"Electric Vehicles"

The Basics, The Good, The Bad, and The Questions?

The Facts, Fictions, and Myths of EVs. Are we really ready for them?

Leaders Guide

Designed for and Presented as an Oregon Association for Family and Community Education (FCE) Zoom Lesson

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"Electric Vehicles" The Basics, The Good, The Bad, and The Questions?

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Outline:

- Welcome and Introduction of Presenters …… 1 minute
- Review Goals and Objectives …… 1 minutes
- Introduction of Lesson …… 1 minute
- "Electric Vehicles" Quiz …… 5 minutes
- A Brief History of Electric Vehicles ……,…… 5 minutes
- Some Basics of Electric Vehicles ……..10 minutes
- Some Good Facts about Electric Vehicles …… 15 minutes
- Some Bad Facts about Electric Vehicles …… 15 minutes
- Conclusion, comments, questions, and Handouts ……7 minutes

60 total minutes

Goals and Objectives

- Participants will gain an understanding of what Electric Vehicles are, some of the basic history, and why they are coming into our lives today.
- Participants will gain an understanding of the good, and the bad, of Electric Vehicles.
- Participants will gain an understanding of some of the questions that are asked about Electric Vehicles.

Note to the Presenter of this Lesson: It is suggested that you read through this lesson and "Hi-Lite" the parts that you want to present and read. This lesson can be shortened or lengthened to meet various meeting times and presentations.

Use the PowerPoint presentation, if possible, so that all the participants can see the pictures.

Items That May Be Needed for Presentation

- Leaders Guide for: **"Electric Vehicles" The Good, The Bad, and The Questions? -*The Facts, Fictions, and Myths of EVs. Are we really ready for them?***
- Various Activities and Handouts (Handouts 1, 2, and 3)
- Pencils or pens for each attendee
- Blank paper for each attendee (if needed)
- *PowerPoint Presentation on **"Electric Vehicles" The Good, The Bad, and The Questions? -*The Facts, Fictions, and Myths of EVs. Are we really ready for them?*** (If needed)
- *Computer
- *PowerPoint projector
- *Screen or wall to project presentation on
- *Computer/projector table
- *Electrical cords/power bars as needed

*Only needed if PowerPoint presentation is used

References and Resources Credit Given to:

- U.S. Department of Energy
- U.S. Energy Information Administration (EIA)
- Science.org
- Young People's Trust for the Environment
- Motor Trend
- Drive Clean Cal.gov
- US Department of Transportation
- Bio Friendly Planet
- Blink Charging
- Home Advisor
- Edmonds
- Consumer Reports
- FOX29 Philadelphia -By Catherine Stoddard
- Natural Resource Defense Council
- US News
- FireSystem.net

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******Handout #1: Quiz******

Only give them 5 or less minutes – Correct Quiz at the end of the lesson.

What are Electric Vehicles (EVs)

An EV is defined as a vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source. An EV includes both a vehicle that can only be powered by an electric motor that draws electricity from a battery (all-electric vehicle) and a vehicle that can be powered by an electric motor that draws electricity from a battery and by an internal combustion engine (plug-in hybrid electric vehicle).

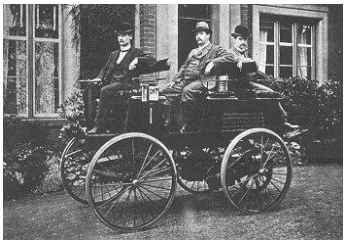
What is the History of Electric Vehicles (EVs) and Why Are They Coming into Our Lives

First Small-Scale Electric Cars

Horse and buggies are the primary mode of transportation, but innovators in Hungary, the Netherlands and the U.S. think to the future, creating some of the first small-scale electric cars.

Photo courtesy of Wikimedia Commons.

1832 - First Crude Electric Vehicle Is Developed



Around 1832, Robert Anderson develops the first crude electric vehicle, but it isn't until the 1870s or later that electric cars become practical.

1889 — 1891 - First Electric Vehicle Debuts in U.S.

William Morrison, from Des Moines, Iowa, creates the first successful electric vehicle in the U.S. His car is little more than an electrified wagon, but it sparks an interest in electric vehicles.

1899 - Electric Cars Gain Popularity

Compared to the gas- and steam-powered automobiles at the time, electric cars are quiet, easy to drive and didn't emit smelly pollutants -- quickly becoming popular with urban residents, especially women.

1900 — 1912 - Electric Cars Reach Their Heyday

By the turn of the century, electric vehicles are all the rage in the U.S., accounting for around a third of all vehicles on the road.

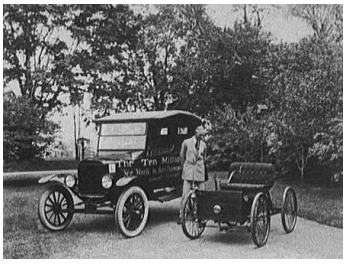
1901 - Edison Takes on Electric Vehicle Batteries

Many innovators take note of the electric car's high demand, exploring ways to improve technology. For example, Thomas Edison thought electric vehicles were the superior mode of transportation and worked to build a better battery.

1901 - World's First Hybrid Electric Car Is Invented

Ferdinand Porsche, founder of the sports car by the same name, created the Lohner-Porsche Mixte -- the world's first hybrid electric car. The vehicle is powered by electricity stored in a battery and a gas engine.

1908 — 1912 - Model T Deals a Blow to Electric Vehicles



The mass-produced Model T makes gas-powered cars widely available and affordable. In 1912, the electric starter is introduced, helping to increase gas-powered vehicle sales even more.

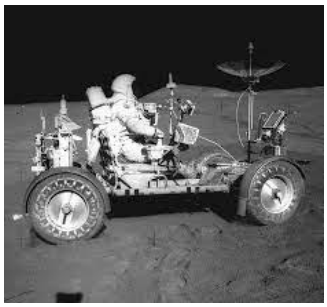
1920 — 1935 - Decline in Electric Vehicles

Better roads and the discovery of cheap Texas crude oil help contribute to the decline in electric vehicles. By 1935, they have all but disappeared. Filling stations that popped up across the U.S., making gas readily available for rural Americans and leading to the rise in popularity of gas-powered vehicles.

1968 — 1973 - Gas Prices Soar

Over the next 30 years or so, cheap, abundant gasoline and continued improvement in the internal combustion engine created little need for alternative fuel vehicles. But in the 1960s and 1970s, gas prices soar through the roof, creating interest in electric vehicles again.

1971 - Over the Moon with Electric Vehicles



Around this same time, the first manned vehicle drives on the moon. NASA's Lunar rover runs on electricity, helping to raise the profile of electric vehicles.

1973 - The Next Generation of Electric Vehicles

Many big and small automakers began exploring options for alternative fuel vehicles. For example, General Motors develops a prototype for an urban electric car, which the company displayed at the First Symposium on Low Pollution Power Systems Development in 1973.

1974 — 1977 - Leader in Electric Vehicle Sales

One successful electric car at this time is Sebring-Vanguard's CitiCar. The company produces more than 2,000 CitiCars -- a wedge-shaped compact car that had a range of 50-60 miles. Its popularity makes Sebring-Vanguard the sixth largest U.S. automaker by 1975.

1979 - Interest in Electric Cars Fades

Compared to gas-powered cars, electric vehicles at this time have drawbacks, including limited performance and range, causing interest in electric cars to fade again.

1990 — 1992 - New Regulations Renew Electric Vehicle Interest

New federal and state regulations create a renewed interest in electric vehicles. The result: Automakers begin modifying popular vehicle models into electric vehicles, enabling them to achieve speeds and performance much closer to gasoline-powered vehicles.

1996 - EV1 Gains a Cult Following

GM releases the EV1, an electric vehicle that was designed and developed from the ground up. The EV1 quickly gains a cult following.

1997 - First Mass-Produced Hybrid

Toyota introduces the first mass-produced hybrid, the Prius. In 2000, Toyota releases the Prius worldwide, and it becomes an instant success with celebrities, increasing its (and the electric vehicle's) profile.

1999 - Building a Better Electric Car

Behind the scenes, scientists and engineers work to improve electric vehicles and their batteries.

2006 - Silicon Valley Startup Takes on Electric Cars

Tesla Motors, a Silicon Valley startup, announces it will produce a luxury electric sports car with a range of 200+ miles. Other automakers take note, accelerating work on their own electric vehicles.

2009 — 2013 - Developing a Nation-Wide Charging Infrastructure

To help consumers charge their vehicles on the go, the Energy Department invests in a nation-wide charging infrastructure, installing 18,000 residential, commercial, and public chargers. Including chargers installed by automakers and other private companies, today there are 8,000 public charging locations in the U.S.

2010 - First Commercially Available Plug-In Hybrid for Sale

GM released the Chevy Volt, making it the first commercially available plug-in hybrid. The Volt uses battery technology developed by the Energy Department.

2010 - Nissan Launches the LEAF

In December 2010, Nissan releases the LEAF, an all-electric, zero tailpipe emissions car. In January 2013, Nissan begins assembling the LEAF in Tennessee for the North American market thanks to a loan from the Energy Department.

2013 - Electric Vehicle Battery Costs Drop

The battery is the most expensive part in an electric vehicle. Thanks to investments by the Energy Department, battery costs dropped by 50 percent in just four years, helping make electric vehicles more affordable for consumers.

2014 - Electric Vehicles and a Multitude of Choices

Consumers now have a multitude of choices when buying an electric vehicle, including hybrids, plug-in hybrids and all-electric. Today, there are currently 23 plug-in electric vehicles and 36 hybrid models available.

2015 – 2022 - The Future of Electric Cars

Electric vehicles hold a lot of potential for helping the U.S. create a more sustainable future. If the U.S. transitioned all the light-duty vehicles to hybrids or plug-in electric vehicles, we could reduce our dependence on foreign oil by 30-60 percent, while lowering the carbon pollution from the transportation sector by as much as 20 percent.

Some Basics of Electric Vehicles (EVs)

What's the Difference Between a HEV or an EV?

A hybrid electric vehicle (or HEV for short) is a vehicle without the capacity to plug in but has an electric drive system and battery. It's driving energy comes only from liquid fuel.

A plug-in hybrid electric vehicle (also called a PHEV) is a vehicle with plug-in capability, and it can use energy for driving from either its battery or liquid fuel.

An all-electric vehicle (often called a battery-electric vehicle, an electric vehicle, or an EV or AEV for short) is a vehicle that gets its energy for driving entirely from its battery and it must be plugged in to be recharged.

A plug-in electric vehicle (or PEV) is any vehicle that can be plugged in (either a plug-in hybrid or an all-electric vehicle).

What is U.S. Electricity Generation by Energy Source? (See Handout #2)

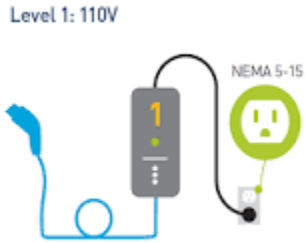
In 2022, about 4,243 billion kilowatt-hours (kWh) (or about 4.24 trillion kWh) of electricity were generated at utility-scale electricity generation facilities in the United States. About 60% of this electricity generation was from fossil fuels—coal, natural gas, petroleum, and other gases. About 18% was from nuclear energy, and about 22% was from renewable energy sources.

Electric Car Charging Station Costs by Level

Residential homeowners have two options for their home EV charging stations: Level 1 and Level 2. There is also a Level 3 station, but it's only available for commercial locations and has a price that reflects that.

Level 1 Charging Stations

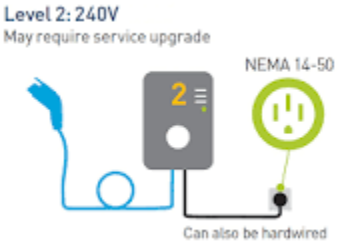
Level 1 charging stations, or L1 stations, cost around $300, and don't require professional installation. They're the slowest but most affordable option. You don't need a dedicated charging station for a Level 1 setup. In fact, L1 chargers typically ship with your new electric car and plug directly into a standard 120-volt AC outlet.



However, suppose you want a dedicated Level 1 charging station to lessen power demands from your home's electrical circuit. In that case, the price to install a Level 1 charging station is between $300 to $600 for the base station and another $1,000 to $1,700 for labor and other cost.

Level 1 stations offer an average power output of 1.3 kilowatts (kW) to 2.4. kW, which is equivalent to three to five miles of EV range per hour. In other words, it will take more than three and a half days for your electric vehicle to fully charge using a Level 1 charger plugged into a standard 120-volt outlet. This makes them great for light use or hybrid vehicles but not as ideal for regular use of a fully electric vehicle.

Level 2 Charging Stations



The price to install an electrical circuit for an L2 EV charging station is between $400 to $1,700 for a single-port station and $800 to $3,400 for a dual-port station. The cost of an L2 charger falls between $500 to $700 for a single-port station and approximately $3,500 for a dual-port station, not including the installation costs.

For serious residential charging of 100% electric vehicles, Level 2 charging stations are your best bet. L2 stations offer beefier stats than L1 stations, with a price tag to match. They also come in two options: single-port and dual-port stations.

Find an Electric Charger Installation Pro Near You

Level 2 chargers give your EV approximately 12 to 80 miles per hour, meaning an overnight charge typically fills a fully depleted battery. These charging stations require some electrical work. They plug into a 50-amp (minimum), 208-240-V dedicated circuit and need a costly and heavy supply line from the breaker box, accounting for the price increase.

Level 3 Charging Stations

Level 3 charging stations cost an average of **$20,000** for the parts alone and upwards of **$50,000** for the installation. L3 stations also offer a massive amount of charging power—**three to 20 minutes of range per mile.** They also utilize an incredible amount of **DC voltage (400V to 900V**), which is why you don't typically see them in residential settings.

Level 3 charging stations are not currently available for residential use, so their exorbitant prices aren't factored into the average costs for homeowners.

Electric Car Charging Station Additional Cost Factors

Parts and labor account for most of the project price, but additional cost factors may impact certain homeowners.

Permits

Count on spending $100 to $200 on permits, especially if you are installing a Level 2 station with a dedicated circuit. The price of a permit varies by location, so check with local regulatory agencies or ask your contractor for accurate pricing. Always check with your local permitting office before starting work.

Electric Vehicle Charging Speeds (See Handout #3)

Level 1

The slowest, Level 1 equipment provides charging through a common residential 120-volt (120V) AC outlet. Level 1 chargers can take 40-50 hours to charge a battery electric vehicle (BEV) from empty and 5-6 hours to charge a plug-in hybrid electric vehicle (PHEV) from empty.

Level 2

Level 2 equipment offers charging through 240V (in residential applications) or 208V (in commercial applications) electrical service, and is common for home, workplace, and public charging. Level 2 chargers can charge a BEV from empty in 4-10 hours and a PHEV from empty in 1-2 hours.

Level 3 - Direct Current Fast Charging (DCFC)

The fastest speed, direct current fast charging (DCFC) equipment, enables rapid charging along heavy-traffic corridors at installed stations. DCFC equipment can charge a BEV to 80 percent in just 20 minutes to 1 hour. Most PHEVs currently on the market do not work with fast chargers.

Without a Gas Tax, How Will EVs Be Charged for Road Use?

Currently very few, if any, states charge a road use tax on electric vehicles. This is a rapidly growing problem because without electric vehicles paying their share of road building and maintenance, it puts the entire burden on vehicles that use fossil fuels. Electric vehicles weigh up to twice the weight of gas vehicles and cause much more road damage. Various methods of charging road taxes on electric vehicles are being tested.

Do Electric Cars Pose a Higher Fire Danger?

When compared to gasoline and hybrid vehicles, electric cars have the lowest number of fires per 100,000 sales. Though electric car fires occur least frequently, they burn longer and hotter than other fires.

Why Electric Car Fires Occur

Electric vehicles are powered by lithium-ion batteries. Most frequently, electric car fires ignite from the battery. There are two main reasons why these fires break out: manufacturing errors and an over-stressed battery, from factors such as over-vibration or electrical shorts.

How Electric Vehicle Fires Are Extinguished

While any type of car fire is dangerous, electric car fires tend to burn longer and hotter than most. Unfortunately, not many fire departments are adequately trained or equipped with the necessary special agents to extinguish them. Lithium-ion battery fires can take thousands of gallons of water to put out. With a governmental call for half of all new vehicles to be zero-emission by the year 2030, it will be necessary to greatly improve safety protocols for firefighters.

Is It Cheaper To Drive an Electric Vehicle?

Chances are, maybe. Here's how to be sure. There are plenty of climate and air quality reasons to buy an electric vehicle, but is it cheaper to drive? A lot can determine your EV's price tag—from fuel costs to maintenance—and whether you'll save money in the long run.

Sticker Prices for Electric vs. Gas Cars

The average sticker price of a new electric car in 2021 was about $20,000 higher than the industry average, which includes both gas-powered and electric vehicles. But the EV market is growing rapidly, and this price margin is expected to shrink considerably in the coming years as manufacturers produce more affordable models and battery technology (which is the most expensive part of an EV) improves. You can mitigate some of that cost by making use of tax incentives.

Cost of Electricity vs. Gasoline

Here's where EV owners win out. Going electric means, you get to skip pricey trips to the pump, which is one of the biggest draws for making the switch. A 2018 study by the University of Michigan's Transportation Research Institute found that the average cost to fuel an electric car was $485 a year, compared to $1,117 for a gas-powered vehicle.
A 2020 Consumer Reports study similarly showed that EV drivers tend to spend about 60 percent less each year on fuel costs compared to drivers of gas-powered cars.

Electric Vehicle Efficiency Range

Electric vehicles range in efficiency—that is, how far they can go on the same amount of electricity. For an EV, efficiency is measured by how many kilowatt-hours (kWh) of electricity it consumes per 100 miles—similar to a gas-powered car's miles-per-gallon stat. (A lower kWh/100 miles rate is better.) The 2022 Tesla Model 3 RWD leads the pack in efficiency, with 25 kWh/100 miles. But the more budget-friendly 2022 Chevrolet Bolt EUV is comparable, with a 29 kWh/100 miles rating. Charging your car at home will also cause your electricity bill to rise, but how much will depend on factors like when you charge it and where you live.

Maintenance Costs for Electric vs. Gas Cars

Without spark plugs to replace or oil to change, electric vehicles have a clear leg up on maintenance costs. Electric cars do still require some basic maintenance—like service checks and tire rotations. But in general, electric vehicles typically cost half as much to maintain and repair as gas-powered cars.

Calculating the Cost of Vehicle Types

You can figure out your savings estimate by calculating the upfront costs of your specific model (minus tax rebates) and then ongoing costs. Those should account for your model's efficiency, how much you plan to drive, regional electricity costs, charging habits, and maintenance costs per year. Then compare those to the gas-powered alternative.

Good Facts About Electric Vehicles (EVs)

Electric Cars Are More Energy Efficient

An amazing advantage electric cars have over fossil-fuel powered ones is their efficient use of the energy you put into their batteries. An electric car converts between 75 and 95% of it's available energy into motion. A fossil fuel car can only convert a maximum of around 30% of the energy stored in its fuel into motion. The rest is lost in heat and friction.

Electric Cars Have Incredible Acceleration

While this might not be considered a benefit, many electric cars are capable of phenomenal acceleration. This is because electric cars produce maximum torque at zero revolutions per minute (rpm) and can continue this pretty much through their rev range.

They Can Be Really Cool

Electric cars can look strikingly different. Electric cars like those produced by Tesla and BMW look highly distinctive and they are filled with all kinds of exciting technology. When driving an electric car, there is something pretty amazing about whizzing down the road with no noise except the wind and the tires on the road.

Safety

EVs include the same safety features standard on nearly all cars today, including antilock brakes, stability control, front-seat side airbags and often additional airbags such as full-length side curtain and driver knee airbags.

Electric vehicles perform as well as their gasoline counterparts in government and insurance industry crash testing, and officials believe battery-powered cars pose no greater risk than gasoline-powered cars for fire or other perceived electrical risks.

No Air Pollution

EVs have no tailpipe emissions that contribute to air pollution.

Very Little Noise Pollution
EVs are relatively quiet, so they do not contribute to noise pollution.

No Engine Oil
EVs do not use engine oil, which is generally bad for the environment.

Less Direct Environmental Impact
EV chargers, ***when powered by renewable energy sources***, have less impact on the environment and its natural resources than traditional gas stations. No transportation, other than power lines and electrical infrastructure, is required to get the "fuel" to the chargers, unlike a gas station's need to transport fuel.

Some Bad Things About Electric Vehicles (EVs)

For almost 10 years now, electric vehicles have been the talk of the car industry. From the early Tesla models up to today's Mustang Mach E, electric vehicles tried to show what the future of personal transport looks like. To some, they are appealing since modern electric vehicles introduced zero emissions and high-tech driving interfaces. However, **EV manufacturers have hidden the downsides of those vehicles**. Electric cars are still far from perfect. Here's why you should think twice before purchasing one.

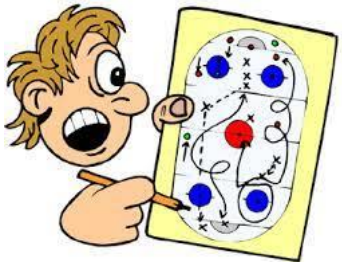
Short Range Anxiety - You Can't Drive As far In An Electric Car
Although battery technology is improving all the time, this is a fact at the moment. The best electric cars now have ranges of well over 300 miles between charges. But many have a range of just 150 miles or less between charges, which means they are much more suited for use in cities and on short, local journeys, rather than for long-distance travel. And to recharge them, they need at least half an hour of charging at a dedicated, high voltage charging point - the kind you see on motorway services. Compare that with the time it takes to fill the tank of a petrol or diesel-engine car and the fact that many new cars can now go 500 miles or more between refills and it's obvious that fossil fuels still have a distinct advantage in this area. Using the heater or air conditioner in an electric car will also have an impact on their range, and batteries hold less charge when it's cold.

Long Charging Times

Long charging time is another big problem concerning electric cars. To fully charge the batteries, you need to connect your vehicle to a power source. This can often take at least several hours. However, Tesla and Porsche advertise their models with supercharging abilities. That means they can recharge their batteries to nearly 80 percent in just 20 to 30 minutes.

Even though Tesla and Porsche have made significant improvements, charging is still far from the speed to fill a gas tank. Putting the fuel in your car only takes a couple of minutes compared to charging your vehicle overnight. If the industry doesn't find a solution to this problem soon, it could seriously hurt the electric vehicle market.

Trip Planning Problems



Small ranges and long charging times can put a strain on any road trip plans. You can't plan a fast trip in an electric car without knowing the location of charging stations. You will also need to know the estimated duration of charging or supercharging. Other factors to be aware of are the latest weather conditions and temperature changes. Those metrological circumstances affect the electric car's range significantly.

That is why electric cars are only suitable for short trips. You can forget driving from coast to coast, at least not in a reasonable amount of time. You'll have to plan each charging stop along the way to avoid getting stranded in the middle of nowhere.

Mostly Good for Urban Use

So, what is the main playground for electric vehicles? Simply put, it's urban areas. The EV's range is longer if you drive in the city. Second, there are far more charging stations in metropolitan areas.

Also, if you run out of juice while driving in the city, which often happens with electric vehicles, you can easily find a cab, Uber, bus, or some other form of transportation to get home.

Not So Environmentally Friendly

While it's true that electric vehicles have zero emissions, did you ever think about what it takes to make just one electric vehicle? The process of making a big chunk of Lithium-Ion batteries as well as their disposal is polluting since they aren't recyclable.

Also, electric vehicles demand more electricity. That comes from thermoelectric or nuclear power plants, which are extremely dangerous because they're choking the Earth. The rising demand for electric power will only raise the level of global pollution. This is actually far beyond what internal combustion engines are doing now.

Too Expensive

Since electric vehicles feature the latest, most advanced technology, they cost more. For example, there is a range of electric cars for sale on the current market, with the top models going for well over **$100,000.**

Although there are affordable models like the Volkswagen Golf E or Nissan Leaf, electric vehicles still cost significantly more than models that run on fossil fuels.

Repair Difficulties

If you own an electric car, you can forget going to your local shop or fixing it inexpensively. Regardless of the type and the model, all-electric vehicles require specific maintenance and service procedures as well as extremely high safety standards.

Also, servicing electric cars can be quite dangerous because most of the car's mechanics consist of battery packs under high voltage. Also, in case of a fire, you can't just put it out with water. You have to use a special fire extinguisher since the batteries burn at a much higher temperature.

Too Heavy

One of the main downsides of having a big battery pack underneath your car is the additional weight. While most modern vehicles are heavy due to all the extra safety and

comfort options, electric vehicles are the heaviest champions. On smaller models like the Kia Soul EV, the electric batteries add around 450 extra pounds of weight.

However, on some of the high-end models like the Tesla Model X, the battery pack weighs in at over 1,000 pounds. Also, the car itself weighs over 2.3 tons. Heavy vehicles mean more tire wear, more energy consumption, and maintenance too.

Cold Temperature Issues

When it's freezing outside, electric vehicles are notorious for displaying specific problems. One of the most common issues is the loss of battery power. It's similar to old cell phones that would stop working once you took them out of your pocket in the winter.

Since the bulk of the electric vehicle market is in the Northern Hemisphere where the winters are cold and snowy, cold weather battery drain can be a big problem for everyday use. Owners report a reduced range and even the failure to operate in especially harsh winter conditions. That could be life-threatening.

Cold temperatures do affect electric vehicles and steal some of their range. The amount of range lost depends on many factors such as the car itself, its potential range in normal weather, and whether the heat is on. According to AAA, EVs often lose 12% of their range in cold weather, but the loss leaps to 41% with the heater on full blast. Anything below 40 or above 115 degrees Fahrenheit and they're not going to deliver their peak performance."

Just Plain Ugly

There are some electric vehicles that are stunning beauties, but most of them are just plain ugly or ordinary at the very least. In the case of the Golf E and Kia Soul EV, the design hasn't changed a bit. However, in the case of Tesla cars or the Nissan Leaf, the design is specific to the model and not everyone's cup of tea.

Threatening Existing Economy Models

Some economic experts fear that the mass production of electric vehicles and focus on this kind of technology will destroy the current economic model. That, in turn, will affect global politics and all the worldwide monetary systems as well. If the oil companies lose their monopoly on energy and the oil-rich nations lose their authority on the global political scene, the world could be heading to another crisis.

Also, think about the enormous car industry with all the companies that make fuel-related products, such as engine parts, fuel injection systems, transmissions, and drivetrain components. All those companies and millions of people will be out of a job, which would put further strain on the economy and global standards.

Major Car Companies Aren't So Sure

Although almost all the major car manufacturers have at least one electric vehicle in their lineup, most of their CEOs are not fully convinced that electric cars are the future of the industry. Their board of directors and marketing people have observed how problematic the EV segment is, so they hesitate to go all-in on electric cars.

Also, there is still a lot of money to be made on internal combustion engines and a lot more development to do, so none of the big-name players is going to be fully electric anytime soon.

Practically Unusable in Third World Countries and Markets

The EV craze is limited to just a few first world countries and markets in the world. But other than that, electric vehicles in other areas are nonexistent. Even China, the world's biggest market, has a hard time implementing any initiatives for electric cars. If you go to remote parts of the world or any of the developing countries, you'll notice that fossil fuels are still the primary source of energy, and that's not likely to change soon.

Buyers Still Consider Them A Gimmick

Although Tesla has sold over 300,000 cars all over the world, with other manufacturers posting considerable production numbers, most car buyers still

consider EVs to be some sort of a sales trick. Their specific operation procedures, limited usability, and different driving dynamics make them cars for tech geeks, but not as regular transport devices.

Car consumers are still waiting for mass-produced electric vehicles that will fully replace gasoline-powered models. But to do that, they'll need to introduce some improvements that will draw buyers to EVs.

An EV Can't Be the Only Car in Your Household

Clearly, there are many limits to electric vehicles in general. Even if you own one or are looking to acquire an EV, you should know that it can't fulfill all your transportation needs. That's especially true if you have a family and need a dependable vehicle for your family.

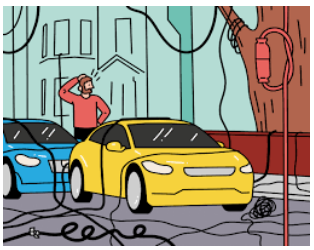
You could use your electric vehicle in the city for your everyday commute. However, if you want to go on a road trip with your family, you will need an internal-combustion vehicle due to range concerns and personal peace of mind.

A Hard Sell

Most drivers lease their electric cars and then return them to the dealer after a few years to get a new model. However, those people who have bought electric vehicles could experience great difficulty selling them on the used car market or trading them in at the dealership. That is because electric cars depreciate much faster than gas-powered vehicles since the technology is so new and still evolving.

People looking for deals on the used-car market are still extremely cautious when it comes to electric cars. They don't know how the used electric vehicles act or how to maintain them properly. Many also don't know what the common problems are, for example. Hopefully, EVs will continue to evolve and improve, making them easier to drive long distances, less expensive to repair, and more dependable.

A Dead Battery Dilemma (Problems with Recycling)



EV batteries only have an estimated life of 4 to 6 years and usually cost about $20,000 to replace. A shredded electric vehicle battery can yield recyclable metals, but it is often

cheaper for battery makers to use new materials therefore, very few electric batteries are currently being recycled.

Complying won't be easy. Batteries differ widely in chemistry and construction, which makes it difficult to create efficient recycling systems. And the cells are often held together with tough glues that make them difficult to take apart. That has contributed to an economic obstacle.

Cargo Space

Although it depends on where the batteries are positioned in the vehicle, electric cars often have similar, if not more, cargo space than their gasoline counterparts. The space reserved for engines, in fact, often becomes a front trunk (sometimes called a "frunk"), offering additional room for luggage, groceries and small-item storage. Although EVs can yield more passenger or cargo space, payload capacity — the total weight that the car can carry safely — can still be an issue.

Electric Vehicles Rely on Power Plants

EV chargers generally rely on electricity from power plants, which most still use fossil fuels. This could be problematic in states like California where the energy grid is already being pushed to its limit during the hot, summer months, so residents will be forced to experience more rolling blackouts.

Electric Vehicle Batteries are Hard on the Environment

EV battery production can adversely impact the environment, such as a loss of biodiversity, air pollution and decreased freshwater supply. EV batteries consist of materials like nickel, lithium, cobalt and others, which are energy-intensive to mine. These minerals are also often mined in regions with a poor environmental record. Argentina accounts for 21% of the world's lithium reserves and plans are already in place to open 13 more mines (in addition to the two already in production). Many worry the mining could cause massive destruction, corrupt an already fragile ecosystem and pillage the country's natural resources all in the name of "green progress". In many of these countries, children as young as 6 years old are used in the mining process.

Electric Vehicles Wear Out Tires Faster

EV tires wear out faster due to the heavier weight and increased torque of the vehicle. Expected lifespan on EV tires is only between 30,000 to 40,000 miles. This means you'll be buying tires more often and thus contributing to increased emissions.

Electric Vehicles Are Not Always As Environmentally Friendly as They Appear

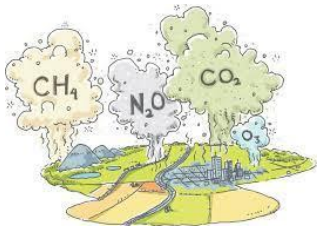
Sometime EVs are a "feelgood feeling: for many people. The main takeaway is EVs, in certain circumstances, can have an improved environmental impact vs. conventional gas-powered vehicles. However, batteries, charging and various manufacturing processes still negatively affect the environment. More work must be done to ensure these cars are as eco-friendly as possible.

Their Batteries Need Rare Metals

The batteries for electric cars use a lot of lithium, the lightest metal and the lightest solid element under normal conditions. Chile produces the largest amount of lithium (8,800 tons per year), with other big producers including Argentina and China, while Bolivia has the world's largest known reserves. Other metals used in electric cars include copper, cobalt, aluminum, nickel and sometimes manganese, along with conductive non-metal graphite. There are rich cobalt deposits in countries like the Democratic Republic of Congo, where it lies on the surface and is picked up by miners who include women and children. Cobalt is toxic to humans and most of these miners work with little or no protective equipment.

It has been suggested that we will struggle to create large numbers of electric cars in Europe in the near term, simply because we don't have sufficient access to sources of lithium to make the batteries and we don't have the factories to make them in either.

Making Electric Cars Creates More Emissions



To get a real idea of how much greenhouse gas is emitted during the manufacture of an electric car, you have to look at how its components are sourced and made. The raw materials for making the car have to be mined, and the process of mining creates a lot of greenhouse gases. Then the raw materials have to be refined before they can be used, which again emits more greenhouse gases. Then more greenhouse gas is emitted in the manufacturing process.

Of course, the above is also true when manufacturing a petrol or diesel car. In fact, taking into account the whole production process, making a petrol or diesel car releases about 7 to 10 tons of CO2.

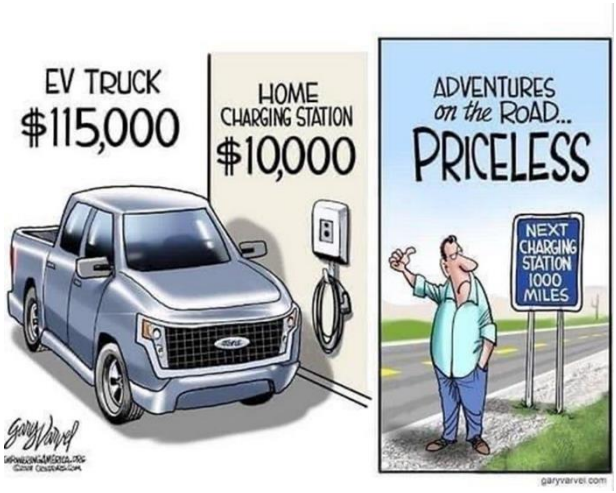
Making an electric car releases roughly the same amount of CO2, but then you have to add in the production of the battery. Estimates suggest that 150kg of CO2 are released for every 1 Kilowatt hour (kWh) of battery capacity. For an electric car to have a decent range (say 300 miles) between charges, it needs a battery that's at least 60kWh in capacity. This means that a further 9 tons of CO2 will be emitted during the making of an electric car, giving a total of 16-19 tons of CO2 emitted. So at this point, an electric car seems worse for the environment than a fossil fuel one.

They Are Only as Green as Their Power Sources

The environmental impact of an electric car can increase or decrease considerably depending on how the electricity that charges its battery is made. A coal-fired power station emits 800-850 grams of CO2 per kWh (recent estimates suggest this may be lower, at 650g per kWh), whilst a cleaner, gas-fired power station emits 350-400g CO2 per kWh. Using renewable energy, like solar panels or wind turbines, around 36g CO2 is emitted per kWh, taking into account the emissions created during their manufacturing process. So if a car is recharged using renewable energy, its negative impact on the environment is far lower than if it's charged using electricity from a coal-fired power station.

There Aren't Enough Charging Points.

Charging stations are growing in number (8,000 currently) but there are still not enough of them, especially in rural areas. Even with the growing number of charging stations there are other problems. Filling a car with diesel or petrol takes a couple of minutes, not 30 minutes or more and many petrol stations have 4 to 6 pumps or more.



Many people get around this by having their own charging point installed at home. But that's not really an option for people living in streets of terraced housing where on-street parking means they often have to park their cars some distance from their house. The need to charge our vehicles could potentially cause problems. What if everyone plugs their car into a charger when they arrive at work at 9am, or when they get home at 6pm? How will the surge in demand be dealt with?

Problems With the Cost and Maintenance of Charging Stations

There is a tremendous cost of setting up and maintaining charging stations. Also, EVs can put a tremendous strain on the electric infrastructure.

Politicians are Rushing for a Transition to Electric Vehicles Yet Small Business Will Pay For It?

Small business owners beware: From California to Minnesota to Washington, D.C., governments are pushing policies to eventually eliminate gas-powered vehicles and subsidize the electric car market. For consumers and small businesses alike, the consequences will be higher prices, rising taxes, and fewer transportation options to fit your needs.

These policies come in various shapes. In some states, utility companies are looking to raise electricity bills to pay for electric vehicle (EV) charging infrastructure, even though these utilities will profit off of what is being built.

Meanwhile, California recently announced a full ban on gas- and diesel-powered cars by 2035. Minnesota finalized EV sales mandate this summer, and New Jersey and Virginia want to be next.

While these policies may not fully take effect for years, the hardship for business owners and consumers starts now. Small businesses are already struggling from the pandemic and higher labor costs, and these bans and mandates will now raise the price of transportation. Higher prices will impact any business that uses vehicles, from service providers like plumbers, landscapers, and delivery drivers to manufacturing. Or, supply companies that transport products to market. Even those few businesses that don't require transportation will face higher taxes.

The Real Costs of Electric Cars vs Gas Cars

Electric Vehicles vs Gas Cars

(6 Year Average Ownership)

Source: Car Coach Report 2023

Electric Cars vs Gas Cars – Which Truly Saves You Money.

Electric Car	Category	Gasoline Car
$57,000	Cost of Vehicle	$35,000
-$5,000	Rebates (Federal/State)	No Rebates
$1,910	Insurance	$1,592
$485	Yearly Operation	$1,117
$900	Vehicle Maintenance	$1,235
$19,770 (6 x $3,295)	6 Year Longevity 6 x Amount	$23,664 (6 x $3,944)
$71,770 Total Cost for 6 Years	Average for 6 Year Ownership	**$58,664 Total Cost for 6 Years**

An Electric Vehicle Cost **$13,036** more than a Gas Car over a 6-year ownership.
(**$2,173** more per year)

Summary

Sales of electric vehicles (EVs) are increasing worldwide, particularly in countries like Norway, Iceland, and Sweden. In 2021, sales numbers doubled from the previous year and the World Economic Forum suggests more EVs are sold per week than the entire number sold in 2012.

The standard internal combustion engine (ICE) market experienced declines in sales due to the COVID-19 pandemic, yet the EV market has maintained. With more EVs on the road now than ever, some consumers wonder how these new vehicles impact the environment. But, there lots of things to consider.

Now is the time for you to study and ponder the facts about Electric Vehicles. Are they something that you want to have in your future. **The choice is up to you.**

Note: Watch video if time allows.

Conclusion and Questions?

Review Handout #1
Distribute Handouts #2, #3, and 4.

Handout #1

Electric Car Quiz

1. T or F The first electric car was invented in 1832.
2. T or F The first hybrid car was invented in 1960.
3. T or F An electric car was used on the moon in 1966.
4. T or F The first hybrid car was mass produced in 1997.
5. T or F Nissan launched the LEAF in 2010.
6. T or F A HEV can operate of either gasoline or electricity.
7. T or F An EV can operate on either gasoline or electricity.
8. T or F 70% of the electrical energy used in United States comes from renewable sources such as wind and solar.
9. T or F Over 60% of the electrical energy used in the United States comes from fossil fuels.
10. T or F 18% of the electrical energy used in the United State comes from nuclear energy.
11. T or F A Level 1 charging station is used for rapid high voltage DC charging.
12. T or F A Level 1 charging station cost about $300 to $600.
13. T or F A Level 3 charging station is the fastest, and most expensive, method of charging an electric car.
14. T or F A Level 1 charging station can take 40-50 hours to fully charge an electric car.
15. T or F The cost of installing a Level 3 charging station is between $20,000 to $50,000.
16. T or F Fires in electric cars can be very difficult to put out because of the Lithium-ion batteries. This requires a special fire extinguisher.
17. T or F Sticker prices for an electric car are about $20,000 higher than gasoline cars.
18. T or F Maintenance of an electric car needs to be done by an electric car specialist.
19. T or F Electric cars are more energy efficient.
20. T or F Electric cars are known for their lack of acceleration.
21. T or F The best electric cars have a range of 300 miles and some as little as 150 miles or less.
22. T or F Electric cars usually have long charging times, depending on the charging station being used.

23. T or F Because of the low range, long charging times, and lack of charging stations, long trips can become a real problem, especially with trip planning.
24. T or F Electric cars are best used for cross-country trips.
25. T or F Electric cars produce zero emissions in driving, production of the car and production of the batteries.
26. T or F The cost of purchasing an electric vehicle is much lower than the cost of a gasoline vehicle.
27. T or F Currently there are little or no road taxes on electric vehicles which puts all of the burden of road taxes on gasoline and diesel vehicles.
28. T or F Electric vehicles have excellent acceleration.
29. T or F Electric vehicles can be charged faster than a gasoline vehicle can be refilled.
30. T or F Electric vehicles weigh much more than gasoline vehicles.
31. T or F Electric vehicles have little or no problems dealing with cold temperature issues.
32. T or F Some electric vehicles are just plain ugly.
33. T or F Electric vehicles can easily be used in all countries throughout the world.
34. T or F Currently, it would be difficult for a family to have only an electric vehicle.
35. T or F The normal life of an electric vehicle is between 4 and 6 years.
36. T or F The tires on electric vehicles wear out faster.
37. T or F Electric vehicle batteries are easily recycled.
38. T or F Electric vehicles are only as green as their power sources.
39. T or F Currently, there a plenty of charging stations in the United States.
40. T or F During a 6-year period, the overall expenses of a gasoline car is less than that of an electric vehicle.

Electric Car Quiz – Answer Sheet

1. True
2. False
3. False
4. True
5. True
6. True
7. False
8. False
9. True
10. True
11. False
12. True
13. True
14. True
15. True
16. True
17. True
18. True
19. True
20. False
21. True
22. True
23. True
24. False
25. False
26. False
27. True
28. True
29. False
30. True
31. False
32. True
33. False
34. True
35. True
36. True
37. False
38. True
39. False
40. False

Handout #2

U.S. utility-scale electricity generation by source, amount, and share of total in 2022[1]

Data as of February 2023

Energy source	Billion kWh	Share of total
Total - all sources	4,243	
Fossil fuels (total)	2,554	**60.2%**
Natural gas	1,689	39.8%
Coal	828	19.5%
Petroleum (total)	23	0.6%
Petroleum liquids	16	0.4%
Petroleum coke	7	0.2%
Other gases[3]	12	0.3%
Nuclear	772	**18.2%**
Renewables (total)	913	**21.5%**
Wind	435	10.2%
Hydropower	262	6.2%
Solar (total)	146	3.4%
Photovoltaic	143	3.4%
Solar thermal	3	0.1%
Biomass (total)	53	1.3%
Wood	37	0.9%
Landfill gas	9	0.2%

Energy source	Billion kWh	Share of total
Municipal solid waste (biogenic)	6	0.1%
Other biomass waste	2	0.1%
Geothermal	17	0.4%
Pumped storage hydropower[4]	-6	**-0.1%**
Other sources[5]	11	**0.3%**

[1] Utility-scale electricity generation is electricity generation from power plants with at least one megawatt (or 1,000 kilowatts) of total electricity generating capacity. Data are for net electricity generation.

[2] Small-scale solar photovoltaic (PV) systems are electricity generators with less than one megawatt (MW) of electricity generating capacity, which are not connected at a power plant that has a combined capacity of one MW or larger. Most small-scale PV systems are at or near the location where the electricity is consumed and many are net metered systems. The smaller ones are usually installed on building rooftops.

Handout #3

Overview of EV chargers: power output, plug type, and charge time for light-duty vehicles. (Adapted from the Alternative Fuels Data Center)

	Level 1	Level 2	DC Fast Charging
Connector Type[1]	J1772 connector 	J1772 connector 	CCS connector  CHAdeMO connector  Tesla connector 
Typical Power Output	1 kW	7 kW - 19 kW	50 - 350 kW
Estimated PHEV Charge Time from Empty[2]	5 - 6 hours	1 - 2 hours	N/A
Estimated BEV Charge Time from Empty[3]	40 - 50 hours	4 - 10 hours	20 minutes - 1 hour[4]
Estimated Electric Range per Hour of Charging	2 - 5 miles	10 - 20 miles	180 - 240 miles
Typical Locations	Home	Home, Workplace, and Public	Public

Handout #4

Electric Vehicles vs Gas Cars

(6 Year Average Ownership)

Source: Car Coach Report 2023

Electric Cars vs Gas Cars – Which Truly Saves You Money.

Electric Car	Category	Gasoline Car
$57,000	Cost of Vehicle	$35,000
-$5,000	Rebates (Federal/State)	No Rebates
$1,910	Insurance	$1,592
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ENVIRONMENT ISSUES