



Lab Summary

The Tech Science Labs: Green by Design

To discover how to harness solar energy, students learn about circuit design, nanotechnology, and solar panels. They then plan and prototype a solar-powered city.

Grade Levels:

3 – 8

Learning Outcomes:

- Students will learn about green energy and renewable/non-renewable resources.
- Students will learn simple circuits: series and parallel.
- Students will use solar panels to light up a “future city”.

Estimated Time:

1.5 hours

- Introductory Discussion: 5 minutes
- Demonstration: 5 minutes
- Activity: 10 minutes
- Follow-up Science Talk: 10 minutes
- Activity: 40 minutes
- Summary: 5 minutes

California Science Content Standards Connections:

- Grade 3: Physical Sciences: 1a, 1b, 1d, 1f, 1h, 2a, 2b; Life Sciences: 3c, 3d, 3e
- Grade 4: Physical Sciences: 1, 1a
- Grade 6: Physical Sciences: 3a, 3b; Earth Sciences: 4a, 4b; Life Sciences: 5a; Earth Sciences: 6, 6a, 6b, 6c
- Grade 7: Life Sciences: 3e; Physical Sciences: 6c, 6f
- Grade 8: Earth Sciences: 4d
- All Grades: Investigation and Experimentation: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other 3 strands, students should develop their own questions and perform investigations.

The Tech Museum™ Gallery Connections:

The Tech Energy Gallery:

- “Harnessing Energy”: Students work together to “power the tower” using renewable resources such as wind, water and solar power.
- “View From Space”: Check out the NOAA Science on a Sphere and learn more about our Planet’s energy systems.
- “Green Garage”: Students can pull into the garage and learn about many different electric vehicles.

The Tech Museum™ Gallery Connections (continued):*The Tech Challenge Gallery:*

- “Electrical Circuit Station”: Students explore electricity with snap circuits and start to imagine how they might use circuits and other physics principles to design a real-world solution to this year’s challenge.
- “Solar Energy Station”: Students tinker with the latest solar technology as they charge a solar panel with simulated sunlight that makes a motor go.

The Tech Awards Gallery:

- “Super Moneymaker Pump”: Students see how a laureate of The Tech Awards designed a human-powered stair-stepping device that serves as a low-cost water pump and allows famers to increase their crop yield.
- “Barefoot Brilliance”: Students see how a laureate of The Tech Awards leverages solar technology and teaches women to make use of solar energy instead of fuel for light so people can go to school at night.
- “Stay Tuned”: Students see how a laureate of The Tech Awards designed wind-up and solar-powered radios to eliminate the need for costly batteries and provide news and education to all.

The Tech Life Tech Gallery:

- “Human Powered Vehicles”: Students learn how to design human powered vehicles and help lessen our dependence on fossil fuels.

Pre-Visit Vocabulary:

These are words and concepts that we will discuss in the lab. Your students’ lab experience will be enhanced if they are familiar with these terms prior to your visit.

- Energy: “Nature’s way of keeping score.” Measured in joules. Appears in many forms, most of which are ultimately derived from the sun or from radioactivity.
- Natural Resource: Something from the natural environment (water, air, trees, fuels) that is used to meet one’s needs and wants.
- Renewable: A resource that can be replaced in a relatively short time; examples are tides, wind, and solar energy.
- Non-renewable: A natural resource such as coal or mineral ores that is not replaceable after its removal.
- Energy Efficiency: Energy efficiency refers to products or systems designed to use less energy for the same or higher performance than regular products or systems.
- Solar Energy: The radiant energy of the sun that can be converted into other forms of energy, such as heat or electricity.
- Reflection: The ability to reflect beams or rays.
- Refraction: The bending of light as it enters a medium and slows down.
- Circuit: An electrical device that provides a path for electrical current to flow.

Teacher Resources:

- Emissions and Emission Reduction Calculators Online

Do some math and start a classroom awareness project around clean energy. Who knows you might inspire the whole school! Calculate how much pollution is caused by the energy used in your home or business. Just enter your monthly energy bill and answer a few questions, and the calculator displays emissions information including greenhouse gases, smog-forming gases and toxic materials.

<http://www.cleanerandgreener.org/resources/calculators.htm>

- Math Can Be Electrifying

Ideas for how to incorporate the above emissions and emission reduction calculators into a fun math lesson.

http://www.educatorresourcecenter.org/view_lesson.aspx?lesson_plan_id=248

Teacher Resources (continued):

- Infinite Power.org

This education page was set up to support interested educators who are willing to incorporate green ideas into their lessons. The lesson plans were created by a team of professional educators and renewable energy experts and include teacher resource guides, reading passages for students, student worksheets, and many other helpful improvements in an easy-to-download format.

<http://www.infinitepower.org/lessonplans.htm>

Post-Lab Activity—Lemon Battery:

Handout available in The Tech Science Labs

Estimated Time: 45 minutes

Students will generate enough electricity to power a LED made from lemons, nails, and pennies.

Learning Outcomes:

- Students will enhance their understanding of simple circuits.
- Students will gain an understanding of the components of a battery.
- Students will be able to describe insulators and conductors.