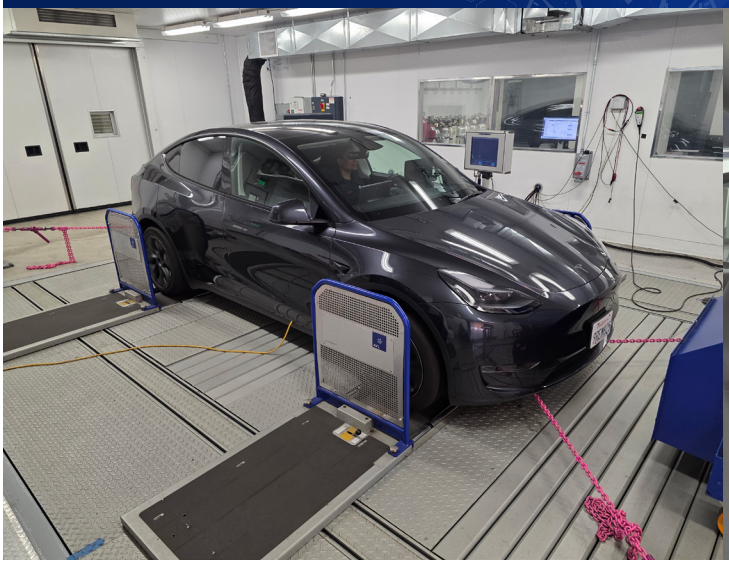
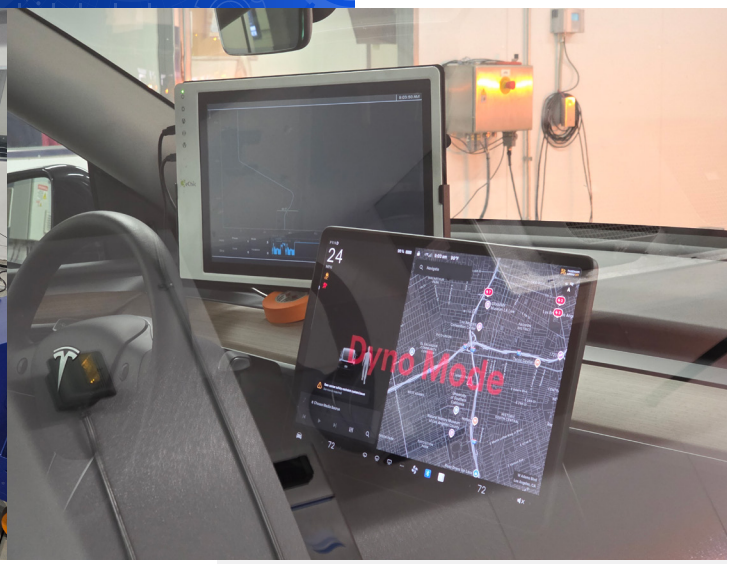
MAY 2026

FACT SHEET

EV VS HYBRID TEMPERATURE EFFICIENCY TESTING





Background & Testing

Electric vehicle technologies—like EVs and hybrids—give drivers across the United States new options for their transportation needs. AAA's 2019 research showed that extreme cold temperatures, especially when using HVAC systems, can significantly decrease both fuel efficiency and driving range in EVs. Working with the Automobile Club of Southern California's Automotive Research Center, AAA's engineering team carried out primary research to examine how different climates affect real-world driving range and operation costs. They evaluated three popular battery electric vehicles (BEVs) and three hybrids available in the U.S. market.

To better understand how EV technology has evolved and to incorporate hybrid testing into their evaluations, AAA pursued two lines of inquiry:

1. Do hybrid electric vehicles exhibit efficiency degradation comparable to battery electric vehicles when subjected to low-temperature (20 °F) and high-temperature (95 °F) operating conditions relative to a baseline of 75°F?
2. What are the "fuel" costs of battery electric vehicles and hybrids across cold, hot, and baseline temperatures?

Building on their 2019 study, the AAA automotive engineering team, in partnership with the Automobile Club of Southern California's Automotive Research Center, evaluated the powertrains of three EVs and three hybrids. Testing was conducted on a chassis dynamometer — a device like a treadmill for cars — with the HVAC (Heating, Ventilation, and Air Conditioning) set at 72 degrees in the vehicles and the temperatures in the laboratory test cell at **20°F, 75°F, and 95°F**. The cost portion of the research leveraged the AAA Gas Price Data to determine national average fuel and electricity prices as of March 27, 2026.

Quick Facts

- Temperature change affects how efficiently EVs and hybrids operate, how far they travel on a charge or tank of fuel, and how much they cost to drive.
- Cold weather has the greatest impact — particularly for EVs — while heat introduces smaller but meaningful efficiency losses for both hybrids and EVs.

***Note comparability:** Both hybrids and EVs were evaluated using industry standard test cycles, and the MPG and MPGe results are comparable. Range-based results apply to EVs only and cannot be directly compared with hybrid results.

Key Findings

Impact of hot temperatures (95°F):

- Hybrid vehicles experience a 12.0% decrease in fuel efficiency (miles per gallon, MPG).
- EVs show a 10.4% reduction in efficiency (MPGe, miles per gallon of gasoline equivalent) and an 8.5% loss of driving range compared to moderate temperature (75°F) conditions.

Impact of cold temperatures (20°F):

- Hybrids lose 22.8% in fuel economy.
- EVs demonstrate a 35.6% drop in MPGe and a 39.0% decrease in calculated driving range.

Impacts of cold temperatures (20°F) on operating costs:

- Hybrids showed an increase in fuel cost of $28.44 per 1,000 miles.
- EVs experienced an increase in operating costs of $32.11 per 1,000 miles when charged at home electricity rates and $76.93 per 1,000 miles when using public charging.

Impacts of hot temperatures (95°F) on operating costs:

- Hybrid operating costs increased by $13.02 per 1,000 mi.
- For EVs using home charging, operating expenses rose by $6.78 per 1,000 mi, while public charging costs climbed $16.25 per 1,000 mi.

Powertrain Cost Comparison:

- Cold operation (20°F) showed the largest cost gap: EVs cost $36.19 less per 1,000 miles at home electricity rates but $86.26 more using public chargers than hybrids.
- At high temperatures (95°F), EVs were $46.11 cheaper per 1,000 miles at home electricity rates, but $41.00 more expensive at public charging rates compared to hybrids.

Recommendations:

There are some proactive tips that drivers can take before hitting the road to help offset potential reductions in driving range and costs.

AAA recommends:

- **Consider climate when choosing a vehicle:** Cold weather increases energy use for all electric vehicles, but EVs can be impacted more. If you live in a cold area, expect your EV to have less range and need to charge more often.
- **Plan for higher winter costs:** EVs use more energy in the winter/cold, especially if you charge at expensive public stations. Hybrids also use more fuel because their engines need to warm up and heat the car.
- **Manage efficiency in hot weather:** In high heat, A/C and battery cooling can reduce efficiency in EVs and hybrids. The impact is smaller than in cold weather.
- **Prepare and Plan:** Pre-condition an EV while plugged in, use heated seats and wheel, keep tires inflated, and drive moderately in extreme temperatures.
- **Consider charging methods and electricity rates:** EV expenses depend on electricity prices and location. Home charging is generally cheaper and more reliable than public stations.
  - **The AAA Your Driving Costs calculator** can help estimate ownership and operating costs by incorporating local fuel and electricity prices and customized driving habits.
  - **AAA Gas Price Data** provides valuable information about national averages for both gas prices and EV charging costs.

Methodology

Dynamometer drive cycles were performed according to SAE J1634 (BEV) and SAE J1711 (HEV) at an ambient temperature of 20°F, 75°F, and 95°F. Refer to the test matrix on page 24 for drive cycles, temperature, and vehicle HVAC settings. Road load coefficients were sourced from EPA-published resources based on vehicle details and powertrain configuration. AAA used a modified version of the SAE test standards to better reflect how drivers would use their vehicles in the real world. The modified version enabled the use of cabin air conditioning set to 72°F as well as testing at temperature extremes of 20°F and 95°F. Please see the report for the detailed methodology.