Should My Next Car Be An EV?

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SHOULD MY NEXT CAR BE AN EV?

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VEHICLE OPTIONS

- ICE
- Hybrid
- PHEV
- EV
EV VS. HYBRID VS. PLUG-IN HYBRID

• Hybrid = Internal combustion engine (ICE) + Battery
  • Charges battery with combustion engine and regenerative braking
  • 1-2 miles battery range
• Plug-in hybrid electric vehicle (PHEV) = 10-40 miles per charge
  • Small amount of driving on most days and longer trips with some regularity
• Electric vehicle (EV) = complete reliance on electric power
WHY NOT PLUG-IN HYBRID?

• ICE + Heavy battery
  • Extra cost while running regular combustion engine

• Expensive battery pack
  • Additional upfront cost for battery and electric motor

• Still has a combustion engine, tailpipe emissions, maintenance costs

• I have another vehicle for long trips
EV AVAILABILITY IN USA

- Luxury Brands EV exclusive
  - Tesla
  - Rivian
  - Lucid
  - Polestar
  - Fisker

- Luxury Brands w/EV options
  - Volvo
  - Mercedes
  - Audi
  - BMW
  - Porsche
  - Cadillac
EV AVAILABILITY IN USA IN 2023

- Consumer Brands (Base price starting ~$30K)
  - Ford Mustang Mac-e
  - Mazda MX-30 (California only)
  - Hyundai Ioniq
  - Hyundai Kona
  - Chevrolet Bolt
  - Nissan Leaf
  - Nissan Ariya
  - Subaru Solterra
  - Volkswagen ID.4
  - Mini Cooper SE
  - Kia Nero
  - Toyota bZ4X
MY TOP CHOICES IN 2022

- Tesla Model 3
- Ford Mustang Mach-e
- Volkswagen ID.4
- Mercedes EQB
- Hyundai Ioniq 5
WHY ID.4?

• 255 miles range
• Free level-3 charging for 3 years
• Vast charging network
• Tax rebate eligible
• Assembled in the US
• 100k miles battery warranty
• Easy transition to EV (peace of mind)
• Save thousands of $ over 5 years
EV RANGE - WHAT TO LOOK FOR:

- 300+ miles = exceptional
- 200+ miles = good
- 100-200 miles = poor

- Battery capacity (kW) determines how long it takes to charge
  - Gross vs. Net
- Range depends on battery capacity, car weight, Hp, size, aerodynamics, etc.
- Battery warranty (8 years, 100k miles is great)
**MPG VS MPGe**

- Typical ICE vehicles has fuel economy of **25 MPG**, usually **22 city - 28 highway**

- Typical EV has fuel economy of **100 MPGe**, usually **105 city - 94 highway**
THINGS TO CONSIDER BEFORE BUYING

• Range and personal needs
• Where do you plan to charge?
  • Rent vs own your house
  • Can you install a charging station in your garage?
• Type of charger connector
  • CHADEMO, CCS, Tesla NACS
• Battery warranty
CHARGE TIMES

• Level 1 = standard home outlet (1-2 kW) = 2-5 miles/hr = 2-5 days full charge
• Level 2 = EV charger (up to 11 kW) full charge in 7.5 hrs, typical charge in 4 hrs
• Level 3 = DC Fast charger (up to 350 kW) full charge 45 min, typical charge 30 min
LEVEL 2 CHARGERS WORK INDOORS AND OUTDOORS

Installation cost: $1000 for parts + DIY or pay an electrician
CHARGING COST

- At home $0.094 per Kw
  - 0%-100% = $7.2
  - 20%-80% = $4.3
  - $21.7/week

- Charging Station $0.36 per Kw
  - 0%-100% = $27
  - 20%-80% = $17
  - $83/week
COST OF OPERATION OF EV VS. ICE

- EV: $21.7/week x 52 weeks x 5 years = $5,642
- ICE: $80/week x 52 weeks x 5 years = $20,800
DRIVING EXPERIENCE

• Quiet
• Smooth
• Immediate response
• Instant torque
• One-pedal driving option
LONG TRIPS AND RANGE ANXIETY

• Built-in navigation system calculates distance and battery level and finds charging stations along the route
• The vehicle warns you at 20% battery and asks if you wish to be navigated to the closest charging station
• Google and Apple maps allow you to set the fuel type of your vehicle
• Easy to find charging stations along your route
• Third party Apps help plan long trips based on charging needs
ENVIRONMENTAL IMPACTS

• ARGUMENTS AGAINST EVs:
  • Manufacturing EV batteries is very energy-intensive
  • Emissions from manufacturing the battery
  • Emissions from mining and processing raw materials
  • Making electricity produces just as much carbon emissions as burning gas in an engine

• HOWEVER
  • Life-cycle greenhouse gas emissions = vehicle production + fuel production + vehicle operation
ENVIRONMENTAL IMPACTS

• Considering both production and operation over a vehicle’s lifetime, the carbon emissions associated with driving an EV in the US are about half those of a conventional car.

• As the electric grid becomes decarbonized, environmental impacts of EVs will improve.

• Electric motor achieves over 80% efficiency compared to 30% for ICE.

• MPGe = 100 miles/gallon

Source: The International Council on Clean Transportation
FAQS

• How often do you charge?
  • In summer: once or twice a week
  • Busy driving days during school year: daily

• Is insurance for EVs more expensive?
  • No, it’s based on the cost of the car

• What if you get stranded with no battery?
  • 3 years of free towing to charging station

• Does the car need oil changes?
  • No and no emissions inspection, just safety inspections

• Does it have a radiator?
  • Yes, smaller than typical ICE vehicles, for cooling the battery during usage and charging

• Will the resale value decrease as the battery deteriorates?
  • Lithium-ion batteries used in new EVs can power a vehicle for more than 1.6 million kilometers, or a million miles (Harlow et al., 2019 Journal of Electrochemical Society)
SUMMARY

• The higher the range the better
• Recommended battery usage can be as little as 80%
• Can charge as often as you wish 20%-80%
• It’s fine to charge to 100% for long trips
• Install Level 2 charger at home
• Charging is easy and the convenience from home is priceless
• Batteries do not deplete when sitting unused
• Average person drives <50 miles/day
• No road-usage taxes yet
• Cut your CO₂ emission in half
WIRELESS CHARGING TECHNOLOGIES