Sustainability Challenge
Event Specifications
MESA Day 2025

LEVEL:	Middle School/High School
NUMBER OF TEAMS:	One (1) team per school can participate at the MESA Day state competition. Up to three (3) teams can participate at MESA regional events.
TEAM MEMBERS:	Two (2) to Six (6) Students per Team
OBJECTIVE:	Students will design and present a Sustainability idea for a site in their community that is centered around an art installation with sustainable renewable energy features, which can include solar, hydro, wind, and biofuels. Teams will create a model and poster to present their idea. Teams can use current technology or future technologies (i.e technologies that will be available in the next five years) HS Teams Only – will need to estimate cost. The model and display will be designed and constructed prior to the event.
MATERIALS:	Model - All materials are allowed. Students are **heavily encouraged to use recycled materials** for physical models. Digital models are NOT allowed. Academic Posters– 36" x 48" digital poster (PDF)

REASONING

The global use of energy has evolved over time. Before about 1880, the main energies came from wood, charcoal, and crop residue. As demand increased, coal became the primary energy producer. Other popular energies came from steam and water. In modern times, nuclear energy also became popular. In the last 30 years, societies are moving towards renewable energies such as solar, wind, and biofuels.

Current solutions being proposed or implemented are ideas such as solar panels over water canals, pairing ollas and solar panels, solar powered gardens, water filtration for cooling homes, energy collection sites (solar, water, wind turbines) to distribute energy, and many more.

Many times, new engineering innovations fail not because of the technology, but because of social issues - people may not like the way a new technology looks, or they might not trust that it will be good for the community. Beauty and aesthetics can be an important part of integrating renewable technologies in a community. Your challenge is to design a relevant art installation that has significance to the community as well as serve as a feature of sustainability. *"Art is solving problems that cannot be formulated before they are solved. The shaping of the question is part of the answer." – Pete Hein*

DESIGN PARAMETERS:

1. Teams must design a project that improves sustainability in their community.
    a. In 1987, the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." This project should focus on identifying situations, systems, or processes in their community that are unsustainable and finding ways to change them to be more sustainable.
    b. Teams should refer to the UN Sustainability Goals, especially goal 11, as a resource while creating their design. Students must reference how the goals influenced their project in their poster and in their presentation. More info about the goals can be found at https://sdgs.un.org/goals.
2. Projects must be planned for a physical site located in their community. Students should define how they defined "*community"* for their project and how they selected their site on their poster and in their presentation.
3. Designs should be constructed sturdy and durable enough to withstand a minimal amount of movement (i.e. transportation to competition, table movement, judges handling).
4. Every effort should be made to construct the model from recycled/re-used materials.
5. Model Requirements:
    a. Site dimensions – labels should define the physical dimensions of the geographic site location selected for your art installation. Models should be to scale and the scale used should be included.
    b. Key energy features
    c. The model must be a 3-D model
    d. Working models are highly encouraged, but not required. If a team is proposing to use a near or far-future technology, it is highly recommended that they be able to explain how that technology works.
    e. Labels for renewable energy features. Examples include physical changes made, changes made to improve processes (e.g. water flow), and expected energy improvements
    f. Project Title
    g. School and Team Members Names
    h. MESA and School Logo
6. Academic Poster Requirements
    a. Must be designed as a 36" tall by 48" wide digital slide.
    b. Project Overview – in a 100 words or less, team explains the project's purpose, who it serves, and how it improves energy collection and distribution in their community. Includes a discussion of the team's next steps.
    c. Design Graphics – digital representations of your project with key features identified and labeled.
    d. Picture of Site - use GIS picture of geographical site to be used for installation.
    e. Description of the renewable energy technologies used in the project (e.g., type and number of solar panels, number and size of wind turbines, type of biofuels)

   f. Project Data – teams should have two (2) charts or graphs that share essential data from the project. Data should help the reader understand how the project improves a transition toward more sustainable energy systems for their community. If using future technologies, data can be estimated and/or anticipated data. One data graphic **MUST** include data of energy collection estimates of the project.
   g. Project Title
   h. School and Team Members Names
   i. MESA and School Logo
   j. HS Only – Projected Costs of materials and installation. Can be an estimate.

7. Presentation Requirements
   a. Introduction of Team Members - should at least include first name and school..
   b. Discuss how the team:
      i. Used the UN Sustainability Goals to influence the project goals and purposes
      ii. Identified the method for energy collection
      iii. Selected Project Goals
   c. An overview of how the project improves energy collection in their community, including a description of the project's key features.
   d. How the art installation is relevant to the community's needs, values, and strengths, and helps promote energy collection
   e. estimate the amount of electrical power that would be generated by your art installation and explain how that electrical power would be used by community members.
   f. HS Only – Project Costs and timeline for installation. Can be an estimate.

TESTING PARAMETERS:

1. Two (2) team members are required to be present during testing
2. Team will conduct the presentation using the poster and model as visual aids.
3. The judges will ask questions about the project.

SPECIFICATION CHECK:

1. Teams will submit their design poster a minimum of two (2) weeks before competition for judging. MESA will notify schools when a deadline is set.
2. Teams must arrive during the designated specification check time. Teams not arriving during spec check will receive a performance score of zero. See event agenda for exact times.
3. During specification check, teams will check in to the competition area and submit their physical models for inspection to ensure the design conforms to dimensions, materials, and construction rules, and to confirm their presentation time.
4. After clearing specification check, all physical models will be impounded until the time for presentation.

JUDGING:

1. Team will arrive at testing site ten (10) minutes prior to testing time
2. Team will have at maximum, seven (7) minutes to present their sustainability project
3. Teams that go the seven minutes will be assessed a penalty. The penalty will be 5 points.
4. Judges will have at maximum, three (3) minutes to ask questions about the project

SCORING CRITERIA:

Teams will be judged on:

1. Presentation (36 points)
2. Model (19 points)
3. Poster (31 points)

RESOURCES

Aspects of project that might be emphasized: https://padlet.com/michelle_e_jord/pvsc-library-kud13ira3hp0b22g

Land Art Generator: https://landartgenerator.org/index.html

Organic Photo Voltaics https://www.energy.gov/eere/solar/organic-photovoltaics-research

Hydroelectric Power Generation formula with explanation: https://renewablesfirst.co.uk/renewable-energy-technologies/hydropower/hydropower-learning-centreold/how-much-power-could-i-generate-from-a-hydro-turbine/

Wind Energy Power Generation formula with calculator:
https://x-engineer.org/wind-turbine-energy/

Solar Power Generation formula:

$P_S = .2 * P_{SL} * SA * PE$

P_s = Power of the system in Watts

P_{SL} = Power at sea level. Is a constant. 1000 Watts/meter^2

SA = Surface area of Photovoltaic cells in meter^2

PE = Photovoltaic efficiency. Usually between 10-20% (.1-.2)

Example: A system with a surface area of 1500 m^2 and an efficiency rating of 12%

$P_s = .2 * 1000 * 1500 * .12 = 3600$ W

School: _____

Student Names: _____

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Specification Check	**Pass**	**Fail**
1. Team arrived on time for specification check	Yes	No
2. Team has a model for presentation	Yes	No

If the answer is No for any of the above checks, the team is disqualified.

Poster	
Model	
Presentation	
Total Score	

Judge's signature: _____

Student signature: _____

Comments:

Poster Rubric

Category	Excellent (3 points)	Met Criteria (2 points)	Poor (1 point)	Not Present (0 points)
Project Overview - In 100 words or less, team explains the project's purpose, who it serves, and how it improves energy collection and distribution in their community. Includes a discussion of the team's next steps				
Design Graphic 1 – graphic presents the design and helps the reader understand how the project addresses renewable energy				
Design Graphic 2 – graphic presents the design and helps the reader understand how the project addresses renewable energy				
Design Features – Team describes their design with callouts to key features on graphics				
Data 1 – Team has a graphic of data that helps the reader understand the energy production of the art installation.				
Data 2 – Team has a 2nd graphic of data that helps the reader understand how the project improves renewable energy				
Picture of Site - Team includes a picture of the site.				
Description of Renewable Energy - Description of the renewable energy technologies used in the project (e.g., type and number of solar panels, number and size of wind turbines, type of biofuels)				
Cost of Project (HS Only) - Team provides an estimate of materials and construction.				
Project Title	[redacted]		Yes	No
School & Team Member Names			Yes	No
School Logo			Yes	No
MESA Logo			Yes	No
Column Totals				
			Total Score:	

Model Rubric

Category	Excellent (3 points)	Met Criteria (2 points)	Poor (1 point)	Not Present (0 points)
Dimensions –Model is to scale and shown within the site, with dimensions, for installation.				
Key Renewable Energy Features – Energy features on the model are clear and obvious.				
Labels – sustainability features are clearly labeled and easy to understand.				
Working Model – the model demonstrates how the project improves sustainability in a non-static way				
Aesthetics & Resemblance – the model appears to be an accurate representation of the site and shows careful attention to detail				
Project Title			Yes	No
School & Team Member Names			Yes	No
School Logo			Yes	No
MESA Logo			Yes	No
Column Totals				
			Total Score:	

Presentation Rubric

Category	Excellent (3 points)	Met Criteria (2 points)	Poor (1 point)	Not Present (0 points)
Introduction			Yes	No
UN Sustainability Goals – includes a clear explanation of how the UN goals influenced their project.				
Energy Collection - Team clearly identifies how they are going to collect the energy (i.e. solar, biofuel, etc.).				
Project Goals Team describes how the project improves energy collection, including key features				
Project Relevance – Team explains relevance of project to community needs, values, and strengths				
Project Impact – Estimation of energy generated by the art piece.				
Project Influence - Team explains how the project will promote renewable energy collection				
Project Cost (HS Only) - Team explains an estimated cost to construct and install their project				
Flow: The ideas/concepts flowed well together				
Organization: The information presented was well organized and easy to follow				
Transitions: All transitions are smooth				
Teamwork: The team worked well together				
Model & Poster Usage: Model and poster were used effectively to highlight important points or features				
Column Totals				
Time Penalty: Team was over the 7 minute maximum (-5 points)				
			Total Score:	