Electric Vehicles

NC State University
North Carolina Solar Center

What are the benefits of using an electric vehicle?

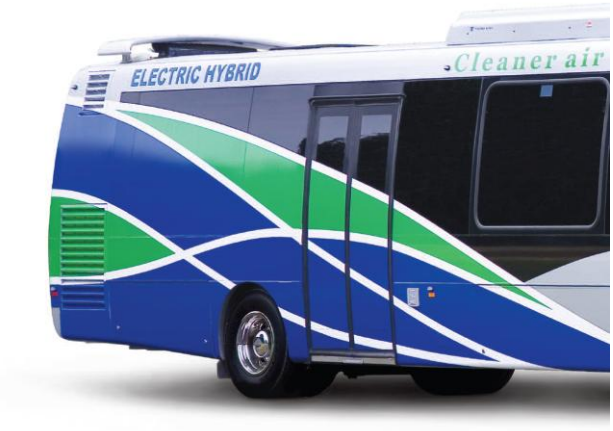
- **Lower emissions** .Electric vehicles (EVs) have zero tailpipe emissions and potentially zero lifecycle emissions if renewable energy such as biomass, wind or solar is used for electricity generation.

- **Lower fuel cost.** EVs with direct current (DC) electric systems get about 0.4 kilowatt-hours (kWh) per mile, while those with more efficient alternating current (AC) systems get about 0.174 to 0.288 kWh per mile. With North Carolina electricity rate averages of $0.10 per kWh, it would cost about $0.04 per mile for DC operation and $0.03 cents per mile for AC operation. You would pay $0.12 per mile for gasoline in a vehicle that gets 25 miles per gallon when gasoline sells for $3 per gallon.
- **Ability for an EV to serve as an energy resource**. Upgrades to our national grid will allow 2- way communications between power generation and our homes, businesses, and vehicles. Charging EVs in at night when there is excess grid capacity will even out power loads and increase overall efficiency. Currently our power delivery is on-demand, meaning that electricity is not stored. This poses a challenge for intermittent renewable resources like wind and solar. When electric vehicles are plugged into an electric outlet they can provide storage capacity for intermittent power, which will require development of the “smart grid” to reach its potential.
- **Enhanced performance and reduced maintenance.** EVs are quiet and have fewer moving parts. They do not require oil changes or other internal combustion engine maintenance. Testing has demonstrated that EV acceleration, speed, and handling can equal or exceed that of conventional vehicles. EVs are also more energy efficient, particularly in stop-and-go traffic, because braking energy can be partly recovered to recharge the battery and the engine does not run if the car is not moving.

What types of Electric Vehicles are being manufactured?

All-electric vehicles for the U.S. and world market are under rapid development. A full-size all-electric vehicle is powered entirely by electricity, can be operated on all roads and all speeds, and can be charged from a wall outlet with either 120 or 240 volts. In advance of original equipment manufactured EVs, EV Innovations (with NC based Development Office), converts a range of gasoline vehicles to all electrics for customers worldwide.

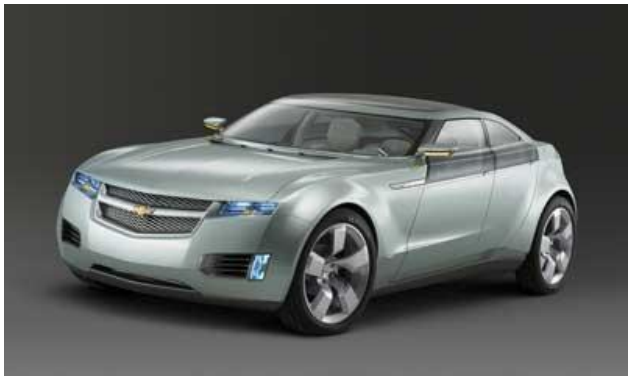
EV challanges are currently a limited distance between recharges (30-70 miles) and slow recharge times (30 min to 6 hr). However, since 70% of all travel is commuting and local trips in this range, EVs are often the perfect answer for a second or commuter car, especially if it can be plugged in at work or in parking lots, as well as at home.



Medium and heavy duty EV options include: **all electric transit buses and delivery trucks, plug-in hybrid utility trucks, transit and school buses**. DesignLine International,I s manufacturing 35 ft plug in hybrid electric transit buses in Charlotte. Heavy duty plug in hybrid vehicles often show more than double the fuel economy of conventional trucks while significantly reducing emissions.

This factsheet was developed through Clean Fuel Advanced Technology (CFAT), a project of the NC Solar Center at NC State University which is sponsored by the NC Department of Transportation, NC Division of Air Quality, and State Energy Office with support from the Triangle Clean Cities, Centralina Clean Fuels Coalition, and Land-of-Sky’s Clean Vehicle Coalition

Plug-in hybrid electric vehicles (PHEVs) will soon be commercially available in the mass market. They can be charged with electricity like pure electric vehicles or run under gasoline engine power like standard hybrid electric vehicles. This combination offers increased driving range with potentially large fuel and cost savings, emissions reductions, and other benefits. Sometimes the terms PHEVs and extended range electric vehicles (EREV) are used interchangeably. An EREV has full EV capability plus an engine that turns on to reduce/replace the current from the battery. This means an EREV can perform ANY driving maneuver on electricity alone. A PHEV MAY be capable of this, but they typically cannot produce full power and/or speed from their electrical systems alone. PHEVs require a simultaneous blending of gasoline power and battery power. An example of an EREV is the Chevy Volt, pictured here.



Certain hybrids are being converted to PHEVs. There are several conversion kits and installation companies. A larger battery pack than a conventional hybrid electric vehicle batteries allows the PHEV driver to achieve up to a 100 miles per gallon for an 80 mile trip or to operate in an all electric mode for a typical round trip commute of 50 miles. PHEV owners may eventually get "paid" by utilities for providing extra electrical storage capacity from their vehicles' batteries to help meet peak electricity demand, provide grid support services, or respond to power outages if "vehicle-to-grid" technologies being researched now become available.

Currently, **Neighborhood Electric Vehicles (NEVs)** are widely available and especially popular in retirement communities and on college campuses where short distances and low speeds are used. A NEV is a Low-Speed Vehicle (LSV) with top speeds of 20 to 25 miles per hour that complies with certain U.S. National Highway Traffic Safety Administration (NHTSA) standards. NEVs are charged by plugging into a common household 110 volt outlet and can travel between 30 to 60 miles before needing to be recharged. North Carolina allows NEVs to be operated on streets and highways where the posted speed limit is 35 mph or less. NEVs can be titled and licensed as private passenger vehicles. **Low speed vehicles** (LSV) that are not NEVs may take the place of conventional vehicles in certain settings. These vehicles are not plated nor permitted on public streets. These vehicles help reduce petroleum consumption and emissions by operating on electricity and other alternative fuels

Are there any incentives for EVs?

Current federal incentives include a plug-in electric drive vehicle tax credit. The credit is limited to between $2,500 to $7,500 based on battery capacity (4 to 16 kWh) for vehicles weighing less than 14,000 lbs. The credit will eventually scale back based on sales volume per model. Sales and leases are both covered. Low speed electric vehicles and 2&3 wheeled vehicles with batteries of at least 2.5 kWh are eligible for a 10% tax credit up to $2,500 through 2011. Qualified conversions of vehicles to plug-in hybrid or all electric are eligible for a 10% tax credit up to $4,000 through 2011.
There is a federal tax credit for electric vehicle charging infrastructure equaling 50% of the cost of the [refueling - recharging?] equipment; up to $50,000 for commercial and $2,000 for residential.

Resources:

Advanced Energy	www.NCGetReady.com
Centralina Clean Fuels Coalition	www.4cleanfuels.com
Land-of-Sky Clean Vehicles Coalition	www.landofsky.org/planning/p_cvc_home.html
NC Solar Center	www.cleantransportation.org
Plug In Carolina	http://www.plugincarolina.org/
Triangle Clean Cities Coalition	www.trianglecleancities.org

References:

U.S. Dept of Energy http://www.afdc.energy.gov/afdc/vehicles/hybrid_electric_publications.html
U.S. Environmental Protection Agency http://www.epa.gov/OMS/consumer/fuels/altfuels/420f00034.htm