

INFO5992 Understanding IT Innovations

Tutorial 02 Summary

Is there a Dominant Design in Electrical Vehicles?

Q1. Briefly describe the three different types of electric vehicle (BEV, PHEV, Range-extended electric vehicle). What are their advantages and disadvantages related to each other?

Battery Electric Vehicles (BEV): NO combustion engine and only have on-board battery.

Advantages:

1. Lowest running cost (No gas fees)
2. Environment friendly (zero CO₂ emissions)
3. High-tech, looks cool.
4. Near-silent running

Disadvantages:

1. Not convenient to charge the battery since the power station is not quite widespread in each city.
2. No gas tank means you don't have a plan B when something going wrong with your battery.
3. BEVs have a shorter overall driving distance per fill-up compared to PHEVs.
4. High initial price

Plug-in Hybrid Electric Vehicles (PHEV): Having an electric powertrain and a small- to medium-sized combustion engine.

Advantages:

1. The electricity cost is cheaper than the fuel cost.
2. The longer journey can be satisfied, which compares to BEVs.
3. Greater fuel flexibility because a PHEV can be enabled through charging by electricity or refuelling by petrol or diesel.
4. Decreased CO₂ emissions in certain degrees.

Disadvantages:

1. Because of the smaller battery backs, BEV's electric driving range is longer than the PHEV's.
2. PHEVs are heavier and more complex than BEVs because of the two powertrain technologies. (High initial price)
3. It can be difficult to find third-party mechanics to fix your cars in some small cities or countries.

Range-extended Electric Vehicle (REV): It has a battery and a small internal combustion. However, the combustion was only used for charging the battery, it will never drive the wheels directly.

Advantages:

1. Longer drive range (Unlike BEV, it can charge the battery by the internal combustion)
2. Reduced drive cost (but not least)
3. Ultra-low CO₂ emission

Disadvantages:

1. Compared with BEV, the cost is relatively high.
2. Not completely environmental-friendly

Q2. Describe the product category of electric vehicles by listing some general functionalities and features.

General Functionalities:

- Electric motor
- Rechargeable battery
- No emissions when running on battery.
- Silent engine
- Passenger vehicle

Features:

- Option to self-drive or auto drive
- Fast charging at home or on the road
- Compact size
- Voice commands
- Integrated personal software communication.

Additional features:

- Intelligent operation platform
- Can use electricity as motor power.
- Driving assistance
- Internet of cars (i.e., monitor the speed remotely...)
- Power a campsite
- Integration with smart home...

Benefits of electric vehicles:

- Reduced fuel costs
- Lower maintenance costs
- Enhanced energy security
- Reduced air pollution (with associated health benefits)
- Improved driving experience
- Greenhouse gas emissions can be eliminated if EVs are charged using renewable energy.

Q3. Explain which phase of the design dominance and technology cycle electric vehicles are in?

Now, electric vehicles are in the **fluid phase** of design dominance.

- It is in between Technological Discontinuity 1 and Dominant Design 1 but closer to Discontinuity 1
- Tesla is the innovator of the electric vehicle industry and currently dominates the market
- As sharing and development of technology continue, more traditional and new vehicle companies are entering the field and competing with Tesla
- EV is in the specific phase of design dominance, with a stabilized architecture and incremental innovations
- EV companies focus on process innovation, such as improving production efficiency and battery storage
- EV companies increase market penetration and improve product/component functionality to fulfill various customer needs

The technology cycle phase electric vehicle technologies are in the **era of ferment**.

- There are lots of different hybrid designs with alternate battery options, causing confusion for consumers
- No stable architecture yet, and firms are experimenting with different product designs
- There is no standard yet, and each company is developing its own solution

Q4. Have electric vehicles crossed “the Chasm” in the technology adoption lifecycle model? Explain Why.

It didn't cross "the Chasm" in the Technology Adoption Lifecycle Model.

- Global market share of electric vehicles is only 10% of that of fuel cars.
- Electric cars are currently only popular in some developed countries or first-tier cities, and most regions lack infrastructure.
- Australia has not seen an early majority adoption.
- There are still some problems with the technology, such as cost and endurance capacity, which hinder development and investment.
- Many wait-and-see companies are unable to enter and invest in the development of this technology due to development cost.

Region Dependent

1. **China:** China is the largest EV market in the world, with a market share of 4.9% of total passenger car sales in 2021. China has been promoting EV adoption through various policies, such as subsidies and tax exemptions, as part of its efforts to reduce air pollution and carbon emissions.
2. **Europe:** Europe is the second-largest EV market in the world, with a market share of 15.9% of total passenger car sales in 2021. Several European countries have set ambitious targets for phasing out gasoline and diesel-powered vehicles and transitioning to electric mobility.
3. **United States:** The US is the third-largest EV market in the world, with a market share of 3.1% of total passenger car sales in 2021. EV adoption in the US has been driven by a combination of federal and state incentives, as well as the growing availability of EV models from major automakers.
4. **Norway:** Norway has the highest EV market share in the world, with 80.8% of new passenger cars sold in 2021 being electric. This is due to a combination of strong government incentives, such as tax exemptions and toll road exemptions, as well as high fuel prices that make EVs a more attractive option.

If only consider the market shares, only in Norway has EV crossed 'the Chasm'. Factors that will help or hinder EV adoption include gas prices, battery range, and EV charging for renters. However, electric vehicles are widely considered a solution to the negative effects of conventional vehicles, and there is increasing support from consumers, businesses, and governments, which will likely lead to increased adoption in the future and crossed "the Chasm".