ECO-CITY CHALLENGE

Sustainable City Design Contest

HANDBOOK

2024

Design - Create - Present

Cradle of Aviation Museum is proud to present the inaugural "Eco-City Challenge" where students work together to create a sustainable city model. Participants gain valuable critical thinking, problem solving and teamwork skills through this transformative experience.

www.cradleofaviation.org

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Contest Guidelines

- The competition is open to Middle and High School students.
- You may have groups of 3-5 students working together. You may have an adult mentor from the engineering community or in a technical field participate in the project, but they may not answer questions from the judges or present the model on competition day.
- There are 3 parts of this project that will be scored using the attached rubrics; The City Model, The Presentation w/Q&A, and the Project Plan. A team can earn a total of 167 possible points in total.
- Teams must design an original model, made by all members of their current team (it is not permitted to re-use previous year's designs).
- No perishable food items or live animals may be used. If water is used it must be self contained or drainable.
- 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 self-contained (e.g. a household battery and simple circuit). Use of electrical outlets is not permitted.
- The value of materials for the entire project (model materials, presentation, visual aids, costumes, color copying, 3D-printing, etc) may not exceed $100.
- All materials used must be listed on the competition expense form with their value documented.
    * This includes any donated items*

Contest Guidelines

- Rotating models are accepted, and will be measured from the tabletop up.

- Use of 3D printers for any model materials must be valued using the following:

  Regular white printing: $2 per cubic inch
  Color 3D printing: $5 per cubic inch

- Student presentations may not exceed 7 minutes. When the timer signals, the team must end their presentation. The Q&A session is immediately following and will take 5-8 minutes.

- Technology of any type may not be used for 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 Eco-City Challenge, students are required to develop a comprehensive Project Plan consisting of four parts to effectively manage their work, maintain focus, and adhere to deadlines while completing project deliverables.

Let's break down what a Project Plan entails and its significance:

What Is a Project Plan?

A project plan is a tool utilized by engineers to organize their tasks, set goals, outline strategies for completing deliverables, and monitor progress throughout the project duration.

Participants in the Eco-City Challenge utilize the Project Plan to guide their research and design processes, akin to a flexible roadmap that evolves as the project unfolds.

Project Plan Structure

The Project Plan consists of four distinct parts aligned with stages of the project management cycle: Define, Plan, Do, and Review.

Each part is submitted as a separate document, with specific due dates for completion.

Project Plan Requirements

All parts of the plan are due to the museum (by electronic submission) on May 20, 2024.

The Project Plan template provided offers guidance on content requirements and formatting. Teams have the flexibility to tailor the Project Plan to suit their project's needs, team dynamics, and preferred working style.

Competition Scoring

Completion of all four segments of the Project Plan, submitted in full and on time, earns teams 10 points.
Incomplete or late submissions will receive 5 points.
Failure to submit a Project Plan results in zero points.

Project Plan Resources

A Project Plan template is provided to assist teams in structuring their documents effectively.
Teams are encouraged to utilize the template and allocate sufficient space for each section. No strict page limitation is imposed on any segment.

Project Plan Template: Set Goals

Project Planning Instructions

As you embark on your project, it's essential to establish clear goals, identify available resources, recognize potential constraints, and address any assumptions you and your team may have. Follow the instructions below to complete your Set Goals project plan effectively.

1. Project Resources
   - Define the resources necessary for completing your city model, including:
     - Equipment and supplies required.
     - Storage options for your model during the construction phase.
     - Individuals to interview or seek assistance from.
     - Desired team skills such as writing, presentation, or research abilities.

2. Project Obstacles
   - Identify factors that may limit your team's ability to accomplish tasks, such as:
     - Budgetary constraints within the $100 limit.
     - Adequacy of team members to fulfill all tasks.
     - Impact of competition rules on project execution.

3. Assumptions
   - List assumptions regarding aspects you believe to be true or potentially true, addressing:
     - Perceived difficulty levels of project components.
     - Existing commitments of team members.
     - Time availability for project involvement.

4. Project Goals
   - Define overarching objectives to be achieved by the project's completion, including:
     - Learning objectives.
     - Teamwork dynamics and collaboration goals.
     - Balancing enjoyment and productivity.

Project Plan 1: Set Goals
Team

Name:_____

Organization/School:_____

Educator:_____

Team Goals
Come up with at least three goals related to sustainability in your city.

Goal

1:_____

Goal

2:_____

Goal

3:_____

Goal

4:_____

Brainstorm resources, obstacles, and assumptions for your project.

Resources:

Obstacles:

Assumptions (things that you think are true or might be true):

Project Plan 2: Schedule

Instructions for Creating a Project Schedule

Creating a project schedule is essential for keeping your team organized and on track. Follow these organized instructions:

1. Establish Milestones & Tasks
   - Identify milestones, which are critical points in the project timeline.
     - 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 specific tasks needed to accomplish them.
     - Examples of tasks include
       - Researching cities using electric-powered sources
       - Deciding the city's location.
   - Write milestones and tasks for each deliverable on index cards or in a shared spreadsheet.
   - Consider using different colors for each deliverable to more easily tasks for each.
2. Put Tasks in Order
   - Arrange tasks for each deliverable in a logical sequence.
   - Consider task dependencies, *i.e.* one task must be completed before starting another.
   - Review the model rubric before building the model or model segments.
3. Estimate the Time Each Task Will Take
   - Estimate the time required for each task and record it on your team schedule.
   - Be prepared to update time estimates as work progresses.
4. Make Role Assignments
   - Consider each team member's strengths and interests.
   - Assign tasks based on individual skills and preferences.

- Ensure fair distribution of work among team members.
- Record assigned roles as the schedule forms.

5. Maintain the Schedule
    - Create a full schedule on a bulletin board, whiteboard, or shared online spreadsheet.
    - Track tasks and progress; review and revise the schedule as needed.
    - Adapt to changes that may occur during the project.
6. Show Us Your Style!
    - Include an image of your schedule in the Project Plan deliverable.
    - Choose a format that suits your team's preferences, such as a wall calendar or shared online calendar.

Project Plan 2: Schedule

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.

Project Plan 1: Set Goals

Project Plan 3: Check-in
Check-In Instructions:

To ensure progress and meet deadlines effectively, conduct regular check-ins with your teammates. At least one check-in should be documented and included in your Project Plan deliverable. Follow these organized instructions:

- Purpose of Check-Ins:
    - Check-ins are essential for monitoring progress and ensuring adherence to deadlines.
    - Most check-ins can be conducted through quick conversations.
- Documentation Recommendation:
    - Choose a significant point in your project for documentation.
    - Document instances such as problem-solving, critical revisions, or achievement of major milestones during a check-in.
    - Submit the documented check-in as part of your Project Plan to illustrate key project developments.

Project Plan 3: Check-in

Team

Name:_____

Organization/School:_____

Educator:_____

Project Plan 1: 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 lessons have you learned so far that you can apply to other areas of this project?

Check the schedule. What adjustments do you need to make?

Project Plan 1: Set Goals

Project Plan 4: Reflect
Team

Name:_____

Organization/School:_____

Educator:_____

Team Reflection

Look back at your original project goals. Did your team meet your stated goals? Were some goals met more than others?

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.

How well did your team work together? What have you learned about being a part of a team that you did not know before?

What was the most valuable experience you gained from this competition?

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:

Students are tasked with constructing a physical representation of their envisioned city using recycled materials, while demonstrating sustainability initiatives within their design. The model should incorporate at least one moving part, adhere to scale, and remain within a $100 expense budget.

Introduction to Model Building:

Explain to the team the significance of models in various fields such as engineering, architecture, science, and city planning. Models serve as effective tools for communicating ideas, sharing research findings, and predicting design success.

Model Options:

Teams have two options for their city model:

- Option 1: Build a single comprehensive model.
- Option 2: Construct multiple model segments representing different city sections.

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 adhere to overall size restrictions when placed together on a tabletop.
- Extended parts like access doors or compartments are permissible if fully self-supported or removable.

Scale

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

Moving Part

- Each model must incorporate at least one moving part. Individual segments are not required to have their own, but at least one per team is mandatory.

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 essential team information for judges, including city name, school/organization name, names of presenting students, educator, mentor, and model scales used.

General

- Prohibited 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 judges 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**
   - Encourage students to explore yard sales or their own family's garage/basement for items like bottles, tins, or buttons.
2. **Old Toys**
   - Mention that 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 repurposed for the model.
4. **Obsolete Electronics**
   - Suggest considering 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 incorporated into the model's design?

4. Scale Selection
- What scale(s) will work best for your model? Remember, teams may utilize 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 incorporate 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 innovative 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

Enhancing your city model with detailed elements 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 using 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:**
    - Utilize 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 essential to ensure that it can be repeatedly activated and serves a purpose relevant to the city's function. Here are some innovative ideas for moving part mechanisms:

1. **Rubber Bands:**
   - Utilize rubber bands to create kinetic motion within your model, such as moving vehicles or machinery.
2. **Heat:**
   - Incorporate 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:**
   - Employ weights to power mechanisms, allowing for controlled motion in various components of your city model.
5. **Springs:**
   - Integrate springs to generate kinetic energy and facilitate movement, mimicking actions like opening doors or raising platforms.

6. Pulleys:
- Implement 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, demonstrating the principles of electricity and circuit design.

Designing your moving part from scratch or creatively modifying existing items will enhance your model's authenticity and earn more points from judges over prebuilt items. This presents an excellent opportunity to delve into the physics of simple power sources while showcasing your understanding of scientific concepts and engineering principles.

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 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 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 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 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 examples 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	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.

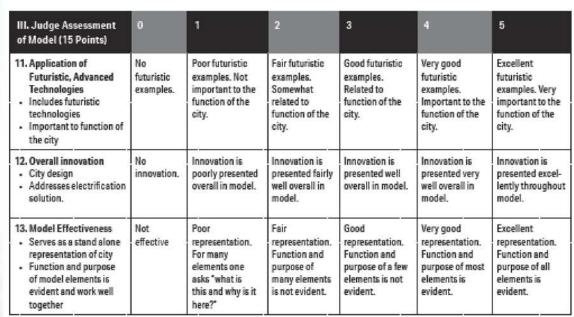| II. Build It: Quality, Scale, & Materials (20 Points)	0	1	2	3	4	5
7. Innovative Construction • Variety of materials • Imaginative, unusual, or noteworthy materials • Creative modifications of recycled materials	No creativity or innovation. No recycled/repurposed materials.	Very little creativity and 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.

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.
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: City Model

City Presentation

Students have up to 7 minutes to present their future city and solutions to this year's challenge. 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 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 during a live 8-minute question and answer session about their future city with judges from engineering and technical fields. Students should strive to demonstrate knowledge and understanding of all aspects of their project. Engineers must understand the projects they are working on and be able to answer questions clearly and concisely. For this deliverable, students develop critical thinking and communication skills by answering questions that demonstrate an understanding of engineering and their 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

Student Handout

City Q&A Practice Questions

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

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?

Presentation Rubric

City Presentation Rubric

Deliverable: City Presentation

	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. 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 addressed.	Poorly organized and missing major elements. Few supporting details.	Fair organization. Contains most 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. 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.	Very creative and confident delivery by most of team. Good balance of student presenters and visual aids.	Extremely creative and confident delivery by entire team. 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 residents' lives	No description.	Underdeveloped overview does not provide basic information.	Fair overview. Lacks 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, healthcare, fire, etc.)	No description.	Underdeveloped description. Lacks 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 with variety of thorough, supporting details.

Presentation Rubric

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.
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 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. Teamwork • 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 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 engineering design process.	Underdeveloped discussion of engineering design process.	Good discussion of engineering design process and how they applied it.	Very good discussion and understanding of engineering process and application to Future City project.	Excellent discussion and understanding of engineering design process and application to Future City project.
9. Engineering and Roles • Demonstrates a 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 or trade-offs.	Little mention of risks, benefits, or trade-offs.	Some discussion of risks, benefits, or 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.

Deliverable: City Presentation

Q&A Rubric

2022 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 Pts)	0	1-2	4-5	5-6	7	
1. Engineering & Technology • Demonstrates understanding of engineering & technology	Provides little or no detail & shows no understanding.	Answers questions with limited details. Understanding of concepts seems to be lacking.	Answers questions adequately, but details could be better. Decent understanding of	Answers questions clearly with sufficient details. Good understanding of concepts.	Answers questions clearly & thoroughly. Elaborates with related details. Excellent understanding of	
2. Climate Change Challenge Theme •Demonstrates understanding climate change impact, adaptation, and mitigation strategies	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	
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 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.	
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.	
II. Delivery (14 Pts)	0	1-2	4-5	5-6	7	
5. Use of Model • Team refers to model (or visual representations) while	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 team's answers.	
6. Collaboration • Team members displayed similar amounts 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

All teams must provide a complete list of all items used in your model, your presentation, or any part of your deliverables. Include actual costs if items were purchased or a reasonable cost estimate if items were donated or repurposed. ALL MATERIALS must be listed. Misrepresenting the value of any of your materials will result in a 20 point deduction off your score.

FAQ's

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.

3. **How do we figure out the fair market value?**
Items that have been 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 value or salvage 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. Scrapmonster.com is a good place to start.

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 Material	Purchased	Donated	Recycled	Value
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
Total				

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