



BUILD BEYOND

Invent Tomorrow Challenge



Student Handbook

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Contest Guidelines

- Teams must have 3-5 students. Your team may work with an adult mentor who is an engineer or works in a technical field. Mentors may help your team prepare, but they may not present the model or answer judges' questions on competition day.
- Your team will be scored on three parts: The City Model, The Presentation w/Q&A, and the Project Plan. You can earn a total of 167 possible points in total.
- Your team must create an original model together. You may not reuse a design from a previous year.
- **Do not** use food that can spoil or any live animals. If you use water, it must be self-contained or be easy to drain.
- The model may be no larger than 25" (W) x 50" (L) x 20" (H).
- The model must contain one or more moving parts.
- Any power source must be part of your model, such as a household battery and simple circuit. You may not use electrical outlets.
- The value of everything used for your project may not be more than \$100. This includes model materials, 3D printing, and more.
- All materials used must be listed on the competition expense form with their value documented.
This includes any donated items
- Rotating models are allowed. Model height will be measured from the tabletop.
- If you use a 3D printers, count the printing material towards your budget using the values:
 - Regular white printing: \$2 per cubic inch
 - Color 3D printing: \$5 per cubic inch
- Your presentation may be up to 7 minutes. When the timer sounds, your team must stop. The judges' Q&A will begin right after the presentation and will last 5-8 minutes.
- You may not use electronic technology during the presentation.
- Visual aid limitations are as follows: One visual aid displayed at a time (e.g., a stack of signs on an easel) can be up to 60" x 36", or two visual aids displayed simultaneously can be up to 30" x 36".

Project Plan

Sustainability: meeting the needs of the present without compromising the ability of future generations to meet their own needs.

-United Nations Brundtland Commission

Project Plan Overview

In the Build Beyond: Invent Tomorrow Challenge, you are required to develop a complete Project Plan consisting of four parts to effectively manage your work, maintain focus, and follow deadlines while completing project deliverables.

Here's what a Project Plan is and why it matters:

What Is a Project Plan?

A project plan is a tool engineers use to organize tasks, set goals, decide how to complete the work, and track progress.

Think of your Project Plan as a roadmap for your research and design. You can update it as your ideas and project change.

Project Plan Structure

The Project Plan has four parts that follow the project cycle: Define, Plan, Do, and Review.

Each part is a separate document. Follow the submission directions and deadlines.

Project Plan Requirements

All parts of the Project Plan must be submitted electronically to the museum by **February 26, 2027**.

Use the Project Plan template to see what to include. Your team may adjust the plan to fit how you work best.

Competition Scoring

Submit all four parts, complete and on time, to earn 10 points.

An incomplete or late Project Plan earns 5 points.

If you do not submit a Project Plan, you will earn zero points for this part.

Project Plan Resources

A Project Plan template is provided to help teams organize each part.

Use as much space as you need for each section. There is no set page limit.

Project Plan: Schedule

Instructions for Creating a Project Schedule

A project schedule helps your team stay organized and finish on time. Follow these steps:

1. Establish Milestones & Tasks
 - Identify milestones, or important goals you want to reach during the project.
 - Examples of milestones include:
 - Completing the City Model's moving part
 - Completing a sketch of the City Model's industrial zone.
 - Break down milestones into smaller tasks for your team can complete.
 - Examples of tasks include
 - Researching cities using electric-powered sources
 - Deciding the city's location.
 - Write your milestones and tasks on index cards or in a shared spreadsheet.
 - Try using a different color for each part of the project so tasks are easy to spot.
2. Put Tasks in Order
 - Put your tasks in the order they need to be completed.
 - Notice which tasks depend on another task being finished first.
 - Review the model rubric before building the model or model segments.
3. Estimate the Time Each Task Will Take
 - Estimate how long each task will take and add it to your team schedule.
 - Update your time estimates if your plan changes.
4. Make Role Assignments
 - Consider each team member's strengths and interests.
 - Assign tasks based on individual skills and preferences.
 - Make sure the work is shared fairly among team members.
 - Write each person's role on the schedule.
5. Maintain the Schedule
 - Create a full schedule on a bulletin board, whiteboard, or shared online spreadsheet.
 - Track your progress and update the schedule when needed.
 - Be ready to adjust your plan when things change.
6. Show Us Your Style!
 - Include a photo, drawing, or screenshot of your schedule in your Project Plan.
 - Use a schedule format that works for your team, such as a wall calendar or shared online calendar.

Project Plan: Schedule

Team

Name: _____

School: _____

Educator: _____

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

Project Plan: Set Goals & Check In

Project Plan: Check-in & Goals

Check-In Instructions:

Check in with your teammates regularly so everyone knows what is finished and what still needs to be done. Record at least one team check-in and include it in your Project Plan.

- Purpose of Check-Ins:
 - Check-ins help your team progress and stay on schedule.
 - Most check-ins can be quick conversations.
- Documentation Recommendation:
 - Choose one important check-in to record.
 - Record a check-in when your team solves a problem, makes an important change, or reaches a major milestone.
 - Include the completed check-in report in your Project Plan.

Project Plan: Check-In**Team**

Name: _____

School: _____

Educator: _____

Project Plan: Set Goals**Team Check-in Report**

Date: _____

Team Member(s): _____

How are things going? Are there any issues making it difficult to complete tasks and goals?

What's going well? What have you learned that can help with another part of the project?

Look at your schedule. What changes do you need to make?

Project Plan 3: Set Goals**Project Plan 4: Reflect**

Team Name: _____

School: _____

Educator: _____

Team Reflection

Look back at your original project goals. Which goals did your team meet? Were some easier to meet than others?

Think about your team's first ideas for your city. What changed while you designed and built it? Describe one change and explain why your team made it.

How well did your team work together? What have you learned about teamwork?

What was the most important or useful thing you learned from this competition?

Deliverable: City Model

City Model

Sustainability: meeting the needs of the present without compromising the ability of future generations to meet their own needs.

-United Nations Brundtland Commission

Objective:

Your challenge is to build a physical model of your future city using recycled materials. Your city should show sustainable ideas, include at least one moving part, use scale, and stay within the \$100 budget.

Introduction to Model Building:

Engineers, architects, scientists, and city planners use models to test ideas and explain how designs may work. Your model should clearly show your team's ideas and research.

Model Options:

Choose one of these two ways to build your city model:

- Option 1: Build one complete city model.
- Option 2: Build separate model sections that fit together to represent your city.

City Model Requirements:

Model Size

- City model or segments must not exceed dimensions of 25" (W) x 50" (L) x 20" (H).
- Multiple segments should follow overall size restrictions when placed together on a tabletop.
- Extended parts like access doors or compartments are allowed if fully self-supported or removable.

Scale

- Teams can use up to four different scales within the model or its segments.
- Each scale must be clearly defined, easily easy to see, and indicated on the team's index card (see below).

Moving Part

- Each model must include one moving part. Individual segments do not need their own, but at least one per team is required.

Budget

- Total expenses, including materials for the city model, presentation, Q&A, and special awards, must not exceed \$100.
- Expenses must be reported using the Competition Expense Form.
- The cost of the base material (e.g., plywood) is exempt from the budget.

City Model Identification Card

- A 4" x 6" index card containing important team information for judges, including city name, school/organization name, names of presenting students, educator, mentor, and model scales used.

General

- Not allowed items in the model or presentation include live animals, perishable items, or hazardous materials.
- Any electrical power must be self-contained, such as a household battery.
- Wall or floor outlets are not permitted.

Competition Scoring:

Models will be judged according to the following criteria:

- City Design (30 points)
- Build Quality, Scale, & Materials (20 points)
- Judge Assessment of Model (15 points)
- Total: 65 points

Sources of Recycled Materials:**1. *Yard Sales and Family Sources***

- Explore yard sales or your own family's garage/basement for items like bottles, tins, or buttons.

2. *Old Toys*

- Old toys such as Lego pieces, gears, Tinkertoys, and blocks can serve as excellent building materials.

3. *Discarded Items*

- Advise keeping an eye out for discarded pieces of pipe, wire, and plastic, which can be reused for the model.

4. *Obsolete Electronics*

- Consider using obsolete or outdated electronic equipment, as they may be reused to add visual interest to the city model.

Note:

- All collected items, regardless of their source, must be listed on the Competition Expense Form to ensure transparency and adherence to the budget.

Building Your City Model: Questions to Consider**1. *Model Structure***

- Will your team create a single cohesive model or opt for multiple segments representing various sections of the city?

2. *Division of Responsibilities*

- How will you divide tasks among team members to ensure efficient construction and presentation?
- 3. ***Utilization of Recycled Materials***
 - What recycled materials could you use, and how can they be creatively included into the model's design?
- 4. ***Scale Selection***
 - What scale(s) will work best for your model? Remember, teams may use up to four different scales but should maintain consistency.
- 5. ***Visual Distinctiveness***
 - How will you visually distinguish different city zones within the model? There must be three zones: Industrial, Commercial, and Residential.
- 6. ***Infrastructure Considerations***
 - Where are the energy production facilities located? What does the transportation system entail? How does the city's electric-powered design influence infrastructure choices?
- 7. ***Representation of Services***
 - What services are available in your city, and how will you represent them in the model?
- 8. ***Integration of Electric-Powered Design***
 - How will you include your city's electric-powered design into the model, including showcasing the power source?
- 9. ***Moving Part Functionality***
 - What will the moving part in your model do, and how does it relate to an aspect of your city's design or function?
- 10. ***Power Source for Moving Part***
 - How will the moving part be powered within the model?
- 11. ***Innovation and Futuristic Elements***
 - What aspects make your city creative and futuristic, and how can you demonstrate that these ideas are grounded in real science and engineering principles?
- 12. ***Utilization of Engineering Design Process***
 - How can the engineering design process aid in the construction and refinement of your model?

Scale Measurement Guidelines for City Models

When determining the scale for your city model, (or scales if you are building different segments of your city) it's essential to consider both large and small features to ensure proportional representation. Below are standard measurements for common city elements, serving as a general guide:

- Width of Traffic Lane: 12 feet
- Height of Stop Sign: 8 feet
- Height of a Building Story: 10 feet
- Minimum width of residential sidewalk: 4ft.

Model Enhancement Ideas for City Models

Adding detailed elements to your city model can elevate its realism and visual appeal. Here are some creative ideas to enhance various aspects of your city:

1. Trees:

- Construct trees using twigs, sticks, and cotton balls (painted green).
 - Utilize lichen from hobby stores, dried flowers, or weeds for foliage.
 - Alternatively, dye sponges with food coloring to represent foliage.
2. **People:**
 - Craft people use sticks, toothpicks, or pipe cleaners.
 - Experiment with materials like mat board, pins, dowels, and pipe cleaners to create figurines.
 3. **Cars:**
 - Build cars using layers of mat board or cardboard glued together.
 - Consider using appropriately scaled toy cars or Styrofoam to represent vehicles.
 4. **Glass:**
 - Use clear plastic dividers, sleeves, or sheets to depict glass elements in buildings.
 - Apply glass components as the final touch to avoid scratches.
 5. **Bricks/Pavers:**
 - Use colored paper or matching materials to create brick patterns.
 - Draw patterns on white paper or material using markers or crayons, ensuring to depict the desired design.
 6. **Asphalt:**
 - Use black paper or color white paper black to simulate asphalt.
 - Draw lane markers with white and/or yellow colored pencils or crayons, then cut to size.
 7. **Cement:**
 - Use gray paper or color white paper to represent cement.
 - Cut the paper to size to depict sidewalks, roads, or other cemented areas.
 8. **Grade Changes (Hills or Craters):**
 - Sculpt grade changes using Styrofoam, shaping them to fit your desired terrain.
 - Layer cardboard or mat board to create contours or slopes, enhancing the realism of your model.
 9. **Water:**
 - Represent bodies of water using blue-colored paper or by coloring white paper blue.
 - Add realism by overlaying clear plastic or plastic wrap for a glossy effect.
 10. **Building Material Look:**
 - Emphasize realism by drawing joint lines on building materials to simulate construction.
 11. **Sand/Beach:**
 - Use sandpaper with a fine grit to represent sandy or beach areas in your model.

Moving Part Mechanisms for City Models

When incorporating a moving part into your city model, it's important to ensure that it can be repeatedly activated and serves a purpose relevant to the city's function. Here are some creative ideas for moving part mechanisms:

1. **Rubber Bands:**
 - Use rubber bands to create kinetic motion within your model, such as moving vehicles or machinery.
2. **Heat:**
 - Include heat as a source of energy to activate moving parts, representing processes like thermal power generation or heating systems.

3. Light/Solar:

- Harness light or solar power to drive movement, symbolizing sustainable energy solutions or automated lighting systems.

4. Weights:

- Use weights to power mechanisms, allowing for controlled motion in various components of your city model.

5. Springs:

- Integrate springs to generate kinetic energy and help movement, mimicking actions like opening doors or raising platforms.

6. Pulleys:

- Use pulley systems to transfer force and enable movement, representing mechanisms such as elevators or cranes.

7. Batteries:

- Use batteries as a power source to drive motorized components, showcasing the role of electrical energy in modern infrastructure.

8. Simple Circuitry:

- Construct basic electrical circuits to power moving parts, showing the principles of electricity and circuit design.

Try to design your moving part yourself or creatively change an existing item instead of using something prebuilt. This gives you a chance to show the judges how well you understand motion, energy, science, and engineering.

City Model Rubric

City Model Rubric

0 No Points Requirements missing	1 Poor Poor-fair quality. Fulfills at least 20% of Requirement s	2 Fair Fair-average quality. Fulfills at least 50% of the requirements.	3 Good Average quality. Fulfills at least 85% of the requirements.	4 Very Good Above average quality. Fulfills 95% of the requirements.	5 Excellent Excellent quality. Fulfills 100% of the requirements with additional distinctive features.
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<i>I. City Design (30 Points)</i>	0	1	2	3	4	5
1. City Zoning • Includes the three primary zones: residential, commercial, and industrial	There is no evidence of zoning. There is no variety of structures.	Zoning unclear. There is little variety of structures. Only one type of zone is 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 infrastructure 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 Service • 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 • Variety of transportation modes. • Transportation system(s) addresses the city's needs and its residents.	No transportation 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 the system does not meet the needs of the 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 example of electrification solution.	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 demonstrated	Planned design. Fair representation of livability concepts.	Well-planned design. Good representation of livability concepts	Clear and thorough planning and design. Excellent representation of livability concepts.

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 with additional distinctive features.
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II. Built 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 the 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 four different scales may be used, but all should be clearly identifiable and consistently 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 minimal.	Scale(s) consistently 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 the design or function of the 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 the city function. Excellent description of how the team built the moving part.

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 with additional distinctive features.
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III. Judge Assessment of Model (15 Points)	0	1	2	3	4	5
11. Application of Futuristic, Advanced Technologies - Includes futuristic technologies - Important to the function of the city	No futuristic examples.	Poor futuristic examples. Not important to the function of the city.	Fairly futuristic examples. Somewhat related to the 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 the model.	Innovation is presented well overall in the model.	Innovation is presented very well overall in the model.	Innovation is presented excellently throughout the 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. The function and purpose of most elements are evident.	Excellent representation. Function and purpose of all elements is evident.

Deliverable: City Presentation/Q&A

City Presentation

Your team has up to 7 minutes to present your future city and explain your solutions to this year's challenge. Engineers need to explain ideas clearly to many different people. Your goal is to bring your city to life and clearly show the judges what makes your solutions creative, useful, and innovative.

City Presentation Requirements

- Time allowed: The presentation can be up to 7 minutes.
- Presenters: Three students will represent the team.
- 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.
 - 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 museum competition. Make sure students have thoroughly covered all categories in the rubric to maximize points:

Content & Delivery – 35 points

Engineering and Technology - 15 Points

Total - 50 Points

Student Handout

Presentation 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 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 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.

City Q&A

Three students will represent the team in an 8-minute Q&A with judges who work in engineering or technical fields. Be ready to explain all parts of your project and answer questions clearly. This is your chance to show what you know about engineering and your future city.

Q&A Requirements

- Time allowed: Teams will have 8 minutes to answer judges' questions.
- Teamwork: The three student representatives should share time equally and display a similar amount of knowledge and understanding of topics.
- Team members: The official team presenters (limited to three students) must be the same as the city presentation representatives.

Q&A Resources

- City 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.

Competition Scoring

The City Q&A is judged at the museum competition. Make sure students are able to show both knowledge and understanding of the concepts in the rubric in order to maximize points:

Knowledge & Understanding - 28 points

Delivery - 14 points

Total - 42 points

City Q&A Practice Questions

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

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 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?

City Design, Systems, & Operations

- 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?
- 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?
 - How does your city's design ensure equal access and opportunity for people with disabilities?

Climate Change Challenge

- What climate change impact did your team decide to address? Share how it affected your city and your residents.
- What trade-offs did your city have to make to implement its climate change adaptation?
- What innovative and futuristic technologies is your city using in the production of its power, and how has this reduced or eliminated carbon emissions?
- What is the most futuristic part of your city's climate change solution?

City Presentation 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 with additional distinctive features.
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I. Content & Delivery (35 Points)	0	1	2	3	4	5
1. Overall Presentation Content - Major elements: intro, body, and conclusion - Logical flow and transitions - Supporting details	Disorganized, and no major elements were addressed.	Poorly organized and missing major elements. Few supporting details.	Fair organization. Contains major elements. Some details and transitions, but ideas could be more developed.	Contains all major elements and good transitions. Details could be clearer.	Well organized and contains all major elements. Very good supporting details.	Extremely well organized. Effective variety of supporting details. The 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.	Not very creative. Needs more practice. Poor balance of student presenters and visual aids.	Somewhat creative and confident. Poor balance of presenters and visual aids.	Creative and confident. Good Balance of student presenters and visual aids.	Most of the team delivered very creative and confidently. Good balance of student presenters and visual aids.	The entire team delivered extremely creatively and confidently. Good balance of student presenters and visual aids.
3. City Overview & Chosen Climate Impact - Location - What makes the city special, and why do people want to live there? - Overview of climate change impact on city and resident's lives	No description	Underdeveloped overview does not provide basic information.	Fair overview. Lack of sufficient details.	Good overview supported by sufficient details.	Very 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, health care, fire, etc.)	No description	Underdeveloped description. Lack of detail about infrastructure and services.	Fair description. Some details about infrastructure and services. Not very futuristic or innovative.	Good description. Many details about infrastructure and services. Somewhat futuristic.	Very good description. Many details about infrastructure and services. Futuristic.	Highly detailed and thorough description of infrastructure and services. Very futuristic.
5. Climate Change Challenge Solutions - Adaptation (reduction of harmful impacts) - Mitigation strategy	No description	Brief mentions of adaptation and mitigation, but offers little detail.	Fair explanation of adaptation and mitigation but lacks necessary detail.	Good description of adaptation and mitigation. Supporting details could be improved.	Very good description of adaptation and mitigation. Many supporting details.	Excellent description of adaptation and mitigation, variety of thorough, supporting details.

City Presentation 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 with additional distinctive features.
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I. Content & Delivery (35 Points) (Continued)	0	1	2	3	4	5
6. Use of Demonstration Aids - Use of model - Additional visual aids (if used) are well-prepared, legible, and relevant - Enhance rather than distract from presentation	Model not referenced. No other visual aids.	Model is not used effectively. Other demonstration aids poor 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 generally add to the presentation.	Model used effectively to illustrate city design, function, and innovations. Other visual aids are very good and enhance the presentation.	Extremely creative, integrated use of model contributed to the understanding of city design and function and innovations. Other visual aids are excellent.
7. Team Work - Team members supported each other - Team members shared time equally	No evidence of teamwork.	A small amount of collaboration among team members but more support of one another is needed; one or two tend to dominate.	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 most members.	Very good collaboration, support, and sharing among the team. Equivalent knowledge level for most of the team.	Excellent collaboration, support, and sharing among team members. All members display thorough knowledge.
II. Engineering and Technology (15 Points)	0	1	2	3	4	5
8. Engineering Design Process Discusses the application of the engineering design process to their project	No discussion.	Little or no discussion of the engineering design process.	Underdeveloped discussion of the engineering design process.	Good discussion of the engineering design process and how they applied it.	Very good discussion and understanding of the engineering design process and application to Future City projects.	Excellent discussion and understanding of the engineering design process and application to Future City project.
9. Engineering and Roles Demonstrates knowledge of engineering roles in city design and operation	No mention of engineering roles.	Mentions engineering, but little discussion of roles.	Demonstrates limited knowledge and understanding of engineering and roles.	Demonstrates good knowledge and understanding of engineering and roles.	Demonstrates very good knowledge and understanding of engineering and roles.	Demonstrates excellent and thorough knowledge and understanding of engineering and roles.
10. Risks, Trade-offs, & Compromises - Discusses potential risks and benefits - Analyzes trade-offs	No mention of risks, benefits, or trade-offs.	Little mention of risks, benefits, or trade-offs.	Some discussion of risks, benefits, and trade-offs.	Good analysis of risks, benefits, and trade-offs.	Very good analysis of risks, benefits, and the trade-offs made.	Excellent and thorough analysis of risks, benefits, and trade-offs.

City Q&A Rubric

0
Inadequate
Quality

1 or 2
Poor – Fair
Quality

3 or 4
Satisfactory –
Average
Quality

5 or 6
Good – Great
Quality

7
Exemplary
Quality

SCORES

I. Knowledge & Understanding (28 Points)	0	1 – 2	3 – 4	5 – 6	7	
1. Engineering & Technology Demonstrates understanding of engineering & technology	Provides little or no details & shows no understanding	Answers questions with limited details. Understanding of concepts seems to be lacking.	Answers questions adequately, but detail could be better. Decent understanding of concepts	Answers questions clearly with sufficient details. Good Understanding of concepts.	Answers questions clearly & thoroughly. Elaborates with related details. Excellent understanding of concepts.	
2. Team Work Demonstrates understanding of climate change impact, adaptation, and mitigation strategies	Answers questions with little or no details. Shows little or no understanding of concepts.	Answer questions with limited details. Understanding of concepts seems to be lacking.	Answers questions adequately, but details could be better. Decent understanding of concepts.	Answers questions clearly with sufficient detail. Good understanding of concepts.	Answers questions clearly and thoroughly. Elaborates with related details. Excellent understanding of concepts.	
3. Teamwork & Project Management - Demonstrates understanding of teamwork - Demonstrates knowledge of PM concepts	Answers questions with little or no details. Shows little or no understanding of concepts.	Answers questions with limited details. Understanding of concepts seems to be lacking.	Answers questions adequately, but could use more detail. Decent understanding of concepts.	Answers questions clearly with sufficient details. Good understanding of concepts.	Answers questions clearly and thoroughly. Elaborates with related details. Excellent understanding of concepts.	
4. City Design, Systems, & Operations - Demonstrates understanding of components that make a city livable - Understanding of systems and operations needed for city to function	Answers questions with little or no details. Shows little or no understanding of concepts.	Answers questions with limited details. Understanding of concepts seems to be lacking.	Answers questions adequately, but details could be better. Decent understanding of concepts.	Answers questions clearly with sufficient details. Good understanding of concepts.	Answers questions clearly and thoroughly. Elaborates with related details. Excellent understanding of concepts.	

City Q&A Rubric

0
Inadequate
Quality

1 or 2
Poor – Fair
Quality

3 or 4
Satisfactory –
Average
Quality

5 or 6
Good – Great
Quality

7
Exemplary
Quality

SCORES

5. Risks, Trade-offs, & Compromises Team refers to model (or visual representations) while presenting	Model/model segments are not referenced at all.	Few references to model/model segments	Some references to model/model segments.	Some references to model/model segments. References	Frequent references that enhance the team's answer.	
6. Collaboration - Team Members displayed a similar amount of knowledge - Team members shared time equally	Little or no collaboration and sharing. Unequal levels of knowledge.	Below–average collaboration and sharing. Unequal knowledge: one or two dominate.	Average collaboration and sharing. Knowledge level seems similar among team.	Very good collaboration, support, and sharing among the team. Equivalent knowledge level for most of team.	Excellent collaboration and sharing among team members. All three team members display thorough knowledge.	
						Total Score

Expense Form Instructions

List every item used for your model, presentation, or other project materials. If you bought an item, list the actual cost. If it was donated or reused, list a reasonable estimated value. ALL MATERIALS must be listed. Giving an incorrect or misleading value for materials will result in a 20-point deduction.

FAQ's

1. *Why is there a \$100 limit?*

The \$100 limit helps keep the competition fair for every team and encourages creative use of recycled materials.

2. *When can we assign a zero value?*

Items that would normally go into a home or school recycling bin or the trash may be listed as \$0. Examples include paper, plastic bottles, glass jars, metal cans, bottle caps, used plastic utensils, and used-up batteries.

3. *How do we figure out the fair market value?*

Items that have been donated or 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. You can determine fair market value or salvage value by checking prices at a yard sale, auction, classified ad, surplus store, e-recycling service, etc.

4. *What about items we take apart?*

If you take apart computers, electronics, or other objects to reuse their parts, those parts still need a value on the Expense Form. Use a reasonable scrap or resale value.

Sample Expense Form

Description of Material	Purchased	Donated	Recycled	Value
Assorted Paint from parents garage	☐	☒	☐	\$2.00
Two 1-liter soda bottles	☐	☐	☒	\$0
Egg Carton	☐	☐	☒	\$0
Toy Train	☐	☐	☒	\$.50
Motherboard from scrapped computer	☐	☐	☐	\$2.50
Total				\$5.00

Expense Form

Description of Materials	Purchased	Donated	Recycled	Value
Total				