New Mexico Electric Car Challenge
A Collaborative STEM Program

2021 Guidelines
The New Mexico Electric Car Challenge provides an opportunity for middle school students to work together in a team to develop and use applied science and engineering skills, and face technical challenges comparable to those that scientists and engineers face every day. Students get excited about generating ideas in a group and then applying, building and modifying projects. They can see for themselves how changes in their design / project reflects in performance. The role of the teachers / coaches is to nurture the spirit of excitement, joy of discovery and learning that awaits students in the quest of knowledge.

- Present engineer concepts in a fun and exciting way.
- Create and develop teamwork and team-building skills.
- Stimulate creative thinking through a hands-on design project.
- Help develop and enhance research and oral presentation skills.

Basics:
1. Teams consist of 2-6 students.
2. Students in grades 6th, 7th and 8th are eligible to participate.
3. Students may elect to work on different challenges (construction, race, design, and research/oral presentation) – all team members do not have to work on each challenge.
4. A teacher or coach from the participating school must be present in race videos.
5. Each school may register a maximum of 2 teams – each team must have an adult coach.
6. A maximum of 20 teams will be allowed to participate.
7. The competition will be held virtually.
8. Coaches must submit a signed participant release for all student participants.

3 Challenges:

Race Challenge – challenge based the car’s speed (3 videotaped heats)

Design Challenge – challenge based on student demonstration and understanding of the design process (10-minute scheduled virtual interview)

Research Challenge (formerly Orals) – challenge based on student research and presentation on an energy-related topic (5 minute video)
2021 NM Electric Car Challenge

Each Challenge is scored individually, and awards will be provided to the top three teams for each Challenge. In addition, scores for all Challenges will be added to determine the top three Overall winners. Participation in the Research Challenge earns points towards the Overall winners.

**Parade of Cars:**
Students will submit a photo of their car, along with car and team name

**Car Specifications and Design Rules:**

1. Each team is responsible for designing and building an AA alkaline battery powered model racecar.
2. All vehicles must be safe for contestants and spectators (e.g. no sharp edges, projectiles, etc.)
3. The dimensions of the car cannot exceed:
   a. 20 cm in width (7.87 in.)
   b. 40 cm in length (15.75 in.)
   c. 20 cm in height (7.87 in.)
4. The DC motor and AA Alkaline batteries must be used in the design – the battery holder and motor may **not** be modified in any way.
5. The switch on the battery module MUST be used and the module mounted so that the switch moves "side-to-side" or "up and down" when mounted. The switch may be engaged with the car flat on the track, but it is recommended the car be lifted at the back (assuming rear wheel drive) and the car released by dropping the rear while the motor is on and at full speed. The car CANNOT be pushed!
6. The vehicle must be designed to carry a payload of 700g. The mass is up to the discretion of the team. The car will need to weigh at least 700g when raced.
7. Each team provides the parts needed for the construction of the car – wheels, car body/chasses, axles, gears, etc. The motor and battery pack are required!
8. All cars will be inspected – during the design interview and in the race videos.
9. The body may be decorated at the team’s discretion. The car must remain intact for the entire competition – including Design. No body parts can be removed or altered between the Design and Race Challenges.

**Race Challenge Guidelines:**

1. Race heats will take place in your school's gymnasium or other flat surface. (see sample track below)
2. Students will submit videorecording of your cars top 3 heats.
3. Track Requirements:
   a. Track must be 10 meters long – on an even, flat surface.
   b. There must be a highly visible start and finish line
   c. The use of a guide wire is optional

4. Video of the race heat must be one continuous shot and include:
   a. Demonstrate that the track meets the 10-meter requirements (meter sticks, tape measure) - the entire track must be in the frame of the video.
   b. Student shows the side, front, and top view of their car and demonstrates that the car meets the specifications/dimensions:
      i. 20 cm in width (7.87 in.)
      ii. 40 cm in length (15.75 in.)
      iii. 20 cm in height (7.87 in.)
   c. Student shows car being weighed on a scale (must be at least 700g) and ensures the scale measurement is visible on the video, then immediately places car at the starting line
   d. At countdown, all wheels of the car must stay on the track
   e. A student raises a red flag (8 ½ x 11 construction paper) and says “go” to start the race
   f. Another student energizes car by the switch
   g. Cars may not be pushed
   h. The race is timed (cell phone, stop watch, etc.) and the timer shows the race time at the conclusion of the race

5. Instructions will be provided about how to submit videos.
6. Upon receipt of the videos, an email confirming receipt and completeness will be sent.

7. The races will be reviewed by Race judges.
Design Challenge Guidelines:

1. All teams are required to compete in the Design Challenge.

2. Judges will interview the students virtually.

3. Teams will receive notification and instructions for Design interview time.

4. Car inspection - students must show the car and demonstrate that the car meets the size requirements using a measuring tool.

5. Students should be prepared to discuss their design and answer judge questions. Students should not provide a prepared presentation.

6. Scoring will be determined using Design Challenge Scoring (Attachment A).

7. Top teams will be invited to a Finals interview.

Research Challenge Guidelines:

1. Each team is encouraged, but not required, to compete in the Research Challenge.

2. The 2021 presentation topic is: "Why is clean energy important for the environment?"

3. The presentation should be videotaped and be no longer than 5 minutes in length.
4. Submit videos by the deadline. Teams will receive instructions for submitting presentation videos.

5. Upon receipt of the videos, an email confirming receipt and completeness will be sent.

6. The videos will be reviewed by Research judges.

7. Scoring will be determined using the Oral Presentation Rubric (Attachment B).

NMECC Schedule – subject to change:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DATE</th>
<th>TIME</th>
<th>LINK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information to Schools</td>
<td>September 16</td>
<td></td>
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<tr>
<td>Registration Deadline</td>
<td>September 27</td>
<td></td>
<td></td>
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<tr>
<td>Mail Kits/Medals to Schools</td>
<td>September 28</td>
<td></td>
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<tr>
<td>Orientation (optional)</td>
<td>October 5</td>
<td>5:00-6:00pm</td>
<td>Teams</td>
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<tr>
<td>Project Time</td>
<td>October 4 – November 10</td>
<td></td>
<td></td>
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<tr>
<td>Entry of Parade of Cars photos, Research Challenge Video, Race Challenge Videos, and signed Release forms for participating students</td>
<td>November 10</td>
<td>By 5:00pm</td>
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<tr>
<td>Design Challenge Interviews – all teams</td>
<td>November 17</td>
<td>3:30-5:30</td>
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<tr>
<td>Design Challenge Interview s- 6 finalist teams</td>
<td>November 18</td>
<td>3:30-5:30</td>
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<tr>
<td>Awards Ceremony</td>
<td>November 19</td>
<td>3:30-5:30</td>
<td>Zoom</td>
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Awards Ceremony Agenda (draft):

Welcome and Parade of Cars (PowerPoint of all teams)
Career Speaker ~ 10 minutes, battery testing or energy/climate change
Awards
Research Challenge – announce 1st, 2nd and 3rd place and show 1st place video
Race Challenge – announce 1st, 2nd and 3rd place and show videos of top 3 races
Design Challenge – announce 1st, 2nd and 3rd place
Overall – announce 1st, 2nd and 3rd place
**Attachment A**

**Design Challenge Scoring**

<table>
<thead>
<tr>
<th></th>
<th>Basic</th>
<th>2</th>
<th>Intermediate</th>
<th>4</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chassis</strong></td>
<td>Incorporates basic design components of chassis</td>
<td>Incorporates moderate level of sophistication into chassis design</td>
<td>Incorporates high level of sophistication into chassis design and mounting of equipment</td>
<td></td>
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<tr>
<td><strong>Body</strong></td>
<td>Very little in body design and creativity</td>
<td>Incorporates moderate level of sophistication &amp; functionality in body design &amp; application; draws a second look</td>
<td>Incorporates high level of sophistication and functionality, aerodynamics into body design</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Creativity/ Aesthetics</strong></td>
<td>Very little in body creativity (basic paint &amp; attachment)</td>
<td>Some creativity used in the design (unique painting, more interesting than basic design)</td>
<td>Very creative design that also enhance the performance of the vehicle (great aesthetic value; attracts attention)</td>
<td></td>
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</tr>
<tr>
<td><strong>Drive Train Transmission &amp; Gear Application</strong></td>
<td>Uses transmission &amp; gears supplied in kit with basic wheels &amp; tires</td>
<td>Uses kit transmission &amp; gears with modifications; better wheels &amp; tires</td>
<td>Enhanced modifications to transmission &amp; gears to increase torque &amp; speed; enhance wheels &amp; tires</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Construction Quality</strong></td>
<td>Basic construction &amp; materials used; little more than basic kit</td>
<td>Moderate attempt to improve overall construction quality with adherence to detail</td>
<td>Very high quality &amp; detail in construction; well thought out &amp; applied</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall Design</strong></td>
<td>Very little modification to basic kit; simple &amp; effective overall design</td>
<td>More advanced design concept with some modifications; creative; good overall design</td>
<td>Extensive modifications demonstrating an understanding of engineering &amp; physics in the design</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Response Skills</strong></td>
<td>Missing some ideas of the project development &amp; application; lacks eye contact; hesitating in response</td>
<td>Has the main idea and effective in sharing the concept; good eye contact; speaks clearly with confidence</td>
<td>Thorough in concept of the project &amp; able to express it very well; good eye contact; speaks very confidently</td>
<td></td>
<td></td>
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</tbody>
</table>
# Attachment B

## Research Presentation Challenge Scoring

<table>
<thead>
<tr>
<th>Category</th>
<th>Basic 1</th>
<th>Intermediate 3</th>
<th>Advanced 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informative</strong></td>
<td>Missing some main ideas, inaccurate information</td>
<td>Captures main ideas, mostly accurate</td>
<td>Captures main ideas, thorough, accurate, provides good examples, and insightful</td>
</tr>
<tr>
<td><strong>Professional Attitude</strong></td>
<td>Often slouches, sways, turns back on audience frequently, fidgets frequently, hard to hear rare eye contact</td>
<td>Sometimes slouches, sways, sometimes turns back on audience, fidgets, volume too low at times, some eye contact</td>
<td>Stands straight, faces audience, words pronounced and heard clearly, good eye contact</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Information not presented in a logical, interesting sequence; the audience could not follow</td>
<td>Information was interesting but not presented in a logical order; audience had difficulty following</td>
<td>Information presented in a logical, interesting sequence which the audience could follow</td>
</tr>
<tr>
<td><strong>Visual Aides</strong></td>
<td>Utilized less than two different types of media; information not relevant to outcome/content; messy; minimal artistic effort</td>
<td>Utilized two different types of media, information relevant to outcomes/content; messy; adequate artistic effort</td>
<td>Utilized more than two different types of media; information relevant to outcomes/content; very neat; excellent artistic effort</td>
</tr>
<tr>
<td><strong>Time/Flow</strong></td>
<td>Used significantly less or more than allotted time; time punctuated with many pauses and “bridges”</td>
<td>Used less or more than allotted time; time punctuated with some pauses and “bridges”</td>
<td>Used allotted time efficiently; utilized very few pauses and “bridging”</td>
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**Topic:**

“Why is clean energy important for the environment?”
Contacts:

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