Episode 5: Wind Energy Solutions for Urban Environments

7th Grade Science Lesson

Summary

In this episode, Erica Boeing from Accelerate Wind discusses how wind energy can be harnessed in urban environments. The technology focuses on utilizing the increased wind speed around the edges of rooftops to generate power, complementing solar energy systems. The episode explores the benefits of wind energy for commercial buildings, including resilience, cost-saving, and decarbonization. It also highlights the importance of community engagement and how students can get involved in renewable energy projects.

Teacher Discussion Guide:

Objective:

- Understand how wind energy can be integrated into urban environments to achieve sustainability goals.
- Identify the environmental benefits of wind energy, especially in terms of reducing pollution and emissions.
- Explore how different renewable energy sources can work together to improve energy efficiency and help buildings reach net-zero energy consumption.
- Discuss ways in which students can become involved in renewable energy projects and contribute to environmental sustainability.

Key Concepts:

1. Wind energy
2. Net-zero energy

3. Complementary renewable technologies (wind and solar)
4. Life Cycle Assessment
5. Community engagement in sustainability efforts

Key Vocabulary:

- **Wind turbine**: A device that converts the kinetic energy of the wind into electrical energy. It typically consists of blades that rotate when wind passes over them, driving a generator to produce power.
- **Decarbonization**: The process of reducing carbon dioxide (CO2) emissions, particularly from the burning of fossil fuels. This is an important step in combating climate change and is often a key goal for industries and governments.
- **Energy resilience**: The ability of an energy system or building to continue to function despite disruptions, such as power outages, natural disasters, or fluctuating energy availability. Energy resilience often involves using renewable sources like wind and solar to ensure a reliable energy supply.
- **Solar energy**: Energy derived from the Sun's radiation, typically harnessed through solar panels to generate electricity or heat. It is a clean and renewable energy source, widely used for residential, commercial, and industrial applications.
- **Net-zero**: A state where the amount of energy a building, community, or organization generates is equal to or greater than the amount it consumes from external sources like the electrical grid. Achieving net-zero is a key target for reducing environmental impact and fostering sustainability.
- **Life Cycle Assessment (LCA)**: A methodology for evaluating the environmental impacts of a product or technology over its entire life cycle. LCA includes assessing raw material extraction, production, use, and disposal stages, and is often used to determine the environmental benefits of renewable energy technologies like wind and solar power.

Pre-Video Discussion Questions:

What are some examples of renewable energy sources, and how do they benefit the environment?

- *Prompt*: Think about the different forms of energy we use in our daily lives. What are some sources that don't rely on fossil fuels? How do renewable energy sources, like wind, solar, and geothermal, help reduce pollution and combat climate change?
- *Follow-up*: How do these energy sources differ from non-renewable ones? What makes them more sustainable?

How do you think wind energy could be used in cities or urban areas?

- *Prompt*: Imagine you're designing a city of the future. Where could wind turbines be placed in urban areas? What do you think would be the advantages of using wind energy in places like skyscrapers or commercial buildings?
- *Follow-up*: What might make urban areas more suitable (or less suitable) for wind energy compared to rural or open land?

What challenges do you think might arise when trying to implement wind energy technology in commercial buildings?

- *Prompt*: What factors do you think engineers and architects need to consider when installing wind turbines on commercial buildings? What are some obstacles related to space, safety, or cost that might need to be addressed?
- *Follow-up*: How might community concerns or local regulations affect the implementation of wind technology?

How might combining different renewable energy sources, like solar and wind, be more effective than using just one?

- *Prompt*: If we combine wind turbines with solar panels on the same building, how do you think they might complement each other? Why is it beneficial to use both energy sources together, especially in urban environments?
- *Follow-up*: How could adding energy storage systems (like batteries) make these combined systems even more effective?

Activity:

1. **Wind Turbine Location Brainstorm:**
    - In pairs, students will brainstorm and list places in their community where wind turbines might be useful (e.g., rooftops of buildings, open fields, etc.).
    - They will consider factors like wind patterns, accessibility, and energy needs of the location.
    - Share ideas with the class.
2. **Life Cycle Assessment Research:**

    Use this as a LCA reference:
    https://www.rit.edu/sustainabilityinstitute/blog/what-life-cycle-assessment-lca

    - Students will research Life Cycle Assessment (LCA) to understand how renewable energy technologies like wind power impact pollution, emissions, and air quality.
    - In small groups, students will create a visual infographic summarizing the benefits of wind energy using LCA.
3. **Design a Renewable Energy Project:**

- In groups, students will design a renewable energy project for their school or neighborhood, integrating wind energy with other sustainable practices like solar power or energy storage.
- Present the idea to the class.

Analysis:

After watching the video, students will:

1. Analyze how wind energy solutions can complement existing energy systems in urban settings.
2. Discuss the potential challenges and benefits of wind turbines on commercial buildings, including environmental and economic factors.
3. Evaluate the role of community groups and students in promoting renewable energy solutions in their local environments.

Extension Activities:

1. **Field Research:** Students can visit a local building (e.g., school, business, factory) to assess its suitability for wind or solar energy installations. They will present their findings and suggestions for renewable energy integration.
2. **Community Survey:** Design a survey asking local residents about their views on wind energy and other renewable energy sources. Analyze the results and present conclusions to the class.

Post-Video Discussion Questions (with answers):

1. **What is one advantage of using wind energy in urban environments?**
   - *Answer:* Wind energy can complement solar energy, especially in areas where solar panels are less effective, such as the edges of rooftops where wind speeds are higher.
2. **How do wind turbines work in relation to buildings with solar panels?**
   - *Answer:* Wind turbines can be installed on the edges of rooftops, where wind speeds are naturally higher, while solar panels can be placed on the rest of the roof. Together, they allow buildings to generate more renewable energy, helping them approach net-zero energy usage.
3. **What is Life Cycle Assessment, and how does it relate to renewable energy?**
   - *Answer:* Life Cycle Assessment (LCA) is a modeling technique used to measure the environmental impact of a product or technology over its entire life cycle. It can quantify the benefits of renewable technologies like wind power by assessing reductions in pollution, emissions, and other negative environmental impacts.

4. **Why is community engagement important when introducing new technologies like wind turbines?**
    - *Answer:* Community groups can help share successful stories, build excitement and acceptance, and provide feedback on how the technology can be best implemented in their area. They play a crucial role in making new technologies widely accepted and successful.