LAB GUIDE

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.

Table of Contents	Page

When to implement

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

Grade Levels: 4-12

Duration: 45 minutes

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.
- Act as a city planner to prioritize the concerns of imaginary city residents in a city planning scenario

Career Connections

Let students know that during the lab, they will take on the role of someone in a specific career, collaborating with their peers to solve a real world challenge. Students will be working as **city planners** to design a sustainable city.

For Begining City Planners *(suggested Grades 4-6)*

Pre-visit prompts

Before their field trip, review the city planner Sustainable Careers Profile (see **Lab Related Resources**) with your students. The career profile will give students context for the work these professionals do and the kinds of skills they use. Help students think about the kind of work a city planner does and what students might already know or be interested in about the role. Have groups of students discuss one or more of the following:

- What part/s of the role seems most interesting to you?
- How have you used one of the skills of a city planner in your own life?
- What are you curious to learn about in the lab?

Post-visit prompts

After their field trip, have students reflect on the the lab experience and discuss one or more of the following:

- How did it feel to be a city planner during the lab activity?
- What part of the lab activity did you most enjoy?
- What other careers are interested in learning more about?

For Advanced City Planners *(suggested Grades 7-12)*

Pre-visit prompts

Before their field trip, have students review the city planner Sustainable Careers Profile (see **Lab Related Resources**) The career profile will give students context for the work these professionals do and the kinds of skills they use. Reviewing the profiles ahead of time will help students arrive prepared to participate. Have students discuss one or more of the following:

- What interests, skills, or goals do you notice you have in common with this career?
- What things surprised you about this career?
- What are you curious to learn about in the lab?

Post-visit prompts

After their field trip, have students reflect on the lab experience and discuss one or more of the following:

- How did it feel to act as a city planner solving a city wide issue during the activity?
- What skills did you use in the lab that you might want to use in a future career?
- What other careers are you interested in after exploring the lab and exhibits?

Students can complete the **Lab Related Resource** Career Exploration Mosaic Lesson to consider potential career paths for themselves.

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
City Planning	The planning of new buildings, roads, parks and more to make them functional and convenient for resid ents.
CO2 emissions	Heat-trapping gas produced as a by-product from many manufacturing or factory processes.
Natural resource	Something that is not created by humans that is usually a finite material like clean water or forests.
Optimization	The process of iterating, refining and making trade-offs until a solution best meets the criteria and constraints.
Pollution	A substance or thing whose presence, when it enters an environment, has a harmful effect.
Renewable energy	Energy that comes from natural resources that are replenished constantly and will not run out, for example sunlight or wind.
Sustainability	To keep something at a certain level. For example, minimizing the use of a natural resource so it can be kept or conserved to be used in the future.
Trade-off	Balancing between two desirable but incompatible features.

Advanced Vocabulary	These terms may come up in your lab depending on time constraints:
Urban heat island	A phenomenon in which 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.
Mixed-use development	A method of city building planning designed to make cities easily travelable on foot, by bike, or with public transit. All residences, workplaces and shops are in close proximity to each other or even in the same building.

Related Texts BEFORE DURING AFTER

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
Grades 4-5	"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.
Grades 4-6	"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.
Grades 5-9	"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.
Grades 6-9	"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.
Grades 6-12	"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.
Grades 9-12	"The Water Will Come: Rising Seas, Sinking Cities, and the Remaking of the Civilized World" by Jeff Goodell	Narrative, non-fiction	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

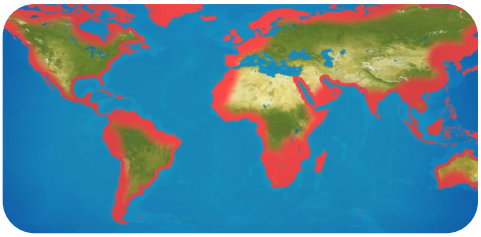
Make connections between learning from the lab and the exhibits and programs found in The Tech Interactive's galleries.

Solve for Earth *(Lower Level)*

The Solve for Earth exhibit 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 converting an antiquated grid to a smart grid.

Community Voices
In 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
In 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 the engineers as they imagine and draw ways to help protect areas from sea level rise.

Lab-Related Activites

Activity	Description	Time
Career Exploration Mosaic	For more advanced learners. Students will create a mosaic that represents their current selves and future career aspirations, then explore careers and opportunities that align with their interests and goals.	75 minutes
Connecting with Climate	Students explore interconnected environmental issues and their ripple effects through systems engineering by designing solutions to real-world multidimensional climate problems.	90 minutes
Responsible Reservoirs	Students play an unplugged computational thinking game to weigh the pros and cons of building a dam in their town.	20+ minutes
#PlanetProtector	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 or resources to use in your classroom?
Check out our **education resources** page!

Next Generation Science Standards

Sustainable Cities supports the following Next Generation Science Standards

Grades	Engineernig Design	Earth and Space Science	Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
4	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
5	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
6-8	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
9-12	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

Visit thetech.org/fieldtrips for more information on field trip offerings, booking information, and more!

The Tech Interactive
thetech.org