

Episode 2: Engineering Electric Skateboards: Sustainability in Urban Transportation

High School Environmental Science

Summary

This lesson explores the integration of renewable energy into modern transportation through the lens of electric skateboards. Students will analyze the environmental impact, energy efficiency, and challenges related to this technology, connecting these concepts to broader themes of sustainability, energy resource management, and environmental science principles.

Teacher Discussion Guide

Objective:

1. Evaluate the environmental and energy-related advantages of electric skateboards over traditional urban transportation methods.
2. Analyze the feasibility and challenges of renewable energy applications in transportation.
3. Apply critical thinking to propose sustainable improvements to electric skateboard technology.

Key Concepts:

1. Renewable and nonrenewable energy resources in transportation.
 2. Environmental costs and benefits of urban transport technologies.
 3. Energy efficiency and battery storage considerations.
 4. Risk analysis: challenges of battery disposal and material sourcing.
 5. Conservation laws and scientific rationale behind regulations.
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Key Vocabulary:

1. **Renewable Energy:** Energy derived from natural sources that are replenished on a human timescale, such as solar, wind, and geothermal energy.
2. **Nonrenewable Energy:** Energy from finite resources, such as coal, oil, and natural gas, that cannot be replenished quickly.
3. **Energy Efficiency:** The ratio of useful energy output to the total energy input; it reflects how well energy is converted into work.
4. **Environmental Impact:** The effect of human activities, such as transportation, on the environment, including pollution, resource depletion, and ecosystem disruption.
5. **Conservation:** The responsible use and protection of natural resources to prevent depletion and preserve ecosystems.
6. **Toxicology:** The study of the effects of toxic substances on humans, animals, and the environment.

Pre-Video Discussion Questions

1. **What forms of renewable energy do you encounter in daily life?**
 - **Discussion Point:** Highlight familiar examples like solar panels, wind turbines, or geothermal heating. Discuss how these forms of energy differ from traditional fossil fuels.
2. **How does urban transportation affect energy consumption and pollution levels?**
 - **Discussion Point:** Explore how vehicles contribute to greenhouse gas emissions, noise pollution, and urban congestion. Discuss potential alternatives and their benefits.
3. **What are the potential benefits and drawbacks of using smaller, electric-powered vehicles like skateboards?**
 - **Discussion Point:** Consider benefits like reduced emissions and portability, alongside challenges like limited range and battery disposal issues.

Activity - Sustainable Skateboard Challenge:

Task: Design an improved electric skateboard that is more energy-efficient and environmentally friendly.

Instructions:

1. In small groups, review the provided data sheet comparing electric skateboards, cars, and public transportation for energy use and emissions.
2. Identify one key area for improvement in electric skateboard design (e.g., battery life, material sustainability, energy source).

3. Create a sketch or written description of your improved skateboard.
4. Present your ideas to the class, explaining how your feature aligns with environmental science principles.

Analysis

Discussion Points:

- Analyze trade-offs between environmental benefits and the challenges of electric skateboard production (e.g., battery sourcing and disposal).
- Compare electric skateboards to other forms of renewable energy transportation in terms of practicality and feasibility.

Extension Activities

1. **Research Report:** Investigate a recent innovation in renewable energy technology for urban transportation (e.g., solar-powered scooters). Write a one-page report linking your findings to electric skateboards.
2. **Field Study:** Interview a local engineer or designer about the challenges of incorporating sustainability into transportation design.
3. **Debate:** Host a class debate on whether electric skateboards should be prioritized in urban sustainability initiatives.


Post-Video Discussion Questions:

1. **What makes electric skateboards more environmentally friendly than traditional gas-powered vehicles?**

Answer: Electric skateboards produce no emissions during operation and often use renewable energy sources for charging.

2. **What are some environmental challenges associated with electric skateboards?**

Answer: Challenges include the environmental cost of producing and disposing of batteries, as well as sourcing materials like lithium.

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3. **How can conservation laws and regulations promote better use of renewable energy in transportation?**

Answer: By setting standards for energy efficiency, reducing emissions, and encouraging the development of sustainable materials.

4. **Why is energy efficiency important in designing transportation systems?**

Answer: Higher energy efficiency reduces resource use and environmental impact, making systems more sustainable over time.

5. **How does technology like electric skateboards contribute to global sustainability goals?**

Answer: It provides an alternative to fossil-fuel-powered transport, reducing carbon footprints and urban pollution.

