

# New Mexico Electric Car Challenge (NMECC) Guide



**NMELECTRIC CAR  
CHALLENGE**

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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

- Teams: With a range of 2-6 members, participants collaborate to tackle the challenges ahead.
- Team Registration: Register up to two teams per school, with an adult coach leading each team.
- Limited Participation: The opportunity to participate is available to the first 50 teams that register.
- Materials: Car kits with required materials will be shipped to the designated coaches upon registration.
- Participant Release Forms: Coaches must submit a signed form for all students attending.

## Teacher Workshop (optional)

**Date:** Saturday, September 16<sup>th</sup>

**Time:** 9:00 -12:00

**Location:** Nex+Gen Academy High School (5325 Montgomery Blvd NE, Albuquerque)

**Format:** Virtual or in-person

## Three Challenges

- 1. Race Challenge:** Test the electric car's speed and agility with five qualifying runs over a 10-meter course followed by head-to-head competition for the fastest cars. **Back by popular demand in 2023:** The vehicle must be designed to carry a payload of 1 full cylindrical salt container: height: 13.5 cm, diameter of 8.3 cm and mass of 737g (+ or - 1%).
- 2. Design Challenge:** Showcase understanding of the design process with a scheduled 10-minute interview for all teams, demonstrating their knowledge and application of design concepts. **Note:** No prepared PowerPoint presentations for the design challenge. Students must be prepared to be asked and answer questions posed by the Design Judges.
- 3. Optional Research Challenge:** Dive into an energy-related topic provided, presenting a 5-7-minute research presentation (PowerPoint preferred) to showcase their findings and insights. This year students research: **"What are the most effective ways to reduce carbon emissions throughout the entire life cycle of the vehicle, from manufacturing to disposal?"**

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.

## Car Specifications and Design Rules:

1. Each team is responsible for designing and building an AA alkaline 3-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.) **Note:** A minimum height of 1.5" is recommended. Flags or other props can be added.
4. The DC motor and AA Alkaline batteries must be used in the design – the 3-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 1 full cylindrical salt container: height: 13.5 cm, diameter of 8.3 cm and mass of 737g (+ or - 1%).**
7. The salt container may not be part of the vehicle’s structure and must be easily and rapidly removed or reinserted. The following materials are examples of items you can use to hold the salt container on the chassis: cardboard, rubber bands, string, cable ties, structured compartment, etc.
8. Tape or any other adhesive cannot be used to secure the salt container.
9. The salt container will be supplied before the race and must remain unaltered. Salt containers will be reused for each race.
10. Each team is provided the parts needed for the construction of the car – wheels, car body/chasses, axles, gears, etc. The motor and battery pack are required!
11. All cars will be inspected at registration.
12. 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 - In-Person

## Race Challenge Guidelines:

**All cars will be inspected and qualified at Registration.** They must meet all vehicle specifications including payload weight of 700 grams 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 Vinyl track. A guide wire will be 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.

**Important Note:** New battery sets will be provided by the competition for the final elimination rounds to even the playing field. These will be brand new and tested by race administration. **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. (See sample color coded schedule Attachment C)
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. For all “Trial” rounds, the track official will write “T” on the timing sheet to be submitted to the official score keeping 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.

### **The Starting Line (all races):**

- A team must have a minimum of two members always present 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.
- If 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. Teams report to designated rooms during the time set for the "Group" their team is in. (See sample color coded schedule Attachment C).
4. Car inspection - students must show the car and demonstrate that the car meets the size requirements using a measuring tool and scale.
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 after lunch.

## Research Challenge Guidelines:

1. Each team is encouraged, but not required, to compete in the Research Challenge. Teams report to designated rooms during the time set for the "Group" their team is in. (See sample color coded schedule Attachment C).
2. The 2023 presentation topic is: ***What are the most effective ways to reduce carbon emissions throughout the entire life cycle of the vehicle, from manufacturing to disposal?***
3. The presentation will be in-person and 5-7 minutes in length.
4. If presenting using a PowerPoint presentation, teams must submit by October 27. 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 on a drive.

## 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.
3. An awards ceremony will follow the completion of all Challenges.
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 - 11:20 AM	Rotation 2
12:05 PM - 1:25 PM	Rotation 3
1:30 AM – 2:15 PM	Design Challenge & Research Challenge Finals <i>Second Chance</i> 8 team, single elimination "Head-to-Head" race contest
2:20 PM - 3:05 PM	8 team, single elimination "Head-to-Head" Race Final Rounds
3:15 PM -3:25 PM	Final calculations to determine Overall Winners in all categories
3:25 PM - 3:35 PM	Awards Ceremony


# New Mexico Electric Car Challenge Schedule

## Timeline of Events


### In-person Event @ Kennedy Middle School

ACTIVITY	DATE	TIME
Information to Schools	August 10	
Registration Deadline	September 18	
Mail Kits to Schools	September 11	
Teacher Workshop	September 16	9:00 AM – 12:00 PM
Project Work Time	September 18 – October 27	
Submit Research Slide Presentation (PowerPoint preferred), and signed Release forms for participating students.	October 27	By 5:00 PM
In-person Event	November 4	8:00 AM - 3:45 PM

# Attachment A - Design Challenge Scoring

	<b>Basic 1</b>	<b>2</b>	<b>Intermediate 3</b>	<b>4</b>	<b>Advanced 5</b>
<b>Chassis</b>	Incorporates basic design components of chassis		Incorporates moderate level of sophistication into chassis design		Incorporates high level of sophistication into chassis design and mounting of equipment
<b>Body</b>	Very little in body design and creativity		Incorporates moderate level of sophistication & functionality in body design & application; draws a second look		Incorporates high level of sophistication and functionality, aerodynamics into body design
<b>Creativity/ Aesthetics</b>	Very little in body creativity (basic paint & attachment)		Some creativity used in the design (unique painting, more interesting than basic design)		Very creative design that also enhance the performance of the vehicle (great aesthetic value; attracts attention)
<b>Drive Train Transmission &amp; Gear Application</b>	Uses transmission & gears supplied in kit with basic wheels & tires		Uses kit transmission & gears with modifications; better wheels & tires		Enhanced modifications to transmission & gears to increase torque & speed; enhance wheels & tires
<b>Construction Quality</b>	Basic construction & materials used; little more than basic kit		Moderate attempt to improve overall construction quality with adherence to detail		Very high quality & detail in construction; well thought out & applied
<b>Overall Design</b>	Very little modification to basic kit; simple & effective overall design		More advanced design concept with some modifications; creative; good overall design		Extensive modifications demonstrating an understanding of engineering & physics in the design
<b>Response Skills</b>	Missing some ideas of the project development & application; lacks eye contact; hesitating in response		Has the main idea and effective in sharing the concept; good eye contact; speaks clearly with confidence		Thorough in concept of the project & able to express it very well; good eye contact; speaks very confidently

## Attachment B - Research Presentation Scoring

	<b>Basic</b> <b>1</b>	<b>2</b>	<b>Intermediate</b> <b>3</b>	<b>4</b>	<b>Advanced</b> <b>5</b>
<b>Informative</b>	Missing some main ideas, inaccurate information		Captures main ideas, mostly accurate		Captures main ideas, thorough, accurate, provides good examples, and insightful
<b>Professional Attitude</b>	Often slouches, sways, turns back on audience frequently, fidgets frequently, hard to hear rare eye contact		Sometimes slouches, sways, sometimes turns back on audience, fidgets, volume too low at times, some eye contact		Stands straight, faces audience, words pronounced and heard clearly, good eye contact
<b>Organization</b>	Information not presented in a logical, interesting sequence; the audience could not follow		Information was interesting but not presented in a logical order; audience had difficulty following		Information presented in a logical, interesting sequence which the audience could follow
<b>Visual Aides</b>	Utilized less than two different types of media; information not relevant to outcome/content; messy; minimal artistic effort		Utilized two different types of media, information relevant to outcomes/content; messy; adequate artistic effort		Utilized more than two different types of media; information relevant to outcomes/content; very neat; excellent artistic effort
<b>Time/Flow</b>	Used significantly less or more than allotted time; time punctuated with many pauses and "bridges"		Used less or more than allotted time; time punctuated with some pauses and "bridges"		Used allotted time efficiently; utilized very few pauses and "bridging"
<p><b>Topic: <i>What are the most effective ways to reduce carbon emissions throughout the entire life cycle of the vehicle, from manufacturing to disposal?</i></b></p>					

## Attachment C – Sample Schedules

### New Mexico Electric Car Challenge Agenda

<b>7:30 AM - 8:10 AM</b>	<b>Team Registration</b>
<b>8:10 AM - 8:15 AM</b>	<b>2023 NMECC Opening</b>
<b>8:15 AM - 8:30 AM</b>	<b>Coaches Meeting &amp; Volunteer Briefings</b>
<b>8:30 AM - 10:00 AM</b>	<b>Team Rotations</b>
RED TEAMS	RACE TRACK
BLUE TEAMS	ORAL PRESENTATIONS
GREEN TEAMS	DESIGN PRESENTATIONS
<b>10:00 AM - 11:20 AM</b>	<b>Team Rotations</b>
BLUE TEAMS	RACE TRACK
GREEN TEAMS	ORAL PRESENTATIONS
RED TEAMS	DESIGN PRESENTATIONS
<b>11:20 AM - 11:55 AM</b>	<b>Lunch Break</b>
<b>12:00 PM - 12:05 PM</b>	<b>Mandatory Announcements in Main Gym</b>
<b>12:05 PM - 1:25 PM</b>	<b>Team Rotations</b>
GREEN TEAMS	RACE TRACK
RED TEAMS	ORAL PRESENTATIONS
BLUE TEAMS	DESIGN PRESENTATIONS
<b>1:30 PM - 2:15 PM</b>	<b>Design Challenge &amp; Research Presentation Finals/ Call Backs</b>
<b>2:20 PM - 3:05 PM</b>	<b>8 Team, Single Elimination “Head to Head” Final Race Rounds</b>
<b>3:15 PM - 3:25 PM</b>	<b>Overall Winner Determination Calculations</b>
<b>3:25 PM - 3:35 PM</b>	<b>Awards Ceremony</b>



Sandia  
National  
Laboratories



## Design Challenge

Time	Room 401	Room 402	Room 403
8:30 - 8:40	Aspen 1	Berrendo 1	Carlos Vigil 1
8:40 - 8:50	Carlos Vigil 2	Aspen 2	Carlsbad Alta Vista 1
8:50 - 9:00	Carlsbad Alta Vista 2	Carlos Vigil 3	Aspen 3
9:00 - 9:10	Carlsbad PR Leyva 2	Carlsbad Alta Vista 3	Carlsbad PR Leyva 1
9:10 - 9:20	Chamisa 2	Carlsbad PR Leyva 3	Chamisa 1
9:20 - 9:30	Berrendo 3		Berrendo 2
9:35 - 9:45	Desert Willow 1	Ernie Pyle 1	Jefferson 1
9:45 - 9:55	Ernie Pyle 2	Desert Willow 2	La Tierra 1
9:55 - 10:05	Jefferson 2	La Tierra 2	Desert Willow 3
10:05 - 10:15	Pinon 1	Jefferson 3	Nina Otero 1
10:15 - 10:25	La Tierra 3	Nina Otero 2	Pinon 2
10:25 - 10:35	Nina Otero 3	Pinon 3	
10:40 - 10:50	Roosevelt 1		Lynn 1
10:50 - 11:00	Lynn 2	Roosevelt 2	Dixon 2
11:00 - 11:10		Ruidoso 1	Roosevelt 3
11:10 - 11:20	Ruidoso 2	Taos 1	Ruidoso 3
11:20-11:30	Taos 2	Van Buren	Taos 3
11:30-11:40			

## Research Challenge

Time	Room 500	Room 501
8:30 - 8:40	Roosevelt 1	Lynn 1
8:40 - 8:50	Roosevelt 3	Ruidoso 1
8:50 - 9:00	Ruidoso 2	Taos 1
9:00 - 9:10	Lynn 2	Ruidoso 3
9:10 - 9:20	Taos 2 added	Roosevelt 2
9:20 - 9:30	Taos 3	
9:30		
9:35- 9:45	Aspen 1	Chamisa 1
9:45-9:55	Berrendo 1	Berrendo 2
9:55-10:05	Aspen 2	Carlsbad Alta Vista 1
10:05 - 10:15	Berrendo 3	Carlsbad Alta Vista 2
10:15 - 10:25	Carlsbad Alta Vista 3	Chamisa 2
10:25 - 10:35		Aspen 3
10:40 - 10:50	Desert Willow 1	Desert Willow 2
10:50 - 11:00	Desert Willow 3	Nina Otero 1
11:00 - 11:10	Jefferson 1	La Tierra 1
11:10 - 11:20	Jefferson 2	Nina Otero 2
11:20 - 11:30	Nina Otero 3	Jefferson 3
11:30 - 11:40		



## Contact Information

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