home Project Rubric (per team at this phase) ➢ PDF ➢ Canva template

	improving their own designs.	
10 minutes	**Activity 6**: Revisit the class RAN chart. • Read over the ideas in the first column and move any accurate understandings into the 'Confirmed' column and any inaccurate understandings into the 'Misconceptions' column. • Have students record their new learning and any lingering questions onto sticky notes and post them in the remaining columns.	☐ RAN Chart (on chart paper)
	Optional Extension Questions • How do we know if our model home is limiting energy transfer? How could we test our model home's energy efficiency? Recommended format: think-pair-share	

Lesson 7: Creative Writing (1 to 1 ½ hours over one to several days)

Learning Objective: Students will be able to…

Craft an argument that includes a claim and related evidence to justify their energy efficient model home is highly effective at conserving energy.

Language Objectives: Students will be able to…

1. Describe characteristics of a piece of writing using adjectives and discipline specific vocabulary.
2. State a claim and justify it with simple, compound and complex sentences.

Lesson 7 Slides

Duration	Activity	Materials & Prep
15 minutes	Study a mentor text.	Lesson 7 Slides ☐ PDF

	• Read aloud the sample real estate listing.
	• Students identify the characteristics of a convincing real estate listing using these guiding questions:
	  ○ What details about the home did the author include?
	  ○ How did the author try to convince you that this is a good home to buy?
	  ○ What energy saving qualities did the author describe?
	• Students underline the characteristics of a convincing real estate listing in the mentor text and/or the teacher creates a shared list of the characteristics on chart paper.
		☐ Google slides
		☐ Canva template
		
		☐ Mentor Text: Real Estate Listing
		➢ PDF
		➢ Canva template
		
		☐ Chart Paper (if recording a list of characteristics of a convincing real estate listing)

30 -60 minutes	Students write their own real estate listing or work together to write one real estate listing per team. • Students write a real estate listing for their home that is focused on energy efficiency. • Students revise and edit real estate listings after receiving teacher feedback. • Students may write with paper and pencil or type on personal devices.	☐ Real Estate Listing Checklist (per team or per student, depending on how the listing was assigned) (recommend photocopying on back of mentor text) ➢ PDF ➢ Canva template ☐ Student Devices *or* ☐ Paper & Pencil ☐ Model Home Project Rubric (per team or per student) ➢ PDF ➢ Canva template
15 minutes	Teams practice presenting in preparation for a live audience. • Students assign roles for their presentation such as: ○ Read the real estate listing	

	○ Point to items in the model home ○ Answer questions from visitors ● The student assigned the role of reading the real estate listing can practice reading it aloud to their teammate(s). ● Students generate ideas about which questions audience members might ask them and come up with possible answers.	

Lesson 8: Student Presentations & Reflections (1 hour)

Learning Objectives: Students will be able to…

1. Construct explanations and engage in an argument from evidence about a model home's energy efficiency.
2. Communicate information regarding a model home's energy efficiency.

Language Objective: Students will be able to…

Describe the energy efficiency features of their model home.

Lesson 8 Slides

Duration	Activity	Materials & Prep
30 minutes	Students present their energy-efficient model homes and real estate listings to a live audience of community members. ● Recommended presentation style: Gallery walk - Audience members visit each student team's project "station", listen to their real estate listings, and ask questions. Students may also take turns participating in the gallery walk. ● Invite visitors to complete the "Model Home Visitor Feedback" form for each model home they visit.	Lesson 8 Slides ☐ PDF ☐ Google slides ☐ Canva template ☐ Sample Invitations to Community Members (recommend sending virtually) ➢ PDF ➢ Canva template ☐ Completed Model Homes (per team)

		☐ Completed Real Estate Listings (per team or per student) ☐ Visitor Feedback form (recommend 4 per visitor, printing 2 per side, so they have all 4 on one paper) ➢ PDF ➢ Canva template
20 minutes	Create final energy models. ● Students create a *final* model to illustrate why Charlie's roof has snow and Annabeth's roof does not. ● Their final models are based on their most recent understanding of energy transfer, including what they learned in Lessons 1-8. ● Students can create their own final models and/or this final model can be created on chart paper as a class. ● For the teacher: Final energy model exemplar ● Compare and contrast their initial models with their final models. Have a short discussion about the nature of science and how scientific concepts are updated when new information becomes available.	☐ Science Notebooks *or* ☐ Final Model ➢ PDF ➢ Canva template *or* ☐ Chart Paper
15 minutes	Reflection ● Students reflect on the energy-efficient model home project in their science notebooks or on the provided "Student Reflection" handout.	☐ Science Notebooks *or* ☐ Student Reflection ➢ PDF ➢ Canva template

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