

Episode 1: Introduction to Electric Vehicles and Renewable Energy

High School Environmental Science

Summary

After watching *Episode 1: Introduction to Electric Vehicles and Renewable Energy*, and completing these activities, students should be able to connect local energy issues to global environmental challenges and appreciate the balance between resource usage, environmental impact, and sustainability. Through critical thinking and group discussion, they will gain a deeper understanding of how energy resources affect the environment on a large scale and how scientific methods can address these challenges.

Teacher Discussion Guide:

Objective:

- Introduce students to the environmental science topics that will be covered in *Episode 1: Introduction to Electric Vehicles and Renewable Energy*, focusing on energy resources, their impact, and environmental issues.
- Stimulate critical thinking about the feasibility, environmental costs, and global implications of various energy resources (nuclear, geothermal, renewable, and nonrenewable).
- Encourage students to think about the role of technology, laws, and regulations in managing environmental resources.

Key Concepts:

1. **Renewable and Nonrenewable Energy Resources** – Types of energy and their effectiveness, risks, and efficiency at local, state, national, and global levels.
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2. **Environmental Costs** – The extraction, storage, use, and disposal of abiotic and biotic resources.
3. **Environmental and Human Risks** – Understanding chemical hazards, biological hazards, and radiation.
4. **Global Environmental Problems** – Understanding issues like climate change, endangered species, and human impact on global resources.
5. **Technological Impact on the Environment** – Exploring how technology influences and is influenced by environmental science.

Key Vocabulary:

- **Renewable Energy:** Energy from sources that are naturally replenishing, such as solar, wind, hydro, and geothermal.
- **Nonrenewable Energy:** Energy from sources that are finite and cannot be replenished on a human timescale, such as coal, oil, and natural gas.
- **Human Risks:** Risks to human health and safety, including exposure to hazardous chemicals, radiation, and the health impacts of environmental degradation.
- **Global Environmental Problems:** Large-scale issues such as climate change, species extinction, and resource depletion that affect the global environment.
- **Sustainability:** The ability to use resources in a way that meets current needs without compromising the ability of future generations to meet their own needs.
- **Carbon Footprint:** The amount of carbon dioxide and other greenhouse gases emitted during the production, use, and disposal of goods and services.
- **Technological Impact:** How technological advancements, such as electric vehicles and renewable energy systems, influence the environment and society.

Pre-Video Discussion Questions:

1. What are some examples of renewable and nonrenewable energy sources?

- Have students list examples of both types of energy sources.
- Discuss the benefits and limitations of each type in terms of sustainability, efficiency, and environmental impact.
- Consider how energy consumption affects global and local communities.

2. How do you think using renewable energy sources (like wind or solar) differs from using nonrenewable sources (like coal or natural gas) in terms of environmental impact?

- Lead a discussion on the environmental costs of both types of energy sources.
- Ask students to consider how each type of energy affects air quality, water resources, and ecosystems.

- Explore the long-term sustainability of renewable vs. nonrenewable sources.

3. How does human activity contribute to global environmental problems like climate change or resource depletion?

- Discuss the direct and indirect ways in which energy production, waste, and consumption contribute to global environmental issues.
- Consider how over-reliance on nonrenewable energy resources accelerates climate change and environmental degradation.

4. In what ways do you think electric vehicles (EVs) and renewable energy technologies can help solve some of these global problems?

- Introduce the role of electric vehicles and renewable energy in reducing carbon footprints.
- Ask students to think about how transitioning to these technologies could alleviate problems like pollution, resource scarcity, and climate change.

5. What role do governments and regulations play in addressing the environmental costs of energy production and consumption?

- Discuss the importance of laws like the Clean Air Act, Paris Agreement, and other policies that regulate energy use and its environmental impact.
- Have students consider what kind of regulations are necessary to transition to a more sustainable energy future.

Pre-Video Activities

1. Introduction to Energy Resources

- **Objective:** Students will classify different types of energy resources as renewable or nonrenewable, and discuss their environmental costs.
- **Activity:**
 - Have students work in groups to create a chart comparing renewable (solar, wind, hydro, geothermal) and nonrenewable (coal, oil, natural gas, nuclear) energy sources.
 - In each column, they will list the effectiveness, risks, environmental impacts, and efficiency of each energy type.
 - Discuss the differences between the two categories and ask the students to reflect on how each energy source could impact the environment at the global scale.

2. Environmental Hazards and Risks

- **Objective:** Understand environmental and human risks associated with different types of energy resources.

- **Activity:**
 - Provide each group with a case study on an environmental issue (e.g., nuclear disaster, oil spills, deforestation, chemical pollution from energy production).
 - Have students identify the risks involved in each case and categorize them (biological, chemical, radiation, etc.).
 - Students will then share their findings with the class, discussing the environmental and human costs involved in resource extraction and use.

3. Global Environmental Impact Simulation

- **Objective:** Connect local resource issues to global-scale environmental problems.
- **Activity:**
 - Create a simulation where students take on the roles of different countries, each with its own resources (renewable and nonrenewable) and environmental policies.
 - Students will need to collaborate to address global challenges like climate change, endangered species, or water pollution. They will use real-world data (such as resource availability, global temperature data, or species population reports) to guide their decisions.
 - At the end, have students reflect on the impact of their decisions on global environmental issues.

4. Introduction to Laws and Regulations

- **Objective:** Examine the role of laws and regulations in managing environmental resources and reducing contamination.
- **Activity:**
 - Present a brief overview of key environmental laws (e.g., Clean Water Act, Kyoto Protocol, Paris Agreement).
 - Ask students to research how these laws aim to protect resources and reduce environmental impact. They can use the internet, textbooks, or prepared handouts.
 - Students should discuss the science behind these laws—why certain practices are regulated and what evidence is used to support these decisions.

Extensions

1. Energy Source Research Project

- **Objective:** Research and present a specific energy source, analyzing its effectiveness, environmental cost, and global impact.
- **Activity:** Students select one energy resource (renewable or nonrenewable) and conduct in-depth research. They will:
 - Investigate its environmental costs, efficiency, and potential for global use.
 - Discuss its risks (chemical, radiation, biological) and explore case studies.

- Present their findings to the class, proposing solutions for increasing sustainability or reducing harm in energy production.

2. Technology and Environmental Solutions

- **Objective:** Explore how technological advances can address global environmental issues.
- **Activity:** Have students research recent technological innovations in renewable energy or environmental protection (e.g., solar panels, carbon capture technology, water filtration systems).
 - Students will write a short report on one technology, discussing how it works, its potential environmental impact, and its role in addressing global environmental problems.

3. Comparative Data Collection Project

- **Objective:** Use global data to understand resource usage and environmental impact.
- **Activity:** Students use online databases (e.g., Global Energy Monitor, World Bank Environmental Data) to collect data on global energy consumption, resource availability, or environmental quality.
 - Have students compare data from different regions (e.g., comparing energy use and environmental impact in developing vs. developed countries).
 - Students should analyze how resource extraction, energy consumption, and environmental impact vary across different parts of the world.


Post-Video Questions and Answers

1. How do electric vehicles help reduce carbon emissions, and why is this easier than reducing emissions from traditional gas-powered vehicles?

Answer: EVs help reduce carbon emissions because they don't produce exhaust emissions when operating. Jing mentioned that while cleaning up electricity production to reduce its carbon impact is challenging, it's still easier than cleaning up every individual gas-powered car. This highlights the scalability of decarbonizing energy production compared to addressing emissions from millions of gas vehicles.

2. What are some ways advancements in battery technology can contribute to creating a more sustainable transportation system?

Answer: Advances in battery technology can improve efficiency by optimizing battery chemistry and management systems. Jing highlighted developments like using EV batteries for energy storage on the power grid, which can support renewable energy integration and sustainability. These innovations also



make EVs more effective and environmentally friendly.

3. Why are gas-powered vehicles more carbon-intensive compared to electric vehicles?

Answer: Gas-powered vehicles are carbon-intensive because they rely on fossil fuels, which produce emissions when burned. Jing explained that while EVs don't have direct emissions, their energy source can be decarbonized, making EVs a cleaner option for the future.

4. Why does Jing Lion think EV technology is exciting and accessible for students?

Answer: Jing mentioned that EV systems are simpler than gasoline systems because they only require a battery and a motor. Students can easily experiment with this technology using simple tools like a battery and wires, which makes it accessible and engaging for learning purposes.

5. What role do community events play in helping students learn about electric vehicles and renewable energy?

Answer: Jing highlighted community science education events, like the Northeast Ohio Sustainability Summit, as opportunities for students to learn about EVs. These events provide hands-on experiences and insights into sustainability practices, encouraging youth engagement in green technology.

6. How might urban centers change as more vehicles convert to electric power?

Answer: Jing described a future where gas stations may no longer need to be centralized, as EV charging can happen in various locations like restaurants or other public spaces. This shift could redefine urban planning and transportation hubs.

