New Mexico Electric Car Challenge (NMECC) 2022 Guidelines
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New Mexico Electric Car Challenge Overview

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 their car. They can see for themselves how changes in their design reflects in performance. The role of the teacher/coach is to nurture the spirit of excitement, joy of discovery and learning that awaits students in the quest of knowledge.

- Present engineering 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.
The 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 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 and/or at the in-person event.
5. Each school may register a maximum of 3 teams – each team must have an adult coach.
6. A maximum of 50 teams will be allowed to participate.
7. Teams may participate in either the in-person or virtual event (held on different dates).
8. Coaches must submit a signed participant release for all student participants.

Teacher Workshop (optional)

Date: Saturday, September 24th
Time: 9:00 -12:00
Location: Nex+Gen Academy High School (5325 Montgomery Blvd NE, Albuquerque)
Format: Virtual or in-person (workshop will also be recorded for later viewing)
Three Challenges

1. **Race Challenge**: Challenge based on speed of electric car. In-person - maximum of 5 qualifying runs over a 10-meter course, fastest cars compete in a head-to-head race. Virtual – team submits 3 videotaped heats.

2. **Design Challenge**: Challenge based on student demonstration and understanding of the design process. In-person and virtual – teams will participate in a scheduled 10-minute interview.


Each Challenge is scored individually, and awards will be provided to the top three teams for each Challenge in both the In-Person and Virtual competitions. 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.

The virtual event will also feature a *Parade of Cars* that will feature a photo of each team and their car.
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. In-person – at registration. Virtual – 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.
Challenge Guidelines - Virtual Event

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 event.

Research Challenge Guidelines:
1. Each team is encouraged, but not required, to compete in the Research Challenge.
2. The 2022 presentation topic is: 
   "What are some barriers to using electric cars in New Mexico? What are possible solutions?"
3. The presentation should be videotaped and be no longer than 5-7 minutes in length.
4. Submit videos by the deadline. Teams will receive instructions for submitting presentation videos.
5. The videos will be reviewed by Research judges.
7. Scoring will be determined using the Research Presentation Scoring (Attachment B).
Challenge Guidelines - In-Person

Race Challenge Guidelines:

All cars will be inspected and qualified at Registration. They must meet all vehicle specifications and will be inspected sticker placed on the car in a 3x3 cm space left free on each side for the official vehicle inspection sticker. This must remain visible.

Steering: A wire guide must be attached to the bottom front of the car. Two spiral guides have been provided. Only ONE should be attached at the front end of the vehicle. A guide wire, 1 cm. (+/- .5 cm) from the surface of the track, will go through the attached eyelets on the car, serving as the steering mechanism, and keeping the car in its lane. The guide wire will pass through the spiral guide to keep your car in its lane. The wire is set into the guide and moved in a spiral motion to lock the car on the wire. A similar movement in the opposite direction will detach the guide from the wire after it travels across the track. Two guides are NOT recommended!

The vehicle must be easily removed from the guide wire, without disconnecting the guide wire. This is the only allowable method of steering the car. Lane changing or crossing during the race will result in Did Not Finish (DNF).

Tip: Not tracking the wire is the biggest reason some cars do not win. Setting the car down straight isn’t enough. Consider this carefully in your planning and design. If the car cannot travel relatively straight without a wire, significant energy will be lost keeping the car on-track!

Track Specifications:
Lane Length: 10 meters
Lane Width: 50 centimeters per lane

Track Surface:
Race surface will be on a rubber pad that is indoors. A guide wire will be located in the center of each lane of the track and will not be more than 1.5 cm above the track surface.

Race Challenge Procedure:
The time trial phase is made up of all registered competing teams and teams will be assigned to a racing group at registration. The race event will use preliminary time trials before progressing to a single elimination tournament for the finals. Each team will have the opportunity of 5-time trials to achieve their fastest times. The fastest time in any of the 5 qualifying runs is used to determine the fastest teams. The 8 teams with the fastest times will progress to the single elimination
tournament for final run off. In the event of ties, the next fastest time from one of the 5 qualifying runs will be used to qualify for the single elimination competition.

**Pit Stop – aka - Repair/Charging Station:**
Teams should bring two or more new AA battery sets to the competition. Fresh battery sets will be provided by the competition for the final elimination rounds to even the playing field. They MUST be used. Teams are responsible for bringing their own supplies for possible repairs or adjustments to their vehicle. A triage table will be set for limited troubleshooting.

**Qualifying Race Procedure:**
1. Teams must get their 5 qualifying runs in during the time set for the “Group” their team is in.
2. When a team is ready for a “Qualifying Run” they will report to a race official at one of the racetracks.
3. Cars must race as presented/judged in the Design Phase of the competition, i.e., any additional modifications presented in Design Phase such as a “body” must be on during the races.
4. The team’s vehicle “run time” will be recorded and given to the “Race Table.”
5. A “Did Not Finish” (DNF) will be given for any of the following (Note that this counts as 1 of the 5 runs):
   - Any vehicle that does not cross the finish line within 30 seconds.
   - If a car veers out of its assigned lane at any point, even if only briefly.
6. The eight teams with the fastest race times will be seeded into the Single Elimination Race Competition. The two teams eliminated in the semifinal round will race for third and fourth place points. (See Attachment C)

**The Starting Line (all races):**
- A team must have a minimum of two members present at all times or it will be disqualified.
- A team member must be positioned at each end of the lane or track. Do not move into the race areas until the race is officially over, and ONLY to retrieve your car, then exit the track promptly.
- A Judge will tell the teams to start their car, teams will lift their drive wheels off the track and flip the switch to start the motor.
- Team members may not push a vehicle to start it.
NOTE: It's recommended that the students practice releasing the car to start the race – a slight push from the student will result in the team forfeiting that run.

- Team members may not accompany the vehicle in its lane during the race.
- Team members may not touch the vehicle until the judge has declared the race over.
- All decisions of the race officials are final.

**Single Elimination Race Competition:**

- The eight fastest teams, based on the qualifying runs, compete in a timed “head-to-head” single elimination competition. Two teams race at the same time and the winner is determined by the fastest time for that race. The winner goes to the next round in the single elimination competition as shown by the bracket in Appendix C.
- In the event that both cars do not finish the race, the car that traveled the farthest will be declared the winner in the “single elimination” competition.

**Race Dispute Procedure:**

- All disputes must be made to the Head Track Judge within one minute of the end of the challenged race.
- All disputes must come from members of the team who actively raced during the race in question.
- Non-racing team members, coaches, parents, or anyone else may not object verbally or by signal.
- All decisions made the Head Track Judge are final and may not be appealed.
Design Challenge Guidelines:
1. All teams are required to compete in the Design Challenge.
2. Judges will interview the students in-person.
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 event.

Research Challenge Guidelines:
1. Each team is encouraged, but not required, to compete in the Research Challenge.
2. The 2022 presentation topic is: "What are some barriers to using electric cars in New Mexico? What are possible solutions?"
3. The presentation will be in-person and 5-7 minutes in length.
4. If presenting using a PowerPoint presentation, teams must submit by November 16. Teams will receive instructions for submitting presentations. If presenting using other materials, please bring your needed materials.
5. The presentations will be loaded onto laptops prior to the morning of the event. File names must include the school and team number. This will ensure that files are operational and will avoid delays during the challenge.
6. Scoring will be determined using the Research Presentation Scoring (Attachment B).

   NOTE: Prepared videos or movies are NOT ALLOWED to substitute for an in-person presentation – students must present “live” in front of the judges. As a precaution, each team should also bring a copy of their electronic presentation.

Overall Event Winners
Points will be awarded to the top four placements in all three categories of the Challenge. Participation points will also be awarded in the optional Research competition. The three overall winners will be determined by the points earned through the scoring rubric.

Race Day Logistics:
1. Students MUST meet their school’s “Dress Code Standards”
2. Food can be brought to the competition. Each student and coach will receive a ticket for one lunch. Food will also be available for purchase.

3. An awards ceremony will follow the completion of all Challenges. All student participants will receive a personal medal for participation.

4. Awards will be given to 1st, 2nd, and 3rd place teams in each Challenge and Overall.

5. Be prepared to store and maintain control of your model between challenges.

**Sample Race Day Schedule**

7:30 AM - 8:30 AM  
Team Registration & Judge Training

8:30 AM - 10:00 AM  
Rotation 1

10:00 AM - 11:30 AM  
Rotation 2

11:30 AM - 1:00 PM  
Rotation 3

1:00 AM - 1:45 PM  
Design Challenge & Research Challenge Finals  
*Second Chance* 8 team, single elimination “Head-to-Head” race contest

1:45 PM - 2:45 PM  
8 team, single elimination “Head-to-Head” Race Final Rounds

2:45 PM - 3:00 PM  
Final calculations to determine Overall Winners in all categories

3:00 PM - 3:30 PM  
Awards Ceremony
New Mexico Electric Car Challenge Schedules

Timeline of Events

Virtual Event

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information to Schools</td>
<td>August 15</td>
<td></td>
</tr>
<tr>
<td>Registration Deadline</td>
<td>September 9</td>
<td></td>
</tr>
<tr>
<td>Mail Kits to Schools</td>
<td>September 12</td>
<td></td>
</tr>
<tr>
<td>Teacher Workshop</td>
<td>September 24</td>
<td>9:00 AM – 12:00 PM</td>
</tr>
<tr>
<td>Project Work Time</td>
<td>September 26 – November 4</td>
<td></td>
</tr>
<tr>
<td>Submit Parade of Cars photos, Research Challenge Video, Race Challenge Videos, and signed Release forms for participating students.</td>
<td>November 4</td>
<td>By 5:00 PM</td>
</tr>
<tr>
<td>Virtual Design Challenge Interviews – all teams</td>
<td>November 7</td>
<td>3:30 PM - 5:30 PM</td>
</tr>
<tr>
<td>Virtual Design Challenge Interviews – Finals</td>
<td>November 8</td>
<td>3:30 PM - 5:30 PM</td>
</tr>
<tr>
<td>Virtual Awards Ceremony – ZOOM Participation link will be provided</td>
<td>November 10</td>
<td>3:30 PM - 5:30 PM</td>
</tr>
</tbody>
</table>

In-person Event @ Van Buren Middle School

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DATE</th>
<th>TIME</th>
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</thead>
<tbody>
<tr>
<td>Information to Schools</td>
<td>August 15</td>
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<tr>
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</tr>
<tr>
<td>Teacher Workshop</td>
<td>September 24</td>
<td>9:00 AM – 12:00 PM</td>
</tr>
<tr>
<td>Project Work Time</td>
<td>September 26 – November 4</td>
<td></td>
</tr>
<tr>
<td>Submit, Research Challenge presentation and signed Release forms for participating students.</td>
<td>November 4</td>
<td>By 5:00 PM</td>
</tr>
<tr>
<td>In-person Event</td>
<td>November 19</td>
<td>8:00 AM - 3:30 PM</td>
</tr>
</tbody>
</table>
### Attachment A - Design Challenge Scoring

<table>
<thead>
<tr>
<th></th>
<th>Basic 1</th>
<th>Intermediate 3</th>
<th>Advanced 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chassis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>
</tr>
<tr>
<td><strong>Body</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>
</tr>
<tr>
<td><strong>Creativity/ Aesthetics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>
</tr>
<tr>
<td><strong>Drive Train Transmission &amp; Gear Application</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<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>
</tr>
<tr>
<td><strong>Construction Quality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>
</tr>
<tr>
<td><strong>Overall Design</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>
</tr>
<tr>
<td><strong>Response Skills</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>
## Attachment B - Research Presentation Scoring

<table>
<thead>
<tr>
<th></th>
<th><strong>Basic</strong></th>
<th></th>
<th><strong>Intermediate</strong></th>
<th></th>
<th><strong>Advanced</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<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>
<td></td>
<td></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>
<td></td>
<td></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>
<td></td>
<td></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>
<td></td>
<td></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 “bridging”</td>
<td>Used allotted time efficiently; utilized very few pauses and “bridging”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Topic:** “What are some barriers to using electric cars in New Mexico? What are possible solutions?”
Contact Information

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