

EV Auxiliary Systems Impacts

As with gasoline-powered vehicles, electric vehicles have a number of auxiliary systems. Some systems, such as the radio/tape player, lights, and horn, operate the same way as they do on a gasoline-powered vehicle. Other systems, such as the power steering and power brakes, require an additional small electric motor and have minor impact on the vehicle range. However, the air conditioning and heating systems on electric vehicles are different and can have a dramatic impact on the range.

Federal safety standards require all vehicles to have adequate heating and defrosting systems. The heater/defroster system is easily operated in a conventional gasoline-powered vehicle because a supply of heated water from the engine cooling system is readily available. Electric vehicles do not have this heat source and therefore must provide the heat with an auxiliary heating system. Some electric vehicles use an electric resistance heater, similar to a common hair dryer, which requires electric power. This power must come from the main battery pack with a corresponding decrease in vehicle range. Depending on the outside temperature and the desired temperature in the vehicle, the range reduction can approach 35%.

Impact of Equipment on EV Performance

Accessory	Range Impact	Comments
Air Conditioning	Up to 30%	Highly Dependent on ambient temperature, cabin temperature, and air volume
Heating	Up to 35%	Highly Dependent on ambient temperature and cabin temperature
Power Steering	Up to 5%	
Power Brakes	Up to 5%	
Defroster	Up to 5%	Depending on use
Other Lights, Stereo, Phone, Power-assisted seats, windows, locks	Up to 5%	Depending on use

Air conditioning systems on electric vehicles can also have a significant impact on a vehicle's range. These are usually standard automotive air conditioning units that must be powered by an auxiliary electric motor instead of being powered by the engine. This additional motor requires power from the battery pack, which reduces the range of the vehicle. The amount of power needed for air conditioning depends on the outside temperature and the desired inside temperature.

The electric vehicle has a 12-volt auxiliary battery just as in the gasoline-powered vehicle to operate the lights, radio, and other equipment. The 12-volt battery in a gasoline-powered

vehicle is recharged with an alternator driven by the engine. In an electric vehicle, the auxiliary battery is recharged with the use of a DC-to-DC converter. This electrical device provides power to the 12-volt auxiliary battery from the high-voltage battery pack used to power the vehicle.

Heat pumps similar to those used in homes are being used on the latest electric vehicles; these reduce the power requirements for heating and cooling. An example is the General Motors EV1, which uses an electrically driven heat pump for climate control.

Impact of Desired Vehicle Temperature on EV Energy Consumption (EV Drivers' thermal comfort will play a key role in determining ranges)		
Outside Temp	Desired Vehicle Temp	Energy Consumption
110 ° F	70 ° F	1.5-2 kw
110 ° F	77 ° F	1 kw
110 ° F	84 ° F	0.5 kw