Welcome to the EVolution

The future of cars is here.
Finally...
If you’ve been waiting for electric vehicles to:

- look like other vehicles
- perform like other vehicles
- travel greater distances
- be made by American manufacturers
- take a bite out of our reliance on oil
- help protect the environment
- avoid gas stations, oil changes, spark plugs, air filters and mufflers
- allow you to use your smartphone to warm up your car
- meet the safety standards of traditional vehicles

Gain everything. Lose nothing.

If any of the above applies to you, then keep reading. This guide was created to make it easy for you to find answers to your questions and give you the facts on owning an electric vehicle.
More auto manufacturers than ever are now making EVs, including BMW, Chevrolet, Ford, Honda, Toyota, Nissan, Mitsubishi, Volkswagen, and Tesla.
There is a major EVolution in personal transportation taking place. Your timing to jump in could not be better! You now have more options in more makes and models than ever before. No compromises necessary.

- EVs now travel long distances thanks to rapid improvements in electric battery technology.
- Battery charging stations being installed along highways and in our communities make driving EVs, even for longer trips, more convenient.
- Many EVs are made by American manufacturers.
- EVs help protect the environment.
- EVs reduce our reliance on oil.
- EVs don’t have all that maintenance - no oil changes, spark plugs, air filters or mufflers.
- EVs meet or exceed all highway safety standards.
Multiple technologies mean multiple choices

(Though it is a bit of an acronym jungle)
EVs or BEVs - Electric Vehicles or Battery Electric Vehicles

Electric vehicles use electricity stored in batteries to propel the vehicle. The battery can be charged by a variety of equipment ranging from a standard outlet to a sophisticated high voltage rapid charger. Like hybrids, some energy is recovered when using the brakes. There is no option to run the vehicle on gasoline.

Because short distances represent about 80% of car trips in the U.S., EVs meet the needs of most drivers.

PHEVs - Plug-in Hybrids

A plug-in hybrid uses a combination of electricity and gasoline to propel itself. The vehicle is equipped with a small gasoline engine that can assist the wheels and provide electricity for the batteries and electric motor.

PHEVs have a battery system similar to an EV and can recharge using the same types of equipment. The batteries are smaller in PHEVs and therefore charge in less time.
EV drivers often say that one of the most convenient features of an EV is the ability to refuel at home and leave the house each day with a “full tank.”
Here’s the skinny on charging at home:

Currently there are three types (levels) of charging systems available:

**Level 1:** All plug-in cars come equipped to receive power from standard 110-volt outlets. The charge is delivered slowly, so it can take many hours to deliver a full charge to an all-electric car. Level 1 charging may be perfectly adequate for a plug-in hybrid, for topping off a battery, or for when the vehicle is sitting unused for long periods.

**Level 2:** Most owners of new all-electric cars will want to have access to a Level 2, 240-volt electricity supply (like what’s used for an electric clothes dryer). This will recharge a vehicle in much less time. Many EVs and chargers can be programmed to start and stop charging at a particular time, keeping track of how much electricity they are “pumping.” Many public charging stations can also be reserved remotely. You will need a 240-volt circuit installed in your garage to charge at this level. Although an electrical permit is required for 240-volt circuit installation, these are inexpensive and simple to process (your electrician will handle that). Purchasing (if not included with the vehicle purchase) and installing home Level 2 charging equipment will cost from $500 to $1,500 for most consumers.

**Level 3 (DC fast charge):** These chargers are super-high-speed and not currently intended for home use because of high costs and the requirement of a dedicated electrical service. Expect to find these along travel corridors and at select retailers.

<table>
<thead>
<tr>
<th></th>
<th>Level 1 charging</th>
<th>Level 2 charging</th>
<th>DC fast charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>Mobile cord comes with the car; plugs into any 110V socket</td>
<td>Must be purchased (or bundled with car)</td>
<td>Not suitable for home application</td>
</tr>
<tr>
<td>Cost</td>
<td>Included with vehicle</td>
<td>$500-$1,500</td>
<td>$50,000</td>
</tr>
<tr>
<td>Installation</td>
<td>No installation required</td>
<td>Electrical circuit installation required for majority of consumers</td>
<td>Located on thoroughfares and select gas stations</td>
</tr>
<tr>
<td>Range per hour of charge</td>
<td>2-5 miles per hour</td>
<td>12-23 miles per hour</td>
<td>60-80 miles per 20 minutes</td>
</tr>
<tr>
<td>Time required to recharge an empty Nissan LEAF battery</td>
<td>17 hours</td>
<td>4-7 hours</td>
<td>80% in 15 minutes</td>
</tr>
</tbody>
</table>

Find links to learn more about charging equipment in our Resources section.
Electric vehicle sales in the US are higher than they have ever been with more than 130,000 EVs sold between November 2015 and November 2016. There are now about 535,000 EVs on the road today.

Utah is the fastest growing state for EVs with a 60% increase in EV registrations.
The Wasatch Front emerges as one of the best places to own an electric vehicle

Utah employers of all sizes and industry types are joining the LIVE Electric Workplace Charging Challenge, benefiting themselves, employees, and all of Utah.

The University of Utah

By partnering with Leaders for Clean Air, the U’s Commuter Services was able to buy charging stations at affordable prices—less than $500 each. They were also able to combine the installation costs with the construction of two new parking garages.

Salt Lake City

The City purchased and installed charging stations at twelve sites across Salt Lake City, thanks to a Utah Division of Air Quality (DAQ) grant and City funding. As part of a mobile-enabled network, motorists can check for available units on their smartphones.

Packsize

Thanks to Hanko Keissner, Packsize’s CEO, and his Leaders for Clean Air nonprofit, Packsize has now installed 50 Level 2 EVC’s and 2 DC Fast chargers. Packsize employees are purchasing vehicles at a higher rate than any other employees in Utah. Build it, and they will come!
14 truths about EVs

#1

EVs go the distance – the truth about range anxiety

Transportation experts report that more than three quarters of all drivers go fewer than 40 miles in a day. Electric cars easily meet those needs. In fact, seemingly every year, EVs exhibit longer all-electric range. So why all the talk about range anxiety?

Range anxiety comes from thinking a destination is beyond the fuel supply. You know the feeling: You suddenly need to hurry to an appointment, and then discover that you might not have enough gas to get there. That’s range anxiety.

The best way to avoid range anxiety is to install car-charging equipment at home. It is like having your own fuel pump and you get to start every day with a full tank. You can also plan trips in advance, which will help match your available charge to the miles you plan to travel.

The rapidly expanding network of charging facilities makes topping off very convenient. Using any number of smartphone apps or the vehicle’s computer, drivers can find chargers at locations such as Park-N-Ride lots, municipal buildings, public parking garages, car dealerships, shopping centers and malls, office buildings, and sports facilities.

But if you still worry about EV range you might want to consider a plug-in hybrid vehicle, which has battery capacity for most daily driving excursions, but includes a small gasoline engine for long-range driving.
EVs can save money

The price of a car isn't the true reflection of how much it will cost. A big economic fact to consider is the life of the car. Electricity is inexpensive compared to the high cost of gasoline or diesel, and Washington State enjoys some of the lowest electricity rates in the nation. EVs can deliver their passengers to destinations at a cost of about 2-3 cents per mile, compared to gasoline at a cost of 15-30 cents per mile. That works out to ten times more money per mile for a gasoline-powered car.

Another factor in the total cost of a vehicle is maintenance. An electric motor has fewer moving parts. It does not require oil changes, spark plug changes or filter changes. Manufacturers report that EVs eliminate more than two dozen mechanical components that would normally require maintenance during the life of the vehicle. No more noisy mufflers, broken radiator hoses or alternator belts.

Government incentives can make EVs even more financially attractive. For example, taxpayers may be eligible for a $7,500 federal tax credit for the first-time purchase of an electric car. In Washington, most EV purchases are exempt from state and local sales tax (approximately 7-10% of the sale price).

“... My husband wanted my next car to be an electric car because it was cool. I wanted a car that I felt comfortable driving. With our LEAF we have both, but to be honest I hardly think about the fact that my car is electric. I just think of it as my car.”

Beth Carper, Nissan LEAF Owner
EVs are fun to drive.
EVs are fun to drive

It is often the first thing you hear from the owner of an EV. Go ahead, test drive one yourself. They are quiet, and they are peppy. Electric motors have instant power, whereas gasoline engines have to build up power. EVs also provide information in real time that will keep your passengers entertained and envious.

EVs are safe

All vehicles, whether gasoline, electric or hybrid, must meet the same federal safety requirements. Both the Toyota Prius Prime and the Chevrolet Volt have gone above and beyond federal safety standards, earning the highest possible safety ratings from the Insurance Institute for Highway Safety for the higher level of protection they provide.

The unique design considerations of EVs provide additional safety benefits. The batteries are located in the base of the vehicle, lowering their center of gravity, and reducing the likelihood of rolling over. Similarly, the vehicle frame is reinforced to support the battery systems, further improving their collision performance.

Though EVs have high-voltage batteries on board, they also have extensive safety systems that turn off and isolate the power from battery packs when a collision or short circuit is detected. As an EV owner you can rest assured that you are not compromising safety when driving an electric vehicle.
#5

Public vehicle charging makes driving EVs more convenient

Many businesses and communities are installing charging facilities at convenient locations allowing EV drivers to "top off" in the course of their day. Public charging equipment is easy to find. Similar to the parking spaces reserved for handicapped drivers, chargers are installed at spaces set aside for plug-in vehicles.

Drivers are able to locate these chargers using smartphone apps, the car's GPS system, and through online tools such as the U.S. Department of Energy's Alternative Fueling Station Locator. See the Resource section for links to station locator tools.
“After 6 months of driving our Nissan LEAF the only complaint we have is that we didn’t have one 20 years ago!”

– Dean West, Nissan LEAF owner

### #6

**EVs are efficient**

EVs convert 75% of the energy from their batteries to power their wheels. The motor turns off at stops – no idling; and EVs use regenerative braking systems, so energy from braking is captured in the car’s batteries to be used again.

Gasoline-powered engines waste a lot of energy. As little as 40% of the energy in gasoline actually moves the wheels, the rest is simply wasted as heat from the engine. Of the usable 40%, approximately 17% is wasted during engine idling, and roughly 6% is wasted through braking.
EVs are quiet

So quiet in fact, that starting the car will be a daily reminder of just how much noise you are leaving behind with your new car. You may at first miss that initial vroom-vroom reminder of the gas engine, but you will quickly prefer the peace and quiet or the full sound of the car stereo without background engine noise.

EVs are smart

EVs are among the smartest cars on the road. In addition to sophisticated GPS systems that direct drivers to charging stations, they communicate with drivers about their charging state and driving efficiency. Many EVs can even start their cooling or heating systems by phone while still plugged in.
Utah drivers want cars that can safely tackle hills, wet roads, and snowy conditions. With a low center of gravity, balanced weight distribution and traction control, EVs have demonstrated excellent adverse-weather handling. Some EVs even come equipped with a special winter driving low gear that decreases the torque from the electric motor to prevent spin-out when accelerating in slippery conditions.

Advanced, on-board computers give you real-time data about energy use and expected range. And, as an extra benefit, you can program your EV to warm up or cool down the interior temperature of the car before you even leave home, using your household electricity and without drawing any charge from your battery.

As with any car, the more experience you have driving the vehicle, the more attuned you will be to the impact of weather, terrain, and climate control on your battery range.
Trying to source photo and see if it is available.
Annual Greenhouse Gas Emissions

- **U.S. Average Passenger Vehicle**: 11,435 lbs Gasoline
- **Toyota Prius**: 6,258 lbs Hybrid
- **Chevrolet Volt**: 3,839 lbs Plug-in Hybrid
- **Nissan LEAF**: 855 lbs All-Electric

Graph is from [http://www.afdc.energy.gov/vehicles/electric_emissions.php](http://www.afdc.energy.gov/vehicles/electric_emissions.php)
EVs = zero tailpipe emissions

EVs don’t even have tailpipes! They emit no air pollution or greenhouse gases. Compare that with a conventional gasoline vehicle, which emits 20 pounds of pollution per gallon burned. With roughly two-thirds of the region’s air pollution coming from motor vehicles, EVs are a breath of fresh air to our communities.

“Combining electric and gas mode, the Volt’s trip computer said I was seeing over 150 mpg at times!”

— Ben Lewis, automedia.com
EVs reduce reliance on gas & electricity

Drilling and refining oil for gasoline is much more energy-intensive than the energy required to power an EV. Refining gasoline from petroleum requires electricity, as much as 4 to 7.5 kWh per gallon. For every gallon of gasoline we do not need to produce, we save enough energy to power the average EV for 16 to 20 miles.

70% of oil consumed in the United States is used for transportation.

Our dependence on oil weakens the U.S. economy by sending hundreds of billions of dollars per year out of the country and represents more than half of our trade deficit. Consumers and businesses are impacted through volatile price hikes and the use of so much fossil fuel emits large amounts of air pollution and greenhouse gases.
EV batteries are better than ever

Batteries used in modern electric vehicles hold three times more power than those used in hybrid vehicles, and they’re easier on the environment. Modern electric vehicles like the Nissan LEAF and Chevrolet Volt use the most efficient batteries on the market, known as lithium-ion. These hold three times the energy and generate twice the power of batteries used in today’s hybrids, and are less toxic than lead or nickel. Though lithium is a valuable earth metal, industry observers report that there is a sufficient supply (including in the U.S.) to support the emerging EV market. Because of their value, the incentive to reuse and recycle these batteries is very high.

Electric vehicle batteries have a much longer life than those used in mobile phones and laptops. EV manufacturers estimate up to 70% of the battery capacity will remain after 10 years of regular use. In fact, battery warranties from EV manufacturers are more competitive than those offered for gasoline engines (for example, the Nissan LEAF has a 100,000 mile battery warranty).
Local governments are choosing EVs. Municipal fleet managers must balance the needs of their drivers while ensuring their fleets are as efficient, safe, and reliable as possible. So it’s no surprise that municipalities like Salt Lake and Park City both jumped at the opportunity to replace gasoline vehicles with electric.

Since the launch of the Electric Xpress rapid transit route in Park City, public transit ridership has increased by 40%.
Business owners embrace EVs

A national survey found that the top concern of fleet managers was rising, volatile fuel prices. As a result, 28% of the fleet managers questioned said they would add EVs to their fleets within a year. These may include plug-in cars, trucks, and specialized vehicles.

- FedEx and UPS have already added a variety of EVs to their fleets.

- Staples and Frito-Lay use electric trucks for in-city stop-and-go driving with a top speed of 55 mph. These trucks can carry as much as 16,000 pounds and travel 50 to 120 miles on a single charge.

- Packsize’s Salt Lake City office uses solar and wind energy, and about 15% of its employee base commutes to work in zero-emission vehicles with access to 52 EVCs on-premise to recharge.

- REI has a goal to become climate-neutral in their operations by 2020. As part of that initiative, they installed EV fast-charging stations at their stores in Salt Lake City, Colorado Springs, and Seattle to support cleaner, low-emissions vehicles on the road.

- The University of Utah did a bulk purchase and in three months put 127 low-or-no-emissions vehicles on the road.

- Salt Lake City installed 28 new public EV charging stations.

- REI has a goal to become climate-neutral in their operations by 2020. As part of that initiative, they installed EV fast-charging stations at their stores in Salt Lake City, Colorado Springs, and Seattle to support cleaner, low-emissions vehicles on the road.

- The University of Utah did a bulk purchase and in three months put 127 low-or-no-emissions vehicles on the road.

- Salt Lake City installed 28 new public EV charging stations.

"Packsize takes pollution very seriously. We do our part to build a culture around reducing CO2 emissions. We realize this vision daily through Leaders for Clean Air, an organization principally established to create an electric vehicle infrastructure along the Wasatch Front. The trend toward zero tailpipe emissions is gaining traction and I am convinced that flipping the switch on EV charging will continue to be a smart decision for every Utahn."

-Hanko Kiesner, CEO, Packsize International

Salt Lake City, Colorado Springs, and Seattle to support cleaner, low-emissions vehicles on the road.

The University of Utah did a bulk purchase and in three months put 127 low-or-no-emissions vehicles on the road.

Salt Lake City installed 28 new public EV charging stations.

REI has a goal to become climate-neutral in their operations by 2020. As part of that initiative, they installed EV fast-charging stations at their stores in Salt Lake City, Colorado Springs, and Seattle to support cleaner, low-emissions vehicles on the road.

The University of Utah did a bulk purchase and in three months put 127 low-or-no-emissions vehicles on the road.

Salt Lake City installed 28 new public EV charging stations.
EVs currently available or coming soon

**Battery Electric Vehicles**
- BMW i3
- Chevrolet Bolt
- Chevrolet Spark EV
- Fiat 500e
- Ford Focus EV
- Hyundai Ioniq Electric
- Kia Soul EV
- Mercedes B Class Electric Drive
- Mitsubishi i-MiEV
- Nissan LEAF
- Smart Electric Drive
- Tesla Motors Roadster Sport 2.5
- Tesla Model 3
- Tesla Model S
- Tesla Model X
- Volkswagen e-Golf

**Plug-in Hybrid Vehicles**
- Audi A3 Sportback e-tron
- BMW 330e
- BMW i3 with Range-Extender
- BMW i8
- BMW X5 xdrive40e
- Cadillac ELR
- Chevrolet Volt
- Chrysler Pacifica Plug-in Hybrid
- Ford Fusion Energi
- Ford Fusion Plug-In Hybrid
- Ford C-Max Energi
- Honda Accord Plug-In Hybrid
- Honda Clarity Plug-In Hybrid
- Hyundai Ioniq Plug-In Hybrid
- Hyundai Sonata Plug-in Hybrid
- Mercedes C350 Plug-in Hybrid
- Mercedes S550 Plug-in Hybrid
- Mercedes-Benz GLE550e
- Mitsubishi Outlander PHEV
- Porsche Cayenne S E-Hybrid
- Porsche Panamera S E-Hybrid
- Toyota Prius Plug-In
- Toyota Prius Prime
- Volvo XC90 T8
- Via Motors VTRUX
Resources

Learn more about electric vehicles and charging options:

afdc.energy.gov/fuels/electricity
goelectricdrive.com
pluginamerica.org
www.cleancities.org

Find charging stations:
Visit the U.S. Department of Energy’s Alternative Fueling Station Locator:
afdc.energy.gov/afdc/locator/stations/

Learn about incentives and opportunities:
liveelectric.org
utahcleancities.org
What’s not to get amped up about?

- Reduced demand for oil
- Modern innovation
- High tech
- Cleaner air
- Affordable
- Fun to drive
- Quiet