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Advantages and Disadvantages of Electric Vehicles and Hybrid Electric Vehicles

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Abstract: This article explores the advantages and disadvantages of Electric Vehicles (EVs) and Plug-in Hybrid Electric Vehicles (PHEVs) as transformative solutions in the automotive industry. The analysis covers key aspects, including environmental impact, energy efficiency, operating costs, and technological innovation. While EVs and PHEVs offer zero-emission benefits and reduced reliance on fossil fuels, challenges such as limited range, charging infrastructure, and upfront costs are discussed. The conclusion emphasizes the pivotal role these vehicles play in sustainable transportation, underscoring the need for ongoing technological advancements and infrastructure development to fully unlock their potential. As the automotive landscape evolves, understanding the nuanced dynamics of EVs and PHEVs becomes essential for informed decision-making and fostering a cleaner, more sustainable future.

Keywords: Electric vehicle, shock absorber, regenerative braking systems, suspension system, frictional braking.

An electric vehicle (EV) is a type of vehicle that uses one or more electric motors for propulsion. These vehicles are powered by electricity stored in batteries and do not rely on traditional internal combustion engines that use gasoline or diesel. Electric vehicles have gained popularity as a more environmentally friendly alternative to traditional vehicles, as they produce zero tailpipe emissions. There are two main types of electric vehicles: Battery Electric Vehicle (BEV): BEVs are fully electric vehicles that rely solely on electric power stored in batteries. They do not have an internal combustion engine and produce zero emissions during operation.

Plug-in Hybrid Electric Vehicle (PHEV): PHEVs combine an electric motor with an internal combustion engine. These vehicles have a larger battery compared to traditional hybrid vehicles, allowing them to travel a certain distance on electric power alone before the internal combustion engine is engaged. PHEVs can be plugged into an electric power source to charge their batteries. EV stands for "Electric Vehicle," and the power is not an internal combustion engine such as a gasoline engine, but rather uses electricity stored in a battery to drive a motor. Since it does not emit CO_2 while driving, it is clean and has no environmental impact. Lithium-ion batteries are mainly used, and the distance the vehicle can travel (cruising range) varies depending on its capacity. EVs generally have short cruising ranges, making them unsuitable for long-distance driving, and there are few charging facilities, among other issues.

Certainly! Below is a simple table outlining the key characteristics of Electric Vehicles (EVs) and Plug-in Hybrid Electric Vehicles (PHEVs):

Characteristic	Electric Vehicle (EV)	Plug-in Hybrid Electric Vehicle (PHEV)
Propulsion System	Electric motor(s)	Electric motor(s) + Internal Combustion Engine (ICE)
Primary Energy Source	Electricity stored in batteries	Electricity stored in batteries + Gasoline or other fuel (for ICE)
Tailpipe Emissions	Zero emissions during operation	Zero emissions during electric mode, emissions from ICE during hybrid mode
Range	Depends on battery capacity	Electric-only range + Total range (Electric + Gasoline)
Charging	Plug into electric power source	Plug into electric power source + Refuel at gas stations
Charging Time	Varies based on charging infrastructure and battery capacity	Varies based on charging infrastructure, typically shorter than EVs
Typical Use	Daily commuting and short trips	Suitable for both short and long-distance travel, with flexibility to use electric or hybrid mode
Infrastructure Dependence	Relies on availability of charging infrastructure	Less dependent on charging infrastructure due to dual power sources
Fuel Efficiency	Measured in kWh/100 miles or km	Measured in miles or km per gallon (MPGe) for electric mode, miles per gallon (MPG) for gasoline mode
Environmental Impact	Lower carbon footprint if electricity is from renewable sources	Lower emissions compared to traditional vehicles, but higher than pure EVs in hybrid mode
Cost	May have higher upfront cost but lower operating costs	Generally has a lower upfront cost than pure EVs, operating costs depend on usage pattern

Keep in mind that specific models and technologies may vary, and advancements in the automotive industry can lead to changes in these characteristics over time.

A plug-in hybrid vehicle (PHEV) is a vehicle that complements the challenges faced by EVs. In addition to a motor, a PHEV is equipped with an engine that serves as a generator. Basically, it runs as an EV, but when the battery charge gets low, the generator is turned on by the combined engine for power generation (partly for driving). The cruising distance can be extended by turning the wheel to generate electricity and perform hybrid driving. Another feature is that it can be charged using an external power source such as a charging station, and its strength is that it can use both electricity and gasoline.

Advantages of EV/PHEV

No exhaust gas (PHEV has less),acceleration is smooth and feels good,low vibration and high quietness,low center of gravity, which has a positive impact on maneuverability,electricity costs are cheaper than gasoline costs,tax reduction and subsidies available,can be used as a storage battery. Long range (PHEV)

EV/PHEV does not emit exhaust gas (low) .EVs use electricity stored in batteries to drive motors to move the car, so they do not burn gasoline and emit exhaust gas or CO2 like gasoline cars. If you look at the vehicle itself, it can be said to be a clean and eco-friendly vehicle for the environment.

In addition, PHEVs use electricity and run only with the motor when the battery is in a good state of charge. Even after the battery runs out, the vehicle can continue running as a hybrid vehicle using both the engine and electric motor, resulting in better overall fuel efficiency and environmental performance.

However, what is important about the impact that EVs have on the environment is that although the vehicle itself may be clean and eco-friendly, if the electricity supplied to the EV is supplied by thermal power generation using oil or coal, it will be putting the cart before the horse. It is also necessary to consider shifting the national energy policy toward renewable energy such as solar power generation.

EV/PHEV has smooth acceleration and feels good. Due to the characteristics of the motor, EV/PHEV has the advantage of superior acceleration performance because the torque increases the moment you step on the accelerator. Gasoline cars have a characteristic of increasing power as the rotation speed increases, so the driving sensation is very different. Additionally, there is less delay in response to pressing the accelerator compared to gasoline-powered cars, so drivers can get the acceleration they desire.

EV/PHEV has less vibration and is quieter. Gasoline and diesel cars inevitably produce engine vibrations and noise, but EVs/PHEVs have less vibration and noise due to the characteristics of their motors. As a result, I am more concerned about the road noise and wind noise generated by the tires. The latest EV/PHEV models are emerging with particular attention to sound insulation.

EV/PHEV has a low center of gravity, which has a positive impact on maneuverability.

In most EVs/PHEVs, the battery is mounted under the floor in the center of the vehicle body. By housing the battery, which is one of the heaviest parts of this car, at the bottom near the center of the vehicle, the center of gravity is lower than that of a gasoline-powered vehicle, allowing it to stably clear corners, such as turning around S-shaped corners. can do.

Electricity costs are cheaper than gasoline costs. EVs have the advantage of lower electricity costs when driving the same distance. For example, let's compare the costs of running Peugeot's 208 and e-208, both gasoline and EV versions of the same model. To make the story easier to understand, let's assume that the e-208 will run 380km on a single charge (WLTC mode).1 liter of gasoline costs 150 yen, WLTC mode fuel efficiency for a gasoline car is 17.9 km/liter, 1 kWh of electricity costs 30 yen, EV mileage per charge (WLTC mode fuel economy) is 380 km, and total electricity consumption is 50 kWh.

When traveling 380km, the gasoline cost for the 208 is 3,184 yen, and the electricity cost for the e-208 is 1,500 yen, which means that you can run an EV for almost half the price. In other words, EVs are more economical (= wallet-friendly).

06 EV/PHEV can receive tax reduction and subsidies

When purchasing an EV/PHEV, in addition to receiving eco-car tax reductions and automobile tax reductions, you can also receive subsidies from the national and local governments.

Example) When purchasing a Nissan Leaf e+ G (vehicle price: 34,000 $) in Tokyo

Eco car tax reduction 210$ + automobile tax reduction 125$ = 34,335$

National subsidy: 2,800$ *FY2021 CEV subsidy

Local government subsidy: 3,550$ *In the case of Tokyo

Total: 59,050 $

The vehicle price is 34,000$, which is relatively high compared to models in the same class, but the total tax reduction and subsidy is 59,050$, so if you take advantage of the preferential treatment, you can purchase the Leaf e+ G for 28,050$ can do.

07 EVs can be used as storage batteries during disasters and outdoors.

Since EVs are equipped with large-capacity batteries, they can be used as storage batteries not only during disasters but also during normal times.

For example, the Nissan Leaf e+ (64kWh) can provide electricity for a typical household for four days.

*Estimated value assuming the daily power consumption in a general household is approximately 12kWh/day.

In addition, it is possible to use electricity for outdoor activities such as camping, and EVs can be used as storage batteries in places that were previously unimaginable.

08PHEVs have a long range

PHEVs can run on gasoline even if the battery runs out of electricity. For example, in the case of the Mitsubishi Outlander PHEV M grade, the battery capacity is 20kWh and the distance it can run on electricity alone is 87km, but on gasoline it can run 16.6km/liter in WLTC mode x fuel economy tank capacity of 56 liters = 929.6km. The total cruising distance is 87+929.6=1016.6km, which is overwhelmingly long.

Disadvantages of EV/PHEV. Cruising range is shorter than gasoline vehicles (EV),Charging takes time,Not enough charging stations,Vehicle price is high,Requires charging equipment at home

Cruising range is shorter than gasoline vehicles (EV). “Cruising range” is the distance that a vehicle can travel without refueling (no electricity). In the case of EVs, it has the same meaning as ``distance traveled on one charge." EVs have a shorter cruising range than gasoline cars.

Let's take a look at the Peugeot 208 and e-208 mentioned earlier as examples.

Cruising distance of 208 (gasoline car)	17.9×44=787.6km WLTC mode fuel consumption: 17.9km/liter Fuel tank capacity: 44 liters
Cruising distance of e-208 (EV) (WLTC mode single charge mileage)	380km

As you can see from this example, a gasoline car can run more than twice as long as an EV. Recently, cars such as Tesla's Model S that have a long cruising range of 652 km (estimated) have appeared, but they are still in the minority due to their high prices.

EVs take a long time to charge. Gasoline cars can be refilled from empty to full in a few minutes, but this is not the case with EVs. Even if you use the quick charger described below, depending on the performance of the charger, the best you can do is charge the battery to 80% in 30 minutes, so there will be some waiting time.

At roadside stations and service areas, you can kill time by drinking tea or shopping at cafes, but if you are running long distances, you need to plan carefully before you go, otherwise you will not be able to reach your destination on time. Please be careful as there may not be any.

Also, with a regular charger, it typically takes longer, 8 to 12 hours, to fully charge the battery.

There are few charging stations for EV/PHEV. The number of registered EV charging stations has expanded over the past few years, with 4,995 quick chargers and 11,049 regular chargers (according to personal car management service e-fuel efficiency research, as of February 9, 2022). However, it still falls short of the 29,005 figure for gas stations (referenced by the Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry, as of March 31, 2021).

The advantage of EVs/PHEVs is that they can be charged at home, but it is true that some people feel uneasy about charging when they go away or thinking about the possibility of running out of power. Also, if it takes a long time to charge as in [02] , there is a high possibility that charging congestion will occur at the charging station, so it cannot be said that it is still very convenient.

EV/PHEV has a high vehicle price. In the merit section, I wrote that ``you can receive tax breaks and subsidies," but EVs are still more expensive than gasoline cars.

Let's take a look at the Peugeot 208 (gasoline car) and e-208 (EV) as examples.

Peugeot 208 GT vehicle price	3,161,000 yen
Peugeot e-208 GT vehicle price	4,503,000 yen
e-208 subsidy	786,000 yen (national subsidy of 336,000 yen + local government subsidy of 450,000 yen) *For Tokyo)
The amount after subtracting the subsidy from the vehicle price of e-208	4,503,000 yen - 786,000 yen = 3,717,000 yen

So, in the case of Peugeot 208 and e-208, the EV costs 556,000 yen more than the gasoline car even after subsidy. If tax reductions are taken into account, the difference will narrow a little more, but it cannot be denied that they are currently more expensive than gasoline-powered cars.

Additionally, PHEVs are equipped with more complex mechanisms and more expensive batteries than gasoline-powered vehicles, so the price of the vehicle is inevitably higher.

EV/PHEV requires charging equipment at home. Even in the case of a single-family home, a charging facility is required near the parking lot. Installation costs around 100,000 yen including product and construction costs, so there is an initial cost. Additionally, charging facilities may not be available in apartments, so you need to check to see if there are charging stations in your neighborhood or within your living area.

Conclusion: Electric Vehicles and Plug-in Hybrid Electric Vehicles offer a transformative path towards a more sustainable and eco-friendly transportation future. The advantages, including zero emissions, lower operating costs, and technological innovation, are compelling. However, challenges such as charging infrastructure and upfront costs need to be addressed for broader adoption. As technology advances and infrastructure improves, EVs and PHEVs are poised to play a crucial role in reducing the environmental impact of the automotive industry, contributing to a cleaner and more sustainable planet. The ongoing commitment to research, development, and infrastructure investment will be key to realizing the full potential of electric and hybrid vehicles.

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