



STEM

COMPARING “GREEN” CITIES

How Green is my City?

**High
School**

How Green is My City? Comparing the sustainability of your own city to the modern German city of Karlsruhe

<p>Next Generation Science Standards (NGSS)</p>	<p>HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.</p> <p>HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.</p> <p>HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</p>
<p>Materials Needed</p>	<p>Access to internet and devices, digital slides (project overview and Karlsruhe sustainability slides), rubric for final proposal, blank paper for each student, poster paper for each group, pens, pencils, colored pencils and/or markers.</p>
<p style="text-align: center;">Phenomenon</p>	
<p>Engage</p>	<p>Students will draw a simple model (quick sketch) of what a sustainable city looks like and partner with another student to compare and contrast their models. Groups will share out with the whole class and the teacher will take visible notes.</p>
<p>Explore</p>	<p>Students will be provided digital slides and links that focus on Karlsruhe’s main sustainability goals and its partnership with the local university sustainability lab. Students will also research the sustainability information provided online by the city in which they live or a nearby city.</p>
<p>Featured Sources</p>	<p>Students create T-Chart based on article and create comprehensive list as a class including items not included in the article.</p> <p>Assign different articles to groups and have students discuss sustainability goals before free writing what they have learned.</p>
<p>Featured Sources</p>	<p>https://www.karlsruhe.de/umwelt-klima https://www.karlsruhe.de/stadt-rathaus/so-ist-karlsruhe/innovativ-und-quer/gruene-stadt https://www.transformationszentrum.org/</p>
<p>Explain</p>	<p>Students will record their findings about the plans of the two cities on a compare/contrast graphic organizer and create a product to showcase one innovative measure that Karlsruhe is doing that could benefit their own city They will create a new city model combining their findings plus two completely new sustainability features.</p>
<p>Create a Prototype</p>	<p>The teacher could demonstrate what a different city’s sustainability websites look like and how to gather information from them.</p>
<p>Elaborate</p>	<p>Understand: Students read about the Karlsruhe sustainability plan</p> <p>Assess: Students will compare the sustainability plan of their own city to that of Karlsruhe and propose one innovative sustainability measure from Karlsruhe for their own city.</p> <p>Act: Students will share their sustainability proposal with their class and a city official and produce a model of an ideal city combining all of this information.</p>
<p>Evaluate</p>	<p>Students will self-evaluate their final proposal product (video, digital slides, or poster) using a provided rubric.</p>

Phenomenon

How Green is My City? Comparing the sustainability of your own city to the modern German city of Karlsruhe

Target Grade Level: 11-12

Target Course: Environmental Science

Inquiry Overview

In this lesson, students will compare the sustainability plan of the German city of Karlsruhe to the sustainability plan of their own city. (Alternatively, if data are not available for their own city, students could compare the data to that of a US city of similar population, such as Cincinnati, Ohio.) Students will look for similarities and differences in the plans and choose one thing that Karlsruhe is doing that they could propose for their own city. Working in groups, students will prepare a proposal to share with a member of their own city sustainability council.

Teacher Background Information

Most cities have a sustainability plan that involves multiple facets of the city's government working together. The city of Karlsruhe has an exceptional plan that involves both collaboration among various municipal departments as well as a partnership with a local public university, Karlsruhe Institute of Technology (KIT). KIT researchers operate a real-world sustainability lab in part of the city of Karlsruhe where the community is encouraged to engage in sustainable transformation. In this lesson, students will research and compare their own city's (or a chosen city's) sustainability plan in order to compare/contrast the two plans. This lesson begins with individual work, progresses to partner work and/or group work (3-4 students).

Suggested Time Frame

Three Days

Concept List

- Sustainability
- Green Spaces
- Urban Planning
- Solar Energy
- Environmental
- Biodiversity
- Green Roof
- Cargo Bike
- Climate Change
- Climate Neutral

Materials Needed

Access to internet and devices, digital slides (project overview and Karlsruhe sustainability slides), rubric for final proposal, blank paper for each student, poster paper for each group, pens, pencils, colored pencils and/or markers.

Featured Sources

- <https://www.karlsruhe.de/umwelt-klima>
- <https://www.karlsruhe.de/stadt-rathaus/so-ist-karlsruhe/innovativ-und-quer/gruene-stadt>
- <https://www.transformationszentrum.org/>

Next Generation Science Standards (NGSS) / State Content Area Standards

- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Outcomes for Student Learning

- Students will understand that city governments work together to write sustainability plans that guide their city.
- Students will become more aware of the human impact upon the environment, specifically in an urban setting.
- Students will gain experience analyzing, comparing and contrasting city sustainability plans.
- Students will identify a sustainability goal or action that the city of Karlsruhe has implemented that could benefit their own city.
- Students will gain experience communicating their proposal for the incorporation of this new sustainability measure through a visual or graphic product depicting this measure.
- Students will learn how they can use civic connections to convey their opinions to their local city officials.
- Students will practice effective communication by making a persuasive presentation to a city official regarding their new sustainability proposal.

Germany-Related Learning Goals

- After students successfully complete this unit, students will understand how a contemporary city in Germany addresses sustainability issues.

Phenomenon / Main Problem

Humans must work together in their communities to slow, reduce, eliminate and/or mitigate their impacts on natural resources, ecosystems, and Earth systems. The German city of Karlsruhe is a “green city” that can serve as a model for other cities because of their work in the areas of climate action, nature, and health in urban areas.

Engage

Students will be asked to think about what a sustainable city looks like based on their own prior knowledge. Without discussion or research and working independently, students will draw a simple model (quick sketch) of what a sustainable city looks like. Then they will partner with another student to compare and contrast the sustainability elements in each of their models. Those groups will share out with the whole class. As they share, the teacher will keep a running list of the sustainability elements students would like to see in an ideal sustainable city.

➤ Anticipated Guiding Questions

- How can we reduce or mitigate the impact of humans on our natural resources, ecosystems and Earth systems?
- What does it mean to be a “green city?”
- What are some ways that the city of Karlsruhe practice sustainability?
- How does my own city practice sustainability?
- What is one sustainability practice that Karlsruhe has adopted that could benefit my city as well?
- How can I take action locally with the sustainability proposal I have created?

Explore

- Students will be provided digital slides that focus on Karlsruhe’s main sustainability goals and its partnership with the local university sustainability lab. The information will contain links to take students to more details about every sustainability measure.
- Students will also research the sustainability information provided online by the city in which they live or a nearby city. Alternatively, students could compare the sustainability websites of US cities of similar population size as compared to Karlsruhe, such as Orlando, Florida or Lexington, Kentucky.

➤ Resources

- <https://www.karlsruhe.de/umwelt-klima>
- <https://www.karlsruhe.de/stadt-rathaus/so-ist-karlsruhe/innovativ-und-quer/gruene-stadt>
- <https://www.transformationszentrum.org/>

Please Note: You will need to switch the language of the websites to “English” since they will open in German

Explain

- Students will use a graphic organizer to organize their findings, using a compare/contrast format. Additionally, students will work together to choose one innovative sustainability measure being used in Karlsruhe that they think could benefit their own city.
- Each student group will communicate their proposed sustainability measure in a format of their own choosing, as a poster, or a slide presentation with the target audience being a local member of their city’s sustainability team. The presentation should include a detailed description of the sustainability action, at least one graphic that depicts this action, information about how it was implemented in Karlsruhe and how successful it has been, a description of how it would benefit their own city, and of any challenges that would come with implementation of this measure.

Explain Cont'd

- At the end of the unit, each student group will revisit the sustainable city drawing activity from the Explore section. Have them work together to make a larger, more detailed model of a sustainable city including labels and explanation. They should incorporate elements from their research about the sustainability plans of both Karlsruhe and their own city. Additionally, each group should include at least two elements that were not featured in either of the city plans. These could be created on large pieces of butcher paper or poster paper and displayed in the classroom hallway.

Create a Prototype

Teachers could model the research portion of the project by using a different city's website and modeling the steps to evaluate that plan for similarities and differences to the plan of Karlsruhe.

Elaborate

- **Understand** – Students will work together to fill out a graphic organizer highlighting similarities and differences between the sustainability plan of their own city and the city of Karlsruhe.
- **Assess** - Students will work with a group to research sustainability measures their own city is practicing and choose an innovative sustainability action from the Karlsruhe plan that could benefit their own city
- **Act** – Students can practice effective communication by sharing their proposal with the class. Once they have practiced with the class, invite a local municipal sustainability official into the classroom and have them share their pitch as concerned citizens. Students will create a final model of an ideal sustainable city by combining the measures from both cities and adding two new elements that they brainstormed themselves.

Evaluate

- Students will self-evaluate their final proposal product (digital slides, or poster) using a provided rubric.

Virtual Exchange

- After analyzing the Karlsruhe sustainability plan, students could write specific questions for the Karlsruhe government officials or the researchers at KIT about their plan. This could be done in a written format using a tool such as Padlet or as a YouTube video.
- To extend this activity, students could partner with another STEM/MINT class in Germany. The students could use tools such as Padlet or YouTube to share their findings on their city's sustainability goals, they could then compare and contrast their findings together through collaborative work.
 - Another option would be to partner with a school specifically in Karlsruhe in order to start a virtual or live video conversation about what they think is actually working in their city with regard to sustainability.

Career Connection Exploration

- As students are working on this project, opportunities may arise for the teacher to discuss relevant career opportunities including work as a sustainability coordinator, urban planner, science or social science researcher, or as a data analyst. Students may also be curious about what career pathways allow people to become elected municipal officials. If interacting live with a local sustainability official, students could ask that person about their personal career pathway.

Modifications for Differentiation

- Read aloud for articles (or text-to-speech).
- Deliberate student grouping to promote engagement.
- Teacher notes from discussion projected on the whiteboard, and then available to the class via Google Classroom or other LMS.



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