Sustainability September: Green Transportation

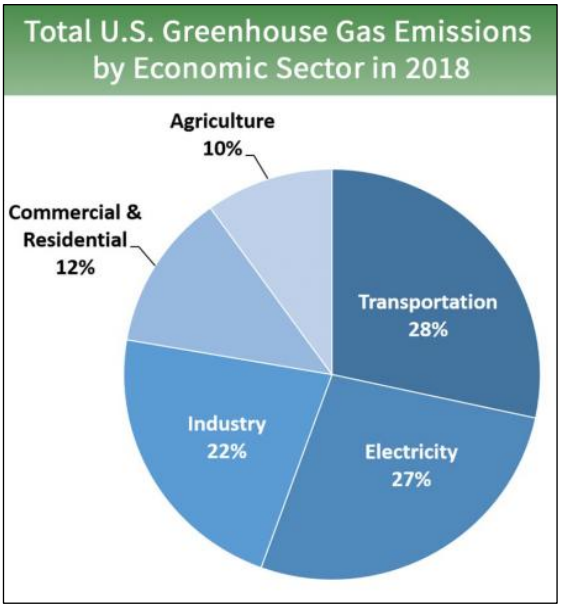
Learn about different forms of transportation at Duke Farms and their benefits.

If you have ever explored Duke Farms, you have probably noticed that people use a variety of transportation methods to get around the 18 miles of trails! Visitors of all ages choose to walk, bike, rollerblade, skate, or scooter around to view the beautiful sights on the property. Staff have the option of driving a fully electric vehicles (EVs) to get around the property a little faster when working on site.

One of our electric vehicles at Duke Farms. Source.

What do all the transportation options listed above have in common in terms of sustainability?

<u>They all release *zero emissions*.</u> As concerns of climate change continue to grow, it is important that we are continuously aware of how we live our daily lives. How do our choices impact the environment, and in turn, everything else on this planet? This can be an overwhelming thought for most, especially people who adore the natural world around us. While it is important to make changes as quickly as we can to combat climate change, some changes are not possible for everyone to make right away. So, when in doubt, start by making little changes that you can afford to make physically and financially. While transportation is a large contributor to an excess of carbon emissions in the atmosphere, it is just one way we can reduce our carbon emissions and combat climate change. Next time you are in the market for a new car, do your research on electric vehicles, test drive a few, and consider them as an option.

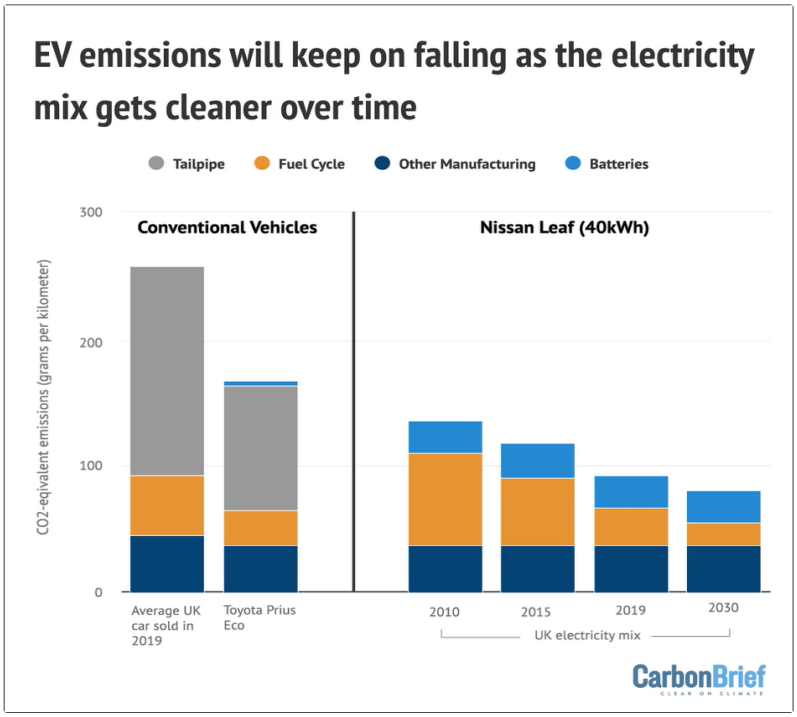


Greenhouse gas emissions, 2018. Source.

Emissions of Gas Vehicles vs. Hybrid Vehicles vs. Fully Electric Vehicles

The graph below (on page 2) shows the amount of emissions created and released by 3 different types of vehicles; a car that runs fully on gas, a hybrid car that runs on gas and electric (Toyota Prius), and a fully electric vehicle (Nissan Leaf) and where those emissions come from. The **grey bars** are the emissions released from the tailpipe. You can see that these only show up with the conventional cars that use gasoline - the leading source of emissions. The **orange bars** are the emissions released from the fuel cycle - this includes oil production, transportation, refinement, and electricity generation. You can see that this bar continues to shrink when looking at the electric vehicles from 2010 to 2019, because the source of energy is continuing to get cleaner with the use and evolution of renewable energy. You

can also see that the projected emissions from the fuel cycle in 2030 is approximately half of what is was in 2019. The **dark blue bars** show emissions from manufacturing, which have stayed consistent throughout the years for all vehicle types. Finally, the **light blue bars** show the emissions from battery manufacturing. What the graph *does not* show is that technology is getting better and better each year, so the batteries used in electric vehicles are lasting longer and charging faster without being responsible for emission. Read the full report here.



Graph of emissions from conventional vehicles and an electric vehicle over time. Source.

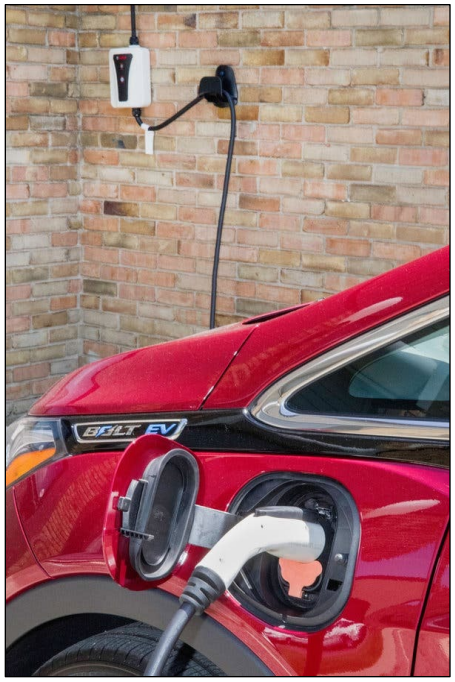
Common Consumer Concerns with Electric Vehicles

There are various consumer concerns when it comes to electric vehicles. Some common ones are:

1. Driving range of the vehicle
2. The battery charging time
3. Access to charging stations

As time goes on, technology will only get better and EV's will become more popular. Scientists and manufacturers have been testing and producing EV's since the 1800's. Check out this article for a brief history of electric vehicles.

In 2020, the average driving range is about 200 miles. Here are a few examples of electric vehicles and their specs. Charging time will also vary depending on how low your battery is, which type of charging station you're hooked up to, and how large your battery is. Charging can take anywhere from 30 minutes to 8 hours depending on these factors. Charging stations can also be set up in the home garage for easy and convenient charging access.



In 2019, there were almost 70,000 charging stations in the United States alone. Click here to see a breakdown of where you can find these electric charging stations in the US and respond to the questions below.

1. Which state(s) have the most charging stations? How many do they have?

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2. Which state(s) seem like they could use more charging stations?

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3. Look at the size of the states in comparison to how many charging stations they have. Any observations to note?

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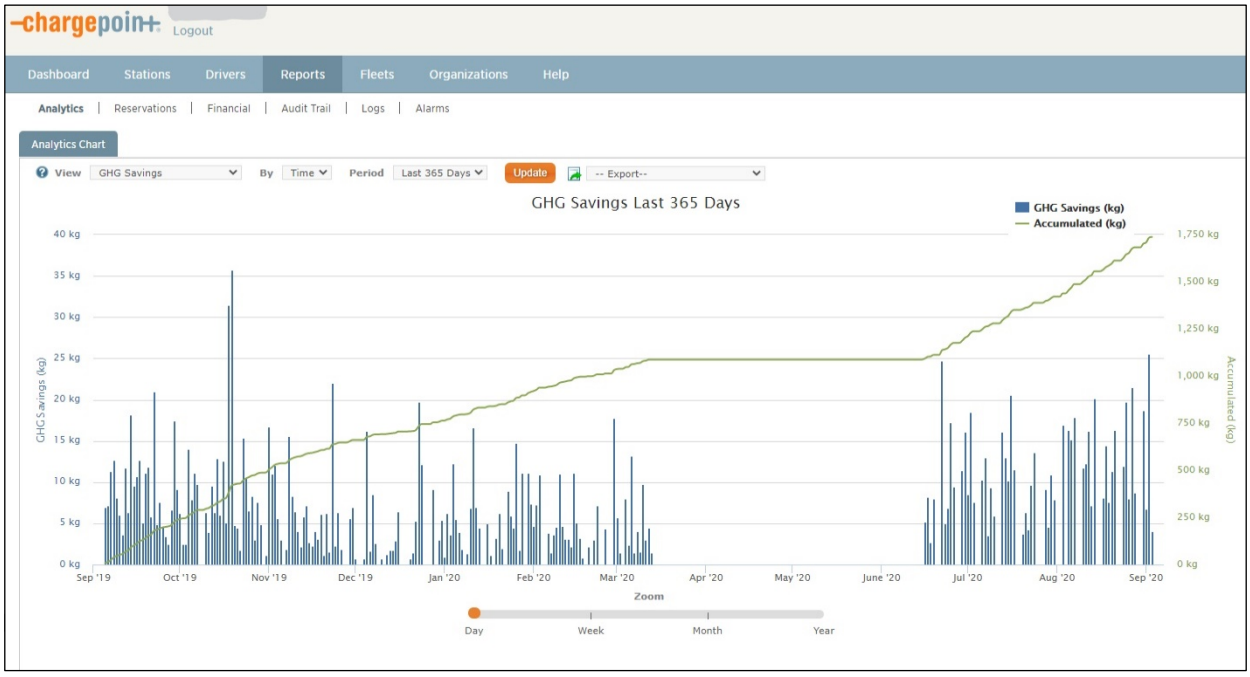
Bonus: Can you find Duke Farms on the map?

Electric vehicles and features at Duke Farms. Along with our own electric vehicles and charging stations for staff, we also have 2 Level II ChargePoint chargers available to the public that run on 100% solar energy! These are in the main parking lot along with a row of priority parking for electric vehicles. See the graph below for information on GHG savings at Duke Farms.



Graph of GHG savings from public charging stations on the property, September 2019 to September 2020.

For those who want to learn more about electric vehicles, there are numerous EV Clubs located around America. Their members usually have lots of experience and are very willing to share their stories. There also have been many gatherings and events that showcase the latest technological advances. The features and advancements regarding these vehicles are rapidly changing, so these groups are generally a great source of the latest information. Also, check out Duke Farms Classes and Events web page for virtual classes!

Activity: Design Your Own Electric Vehicle

For this activity participants will design, draw, and make a list of detailed specs about their very own electric vehicle. If this is being used in a class or a space with more than a couple participants, you can have them work in groups and pitch their final designs out to the rest of the room and try to sell their vehicle. Who had the most liked design? Why?

Features to think about:

- Size of the vehicle: weight, length, height
- Battery: where will it go, how large it is
- Charging time
- Price of the vehicle: will it be affordable or expensive?
- What other sustainable features will your car have?
- Special features: what make your car stand out from the rest? (This is where it can get fun, be creative!)

Building Model Vehicles that GO!

Buggies Built for Fun: Found on the Electronics Weekly blog, the Buggies Built for Fun resource covers a wide range of vehicles from starter models to very elaborate designs including go-karts and trikes. These projects are advanced and need very specific materials, but they are also great to use for your own ideas, analysis and modifications that can be just done on paper.

DIY Mini Electric Car: One of the best aspects of this project is that the body of the car is made from recycled materials. If you have a juice box, egg carton, or even a laundry detergent container, you can put it to good use. These models might be used in classrooms or for extensions and home extensions for those who like to tinker. Check it out instructions on the project here.

Student Learning Standards: Learning about electric vehicles is directly aligned to the new climate change learning standards for NJ Public Schools, but it is also applicable to other content areas such as technology and engineering. For example:

Grade 4 Model Curriculum NJDOE

Unit 7: Using Engineering Design with Force and Motion Systems

In this unit of study, students use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from objects through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of energy and matter and the influence of engineering, technology, and science on society and the natural world…

Adopted 2020 New Jersey Student Learning Standards (NJSLS)

Climate Change

New Jersey is the first state in the country to require climate change curriculum across all content areas and at a K-12 level. As stated by the NJDOE:

On June 3, 2020, the State Board of Education adopted the 2020 NJSLS in the following content areas:

- Career Readiness, Life Literacies, and Key Skills;
- Comprehensive Health and Physical Education;
- Computer Science & Design Thinking;
- Science;
- Social Studies;
- Visual and Performing Arts;
- and World Languages.

These standards truly represent a foundation from which districts will build coherent curriculum and instruction that prepares each New Jersey student with the knowledge and skills to succeed in our rapidly changing world. They will put New Jersey again at the forefront of national education by including the following:

- Climate Change across all content areas, leveraging the passion students have shown for this critical issue and providing them opportunities to develop a deep understanding of the science behind the changes and to explore the solutions our world desperately needs.

For more information about this topic and how to integrate it into your classroom curriculum or for more explorations at home, contact Kate Reilly, Manager of Education, Duke Farms at kreilly@dukefarms.org