

Energy Transfer Machine Rules

These rules are for the Energy Transfer Machine in-person competition at the Orange County STEM Saturday event, which includes a team interview to be conducted during STEM Saturday.



Student teams are challenged to transform everyday materials into unusual, Rube Goldberg-type machines to accomplish a team-specified task using a variety of energy transfers including power from a battery. The team must also record a video of their ET Machine performing its various energy transfers from start to finish, and submit their video for judging on a team created web page.

Energy Transfer Machine is open to teams of 1 - 6 students in grades 3 - 12. The competition is divided into three divisions: Elementary (3rd - 5th grade), Middle School (6th - 8th grade) and High School (9th - 12th grade). Teams of mixed grade levels will compete in the division of the highest grade level student.

Machine Specifications

The size, shape and dimensions of the ET Machines are not limited. However, it must be designed so that it is possible to take a video of the performance of the ET Machine from start to finish from a single camera without using cuts or edits in the taping.

The machine shall

- perform a team-specified operation at the one (1) minute mark as the final step of the machine.
- have a minimum of five (5) steps in completing its team-specified task with at least one (1) step powered by electricity provided by batteries (not to exceed a total of 9 volts).
- demonstrate a series of energy transfers. Identical transfers of energy in succession (such as a row of dominoes falling into each other) are considered one step.
- not use any actual timing devices manufactured for that purpose.
- be constructed solely of parts provided by the team. Individualized components may be purchased, but the entire machine must be designed, assembled and when possible, fabricated by students. All component and fabrication choices must also be made by student team members.
- not use animals, hazardous materials, explosives or flames.
- not imply nor convey profane, indecent or lewd expressions.
- be safe and not pose harm to anyone or anything.

The machine may use programmable logic controllers or any other electronic controller; however, the programmable logic controller must not use any internal timer.

Video Specifications

1) Introductory Segment

At least one team member is required to clearly narrate and be on-screen in the introductory segment. A non-team member may do the video recording, but non-team members on-screen will result in disqualification. In this introductory portion, the narrator(s) will include:

- school name
- project or machine name

- how electricity is used in their machine
- a description of the various steps and energy transfers in their machine. As the steps and energy transfers are described, those areas of the machine pertaining to that step should be pointed to by the narrator (or other team member) and shown in the camera view.
- what the machine will do as its final task at the 1 minute mark.

This part may be edited and/or pieced together. However, this sequence may not exceed 3 minutes in duration or judging points will be deducted.

2) Machine Run

- At the beginning of the **machine sequence** of the video, the announcer will say, “Ready, Set, Go” for the official timing process to begin. No edits are allowed to the machine portion of the video from the point where the narrator says, “Ready, Set, Go” to the completion of the ET Machine’s final task. Any edits to this portion of the video will be grounds for disqualification.
- The clock will be stopped and time recorded when the team designated, one-minute, final task occurs. If any team member interacts with, interferes, or assists their machines once time has started, the machine timing (for the precision score) will stop at that point. However, judging for other criteria continues.

It is expected that the video of your most successful run (from start to finish – no edits) will be submitted for judging on competition day. Take advantage of the opportunity to record your machine multiple times to get the best run documented.

The two parts of the video (introduction and machine run) may be edited together into one video, or they may be posted on the team’s web page separately.

Tips for better quality ETM videos

- Turn your phone on it’s side. Wide videos look better on screen.
- Speak up! Pretend you are on a stage and you need to talk to a person who is in the back of the auditorium.
- Light it up! Turn on all available lights. If you are outside, make sure the sun is to the back of the camera operator.
- Record the video at the largest size and highest quality settings available.
- When you export your video, don’t compress it too heavily. Upload a large video file to maintain the quality.

Team Web Page Submission

Each team will populate a web page on the EnergyWhiz site (using Wordpress) that showcases their Energy Transfer Machine. These pages will be used to judge the project, and will be viewed by other students and the public.

The web page must include:

1) Photo & Basic Info

- Team, project or machine name
- School name
- First name(s) of students on the team (no last names on the public page)
- Grade level of each team member
- A still photo, possibly a close-up of one section of the ET Machine (use this as the featured image on your page)

2) Design Documentation

- Photos - a minimum of four close-up photos of parts of the machine that you want to showcase
- A list of the steps/energy transfers that your machine goes through
- A statement of how you used the electricity from the battery(s) in your machine
- A statement of what your machine's final step is (for example ringing a bell, or raising a flag)

3) Machine Performance

- The video will be hosted on our Vimeo site and included in your web page. The two parts of the video (introduction and machine run) may be posted separately or as one video.

These are the minimum requirements for the web page. However, teams are encouraged to use the judging criteria as a guide to what extras they may want to include in their web page. For example, the web page **may** include:

- an explanation of the theme used in the machine
- extra photos of the construction process
- team explanation of the challenges encountered while building or testing their machine
- drawings made during the planning stage of the layout of the machine
- list of internet sites and/or videos watched to get ideas for their machine
- explanation of unusual parts or segments constructed by the team members for the machine
- any items that the team feels will showcase the complexity of their machine, or be helpful to the judges to pick them as the winning team!

Energy Transfer Machine web page submissions are due approximately one week before the opening of the event. The exact deadline will be communicated to the team by the OCPS STEM Saturday officials.

During the week leading up to the event and during OCPS STEM Saturday itself, all Energy Transfer Machine pages will be available for public viewing. Students are encouraged to share their web page address with family and friends, and to visit other team pages.

Competition Day

During STEM Saturday, team interviews will be conducted by the judges. Teams of one or two members must have at least one member present; teams of three - six students must have at least two team members available for the interview. The judges will review the team video of the machine run, ask questions about the build, and give the team the opportunity to talk about the process.

Judging Criteria

Overall **1st - 3rd Place Awards** will be given in each division, as well as one combined division **1st Place Precision Award**.

The judges will be looking at:

- **Amount of transfers** - How many energy transfers does the machine use? Was there diversity in the types of energy transfers within the machine?
- **Complexity** - How complex is the machine? (A Rube Goldberg type machine should do a simple

task in a very complex way) Does the machine make use of more complex energy transfers than just domino runs and marble ramps?

- **Battery Usage** - Was the electric power a major step/part of the workings of the machine? Does the machine use the electricity in an unusual way?
- **Craftsmanship** - How well is the machine constructed? Is the machine visually appealing?
- **Creativity** - How creative is the machine? Does it use unusual materials? Does the machine have a theme? Is it interesting?
- **Precision** - How close to the 1 minute mark was the machine run?
- **Video** - Is the video clear, easy to watch, and close enough to see what is happening? Is the audio clear? Did the team explain their device clearly? Did the team fulfill the video requirements?
- **Web Page** - Does the web page effectively showcase the team's project? Is the web page arranged attractively? Does it show creativity? Is it enjoyable?
- **Interview** - Did the team answer the interview questions completely? Did all of the team members contribute to the ETM process? Do the team members understand the concept of energy transfer?

One 1st Place Precision award (combined divisions) will be given to the team whose machine's final action comes the closest (+/-) to the one minute mark.