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Electric vehicles can work in any temperature although they do work best in a sort of Goldilocks temperature range where the outside environment isnt too cold to have an adverse effect on the battery capacity and isnt hot enough to require air conditioning. Electric vehicle range in extreme cold and heat may not be as dire as you expect though and, for the record, gas-powered vehicles arent immune from temperature extremes either. Still, it's advantageous to understand how heat and cold impact EVs. Overall, EVs can and do perform well in all types of weather. Some weather conditions, just like with gasoline-powered vehicles, do mean that EV owners need to pay a little closer attention to the way they drive and conserve battery energy. For example, EVs work better in extreme heat than cold because cold enough weather will temporarily reduce the capacity of EV batteries. Turning on the air conditioning in hot weather, however, can also reduce overall range. All of this is because electric car batteries are significantly more advanced than most of the batteries we run into in our daily lives, but they are still bound by the same basic laws of physics. That means EV batteries work in slightly mysterious ways to most of us. The key to understanding temperature impact on EV batteries lies in remembering that, first and foremost, the battery must be able to effectively hold and discharge energy. That means a battery must not only be able to powerfully charge the car, it must be able to hold enough charges to use when needed in different driving situations. The ability to hold those charges is referred to as capacity or storage capacity. When those charges are used by the car, they are discharged by feeding power to the EVs motor. When a battery is exposed to extremely cold temperatures, its capacity to store a charge can be diminished. According to one study, lithium ion battery charge capacity drops to about 77 percent at a testing temperature of 5 degrees Fahrenheit, and measured discharge capacity drops to 82 percent at the same testing temperature.EVs use lithium ion (Li-ion) batteries. These are rechargeable, lightweight, and have a higher energy density than other types of rechargeable batteries. As a result, these batteries are smaller than those in gasoline-powered vehicles. Although battery capacity typically increases as the temperature of the battery increases, extremely high external temperatures can actually cause deterioration and even lower the operational life of a battery. That degradation can cause an EV battery to perform less effectively. Temperature issues dont just affect the battery itself. It can also impact an EVs overall range. Temperature affects EV range from both a capacity and use perspective: Low external temperatures can reduce the storage capacity of EV batteries, which means the EV cant store enough battery charges to go as far as it normally would.The drain from heating or cooling the interior cabin of an EV can reduce the available amount of stored energy needed to actually move a vehicle from point A to point B. The effect of low or high external temperatures on battery storage capacity is an important factor, but it doesnt fully account for the reduction in EV range seen in both low and high temperatures. It turns out that driver and passenger comfort actually has a bigger effect on EV range because it takes a lot of power to heat or cool the cabin of an EV in extreme weather conditions. In fact, real-world testing has shown that EV range drops to about 54 percent when the ambient temperature dips to 5 degrees Fahrenheit. That reduction is usually due to the power requirements of running an electric heater in extremely cold conditions. This is one area where gasoline-powered vehicles have an advantage, because internal combustion engines generate a lot of waste heat as a natural byproduct of operation. That makes it essentially free to heat a gas-powered car, while an EV instead needs to send energy that could have otherwise gone to increasing its range into running a heat pump or resistive heater. However, gasoline-powered vehicles still experience troubles in extreme weather situations, too, including reduced fuel economy in cold temperatures due to other factors. According to the U.S. Department of Energy, gas-powered vehicle fuel economy drops by about 15 percent when the temperature dips to 20 degrees Fahrenheit compared to fuel economy in balmier conditions. When extreme temperatures swing in the other direction, EV range reduction is entirely due to the energy costs of cooling the cabin. This is an area where gas-powered vehicles dont have an advantage, because running the A/C in a gas-powered vehicle takes gas that could have otherwise been used to move the vehicle. According to the U.S. Department of Energy, a gas-powered car can have its range decreased by over 25 percent when running the A/C in extremely hot weather. In comparison, the average EV can be expected to reach about 80 percent of its rated range in conditions where the ambient temperature is 104 degrees. In that particular situation, an EV is likely to beat a gas-powered vehicle in terms of retaining more of its range. Both resistive heaters and heat pumps can be used in EVs. The benefit of using a heat pump in an EV instead of a resistive heater is that heat pumps are simply more energy efficient. Resistive heaters convert electrical energy into heat because they get hot when electricity flows through them. Heat pumps, on the other hand, essentially just move thermal energy from one place to another. An air conditioner is kind of like a one-way heat pump that moves heat from the interior of a vehicle to the exterior, effectively cooling the interior in the process. Heat pumps are reversible, too, which means that one can be used to either raise or lower the temperature in an enclosed space. In fact, according to one study available from the NHTSA, the range of an EV with a heat pump is about 30 percent greater than the range of an EV equipped only with a resistive heater when operated in extremely cold temperatures. Heat pumps are typically capable of operating in EVs in temperatures down to about 25 to 30 degrees Fahrenheit, although efficiency does drop off the colder it gets. In even colder temperatures, it becomes more efficient to switch over to a resistive heater. While its true that EV range can be reduced by both extremely hot and cold weather, there are a number of things you can do to improve the range of an EV in extreme weather conditions: Reduce the use of air conditioning in hot weather. Set the A/C at the highest temperature youre comfortable with, and consider cooling off with other methods like a portable battery-powered fan and an ice chest full of cool drinks when going on long road trips.Dont use accessory systems unless you need them. All the systems in your EV draw power from the same batteries, so everything from using the entertainment system to turning on the headlights instead of just the running lights during the day can cut into your EVs range. Keep nonessential use to a minimum to improve your range when youre already needing to draw extra power to heat or cool the cabin.Heat or cool your EVs passenger compartment while its still plugged in. If you think ahead and get the cabin to a comfortable temperature ahead of time, you wont need to burn through battery power once youre on the road. If you can keep your EV in a garage, especially a climate-controlled garage, all the better.Park in the shade when its hot out. Youll still need to run the A/C during extremely hot conditions, but parking in the shade will keep the passenger compartment cooler and you wont need to use as much energy to get comfortable.Try to stick to economy mode if your vehicle has it. Most EVs have a mode like this that provides better battery life, and range, at the cost of performance.Take it easy when starting and stopping. Sudden, hard acceleration takes a lot more power than accelerating slowly. On the flip side, your EVs regenerative braking system captures a lot more power when you brake slowly, anticipating a stop early, than it does when you slam on the brakes at the last moment. Keep in mind that if youre driving in extreme conditions, like ice or snow, that will also affect how long it takes you to stop.Keep your cruising speed under control. Most EVs provide the best battery life, and longest range, when you keep your speed below 50 MPH. Efficiency, and range, drop off sharply after that.Avoid charging your battery outside when the ambient temperature is extremely cold. Battery charging capacity drops off the colder it gets, so you start from a better place if your battery isnt extremely cold during the charging process.Keep your load light. Did you load up for a skiing trip or a day at the beach on the weekend? Driving around with all that extra weight all week will reduce your range. If you have a rooftop cargo carrier, consider removing it as well when it isnt in use, as the extra drag will also reduce your range. If you're switching from an internal combustion vehicle to an electric one, the winter may bring some surprises. Range, charging and battery health are all impacted by cold weather, so driving your new EVthrough the winter months will require some adjustments to your routine as well as some extra planningespecially if you want to go on a longer journey that will require charging along the way.Keeping the battery pack as close as possible to its optimal temperature is key to getting the most out of your EV in winter, and depending on the car, you have several options to play with to achieve that. Most modern EVs can regulate their battery pack temperature, and you will need to understand how this thermal management works and how to use it best.Having said all that, cold temperatures may not be as apocalyptic for your EV as you might have heard. Read on to learn more about how to navigate this situation. The range takes a big hit in cold temperatures, and dont think that it has to be close to freezing out for your EVs range to drop by 30 percent or more in some extreme cases. This is caused by increased resistance in the battery cells. This, in turn, affects the entire packs efficiency and performance.Theoptimal operating temperature range for an EV's lithium-ion battery pack is roughly between 68F and 113F (20C and 45C). So if the outside temperature drops below about 68F, your vehicle will use some of its electricity to increase the pack temperature and hold it there. Keep in mind that this is happening even when your EV is turned off, so if you leave it parked outside on a very cold night and dont plug it in, you will see much more significant range loss compared to leaving it out in milder temperatures.According to data recently presented by battery health startupRecurrent Auto, which tested a pool of over 10,000 cars comprised of the 18 most popular electric models in the US, EVs retained 70.3 percent of their range in freezing temperatures.Some vehicles performed much better than average in this respect. For instance, the Audi e-tron lost just 16 percent of its range in winter, making it the best performer of the study. The weakest model from this study was the Volkswagen ID.4, which lost a whopping 46 percent of its range under such conditions. Lithium-ion batteries of the kind found in most EVs dont operate as efficiently in cold weather, especially when temperatures dip below freezing. This affects the battery anodes capacity to capture the lithium ions, which will tend to coat the surface of the anode in a process called coating. Most of this coating goes away through the use of the battery, but it wont go away completely, and it will accumulate and affect battery performance over time.You will observe this as a drop in the batterys capacity, and you will also notice capacity going back up as outside temperatures increase and the lithium coating around the anode is reduced.An electric cars battery monitoring system and its thermal management system (usually centered around a heat pump) will be working overtime in freezing conditions to not only give you the maximum possible range but also to prevent damage to the battery. Luckily, modern EVs have evolved to a point where damage to the battery shouldnt be a concern to you since they are tested and designed to withstand temperature extremes. Since EV charging speeds are highly dependent on battery pack temperatures, the rate of electron replenishment might slow to a crawl in winter. Matching your EVs summer charging speed numbers in winter can be difficult, and it will require additional planning.In many EVs, there is a separate option to tell the car to precondition the battery and prepare it for charging, while in others, the car will do this automatically if youve selected a fast charger as your destination. Once youve picked out a charger in the nav system, your EV will know that you have the intention of plugging it in, and it will begin to raise battery temperatures in preparation for charging. Definitely check your user manual to see if your car is capable of this, and even watch some YouTube videos to find out how the process works. If you omit this step and take the vehicle by surprise and plug it into a DC fast charger with a cold battery, you will only be getting a fraction of the advertised charging speed. This may partly explain the Idaho National Laboratorys report that EVs can take up to three times longer to charge in the cold. The study also discovered that this varied greatly depending on where you lived; EV owners in the northern US (or colder areas with harsher winters, generally speaking) were more likely to experience these longer charging times. One of the easiest ways you can tell your EVs battery is not at optimal temperature is by the level of regenerative braking it can provide. Some EVs can put well over 100 kW back into the battery under regen (up to 300 kW for the Rimac Nevera or 290 kW for the Porsche Taycan), but if the battery is cold and it cant take the power flowing into it from the motors, the vehicle will simply reduce the rate of recuperation until the battery is warm enough to take it.The level of available regen will increase as you drive, or you can remotely precondition your vehicle so that its already up to temperature when you set off. Always leaving your EV plugged in overnight in winter and setting your departure time for the next day will ensure the level of regen you experience wont vary too much. If youre moving from an ICE vehicle to an EV, it may seem counterintuitive that youre not actually producing as much heat as you drive around normally. In a combustion car, the engine produces a lot of heatmore than enough to heat the cabinand you dont really think about its impact on efficiency or range as you do in an EV.EVs equipped with heat pumps will scavenge some of the waste heat produced by the electric motors and other components, and part of it will be used to heat the cabin. But this often wont be enough, and they will have to also use their resistance heater to make the cabin toasty on a cold winters day.This is why turning on the heater in an EV, even one with a heat pump, will instantly cause the predicted range to drop. Polestar says that outside temperatures can reduce the range of its EVs by 10 to 12 percent, but if you also use the climate system, that can go up to 41 percent.One way to get around this issue and stay warm in your EV is to solely rely on the heated seats and steering wheel if theyre available. Keeping the ventilation off will allow the heat pump to use all the heat for the battery pack, keeping it closer to its optimal temperature and giving you the best range.BMW is equipping its iX flagship electric SUV with the Radiant Heating package, which adds infrared heaters in the armrests, the door panels, and even the lower part of the dashboard. This complements seat and steering wheel heating and encourages you to not use the ventilation system and just rely on radiant heating for warmth during winter driving. Many EVs have flush-fitting (sometimes powered) door handles that pop out when the vehicle is unlocked. These have the advantage of slightly improving the vehicles aero while also making it look cool and modern, but ice buildup can form on top of them, making it difficult to get inside the vehicle.If the manufacturer doesnt have a specific technique that you need to apply to get the ice off without causing damage to the bodywork, you may have to get creative and exercise patience. The same can be true for charging port doors, many of which seem poorly designed to deal with the issue of ice buildup. Another range-sapping part of cold-weather EV driving is the switch from summer to winter tires. Between their different rubber compounds and tread patterns, they produce more rolling resistance, and this will incur a range drop.You should regularly check the tire pressure in winter, as it can vary depending on outside conditions, and having them underinflated can further penalize efficiency.Michelin says that rolling resistance can lower an EVs range by up to 20 percent. It also notes that a 30 percent increase in rolling resistance will increase electricity consumption by between 3 and 5 percent.Some tire manufacturers like Michelin, Hankook, or Nokian have announced EV-specific winter tires, which aim to strike a better balance between grip and rolling resistance, thus helping electric cars drive further in winter without compromising on safety.Do you have more questions about winter driving range? Drop them in the comments below. More On EVs In Winter Got a tip for us? Email: tips@insideevs.com Winter weather can cause bigger headaches for electric vehicle drivers than shoveling their driveways. Many are finding cold temperatures reduce their cars driving range.Fully electric vehicles, which run exclusively on battery packs, typically lose an average of 41% of their range when outdoor temperatures drop to 20 degrees Fahrenheit and the heats cranked on, AAA researchers have found. Thats because batteries dont work as efficiently in the cold and regulating cabin temperature can gobble up a significant amount of power, depending on how a cars HVAC system is designed.It was a rough time to start driving for Uber in Chicago this month, said Marcus Campbell, who signed up with the ride-hailing company last week using a rented car. Campbell said he has already found the frigid weather buffeting the Windy City can make for a longer workday and fewer fares, requiring him to spend several hours waiting his turn at a charging station and powering up.When I should be asleep, Im outside charging my vehicle, falling asleep in my car, he told NBC News Adrienne Broaddus. Im not making any money.Many drivers across the country are likely to face frustrations like Campbells this winter.There are more EVs on American roadways than ever before, with a record 1.2 million sold nationwide in 2023, according to Cox Automotive. Sales are still rising, but some consumers have been put off by a dearth of charging infrastructure that remains a work in process. Now, the bitter cold sweeping parts of the U.S. is giving many current and would-be EV drivers another reason for range anxiety.EV batteries work less efficiently in very cold weather, requiring some drivers to charge their vehicles more frequently.William Hale Irwin / Sipa USA via APThe way engines work plays a big part in how a car is heated, said Scott Case, the CEO of Recurrent, a company that measures EV battery performance. Around 10% of a gas engine vehicles energy is used for forward momentum, compared to 90% in EVs, he said. With all-electric models, theres not a lot of waste heat that you can just use to warm up the cabin, Case said, which puts more onus on the battery to do so.Auto industry experts said EVs built with heat pumps for warming their interiors will undergo less battery strain in cold weather. Most newer models have them, but less efficient resistive heaters are more common in older vehicles. Case estimated that EVs with heat pumps lose an average 20% of their range in extreme weather, compared with up to 40% in those without heat pumps.Theres not a lot of waste heat that you can just use to warm up the cabin.Scott Case, CEO of RecurrentThe age of a vehicles battery can also affect how it performs in cold temperatures, said Alex Knizek, Consumer Reports manager of automotive testing and insights.Batteries in your EV do degrade over time, just like your smartphone after you charge it and discharge it a bunch, he said.Consumer Reports testing of four popular EV models the Hyundai Ioniq 5, the Volkswagen ID-4, the Ford Mustang Mach-E and the Tesla Model Y also found significant battery depletion in cold weather. Battery range dropped 25% from spring to winter and 30% from summer to winter, with the researchers looking at temperatures near zero Fahrenheit for the coldest conditions and around 80 degrees in the summer.An electric vehicle charges during a snowstorm in Austria in 2020.K M Krause / ShutterstockIn Chicago, tow truck driver David Birts said his companys calls have increased substantially since Friday, mostly because of stuck EVs. I have never seen this volume for electric cars, he said.Knizek noted that all cars lose some efficiency in extreme weather, especially when its very cold. But EVs, for now, lose more than their gas-burning counterparts. And the issue can be more urgent for EV drivers because recharging takes longer than refueling at gas pumps, which so far remain more pervasive than charging stations in much of the U.S.Batteries in your EV do degrade over time, just like your smartphone.Alex Knizek, manager of automotive testing and insights, Consumer ReportsAs the automakers want to get more EVs on the road, said Greg Morrison of Bumper2BumperTV, they need to work in tandem with those who are providing public charging and those who are selling home charging units, so that its not as much of a crisis at these charging stations.EVs can help reduce the 29% of greenhouse gas emissions attributable to transportation in the U.S. every year, according to the Environmental Protection Agency. Thats one reason the Biden administration has committed billions of dollars through the Inflation Reduction Act and the Bipartisan Infrastructure Law to support charging infrastructure and speed electrification of the nations transportation system.In the meantime, for prospective and current EV drivers looking to maximize their range in cold weather, it all comes down to trying to maintain the temperature of the battery and the interior of the car, Knizek said.One common approach is called pre-conditioning. Turning on the heat while an EV is still plugged in which can often be done through a smartphone app connected to the vehicle will use energy from the charging station, rather than the battery, to heat the cabin. The benefit to you is not only extra range, but you also show up to a nice, toasty, comfortable car, Knizek said.Automakers tend to advise against keeping all-electric cars parked outdoors in cold weather for extended periods, he said. So drivers with garage space may want to move their vehicles there when temperatures plunge.When youre shopping for an electric vehicle that youll need to drive in cold weather, Knizek advised opting for the longest-range model you can afford. That way, if you lose a little range in the winter or during other extreme weather, it wont be a dealbreaker for your daily driving needs.You dont necessarily know how much degradation a battery has when you shop for it, Knizek said. Services like Recurrent and others can give EV buyers a better idea of how various models batteries will perform over time, he said, including in different weather conditions.Emily PandiseAdrienne Broaddus, Aaron Franco and Micki Fahner contributed.

Do electric car batteries drain faster in cold weather. Ev battery in cold weather. Electric car battery life in cold weather. How long do electric car batteries last in cold weather. Do electric car batteries work in cold weather. Do electric car batteries drain in cold weather. Battery cold weather. Do electric car batteries degrade in cold weather. Car battery cold weather. Do electric car batteries die in cold weather. Does cold weather affect electric car batteries.