

# Sustainable Cities

Grade Levels: 4-12

Duration: 45 min

Design a robust learning experience by selecting resources from this guide that fit the needs of your students. Reinforce learning before, after, and even during your visit by diving deeper into some of the science and engineering concepts.



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## When to implement

The following icons indicate when resources should be implemented for the greatest benefit to your students' experience in the lab.



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### Concepts/Skills

City planning, sustainability, trade-offs, trial and error experimentation

### Objectives

Students will:

- Design and iterate their city prototype focused on sustainability.
- Assess and choose between overlapping goals for their city.
- Prioritize the needs of an imaginary resident to develop their ideal city.

## Vocabulary

These are words and concepts that we will discuss in the lab. Your students' experience will be enhanced if they are familiar with these terms prior to your visit. If you need inspiration for vocabulary activities, please see our Vocabulary Choice Board activity.

Term	Definition
<b>City Planning</b>	The planning of all new buildings, roads, parks and more in a place to make them functional and convenient for residents.
<b>CO<sub>2</sub> Emissions</b>	Heat-trapping gas produced as a by-product from many manufacturing or factory processes.
<b>Natural Resource</b>	Something that is not created by humans that is usually a finite material like clean water or forests.
<b>Optimization</b>	The process of iterating, refining and making trade-offs until a solution best meets the criteria and constraints.
<b>Pollution</b>	A substance or thing whose presence, when it enters an environment, has a harmful effect.
<b>Renewable energy</b>	Energy that comes from natural resources that are replenished constantly and will not run out, for example sunlight or wind.
<b>Sustainability</b>	To keep something at a certain level. For example, minimize the use of a natural resource, so it can be kept or conserved to be used in the future.
<b>Trade-off</b>	Balancing between two desirable but incompatible features.
<b>Advanced Vocabulary</b>	These terms may come up in your lab depending on time constraints and age range:
<b>Urban Heat Island</b>	A phenomenon where a city experiences much warmer temperatures than nearby areas often related to dense and tall buildings, less vegetative cover, and building materials that absorb and hold heat.
<b>Mixed-use development</b>	A method of city building planning designed to make cities easily traveled on foot, by bike, or public transit. All residences, work places, and shops are in close proximity to each other or even within the same building.

## Related Texts

The following titles may provide students with a greater contextual understanding of the field of climate change and sustainability and give additional opportunities to incorporate science and engineering into Language Arts lessons. We are not endorsing the following authors but feel that the information presented in these texts may benefit your students and enhance their learning experience.

Age Range	Title and author	Text Type	Description
<b>Grades 4-5</b>	"The Lorax" by Dr. Seuss	Narrative, fiction	In this classic Dr. Seuss tale we meet the Once-ler, the Lorax, and a personified battle for environmental activism.
<b>Grades 4-6</b>	"Trash Revolution: Breaking the Waste Cycle" by Erica Fyvie	Reference	This reference book asks children to consider common items in their lives, how they are produced, and how trash impacts our world. With informative illustrations, everyone can understand the processes and principles at play.
<b>Grades 5-9</b>	"The Cartoon Guide to the Environment" by Larry Gonick and Alice Outwater	Reference	A humorous exploration of the basics of the environment, including sources of energy and raw materials, waste disposal and recycling, cities, pollution, deforestation, global warming, and more.
<b>Grades 6-9</b>	"Hoot" by Carl Hiaasen	Narrative, fiction	A group of children work together to save a colony of owls whose habitat is in danger because of new construction. This humorous adventure novel tackles standing up for what you believe in with an environmental message.
<b>Grades 6-12</b>	"A Hot Mess: How the Climate Crisis is Changing Our World" by Jeff Fleischer	Reference	Jeff Fleischer details the science behind climate change, humankind's responsibility for it, and what we need to do to avoid the worst outcomes. Filled with relevant examples, Fleischer provides vital information about what is happening for those who want to understand it all.
<b>Grades 9-12</b>	"The Water Will Come: Rising Seas, Sinking Cities, and the Remaking of the Civilized World" by Jeff Goodell	Narrative, non-fiction	"The Water Will Come" is an account of the future of sea level rise. Jeff Goodell travels across twelve countries and reports from the front lines in this journalistic approach to the reality of rising seas and the impacts society will face.

## Exhibit Connections

Make connections between learning from the lab and the exhibits and programs found in The Tech Interactive’s galleries.

### Solve for Earth

The Solve for Earth exhibition at The Tech Interactive creates a space where we can discuss as a community how to live sustainably and reduce the impacts of climate change. Solve for Earth looks at the whole picture: where we live, what we eat, how we move and more. Students can dive into a specific issue they are passionate about or look around the gallery to get the whole story.



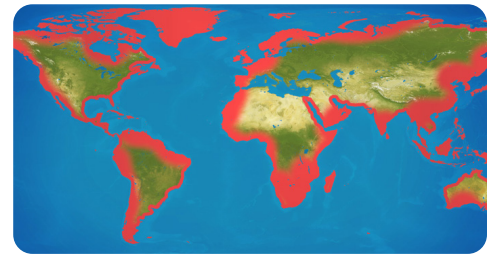
#### Balance of Power

Students will play an electrical grid simulation game to juggle power generation and consumption. They will be tasked with shifting from consumer to producer and convert an antiquated grid to a smart grid.



#### Community Voices

At this story-sharing exhibit about the impacts of climate change, students will see and hear stories from real people in the Bay Area. Students will see how communities nearby are being impacted and how everyday people are addressing it.









#### Sea Level Rise and Sea Level Rise Future Solutions

At this pair of exhibits, students will get an in-depth look at future sea level rise and how it will impact different areas around the world. They will then become engineers as they imagine and draw ways to help protect areas from sea level rise.

## Lab-Related Activities

The following activities can be implemented either before or after the lab and are meant to bridge the learning from the lab to the classroom.

Activity	Description	Time
<b>Connecting with Climate</b> 	Students explore interconnected environmental issues and their ripple effects through systems engineering by designing solutions to real world multi dimensional climate problems.	 90 minutes
<b>Responsible Reservoirs</b> 	Students play an unplugged computational thinking game to weigh the pros and cons of building a dam in their town.	 20+ minutes
<b>#Planet Protector</b> 	Students work together to create a Public Service Announcement (PSA) which educates others about protecting our planet.	 120 minutes



Looking for other hands-on activities and resources to use in your classroom? Check out our [education resources](#) page!

## Next Generation Science Standards

Sustainable Cities supports the following NGSS:

Grades	Engineering Design	Earth and Space Science	Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
<b>Grade 4</b>	3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	4-ESS3-1	ESS3.A ETS1.A ETS1.B ETS1.C	Cause and Effect	1, 3, 6, 8
<b>Grade 5</b>	3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	5-ESS3-1	ESS3.C ETS1.A ETS1.B ETS1.C	Systems and System Models	1, 3, 6, 8
<b>Grades 6-8</b>	MS-ETS1-1 MS-ETS1-2 MS-ETS1-3	MS-ESS3-3 MS-ESS3-5	ESS3.C ESS3.D ETS1.B ETS1.C	Cause and Effect Stability and Change	1, 4, 6, 7
<b>Grades 9-12</b>	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4	HS-ESS3-3 HS-ESS3-4 HS-ESS3-6	ESS2.D ESS3.C ESS3.D ETS1.A ETS1.B ETS1.C	Stability and Change System and System Models	1, 5, 6



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