

Understanding AI in Renewable Energy Systems

Grade Levels: **9-12** | Duration: **75 minutes** | Subject Area: **Environmental Science**

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This lesson was designed for the WeTeach_AI **Advancing AI Literacy Project**. The project supports the development of standards-aligned AI literacy lessons written by teachers for teachers. Additional lesson plan material, such as rubrics, answer keys, activity guides, and instructional considerations can be [found here](#) on our website.

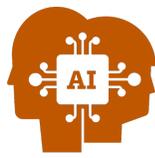
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“I am Leslie Llamas, a STEM educator, robotics coach, and mechanical engineer in my third year of teaching. My journey in STEM began as a FIRST robotics student, and today I bring that same passion into my classroom, where I teach Environmental Science, Robotics, and Principles of Architecture. I focus on integrating artificial intelligence, sustainability, and engineering into hands-on projects that challenge and inspire my students.”

Lesson Description

In this introductory lesson, students explore how artificial intelligence (AI) is transforming renewable energy systems. Through collaborative research and scaffolded activities, students will define key concepts such as smart grids, predictive maintenance, and energy equity. They will investigate real-world applications of AI in solar, wind, and water systems, and begin to consider the ethical and environmental implications of these technologies. This lesson builds foundational knowledge and prepares students for deeper analysis and solution design.



Lesson Objectives

(formatted as “Students will be able to...” statements)

- Analyze how artificial intelligence enhances renewable energy systems through smart grid optimization, predictive maintenance, and resource management.
- Evaluate the benefits and limitations of AI applications in sustainability, including their environmental and societal impacts.
- Interpret real-world data and case studies to explain how AI contributes to energy efficiency and reliability.
- Critique ethical considerations such as energy equity, data privacy, and environmental trade-offs in AI-driven energy systems.
- Synthesize research findings into a coherent visual representation that communicates key concepts and implications of AI in renewable energy.

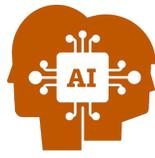
Essential Questions

1. *How can we interpret the role of artificial intelligence in transforming renewable energy systems?*
2. *In what ways does AI contribute to or challenge sustainability and energy equity?*
3. *What patterns or trends emerge when analyzing real-world applications of AI in solar, wind, or water systems?*
4. *How might we evaluate the ethical implications of using AI in environmental decision-making?*
5. *What strategies can we develop to communicate complex AI concepts clearly and responsibly?*

TEKS Alignment (Texas Standards Alignment)

Environmental Science

§112.50(c)(6)(C): Document the use and conservation of both renewable and non-renewable resources as they pertain to sustainability.



§112.49(c)(13)(A): Analyze the policies related to resources from discovery to disposal, including economics, health, technological advances, resource type, concentration and location, waste disposal and recycling, mitigation efforts, and environmental impacts.

CSTA/ISTE Alignment (National Standards Alignment)

CSTA

2-DA-08: Collect data using computational tools and transform the data to make it more useful and reliable.

2-AP-13: Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.

3B-DA-07: Evaluate the ability of models and simulations to test and support the refinement of hypotheses.

3A-IC-24: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.

3A-IC-30: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

3A-IC-27: Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields.

ISTE

1.1.c: Use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.

1.3.d: Build knowledge by exploring real-world issues and gain experience in applying their learning in authentic settings.

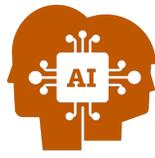
1.7.b: Use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.

Effective Pedagogical Strategies

The instructor deliberately cultivates a classroom community that recognizes, respects, and includes the voices, ideas, needs, and perspectives of all students.

Activities that prioritize student questioning and discussion prompts with an emphasis on questions that promote higher order thinking skills (e.g., apply, analyze, evaluate) are selected.

Curricular content is collaborative and fully engaging for all team members, allowing for full expression.



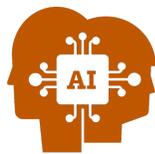
AI Literacy Competencies

(based on TeachAI Framework)

<p>Engaging with AI: 1. Recognize AI’s role and influence in different contexts.</p> <p>Engaging with AI: 4. Explain how AI could be used to amplify societal biases.</p> <p>Engaging with AI: 7. Connect AI’s social and ethical impacts to its technical capabilities and limitations.</p>	<p>Designing AI Competencies: 1. Describe how AI systems can be designed to support a solution to a community problem.</p>
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Key Terms

Term	Definition
Artificial Intelligence (AI)	Technology that allows computers to learn from data, recognize patterns, and make decisions or generate content based on that information.
Predictive Maintenance	Using data and AI to predict when equipment needs repairs before it breaks, saving time and money.
Renewable Energy	Energy from sources that naturally replenish, like sunlight, wind, water, or plants.
Smart Grid	An electricity network that uses digital technology to monitor and manage energy flow efficiently, reducing outages and supporting renewable energy.
Sustainability	The ability to meet present needs without compromising the ability of future generations to meet their own, by balancing environmental, economic, and social considerations.



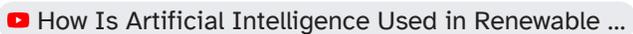
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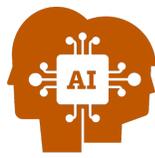
Engaging activity or prompt to introduce the lesson. **Estimated time: 15 minutes**

Objective: Activate prior knowledge and spark curiosity about how AI is transforming renewable energy systems and laying the foundation for ethical considerations.

Materials:

- Device to display video
- Student notebooks or digital notetaking tools
- Vocabulary list (provided on the previous page)
- Optional: KWL chart handout or digital template

Teacher Instructions	Sample Teacher Remarks
<p><u>Opening (5 minutes)</u> Pose the opening question:</p> <ul style="list-style-type: none"> - “How do you think artificial intelligence is changing the way we produce and use renewable energy?” <p>Allow 1–2 minutes for students to think silently.</p> <p>Play this video: </p> <p>Encourage students to jot down new ideas, terms, or examples they notice (e.g., smart grids, predictive maintenance, energy forecasting).</p> <p><u>Think-Pair-Share (10 minutes)</u> Think: During the opening, students wrote their initial thoughts individually.</p> <p>Pair: Discuss ideas with a partner.</p> <p>Share: Volunteers share insights with the class. Record responses on the board or in a shared digital space.</p> <p>Optional: students fill out a KWL chart to track what they know, want to know, and will learn.</p>	<p>“Take a moment to think about the question: How do you think AI is changing the way we produce and use renewable energy? After watching this short video, you’ll share your ideas with a partner and then with the class. As you watch, pay attention to examples like smart grids, predictive maintenance, or energy forecasting.”</p> <p>(Display video and facilitate discussion)</p> <p>“Great ideas! Today, we’ll explore these concepts more deeply and begin building your understanding of how AI is shaping our energy future.”</p> <p>(Display video and provide students time for discussion)</p> <p>“Great ideas! Today, we’ll dive deeper into these concepts and explore not only how AI improves renewable energy systems but also the ethical and environmental challenges that come with it.</p> <p>You’ll work in teams to explore key concepts like smart grids and sustainability, and begin thinking about the ethical and environmental challenges that come with these technologies.”</p>



Anticipated Student Outcomes

- Students suggest examples of AI applications in renewable energy (e.g., smart grids, predictive maintenance, demand forecasting).
- Students recognize that AI can optimize energy production and resource management.
- Students begin to consider ethical and environmental implications of AI in sustainability.

Exploration

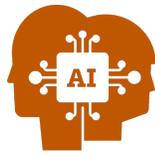
Step-by-step student tasks, experiments, or investigations. **Estimated time: 30 minutes**

Objective: Build foundational understanding of how AI supports renewable energy systems through collaborative research, vocabulary development, and visual synthesis.

Materials:

- Access to curated articles and videos (see lesson resource list)
- Poster paper or digital tools (Google Slides, Canva)
- Printed or digital copies of the AI & Renewable Energy Research Packet
- Optional: Sentence starters and visual aids for Emergent Bilinguals

Teacher Instructions	Sample Teacher Remarks
<p><u>Group Formation and Roles (5 minutes)</u> Form heterogeneous groups of 3–4 students. Assign roles using the packet:</p> <ul style="list-style-type: none">- Researcher – gathers information- Writer – summarizes findings- Presenter – shares with class- Visual Designer – creates poster or slide <p><u>Vocabulary Exploration (5 minutes)</u> Distribute the lesson’s vocabulary list.</p> <p>Students define terms in their own words and match them to real-world examples from the articles or video.</p> <p>Use sentence starters for support:</p> <ul style="list-style-type: none">- “This term means...”- “One example is...”- “It matters because...”	<p><i>“Now that you’ve seen how AI is used in renewable energy, it’s time to dig deeper. Your group will choose one concept and explore how it works, why it matters, and where it’s used in the real world. Use the vocabulary list and research packet to guide your thinking. You’ll create a visual that helps others understand your topic clearly.”</i></p>



<p>Research & Visual Planning (20 minutes) Students use the Research Packet to:</p> <ul style="list-style-type: none">- Choose a concept (e.g., smart grid, predictive maintenance)- Define it, explain its importance, and find a real-world example- Create a visual representation (diagram, infographic, labeled image)- Encourage use of curated resources and vocabulary in their posters/slides. <p>Optional: Provide scaffolded templates (Beginner, Intermediate, Advanced) for differentiation.</p>	<p>Anticipated Student Outcomes</p> <ul style="list-style-type: none">- Students collaborate to research and define key AI concepts in renewable energy.- Students connect vocabulary to real-world applications using curated resources.- Students create visual representations that synthesize their understanding.- Students begin to recognize ethical and environmental implications, preparing for Lesson #2.
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Whole Class Discussion

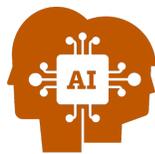
Discussion questions, teacher prompts, and expected student responses. **Estimated time: 25 minutes**

Objective: Students will share their visual presentations, engage in peer dialogue, and synthesize ideas about how AI supports renewable energy systems, including early observations about equity, sustainability, and emerging ethical questions.

Materials:

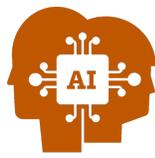
- Devices for uploading work (Padlet, Jamboard, Google Slides)
- Projector or Smartboard
- Student-created posters or slides
- Vocabulary handout or visual of the lesson's vocabulary terms
- Optional: Sticky notes for gallery walk feedback

Teacher Instructions	Sample Teacher Remarks
<p>Student Share-outs (2 minutes) Invite students to share their work in one of the following formats.</p> <ul style="list-style-type: none">- Live Presentation: Share one insight or example from their visual.- Gallery Walk: Display posters/slides around the room.	<p><i>"Now that you've explored how AI supports renewable energy, let's share and reflect. As you present or review others' work, ask yourself:</i></p> <ul style="list-style-type: none">- <i>What patterns do I see? What technologies seem most impactful? What questions do I still have?</i>



<ul style="list-style-type: none"> - Digital Discussion Board: Upload visuals or short reflections to Padlet, Jamboard, or Google Classroom. <p><u>Student Presentations (15 minutes)</u> Each group shares one key concept (e.g., smart grid, predictive maintenance) and explains its importance and real-world application.</p> <p>Encourage students to reference vocabulary and curated resources.</p> <p><u>Facilitate Synthesis Discussion (8 minutes)</u> Guide reflection using discussion questions (see below).</p> <ul style="list-style-type: none"> - Option A: Begin building a Conceptual Anchor Chart with categories like: <ul style="list-style-type: none"> - AI Applications – What technologies are being used? - Benefits – How do these systems improve energy use? - Emerging Questions – What concerns or curiosities are surfacing? - Option B: Use a KWL Chart Extension: Add to the “Learned” and “Want to Know” sections based on student presentations. 	<p><i>This is a chance to learn from each other and build a shared understanding of how AI is shaping our energy future.”</i></p> <p><i>(Transition to student share-outs and follow up with synthesis discussion)</i></p> <hr/> <p><u>Teacher Moves</u></p> <ul style="list-style-type: none"> - Validate ideas: “That’s a great example of predictive maintenance—let’s add that to our chart.” - Encourage citing evidence: “Can you point to that in your article or visual?” - Use real-time annotations on the Conceptual Anchor Chart or KWL chart. <hr/> <p><u>Anticipated Student Outcomes</u></p> <ul style="list-style-type: none"> - Students articulate patterns and common themes across presentations. - Students connect AI concepts to environmental and societal impacts. - Students begin identifying questions and concerns that will be explored in Lesson #2. - Students demonstrate critical thinking by questioning assumptions and data gaps.
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Sample Discussion Questions	Sample Student Responses
1. What surprised you about AI’s role in energy systems?	<i>“I didn’t realize AI could predict equipment failures and reduce waste.”</i>
2. What benefits did you notice across different AI applications?	<i>“Smart grids seem to make energy use more efficient and reduce outages.”</i>
3. What questions do you still have about these technologies?	<i>“I wonder how AI decides which data to use, and if that could be unfair.”</i>
4. What patterns or themes did you notice across different groups’ work?	<i>“Most groups talked about how AI helps manage energy better.”</i>
5. What concerns or challenges came up during your research?	<i>“Some articles mentioned that AI systems use a lot of energy themselves.”</i>



Assessment

Formative or summative assessment tasks and criteria. **Estimated time: 5 minutes**

Objective: Students will demonstrate understanding of key AI concepts in renewable energy systems by defining vocabulary, interpreting real-world applications, and reflecting on their learning.

Materials:

- Assessment prompts (displayed on board, slide, or printed handout)
- Google Form (or other digital tool for collecting responses) or sticky notes/loose-leaf paper for written responses
- Sentence stems for scaffolding responses (on board or slide)
- Optional: Projector or Smartboard (for modeling a sample responses or sentence stems)

⚠ Note: The time estimates for the various assessment options vary. If time is a constraint, it is recommended that the assessment be completed outside of the class period.

Assessment Opportunities	Facilitation Tips
<p>Option A – Exit Ticket Reflection (5 minutes) Use the reflection prompts from the AI & Renewable Energy Research Packet:</p> <ul style="list-style-type: none">- One thing I learned today is...- One question I still have is...- This connects to the real world because... <p>Encourage students to reference their group’s visual and vocabulary work.</p>	<p>Clarify expectations for each option and allow students to choose based on interest, time constraints, and the assessment format that best fits their learning style.</p> <p>Use student responses to identify misconceptions and guide Lesson #2. Highlight strong examples anonymously to model quality thinking.</p>
<p>Option B – Visual Presentation Review (Homework or Extended Time) Students submit a short write-up (½-1 page) explaining their group’s poster or slide:</p> <ul style="list-style-type: none">- The concept they explored- Why it matters- One real-world example- One question they still have	<p>Provide sentence starters for reflections (e.g., “One ethical dilemma is...” or “A solution to reduce harm could be...”). This can be especially helpful for Emergent Bilinguals.</p> <p><input checked="" type="checkbox"/> Use the rubric provided in this lesson’s resources to assess student submissions.</p>