Penn Sustainability

# Low-Emissions Vehicle Purchasing Guidance

November 2024

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## OVERVIEW

### How to Use this Guide:

This guide is intended to be an 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

Penn's *Climate and Sustainability Action Plan (CSAP)* represents a vision for the University's sustainable future. This guide was authored during Penn's transition from the *CSAP 3.0* term (FY20-FY24) to the *CSAP 4.0* term (FY25-FY29). Included in *CSAP 4.0* is a goal to optimize Penn's fleet towards zero-emission vehicles.

These vehicles are not only beneficial in that they reduce our carbon footprint, but they also reduce the negative impact air pollution has on human health, which can lead to conditions like asthma and lung cancer. The American Lung Association gave Philadelphia a "failing" grade for its annual particle pollution levels, showing that there is a lot of room for improvement when it comes to our air pollution. One of the main contributors to Philadelphia's polluted air is local emissions, which Penn's vehicles contribute to.

Recognizing 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. Philadelphia's poor air quality also impacts the University, both in maintenance costs and impacts to the health of faculty and staff.

The two main vehicle types emphasized in this guide are battery electric vehicles (BEVs) and plugin hybrid electric vehicles (PHEVs). When possible, preference should be given to BEVs 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 7th as a top performer in transportation. In FY22, Penn Transportation purchased four Ford electric passenger vans for the first time. A year later, in FY23, two more electric passenger vans were added to the fleet. Each van will eliminate at least 13 MTCDE (metric tons of carbon dioxide equivalents) per year, reducing 78 MTCDE or more annually. Building off that, more Penn departments purchased electric vehicles in FY23, including electric carts and passenger vehicles. 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 2024 Low-Emissions Vehicle Purchasing Guidance is a tool to help Penn fleet managers integrate low-emission vehicles into their fleets. This initiative aligns with the University's *CSAP 4.0* commitment to optimize the campus

fleet towards zero-emission vehicles. By curbing the environmental impact of Penn's fleet, we improve our pursuit of a sustainable campus environment.

The 2024 update of the Low-Emissions Vehicle Purchasing Guidance features these three important sections:

1. **Updated Funding Resources:** Recognizing that funding is often a pivotal obstacle in the path toward low-emission vehicle acquisition, we have updated the funding resources section. This section provides pertinent details such as available amounts of funds, eligible vehicles, and application deadlines.
2. **IRS Tax Credits:** Many electric and hybrid vehicles are eligible for IRS tax credits in FY25, some qualifying for up to $7,500. In a continuation from last year, 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:** This section includes a selection of new vehicles that are eligible for IRS tax credits. This update will aid departments and centers in their integration of low-emission vehicles into their fleet.

The 2024 Low-Emissions Vehicle Purchasing Guidance continues to catalyze the low-emission vehicle transition at Penn. Guided by the principles of *CSAP 3.0* and *4.0*, this document embodies the University's commitment to a greener, more sustainable future.

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

## VEHICLE TYPES AND IMPACTS

Electric vehicles 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, Plugin 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 emissions options may be available and should be considered.

## Achieving Penn's *CSAP* Goals

Both *CSAP 3.0* and *4.0* expand upon previous *CSAPs* to reduce Penn's emissions. The main goals outlined in *CSAP 3.0* 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

*CSAP 4.0* identifies ways to build upon the goals from the previous *CSAP*:

- Facilitate an increase in commuter trips to Penn made by non-single occupancy vehicles
- Make data-informed recommendations to continue to optimize sustainable options in Penn's parking infrastructure

- Facilitate an optimization of Penn's fleet towards zero-emission vehicles

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 ICEV counterparts. This is especially true considering the energy makeup of Philadelphia's electrical grid combined with increases in renewable energy sources from 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 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. According to the National Resources Defense Council, EV drivers spend 60% less each year on fuel costs than those driving gas-powered vehicles. Contributing to these savings, electric vehicles can charge overnight when electricity rates are lower, which can lead to savings of 30% on that charge. For more information, see **Additional Resources: FAQ**.

There are **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 EV charger installation 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.

## FUNDING RESOURCES

The following information provides various funding options for hybrid and electric vehicles and charging stations. For further assistance in searching for 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 links for more details.

| FUNDING QUICK GUIDE | | | | | |
|---|---|---|---|---|---|
| **Federal Programs** | | | | | |
| **Name** | **Source** | **Amount** | **Vehicle Type** | **Notes** | **Contact** |
| IRS Commercial Clean Vehicle Credit | Federal | Up to $7,500 for vehicles with a gross weight under 14,000 lbs or $40,000 for all other vehicles | Plug-in EVs that draw significant propulsion from an electric motor with a battery capacity of at least 7 kilowatt hours (if vehicle is under 14,000lbs) or 15 kilowatt hours (if vehicle is over 14,000lbs) | For businesses and tax-exempt organizations | |
| FTA Grants for Buses and Bus Facilities Competitive Program | Federal | Up to 80% of project costs | Buses / Bus facilities | A competitive grant (check website for most recent information) | |
| EPA Clean Heavy-Duty Vehicle Program | Federal | Varies | Replace class 6 & 7 heavy-duty vehicles with zero-emissions alternatives | Funding available through 2031 in the form of grants and rebates; View website for latest information on how to claim this credit | |
| **State Programs** | | | | | |
| **Name** | **Source** | **Amount** | **Vehicle Type** | **Notes** | **Contact** |
| Alternative Fuels | State | Applicants will be eligible for a | Covers projects that retrofit old | An applicant may submit more | Josh Dziubek, |

| | | | | | |
|---|---|---|---|---|---|
| Incentive Grant Program (AFIG) | | maximum grant award across all applications of $500,000. Individual application awards are still capped at $300,000 | vehicles, purchase new vehicles, purchase charging equipment, and conduct research | than one application; however, no business or business with ownership in common will be awarded more than the maximum applicant award amount ($500,000) from the program during the fiscal year. The AFIG program will reopen for 2025 in the spring. AFIG has approximately $5 million in funding available | Energy Programs Office jdziubek@pa.gov |
| Driving PA Forward: Onroad Rebate Program for Trucks and Buses | State | Diesel and Alternative Fuel Reimbursement Amounts<br><br>Electric Vehicle Reimbursement Amounts<br><br>Electric Vehicle with Infrastructure Reimbursement Amounts | Fund rebates for projects that 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 | As of March 1, 2025, approximately $1.0 million in uncommitted funds remain available | RA-EPVWMITIGATION@pa.gov |
| Driving PA Forward: Clean Diesel Grant Program | State | Reimbursement Chart | Emission reduction technologies include but are not limited to: exhaust controls, engine upgrades, engine and vehicle replacement, | The opening of the federal fiscal years 2023-2024 Pennsylvania State Clean Diesel Grant is delayed, and will open in April 2025. There is approximately $4.0 million | RA-EPVWMITIGATION@pa.gov |

| | | | | | |
|---|---|---|---|---|---|
| | | | idle reduction technologies, aerodynamic technologies | available to award<br><br>The program is jointly funded by Volkswagen settlement monies and the Diesel Emission Reduction Act, which is disbursed by the U.S. EPA | |
| **Private Programs** | | | | | |
| **Name** | **Source** | **Amount** | **Vehicle Type** | **Notes** | **Contact** |
| PECO Public Benefit Charging Program Rebate | Private | Incentives are capped at 50% of the cost of equipment, installation, and make ready work for the project | EV charging infrastructure; Level 2 chargers and Direct Current Fast Chargers (DCFCs) are eligible for rebates. | To receive a rebate, an applicant must be a commercial, industrial, or governmental PECO customer that receives electric service to the project site under PECO Rate GS (General Service), Rate HT (High Tension Power), or Rate PD (Primary Distribution Power), regardless of the retail electric supplier. | |
| PECO Level 2 Commercial Electric Charging Program | Private | The base rebate amount is calculated as the lesser of $2,000 per Charging Port or 50% of eligible makeready costs. For projects located in EJAs, we offer an enhanced rebate | Provides rebates for make-ready costs associated with the installation of new qualifying Level 2 EV chargers at sites with non-residential PECO electric service | To receive a rebate, an applicant must be a commercial, industrial, or governmental PECO customer that receives electric service to the project site under PECO Rate GS (General | |

| | | | | | |
|---|---|---|---|---|---|
| | | calculated as the lesser of $3,000 per Charging Port | | Service), Rate HT (High Tension Power), or Rate PD (Primary Distribution Power), regardless of the retail electric supplier. | |

## Federal Funding

The federal government provides several sources of funding to support purchasing low-emission vehicles and charging infrastructure. As noted earlier, **federal tax credits worth up to $7,500** for eligible vehicles are available for 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 $5 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.

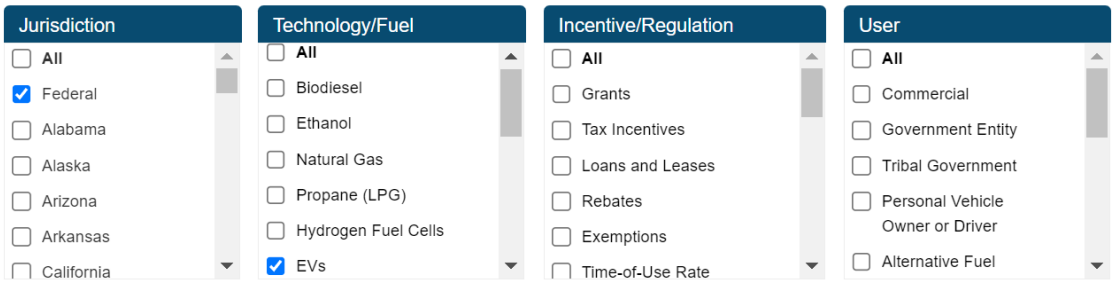
**Driving PA Forward** is another state-funded opportunity that focuses on promoting better air quality. One incentive offered through this program is the Onroad Trucks & Buses Rebate Program. This program allocated approximately $30 million over a 5-year period to fund rebates for projects that replace 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. Follow this link to find other grant and rebate opportunities that focus 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 shown 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**




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 sustainable alternatives by type/utility. The majority of the vehicles eligible for IRS tax credits are 2024 models, but it is important to note that there are some 2022 and 2023 models still eligible. For a complete list of IRS credit eligible vehicles, use this link. Because this market is constantly expanding, referring to the U.S. Department of Energy's database of hybrids and federally recognized alternative fuel vehicles is recommended.

Please note that the **prices listed are estimates** – actual prices may vary depending on the vehicle's specifications/availability. Penn Procurement Services 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.

In addition to these recommendations, please view 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 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Fuji E-Crosstown |  | E-Assist Bike | $1,399 | Battery: Fuji Power Pack 468Wh w/ 2A charger | | |
| Fuji E-Traverse 2.1 ST |  | E-Assist Bike | $1,399 | Battery: Fuji Power Pack 417Wh w/ 2A charger | | |
| Jetson Journey Electric Cruiser Bike |  | E-Assist Bike | $1,299 | Battery: 36V, 8.7Ah Lithium Ion | | |
| RadWagon 5 Electric Cargo Bike |  | E-Assist Bike | $2,399 | Battery: 750W | | |
| **LOW SPEED VEHICLES** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |
| Columbia Utilitruck |  | BEV | $15,389 | Product details | | |
| Deere TE 4x2 Electric Gator |  | BEV | $15,499 | Product details | | |
| GEM eL XD |  | BEV | $18,741 | Product details | | |

| LIGHT-DUTY/PASSENGER VEHICLES | | | | | | |
|---|---|---|---|---|---|---|
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |
| 2022/2023 Chevrolet Bolt EUV SUV |  | BEV | $30,958 | $7,500 total IRS credit amount | | 2022 & 2023 Models |
| 2022/2023 Chevrolet Bolt EV |  | BEV | $28,600 | $7,500 total IRS credit amount | | 2022 & 2023 models |
| 2024 Nissan Leaf |  | BEV | $28,140 | Product details; $3,750 total IRS credit amount | 2024 model | |
| 2024 Chevrolet Blazer EV |  | BEV | $53,200 | Product details; $7,500 total IRS credit amount | 2024 model | |
| 2024 Ford Escape Plug-In Hybrid |  | PHEV | $40,500 | Product details; $3,750 total IRS credit amount | 2024 model | |
| 2024 Honda Prolouge |  | BEV | $47,400 | Product details; $7,500 total IRS credit amount | 2024 model | |
| 2022/24 Jeep Grand Cherokee 4xe |  | PHEV | $60,490 | Product details; $3,750 total IRS credit amount | 2024 model | 2022 & 2023 models |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2024 Rivian R1S Dual Standard |  | BEV | $79,400 | Product details; $3,750 total credit amount | 2024 model | |
| 2024 Tesla Model 3 |  | BEV | $29,990 | Product details; $7,500 total IRS credit amount | 2024 model | |
| 2023/2024 Volkswagen ID.4 Pro |  | BEV | $46,300 | Product details; $7,500 total IRS credit amount | 2024 model | 2023 model |
| 2023/2024 Volkswagen ID.4 Electric SUV |  | BEV | $39,735 | Product details; $7,500 total IRS credit amount | 2024 model | 2023 model |
| 2024 Acura ZDX |  | BEV | $68,500 | Product details; $7,500 total IRS credit amount | 2024 model | |
| 2024 Kia Sportage Plug-In Hybrid |  | PHEV | $39,590 | Product details; $0 total IRS credit amount | | |
| 2024 Hyundai Kona Electric SUV |  | BEV | $32,675 | Product details; $0 total IRS credit amount | | |
| 2024 Cadillac LYRIQ |  | BEV | $57,195 | Product details; $7,500 total IRS credit amount | 2024 model | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2024 Toyota Highlander Hybrid |  | PHEV | $40,970 | Product details; $0 total IRS credit amount | | |
| **PASSENGER VANS** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |
| 2022/2024 Chrysler Pacifica Hybrid |  | PHEV | $51,250 | Product details; $7,500 total IRS credit amount | 2024 model | 2022 & 2023 models |
| 2023 Mercedes-Benz Metris Passenger Van |  | ICEV | $43,600 | Product details; $0 total IRS credit amount | | |
| 2024 Mercedes-Benz e-Sprinter |  | BEV | $71,886 | Product details; $0 total IRS credit amount | | |
| 2022 Ford Forest River Van E-Transit |  | BEV | Contact for pricing options | Product details; $0 total IRS credit amount | | |
| **CARGO VANS** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2022/2023 Ford E-Transit |  | BEV | $45,995 | Available through Sourcewell; Product details; $3,750 total IRS credit amount | | 2022/2023 models |
| 2024 Dodge Ram ProMaster |  | ICEV | $44,405 | Product details; $0 total IRS credit amount | | |
| 2024 BrightDrop Zevo 600 Electric Van |  | BEV | $62,725 | Product details; $0 total IRS credit amount | | |
| 2024 Ford Transit |  | ICEV | $46,890 | Product details; $0 total IRS credit amount | | |
| **PICKUP TRUCKS** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |
| 2022/2024 Ford F-150 Lightning |  | BEV | $62,995 | Product details; $7,500 total IRS credit amount | 2024 model | 2022 & 2023 models |
| 2024 Ford F-150 XL |  | PHEV | $36,965 | Product details; $0 total IRS credit amount | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2024 Ford Maverick |  | PHEV | $23,920 | Product details; $0 total IRS credit amount | | |
| 2024 Rivian R1T Dual Standard |  | BEV | $74,650 | Product details; $3,750 total IRS credit amount | 2024 model | |
| 2023/2025 Rivian R1T Dual Large |  | BEV | $75,500 | Product details; $3,750 total IRS credit amount | 2024 & 2025 models | 2023 model |
| 2024 GMC EV Hummer Pickup |  | BEV | $98,845 | Product details; $0 total IRS credit amount | | |
| **BUSES** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |
| BYD Electric Transit Bus |  | BEV | Contact BYD for pricing | Product details | | |
| Gillig Zero Emissions Electric Bus |  | BEV | Contact sales@gillig.com for pricing | Product details | | |
| GreenPower EV Bus |  | BEV | Contact GreenPower for pricing | Product details | | |
| New Flyer Xcelsior |  | BEV | Contact the local | Product details | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| CHARGE NG | | | rep for pricing | | | |
| **MEDIUM- AND HEAVY-DUTY CHASSIS & EQUIPMENT** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility for the vehicles purchased in 2024 or after** | **IRS Eligibility for the vehicles purchased in 2023 or before** |
| Kenworth K270E/K370E |  | BEV | Contact brett.duarte@paccar.com for pricing | Available through Sourcewell; Product details; medium-duty vehicles | | |
| Kenworth T680E |  | BEV | Contact brett.duarte@paccar.com for pricing | Available through Sourcewell; Product details; for regional haul and drayage | | |
| Lion Electric Lion8 |  | BEV | Contact Lion Electric for pricing | Available through Sourcewell; a class 8 truck that can be customized based on use | | |
| Peterbilt 220EV |  | BEV | Contact Peterbilt.Info@paccar.com for pricing<br><br>General website | Available through Sourcewell; for pickup & delivery; see their operating costs calculator to compare | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | contact page | power consumption & fuel costs | | |
| Peterbilt 579EV |  | BEV | Contact Peterbilt.Info@paccar.com for pricing<br><br>General website contact page | Available through Sourcewell; for regional haul & drayage; see their operating costs calculator to compare power consumption & fuel costs | | |
| Global Environmental Sweepers M4 Electric Sweeper |  | BEV OR FCEV | Contact cbormann@globalsweeper.com for pricing<br><br>General website contact page | Available through Sourcewell; 11 hours of operational time | | |
| Madvac LR50e Compact Sweeper |  | BEV | Contact gbally@exprolink.com for pricing<br><br>General website contact page | Available through Sourcewell | | |
| **PUBLIC SAFETY VEHICLES** | | | | | | |
| **Vehicle** | **Image** | **Fuel type** | **Est. Price** | **Notes** | **IRS Eligibility** | **IRS Eligibility** |

| | | | | | for the vehicles purchased in 2024 or after | for the vehicles purchased in 2023 or before |
|---|---|---|---|---|---|---|
| 2024 Chevy Blazer EV Police Pursuit Vehicle |  | BEV | Contact GM Evolve for a quote | Product details; 190kW, DC Fast-Charging capable; Specialization Guide | | |
| Ford Police Interceptor 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, Manager, Office of Freight and Clean Transportation at the Delaware Valley Regional Planning Commission at sgreene@dvrpc.org.

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

## PURCHASING PROCESS

When purchasing a university vehicle, make sure to complete these 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, a fleet management service that handles leasing and purchasing, at least three bids are 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.

For electric vehicles (EVs), the **Climate Mayors Electric Vehicle Purchasing Collaborative** is the best option. The Collaborative 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. Please contact Penn Procurement for Penn's member number.

## Vehicle Registration

When your department purchases a new vehicle, it is critical that you **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. Additional information can be found on Risk Management's website.

When your department purchases an electric vehicle, there is an additional step that must be taken. After completing all of the steps detailed above, it is important that you also contact the Penn Tax, Compliance, and Payroll Office, notifying them of the EV purchase. This is necessary for documentation purposes, as well as ensuring that the University receives tax credits for which it is eligible.

## 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 also 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 16 EV charging stations on campus are provided by Blink Charging Co. Campus chargers can be found at the following locations:

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

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/or 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 it to before running out of battery?

> Though the range varies with each vehicle make and model, the average 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 104 Fast Chargers in the Philadelphia area, 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 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. 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 number and 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 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 fires and explosions from lithium-ion batteries are estimated to be comparable or less than those for gasoline or diesel vehicles. In fact, the National Renewable Energy Laboratory stated that though they are sensitive to overheating and overcharging, more than 99% of lithium-ion batteries used for EV energy storage will never have safety issues.

According to the U.S. Department of Energy, electric vehicles are manufactured with insulated high-voltage lines as an extra layer of protection. Additionally, light duty EVs are required to have safety features that deactivate or isolate the electrical system when a collision or short-circuit is detected, eliminating any sort of electrical malfunction that may lead to a fire or explosion.

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, they 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 spark plugs, valves, and catalytic converters that tend to fail in ICEVs and need replacement.

The cost to fuel EVs is also lower than it is for ICEVs. As of July 2024, the average Philadelphia commercial electricity rate is $0.0839/kWh. For the most up-to-date rates, click this link. The average battery electric sedan reaches a full charge of 60kWh and is able to run for about 250 miles per charge, costing about $5.03 in total. Comparatively, according to the Federal Bureau of Transportation the average 2022 ICEV light duty passenger vehicle in the United States had a fuel economy of 22.8 mpg. In July 2024, gas in Philadelphia cost $3.58/gallon on average, costing roughly $39.38 to travel 250 miles (AAA). This indicates the large cost gap between using an EV and an ICEV in the Philadelphia area.

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 shown to be lower than that of internal combustion engines.

Philadelphia's electric grid draws its power from four main categories: nuclear power, coal, and natural gas, and "other" sources. Our 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 December 2023 Penn's solar Power Purchase Agreement came online. The PPA will provide approximately 70% of the electricity demand of the University of Pennsylvania and the University of Pennsylvania Health System in Greater Philadelphia. The University will purchase the solar electricity from AES, the developer of the solar power system.

Additionally, Penn's emissions have also been decreasing due to shifts towards renewable energy grid sources. Penn's PPA combined with our region's general trends toward 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 and 4.0* 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 Alternative Fuels Incentive Grant program (AFIG) Due to these factors and rising demand, an increase in charging stations is expected 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. 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 as a result recycles more lithium-ion batteries then the rest of the world combined. Similarly, the European Union is requiring that at least 50%

of an EV battery's weight be recycled, with that percentage set to increase in the coming years.

In the US, 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. In the US, most 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

## APPENDIX I

### Global Warming Potential (GWP) of EVs

In a report published by the European Commission 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 in *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 in accordance with 2020 baseline conditions.

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.

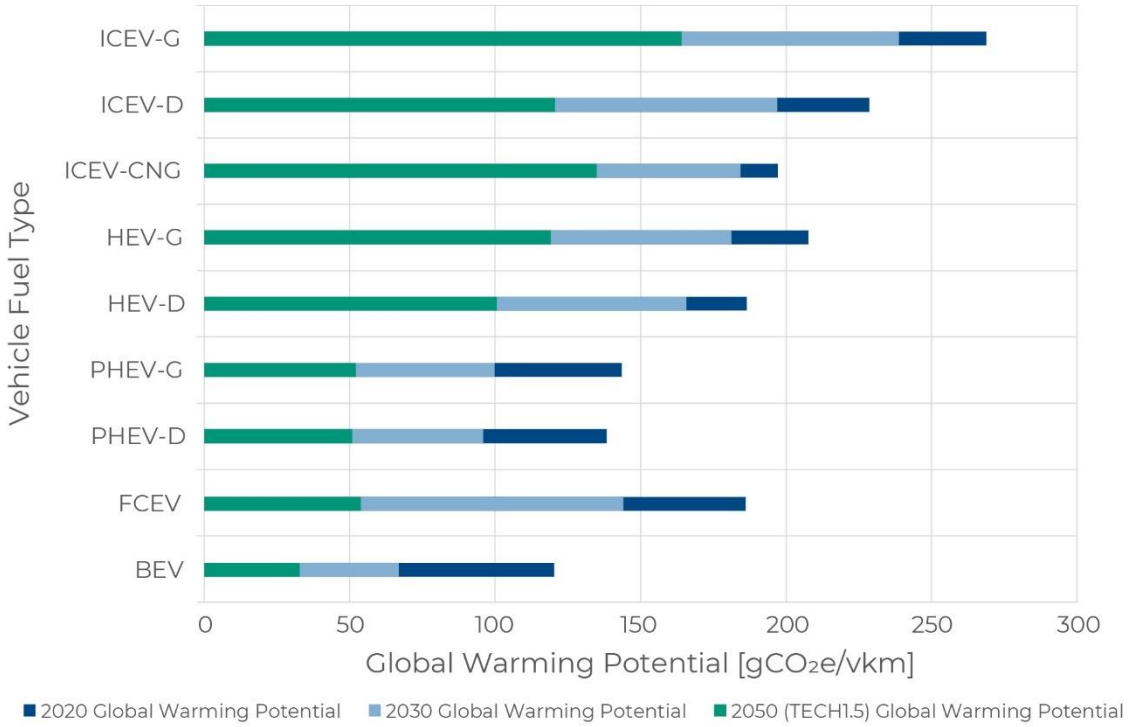



*Figure 1.* Summary of overall lifecycle GWP impacts for Lower Medium Cars by fuel type (*Determining the environmental impacts of conventional and alternatively fueled vehicles through LCA*, Figure 5.58).

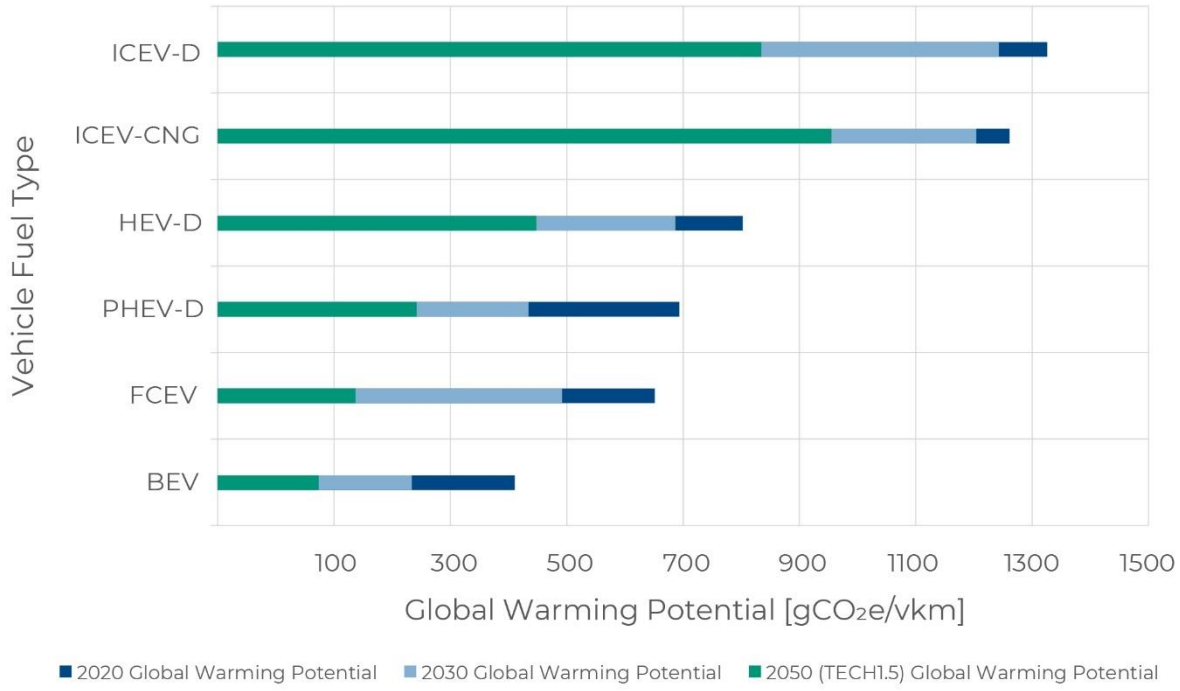



*Figure 2.* Summary of overall lifecycle GWP impacts for Urban Buses by fuel type (*Determining the environmental impacts of conventional and alternatively fueled vehicles through LCA*, Figure 5.72).

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 the state of 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 between 2004 and 2019.

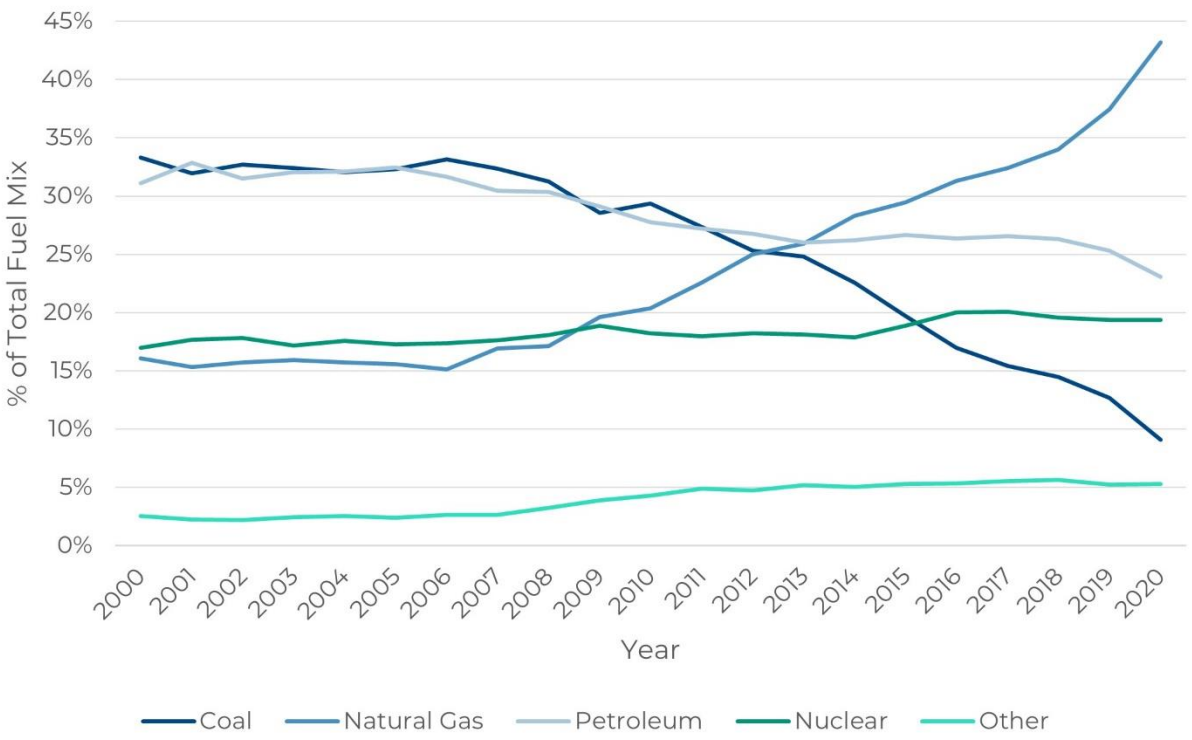



*Figure 3.1.* Pennsylvania electric grid source trends from 2004-2019 (U.S. Energy Information Administration State Energy Data System).

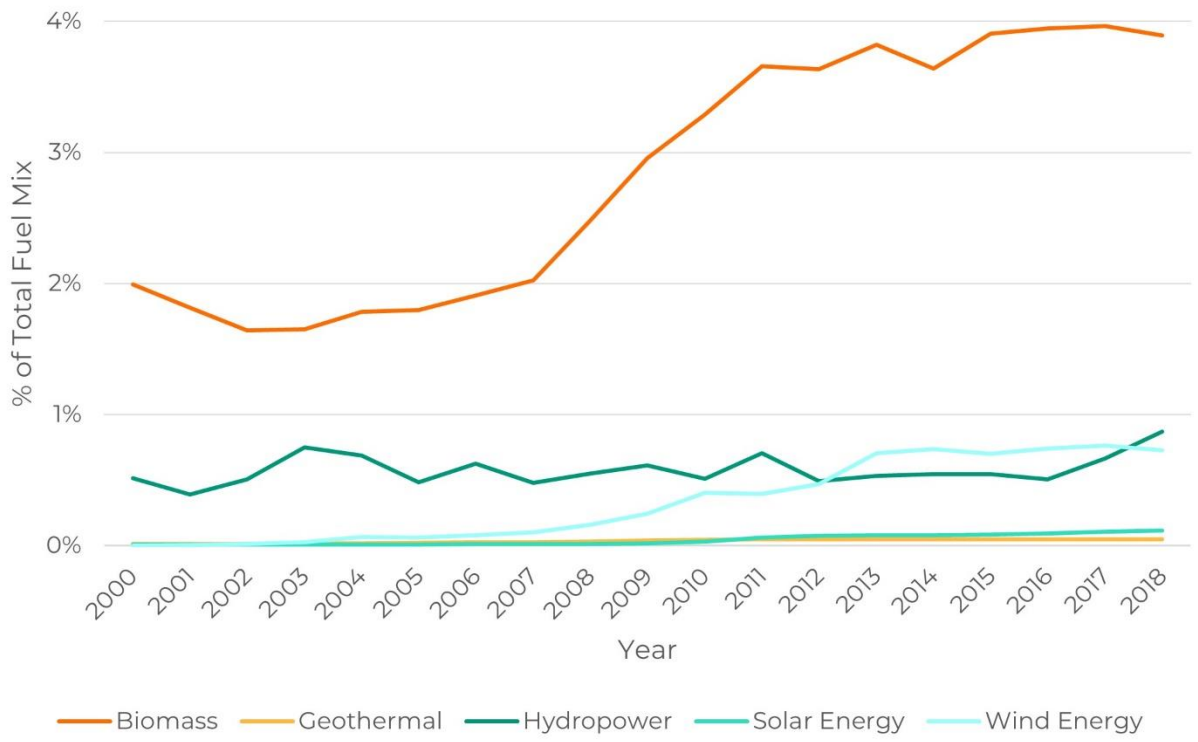



*Figure 3.2.* Pennsylvania electric grid source trends from 2004-2019, breakdown of "other" sources shown in *Figure 3.1* (U.S. Energy Information Administration State Energy Data System).

According to data from the EPA, Pennsylvania's carbon dioxide equivalent emissions ($CO_2e$) have also decreased between 2004 and 2019 and are projected to continue to drop due to the increase in lower emission electricity sources (*Figures 3.1* and *3.2*).

*Figure 4* shows the three main electricity sources used in the Pennsylvania, New Jersey, Delaware, and Maryland region: nuclear power, coal, and natural gas. While making up a small percentage of the total amount, the region has been increasing its use of renewable energy, predominantly in wind and solar.

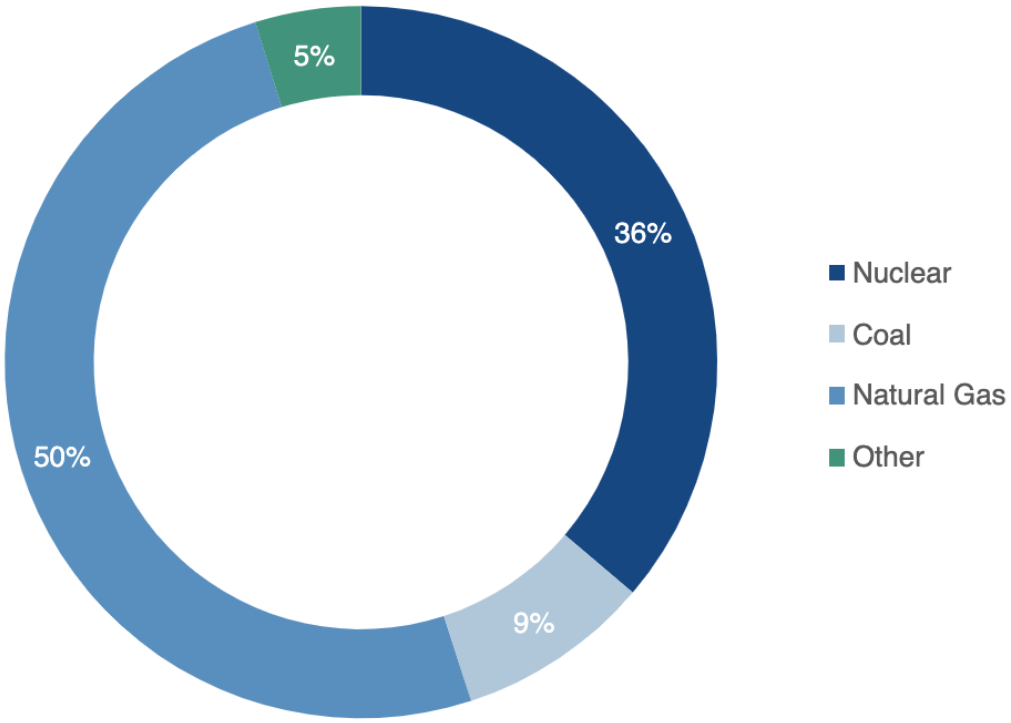


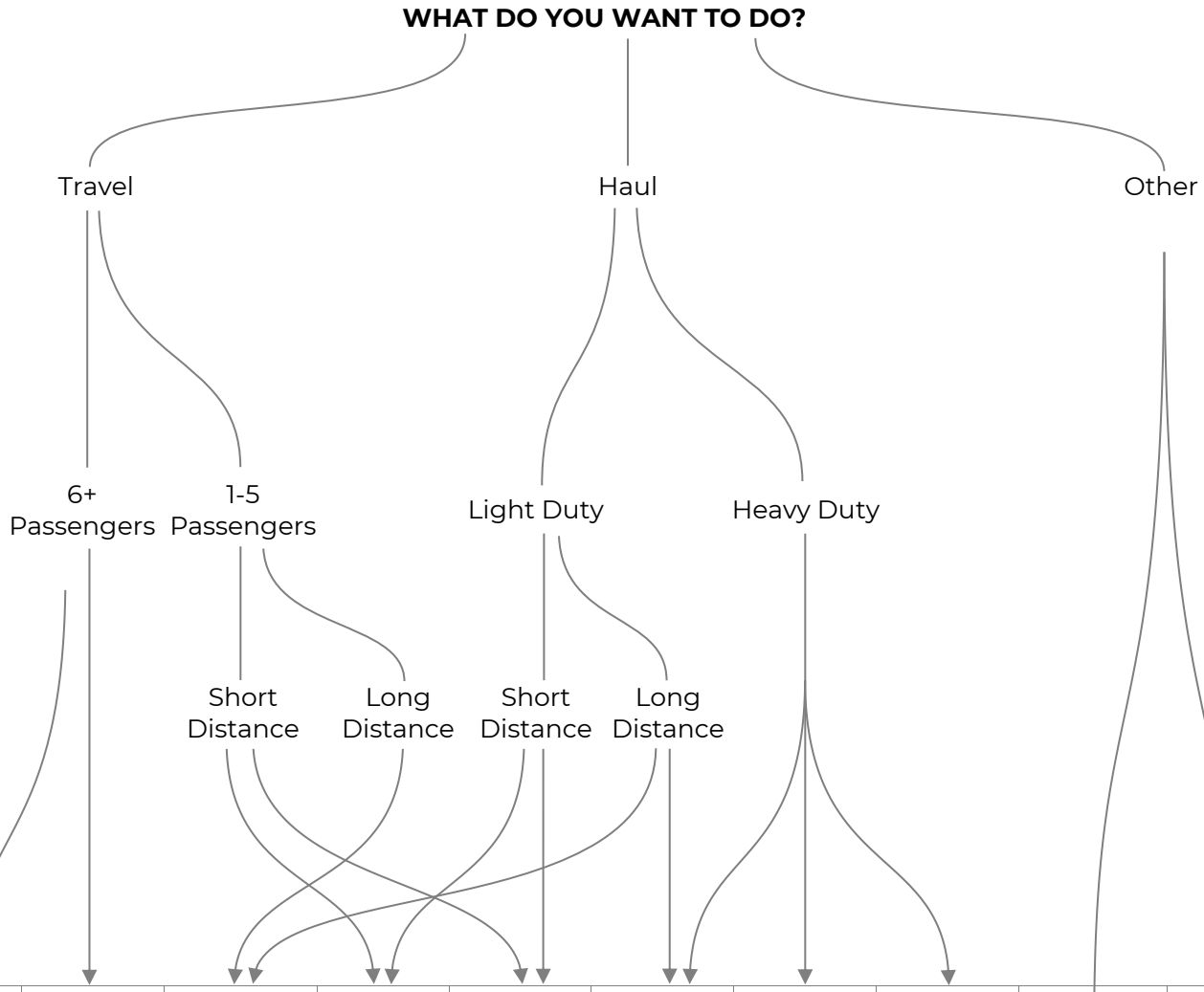

*Figure 4*. Fuel mix used to generate electricity in the RFCE region (includes Pennsylvania, New Jersey, Delaware, and Maryland) as of 2022 (EPA's Power Profiler, Fuel Mix for RFCE Region).

As mentioned earlier, Penn signed a solar Power Purchase Agreement that is providing approximately 70% of the electricity demand of the University of Pennsylvania and the University of Pennsylvania Health System in Greater Philadelphia. This PPA shifts 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 the electricity used to power 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 info, click on the name of each category.




| Bus | Passenger Van | Light-Duty /Passenger Vehicle | E-Assist Bike | Low Speed Vehicle | Cargo Van | Pickup Truck | Chassis | Public Safety Vehicle | Equipment |
|---|---|---|---|---|---|---|---|---|---|
| Consult Vendor for Price Range | Est. Price Range: $31,860 and up | Est. Price Range: $28,040 and up | Est. Price Range: $1,999 and up | Consult Vendor for Price Range | Est. Price Range: $34,100 and up | Est. Price Range: $22,195 and up | Consult Vendor for Price Range | Consult Vendor for Price Range | Consult Vendor for Price Range |