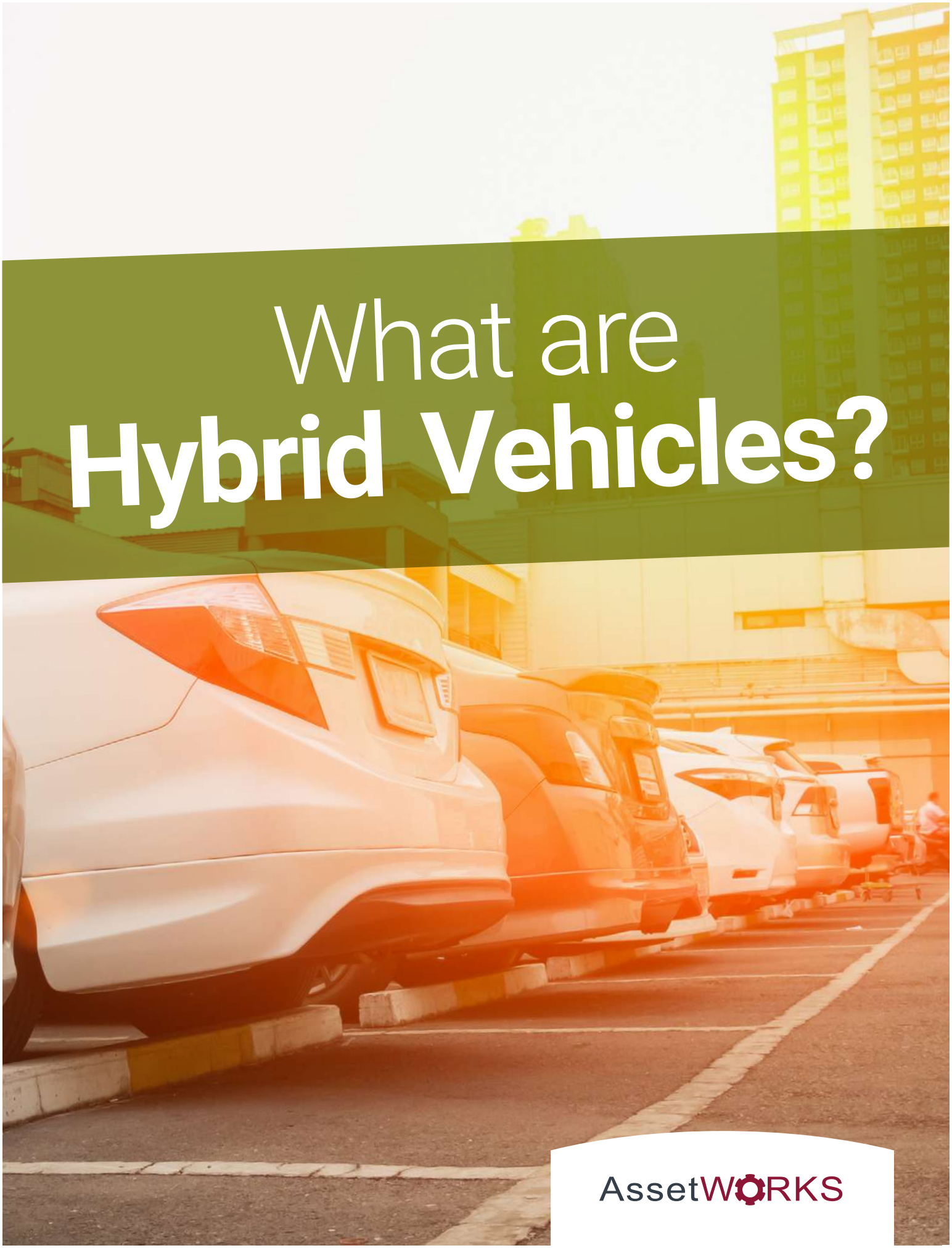

What are **Hybrid Vehicles?**

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The push to replace gasoline-powered vehicles with electric and hybrid vehicles is the most important topic on the minds of climate change pundits. As governments, industries and the public become more environmentally conscious, we start to see more legislation and development related to alternatively-fueled vehicles.

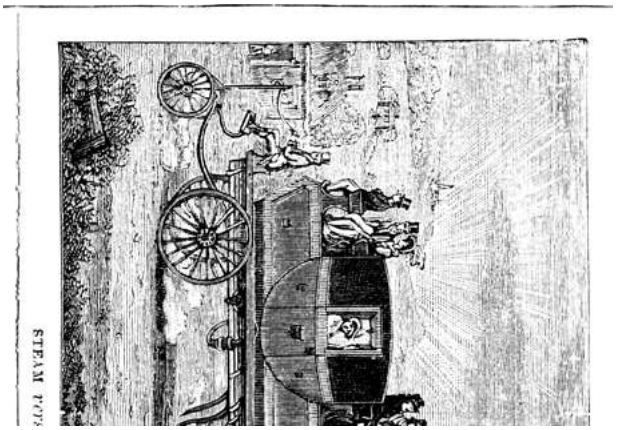
As a result, it has become more pressing for modern fleets to begin to integrate hybrid and electric vehicles into their fleets, both through vehicle procurement, hardware infrastructure and software technology.

HEV's (Hybrid Electric Vehicles) are one option to provide a better alternative to conventional ICE vehicles. Their design can sustain a trend to replace the current majority of automobiles which burn fossil fuels.

Hybrid Vehicle Concept...The Beginning

The hybrid car is such a suitable mode of transportation in these times of environmental and economic concerns that we tend to think of it as a recent modern invention. Actually, these vehicles have been in development for several years now. In fact, it may surprise one to know that they have been in development as far back as even before the 20th century!

It was in 1665 when Ferdinand Verbiest, a Jesuit priest and astronomer, began designing a four-wheeled self-moving wagon powered by steam. Verbiest is known to have toiled on the design well into 1680, but there is no known record that the machine ever worked or if it was even built in the first place. The first working steam-powered vehicle would be built by a Frenchman named Nicholas Cugnot in 1769. Capable of traveling at 6 miles per hour, the downside to Cugnot's creation was that it could not produce sufficient steam to move any faster, as well as being unable to carry adequate amount of fuel to travel farther.



In the succeeding years, there would be several more attempts to invent an alternatively-driven horseless carriage; most notably by employing a then-emerging new power source, electricity. A number of inventors emerged who might have laid claim to having been the first who invented the hybrid car, had it not been for certain flaws that would appear in their designs. A Scotsman named Robert Anderson developed the first electric-powered car in 1839, which was much acclaimed during its time but nonetheless suffered the problem of how its automotive batteries could maintain their charge. In 1870, a certain Sir David Salomon devised an electric-powered vehicle that had a light motor and a very heavy battery, but these innovations came at the expense of its speed and range.

It wouldn't be until the 20th century that the search for an unconventionally fueled form of transportation would be close to fruition. It was in 1962 when Motorola cars founder Russell Feldman approached an electrical engineer named Victor Wouk concerning the growing problem of pollution caused by car emissions. In 1974, assisted by a friend named Charlie Rosen, Wouk's solution was to utilize the body of a Buick Skylark to build the prototype for a vehicle combining the capacity of a gas-powered engine with the low emission rate of an electric-powered car. Wouk would come to be the man who invented the hybrid car as we know it today.

Victor Wouk

Wouk's hybrid car was tested by the US Environmental Protection Agency, which proved the modified Buick to be more efficient than when it was still a typical gas-powered vehicle and ruled that it indeed adhered to the guidelines of the agency's clean air auto program. Despite this, there was no apparent interest in Wouk's creation, as most anti-pollution proponents would prefer the development of a completely electric environment-friendly car. Undaunted, Wouk and Rosen decided to become entrepreneurs, forming a company that would market the hybrid car for everyday use.

Victor Wouk had been developing the modern hybrid car throughout the 1960's to the'70's, but it was not until the late '90's that it had become commercially available. It was an idea that took decades to catch on, but if we take into account the other previous attempts, it had actually taken literally centuries. Nonetheless, the question of who invented the hybrid car should not be in dispute. While others may have thought of the concept before, it was Wouk who was able to make it work.

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How Do Hybrid Electric Cars Work?

Hybrid electric vehicles are powered by an internal combustion engine and an electric motor, which uses energy stored in batteries. HEVs combine the benefits of high fuel economy and low tailpipe emissions with the power and range of conventional vehicles. Most hybrid electric vehicles cannot be plugged in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine. (Some vehicles, like the Chevrolet Volt, allow a user to charge a small battery in tandem with a normal combustion engine. If the user generally completes short commutes, the vehicle is virtually a fully electric vehicle. However, it contains an ICE for longer trips as well.) The extra power provided by the electric motor can potentially allow for a smaller engine. The battery can also power auxiliary loads and reduce engine idling when stopped. Together, these features result in better fuel economy without sacrificing performance.

A wide variety of HEV models are currently available. Although HEVs are often more expensive than similar conventional vehicles, some cost may be recovered through fuel savings or state incentives. Compare HEV and non-hybrid models side by side using the "Can a Hybrid Save Me Money?" tool on FuelEconomy.gov. The tool compares the costs of a selected HEV with a comparably equipped non-hybrid model from the same manufacturer and provides fuel cost savings associated with the HEV option.

Regenerative Braking

As mentioned earlier, an HEV cannot plug in to off-board sources of electricity to charge the battery. Instead, the vehicle uses regenerative braking and the internal combustion engine to charge. The vehicle captures energy normally lost during braking by using the electric motor as a generator and storing the captured energy in the battery.

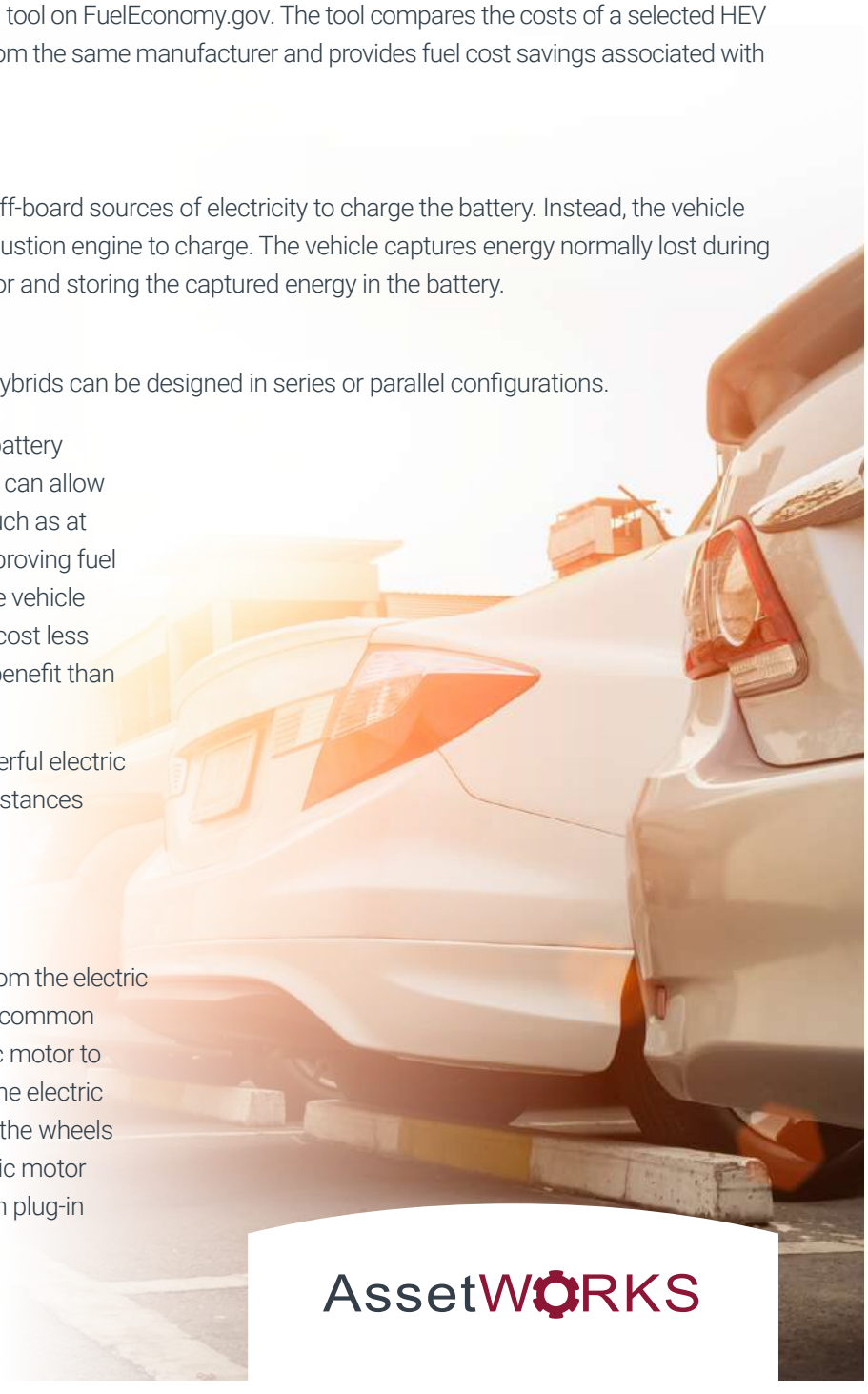
Fuel-Efficient System Design

HEVs can be either mild or full hybrids, and full hybrids can be designed in series or parallel configurations.

Mild hybrids—also called micro hybrids—use a battery and electric motor to help power the vehicle and can allow the engine to shut off when the vehicle stops (such as at traffic lights or in stop-and-go traffic), further improving fuel economy. Mild hybrid systems cannot power the vehicle using electricity alone. These vehicles generally cost less than full hybrids but provide less fuel economy benefit than full hybrids.

Full hybrids have larger batteries and more powerful electric motors, which can power the vehicle for short distances and at low speeds. These vehicles cost more than mild hybrids but provide better fuel economy benefits.

There are different ways to combine the power from the electric motor and the engine. Parallel hybrids—the most common HEV design—connect the engine and the electric motor to the wheels through mechanical coupling. Both the electric motor and the internal combustion engine drive the wheels directly. Series hybrids, which use only the electric motor to drive the wheels, are more commonly found in plug-in hybrid electric vehicles.



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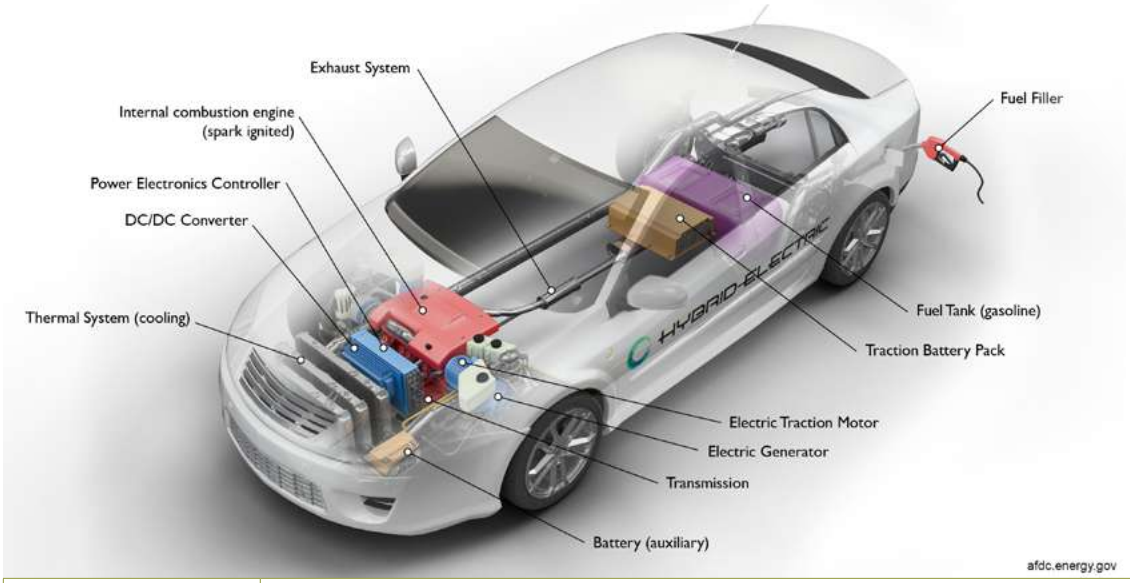
Key Components of a Hybrid Electric Car



Battery (auxiliary)	In an electric drive vehicle, the auxiliary battery provides electricity to start the car before the traction battery is engaged and also powers vehicle accessories.
DC/DC converter	This device converts higher-voltage DC power from the traction battery pack to the lower-voltage DC power needed to run vehicle accessories and recharge the auxiliary battery.
Electric generator	Generates electricity from the rotating wheels while braking, transferring that energy back to the traction battery pack. Some vehicles use motor generators that perform both the drive and regeneration functions.
Electric traction motor	Using power from the traction battery pack, this motor drives the vehicle's wheels. Some vehicles use motor generators that perform both the drive and regeneration functions.
Exhaust system	The exhaust system channels the exhaust gases from the engine out through the tailpipe. A three-way catalyst is designed to reduce engine-out emissions within the exhaust system.
Fuel filler	A nozzle from a fuel dispenser attaches to the receptacle on the vehicle to fill the tank.
Fuel tank (gasoline)	This tank stores gasoline on board the vehicle until it's needed by the engine.
Internal combustion engine (spark-ignited)	In this configuration, fuel is injected into either the intake manifold or the combustion chamber, where it is combined with air, and the air/fuel mixture is ignited by the spark from a spark plug.
Power electronics controller	This unit manages the flow of electrical energy delivered by the traction battery, controlling the speed of the electric traction motor and the torque it produces.
Thermal system (cooling)	This system maintains a proper operating temperature range of the engine, electric motor, power electronics, and other components.
Traction battery pack	Stores electricity for use by the electric traction motor.
Transmission	The transmission transfers mechanical power from the engine and/or electric traction motor to drive the wheels.

Preparing to Transition your Fleet

It can be a daunting task to logistically plan out retiring or reselling your current vehicles, investing in charging hardware, and managing the entire procurement process. AssetWorks has extensive knowledge and services available in the ICE, HEV and EV arenas. In addition, our Capital Asset Management (CAM) software works hand-in-hand with our other systems to streamline your analytics, budgeting, procurement and disposal processes.

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