



Low-Emissions Vehicle Purchasing Guidance

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OVERVIEW

How to Use this Guide:

This guide is intended to be a straightforward, easy-to-use document that provides purchasers considering electric vehicles with:

- A general understanding of the concepts and benefits of purchasing low- or zero- emission vehicles
- Resources for funding
- Recommended vehicle options (including alternatives for vehicle classes whose needs are not currently met by the available low- or zero-emissions vehicles available)
- An overview of the purchasing process at Penn
- Information on infrastructure and other support

Released in October 2019, the Penn's *Climate and Sustainability Action Plan (CSAP) 3.0* represents a vision for the University's sustainable future. In accordance with this vision and to reduce Penn's carbon and other emissions that impact human health, *CSAP 3.0* aims to encourage the purchase of low- or zero-emissions vehicles at Penn.

These vehicles are not only beneficial to the environment in reducing our carbon footprint; they also reduce the negative impact on human health, particularly in terms of air pollution, which leads to health conditions such as asthma and lung cancer. [The American Lung Association's 2022 State of the Air report](#) placed Philadelphia as the 18th most air polluted city by year-round particle pollution in the United States. Some of the main driving factors of Philadelphia's polluted air are local emissions, including those that come from Penn's vehicles. [Philadelphia's individual State of the Air report card](#) can be viewed for more details.

Recognition of the social and environmental impacts of University vehicles is particularly important given the environmental inequity that exists in the communities surrounding Penn's main campus. Contributions to Philadelphia's air quality also impact the University, both in maintenance costs and the health of faculty and staff. For Penn employees who live locally, vehicle emissions put themselves and their families at risk for the negative health impacts mentioned above.

The two main vehicle types that will be emphasized in this guide are battery electric vehicles (BEVs) and plugin hybrid electric vehicles (PHEV). When possible, preference should be given to electric vehicles (EVs) due to their greater ability to contribute to Penn's goal of carbon neutrality by 2042.

In the AASHE (Association of Advancement of Sustainability in Higher Education) 2021 Sustainable Campus Index, Penn ranked seventh as a top performer in transportation. In FY22, Penn Transportation purchased four Ford electric passenger vans for the first time. Each van will eliminate at least 13 MTCDE (metric tons of carbon dioxide equivalents) per year, reducing 53 MTCDE or more annually. Building off that, in FY23 more Penn departments purchased electric vehicles, including electric carts, passenger vehicles, and transit buses. These are great achievements in addressing the carbon footprint of our campus fleets, but Penn hopes this guide will help further those efforts. For any questions about the information within this document, please contact the Penn Sustainability Office at sustainability@upenn.edu.



INTRODUCTION

The 2023 Low-Emissions Vehicle Purchasing Guidance is a tool to help Penn fleet managers integrate low-emission vehicles into their fleets. In accordance with CSAP 3.0, this initiative aligns with the University's commitment to improve energy efficiency within the campus fleet. By curbing the environmental impact of Penn's fleet, we improve our pursuit of a sustainable campus environment.

The FY23 update of the Low-Emissions Vehicle Purchasing Guidance features three notable updates:

1. **New and Updated Funding Resources:** Recognizing that funding is often a pivotal obstacle in the path toward low-emission vehicle acquisition, we have improved the [funding resources section](#). Comprehensive updates encompass pertinent details such as available amounts, eligible vehicles, and application deadlines. Notably, the [National Electric Vehicle Infrastructure \(NEVI\) program](#), recognized by many fleet managers and EV charging enthusiasts, is prioritizing addressing interstate highway EV infrastructure gaps.
2. **IRS Tax Credits Emphasis:** Emphasis on the potential of IRS tax credits in FY23, offering an attractive incentive of up-to-\$7,500 for qualifying vehicles within non-profit educational institutions. Detailed information can be accessed [here](#). Additionally, in continuation from last year, both the "Driving Pennsylvania Forward" and Alternative Fuels Incentive Grant (AFIG) initiatives continue to raise state-level financial support for the adoption of low-emission vehicles alongside programs designed to bolster EV charging infrastructure.
3. **Recommended Vehicles with IRS Eligibility:** An update to the existing vehicle list to include a selection of newly introduced vehicles eligible for IRS tax credits. This update aids departments and centers with constrained budgets that want to continue low-emission vehicle integration. In tandem with these advancements, all vehicle models are categorized as their 2023 or 2024 iterations, complete with estimated prices as of late July 2023.

The 2023 Low-Emissions Vehicle Purchasing Guidance continues to catalyze the low-emission vehicle transition at Penn. Guided by the principles of CSAP 3.0, this document embodies the University's commitment to a greener, more sustainable future.

For detailed information and resources, please refer to the following guidance.

Penn Sustainability

VEHICLE TYPES AND IMPACTS

Electric vehicles (EVs) generally fall under the following four categories:

- **Battery Electric Vehicles** (BEVs) – powered by electric motors and are offered in a wide range of vehicle types for both short- and long-distance travel
- **Low Speed Vehicles** (LSVs) – lightweight vehicles powered by an electric motor with a maximum speed of 25 mph
- **Plug-In Hybrid Vehicles** (PHEVs) – have both an electric motor and a gasoline motor to benefit from both fuel types; these are ideal when charging availability is limited or uncertain
- **Fuel Cell Electric Vehicle** (FCEV) – powered by hydrogen and emit only water vapor and warm air



Ford Focus,
Battery Electric
Model
(BEV)



Columbia
Electric Utilitruck
(LSV)



Chrysler Pacifica,
Plug-In Hybrid
Model
(PHEV)



Hydrogen
Powered Street
Sweeper
(FCEV)

Internal combustion engine vehicles (ICEVs) cover all vehicles that are powered by combustion, most commonly by burning gasoline or diesel. Alternative fuel vehicles (AFVs) are a subset of ICEVs that are powered by fuel sources like compressed natural gas.

In some cases, the utility of a vehicle may not be able to be fulfilled by the current selection of EVs available; however, lower emission options may be available and should be considered.

Achieving Penn's CSAP Goals

CSAP 3.0 expands upon the previous two iterations to further reduce Penn's emissions. The main goals regarding Penn's campus fleets are as follows:

- Achieve carbon neutrality by 2042
- Encourage purchasing of low- or zero- emissions vehicles
- Increase the number of electric vehicle charging stations as demand requires

This guide aims to address these goals by providing a comprehensive set of resources and recommendations for purchasing and funding vehicles.

When possible, **preference should be given to battery electric vehicles** (BEVs) because of their greater ability to contribute to Penn's carbon neutrality goal. Research shows that the emissions associated with the lifecycle of BEVs are significantly less than their gas or diesel internal combustion engine vehicle (ICEV) counterparts, especially considering the energy makeup of Philadelphia's electrical grid combined with projected increases in renewable energy sources both for the electrical grid and through Penn's Power Purchase Agreement.

For more information on the global warming potential (GWP) of EVs see **Appendix I: Global Warming Potential (GWP) of EVs**.

Lifecycle Cost

In addition to reduced emissions, one of the major benefits of incorporating EVs into Penn's fleets is the **lowered cost of maintenance over time**. EVs cost less on average to keep running than internal combustion engine vehicles (ICEVs) because they don't need regular oil changes and have fewer moving parts that need to be maintained or replaced. According to a [2020 report conducted by Consumer Reports](#), the lifetime average maintenance cost per mile for EVs, both battery and hybrid, is half that of ICEVs. Battery electric vehicles and plugin hybrid electric vehicles have a lifetime (defined as 200,000 miles) average maintenance cost of about \$0.03/mile, whereas ICEVs cost about \$0.06/mile.

The cost to power EVs is also lower than it is for ICEVs. In Philadelphia, **it costs almost four times more to fuel a gasoline powered ICEV than an EV**. Based on the average price of commercial electricity for Philadelphia, a compact passenger EV costs about \$5.97 to drive 250 miles. In comparison, based on average gasoline prices in Philadelphia, an equivalent gasoline powered ICEV costs about \$22.34 for the same distance. For more information, see **Additional Resources: FAQ**.



There are also **federal tax credits worth up to \$7,500** available to nonprofit educational institutions via the [Commercial Clean Vehicle credit](#). This and additional rebates/incentives for fleet replacement and installing EV chargers can be found in the table under **Funding Resources**. Purchasing via the Climate Mayors EV Purchasing Collaborative provides further financial and infrastructure resources. For more information on the Collaborative, see the **Purchasing Process** section of this guide or view [the Collaborative's webpage](#).

FUNDING RESOURCES

The following information provides various funding options for hybrid and electric vehicles and charging stations. For more information regarding government rebates, grants, and other funding opportunities, please contact the Sustainability Office at sustainability@upenn.edu.

Funding Quick Guide

The following table provides a quick overview of funding options available. See below or follow the link for each funding option for more details.

FUNDING QUICK GUIDE					
Federal Program					
Name	Source	Amount	Vehicle Type	Notes	Contact
IRS Commercial Clean Vehicle Credit	Federal	a tax credit of up to \$7,500 for an eligible vehicle (\$2,500–\$7,500)	Electric Vehicle (EV) and Fuel Cell Electric Vehicle (FCEV)	For businesses and tax-exempt organization	http://www.irs.gov/
Grants for Buses and Bus Facilities Program	Federal	nearly \$1.7 billion for transit projects in 46 states and territories in FY23	Capital projects to replace, rehabilitate and purchase buses, vans, and related equipment, and to construct bus-related facilities, including technological changes or innovations to modify low or no emission vehicles or facilities.		https://www.transit.dot.gov/buses-program
EPA's Clean Heavy-Duty Vehicle Program	Federal	\$1 billion	Clean, zero-emission vehicles	Supply funds for not only clean, zero-emission vehicles, also: 1) zero-emission vehicle infrastructure	cleanhdvehicle@epa.gov

				2) workforce development and training 3) planning and technical activities	
STATE GRANT PROGRAM					
Name	Source	Amount	Vehicle Type	Notes	Contact
Alternative Fuels Incentive Grant (AFIG) Program	State	approximately \$3 million	Supported alternative fuels include electricity, compressed natural gas, liquefied natural gas, propane, hydrogen, hythane, biodiesel, ethanol, methanol, and other advanced biofuels	Grant funding covers: 1) Incremental costs related to retrofitting vehicles to operate on alternative fuels; 2) incremental costs to purchase alternative fuel vehicles; 3) cost to purchase and install the necessary fleet-refueling or home-refueling equipment for alternative fuel vehicles; 4) cost to perform research, training, development, and demonstration of new applications or next-phase technology related to alternative fuel vehicles Two application periods: will collect and review all applications submitted by 11:59 PM on August 25, 2023, and again by 11:59 PM on December 15, 2023	jdziubek@pa.gov or miferguson@pa.gov
Driving PA Forward: Medium- and Heavy-Duty (MHD) Zero Emission	State	Varies: 75% - 100% Reimbursement rate	Model year 1992–2009 Class 4-8 local freight trucks that operate predominantly in	Funding applications will be evaluated and prioritized based on (but not limited to) a list of criteria. Vehicles being	online application: https://www.esa.dced.state.pa.us/Login.aspx

Vehicle (ZEV) Grant			Pennsylvania are eligible for replacement. Eligible project vehicles must be replaced with new zero-emission trucks of similar class and vocation.	replaced must be scrapped in accordance with Program Guidelines. CY 23 application closed on March 31, 2023. Pay attention to the 2024 application.	
Driving PA Forward: Truck and Bus Fleet Grant Program	State	Approximately \$16 million	Replace or repower fleets of six or more GVWR-Class 4-8 trucks, port drayage trucks, school buses, shuttle buses, and/or transit buses. Replacing or repowering vehicles containing older diesel engines with new technology can reduce emissions by up to 99%	Model Years 1992 - 2009 Class 4-8 Local Freight Trucks (incl. drayage), and Model Year 2009 and older School Buses, Shuttle Buses, and Transit Buses will be eligible for: 1) Repower with new diesel, electric or alternative fuel 2) Replacement with new diesel, electric or alternative fuel CYs 2022 – 2023 application period is anticipated to open September 2023, with approximately \$3.1 million available	online application: https://www.esa.dced.state.pa.us/Login.aspx questions: ra-epvwmitigation@pa.gov

STATE REBATE PROGRAM

Name	Source	Amount	Vehicle Type	Notes	Contact
Driving PA Forward: Onroad Rebate Program for Trucks and Buses	State	Approximately \$30 million	Replace or repower single or fleets of 5 or fewer vehicles, which are GVWR-Class 4-8 trucks, port drayage trucks, school buses, shuttle buses, and/or transit buses	Model Years 1992 - 2009 Class 4-8 trucks and Port Drayage trucks; School Buses, Shuttle Buses and Transit Buses are eligible for rebates for: 1) Repower with new diesel, electric or alternative fuel	RA-EPVWMITIGATION@pa.gov

				2) Replacement with new diesel, electric or alternative fuel Final Round of the CYs 2022-2023 application is anticipated to open in September, with \$5.0 million available	
STATE CHARGING STATION PROGRAM					
Name	Source	Amount	Vehicle Type	Notes	Contact
Pennsylvania's National Electric Vehicle Infrastructure (NEVI) Planning	State	Round One of the NEVI Program closed on May 5, 2023; and Round Two program details are anticipated in early fall and will focus on building out the remaining interstate highway AFC gaps and non-interstate AFCs			
Electric Vehicle (EV) Charging Station and Hydrogen Fuel Cell Infrastructure Grants	State	Varies: Up to 65% Reimbursement Max Per Award up to \$500,000	The acquisition, installation, operation, and maintenance of publicly available direct current fast charging (DCFC) stations and hydrogen fueling infrastructure	Eligible project locations are transportation corridors, destination locations, and locations that serve as community charging or fueling hubs	https://afdc.energy.gov/laws/11989
Driving PA Forward - Electric Vehicle (EV) Charging Station Rebate	State	Varies: Up to 70% Reimbursement Max Per Award up to \$4,000	The acquisition, installation, operation, and maintenance of Level 2 EV charging stations	Eligible projects must be on publicly accessible government-owned or non-government-owned property, at workplaces, or at multi-unit dwellings that are not publicly accessible.	miferguson@pa.gov
Driving PA Forward - DC Fast Charging	State	Approximately \$8.5 million	The acquisition, installation,	EV fast chargers must be available to the public and	Applications no longer being accepted

and Hydrogen Fueling Grant Program			operation, and maintenance of electric vehicle (EV) fast charging equipment and hydrogen fuel cell vehicle supply equipment	installed in: 1) Community Charging Hubs 2) Transportation Corridors 3) Destination Locations Hydrogen fuel cell refueling stations must be available to the public	
Driving PA Forward - Level 2 EV Charging Rebate Program	State	Approximately \$9.2 million	The installation of Level 2 electric vehicle (EV) charging equipment	Rebates will be provided for Level 2 EV charging equipment for: 1) Public use at government owned property 2) Public use at non-government owned property 3) Non-public use at work places 4) Non-public use at multi-unit dwellings	miferguson@pa.gov
PRIVATE INCENTIVES					
Name	Source	Amount	Vehicle Type	Notes	Contact
PECO - Direct Current Fast Charging (DCFC) Station Incentive	Utility/Private Incentives	50% discount	Electricity distribution charges for DCFC stations	The stations are required to be enrolled in the Pilot Discount for Fast Charging Infrastructure Program. Available till June 20, 2024	The PECO Account Manager
PECO - Commercial Electric Vehicle (EV) Charging Station Rebate	Utility/Private Incentives	Up to \$2,000	The purchase and installation of Level 2 EV charging stations	Rebates are available on a first-come, first-served basis, and applicants may receive a maximum of 20 rebates per non-residential account. Recipients must share EV charging station utilization data upon request	PECOEV@energycenter.org

				for two years after project completion. Accept waitlist applications	
Duquesne Light Company (DLC) - Fleet Electric Vehicle (EV) Charging Station Rebate	Utility/Private Incentives	Up to 50% rebate	The cost to purchase eligible Level 2 or direct current fast charging (DCFC) stations	Eligible EV charging stations must be networked, and participants must share charging station utilization data with DLC.	Contact DLC EV Specialist: https://www.duquesnelight.com/energy-money-savings/electric-vehicles/electricfleet#ev-contact-form

Federal Funding

The federal government provides several sources of funding to support the purchase of low-emission vehicles and charging infrastructure. As noted earlier, **federal tax credits worth up to \$7,500** for eligible vehicles are available to nonprofit educational institutions via the [Commercial Clean Vehicle credit](#). Federal funding is also available through the [Grants for Buses and Bus Facilities Competitive Program](#) and the [Clean Heavy-Duty Vehicle Program](#).

Pennsylvania Commonwealth Funding

The **Alternative Fuels Incentive Grant Program** (AFIG) is provided through the Pennsylvania Department of Environmental Protection. This competitive grant program provides up to \$3 million in funding to school districts, municipalities, nonprofit organizations, and businesses in Pennsylvania that want to transition to cleaner fuel transportation. Grant application periods run each year, and more information can be found [here](#).

Driving PA Forward is another state-funded opportunity that focuses on promoting better air quality. One rebate offered through this program is the Truck & Bus Fleet Grant Program, which provides up to \$16 million for the replacement of diesel buses and trucks from 2009 or older for fleets of six or more. The rebate for electric replacements is higher, but the replacement can be of any vehicle type.

Driving PA Forward also offers funding for charging and fueling. The Level 2 EV Charging Rebate program provides \$2,500 - \$4,000 per plug depending on the location of the plugs.

Driving PA Forward also provides multiple other [grant and rebate options that are focused on reducing emissions from diesel engines](#).

Additional Sources

The **Climate Mayors Electric Vehicle Purchasing Collaborative's leasing options** allow savings to be passed along to your department. For more information regarding purchasing through the Climate Mayors EV Purchasing Collaborative, please refer to the **Purchasing Process** section of this guide or [this webpage](#).

The U.S. Department of Energy has a database of all [Federal and State Laws and Incentives](#). This can be used to look for both federal and Pennsylvania specific incentives by fuel type. The example below shows federal incentives

for EVs. This tool is useful to see the most up to date information for both funding and laws/regulations regarding alternative fuel vehicles.

Category Search

Jurisdiction	Technology/Fuel	Incentive/Regulation	User
<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
<input checked="" type="checkbox"/> Federal	<input type="checkbox"/> Biodiesel	<input type="checkbox"/> Grants	<input type="checkbox"/> Commercial
<input type="checkbox"/> Alabama	<input type="checkbox"/> Ethanol	<input type="checkbox"/> Tax Incentives	<input type="checkbox"/> Government Entity
<input type="checkbox"/> Alaska	<input type="checkbox"/> Natural Gas	<input type="checkbox"/> Loans and Leases	<input type="checkbox"/> Tribal Government
<input type="checkbox"/> Arizona	<input type="checkbox"/> Propane (LPG)	<input type="checkbox"/> Rebates	<input type="checkbox"/> Personal Vehicle Owner or Driver
<input type="checkbox"/> Arkansas	<input type="checkbox"/> Hydrogen Fuel Cells	<input type="checkbox"/> Exemptions	<input type="checkbox"/> Alternative Fuel
<input type="checkbox"/> California	<input checked="" type="checkbox"/> EVs	<input type="checkbox"/> Time-of-Use Rate	

SEARCH **CLEAR**

54 results for:
Jurisdiction: US
Technology/Fuel: EVs

Search Results | 54 laws and incentives

[VIEW ALL](#)

[DOWNLOAD CSV](#)

Jurisdiction	Title	Type
Federal	Congestion Mitigation and Air Quality (CMAQ) Improvement Program	Incentives
Federal	State Energy Program (SEP) Funding	Incentives
Federal	Clean School Bus	Incentives
Federal	Electric Vehicle (EV) and Fuel Cell Electric Vehicle (FCEV) Manufacturing Loans	Incentives

RECOMMENDED VEHICLES

Below are recommendations for vehicles that are more sustainable alternatives by type/utility. Because this market is constantly expanding, it would be useful to refer to the [U.S. Department of Energy's database of hybrids and federally recognized alternative fuel vehicles](#).


Please note that the **prices listed are estimates** – actual prices may vary depending on the vehicle's specifications/availability. Procurement Services at Penn recommends working directly with a dealership to obtain the best prices.




Sourcewell/the Climate Mayors EV Purchasing Collaborative updates its offerings frequently, so it is best to check the [Offerings Page](#) of their website for the most up to date information.

For tools to help you decide which vehicle is best for you, see Appendix I for a checklist of questions to consider and a framework for cost analysis between gas and electric powered vehicles.

Terminology:





- E-Assist Bike – Bicycles with built in electric motors
- BEV – Battery Electric Vehicle
- PHEV – Plugin Hybrid Electric Vehicle
- FCEV – Fuel Cell Electric Vehicle (hydrogen cell)
- ICEV – Internal Combustion Engine Vehicle

E-ASSIST BICYCLES/MOTORCYCLES						
Vehicle	Image	Fuel Type	Est. Price	Notes	IRS Eligibility for the vehicles purchased in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
RadWagon 4 Electric Cargo Bike		E-Assist Bike	\$1,999	Product details ; 350 lb weight limit		





Fuji E- Traverse 2.1 ST		E- Assist Bike	\$1,699	Product details; utilized by Universi ty of Florida's Police Depart ment		
Butchers & Bicycles MK1-E		E- Assist Trike	\$7,250	Product details; utilized by Western Washin gton Universi ty for on- campus deliverie s		
Yuba Spicy Curry		E- Assist Bike	\$5,199	Product details; 440 lb weight limit		
LOW SPEED VEHICLES						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchase d in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
Columbia Utilitruck		BEV	\$15,389	Product details		
Deere TE 4x2 Electric Gator		BEV	\$15,499	Product details		


GEM eLD		BEV	\$16,731	Product details		
LIGHT-DUTY/PASSENGER VEHICLES						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchased in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
2023 Chevrolet Bolt EUV SUV		BEV	\$27,800	Product details	2022-2023 Models	2022 Model
2023 Chevrolet Bolt EV		BEV	\$26,500	Product details	2022-2023 Models	2022 Model
2023 Nissan Leaf		BEV	\$28,040 - \$36,040	Product details	N/A	2022 Model
2023 Hyundai Ioniq 5 SUV		BEV	\$41,450	Product details		
2023 Hyundai Kona Electric SUV		BEV	\$47,450	Product details		
2023 Kia Niro EV SUV		BEV	\$52,600	Product details		
2023 Ford Escape SUV		PHEV	\$22,140	Product details	2022-2023 Models	2022 Model




2023 Hyundai Tuscon SUV		PHEV	\$37,500	Product details		
2023 Kia Niro Plug-in Hybrid SUV		PHEV	\$28,950	Product details		
2023 Mitsubishi Outlander SUV		PHEV	\$24,690	Product details		
2023 Toyota Prius Prime		PHEV	\$32,350	Product details		
2024 Chevrolet Blazer		BEV	\$35,400	Product Details	2024 Model	N/A
2024 Chevrolet Equinox		BEV	\$26,600	Product Details	2024 Model	N/A
2023 Volkswagen ID.4 Standard		BEV	\$40,290	Product Details	2023 Model	2021 - 2023 Models
PASSENGER VANS						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchased in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
2023 Chrysler Pacifica Hybrid		PHEV	\$37,620	Product details	2022-2023 Models	2022 Model





2023 Ford Transit Connect Wagon		ICEV	\$35,600	Product details		
2023 Mercedes-Benz Metris Passenger Van		ICEV	\$43,600	Product details		
2023 Ford E-Transit Passenger Van		BEV	\$45,995	Available solely through Creative Bus Sales; Product details		
2023 Ford E-Transit Converted Cargo Van		BEV	\$51,495	Upfit with Service & Cargo upfits available solely through Creative Bus Sales; Product details		
CARGO VANS						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchased in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
2023 Ford E-Transit		BEV	\$45,995	Available through Source well ; Product details	2022-2023 Models	2022 Model



2023 Dodge Ram ProMaster		ICEV	\$34,380	Product details		
2023 Ford Transit Connect Cargo Van		ICEV	\$24,925	Product details		
2023 Mercedes-Benz Metris Cargo Van		ICEV	\$34,900	Product details		
PICKUP TRUCKS / OFF ROAD VEHICLES						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchased in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
2023 Ford F-150 Lightning		BEV	\$39,974	Product details	2022-2023 Models	2022 Model
2023 Rivian R1T		BEV	\$73,000	Battery range of 260-400 miles; all-wheel drive & 3ft wading depth;	2023 Model	2022 Model

				Product details		
2023 Ford Maverick		HEV	\$22,595	This model has experienced high demand, contact local dealer for more information; Product details		
2023 Rivian R1S		BEV	\$78,000	Product Details	2023 Model	2022-2023 Models
2023 GMC Hummer EV Pickup		BEV	\$84,650	Product Details		
2023 Jeep Grand Cherokee PHEV 4xe		PHEV	\$60,460	Product Details	2022-2024 Models	2022-2023 Models
2024 Chevrolet Silverado		BEV	\$43,400	Product Details	2024 Model	N/A
BUSES						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchase	IRS Eligibility for the vehicles purchased

					d in 2023 or after	in 2022 or before
BYD Electric Transit Bus		BEV	Contact BYD for pricing	Product details		
Gillig Zero Emission s Electric Bus		BEV	Contact sales@gi llig.com for pricing	Product details		
GreenPo wer EV Bus		BEV	Contact GreenPo wer for pricing	Product details		
New Flyer Xcelsior CHARGE NG		BEV	Contact the local rep for pricing	Product details		
Proterra ZX5 Electric Transit Bus		BEV	Contact Proterra for pricing	Product details		
MEDIUM- AND HEAVY-DUTY CHASSIS & EQUIPMENT						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchase d in 2023 or after	IRS Eligibility for the vehicles purchased in 2022 or before
Kenwort h K270E/K3 70E		BEV	Contact brett.dua rte @paccar. com for pricing	Availabl e through Source well ; Product details ; medium -duty vehicles		

Kenworth T680E		BEV	Contact brett.duarte@paccar.com for pricing	Available through Source well ; Product details ; for regional haul and drayage		
Lion Electric Lion8 – Tandem		BEV	Contact Lion Electric for pricing	Available through Source well ; a Class 8 truck that can be customized based on use		
Peterbilt 220EV		BEV	Contact Peterbilt.Info@paccar.com for pricing	Available through Source well ; for pickup & delivery; see their operating costs calculator or to compare power consumption & fuel costs		

Peterbilt 579EV		BEV	Contact Peterbilt Info @paccar.com for pricing	Available through Source well ; for regional haul & drayage; see their operating costs calculator or to compare power consumption & fuel costs		
Global Environmental Sweepers M4 Electric Sweeper		BEV OR FCEV	Contact cborman@globalsweeper.com for pricing	Available through Source well ; 11 hours of operational time		
Madvac LR50e Compact Sweeper		BEV	Contact gbally@exprolink.com for pricing	Available through Source well		
Freightliner EM2		BEV	Contact (215)945-0350 for pricing	Pick-up, delivery and beyond, available through Source well		
PUBLIC SAFETY VEHICLES						
Vehicle	Image	Fuel type	Est. Price	Notes	IRS Eligibility for the vehicles purchase	IRS Eligibility for the vehicles purchased

					d in 2023 or after	in 2022 or before
Chevy Bolt Patrol Vehicle EV/SUV		BEV	\$31,000/ \$33,000	Product details ; Max range of 259 miles per charge		
Ford Police Intercept or Utility		HEV	Contact your local rep for pricing	Product details		

For additional options, see the following resources:

- [Sourcewell's complete list of light-duty vehicles](#)
- [Sourcewell's list of medium and heavy-duty vehicles](#)
- [Creative Bus Sales' Ford Transit Passenger Van information](#)
- [U.S. Department of Energy's Alternative Fuel and Advanced Vehicles search](#)
- Contact your preferred local dealer for options for electric or alternative fuel vehicles with competitive quotes
- Popular brands for electric mowers, leaf-blowers, and other equipment: [EGO](#), [Greenworks](#), and [Ryobi](#)

To get connected with municipalities that purchase EV and hybrid police vehicles, please contact Sean Greene at sgreene@dvrpc.org or Liz Compitello at ecompitello@dvrpc.org.

For further assistance in finding more environmentally friendly vehicle options or if you have questions about the information within this document, please contact the Sustainability Office at sustainability@upenn.edu.

PURCHASING PROCESS

When purchasing a University vehicle, make sure to complete the following steps as per Procurement Services' guidelines:

- Obtain at least three bids* (online quotes are discouraged as better prices can be obtained by contacting dealers directly)
- Have the paperwork signed by Procurement Services
- Register the vehicle with Risk Management

*When purchasing through Holman, at least three bids are still required. When purchasing via Sourcewell, multiple bids are encouraged to secure the best price but are not required. Regardless of the vehicle's source, if your department would like to choose a higher bid, a justification should be provided.

When purchasing a vehicle, we recommend buyers **utilize the information and resources provided in this guide** to obtain the best vehicle options to help Penn reach zero emissions. Questions regarding the content of this guide can be directed to the Penn Sustainability Office at sustainability@upenn.edu.

For questions about the purchasing process, please contact Procurement Services at sourcing@upenn.edu.

Sourcing Options

When **purchasing from a dealership**, mention that your department is associated with the University of Pennsylvania and is **eligible for COSTARS** pricing. [COSTARS](#) is the Commonwealth of Pennsylvania's Cooperative Purchasing Program and offers discounts on items purchased through the cooperative.

If your department does not want to purchase directly through a vehicle dealership, **Holman** may be helpful. [Holman](#) is a fleet management service that handles leasing and purchasing.

For electric vehicles (EVs), the **Climate Mayors Electric Vehicle Purchasing Collaborative** is the best option. It is a partnership between Second Nature, Climate Mayors, and Sourcewell, and has recently opened memberships to universities. The Collaborative's main objective is to decrease the upfront costs for EV procurement.

They also give members access to:

- Leasing options
- Competitively solicited EVs
- Charging infrastructure
- Technical analysis support
- Information for best practices with EV fleets

Vehicles that are currently available through the Collaborative can be found on [their website](#). Sourcewell also provides access to [numerous other products](#).

Penn's point of contact at Sourcewell is Abby Meinke and can be reached via [email](#). You can also reach out to the general email at service@sourcewell-mn.gov. Please contact Penn Procurement for Penn's member number.

[Vehicle Registration](#)

When your department purchases a new vehicle, it is critical to **notify Risk Management** so that they can properly insure the vehicle.

When purchasing and registering a new vehicle, please use the following name and address on all vehicle documents:

The Trustees of the University of Pennsylvania
2929 Walnut Street
Suite 460
Philadelphia, PA 19104-5099

The following information should be emailed to the Office of Risk Management and Insurance at dofriskmgmt@pobox.upenn.edu:

- Bill of Sale
- MV-1
- Registration (temporary or permanent if initial registration service provided by vendor)
- Name, mailing address, email, and phone number of the person who will be managing and/or responsible for the vehicle
- 26-digit account code for allocation of annual registration expenses

Risk Management can be reached at dofriskmgmt@pobox.upenn.edu, and additional questions can be emailed to [Dana D'Amore](#). Further information can be found on the Risk Management [website](#).

POLICIES & FORMS

[Risk Management's website](#) summarizes existing vehicle registration, disposition, and driver's safety information.

ADDITIONAL RESOURCES

Charging Stations & Resources

[ChargeHub](#) provides information on the types and number of EV charging stations in Philadelphia. They also provide a map of charging locations, including ones on Penn's campus, which can be viewed [here](#) (type Philadelphia, PA into the "Search for a location" bar).



[PennDOT](#) similarly provides a map of charging stations which is particularly useful for planning longer trips in Pennsylvania, as it shows designated Alternative Fuel Corridors (AFCs). AFCs are populated with EV charging stations to provide accessible roadways for traveling in an EV.

Currently, all installed EV charging stations on campus are provided by Blink Charging Co. Campus charging locations are as follows:

- 34th & Chestnut – x4 Level 2 Plugs
- 38th & Walnut – x4 Level 2 Plugs
- Penn Museum – x4 Level 2 Plugs
- Pennovation - x4 Level 2 Plugs

An additional four charging stations are being planned for purchase and installation in FY23.

If your department would like to purchase and install its own charging stations (Level 1 or Level 2), please reach out to [Penn Transportation and Parking](#). The cost of the project will vary, but funding assistance may be available through the state of Pennsylvania and through PECO. Please refer to the Funding Quick Guide under **Funding Resources** for more information.

Fleet Certification

[CALSTART Sustainable Fleet Accreditation](#) recognizes sustainable fleets by setting objective, meaningful standards and guidelines. This accreditation stems from a partnership between CALSTART and NAFA and performs a rigorous assessment of your fleet's sustainable inventory and practices. There is a focus on collection and organization of data, so documentation is important for fleets interested in this accreditation.

FAQ

Are electric vehicles able to travel as long as or as far as we need them to before running out of battery?

Though the range varies with each vehicle make and model, the average electric vehicle (EV) has a range of around 250 miles. Select parking lots at Penn host Level 2 electric chargers that reach full charge in four-to-six hours. Fast Chargers (Level 3 chargers) reach full charge in around an hour. There are 22 Fast Chargers in Philadelphia, and a map of their locations can be viewed on [ChargeHub](#). In the rare case that a Penn vehicle needs to travel long distances, PennDOT provides a [map](#) of charging stations along designated Alternative Fuel Corridors (AFCs). This allows for easier travel planning along EV accessible roadways.

It should be noted that overusing Fast Chargers may reduce the lifespan of the vehicle's battery.

Are electric vehicle alternatives as powerful as gasoline or diesel-powered models?

Electric motors generate 100% of their available torque instantly, enabling them to accelerate even faster than gasoline-powered vehicles. Although most EVs are able to deliver equivalent power, they do typically have added weight from their fuel cells, which can cut into their total hauling capacity. For some models such as the Rivian R1T, this issue has been fixed; it has a hauling capacity of up to 11,000 lbs. For comparison, the diesel-fueled 2021 Ford F-150 can haul 5,000-11,300 lbs. This shows that attention to detail is important when purchasing specialized utility vehicles to ensure the vehicle will be able to meet the desired use.

Though EVs aren't currently able to cover every corner of the market, the variety of EVs has been expanding and equivalent electric options are expected to emerge steadily.

What if electric models are more expensive?

The cost of most electric vehicles (EVs) is higher than internal combustion vehicles because of the cost to manufacture their batteries. Market trends show that battery prices are decreasing, which will lead to a lower cost of EVs. Given the federal government's goal to achieve a 50-52% reduction in emissions by 2030, the market also expects to see more incentives to reduce the cost of EVs. Additionally, there are opportunities for grants, rebates, and tax credits associated

with purchasing electric or hybrid vehicles, as shown in the **Funding Resources** section of this guide.

Do electric vehicle batteries present a safety risk?

A [2017 report by NHTSA](#) on the safety of lithium-ion batteries, which power battery electric vehicles, states that the risk of fires and explosions from lithium-ion batteries are comparable or less than those from gasoline or diesel vehicles.

Are electric vehicles more costly to maintain and repair than vehicles with internal combustion engines?

While EVs can have a higher upfront cost for each maintenance event, EVs cost less on average to keep running than internal combustion engine vehicles (ICEVs) since they don't need regular oil changes. Additionally, EVs don't have parts such as spark plugs, valves, and catalytic converters that tend to fail and need replacement.

The cost to fuel EVs is also lower than it is for ICEVs. In Philadelphia, the average commercial electricity rate is \$0.09557/kWh ([from PECO](#)). The average battery electric sedan reaches a full charge of 60kWh and is able to run for about 250 miles per charge – each full charge costs about \$5.97. In comparison, the average internal combustion light duty passenger vehicle has a fuel economy of 39.4 mpg (based on 2017 data from the [Federal Bureau of Transportation](#)). Philadelphia's gas is \$3.52/gallon on average, so it costs \$22.34 to travel 250 miles ([from AAA](#), as of February 2023). That means it costs almost four times more to fuel an ICEV than an EV in our region.

Are the emissions from charging an electric vehicle as bad as internal combustion engine vehicle emissions?

No, the overall carbon footprint for electric vehicles has been proven to be lower than that of internal combustion engines.

Philadelphia's electric grid draws its power from four main sources: nuclear power, coal, natural gas, and "other" sources. The region's energy sources have been trending towards an increase in renewable energy sources, especially in wind and solar. This has resulted in an overall decrease in emissions associated with electricity production in Pennsylvania.

In 2020, Penn signed a [Power Purchase Agreement](#) that includes the construction of two solar energy facilities in central Pennsylvania. Penn

will purchase all energy produced, which is estimated to amount to 70% of the campus's demand.

Additionally, Penn's emissions have been decreasing due in large part to shifts towards renewable energy grid sources. Penn's recent Power Purchase Agreement, combined with our region's general trends towards more sustainable energy sources, will result in Penn's energy being sourced from predominantly renewable sources, decreasing the carbon footprint of campus operations including vehicle charging.

More information can be found in the Achieving Penn's *CSAP 3.0* Goals under the **Vehicle Types & Impacts** section.

Can we support the infrastructure needed to use electric vehicles?

While Penn has 16 charging stations across campus, the capacity is currently larger than the demand. Additionally, as batteries become cheaper and more EVs populate the roads, the cost of charging stations is estimated to go down. There are also multiple grant and rebate programs for funding EV charging stations, such as the [Driving PA Forward's Level 2 EV Charging Station Rebate Program](#) and [PennDot NEVI Grants for Charging Infrastructure](#). Due to these factors and rising demand, an increase in charging stations is predicted to be seen not just at Penn but across the region, expanding the number of stations available in general.

How long does it take to charge an electric car at a charging station?

The 16 chargers on Penn's campus are all Level 2 chargers that plug into a regular outlet and can take three-to-five hours to get up to 80% charged.

Among the chargers Penn has already, do they use the NACS or CCS charging ports?

All charging stations utilized by Penn use a J1772 charging port, which is the smaller top half of the larger CCS plug. Also, because all the Penn chargers are from the Blink Charging Station and they have a plan to provide Dual-Port CCS and NACS Connectors, Penn chargers may have the chance to provide dual port service in the future as we expand our charging infrastructure.

How does the manufacturing process for EV batteries impact their overall carbon emissions?

The manufacturing of EVs is more energy intensive and produces more emissions than manufacturing a conventional car because of the electric vehicles' complex batteries. Lithium-ion battery production requires extracting and refining rare earth metals and is energy intensive because of the high heat and sterile conditions needed. However, increasing the percentage of renewable energy used in plants that produce EV batteries would significantly reduce these emissions. Increased demand for EVs has led to the development of larger, more efficient factories that produce a lower carbon footprint per battery. Even without these improvements in manufacturing, EVs still have a lower lifetime carbon footprint than ICVs. [Based on recent European studies](#) of life-cycle emissions of EVs, an average EV produces 50% less life-cycle greenhouse gases over the first 150,000 kilometers (about 93,200 miles) of driving than an internal combustion engine vehicle.

What happens to the batteries of EVs at the end of their useful life?

Currently, it is difficult to recycle most EV batteries. There is no standardized design for EV batteries, and most are not designed with recycling in mind. That being said, some governments are beginning to promote the recycling of EV batteries. China imposed new laws in 2018 that made EV manufacturers responsible for ensuring batteries are recycled, and now [recycles more lithium-ion batteries than the rest of the world combined](#). In the United States, the federal government has yet to tackle EV battery recycling laws, but several states, including California—the nation's largest car market—are exploring setting their own rules. Pennsylvania currently does not have state battery regulations in place. Most domestic EV manufactures can recycle parts of used batteries, but what cannot be recycled goes into the landfill. Tesla reportedly recycles [60 percent of the components](#) from its lithium-ion batteries once they've reached end of life.

References

- [Information on the Health Effects of Ozone Pollution](#) by the EPA
- [Calculator from the Union of Concerned Scientists](#) showing comparisons of emissions from EVs versus internal combustion engines
- [EV Battery Degradation Comparison Tool](#) by Geotab
- [Case Studies on Fleet Electrification](#) by the Climate Mayors Electrification Coalition

- [Electrifying Transportation in Municipalities](#) guide by the Electrification Coalition
- [Plug-In Hybrid & Electric Vehicle Research Center](#) at UC Davis
- [Electric Vehicle Resource Kit](#) provided by the Delaware Valley Regional Planning Commission
- [Resources for Plugin Electric Vehicles and Charging Equipment](#) provided by the Delaware Valley Regional Planning Commission

APPENDIX I

Global Warming Potential (GWP) of EVs

In a report by the European Commission published in 2020, a comprehensive look into the overall environmental impact using life cycle assessment (LCA) was conducted. This study covers fuel and electricity production, vehicle production, use and operation, and end-of-life.

The results of this study are measured by global warming impact (GWP) based on emissions. Lower medium vehicles, shown in *Figure 1*, include the following passenger vehicles: class C vehicles (e.g. Ford Taurus) and medium SUVs (e.g. Ford Escape). Urban buses, shown in *Figure 2*, include models that have a single deck and are 12 meters long.

In *Figure 1* and *Figure 2*, the following fuel types are represented:

- ICEV-G – gasoline fueled internal combustion engine
- ICEV-D – diesel fueled internal combustion engine
- ICEV-CNG – compressed natural gas fueled internal combustion engine
- HEV-G – gasoline and battery hybrid electric vehicle
- HEV-D – diesel and battery hybrid electric vehicle
- PHEV-G – gasoline and battery plug-in hybrid electric vehicle
- PHEV-D – diesel and battery plug-in hybrid electric vehicle
- FCEV – hydrogen fuel cell electric vehicle
- BEV – battery electric vehicle

The calculated GWP for 2020, 2030, and 2050 for each fuel type is shown for *Figures 1* and *2*. For 2050, the “TECH1.5” scenario reflects projected adjustments in infrastructure, policy, etc. to align with the Paris Agreement and keep global temperature increase to a 1.5°C maximum. The GWP for 2020 and 2030 are based on baseline conditions in 2020.

The results of this study indicate that for both classes of vehicles, **battery electric vehicles (BEVs) have the lowest overall global warming potential** projected over the next several decades.

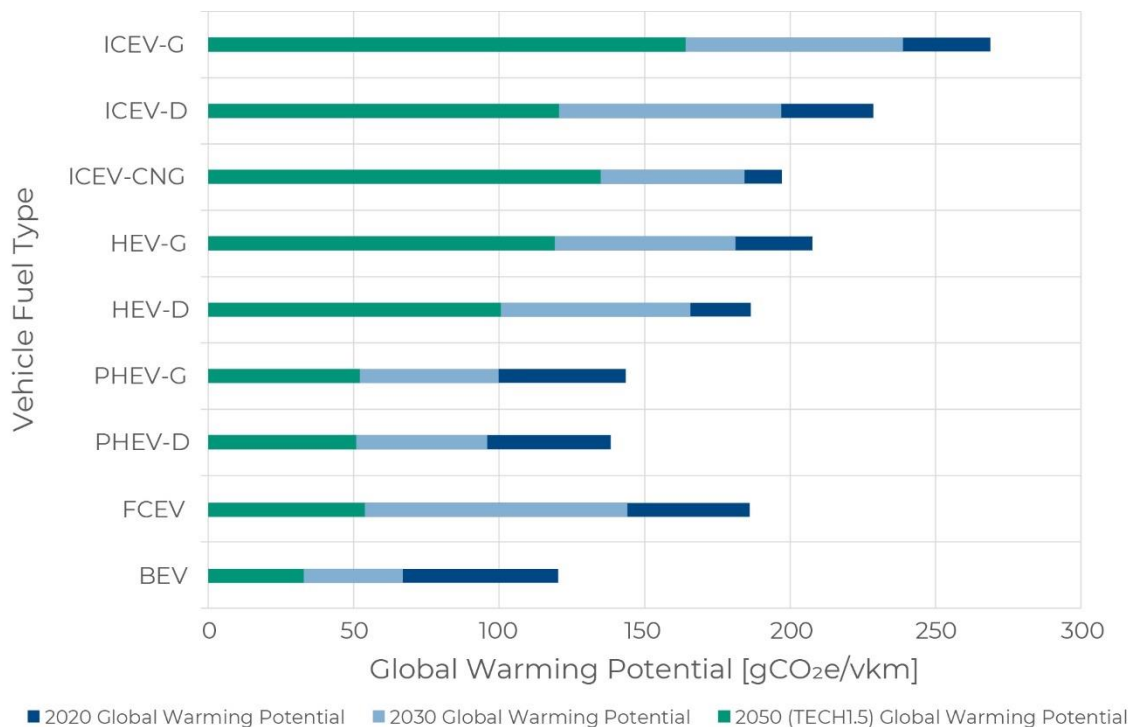


Figure 1. Summary of overall lifecycle GWP impacts for Lower Medium Cars by fuel type ([Determining the environmental impacts of conventional and alternatively fueled vehicles through LCA](#), Figure 5.58).

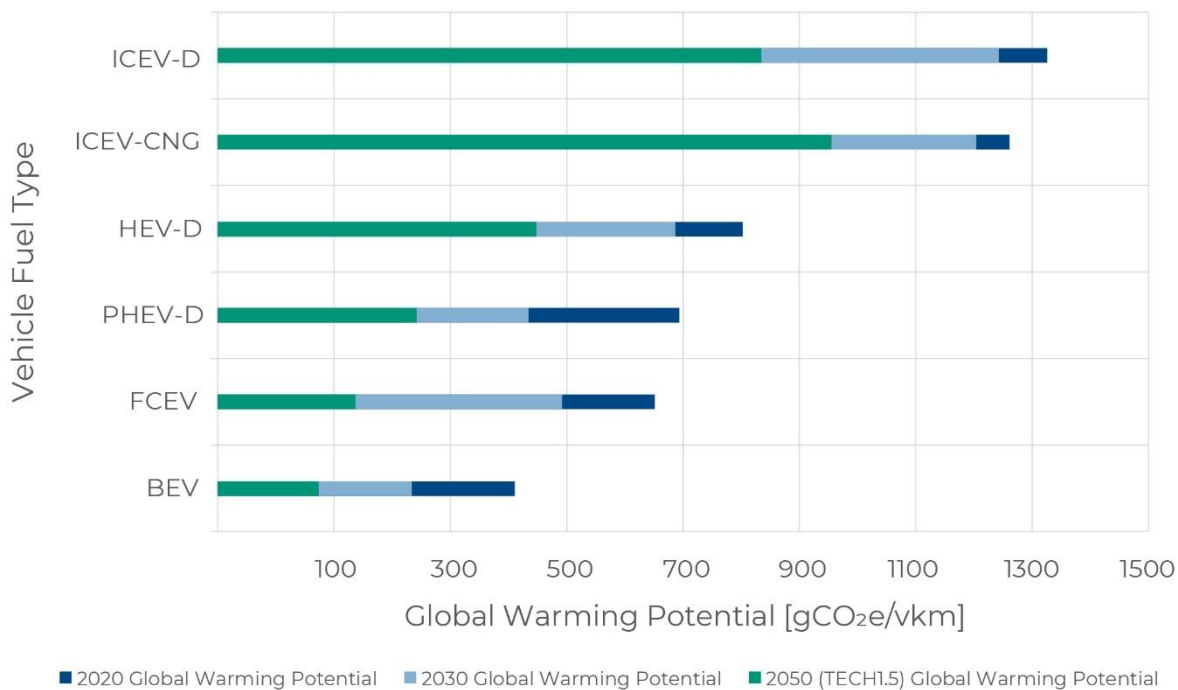


Figure 2. Summary of overall lifecycle GWP impacts for Urban Buses by fuel type ([Determining the environmental impacts of conventional and alternatively fueled vehicles through LCA](#), Figure 5.72).

As shown in *Figures 1 and 2*, adjustments in infrastructure and sources of energy over time will result in a significant decrease in the lifecycle emissions of battery electric vehicles and plug-in hybrid electric vehicles compared to internal combustion engine vehicles.

The primary sources of electricity in Pennsylvania are coal, gas, and nuclear power. Shown in *Figure 3.1*, the percentage of coal sourced electricity has decreased while gas sourced electricity has increased between 2004 and 2019. *Figure 3.2* shows a decrease in oil sourced electricity and an increase in renewable power sources (water (hydro), biomass, and wind) between 2004 and 2019.

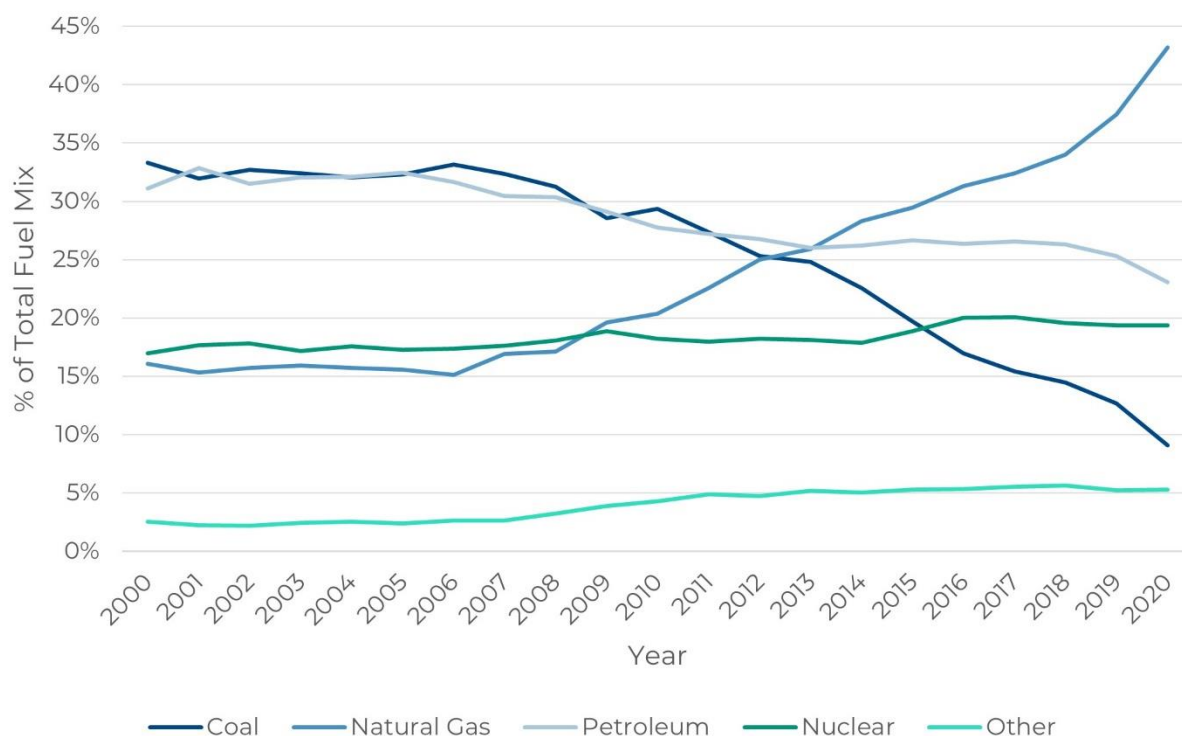


Figure 3.1. Pennsylvania electric grid source trends from 2004-2019 ([U.S. Energy Information Administration State Energy Data System](#)).

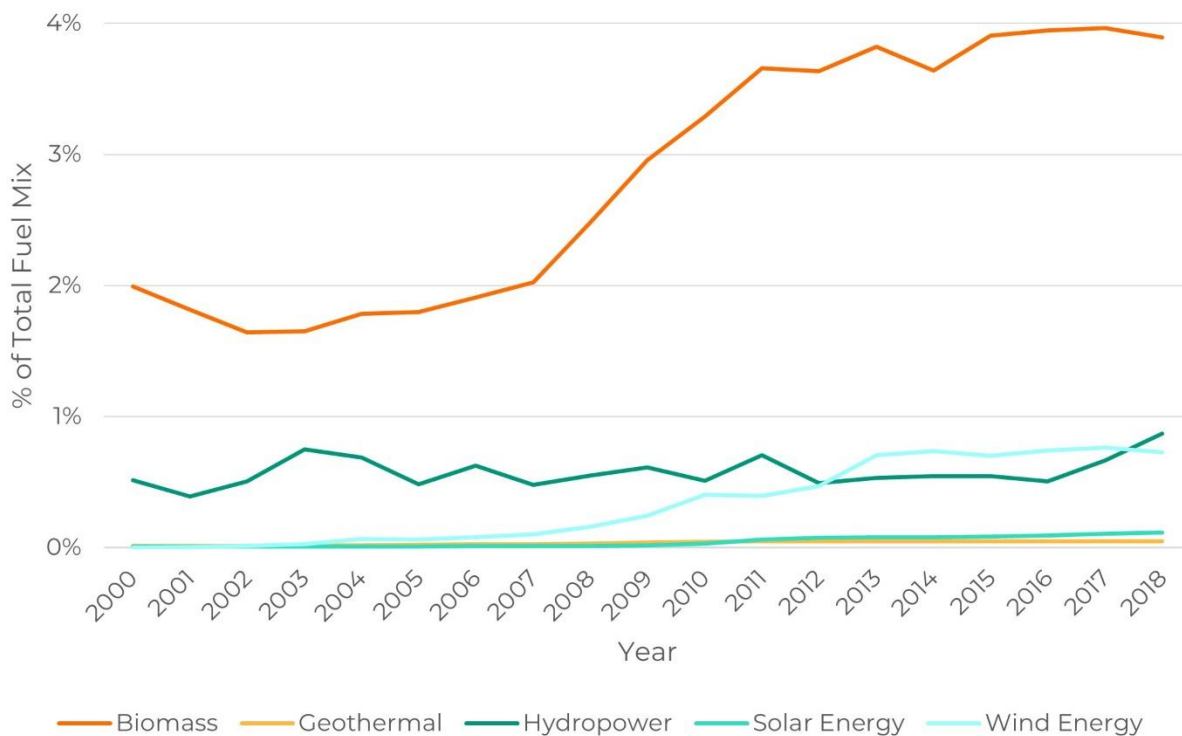


Figure 3.2. Pennsylvania electric grid source trends from 2004-2019, breakdown of “other” sources shown in Figure 3.1 ([U.S. Energy Information Administration State Energy Data System](#)).

According to data from the EPA, Pennsylvania’s carbon dioxide equivalent emissions (CO₂e) have also decreased between 2004 and 2019 and are projected to continue to drop due to an increase in lower emission electricity sources (*Figures 3.1 and 3.2*).

Figure 4 indicates West Philadelphia’s three main electricity sources: nuclear power, coal, and natural gas. These sources have been trending towards an increase in renewable sources, predominantly wind and solar.

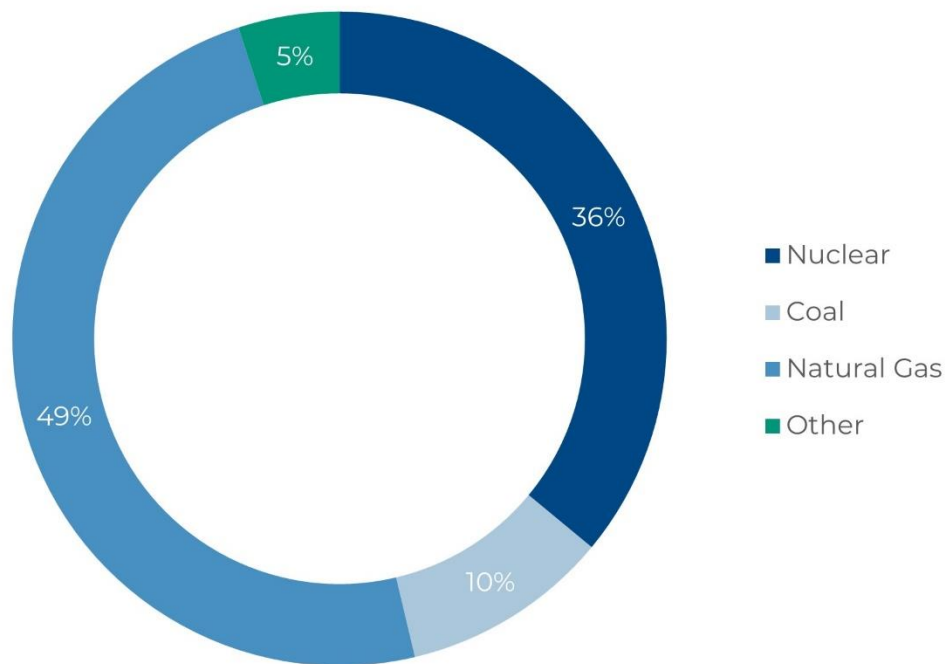


Figure 4. Fuel mix used to generate electricity in the RFCE region (includes Pennsylvania, New Jersey, Delaware, and Maryland) as of 2021 ([EPA's Power Profiler, Fuel Mix for RFCE Region](#)).

In 2020, Penn also signed a Power Purchase Agreement (PPA) that involves the construction of two solar energy facilities in central Pennsylvania. Penn will purchase all electricity produced. An estimated **70% of the campus's electricity demand will be met with solar power** once this is implemented. This PPA will also shift Penn's electricity to be predominantly sourced from renewable sources. Additionally, as the United States moves towards carbon neutrality, it is expected that clean electricity sources will become more accessible, further lowering the emissions associated with EVs (as demonstrated in *Figures 1* and *2's* 2050 TECH 1.5 scenarios).

Overall, the current and projected electricity sources for our area and their associated emissions make EVs highly beneficial for reducing Penn's fleet emissions.

APPENDIX II

EV Selection Quick Guide

For more information, click on the name of each vehicle category. This guide is provided to assist purchasers in vehicle selection.

WHAT DO YOU WANT TO DO?

