

Higher purchase costs for electric vehicles, compared to gasoline and diesel equivalents, are a major barrier for electric vehicle adoption. Electric vehicles are currently (2018) in sales price 30 to 80% more expensive. However, purchase costs are not the only costs of owning a vehicle. For an honest comparison, we use the concept of total cost of ownership, which includes all the cost incurred over the lifetime of a vehicle.

The total cost of ownership of a car consists of the following components:

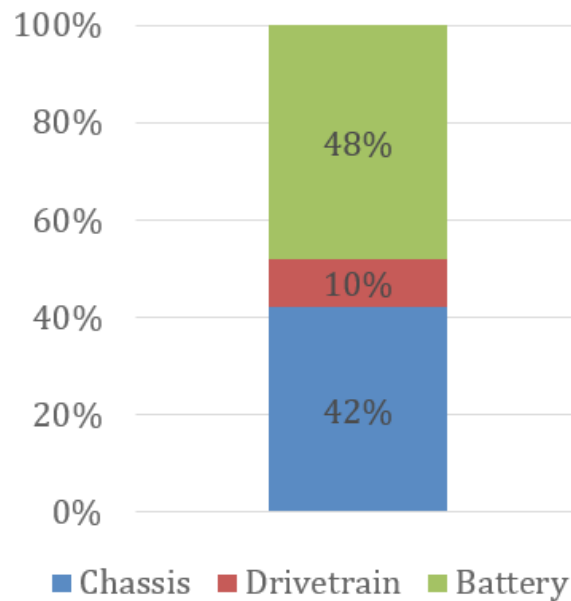
- Purchase
- Financing
- Driving
- Insurance
- Annual taxes
- Maintenance
- Depreciation

Purchase cost

The main cost components of a vehicle are the drivetrain and the chassis of the vehicle. Currently, the battery price determines nearly half of the costs of an electric vehicle. But during the past years the cost of batteries has fallen by about 20% per year due to continued R&D and increasing economies of scale.



Cost breakdown Electric Vehicle



Given an annual rate of 20% of reduction in the battery costs, upfront price parity of electric vehicles with their gasoline equivalents is expected around 2025. By this time the price of battery storage should have fallen to about \$100/kWh of storage. There are some pitfalls that could prevent this scenario from happening:

- Increase in the price of raw materials
- Re-establishing larger profit margins OEMs
- Adding more batteries to vehicles to increase range



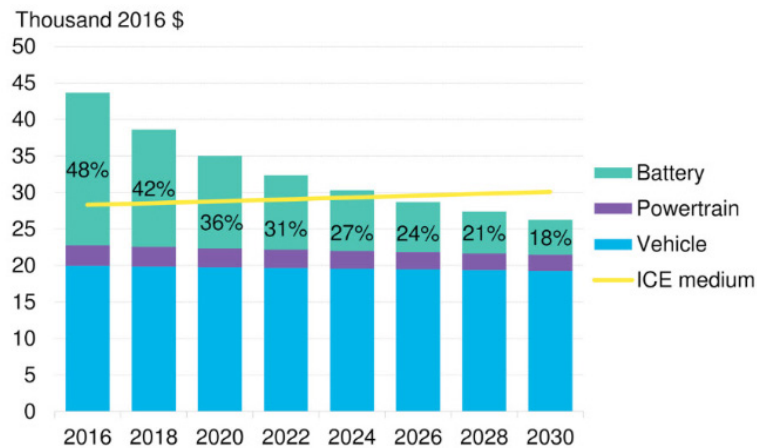


Image source: Electric Vehicle Outlook 2018, 2018, Bloomberg New Energy Finance, retrieved on 12-06-2018 from <https://about.bnef.com/electric-vehicle-outlook/>

Financing

Higher purchase costs of EVs imply higher capital costs, especially if one needs a loan to buy the vehicles. An option that is becoming more popular is leasing, which reduces financial uncertainties. A downside is that leasing is more expensive, as leasing companies have to make a profit.

See [this article](#) on the 5 reasons why should lease instead of buy an electric vehicle.



Driving costs are a significant factor in the total vehicle cost. On average driving an electric vehicle is cheaper than driving on gasoline as can be seen in this simple calculation below.

	Gasoline	Electric
Price	\$1.50/Litre	\$0.20/kWh
Efficiency	20 km/Litre	5 km/kWh
Price per km	\$0.075/km	\$0.04/km

The price of gasoline or diesel, however, varies between countries as well as over time. Depending on the local market and taxes there can be significant differences in the financial gain you might get for switching to electric. Gasoline prices are known to significantly fluctuate over time on the longer scale. The figure below shows that the price of a barrel of oil can vary significantly over the course of a year.





Image source: [macrotrends.net](http://www.macrotrends.net/2516/wti-crude-oil-prices-10-year-daily-chart). Retrieved on 25-06-2018 from <http://www.macrotrends.net/2516/wti-crude-oil-prices-10-year-daily-chart>

Electricity prices vary more on the short term, depending on the (renewable) electricity production and the demand. Prices can easily double or even become negative over the day. However as a consumer you are not likely to trade on the electricity market but agree on a single contract with an utility. You might opt for time-of-use prices which for example allow a cheaper electricity price during the night time. In general electricity prices are more stable than gasoline prices on the long run.



Driving costs

In practice you will not only charge at your home or office but you might also need to charge at public (fast) charging stations. Prices at these stations can vary much more depending on the type and location you need to charge. Especially at public charging stations you can also encounter different billing strategies based on the number of kWhs, either per session or per hour of charging. Paying attention to these price differences can save you quite some money.

Read [this blog](#) on why there are so many different charging tariffs in the public domain.

Insurance

Electric vehicles have higher insurance costs than conventional vehicles. There are three main reasons for these higher costs:

- Electric cars have a higher purchase price than comparable models.
- The repair of these cars requires specialist garages which are more costly.
- Insurance companies are uncertain about driving behavior of EV users, and consequently risks.

Insurance companies will likely get more information about accident risks of electric vehicles, as more electric cars come on the road. Some factors that might increase risks are: the lack of engine sound, fast acceleration and the high weight of an EV.



Taxes

Vehicle taxes generally come in two types: purchase tax and yearly taxes. Most countries use a purchase tax system for cars based on CO2 emissions. The higher the emissions, the higher the purchase tax. Countries can also decide to provide a direct discount for zero-emission vehicles, lowering the purchase price. Such a benefit can also be given at a later stage through a tax return on for example income tax.

The second type of taxes on vehicles that a lot of countries have is a yearly tax on car ownership. Many countries offer a discount on this yearly tax when driving an electric vehicle. As this tax is yearly, the total advantage you might gain over the lifetime of the vehicle can be substantial. Be aware that these policies might change over time and that they are different between countries.

Maintenance

Maintenance of a vehicle is often an expensive part of vehicle ownership, especially when vehicles become older. Maintenance costs of electric vehicles are much lower because they have less than 30 moving parts compared to over 2000 for an ICE vehicle. The use of regenerative braking, putting less stress on tires and brakes, also reduces maintenance costs. However, depending on your driving behaviour, the fast accelerating EVs can offset this gain. And the fact that you have to go to the car dealer results in higher maintenance costs.



Depreciation

Depreciation of the vehicle is the highest cost category of vehicle ownership. One of the factors that plays an important role in the second-hand value of an electric car is the battery life time. Batteries degrade when recharged. The so-called State-of-Health of the battery determines the remaining range. Future tests can reduce uncertainties about the State-Of-Health of batteries.

The second-hand value for electric vehicles is very uncertain because they are on the market only for a few years. Fast technological developments make that cars with longer ranges are coming to the market soon, making older models obsolete. As explained above, to reduce related uncertainties it is an option to lease the car. Fleet owners can spread risks through a so-called diversification strategy, which means keeping a mix of vehicle types in their portfolio.

Local incentives

Local governments can often decide to offer additional incentives for you to purchase an electric vehicle. Here some of the most seen incentives currently in place:

- Free parking
- Access to High-Occupancy-Vehicles or Carpool lanes
- Reduced (or no) tariff on toll roads

Besides offering incentives, many cities are considering banning gasoline or diesel driven engines from their inner cities. If so this could significantly reduce the second-hand value of these cars, making EVs the cheaper option.

