DISCOVER PRESENTS

Future City COMPETITION

Program Handbook

2023–2024

www.futurecity.org

Each year 6th, 7th, and 8th grade students embark on a transformative experience as they explore how to make the world a better place. Working in teams, participants spend four months imagining, researching, designing, and building cities of the future.

DISCOVER E ENGINEERING

What Does DiscoverE Do?

DiscoverE works to ensure people everywhere understand how engineers, technicians, and technologists make the world a better place. Thirty years ago, we were the first to call on the engineering community to volunteer in local schools and help young students discover engineering. Now we lead a growing volunteer and educator movement recognized worldwide.

DID YOU KNOW...

86% of educators and volunteers say that DiscoverE's programs and resources are essential to their ability to engage students in engineering.

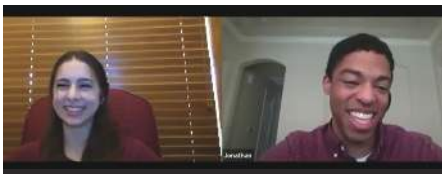
Discover Engineering At Home

ENGINEERING ACTIVITIES

Looking for hands-on engineering activities to do at home or in a classroom? DiscoverE has over 125 educator-tested and approved activities that use easy-to-find, household materials.

CHATS WITH CHANGE MAKERS

Join live conversations with engineers. Hear about their careers, how they got there, and how they are making the world a better place. Your host is Tiffany, a Future City Competition alum and current high school junior in Texas.



AT HOME ENGINEERING

Visit DiscoverE.org/at-home-engineering for free activities, articles, and video challenges, like "Harmless Holder" and "Safe Landing"!

Future City is a program of DiscoverE.

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Overview

What Is Future City?

Future City is a project-based learning program where students in 6th, 7th, and 8th grades imagine, research, design, and build cities of the future. Keeping the engineering design process and project management front and center, students work in teams to ask and answer an authentic, real-world question: How can we make the world a better place?

Future City started in 1992–1993 in just five cities and with 200 students. Today, 67,000 students around the globe learn how engineers make the world a better place.

Students participate in the Future City Competition in teams (of at least three students), guided by an educator and a volunteer STEM mentor. Teams spend approximately four months creating cities that could exist at least 100 years in the future. Each city must incorporate a solution to an annual design challenge. **This year, teams will design a city completely powered by electricity generated from sources that keep your citizens and the environment healthy and safe.** In January, teams present their projects to judges at Regional Competitions throughout the participating International regions for 2023–2024. Teams who earn the top spot at their Regionals will participate in the 2024 Finals.

"One of the biggest tips I would offer is to read the Handbook carefully. It took me a few years of falling down to learn that lesson the hard way myself. So be sure that you read the Handbook carefully, and if you have any questions, reach out to your Regional Coordinator."

– Travis Koupal, Minnesota educator, 10 years doing Future City

The Future City Framework

This project framework is broken down into three pillars: Deliverables, Engineering Design Process (EDP), and Project Management, each supporting and informing the other.

1. Future City Deliverables

During the program, Future City teams design solutions to the annual challenge and create a city that could exist at least 100 years in the future. They present their future city through a:

- 1,500 word essay
- Scale model made from recycled materials
- 15-minute presentation and Q&A sessions with judges
- Project plan

2. The Engineering Design Process (EDP)

Future City introduces students to the engineering design process. As students work through the process, they realize they can think like engineers and see themselves as problem solvers. Once they get the hang of the engineering design process by using it to build their future city, students can apply it to all kinds of challenges and other school assignments.

3. Project Management

The success of a project often hinges on continued management of the project goals, resources, schedule, and regular team check-ins. Project management is a professional organizing system that focuses on keeping projects and teams coordinated and moving forward. Future City uses a student version of the project management process.

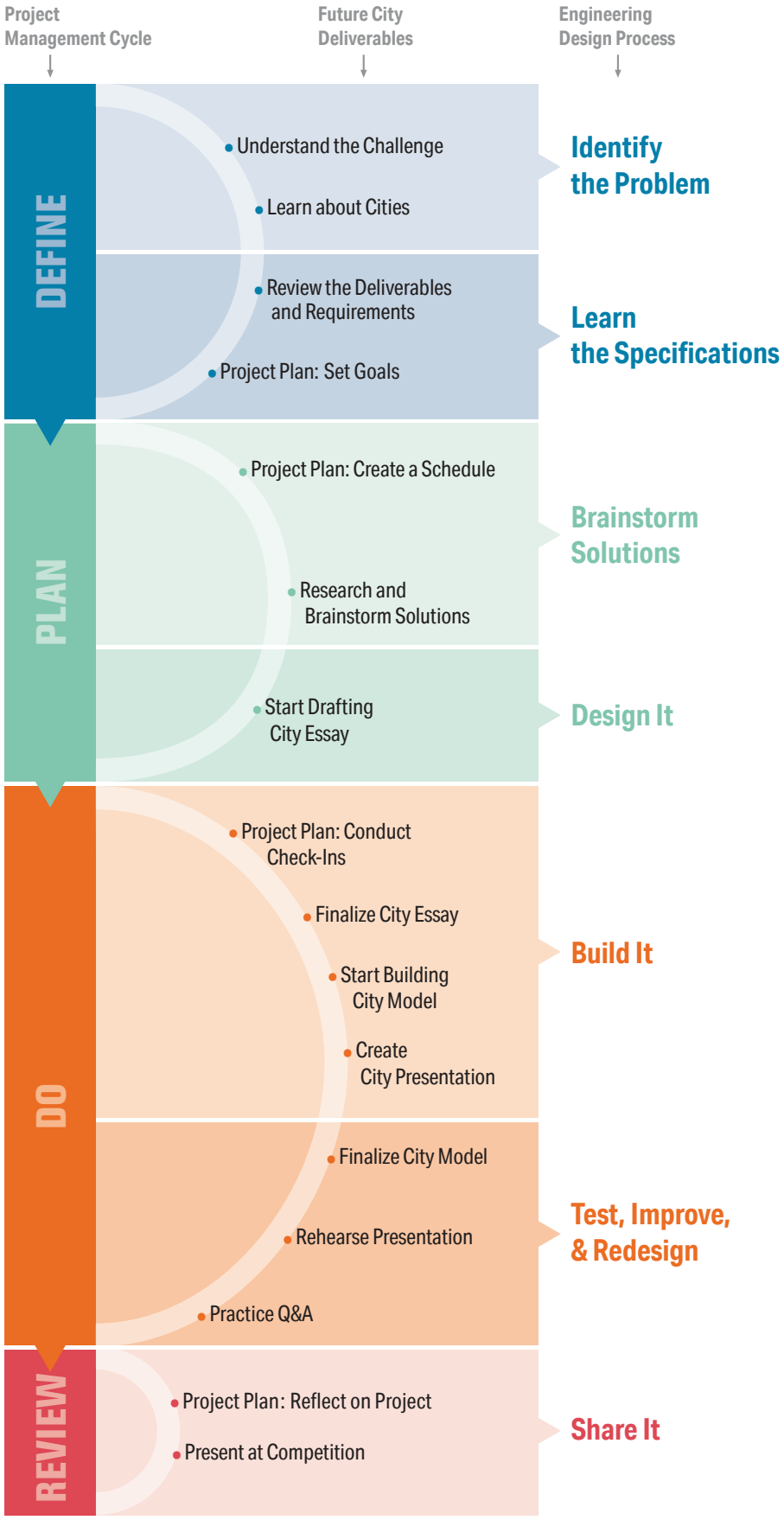
Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

What Educators Are Saying

"88% of educators say Future City helped their students gain confidence in their ability to do STEM activities."

Create Your Future City



Stages and Steps of Future City

This graphic illustrates a basic road map to guiding your team through Future City successfully. Your team may move quickly through some steps and take extra time for others. You can share this graphic with your students by:

- Showing them the animated version.
- Downloading and displaying the colorful printout found in the Resources section of the Educator Dashboard at FutureCity.org.

How Does the Competition Work?

Future City is open to kids in grades 6, 7, and 8 who are from the same school or home school environment, or are members of a nationally, regionally, or state-recognized youth-focused organization, such as the Boy and Girl Scouts, Boys and Girls Clubs, or 4-H. Not sure if your organization qualifies? FutureCity@DiscoverE.org

Can I Still Do Future City Without Competing?

Yes! Anyone is welcome to register (for free!) and access Future City's full library of resources. Many regions encourage teams to participate in the competition even without all the deliverables completed—this is known as being a "partial competitor." Check with your Regional Coordinator to see if the partial competitor option is offered in your region.

PROJECT DELIVERABLE	COMPETITION POINTS	DUE DATE
1. CITY ESSAY	**50 POINTS**	**DUE BEFORE COMPETITION**
Teams describe the unique features of their city and their solution to this year's challenge: Design a city completely powered by electricity generated from sources that keep your citizens and the environment healthy and safe.		
2. CITY MODEL	**65 POINTS**	**AT COMPETITION**
Teams build a physical model of their city (in one piece or multiple segments) using recycled materials. The model showcases the team's city of the future, their solution to this year's challenge, and has at least one moving part.		
3. CITY PRESENTATION AND Q&A	**72 POINTS**	**AT COMPETITION**
Three student team members give a 7-minute presentation about their future city and their solution to the challenge. Teams have an 8-minute question and answer period, conducted with a panel of judges from the engineering, city, and technical communities.		
4. PROJECT PLAN	**10 POINTS**	**DUE BEFORE COMPETITION**
Teams complete a Project Plan to help them plan and organize their work. They use it throughout the project.		

DUE DATES

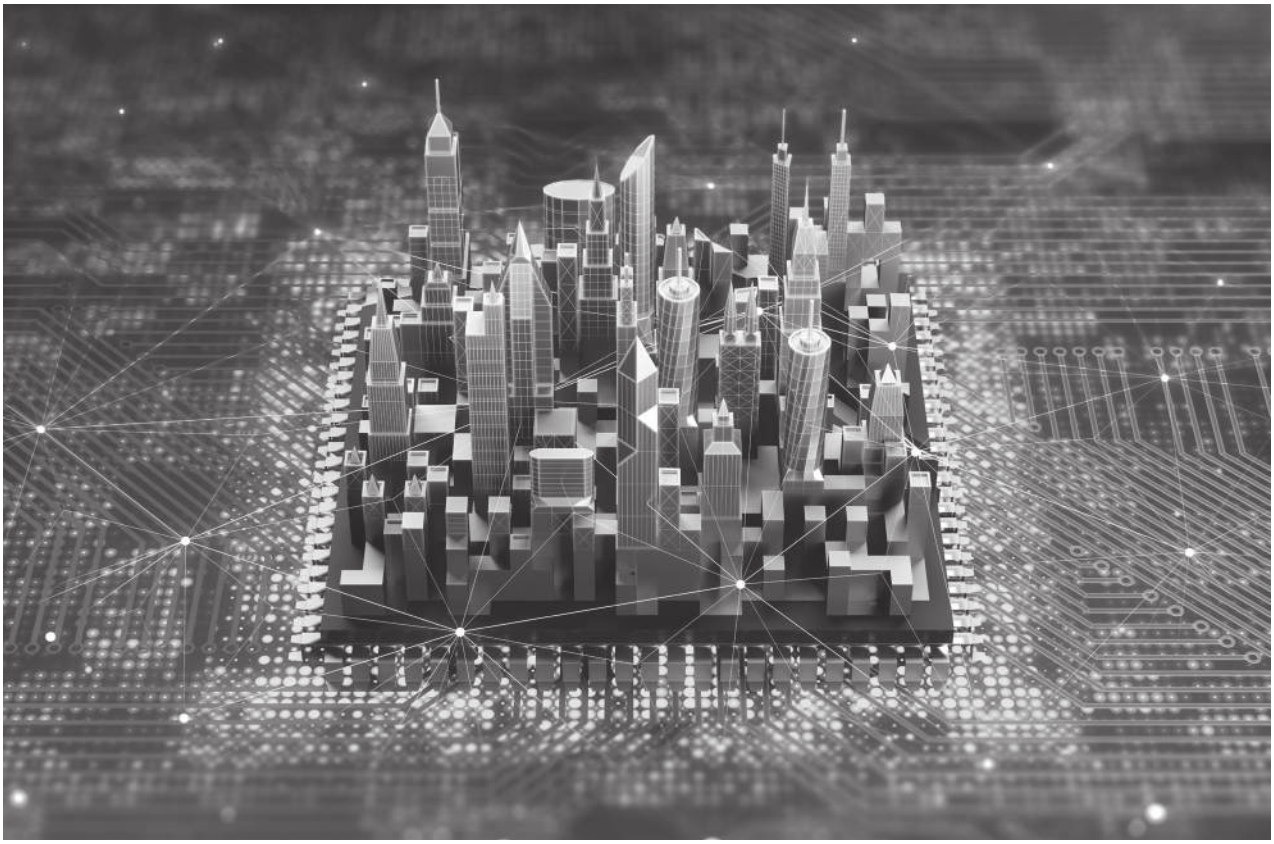
Check your educator dashboard for your region's due dates. Visit Dashboard.FutureCity.Org to organize your team's participation, including your region's competition dates, submission guidelines, and links to required forms, (like the honor statement, expense form and more).

The 2023–2024 Future City Challenge

Working in teams with an educator and STEM mentor, students participating in Future City are challenged to imagine what it would be like to walk down the main street of a city at least 100 years in the future. They'll answer questions like:

- What do you see, hear, smell, and feel?
- How do the people who live in your future city describe it?
- What is different from today? What is futuristic and innovative?

As the team explores these questions, they'll also address this year's challenge—Electrify Your Future: Design a city completely powered by electricity generated from sources that keep your citizens and the environment healthy and safe.



Overview:
Electrify Your Future

Every day we plug in and power up, thanks to electricity. Electricity is essential for heating, cooling, and ventilation. With each day comes new demands on our electrical grid: more electric cars on the road, more buildings switching to electric heat pumps, and more industries electrifying manufacturing processes formerly powered by combustion engines running on fossil fuels.

Today most electricity is generated by large power plants, with over 60% in 2022 from fossil fuels such as coal and natural gas. Burning fossil fuels for electricity, heat, and transportation is the largest source of greenhouse gas emissions in the United States and China. These emissions cause global warming, which in turn causes climate change. As the world works to adapt to and mitigate the impacts of climate change, we need to change how we generate electric power.

There is a growing consensus that future cities could be powered completely by electricity. What clean, green, and renewable energy sources could power the electrical grid? How would these sources generate enough electricity for industry, transportation, agriculture, residential, and commercial uses?

Today's engineers, scientists, architects, and city leaders are working together to make our cities run on electricity created from energy with minimal environmental impact. Can you imagine what future cities will be like when engineers find and implement solutions to the challenge of electrifying our cities?

The students' challenge:

Design a 100% electrically powered city with energy generated from sources that keep your citizens and the environment healthy and safe.

DELIVERABLE #1:

City Essay

Students research and write a 1,500-word essay that describes the unique attributes of their city and provides a solution to this year's challenge.

The City Essay is the first place students will share their vision of the future. Here they will answer the question: What makes your city special, futuristic, and innovative? Students will think deeply about their city: its population, infrastructure, culture, unique characteristics, and community needs. In addition, the essay asks students to thoughtfully address this year's Electrify Your Future Challenge.

City Essay Requirements

- The team's city is set at least 100 years in the future.
- The essay cannot exceed 1,500 words and should be free of grammatical and spelling errors. Be sure to include your essay's exact word count at the end of the essay.
- The essay can include a maximum of four graphics. The graphic's captions are included in the word count.
- The essay must cite at least three sources used during the idea development process. MLA style is preferred.
- Students should use a variety of sources of information, such as interviews with experts, reference books, periodicals, and websites. (Note: Wikipedia is not accepted as a source for citations.)
- The essay must be submitted as a Word document via the Educator Dashboard.

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

Competition Scoring

City essays are submitted and judged *before* the regional competition via the Educator Dashboard. Check here for submission instructions and your region's due date. Make sure they have thoroughly covered these categories in the rubric to maximize points:

Introduce City & Define Problem	24 points
Electrify Your Future Solution	20 points
Writing Skills	6 points
Total	**50 points**

City Essay Resources

- **Electrify Your Future Challenge Research Questions Student Handout:** This resource provides background information and questions for student research.
- **Future City Design: Questions To Consider Student Handout:** These guiding questions will help students remember to research all the different aspects of their future city.
- **Electrify Your Future Challenge Real-World Case Studies Handout:** Gain inspiration from these real life examples of cities completely powered by electricity.
- **City Essay Suggested Outline:** This outline explains what students should include and how to organize their essay.
- **Research Resources:** Start your team's research with this preselected set of resources.
- **City Essay Rubric:** Review this rubric with students so they understand how their essays will be evaluated.
- **City Essays From Past Finals Winners:** Analyzing essays from prior years will give students a strong sense of what they are aiming for in their own essays. Go to futurecity.org/gallery/.

Electrify Your Future: Research Questions

Imagine your city at least 100 years in the future. Think about different forms of green, clean, and renewable forms of energy. What if your city were powered entirely by electricity generated from sources like these? How would it look, smell, sound, and feel different?

For the competition, your team will design a 100% electrically powered city with energy generated from sources that keep your citizens and the environment healthy and safe.

Use the question below and in the **Future City Design Questions to Consider handout** as you start your research and brainstorming. And be sure to read and discuss the **City Essay Suggested Outline** and the **City Essay Rubric** with your teammates, as it provides a clear and detailed picture of what you'll need to include.

Green, Clean, Renewable: What's the Difference?

These are terms for sources of energy to produce electricity that can replace the use of fossil fuels. The terms are often used interchangeably, and there is a lot of overlap, but they are not the same. In fact, each source of energy comes with pros, cons, and trade-offs that need to be researched and considered.

Green: Sources that come from nature: solar, wind, heat, hydro (fresh water from rivers and lakes), ocean water, and biomass. Most create no carbon emissions or other greenhouse gases.

Renewable: Sources that quickly replenish themselves or never run out at all. Examples include solar, wind, hydro, ocean, and geothermal (heat extracted from underground). Whether biomass should be included here is up for debate.

Clean: Creates no greenhouse gases but may have other environmental impacts. Solar, wind, some forms of hydro, ocean, and nuclear are clean sources of energy.

Powering Today's Cities

Below are some questions to get you started with your research. As you learn how today's cities generate and use electricity, look for innovations that engineers and others are developing that may inspire your future city.

Energy Sources and Usage

- What is currently powered by electricity in your city?
- What energy sources are currently being used to generate electricity in your city today?
- In what ways is your city not powered by electricity? What is the power source for these uses (for example, trains running on diesel fuel or manufacturing plants)?
- Today, there are three main types of electricity consumers: industrial, commercial, and residential. How do the electrical needs of the three main types of consumers differ?

Generating and Storing Electricity

Electricity can be created from many power sources and in various ways. Today, there are two types of generation: Centralized generation refers to large-scale generation far away from where it's used (e.g., power plants fueled by coal or nuclear). Decentralized generation occurs close to usage (e.g., rooftop solar).

- What are the different ways electricity is generated?
- Where are electrical power plants typically located, and why?
- How do different types of generation impact the environment? What are the advantages of generating electricity as sustainability as possible?
- What advances or innovations are occurring in electricity generation today?
- What is a microgrid, and how is it different than a traditional electrical grid? What are the advantages and disadvantages of microgrids?
- How much energy can your city's system generate today? If everything ran on electricity, could your city generate enough for all the demands?
- How efficient are today's power plants? How much energy is lost as they convert the primary energy source into electrical energy?

Getting Electricity Where It's Needed: Transmission and Distribution

Sending electricity from power plants to cities is called transmission, while getting electricity to consumers is called distribution.

- How is electricity moved to individual businesses and homes?
- Is today's electrical distribution system capable of providing 100% of a city's power needs? Why or why not?
- What are the geographic challenges to transmission and distribution?
- What innovations are happening in today's transmission and distribution systems to increase capacity?
- How is the electricity supply controlled?
- How are transmission and distribution controlled?

Storing Electricity

Since electricity was first discovered, people have been looking for ways to store it. The challenges of storing electricity on a large scale can make it difficult to balance the level of generation with the level of usage throughout the day.

- Do today's cities store electricity? Why or why not?
- How can electricity be stored with existing technology? What are cutting-edge ideas in energy storage?
- What are some innovative methods of energy storage that engineers are developing?
- What are the benefits and drawbacks of each source of renewable energy storage?
- What happens when we don't store enough energy?
- How do different energy storage systems connect to the power grid? What infrastructure is needed?

Electrifying Your Future City

The more city planners, engineers, and scientists research the feasibility of cities running completely on electricity, the more consensus builds that it is possible. There are many issues to address for this to become a reality, however, and many innovations are in the works. What are all the clean, green, and renewable sources of energy that could be used to make electricity?

- What are the benefits of each source of energy? What are the drawbacks? (Things to consider: how much does it cost, is it readily available, are there any safety concerns?)
- Which energy sources would work best for your city's climate and location?
- Will you have a primary source of energy, with several others for backup? Will you have a range of sources that work together to keep your city powered up?
- What are innovative ways engineers are coming up with to electrify city sectors that are traditionally run on fossil fuels?
- How will electricity be distributed throughout your city?
- If electricity will be generated outside the city, how will it be delivered?
- How will electricity be stored so that supply always meets demand?
- How will life in your future, fully electrified city be different from life in this city today?
- What trade-offs are you willing to make to electrify your city?
- Is it a good idea to power a city 100% on electricity—why and why not?

Future City Design: Questions to Consider

Your challenge is to design a city that runs entirely on electricity that is supplied by alternative sources of energy. These sources will inform how your city will generate, distribute, and store energy.

As you and your teammates begin to design your future city, use the topics and questions below to guide your research, brainstorming, and design sessions. Remember, no city can provide everything. What are the most important features of your city? What trade-offs do you have to make? How might a switch to electricity address more than one problem your city is facing?

City Features

- Where is your city located?
- What is its climate?
- Who lives in your city?
- What are your city's distinctive natural features (e.g., mountains, oceans, rivers)? Where are suitable locations for generating alternative forms of energy in your city?
- What makes your city futuristic and innovative?

Zoning, Government, and Budget

- How is your city zoned? Are the zones separate, or are there mixed-use zones (e.g., commercial and residential or commercial and industrial) in your city?
- How has your city used zoning to achieve its goals around full electrification?
- How is your city governed? Who makes the laws and regulations?
- How does your city fund its operations (i.e., utilities, infrastructure, and public services)?

Food and Agriculture

- Where does your city's food supply come from?
- How will electrifying your city affect the city's food supply system?
- What changes have local and regional farmers made to accommodate alternative energy production?
- How can farmers benefit from the switch to alternative forms of energy?
- How can electricity be generated from agricultural waste?

Industry, Manufacturing, and Jobs

- What drives the economy in your city (e.g., tourism, manufacturing, education, agriculture, sports, medicine, the arts)?
- How has electrifying your city affected its economy? What new jobs or industries have come about since electrification or what jobs have been lost?
- What trade-offs have there been as your city has weaned off fossil fuels?
- How has going 100% electric affected these sectors?
- What types of jobs are available to your reside

Structures and Housing

- Where do your residents live, work, and go to school?
- Do individual homes generate their own electricity, or do they participate in a neighborhood grid?
- How does your city manage energy storage and distribution to homes and other buildings?
- What materials are used in your city's buildings? What makes them innovative? How are materials produced, used, and potentially reused?

Transportation

- What transportation options are available to your residents? Is there more than one way to get around?
- How are goods and materials moved around your city?
- How has your city been redesigned to fully electrify its transportation systems?
- How is your city designed to be accessible for people with mobility issues related to aging or a physical disability?

Utilities and Services

- What services does your future city provide its residents (e.g., medical, education)?
- How does your city address the needs of vulnerable populations, including the poor, the sick, the unhoused, and the elderly?
- What impact has your city's electrification had on its utilities, such as water, sewer, waste management and recycling, electricity, Internet, and so on?

Health and Recreation

- How does your city support a healthy lifestyle for its residents throughout every stage of life?
- What does your city offer for entertainment, recreation, and cultural enrichment?
- How have hospitals and healthcare adapted to full electrification?
- What types of public spaces does your city have? What do people do there?

Electrify Your City Case Studies

Compressed Air: A Breakthrough in Energy Storage

We've known how to make clean, renewable energy from wind, sun, and water for decades. The problem has been figuring out how to store this energy and have it ready when we need it, not just when the wind blows, the sun shines, or the water flows in torrents.

A company called Hydrostor has developed the technology to store large amounts of energy from renewables in the form of compressed air from 5 hours to many days. It is building a facility in Ontario, Canada, and another one in southern California, near Los Angeles. Repurposed components from mining and gas operations are part of this system, which compresses air and stores it underground or in a container. When the air is released, it drives a turbine. It is as powerful as hydro (water) power but uses 10 times less land and up to 20 times less water.

A School Bus That Powers the Grid

School buses are going electric all over the country. This trend reflects the general electrification of transportation in a growing effort to eliminate a major source of carbon dioxide, which is a key contributor to global warming. But electric school buses can do something else—they can serve as batteries, storing energy and pouring it back into the electrical grid.

A process called, V2G which stands for vehicle-to-grid, refers to bidirectional charging programs that turn electric vehicles into sources of energy for the electrical grid. When a school bus has completed the morning route and then again after the afternoon route, it has stored energy that can be sent back to the electrical grid.

The impact of V2G school buses could be substantial. One bus can store enough energy to power five hospital operating rooms for eight hours. Just 10 school buses can make 10 megawatts of power--more than enough energy to power a home for an entire year. Plus, the buses can generate funding for the school district, which gets paid $2/kWh when they send energy to the grid.

Increasing Access to Renewable Energy

As is true for many cities around the world, summers are getting hotter in Melbourne, Australia. Homes and businesses rely on air conditioning to get through the days of extreme heat. Air conditioning requires a lot of energy. But right now, Melbourne's energy infrastructure is fragmented, and many parts of the city do not have good, reliable access to renewable energy.

To solve this problem the City of Melbourne has partnered with universities to develop Power Melbourne, a project to construct a network of coordinated mid-scale batteries across the city. Each battery will range in capacity, but they will be modular; small batteries can stack together to create bigger batteries. The batteries will be charged via rooftop solar or through the grid itself when it has energy to spare. Then the batteries can store and release energy when it is needed, and thousands of air conditioners can run at once to keep everyone safe and cool.

Alice the Electric Airplane

Engineers around the world are working hard to develop airplanes with electric propulsion motors that will make flying carbon-free. Alice, created by a startup in Seattle called Eviation, is at the forefront of this new technology. Carrying as many as nine passengers 500 miles on one charge, Alice has a sleek and futuristic design with a pointed nose, tapered body, and T-shaped fin at the back. Its twin propellers have piston-free motors that make it very quiet. Its lithium-ion battery packs are located on either side of the fuselage (the main body of the plane) so that they contribute to the integrity of the aircraft, which saves weight—even though these battery packs weigh 8,000 pounds!

Charging six times faster than the fastest Tesla; it needs only half an hour of charge time to fly an hour. It requires little maintenance beyond replacing the battery at regular intervals, reducing the costs of maintaining a conventional plane. Alice is expected to be ready to fly passengers by 2024.

City Essay: Suggested Outline

This is a suggested outline to follow. Use this outline and the city essay rubric to make sure you address everything the judges will be evaluating.

Part 1: The Introduction

Briefly introduce your future city by sharing basic information about it.

- Include your city's name, how old it is, where it is (and any relevant natural features, like mountains or rivers), and how many people live there.

Part 2: A Closer Look

Paint a picture of life in your future city, as if you are describing it to someone who has never been there. Share details about:

- Who lives in your city? What makes your city appealing to different types of people?
- What is daily life like for your residents?
  - What do they do for fun?
  - Where do they live? Work? Go to school?
- What is the climate like in your city?
- What services does your city provide (such as education, hospitals, fire stations, public transportation)?
- What are some innovative or futuristic elements of your city's infrastructure (such as housing, transportation, energy, agriculture, etc.)?

Part 3: Define the Problem

Briefly describe the impact producing power had on your city—the residents, environment, and economy—before your city went 100% electric.

Part 4: Describe Your Solution

Here is where you get to describe your city's futuristic and innovative electric solution.

- Describe your future city's main source of power for generating electricity and include any secondary energy sources. Include the following:
  - What are the benefits and drawbacks?
  - Is it renewable, green, clean, or some combination?
  - What's the environmental impact of the primary energy source?
- Explain how your electric solution provides 100% of your city's energy needs.
- Share two futuristic and innovative examples of how the electric system works in your city. For each example, include the following:
  - What issue(s) does your example address?
  - What design and planning decisions made the solution possible?
  - How does it work? What makes it innovative and/or futuristic?
  - What are the risks, trade-offs, and compromises involved in implementing your solution?
  - What impact—both positive and negative—does your solution produce?
- Explain what types of engineering are involved in making your city a model for running on electricity generated entirely by green, clean, or renewable sources of energy.

Part 5: Conclusion

Share why people want to live in your city and what makes it a great place to live. Summarize how a 100% electric city keeps the people of your city healthy and safe.

City Essay Rubric

0	1	2	3	4
Poor Majority of requirements are missing.	**Fair** Fair quality. Fulfills less than 50% of requirements.	**Satisfactory** Average quality. Fulfills at least 75% of requirements.	**Good** Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills all requirements with additional distinctive features.

I. Introduce City and Define the Problem (24 Points)	0	1	2	3	4
1. City basics • Location • Natural features • Population	No description of city.	Underdeveloped description of city.	Description of city is clear but general and lacks required details.	Clearly developed description of city.	Description is clear and thorough and supported with detailed information.
2. City life • Description of resident population • Daily life: recreation, jobs	No description of residents or daily life.	Underdeveloped description of residents or daily life.	General description of residents and daily life but needs additional details.	Clearly developed description of city residents and daily life.	Description of both residents and daily life are clear and thorough and supported with detailed information.
3. Infrastructure • Could include housing, transportation, utlitites, agriculture, etc. • Incorporates advanced technology	No description of city infrastructure.	Underdeveloped description of infrastructure. Technology is not advanced.	Clear description of one type of infrastructure. Technology is somewhat advanced.	Clear description of one or more types of infrastructure. Technology is advanced.	Clear and thorough description of two or more types of city infrastructure. Technology is very advanced.
4. City services • Could include education, healthcare, fire, public transport, etc.	No description of city services.	Underdeveloped description of services.	Clear description of one city service.	Clear and thorough description of one or more city services.	Clear and thorough description of two or more services.
5. City innovation and futuristic elements	No description of innovations and futuristic elements.	Underdeveloped description. Seems like a random collection of information.	Describes innovations and futuristic elements but lacks details.	Clearly developed description of innovations and futuristic elements.	Description is clear and thorough and supported with details.
6. Describe the impact producing power had on the city and residents before it went electric.	No description.	Underdeveloped description with limited details.	General description with sufficient details.	Clear description with a good level of detail.	Clear and thorough description with extensive details.

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City Essay Rubric

0	1	2	3	4
Poor Majority of requirements are missing.	**Fair** Fair quality. Fulfills less than 50% of requirements.	**Satisfactory** Average quality. Fulfills at least 75% of requirements.	**Good** Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills all requirements with additional distinctive features.

II. Electric Solution (20 points)	0	1	2	3	4
7. Identifies power source(s) for generating electricity. • Includes environmental impact • Discusses trade-offs or risks	No description.	Underdeveloped description of power source. No discussion of environmental impact or trade-offs.	General description of power source. Limited discussion of environmental impact or trade-offs.	Clear description of power source. Good discussion of environmental impact or trade-offs.	Clear and thorough description of power source. Extensive discussion of environmental impact or trade-offs.
8. Innovative & Futuristic Example One: • Includes issue(s) it addresses • Design and planning decisions • How it works • Innovative and/or futuristic	No description.	Underdeveloped description. Not futuristic or innovative.	General description with sufficient details. Somewhat futuristic and innovative.	Clear description with a good level of detail. Futuristic and innovative.	Clear and thorough description with extensive details. Very futuristic and innovative.
9. Innovative & Futuristic Example Two: • Includes issue(s) it addresses • Design and planning decisions • How it works • Innovative and/or futuristic	No description.	Underdeveloped description.	General description with sufficient details.	Clear description with a good level of detail.	Clear and thorough description with extensive details.
10. Risks, trade-offs, & compromises of electric solution. • Benefits, risks • Trade-offs & compromises • Assessment & analysis of risks and trade-offs	No discussion.	Underdeveloped description of at least one benefit, risk, or trade-off. Lacks assessment and analysis.	General description of two benefits, risks, or trade-offs. Assessment and analysis could be improved.	Clear description of two or more benefits, risks, or trade-offs. Good assessment and analysis.	Clear and thorough description of two or more benefits, risks, or trade-offs. Excellent assessment and analysis.
11. Engineering disciplines involved and roles of engineers	No description.	Underdeveloped description of one discipline or role.	General description of more than one discipline and/or role.	Clear description of at least two disciplines and roles.	Clear and thorough description of more than two disciplines and roles.

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City Essay Rubric

0	1	2	3	4
Poor Majority of requirements are missing.	**Fair** Fair quality. Fulfills less than 50% of requirements.	**Satisfactory** Average quality. Fulfills at least 75% of requirements.	**Good** Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills all requirements with additional distinctive features.

III. Writing Skills (6 Points)	0	1	2	3	4
12. Organization & Writing	No clear structure. Simplistic skills and style.	Organization mostly makes sense but could be better. Good skills and style.	Essay has a logical order and details are presented effectively. Excellent skills and style.		
13. Grammar & Spelling	Many spelling and grammatical errors.	Some spelling and grammatical errors.	Minimal grammatical and spelling errors if any.		
14. Graphics, References, & Word Count • If used, maximum of 4 graphics/ illustrations (count does not include tables) • At least three acceptable references (Wikipedia is not an acceptable reference) • All words except the title and reference list are included in the 1,500-word count. Word count includes captions and words in graphics, illustrations, and tables	No references: or word count is missing or inaccurate; or exceeds maximum of 4 graphics or illustrations.	Fewer than three acceptable references and/or inaccurate word count.	At least three acceptable references. Accurate word count that is within limit. Does not exceed maximum of 4 graphics or illustrations.		

DELIVERABLE #2:

City Model

Students build a physical representation of their city using recycled materials. In addition to showcasing their city of the future, the City Model must also show the team's solution to this year's challenge. The model must have at least one moving part, be built to scale, and may not exceed the $100 expense budget.

Explain to your team that engineers, architects, scientists, and city planners all use models and visuals like posters to communicate their ideas, share their research, and predict the success of their design. Emphasize that the ideas represented in the City Model should align with their City Essay.

Your team has two model options:

- **Option 1:** Your team can choose to build one single model.
- **Option 2:** Your team can choose to build multiple model segments. These model segments are separate pieces that represent various sections of the city.

City Model Requirements

- **Model Size:**
  - The city model and/or the model segments in its basic state must be no larger than 25" (W) x 50" (L) x 20" (H).
  - If a team makes multiple model segments, they must adhere to the overall size restrictions when placed together on a tabletop. Model segments must be able to fit on the table top together, but the individual pieces are not required to fit together like a puzzle.
  - Extended parts, such as access doors, compartments, and pullouts, are allowed as long as they are fully self-supported by the model, or—if removable—held by a presenter.
  - Multiple model segments must adhere to the size restrictions when placed together.
- **Scale:**
  Each team may use up to four different scales in the city model or segments.
  - Each scale that is used should be clearly defined, easily determined by sight, and indicated on their index card.
- **Moving Part:**
  - Each model must include at least one moving part. Each model segment does not need its own moving part, but at least one is required per team.

- **Budget:**
  - The combined value of materials used in the City Model, City Presentation and Q&A, and special award presentations may not exceed $100.
  - Expenses must be reported using the Competition Expense Form.
  - The cost of the flat empty base (e.g., the cost of plywood or similar material) is exempt. It does not need to be included in your team's expense form.
- **City Model Identification Card:**
  - This 4" x 6" card is used by the judges to identify your team's information and includes:
    - City name (this is the same as the team's name)
    - School/organization name
    - Names of the three presenting students, educator, and mentor
    - Model scale(s) used (no more than 4 per model)
- **General:**
  - Use of live animals, perishable items, or hazardous items (e.g., dry ice, fire, flying objects) is not allowed in the model or presentation.
  - While a small number of individual pieces from previous competition models may be reused, models must be a new representation of a future city and built from the bare baseboards up.
  - Any electrical power must be self-contained (for example, a household battery). Use of floor or wall outlets is not allowed.

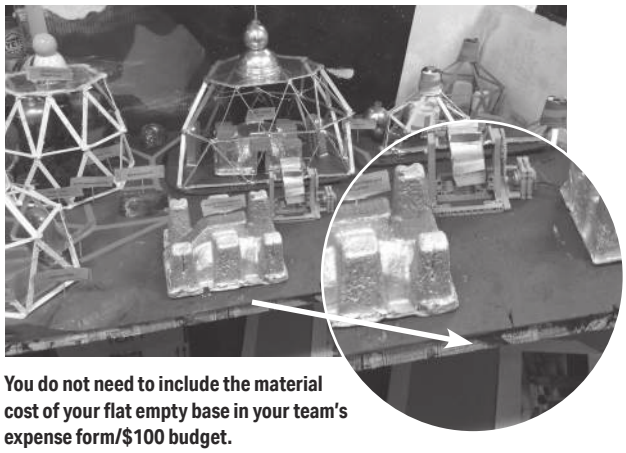
Competition Scoring

Models are judged at the regional competition. Check your Educator Dashboard for the date. Make sure students have thoroughly covered these categories in the rubric to maximize points:

City Design	30 points
Build It: Quality, Scale, & Materials	20 points
Judge Assessment of Model	15 points
Total	**65 points**

City Model Resources

- **Future City Design: Questions to Consider student handout:** This handout helps students focus as they design their cities.
- **Build Your City Model student handout:** Practical tips for building city models.
- **Model Building Activities:**
  - What Is a Model?
  - Plan-Relief and Architectural Models
  - Building Strong
- **Build Scale Model Activities:**
  - Introduction to Scale
  - Plan and Elevation View
  - Proportions, Ratios, and Scale Drawings
  - Scale Map
- **City Model Rubric:** Remind students to check their model against the criteria that the judges will use to evaluate their work.
- **City Model Examples:** Seeing previous examples can give students a lot of ideas. Check them out at futurecity.org/gallery/.



You do not need to include the material cost of your flat empty base in your team's expense form/$100 budget.

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

Collect or Find Recycled Materials

Remind students that they have a maximum budget of $100 and need to think creatively about their building and presentation materials.

- Yard sales or your own family's garage/basement are excellent sources for things like bottles, tins, or buttons.
- Old toys, such as Lego pieces, gears, Tinkertoys, and blocks are great materials.
- Keep an eye out for discarded pieces of pipe, wire, and plastic.
- Old parts from stoves, cabinets, and plumbing fixtures may be sources for moving parts or may provide unusual shapes for buildings.
- Obsolete or outdated electronic equipment may be reused and can provide visual interest in your city.

Note: All of these items have value and need to be listed on the Competition Expense Form.

Facebook Market place or EBay is an easy place to start.

HELPFUL HINTS:

- Although not required, the team may want to include labels within their city as they build the model. Such labels can help judges clearly identify buildings, transportation systems, and other features in your model.

Build Your City Model

Questions to Consider

- Will your team create a single model or multiple segments?
- How will you divide up responsibilities?
- What recycled materials could you use? How could you use them in creative ways?
- What scale works best for your model? (Remember: a team may use up to four different scales in their model, but no more than that. Be sure you are consistent with the scale(s) you choose.)
- How are your different city zones visually distinctive?
- Think about your city's infrastructure. Where are the energy production facilities? What does your city's transportation system look like? How does your electric powered city influence your infrastructure choices?
- What are some of the services in your city? How will you represent them in the model?
- How will you represent your city's electric powered design into your model? How will you showcase your city's power source?
- What will the moving part do? How is it related to an aspect of your city's design or function?
- How will the moving part be powered?
- What makes your city innovative and futuristic? How can you show your futuristic ideas are based on real science and engineering?
- How can the engineering design process help you build your model?

Get Inspired!
Check out videos of great models from previous years on the Future City YouTube channel: www.youtube.com/user/EWEEKFUTURECITY

Scale Measurement

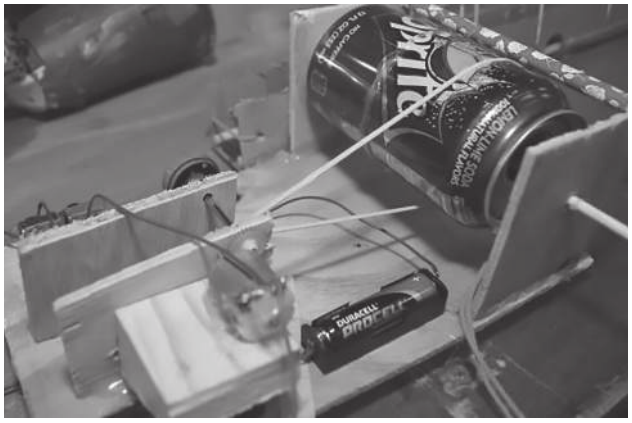
Consider a scale that works for both large items, such as buildings, as well as smaller items, such as windows and traffic signs. These measurements below can be used as a general guide for scaling basic city features. Research dimensions for other features that you plan to include in the model.

12 feet	Width of traffic lane
8 feet	Height of stop sign
10 feet	Height of a building story
4 feet	Minimum width of residential sidewalk

As you figure out your model's scale (or multiple scales), one consideration is materials. If one model segment builder has large materials to work with, they might choose a scale that shows off a larger physical area of the city. If another builder has smaller materials, they might choose a different scale to show more detail.

Model Enhancement Ideas

- **Trees:** These can be made from twigs and sticks with cotton balls (can be painted green), lichen from a hobby store, dried flowers or weeds, or sponges with food coloring.
- **People:** These can be made from sticks, toothpicks, mat board, pins, dowels, pipe cleaners, and so on.
- **Cars:** These can be made from layers of mat board or cardboard glued together, toy cars that are the right scale, Styrofoam, and so on.
- **Glass:** You can use clear plastic dividers, sleeves, or sheets. Remember to put this on last so that it doesn't get scratched.
- **Bricks/Pavers:** You can use colored paper or other colored material that matches what you want it to look like and then draw on the pattern or you can take white paper or material and color it with markers, crayons, or similar, remembering to show the pattern.
- **Asphalt:** You can take black paper or color white paper black, then draw on the lane markers with a white and/or yellow colored pencil or crayon, and then cut to size.
- **Cement:** You can use gray paper or color white paper and then cut to size.
- **Grade changes (like hills or craters):** You can use Styrofoam that is cut/shaped to what you want and use layers of cardboard or mat board to form contours or slope the model.
- **Water:** You can use blue colored paper or color white paper blue. For added effect, you can put clear plastic or plastic wrap (the kind you use for foods) over it.
- **Building material look:** To make something look realistic, you can draw on joint lines.
- **Sand/beach:** You can use sandpaper (very fine grit).



Moving Part Mechanisms

Your moving part must be able to have the motion repeated and must be related to a function of the city or this year's challenge. Ideas for moving part mechanisms include:

- Rubber bands
- Heat
- Light/Solar
- Weights
- Springs
- Pulleys
- Batteries
- Simple circuitry

Designing your own moving part, or creatively modifying an existing item, will earn more points than using a prefabricated or purchased item. The moving part is an excellent opportunity to explore the physics of simple sources of power, such as rubber bands, weights, heat, springs, pulleys, simple circuitry, light, and/or solar power.

City Model Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

I. City Design (30 Points)	0	1	2	3	4	5
1. City zoning • Includes the three primary zones: residential, commercial, and industrial	No evidence of zoning. No variety of structures.	Zoning unclear. Little variety of structures. Only one type of zone presented.	Somewhat clear zones. Small variety of structures. Only two types of zones presented.	Fairly clear zones, some variety of structures. At least three zones.	Clear zones and some variety of structures. Could be more comprehensive. At least three zones.	Clear and thorough zones. Excellent variety of recognizable structures. At least three zones.
2. City infrastructure • Could include housing, utilities, water, etc. • Connection to electrification solution.	No infra-structure examples.	Poor examples. Unrelated to electrification solution.	Some examples. Limited connections to electrification solution.	Fairly clear examples. Some connection to electrification solution.	Multiple examples. Direct connection to electrification solution.	Multiple, clear and thorough examples. Direct and relevant connection to electrification solution.
3. City services • Could include healthcare, education, etc. • Essential to city operations	No city service examples.	Poor examples of services. Unrelated to city operations.	Some examples of services. Barely related to city operations.	Fairly clear examples of services. Slightly related to city operations.	Clear examples of services. Moderately related to city operations.	Clear and thorough examples of services. Essential to city operations.
4. Transportation system • Variety of transportation modes • Transportation system(s) addresses the needs of the city and its residents	No trans-portation system.	Poor description of one mode of transportation. Does not address the transportation needs of the city.	Fair description of one or two modes. Overall system does not meet the needs of city.	Good description of one or two modes of transportation. Overall system meets most needs of the city.	Very good description of at least two modes of transportation. System addresses needs of city and its residents but could be more thorough.	Excellent description of two or more modes of transportation. System fully and thoroughly addresses needs of city and its residents.
5. Model Demonstrates Theme: Electrify Your Future: • Electrification solution showcased in model	No ex-amples of electrifica-tion solu-tion.	Few examples of electrification solution.	Some examples of electrification solution.	Multiple examples of electrification solution.	Multiple and clear examples of electrification solution.	Multiple excellent examples of electrification solution.

6. City Design
• Well planned. Considers:
  • Neighborhoods, green spaces, mixed zones
  • Interconnectivity
  • Sustainable
  • Accessibility
	No planning.	Little planning. Very little demonstration of livability concepts.	Some planning is demon-strated.	Planned design. Fair representa-tion of livability concepts.	Well-planned design. Good representation of livability concepts.	Clear and thor-ough planning and design. Excel-lent representa-tion of livability concepts.

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DOWNLOAD THIS RUBRIC AT DASHBOARD.FUTURECITY.ORG

City Model Rubric

0
No Points
Requirements missing.

1
Poor
Poor–fair quality. Fulfills at least 20% of requirements.

2
Fair
Fair–average quality. Fulfills at least 50% of requirements.

3
Good
Average quality. Fulfills at least 85% of requirements.

4
Very Good
Above average quality. Fulfills 95% of requirements.

5
Excellent
Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

II. Build It: Quality, Scale, & Materials (20 Points)	0	1	2	3	4	5
7. Innovative Construction • Variety of materials • Imaginative, unusual, or noteworthy materials • Creative modifications of recycled materials	No creativity or innovation. No recycled/ repurposed materials.	Very little creativity and modification of materials. Very little variety of materials. Many materials are purchased.	Fairly creative modifications. Some variety of materials, but could be improved. Few recycled/ repurposed materials.	Good creativity shown via modified materials. Good variety of materials. Features recycled/ repurposed materials.	Very good creativity. Very good variety of materials that are creatively modified. Many materials are recycled/ repurposed.	Excellent creativity. Wide variety of materials that are creatively modified. Few purchased items. Most materials are recycled/ repurposed.
8. Appearance • Use of color, graphics, shapes, etc. • Realistic elements (flora, fauna, landscapes) • Age appropriate for 6th, 7th, 8th grades	No aesthetics.	Poor aesthetics.	Fair aesthetics. Age appropriate.	Good aesthetics. Age appropriate.	Very good aesthetics that enhance overall city feel. Age appropriate.	Excellent and realistic aesthetics that enhance the overall city feel. Age appropriate.
9. Model scale • Accurate demonstration of scale • Up to 4 different scales may be used, but all should be clearly identifiable and consistantly applied	Scale not provided. Or more than 4 different scales are used.	Scale(s) are not accurate or consistent.	Scale(s) somewhat consistent and accurate. Multiple mistakes.	Scale(s) mostly consistent. Mistakes are minimul.	Scale(s) consistent and chosen to demonstrate the scope and context of the city clearly.	Scale(s) are extremely consistent and chosen to demonstrate the scope and context of the city clearly and thoroughly.
10. Moving part • Related to design or function of city. • Quality workmanship, durability • Description of part • Successful demonstration of movement	No moving part	Moving part cosmetic; not related to city function. No description of how the team built the moving part.	Moving part not relevant to city function. Unclear or confusing description of how the part was built.	Moving part somewhat related to city function. Good description of how the team built the moving part.	Moving part is related to city function. Very good description of how the team built the moving part.	Moving part is essential to city function. Excellent description of how the team built the moving part.

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City Model Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

III. Judge Assessment of Model (15 Points)	0	1	2	3	4	5
11. Application of Futuristic, Advanced Technologies • Includes futuristic technologies • Important to function of the city	No futuristic examples.	Poor futuristic examples. Not important to the function of the city.	Fair futuristic examples. Somewhat related to function of the city.	Good futuristic examples. Related to function of the city.	Very good futuristic examples. Important to the function of the city.	Excellent futuristic examples. Very important to the function of the city.
12. Overall innovation • City design • Addresses electrification solution.	No innovation.	Innovation is poorly presented overall in model.	Innovation is presented fairly well overall in model.	Innovation is presented well overall in model.	Innovation is presented very well overall in model.	Innovation is presented excellently throughout model.
13. Model Effectiveness • Serves as a stand alone representation of city • Function and purpose of model elements is evident and work well together	Not effective	Poor representation. For many elements one asks "what is this and why is it here?"	Fair representation. Function and purpose of many elements is not evident.	Good representation. Function and purpose of a few elements is not evident.	Very good representation. Function and purpose of most elements is evident.	Excellent representation. Function and purpose of all elements is evident.

DELIVERABLE #3:

City Presentation and Q&A

Students have up to 7 minutes to present their future city and solution to this year's challenge followed by an 8-minute question and answer period with the judges.

Engineers communicate with a variety of professionals every day. Being able to talk about their ideas clearly and succinctly is an important skill that engineers and technical professionals use throughout their careers. For this deliverable, students develop these communication skills by creating and delivering a presentation that brings their future city to life and showcases their innovative solutions to this year's challenge.

City Presentation and Q&A Requirements

- **Time allowed:** The presentation can be up to 7 minutes. Teams will have 8 minutes to answer questions from a panel of judges.
- **Presenters:** The three student representatives must be the same for both the presentation and Q&A.
- **Teamwork:** The three student representatives should share time equally and display a similar amount of knowledge and understanding of topics.
- **Visual aids and props:** The model or model segments should be the primary visual aid. Other visual aids might include pointers, posters, flip charts, handouts, or costumes. With the exception of a handout and costumes, any visible item that is not part of the City Model will be deemed a visual aid and subject to the following size limitations:
  - Display boards—Cannot be larger than standard size (24" x 36" for poster boards, 25" x 30" for flip charts, 36" x 48" for tri-fold boards); up to two poster boards or flip charts may be displayed concurrently, or one tri-fold at one time. Note: signs created with a matte finish look better in photographs.
  - Flip charts—If you are using prepared flip charts, make sure your writing does not show through to the next page. Make your lettering BIG AND DARK. (Use blue, black, brown, purple, or dark green markers.)
  - Costumes—Includes anything the presenters wear or carry that enhances their role.
  - One handout and small mock-ups —All items in this category must collectively fit with a 6"x 6"x 12" volume (think shoe box).
- **Audiovisual equipment:** is not allowed.
- **Budget:** The total value of ALL of the materials you use to build your model, make visual aids, and create costumes is included in your $100 budget.

Competition Scoring

City presentations are judged at the regional competition. Check your Educator Dashboard for the date. Make sure students have thoroughly covered all categories in the rubric to maximize points:

Content & Delivery	48 points
Engineering and Technology	24 points
Total	**72 points**

City Presentation and Q&A Resources

- **Past Presentations:** Videos from past Champions and Runners-up can be found online at www.youtube.com/user/EWEEKFUTURECITY. Past presentations can provide ideas and inspiration.
- **City Presentation and Q&A Tips student handout:** Get tips and strategies for creating a great presentation.
- **City Presentation and Q&A Practice Questions student handout:** Students can get a sense of the kinds of questions the judges may ask by practicing with these questions.
- **Future City Design:** Questions to Consider student handout: Students should also feel confident answering questions like these.

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

City Presentation and Q&A Tips

Prepare the Presentation:

- Create an outline of the main points your team wants to make. Your City Essay outline is a good starting point.
- Review the City Presentation and Q&A rubric as you design your presentation.
- Write a script based on your outline. The script is what each member of the team will say during the presentation. It needs to sound natural and not as if you're reading your essay out loud.
- Decide which team member will say which part of the script. Write each person's lines on note cards and practice, practice, practice! Get really comfortable with your part so that you don't spend the whole presentation staring at your note cards! They're just there if you forget something.
- Take advantage of moments to be especially creative. In the beginning, you want to grab the attention of your audience. Then enthusiastically share details about your future city and its innovative and futuristic features. At the end, you want to make the audience wish they could live in your city!
- Use your City Model. Point out innovative features and interesting landmarks in your city. You can also use other visual aids during your presentation, such as posters and props. Review the rules of what's allowed and any size restrictions.
  - The three presenters should share equal time during the presentation, demonstrate similar levels of knowledge, and showcase how your team works together.
- Dress appropriately for your presentation. You can wear costumes that work with the role that you're playing.

Practice the Presentation:

- Rehearse the presentation until the three presenters feel confident.
- Practice giving your presentation.
- Have friends or family members record your practice and then review it with your team and make adjustments as needed. Reviewers can use the rubric to help give good feedback.
- After each practice presentation, discuss the following:
  - What parts of the presentation were clear and informative?
  - Were there any points they didn't understand?
  - What was one thing they liked about how their peers presented?
  - Did the presenters look at the judges? How were their gestures, tone of voice, and pace of the delivery?
  - How did the presenters use the model and other visual aids?
- Remember to have fun!

City Presentation and Q&A Practice Questions

During the Q&A, judge panels will ask questions similar to the ones below. Use these example questions with your team to prepare.

City Design, Systems, & Operations

- What industries drive the economy in your city? What types of jobs are available?
- How does your city support low-income or vulnerable residents?
- What factors did you consider while laying out the zones in your city? Are the zones separate or mixed-use?
- Describe your city's transportation system. Is it public (like today's trains and buses) or private (like an individual car) or a combination?
- How do residents in your city communicate with each other?
- What does your city offer for entertainment and culture—arts, music, theater, dance, cinema, sports?
- How does your future city attract and support a diverse population of residents? And how does your city's design ensure equal access and opportunity for people with disabilities?

Engineering & Technology

- What types of engineers were involved in designing your future city?
- How did you design and build the moving part for your model?
- How did the engineering design process help you create and develop your future city?
- What is an example of innovative technology in your team's city design?
- What resources did your team use to learn about engineering? Share something your team learned and how you applied it to your project.

Teamwork & Project Management

- Did your team have any disagreements about your project? How did you solve them?
- What was a challenge you encountered while building the model or creating the city presentation? How did your team overcome this challenge?
- How did your team decide how to divide responsibilities?
- What processes did your team use to stay on schedule?
- Did any of your team's initial goals evolve as you worked on your project?

Theme Practice Questions

- What energy source(s) did you choose to power your city? Share how these sources have affected your city and its residents.
- What trade-offs did your city and/ or it's residents have to make due energy sources chosen?
- What innovative and futuristic technologies is your city using for power production and storage and how has this reduced your city's impact on the environment?
- What is the most futuristic part of your city?
- What is the most futuristic part of your city due to the electrical power sources chosen and why?
- Is it a good idea to have a city use 100% electricity? Why or why not?

City Presentation and Q&A Rubric

0 or 1
Poor
Majority of requirements are missing.

2 or 3
Fair
Fair quality. Fulfills less than 50% of requirements.

4 or 5
Good
Above average quality. Fulfills at least 85% of requirements.

6
Excellent
Excellent quality. Fulfills all requirements with additional distinctive features.

Content & Delivery (48 Points)	0 or 1	2 or 3	4 or 5	6
1. Overall Presentation Content • Major elements: intro, body, and conclusion • Logical flow and transitions • Supporting details	Poorly organized and missing major elements. Few or no supporting details.	Fair organization. Contains most to all major elements. Some details and transitions, but ideas could be more developed.	Well organized and contains all major elements. Very good supporting details.	Extremely well organized. Effective variety of supporting details. Overall presentation is thoroughly developed.
2. Overall Presentation Delivery • Clear and audible • Confident and creative • Balance of people and visual aids	Unclear and inaudible. Delivered with no confidence or creativity. Needs more practice.	Somewhat creative and confident. Fair balance of student presenters and visual aids.	Good creative and confident delivery by most of team. Good balance of student presenters and visual aids.	Extremely creative and confident delivery by the entire team. Excellent balance of student presenters and visual aids.
3. City Overview & Daily Life • Location • Describes residents and daily life • Answers what makes the city special and why people want to live there?	No description or underdeveloped overview, does not provide basic information.	Fair overview. Needs more details.	Good overview. Supported by many details.	Excellent overview supported by a variety of thorough details.
4. Infrastructure & Services • Futuristic city features and infrastructure • Innovative city services (could include education, healthcare, fire, etc.)	No description or underdeveloped overview, does not provide basic information.	Fair description. Some details about infrastructure and services. Somewhat futuristic or innovative.	Good description. Many details about infrastructure and services. Futuristic and innovative.	Excellent overview supported by a variety of thorough details. Highly detailed and thorough description of infrastructure and services. Very futuristic and innovative.
5. Annual Challenge: Electrify Your Future • Electrification solutions featured in presentation • Demonstrates understanding of the challenge and it's influence on city development	Few or no electrification solutions are presented. Understanding of concepts seems to be very limited or lacking.	Electrification solutions are presented. Answers questions adequately, but details could be better. Fair understanding of concepts.	Electrification solutions are presented. Answers questions clearly and thoroughly. Good understanding of concepts.	Electrification solutions are presented. Elaborates with related details. Excellent understanding of concepts.
6. Use of Model and Demonstration Aids • Model is a key element • Additional visual aids (if used) are well-prepared, legible, and relevant • Enhance rather than distract from presentation	Model not referenced or used ineffectively. Other visual aids are poor quality or nonexistent.	Model is partially effective at enhancing the presentation. Other visual aids are fair to good.	Good use of the model as an illustration of city design and function. Other visual aids are effective and are good addition to presentation.	Extremely creative, integrated use of model contributed to the understanding of city design and function and innovations. Other visual aids are excellent.

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City Presentation and Q&A Rubric

0 or 1	2 or 3	4 or 5	6
Poor Majority of requirements are missing.	**Fair** Fair quality. Fulfills less than 50% of requirements.	**Good** Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills all requirements with additional distinctive features.

Content & Delivery (48 Points) (Continued)	**0 or 1**	**2 or 3**	**4 or 5**	**6**
7. Teamwork • Team members: • Supported each other • Shared time equally • Displayed equal amounts of knowledge	No teamwork or small amount of collaboration among team members but more support of one another is needed.	Some collaboration, support and sharing among some team members. Amount of knowledge appears unequal. One or two tend to dominate.	Good collaboration, support, and sharing among the team. Equivalent knowledge level for most of team.	Excellent collaboration, support, and sharing among team members. All members display thorough knowledge.
8. Questions and Answers • Accurate, complete answers • Team is well prepared and answers are thorough	Able to answer few or no questions accurately. No supporting facts.	Students answer many questions accurately; provide some supporting facts.	Students answers most questions accurately with supporting facts.	Students answer all questions accurately with many supporting facts.
Engineering & Technology (24 points)	**0 or 1**	**2 or 3**	**4 or 5**	**6**
9. Engineering & Technology • Demonstrates understanding of engineering and technology • Technologies are futuristic and scientifically possible	Shows little to no understanding of technology. Few innovative features.	Fair understanding of technology used in city. Limited innovative features. May not be scientifically possible.	Clear understanding of technology used in city. Many innovative features. Scientifically possible.	Excellent understanding of engineering and technology. All technologies are futuristic and scientifically possible.
10. Engineering Design Process (EDP) & Project Management (PM) • Discusses the application of the EDP to their project • Demonstrates knowledge of PM concepts	Little or no discussion of EDP and/or project management.	Fair discussion of EDP and/or project management.	Good discussion and understanding of EDP and project management and the application to Future City project.	Excellent discussion and understanding of EDP and project management, and the application to Future City project.
11. Engineering and Roles • Demonstrates a knowledge of engineering roles in city design and operation	No mention or mentions engineering, but little discussion of roles.	Demonstrates some knowledge and understanding of engineering and roles.	Demonstrates good knowledge and understanding of engineering and roles.	Demonstrates excellent and thorough knowledge and understanding of engineering and roles.
12. Risks, Trade-offs, & Compromises • Discusses potential risks and benefits • Analyzes trade-offs	Little to no mention of risks or trade-offs.	Some discussion of risks, benefits, or trade-offs.	Good analysis of risks, benefits, and the trade-offs made.	Excellent and thorough analysis of risks, benefits, and trade-offs.

DELIVERABLE #4:

Project Plan

Students work with their team to complete a four-part project plan to help them stay organized, focused, and on schedule as they complete their other Future City project deliverables.

What Is a Project Plan?

A project plan is a tool engineers use to manage their work. It's where Future City participants record their project goals, plan how they'll complete the competition deliverables, and monitor their project's progress. A well-crafted project plan will help students stay on track as they use the engineering design process to research and create their cities. It's like a road map that students refer to as they move through the competition, but it is also changeable. Decisions made at the beginning of the project may turn out to need revising!

For this competition, students will use the four-part Project Plan template that aligns with the project management cycle stages: Define, Plan, Do, and Review. Within each section, students have the leeway to make the plan work for them. It should meet the needs of the project and the style and preferences of the team.

Project Plan Requirements

- Each part of the Project Plan (four in total) is submitted as a separate PDF by the team's educator via the Educator Dashboard.
- Two Due Dates:
  - Part 1: Goal Setting and Part 2: Create a Schedule will be due in mid-December.
  - Part 3: Check-ins and Part 4: Reflect will be due one week before your Regional Competition.

  Check your Educator Dashboard for the specific due date and submission instructions.

Project Plan Resources

- **Project Plan template:** The template includes instructions for what the Project Plan has to include as well as space for students to complete each of the four sections.
  - An editable Word and a Google Drive version of the Project Plan template are available at Dashboard.FutureCity.org.
  - Each section of your team's Project Plan is not limited to a single page. You can write as much as you like.

Competition Scoring

There is no rubric for the Project Plan. Teams who submit the four segments of their Project Plan, fully completed and on time, will receive 10 points. Teams who submit incomplete or late Project Plans may earn 5 points. Teams that do not submit a Project Plan will receive zero points.

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

PROJECT PLAN 1

SET GOALS

Deliverable: Project Plan

INSTRUCTIONS

As you start your project, it's important to think about what you hope to achieve, the resources available to your team, what things might limit your ability to get things done, and any assumptions you and your teammates might have. Use the information and questions below to complete your Set Goals project plan.

Project Resources

This is anything (people, information, or stuff) that you might need to complete your city, like:

- What equipment or supplies do you need?
- Where can you store your model while you are working on it?
- Are there people who you want to interview or ask for help?
- What skills (like good writers, presentation abilities, or research skills) do you want your team to have?

Project Constraints

This is anything that might limit your ability to get things done, such as:

- How does the $100 budget affect what you want to create?
- Do you have enough people on your team to get everything done?
- How do the competition rules impact what you want to do?

Assumptions

This is all of the things you think are true or think might be true. These are the tricky things that might cause problems later if you don't talk about them early and often:

- Which part of the project seems easy, hard, or okay?
- What other commitments do team members have?
- How much time can team members devote to Future City?

Project Goals

Goals explain what will be achieved by the end of Future City. They can help you answer the question, "How do I know when I'm done?" Goals aren't just about the finished products that your team physically makes; they can also be overall team goals, like:

- What do we want to learn?
- How do we want to work together?
- How can we balance having fun and getting our work done?

TIP: Goals can be wide-ranging, realistic, and attainable.

FUTURE CITY TEAM NAME:

ORGANIZATION/SCHOOL:

EDUCATOR:

TEAM GOALS

The first goal is listed for you. Write in at least two more goals.

1. Our team will create a future city with electricity generating power source.

2.

3.

4.

Brainstorm possible resources, constraints, and assumptions for your project.

1. Our project resources:

2. Constraints on our project:

3. Assumptions about our project (these are the things you think are true or think might be true):

PROJECT PLAN 2

SCHEDULE

Deliverable: Project Plan

INSTRUCTIONS

A schedule is a great way to keep your team on track. Before you can make the schedule, you need to identify what needs to be done, in what order, and who is going to do the work.

Step 1: Establish Milestones & Tasks

- Milestones are important points in the project's timeline that help you determine whether your project is on schedule. Milestones are written as statements of what has been or what needs to be accomplished. Examples of milestones are:
  - Complete the City Model's moving part.
  - Draft the City Essay.
- Tasks are the to-do-items you need to complete to accomplish each milestone. Examples include:
  - Research Cities using electric powered sources today.
  - Decide where our city is located.

TIP: Write the milestones and tasks for each deliverable on index cards or in a shared spreadsheet. This will allow you to move them around later. Consider using a different color for each deliverable. This way you can see the tasks for each and how they fit together.

Step 2: Put Tasks in Order

Now it's time to think about the order in which things should be done. Arrange the tasks for each deliverable in a logical order. Think about:

- Does one task need to be completed before another one can begin? Before you start building your model or model segments, your team should read the model rubric closely.

Step 3: Estimate the Time Each Task Will Take

Think about how much time tasks will take and record the time on your team schedule. Remember that as you work, you'll probably need to update these time estimates.

Step 4: Make Role Assignments

Next, think about the strengths and interests of each team member. Look at the different tasks that need to be done and decide who is the best person or group of people on your team to do work on them. Assign team members to each role. Record their names as the schedule begins to form. Be sure to talk about:

- How will you divide the work?
- Is work being distributed fairly among team members?

Step 5: Maintain the Schedule

On a bulletin board, whiteboard, shared online spreadsheet (or any other format you like), create a full schedule on which you can track the tasks. Things will likely change along the way—be sure to review and revise your schedule as needed.

Show Us Your Style!

An image of your schedule is a required part of your Project Plan deliverable. What does your schedule look like? Is it a large wall calendar, shared online calendar, or something else?

FUTURE CITY TEAM NAME: _____

ORGANIZATION/SCHOOL: _____

EDUCATOR: _____

Instructions: In the space below, insert a photo, drawing, screenshot, or other representation that captures how your team scheduled your project.

TEAM SCHEDULE

PROJECT PLAN 3

CHECK-IN

INSTRUCTIONS

Teammates should hold check-ins to monitor progress and ensure deadlines are being met. Most of these check-ins can be quick conversations. But at least one of them needs to be written down as part of your Project Plan deliverable. We suggest submitting a check-in that illustrates an important point in your project, such as when you solved a problem, made a critical revision, or reached a major milestone.

Use the template on the next page.

PROJECT PLAN 4

REFLECT

INSTRUCTIONS

This is the last piece of the project plan and is a place to reflect on what you learned. Each project teaches us a lot, and your thoughts now can make your next project go more smoothly. Working as a team, record your responses to the questions on the Reflect template.

And judges might ask questions just like these. Reviewing your project and answering these questions is a great way to prepare for your City Presentation and Q&A!

FUTURE CITY TEAM NAME: _____

ORGANIZATION/SCHOOL: _____

EDUCATOR: _____

TEAM CHECK-IN REPORT

Date: _____

Team Member(s): _____

How are things going?

What issues are affecting your team's ability to get things done?

What's going well?

What lessons from that experience can you apply to other areas of your project?

Check the schedule.

What adjustments do you need to make?

FUTURE CITY TEAM NAME:

ORGANIZATION/SCHOOL:

EDUCATOR:

TEAM REFLECTION

1. **Look back at your original project goals from the Define stage.** Did your team fully meet your stated goals for the project? Were there some goals that were met more completely than others?

2. **Look back at your original ideas for your city.** Did any of the ideas change as you went through the process of creating your final city? Describe one way your city changed and why.

3. **Consider your team.** How well did your Future City team work together? What do you know now about being part of a team that you didn't know before?

4. **What was the most valuable experience** you gained from the Future City Competition?

Final Checklists

These checklists are in order of when deliverables are typically due. Make sure you have the correct deadline from your educator or mentor for each deliverable.

City Essay Checklist

- ☐ Include the name of your city on each page of your City Essay. Remember that the name of your future city needs to remain the same throughout the competition.
- ☐ Check the word count: 1,500 words is the maximum number allowed. Word count does not include the title and reference list but does include captions and words that appear within a graphic, illustration, or table.
- ☐ Place the exact word count of your essay at the end of the essay (this does not count as part of the word count).
- ☐ Count the graphics. A maximum of four graphics/illustrations are allowed.
- ☐ Cite your sources. Use the Modern Language Association (MLA) format.
- ☐ Review your City Essay to ensure it is free of spelling and grammar errors.
- ☐ Upload your City Essay as a Word document to the Educator Dashboard at FutureCity.org.

City Model Checklist

- ☐ Double-check your City Model against the Competition Requirements.
- ☐ Complete a City Model ID card. Include:
  - City Name
  - School/Organization name
  - Scale(s) used for the model or model segments
- ☐ Verify how the model will be transported to the competition. Models may sustain damage in transit. Teams are encouraged to bring repair kits. The model needs to be sturdy enough for staff and volunteers to move it during the competition.

City Presentation and Q&A Checklist

- ☐ Time your presentation. Remember you have 7 minutes for the presentation and 8 minutes to answer questions from judges.
- ☐ Review the Practice Questions.
- ☐ Check the day, time, and location of your team's live session with the judges.

Project Plan Checklist

- ☐ Make sure each part of the Project Plan (four in total) is uploaded as a separate PDF via the Educator Dashboard at FutureCity.org.

Competition Forms Checklist

The following forms need to be submitted via your Educator Dashboard prior to the competition.

- ☐ **Competition Expense Form & Receipts**

  Fill out the Competition Expense Form with all of the materials used to build the model and the materials that appear in the presentation. Remember that you cannot exceed a combined total of $100.

- ☐ **Honor Statement**

  The Honor Statement must be electronically signed by each student team member and the team educator and mentor prior to the competition.

- ☐ **Media Waiver**

  The Media Waiver must be completed and electronically signed by the parent/guardian of every student team member prior to the competition.

Educator Dashboard

Visit Dashboard.FutureCity.org to organize your team's participation, including your region's competition dates, submission guidelines, and links to required forms (like the Honor Statement, Expense Form, and more).

Competition Expense Form Instructions

Provide a complete list of all items your team used in your Model, City Presentation and Q&A, and in any special award judging. Include actual costs if items were purchased or a reasonable cost estimate if items were donated or repurposed. All materials used in the model/model segments (even if they don't appear in the template) must be listed. One exception to this rule for 2023–2024 is that a team's flat, empty, model baseboard material does not need to be listed on the competition expense form or included in the $100 budget, due to the current high cost of lumber. Strive for accuracy and fairness when estimating costs. Misrepresenting the values of your materials will result in a 20-point penalty.

Commonly Asked Questions

1. Why is there a $100 limit?
This rule was established to ensure equity among teams and to encourage students to creatively use recycled materials.

2. When can we assign a zero value?
Items that are allowed in a home or school recycling bin (such as paper, plastic bottles, glass jar, or metal cans) or items bound for the trash (like used-up batteries, bottle caps, used plastic utensils, etc.) can be assigned a zero $ value.

Download the Competition Expense Form in the Resources section of the Educator Dashboard.

3. How do we figure out the fair market value?
Items that are donated or have been previously used but can't be recycled (such as mirrors, foam core, dowels, wood, magnets, holiday ornaments, old toys, lab coats, etc.) need to be assigned a fair market value. Fair market or salvaged value may be determined by pricing found at a yard sale, auction, classified ad, surplus store, e-recycling service, etc.

4. What about items we take apart?
Many teams take apart computers, electronics, or other items to "harvest" interesting parts. These items need to have a value assigned. Facebook Market place or EBay is an easy place to start.

Description of City Model Materials	Purchased	Donated	Recycled	Expense/Value
Assorted paint from parent's garage		•		$2.00
Two one-liter soda/pop bottles			•	$0.00
Egg carton			•	$0.00
Toy train		•		$0.50
Motherboard from scrapped computer			•	$2.50
Green LED lights	•			$4.50
			Subtotal A—City Model Expenses:	$9.50

Description of City Presentation and Q&A/Special Award Materials	Purchased	Donated	Recycled	Expense/Value
Foam poster board	•			$9.00
5 pages of color printing	•			$5.00
Top hat (costumes)		•		$3.00
Lab coat (borrowed from teacher)		•		$2.00
			Subtotal B—City Presentation and Q&A/Special Award Materials Expenses:	$19.00

Subtotal A $9.50 + Subtotal B $19.00 = Total Expenses $28.50

Official Competition Rules

General

1. The Future City Competition is open to eligible 6th, 7th, and 8th grade students who are enrolled in a public, private, parochial, or home school environment or are members of a nationally, regionally, or state-recognized organization, such as the Scouts, Boys and Girls Clubs, 4-H, etc. If you are unsure if your organization is eligible to participate, please contact FutureCity@DiscoverE.org. Future City has the sole and exclusive authority to determine whether an organization is eligible to participate and has the right to require additional documentation to verify eligibility.
2. Student team members must be from the same school or organization, unless otherwise approved by Future City staff. Students cannot be on multiple teams.
3. Organizations may register in only one region. If they wish to transfer to a different region, they must petition and obtain the approval of the Regional Coordinator and the Program Manager. Teams must commit to a specific region by October 31, 2023.
4. An official competition team is made up of the three official presenters (students), one registered educator and one register mentor. No educators or mentors, parents or additional team members may present or answer questions from the judges during the Presentation and Q&A deliverable.
5. Team mentors are defined as the person officially registered within DiscoverE's Future City Competition Management System (a.k.a. Future City Dashboard), have cleared our background check, and been assigned to a team by January 5, 2024. No exceptions.
6. The team members that compete in the Finals Competition must be the same team members that won the Regional Competition. You may select one student to act as the alternate for both Regionals and Finals. The alternate may only be utilized if one of the original three students cannot compete due to illness or family emergency. The alternate may only compete upon the approval of the Regional Coordinator (for the Regional Competition) and the Program Manager (for the Finals).
7. At least 20 schools/organizations must be registered in a region by October 31, 2023 in order for that region's winner to advance to the Finals Competition.
8. Home school educators must submit an affidavit to their Regional Coordinator stating that the students are covering the material in the 6th, 7th, or 8th grades. Regions reserves the right to require proof of home school students' registration for participation in program.
9. Deliverable deadlines vary by region and are listed in the Future City Dashboard. If deadlines are missed at the Regional or Finals level, points will be deducted.
10. At regional competitions, only one team from a school or organization can advance to the final round of judging. At competitions with a single judging round, only one team from a school or organization may be awarded a place in the top five overall teams.
11. All team members must sign and submit the Honor Statement online prior to the regional deadline.
12. Judges evaluate each deliverable in accordance with the rubrics. The score a judge assigns is final. Teams will not receive raw scoresheets or be able to review scores from individual judges.
13. Actions or comments by any team member or any team supporter that maligns, disparages, or harasses other team members, Regional Coordinators, Future City volunteers, or Future City staff will result in the team's disqualification from that year's competition and could result in the school/organization being ineligible to participate in the future.
14. If a dispute or disagreement occurs at the regional level, an official Future City Team Educator shall bring the matter to the attention of the Regional Coordinator. An official Team Educator is the only person who may submit a complaint to the Regional Coordinator. The Regional Coordinator will thereafter conduct an investigation and make a determination regarding the complaint. All decisions by the Regional Coordinator shall be final and cannot be appealed.
15. In the case of a tie at the Regional Competition, the team with the higher City Presentation and Q&A score will be awarded first place. If the tie still remains, the team with the higher model score will be awarded first place.
16. Educators can see their team's average scores by logging in to the Educator Dashboard at FutureCity.org after the Regional and Finals competitions. Educators may download their team's score information by following the instructions online. Scores will not be saved in the system indefinitely.
17. A person who volunteers in the capacity of a judge (at any level) during the competition cycle may not serve as a mentor or an educator during that same cycle. Nor may they provide guidance, coaching, tips, etc. to any active team member, teacher, engineer mentor, etc. during that same competition cycle. If violated, that judge's scores will be invalidated.
18. If a team is located outside the typical geographical parameters of a region, whether or not they are permitted to participate in said region is at the discretion of the Regional Coordinator.
19. The team's educator must be present any time team members meet virtually or in person with the team mentor.
20. Future City is an educational program established to encourage children to consider and explore careers in science, technology, engineering, and math. Future City participants and their supporters acknowledge that participation in Future City is not a right. By participating in the Future City Competition, team members and team supporters agree and are bound to behave with respect and dignity for their team and for their fellow participants.
21. Future City reserves the sole and exclusive right to amend these rules at any time.

City Essay

22. Students must include a reference page citing at least three sources of information with the essay. (Note: Wikipedia cannot be cited as a reference.)
23. The maximum word count is 1,500. Initial tabulation is done by the "word count" tool within the word processing software. The final word count does not include the title and reference list but does include captions and words that appear within a graphic, illustration, or table. A maximum of four graphics or illustrations are allowed.
24. The City Essay file must be uploaded as a word processing document, not a PDF.
25. If any part of a team's City Essay is determined to be plagiarized, the team will earn zero points.

City Model

26. Each model should feature a Model ID card, a 4" x 6" index card with city name, organization name, team members' names (three student presenters, educator, mentor), and the scale(s) used.
27. Rotating city models are acceptable. The model will be measured from the tabletop up, including dimensions of any turning device below the model itself.
28. Teams must design a new model or model segments. Teams may not use previous years' models. Previous models may be broken down and scavenged for materials, including the bare model platform. Any previously used materials must be reconfigured in a new and original manner and assigned a current market value. Teams do not need to include the cost of their flat empty base (e.g., the cost of plywood or similar material) in the expense form.
29. The city model in its basic state must not exceed 25" (W) x 50" (L) x 20" (H). During the Presentation and Q&A, it is permissible to have extended parts, such as access doors, compartments, and pullouts, as long as they are fully self-supported by the model, or—if removable—held by a presenter. If the team makes multiple model segments, they must adhere to the overall size restrictions noted above when placed together on a tabletop.
30. Prohibited model items: live animals, perishables/food, drones or other flying objects, hazardous items (including dry ice), and fire. If water is used in the model, it must be self-contained or drainable.
31. Each model must include a moving part. A team with multiple model segments is only required to create one moving part, not one for each segment.
32. Power sources must be self-contained, (e.g., a household battery/ simple circuit). Use of electrical wall or floor outlets is not allowed.
33. The total value of the materials used in the Model, Presentation, Q&A, and special awards (including visual aids, costumes, color copying/printing, 3D printing, and other demonstration aids) may not exceed $100.
34. All materials used must be listed on the Competition Expense Form and their value documented for the Model, Presentation and Q&A, and special awards. This includes donated and borrowed items at fair market value.
35. A team may use up to four distinct scales if they are clearly defined, easily determined by sight, and indicated on their index card.
36. Use of 3D printers for any model materials must be assessed using the following values, which account for the cost of filament and the hardware/printer:
    - White 3D printing: $2.00 per cubic inch
    - Color 3D printing: $5.00 per cubic inch
    - All 3D printed materials used—whether new or reused— must be reported on the competition expense form using these values.
37. Programmable circuit boards (ex: Raspberry Pi, Arduino) are permitted as long as the full cost is listed on the expense form. A minimum $35 value is required to be listed.

City Presentation and Q&A

38. At both Regional and Finals Competitions: Only the official three student presenters may participate in the Presentation and Q&A deliverable. The Presentation portion may not exceed 7 minutes. When the timer signals time, the team must stop immediate question and answer sessions immediately following the presentation will be 8 minutes.
39. Presenters may use their model/model segments, posters, graphics, costumes, and other visual aids.
40. Laptop computers, overhead projectors, DVD/video players, battery-operated audio equipment, any mobile devices, and drones may not be used in the presentation.
41. Visual aids, such as flip charts, foam boards, poster boards, etc. must not exceed these parameters: the display(s) cannot be larger than standard size (24" x 36" for poster boards, 25" x 30" for flip charts, 36" x 48" for tri-fold boards); up to two poster boards or flip charts may be displayed concurrently, or one tri-fold at one time.
42. With the exception of a handout/brochure (limited to one 8.5"x 11" sheet of paper) and costumes, any other demonstration aids including pointers, small mock-ups, musical instruments, etc. used to assist with the presentation must collectively fit in a 6" x 6" x 12" volume (e.g., a shoe box). Guns or replicas that could realistically be mistaken for a gun are not permitted. Nonrealistic items (such as a water gun that is clearly a toy) are permitted.

Scoring Deductions

By completing all five deliverables, teams can earn up to 197 points. Judges evaluate each deliverable in accordance with the rubrics. The score a judge assigns is final. At the Regional Competition, the Regional Coordinator has the final word on any dispute. At the Finals Competition, the judges' decisions are final. There is no appeals process at either level of competition.

	Penalty	Description
GENERAL	5–10	• Missed deadline for any deliverable (Deadlines are set by Regional Coordinator; check with them to see if late submissions are accepted.) • Missed deadline for Honor Statement or Competition Expense Form & receipts
	20	• Exceeds the $100 expense limit or misrepresents the values of materials used in the city model and presentation
	Earns 0 points	• Plagiarism

	Disqualification	• Missing Home School Affidavit (for home school groups only)
		• Destruction of another team's work or materials or actions
		• Unsportsmanlike conduct, including but not limited to:
		  • Rude behavior or disruption of judging by any team member or guests
		  • Comments from team members or team supporters that malign, disparage, or harass regional coordinators, staff, or volunteers

PROJECT PLAN	5–10	• Incomplete or late
CITY ESSAY	2–10	• Exceeds 1,500 word limit (includes all words besides title and reference list — including captions and words in graphics, illustrations, and tables)
CITY MODEL	2	• Missing team identification card
	5–15	• Reuses a past model without reconfiguring it in a new and original manner • Exceeds size restrictions of the model (combined model segments collectively) • Uses a prohibited item (see rule 29)
CITY PRESENTATION AND Q&A	5–10	• Presentation exceeds the time limit • Anyone on the team other than the three official team members answers judges' questions • Team does not follow instructions from the timekeeper and/or moderator

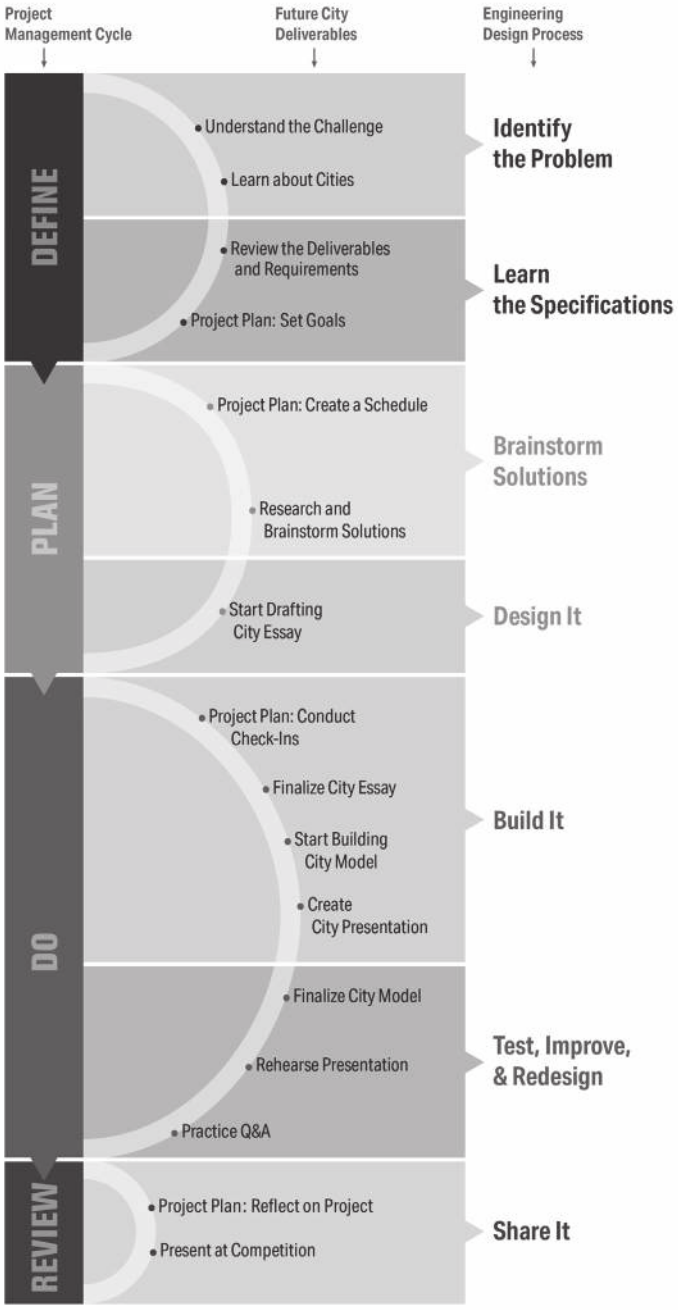
Leading Your Team

Leading Your Team

This section is designed as a step-by-step guide for leading your students through Future City—especially if you are new to the program. It is structured around the Engineering Design Process and the Project Management Cycle. Combining these two processes is a win-win: the engineering design process helps students design their future city and the competition deliverables, and the project management cycle provides the approach they need to successfully complete such a big undertaking.

You'll start by introducing your students to engineering, the engineering design process (EDP), and project management (PM). Then you'll create your cities following the steps of EDP and PM, just like engineers and technicians do in their work.

Each time you reach a new section of the EDP and PM, you'll see the "Create Your Future City" graphic indicating where you are in the process and a new headline.



Preparing Your Students

Students will get the most out of Future City if they first develop some familiarity with:

- Engineering and what engineers do
- The engineering design process
- Project management

Introduce Engineering

What do your students already know about engineers and the different kinds of engineering? Have a conversation to find out.

QUESTIONS TO DISCUSS:

- What do engineers do? Do you know any engineers?
- Can you name a few things that engineers have designed or built?

KEY POINTS TO SHARE:

- Engineers are changing the world all the time. They dream up creative, practical solutions and work with teams of smart, inspiring people to design and create things that matter.
- Engineers get to work in any field they want to. Love music? Engineers design new ways to record and listen to sounds. They also design technology so that deaf people can hear. Love cars? Engineers build better, more efficient engines that run on everything from corn husks to electricity. Engineers protect the planet by developing state-of-the-art recycling systems. They design high-tech running shoes and develop life-saving medical technology. Engineering offers limitless possibilities for your career and your future.

Learn from Real Engineers

Work with your team mentor to provide students with opportunities to learn more about engineering.

- Have students interview different types of engineers and share what they learn with their teammates.
- See engineers in action. Arrange a field trip to an engineer's office, power plant, water treatment center, local engineering college or university, or other engineering-related workplace.
- Invite your mentor and other professionals to talk to the students about science, engineering, and technology careers.
- Share current news about projects your mentor or other engineers are working on.

DIG DEEPER

Have students do a quick search of the many careers and areas of focus within the engineering field. Good resources include:

- DiscoverE.org/discover-engineering
- pbs.org/designsquad

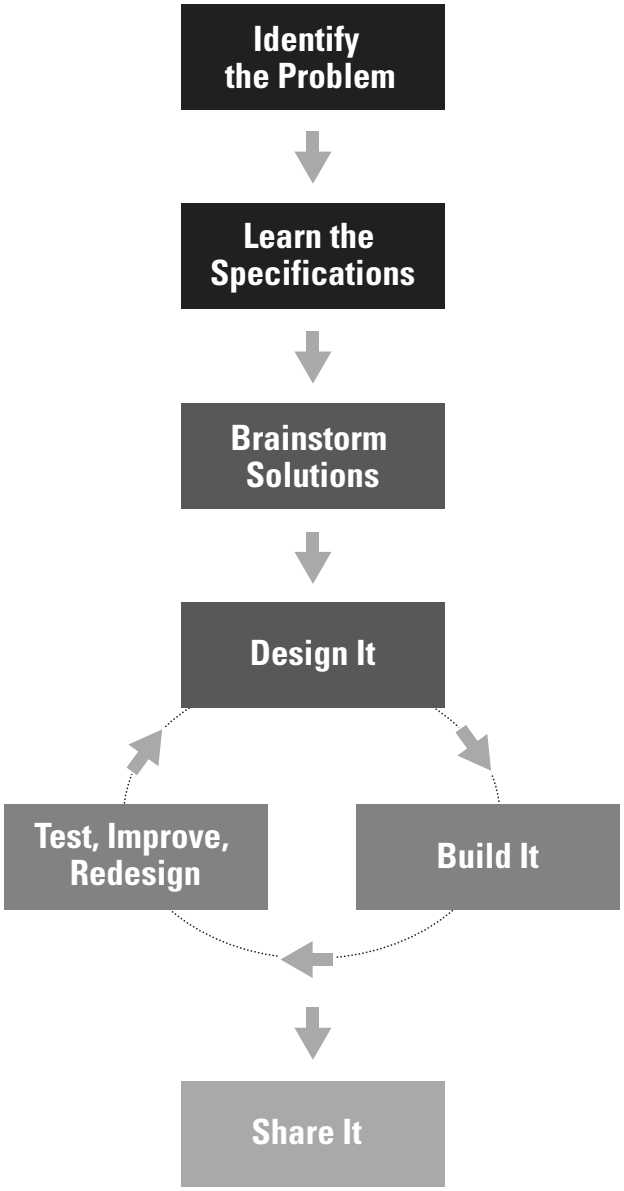
Some of their results might include aerospace, agricultural, bioengineering, biomedical, chemical, civil, computer, electrical, environmental, industrial, manufacturing, materials science, mechanical, nuclear, petroleum, and more!

Engineering Design Process

When engineers work to answer questions or solve problems, they use a specific approach: the engineering design process. It is a great way to work through any challenge that involves creating something that did not exist before or improving a process or product.

As your team learns about engineers through discussion, research, and interviews, introduce them to the engineering design process:

- Show your students the engineering design process animation.
- Review "The Engineering Design Process" graphic and discuss the various stages. Point out that engineers don't follow the engineering design process as if it's a list, with one step followed by another. Instead, it's cyclical: they may begin at one step and move back and forth between steps numerous times. Download the graphic in the Resources section of the Educator Dashboard at FutureCity.org.



DIG DEEPER

Students can practice applying the engineering design process with:

- **Tower Building Activity Resources** section of the Educator Dashboard at FutureCity.org.
- **Critical Load** (https://discovere.org/stem-activities/critical-load-student-instruction/)

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

ENGINEERING DESIGN PROCESS

Display a colorful version of this graphic for students to refer to as they design their city.

Engineering and Teamwork

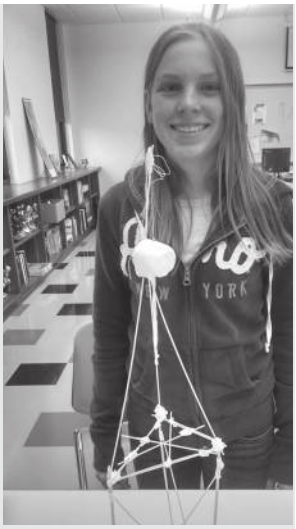
Teamwork is essential to the engineering design process. Engineers have to be able to communicate accurately and work well with colleagues and clients in order to be effective members of a team. Frequently, the combined ideas of the team lead to the best solutions!

The Tower Building activity (referenced on the previous page) also allows you to introduce the teamwork element of the engineering design process. After you've completed the activity, ask:

- How did your team work together? Was it easy or challenging?
- Was there conflict in your group?
- How did you resolve it?

We have more resources on team building. Visit the Resources section of the Educator Dashboard.

DIG DEEPER



Share the following TED talk with students. In this video, Peter Skillman shares his research after conducting more than 70 Marshmallow Challenges with a variety of participants ranging from lawyers to recent business school graduates. His findings include the importance of prototyping and that having a team with diverse skill sets really matters. He also shares some of the reasons why engineers, architects, and kindergarten students are able to create the tallest, most stable structures!

Marshmallow Challenge video:
www.youtube.com/watch?v=1p5sBzMtB3Q

"Once my students understood what the Engineering Design Process was, it became the glue that held their team together.'"

– Aliyah James, Pennsylvania Future City Educator

Project Management

Project Management Cycle
(Student Version)

Project Management Cycle
(Professional Version)

In engineering, the success of a project often hinges on managing the goals, budget, timeline, and resources. As engineers work to solve problems, they incorporate specific project management methods into the engineering design process.

To help students learn this process, the Future City Competition uses a student version of the project management cycle. This version differs slightly from the more detailed project management cycle used by professional project managers.

"I love that Future City asks students to use project management, especially because it isn't something we usually teach. Recently a student told me, 'Oh, you know after Future City, my National History Day project was so much easier because I laid out my deadlines, I figured out what I needed to do, I made a schedule, and I set my goals. It wasn't nearly as stressful.'"

– Kate Baten, Florida (Tampa Bay)
Future City Educator

Introduce Project Management

What do your students already know about project management? Have a conversation to find out.

QUESTIONS TO DISCUSS:

- Has anyone heard of the term "project management"? What do you think it means?
- Have you worked on a big project, one with a lot of steps and a team of people? How did it go? How did everyone know what to do? Did everyone do the same thing, or did you break the project down into smaller parts? Did you encounter any problems or challenges?

KEY POINTS TO SHARE:

- We all manage projects—students, parents, educators, everybody. Planting a garden, remodeling a kitchen, creating a year's worth of lesson plans—projects are how we get important things done. Engineers manage them too. Project management is a short way to describe all the stuff that we have to do to get from the beginning to the end of a project, like knowing what we want to accomplish, what we'll need in order to accomplish it, who needs to do what, and by when. The more complicated the project, the more management it takes.
- There are four main stages of project management: Define, Plan, Do, and Review. Discuss each stage and ask students if they can give any examples from projects they've worked on.
  - ✷ The **Define stage** is where we think about all the things involved in the project. We get a good understanding of the requirements. We learn what the goals are, what the budget is, and the due date. We gather all of the pertinent information about the project.

    For example, pretend you're on a committee planning a school dance. In the Define stage, you would figure out the date of the dance, how much of the school's money you can spend on it, and the committee's specific objectives for the dance (e.g., will it have a theme?).
  - ✷ The **Plan stage** is where we create a schedule, assign roles, and decide what materials we need. The Plan stage is critical to the success of the project. The better a project is planned, the more likely it is to go smoothly! For Future City, your Project Plan is a handy place to write down this information. You will probably have to change things as you go and fill in some things later. Plans need to stay flexible but at the same time help you make your deadlines.

    In the school dance example, the Plan stage is where the committee would figure out who is responsible for doing what (e.g., who is planning the music? Who is in charge of decorations? What about food and drinks?). You would also define a schedule that allows you to accomplish the whole to-do list before the dance.

  - ✷ The **Do stage** is where you build, create, and fix—whatever the project needs. Good communication habits and checking in with each other regularly is key.

    During the Do stage, dance committee members work on their specifically assigned tasks. They make a music playlist. They buy their party decorations and hang them up. They keep each other up to date about accomplishments and any challenges along the way. Finally, the committee puts on a successful dance!
  - ✷ The **Review stage** happens once the project is complete. It's time to share your results, reflect on what you've learned, and celebrate.

    After the dance, the committee meets to review the overall event. Did you meet or stay under your budget? What parts of the dance were really fun? What could be improved next time?
- If you know what you need to do in each stage, your project will go more smoothly. Engineers rely on project management because without a system, their projects can go over budget, take too long, or not meet goals. They also might get really confusing. Using project management as you build your future city will show you how useful it is.

DIG DEEPER

Two resources you can use to introduce project management to your students are:

- A project management cycle animation
- The Lego Structure Activity

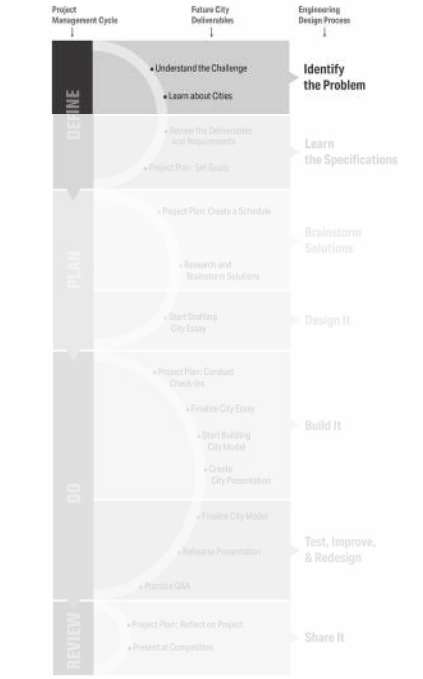
Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

DEFINE

Identify the Problem

During this first stage of the engineering design process—Identify the Problem—students establish an initial understanding of the scope of the challenge and build background knowledge about cities of today. This stage aligns with the first stage of the project management cycle, known as the Define stage.



Getting Started

Briefly introduce students to the objectives of the Future City Competition:

1. You will use the **engineering design process** and **project management steps** to design and create an innovative and futuristic city that exists at least 100 years in the future.
2. You will address this year's challenge: Electrify Your Future. Today's engineers, scientists, architects, and city leaders are working together to make our cities run on electricity created from energy with minimal environmental impact.

   Can you imagine what future cities will be like when engineers find and implement solutions to the challenge of electrifying our cities?

   What clean, green, and renewable energy sources could power the electrical grid? How would these sources generate enough electricity for industry, transportation, agriculture, residential, and commercial uses?

   Your challenge: Design a city powered by electricity to keep your residents healthy and safe. .
3. You will work together with your mentor and educator to create five competition deliverables:

- ☐ **City Essay** – you will describe your city's unique features and your solution to this year's challenge.
- ☐ **City Model** – you will build a scale model (or model segments) of your city using recycled materials and incorporating at least one moving part.
- ☐ **City Presentation and Q&A** – you will give a 7-minute presentation of your city to a panel of judges and answer questions from judges about your city.
- ☐ **Project Plan** – you will create a four-part project plan to help your team stay organized.

Learn About Cities

In order to create cities of the future, students need to understand what a city is. What makes a city a city? What are its underpinnings? Who plans, designs, builds, and maintains cities?

Exploring cities of today is a great way to build students' background knowledge before they start creating their future city.

Defining a City

First things first: What, exactly, is a city? We know that New Delhi, Paris, New York, and Beijing are all cities. But what makes each of them a city? Is it population size, location, presence of government buildings, or social and civic institutions? How do you define a city?

Work with your students to come up with an informal working definition of a city. Write down their first thoughts on the board. Note: These questions are drawn from the What Is a City? Activity.

QUESTIONS TO DISCUSS:

- What do cities look like? Why do people live in cities? Are they designed or do they just happen?
- What are the differences between a city, town, and village?
- If you had to describe your city or town to a stranger, what would you say about it? How is it different from other cities or towns? What do you like about it? What don't you like?

KEY POINTS TO SHARE:

- Cities come in all shapes and sizes, and there is no single population number to define a city. Similarly, Future City does not require a specific population for the cities that teams create.
- You could say that a city is everything inside the border of a particular city's government. Everyone inside that border votes on what happens in their city. But a lot of times the city has outgrown those borders, or there is just as much urban area surrounding those borders. If you had to say how many people lived in Mumbai, how would you decide where that massive city begins and ends?

DIG DEEPER

To highlight the concept of how cities change over time, compare the differences between cities 100 years in the past and cities of today. You can show students the 4-minute video Urbanization and the Future of Cities (youtube.com/watch?v=fKnAJCSGSdk), which illustrates how cities developed and ways cities of the future will need to adapt to growing populations.

City Features and Infrastructure

As students are working through their definition of a city, share with them that they've been talking about both city features and infrastructure. City planners, engineers, elected officials, government employees, developers, and residents spend a lot of time, thought, and money on the location of a city's infrastructure. Yet many people don't think about or even notice these aspects of their cities. Introduce your students to these terms and then start a discussion.

KEY POINTS TO SHARE:

- The term "features" refers to general characteristics of a city. Is it located near a lake or by mountains? Is it a big or small city? Is it densely populated? What is the city's most important industry?
- The term "infrastructure" includes the structures, systems, and facilities that make a city inhabitable—that is, the things people need in order to live and thrive.
  - Structures include bridges, roads, and government buildings.
  - Systems include sewage and water systems, electric and telecommunications systems, and transportation systems.
  - Facilities include hospitals and schools.
  - Soft infrastructure is used to describe the social and cultural resources that nurture communities, like education systems, fire protection, and government.

  You can see why infrastructure is a very important term when we're talking about cities, even though it's a hard word to pin down!
- Engineers and architects design most of a city's infrastructure. For instance, teams of civil and mechanical engineers design water and waste systems, while teams of electrical and systems engineers design power and telecommunication systems. What other types of engineers do you think support a city's infrastructure?

QUESTIONS TO DISCUSS:

- How might a city's location and terrain affect its infrastructure?
- What public services are vital? Why?
- Thinking about where you live, what infrastructure improvements would you recommend?

SIMCITY AVAILABLE!

Request new SimCity codes via the Educator Dashboard. Click on Account Details (in the upper right corner), then select Tools.

- SimCity is Optional.

Zoning

Another important element of city planning is zoning. Zoning refers to the way in which land in a city gets divided up and categorized. Zoning regulations and laws help ensure that a city can grow and change in a manageable, safe, and attractive way.

KEY POINTS TO SHARE:

- City planners work with city officials, engineers, architects, lawyers, and developers to create specific zones for how land will be used within a city. Zones usually fall into one of the following categories:
  - A **residential zone** is where people live. It can be high density, meaning that a lot of people can live in an area, usually in apartment buildings. Or it can be low density, which is usually single-family houses.
  - A **commercial zone** is for stores and restaurants.
  - **Industrial zones** are where factories and power plants are located.
  - **Agricultural zones** contain farmland where food is grown or raised.
  - **Mixed use** means a blend of zones. City developers sometimes use the same area for residential and commercial zoning. An example of mixed use: a city block featuring both apartment buildings and a café, movie theater, clothing store, and grocery store—sometimes in the same structure!

QUESTIONS TO DISCUSS:

- What might you expect to find in each of these different zones?
- Why is zoning an important factor to consider when planning a city?
- How is zoning related to a city's infrastructure and services?
- What happens when thoughtful zoning has not been executed?

DIG DEEPER

- Show students a zoning map of their city and identify different zones. (Research the city name plus "zoning map" online to find a map of your city or one nearby.)
- Have students research the zoning designation for their home address, school, or other local businesses. Many cities have websites that allow individuals to input a specific address and receive information on the property, which includes its zoning designation. What are some of the different zones? What areas in their own city are considered industrial, commercial, mixed, and/or residential zones?
- Invite guest speakers from your local city planning department to show zoning maps and explain how cities are typically zoned. This can be done virtually through a platform like Zoom or Google Classroom.
- Do the **City Zoning Activity** in the Resources section of the Educator Dashboard at FutureCity.org.

City Planning & Simulation Tools

City planning requires an understanding of how all the city features, systems, infrastructure, and zoning come together to make up a city. City planners are always thinking about how to improve the quality of life in a city by fixing problems and planning how the city can grow and change.

SimCity is a great learning tool for students to understand the complexities of city planning and design. Taking the time to experiment in SimCity is highly beneficial to students, as they will gain knowledge that they can then apply to their future city. For example, they can explore:

- **Zoning:** Exploring zones in SimCity will help teams determine what zones need to be near each other in order to optimize city function and resident happiness.
- **Infrastructure:** From transportation to energy and communication systems, SimCity provides endless opportunities to experiment with placing infrastructure and its impact on the city's overall function.
- **Budgets & Taxes:** SimCity citizens are quick to provide their opinions on your city's tax rates and where your budget excels or falls short.
- **Systems thinking:** The simulation aspect of SimCity allows students to see the consequences of their design decisions. For example, where they place their roads may positively or negatively affect their city's public transportation system in the future.

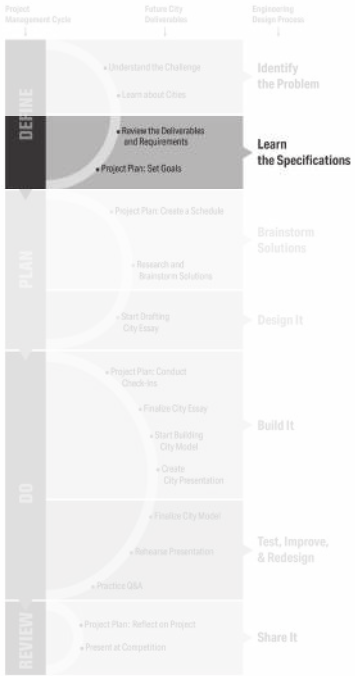
DIG DEEPER

Log in to your Educator Dashboard and visit the Resources section to continue exploring city features and the process of city planning:

- **City Planning Background Information**
- **City Planning Key Terms & Concepts**
- **Infrastructure Scavenger Hunt:** Have fun as students explore urban infrastructure.
- **City Planning Word Investigation**: Research definitions for common city planning words.
- Zones and Interconnectivity: Make basic urban plans for an imaginary city.
- **City Planning Game**: Learn how to design the placement of city elements within zoning areas.

DEFINE

Learn the Specs



In the Learn the Specs stage of the engineering design process, students carefully review the competition requirements and learn about the specific characteristics that each deliverable must meet. They'll also identify resources, team roles, assumptions, and goals as part of their Project Plan.

Future City Deliverables

These four deliverables are required for teams who choose to fully compete in Future City. Your region may also allow teams to participate as "partial competitors." This option is great for educators new to Future City. Check with your Regional Coordinator to see if this is an option in your area.

Carefully review the four deliverables and share the competition requirements and rubrics for each one. Encourage your students to keep these handy and refer back to them as they brainstorm, design, and create each component.

As you dig into each requirement, here are a few pieces of advice from past teams and educators:

City Essay

The essay is the first place the students get to share their vision of their city. While it won't be "done" before they start working on the model, it is a great road map for students to follow for as they create their model and presentation.

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including student handouts, activities, due dates, and more!

City Model

$100 Budget (does not include the baseboard)
What does recycled materials mean? Get familiar with the Compeition Expense Form and how to fill it out. And remember to save your receipts!

City Presentation and Q&A

Present the city to a panel of judges (7 minutes). Answer judges' questions about your city (8 minutes).

Project Plan

Consisting of four parts, the Project Plan helps students stay organized, focused, and on schedule as they complete their other Future City project deliverables.

Project Plan: Set Goals

Before you dive into creating a city of the future, take the time to focus your students on how they are going to get it all done. This is where project management comes in. The first step is Goal Setting. In this stage, get your students thinking about:

- **Project Resources** – This is anything from people (like team members or experts) to time to materials, that the students might need.
- **Project Constraints** – What might limit the team's ability to get it all done? It's often the flip side of resources – not enough time or not enough people. But thinking about it early gives you the chance to strategize ways to address an issue.
- **Assumptions** – These are the tricky unspoken ideas and beliefs each team member might have, from how many times they want to meet to how much effort they want to put into the project. Talking about assumptions will help your team work together and plan more effectively.
- **Project Goals** – Goals explain what will be achieved by the end of Future City. They can be wide-ranging, realistic, and attainable.

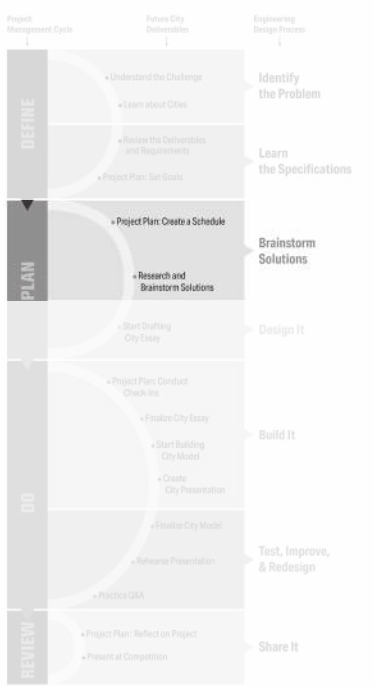
The student handout Project Plan: Goal Setting is a great resource to start this conversation. It defines each of these terms, offers starter questions, and has a worksheet students can fill out (and change!) as they work.

IS THIS BEING GRADED?

There is no rubric for the project plan – this is simply a tool and process you and your students can use to keep your project running smoothly. Turn in all four parts on time and your team receives an automatic 10 points.

PLAN

Brainstorm and Research Solutions



During the Brainstorm Solutions stage of the engineering design process, students use their Project Plan to schedule how they will complete each deliverable. Then they steep themselves in research and brainstorm various solutions to the Electrify Your Future Challenge. Project managers refer to this second stage of the project cycle as the Plan stage.

Project Plan: Start Making a Schedule & Assign Tasks

Explain to students that since they now have a better understanding of the project, it's time to start making a schedule and identify what needs to be done, by whom, and in what order. A schedule will help them keep track of time and the tasks they must do to successfully complete their deliverables.

Of course, there are many unknowns! Emphasize that this schedule is an important starting point, but students should expect to change it as they continue their work.

Creating Schedules

There are many ways to make a schedule, such as:

- Google sheets or docs
- Text message threads
- Emails
- Visual representations and
- Brain maps

The most important thing is for students to use a process that works best for them. The **student handout Project Plan: Schedule** breaks down the five important steps in the process and offers a few suggestions for how students might want to create their own schedule.

Research Solutions

Before students start brainstorming what their city will look like and their solution to this year's challenge, they need to begin the research process. To create an innovative and futuristic city, students will need to ground themselves in not only current city design best practices but also in cutting-edge and futuristic solutions engineers are researching and experimenting with right now.

Research Resources

- **Electrify Your Future Challenge: Research Questions**

  Before your team starts designing their city, students need to learn about electricity generated power solutions; its causes; the impact on the environment, the economy, and people; and the solutions people are working toward today. This handout is a great place to jump-start students' research and exploration.
- **Future City Design: Questions to Consider**

  This handout provides thought-provoking questions designed to help your team think of practical and innovative ideas for their future city, from manufacturing to infrastructure and everything in between.
- **Electrify Your Future Challenge: Real-World Case Studies**

  It can be helpful to read about current cities using electric generating power solutions right now. This handout offers several short examples, including Compressed Air: A Breakthrough in Energy Storage, A School Bus That Powers the Grid, Increasing Access to Renewable Energy, & Alice the Electric Airplane.
- **Electrify Your Future Challenge: Research Resources**

  This handout provides a helpful starting place for your team's research. The list is not exhaustive, though—there are many more sources to discover and research!

Educator Dashboard

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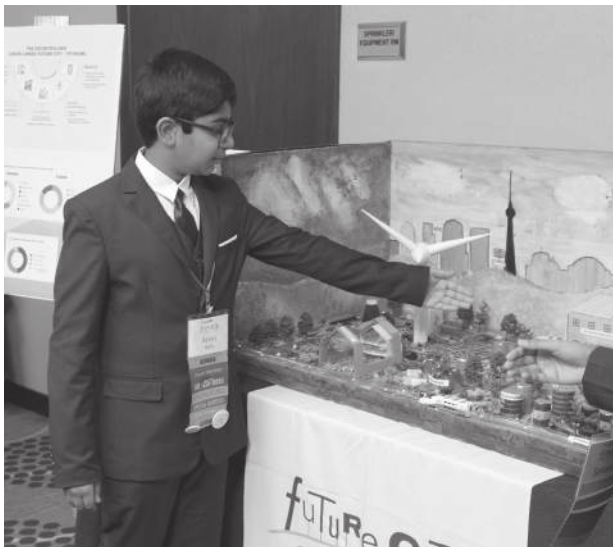
Brainstorm Solutions

It's time for students to begin brainstorming what their future city will look like. Now is the time to encourage creativity, problem-solving, and futuristic thinking. Remind students that their city will exist at least 100 years from now.

Have the students review their research and the **Electrify Your Future Challenge: Research Questions** and **Future City Design: Questions to Consider** student handouts. Discussing these questions and their research with teammates will yield lots of ideas and can serve as a road map for what to include in their future city.

QUESTIONS TO DISCUSS:

- Determining the most critical impact on electrical power that their city needs to address, considering factors such as environment, infrastructure resilience, energy efficiency, or other relevant considerations.
- How are today's cities adapting electricity as a power solution? What solutions are innovative or futuristic?
- What additional challenges or issues does the city face? Are there opportunities to design solutions that address more than one issue?



KEY POINTS TO SHARE:

As students dive into their brainstorming, review the following with them:

- **Engineers identify more than one solution** and explore all kinds of ideas. Recording pros and cons for each one will help students identify the best solution.
- **Engineers use simulation tools** to test various ideas and gather information about possible solutions. We recommend teams use SimCity, CitySkylines, PocketCity, or a similar simulation. What ideas do they want to test out? What might they learn from using a simulation? What might surprise them about their ideas?
- **Engineers are not afraid to take risks.** Tell students that they shouldn't be afraid to share their ideas and try new designs. Even if the design seems too complex or unrealistic, share it! Sometimes the best ideas are born from someone's wacky suggestion.
- **Engineers know that brainstorming is a team effort.** It requires perseverance, creativity, determination, communication, and an open mind. Download Brainstorming Tips from the Resources section of the Educator Dashboard at FutureCity.org for more brainstorming techniques and guidance.

Choose Solutions Before Designing the City

Before students move into the Design It stage, they need to decide what energy sources they will be using to fuel their city, how they will store them and what effects on the community due to their electrification sources.. A good way to narrow their choices is to measure their ideas against the essay, model, presentation, and Q&A rubrics. How well they match up could help students select the best ideas.

Check the Schedule

Teams might need to make some changes to their project schedule at this point. Give students time to add tasks, move them around, and make sure that everybody is sharing the workload.

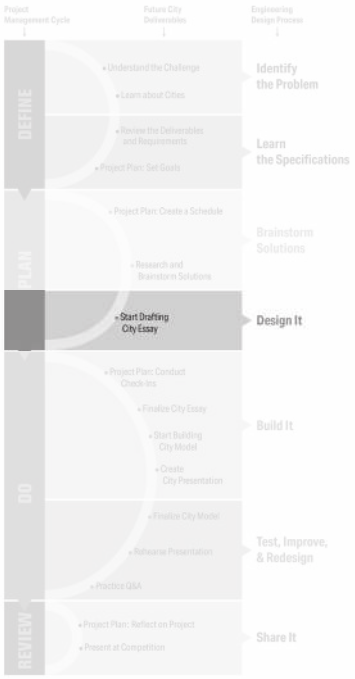
IT'S NOT A STRAIGHT LINE

Although each deliverable is designed to stand on its own, teams may find that they are working on them concurrently and will quickly realize that each deliverable informs the others in critical ways. **The Future City Design: Questions To Consider Student Handout** may prove relevant to keep in mind as students work on the various deliverables.

PLAN

Design It

This stage of the engineering design process is where ideas take shape and visions grow. Students draw from their research and brainstorming to plan how they will create their future city. Encourage students to ask their team mentor for feedback. The mentor may have expertise in this area or be able to call upon colleagues to help evaluate the students' designs.



Draft the City Essay

The City Essay is the first place where students will share their vision of their future city. Here they will answer the question: What makes your city special, futuristic, and innovative? They will also describe their solutions to the Electrify Your Future challenge.

Drafting the essay helps students synthesize their research and finalize key elements of their future city. It also lays the groundwork for the other deliverables. Students will frequently refer to their research, the answers they came up with to the **Future City Design: Questions To Consider Handout**, and their essay to build the model (or model segments), decide what to say in their presentation, and determine how to answer the judges during the Q&A. This is an example of how the engineering design process works: what they accomplish in one stage informs what happens next.

KEY POINTS TO SHARE:

- Before students begin to write, review the City Essay: Suggested Outline and the City Essay rubric with them.
- Share City Essays from past Finals winners. Analyzing essays from prior years will give students a strong sense of what they are aiming for in their own essays. Go to futurecity.org/gallery/ and filter for City Essay.
- A draft is kind of like a prototype: it's the version where you work out the kinks. The draft of the City Essay is the prototype that helps students evaluate ideas, plan resources, and anticipate possible roadblocks before they create their final version of the City Essay, their model or segments, and their presentation.

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QUESTIONS TO DISCUSS:

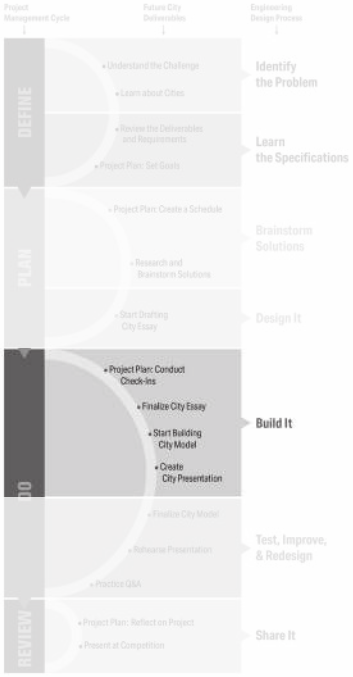
- Is there anything in the City Essay outline or rubric that the team hasn't discussed or developed a solution for? If yes, it's time to go back to the research and brainstorming phase.
- 1,500 words is not a lot. What aspects of the city need to be in the essay? Are there aspects of their city that are better represented in their model or presentation?
- How many drafts are they prepared to write? Have a conversation about their expectations and those of their teammates.

CHECK DEADLINES

The essay is due before the Regional Competition. Find your region's deadlines in the Educator Dashboard and note it on your team's schedule. Ask your Regional Coordinator if you have any questions!

DO

Build It



During the Build It stage of the engineering design process, students create many project deliverables. They finalize their City Essay, build their City Model, and write the script for their City Presentation. As they work, students use the Project Plan to conduct check-ins to make sure their project stays on track. Project managers refer to this third part of the project cycle as the Do stage.

Project Plan: Conduct Check-Ins

As students move into the Build It stage, they should review the requirements for the Future City deliverables and make sure they're working toward meeting them. They may find it necessary to change responsibilities among team members as some tasks are completed and new ones begin.

Conducting regular check-ins will help students monitor their work. Ask each team for a quick verbal check-in every time you meet so that students keep an eye on their schedule and tweak it frequently. Check-ins will also encourage students to become adept at summing up their progress across deliverables for you and the other team members.

Finalize the City Essay

It's time for students to look at the rough draft of their essay and to turn it into the final, polished version. Guide students through this important phase of writing using your preferred method. If you don't have a favorite way of helping students work in groups to complete essays, you can use the following approach.

If each team member wrote the rough draft of one section of the essay, tell the team to put the sections in order and read through them together.

Next comes a group editing process. Students are likely to find repetition and will need to decide where to cut and where to keep content. They will also need to add connecting sentences so that each section flows logically to the next. If they see any errors in spelling or grammar, they can catch them now. Remind students to check their essay against the City Essay Rubric.

Once they have a near-final draft, you or the team mentor should read it and give the students feedback. Together, students can decide how to make changes to their essay based on this feedback. Then one student should be in charge of writing the final version. Everyone on the team should read it one last time and make sure it is in great shape and ready to submit for judging.

DIG DEEPER

Visit the Resources section at dashboard.futurecity.org to access activitities that explore scale:

- **Scale: Background Information**
- **Scale: Key Terms & Concepts**
- **Introduction to Scale**: Learn how to use ratios to create a scale drawing.
- **Plan and Elevation View:** Architects and engineers use sketches as a way to communicate and convey their design ideas to others. This activity introduces students to creating scaled drawings.
- **Proportions, Ratios, and Scale Drawings Activity:** Apply learning about proportions, ratio, and scale to create a scale drawing of a room.
- **Scale Map Activity:** Plan the City Model by creating a two-dimensional city map.

Explore Scale

Before students begin their City Model, introduce the concept of scale.

Scale is a very important requirement for the City Model, and teams should think carefully about the most appropriate scale to use. Factors to consider include the geographical location and terrain of their city, its layout, the level of detail they wish to include, and cost. If students choose too small of a scale, they may have trouble finding objects to build with; too large of a scale may prevent them from including all the details and specifics they would like to feature.

Tell students that engineers use scale models to test their design ideas at an early stage of development without the risk of creating a full-sized model. If you have access to your school's blueprints, compare these drawings with familiar school buildings and rooms to illustrate the concept of scale.

Share the following terms:

- **Scale** is the ratio between two sets of measurements.
- **Scale drawing** is a drawing that uses scale to make an object smaller or larger than the real object.
- **Scale model** is a proportional model of a three-dimensional object.

Build the City Model

Building the model is one of the most exciting aspects of Future City. Start your students off by sharing and reviewing the **Build Your City Model handout**. It's full of valuable information about ways to create different parts of the model, questions to keep in mind, and tips for the moving part component.

KEY POINTS TO SHARE:

- Model segments do not need to fit together to form a single, physical model.
- Each model segment must be consistent in its scale. However, each individual model segment (even among the same team) may use different scales.
- Each team must have at least one moving part on their model. Each model segment does not need its own moving part, but at least one is required per team.
- Remember to refer to the City Model rubric before and as they build, not just at the end.

QUESTIONS TO DISCUSS:

- Will your team build a single model or multiple model segments?
- What are some creative ways you can use recycled materials in your model?
- What scale works best for your model? How will you ensure that the scale is consistent within each model segment?
- What recycled or reused materials are available to your team?

City Model Resources

- **City Model Requirements:** Make sure the team is familiar with the requirements.
- **Build Your City Model Student Handout:** This handout offers questions to consider and model building tips.
- **Past Models: Get inspired!** See models that teams have created over the years at futurecity.org/gallery/.
- **Moving Parts Video:** Get ideas about different kinds of moving parts by watching this video, available in the Resources section of the Educator Dashboard.
- **City Model Rubric:** Review the rubric carefully.

Remind students that as they work toward completing the deliverables, they will be moving back and forth between the different phases of the design process. This is natural. Engineers go back and reevaluate or refine their solution as the need arises; sometimes the best ideas are those that are not selected first!

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- **Model Construction: Key Terms & Concepts**
- **Model Construction: Background Information**
- **What Is a Model?** Activity: Examine different types of models and discuss why they are useful.
- **Plan-Relief and Architectural Models Activity:** Create and compare two-dimensional floor plans and three-dimensional models of a classroom.
- **Building Strong Activity:** Build a paper structure that will support a book.

Create the City Presentation

The City Presentation gives students an opportunity to showcase all that they have accomplished and learned in the Future City Competition. Set a celebratory tone for students! That way their presentations will convey their enthusiasm for, and pride in, their future city.

KEY POINTS TO SHARE:

- Help students get inspired by watching presentations from prior years winning teams on Future City ® – YouTube.
  - What made the presentation engaging?
  - What features and infrastructure made the city appealing, unique, and futuristic?
  - How did the team incorporate last year's challenge into the city design?
  - What will you need to do to prepare for your own presentation?
- Another resource is the **Future City Design: Questions To Consider Student Handout** that the team used when writing their City Essay. Encourage students to revisit their answers to these questions and pick out what is most important and interesting to say in their presentation. They can't say everything; they have to pick and choose.
- Remind teams to keep the rubric in mind as they design and develop their presentation. Refer to it often!

QUESTIONS TO DISCUSS:

- How will you highlight your model or model segments during the presentation?
- What visual aids and props will you use to enhance your presentation?
- How did the engineering design process and project management cycle help you plan your city?
- How can you show the ways you work well as a team? (For example, Do you share presentation tasks? Do you support each other during the presentation? Do you display equal amounts of knowledge?)

City Presentation Resources

Future City has multiple resources to help students create fantastic presentations.

- **City Presentation Requirements:** Make sure students understand the requirements.
- **City Presentation Rubric:** Keep this handy and refer back to it often.
- **Past Presentations:** Watch prior years' winning presentations at futurecity.org/gallery/.
- **City Presentation Tips:** This is full of great questions and tips for creating a presentation.

DIG DEEPER

Share the following presentation:

Why You Don't Have to Wait Till You Grow Up | Ishita Katyal | TEDxBhilwara: https://youtu.be/WIW7uzxurmA

Discuss what made these presentations engaging. Ask:

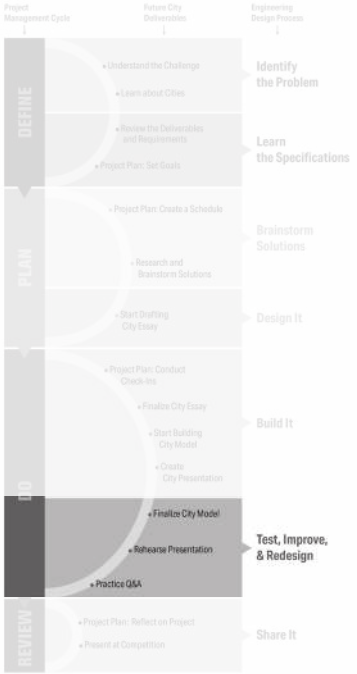
- What did you notice about the speaker's body movements and voice?
- How does the speaker use research, stories, and questions to hook the audience and convey a message?

Encourage students to emulate effective public speaking techniques in their own presentations.

DO

Test, Improve, & Redesign

In the Test, Improve, and Redesign stage of the engineering design process, students evaluate their solutions, get feedback from others, and make improvements based on this feedback. They'll continue to monitor their project's progress through frequent check-ins with you and their teammates. The goal is to make sure their project is the best that it can be.



During this stage, students carefully review the rubric for each deliverable to ensure they have met the requirements. They should also get as much feedback from you and their mentor as possible on each competition deliverable. At this point, feedback should be specific and actionable—students should understand exactly what they need to do to implement your feedback.

Finalize the City Model

Now is the time for the team to put the finishing touches on their model/model segments.

Practice the Presentation

Practicing your presentation is very important and will help the team feel prepared and confident. Remember, only three team members can serve as the official team presenters.

KEY POINTS TO SHARE:

- Continue practicing your presentation in front of friends, family members, and your team mentor. Each of these audiences can provide feedback on what was most interesting, areas to improve, and how well the presentation aligns with the rubric.
- Presenters can record their part and then watch the video to identify ways to improve.
- Practice until they are comfortable and no longer need to refer to their notes.
- It's important to make eye contact with the judges.

QUESTIONS TO DISCUSS:

- What parts of the presentation could your team improve?
- What parts of the presentation were clear and informative? Are there other parts that are unclear or confusing?
- How are you showcasing your team's creativity during the presentation?
- How are the presenters' gestures, posture, tone of voice, and pace of delivery?

Practice the Q&A

The Q&A gives students an opportunity to demonstrate their knowledge and understanding of all aspects of their future city project. This is the team's chance to show off their understanding of engineering, project management, city design and operations, and the Electrify Your future challenge.

KEY POINTS TO SHARE:

- The presentation presenters and the Q&A presenters are the same three students.
- Questions from the judges will run the gamut of the entire Future City project. They could include questions about city design and operations, the engineering design process and project management cycle,your team's specific solutions to the Electrify Your Future challenge, struggles your team encountered, and examples of teamwork.
- Student participants should use their model/model segments to help explain their answers.
- Team members, the mentor, or other adults can play the role of judges and ask questions to the student presenters.
- Review the **City Presentation and Q&A rubric** as teams prepare for the live session.

Educator Dashboard

Visit Dashboard.FutureCity.org for easy access to all Future City resources, including all competition rubrics, forms and due dates.

QUESTIONS TO DISCUSS:

- How can you show the judges that you understand the information, rather than just having talking points about your city memorized?
- How did your team use the engineering design process and project management cycle to complete your project?
- How will you know when to speak and when to let other presenters answer? What systems or signals can you devise to smoothly take turns answering questions?
- What is the best way to show off the model (and any other visual aids) to judges, whether you're answering questions in person or online?

City Presentation and Q&A Resources

- **City Presentation and Q&A Requirements:** Make sure students understand the requirements.
- **City Presentation and Q&A Rubric:** Refer to this as you practice.
- **City Presentation and Q&A Practice Questions student handout:** Be sure to practice answering these questions.

Final Preparations

Review the Final Checklists with your team. Have they completed everything? Anything missing or loose ends that need to be tied up?

IMPORTANT!

There are two methods for submitting team deliverables and competition forms – online and at the competition. Check your Educator Dashboard for regional due dates and submission instructions.

Online Submission

- City Essay
- Project Plan
- Media Waiver Form
- Honor Statement Form
- Competition Expense Form
- Home School Affidavit

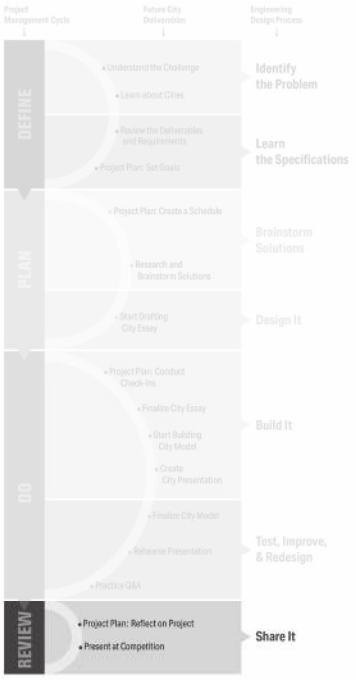
At the Competition

- City Model
- City Presentation and Q&A

REVIEW

Share It

The Review stage is where students look back and reflect on all that they have accomplished—an important step that both engineers and project managers take in any project. Here students will complete the final step of the engineering design process—Share It—by presenting their work to others, answering questions from judges, and celebrating their accomplishments. Now is the time to reflect on everything they've done and complete the final part of their Project Plans.



Project Plan: Reflect on Your Project

During this final stage, students reflect on their Future City experience by reviewing and assessing the process and end products. Let students know that reflecting on their project allows them to consider what worked and how they might do things differently—information that can help make their next projects easier.

Reflection is also a great way to prepare to answer the judges' questions during the competitions. Lead your team through this process with **Part 4 of the Project Plan: Reflect on Your Project.**

City Presentation and Q&A

The City Presentation and Q&A session with judges is a very exciting moment for students and the culmination of months of work. Three student representatives will show off their knowledge of engineering and city design, the team's entire project and process, and their solutions to the Electrify Your Future challenge.

KEY POINTS TO SHARE:

Here are a few final performance tips to share with your students:

- Sleep well the night before the competition.
- Eat a healthy breakfast.
- Remain calm; no one knows your city better than you!
- Be poised and confident; there are no wrong answers.
- Maintain eye contact with the judges.
- Devise signals or systems so that you will know which teammate will answer a judge's question.
- Speak clearly. Put energy in your voice and don't rush, be confident, move with purpose, and have a good time showing off your knowledge!

Congratulations on completing your city of the future!

Advancing to the Future City Finals:
What to Expect Next

Congratulations! Your team has won your regional competition and has advanced to compete in the Future City Final Competition! So, what happens next?

Each team competing in the Future City Finals will receive a Finals Winner Manual. The manual will include the following information about the Finals competition:

- Event Contacts
- Key dates
- Finals Registration and Travel
- Hotel Arrangements
- Regional Winners Team Video & Photo
- Transporting Your Model
- Event Details
- Family and Friends Registration
- Finals Schedule

Registration and Travel

There are two tasks to complete within five days of winning your Regional Competition:

- Register for Finals
- Book travel reservations

The team educator will receive the online registration link. After completing the online registration form, the team's educator can then make travel arrangements with Future City's travel agency. Future City pays the cost of travel for the five official team members (3 students, 1 Educator and Team's Mentor only). Teams must finalize travel arrangements within five days of their Regional Competition. Failure to make your reservations by this deadline may result in the forfeiture of your team's free trip to the Finals.

Transporting Your Model

Teams are responsible for the cost of shipping or transporting all models to and from Finals. Models that are shipped must arrive to the Hyatt Regency (Capitol Hill) no earlier than February 13 and no later than February 17, 2024. More detailed information about transporting your model to finals will be provided in the Future City Winners Manual.

Regional Winners Team Video & Photo

Following the regional competition, the team educator will be asked to submit the following information about the team:

- Team Name
- School/Organization
- Region
- Name of their Future City
- Photos (Photo of the model and a team photo)
- 2 Videos
  - 10 second video (max 2GB) – In this video the winning team should state their team's name, school/organization, region, and the name of their Future City.
  - 4-minute video – The winning team should submit a 4-minute recording of their presentation. This video will be played at the Future City Finals Award Ceremony if your team places in the top 5.

***Please Note:** Video submissions will NOT be judged. In-person judged presentations can be up to 7 minutes in duration. Video Submissions will be played at the Future City Finals Award Ceremony. Detailed instructions on how to submit your videos will be listed in the Future City Finals Winner Manual.

Prizes and Awards

Future City Competition Finals

Teams that win their Regional Competition* will represent their region at the Finals. Finals take place from Feb 16 to 21, 2024 in Washington, DC. Future City will provide roundtrip transportation (most economical fare) and hotel accommodations at the Hyatt Regency Washington on Capitol Hill for the team's three student presenters, educator, and official mentor. All other expenses are the responsibility of the team. Note: All rules and awards details will be provided to all first-place regional teams in the Finals Winner's Memo provided in January.

The Future City Competition is generously sponsored by Bechtel Corporation, Bentley Systems, Inc., the Project Management Institute Educational Foundation, and Shell Energy Company.

Regional Prizes and Special Awards

Teams that compete are also eligible for a number of special awards. Check with your Regional Coordinator for the list of special awards offered in your region.

A region must have registered a minimum of 20 schools/organizations by October 31, 2023, to be eligible to participate in the Finals. Regional eligibility is determined solely by Future City Headquarters. Prizes are nontransferable or exchangeable. Prizes are subject to the discretion of the awarding organization.

Finals Prizes

The top prize at the Finals is $7,500 for the organization's STEM program and a trip to U.S. Space Camp in Huntsville, AL, for up to five people (including an adult chaperone), awarded by Bentley Systems, Inc.

2nd Place is awarded a $5,000 prize for the organization's STEM program, provided by Shell.

3rd Place is awarded a $2,000 prize for the organization's STEM program, provided by Bechtel Corporation.

4th and 5th place teams will receive $750 for their organization's STEM program, provided by NCEES.

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Regional Coordinators

The Future City staff would like to thank and acknowledge the dedication of our tireless Regional Coordinators and their committee members. The countless hours that they contribute as they answer every question (big and small), match mentors to schools, fundraise, and host wonderful Regional Competitions is the foundation on which Future City rests. Thank you!

To contact your Regional Coordinator, visit www.futurecity.org and click on Find My Region.

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INTRODUCE A GIRL TO ENGINEERING DAY (FEBRUARY 22, 2024)

Girl Day is a worldwide campaign to engage girls in engineering. Thousands of people (engineers, educators, and others) act as role models, facilitate hands-on activities, and share how engineers change our world.

ENGINEERS WEEK (FEBRUARY 18 – 24, 2024)

Engineers Week is a time to celebrate how engineers make a difference in our world. It's a great time to do engineering activities, present engineering careers to your students, or bring your students to an Engineers Week event at a local university or business.

WORLD ENGINEERING DAY (MARCH 3, 2024)

Join DiscoverE and the World Engineering Federation for a day of global celebration of engineers and how engineering changes the world for the better.

Future City is a program of DiscoverE.

We would like to thank our generous sponsors for their continued support of the Future City program.

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