

# Episode 6: The Science Behind Solar Energy

## 7th Grade Science Lesson

### Summary

This lesson explores solar energy collection, evaluates potential locations for solar facilities in Ohio, and investigates thermal energy transfer mechanisms: conduction, convection, and radiation. Students will use technology to research, analyze, and make informed decisions while comparing Ohio's solar potential to other U.S. regions.

### Objective:

- Students will research sunlight data, recommend a solar farm location in Ohio, and explain thermal energy transfers using conduction, convection, and radiation.
- Students will also compare Ohio's solar potential with other regions and defend their findings in a presentation.

### Key Concepts:

1. Solar energy collection relies on direct and prolonged sunlight exposure.
2. Conduction involves direct heat transfer through collisions of atoms.
3. Convection occurs via currents caused by the density differences in fluids.
4. Radiation is heat transfer through electromagnetic waves.
5. Technology supports data analysis and visualizing energy transfers.

### Key Terms:

- **Conduction:** The process of thermal energy transfer through direct contact.
  - **Convection:** Thermal energy transfer via fluid currents caused by density differences.
  - **Radiation:** The transfer of thermal energy through electromagnetic waves.
  - **Solar potential:** The capacity of a location to harness solar energy effectively.
  - **Satellite imagery:** Images of Earth captured by satellites used for analysis.
  - **Sustainable development:** Meeting current energy needs without compromising future generations' resources.
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## Pre-Video Questions:

Why is solar energy considered a sustainable energy source?

- Discussion Point: Solar energy relies on sunlight, which is a renewable resource. Discuss how this compares to non-renewable energy sources like coal or natural gas, focusing on environmental and economic benefits.

How do you think thermal energy transfers (conduction, convection, and radiation) affect the efficiency of solar panels?

- Discussion Point: Consider how each type of energy transfer might influence heat management in solar panels. For example, think about why overheating might reduce efficiency and how solar panels are designed to mitigate this.

What factors might make certain areas better for solar farms compared to others?

- Discussion Point: Brainstorm factors such as geographical location, weather patterns, land availability, and economic feasibility. Highlight how students can apply this thinking to Ohio.

## Activity:

### 1. Research Phase:

- Students use provided satellite imagery and online tools to analyze sunlight data for various Ohio locations.
- Groups evaluate data on factors such as latitude, cloud cover, and seasonal sunlight variations.

### 2. Thermal Energy Transfer Demonstration:

- Show how conduction, convection, and radiation function using simple tools: heating a metal rod (conduction), observing steam currents in boiling water (convection), and using a heat lamp to mimic solar radiation.
- Students will sketch the processes and annotate diagrams to explain these energy transfers.

### 3. Design Challenge:

- Groups will model a small solar panel array using materials provided (e.g., paper, aluminum foil, thermometers, and heat lamps).
- They will test their models under simulated conditions (using heat lamps and different angles) to determine the most effective configuration.

- Students will note how positioning and material choice impact thermal energy absorption and retention.

#### 4. Presentation Preparation:

- Groups analyze their findings and finalize a recommendation for the optimal location of a solar farm in Ohio. They will use evidence to support their decision, considering sunlight availability and thermal energy efficiency.

### Post-Video Discussion Questions:

1. How does the amount of sunlight a location receives affect its suitability for solar energy collection?

**Answer:** Locations with more direct and prolonged sunlight are more suitable as they maximize energy production.

2. What role do thermal energy transfer mechanisms play in the design of solar panels?

**Answer:** Solar panels rely on radiation to absorb energy from the sun. Proper conduction and convection management ensure heat is transferred effectively and does not reduce efficiency.

3. Why might Ohio's solar potential differ from regions like the Southwest U.S.?

**Answer:** Ohio receives less direct sunlight year-round compared to sunnier regions like the Southwest, where solar energy is more consistent.

4. How can technology, such as satellite imagery, assist in determining the best location for a solar facility?

**Answer:** Technology provides real-time data and imagery to evaluate sunlight exposure, land conditions, and other factors critical for decision-making.