

Mobile EV Charging Stations

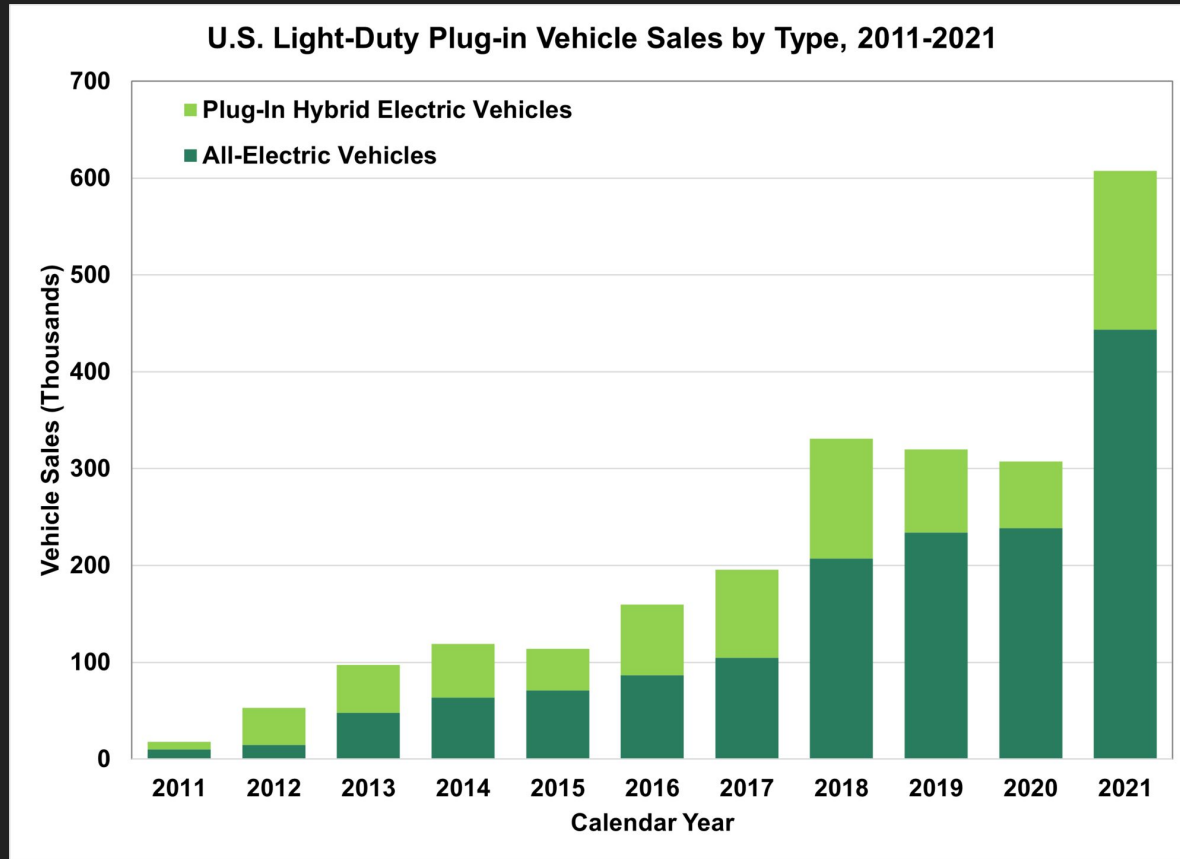
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Electric vehicles are on the rise

- As environmental concerns rise, so too does the desire for electric vehicles
- Many automakers have committed to only producing EV's in the future
- New York is set to ban the sale of gas cars by 2035



This image showcases the rise in popularity of not only fully electric vehicles, but also plug-in hybrid vehicles, or PHEVs.



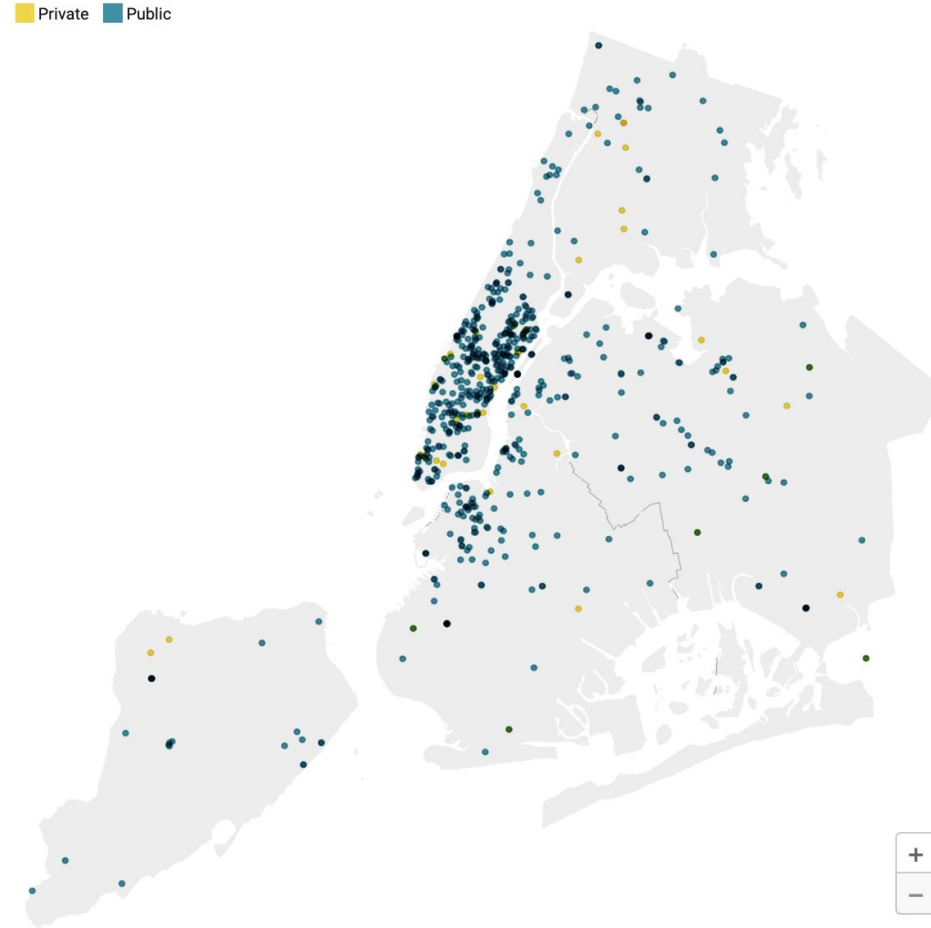
Problems facing EV ownership:

- Charging an electric vehicle is often less convenient than filling up an internal combustion engine vehicle
- The US has 150k gas stations, compared to 46k EV charging stations
- At-home charging is less practical for those without a driveway or their own parking spot
- The average range of a battery-powered car in 2021 was 217 miles, which could be limiting for some

- The following image depicts all the EV chargers, both public and private, across the five boroughs
- As you can see, there are many gaps where there are no EV chargers
- This presents a problem for those in outer boroughs, especially those without access to at-home charging solutions

Electric vehicle charging stations in New York City

This map shows the public and private charging stations in New York City, as compiled by the U.S. Department of Energy. Manhattan has approximately four times as many stations as Brooklyn, despite having way fewer registered electric vehicles.



How are we going to address this problem?

- Our solution involves using mobile charging stations to bring the chargers to to you
- This works by using an EV filled with batteries and chargers that we bring to you
- We can help people who are either far away from EV chargers and need help, or people who need their car charged while it's parked

Mobile charging station - basic design

- We decided to go with something large and spacious enough to fit the battery capacity we need
- Powered by a 68 kWh lithium-ion battery pack
- Range of about 120-130 miles
- About 235" long, 110" tall, 81" wide
- Solar panels on top allow for the car to gain some power even on the road
- We aim to provide mainly level 2 charging
- On-board battery pack (around 350-400 kWh)
- Features standard level 2 charger (40 amp, 38 miles of range per hour)



Benefits:

Reduce the amount of CO₂ emissions to the atmosphere

Increased lifespan, healthier community

Optimize sustainable energy usage

Lessen the effects of climate change

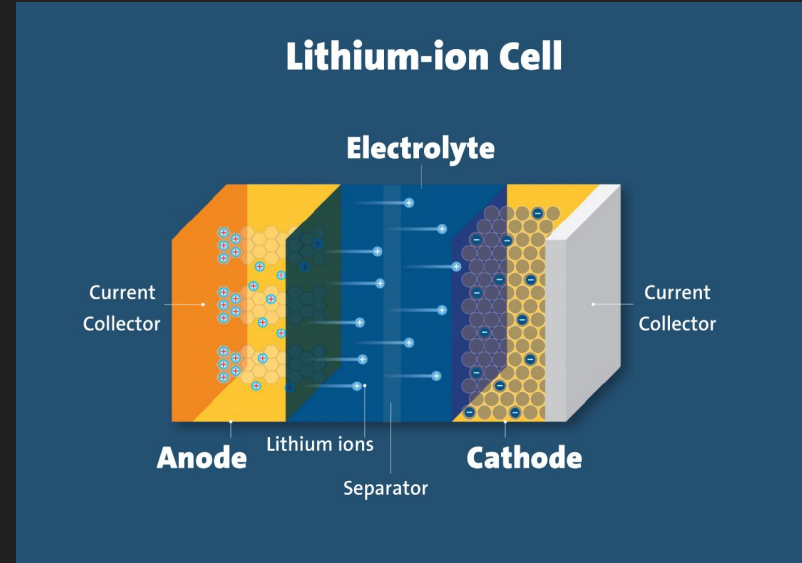


Lithium-ion battery limits:

- Battery capacity is known to decrease in extreme weather (extreme cold and heat)
 - As the battery completes cycles, its capacity decreases
 - Life-expectancy of EV batteries is about 15-20 years
- Ideal operating temperature for lithium ion batteries is 10 to 30 degrees Celsius
- Charging station will have heat pumps and cooling systems to keep ideal operating temperatures year-round
- Lithium ion battery packs have been increasing recently, reaching a peak of \$151/kWh

Lithium-ion batteries explained:

- Lithium ions move between the anode and the cathode
- Electrons move the opposite direction in the external circuit
- When the battery discharges, the anode releases lithium ions to the cathode
 - This generates a flow of electrons and powers the device/vehicle
- The opposite occurs when the battery is charged

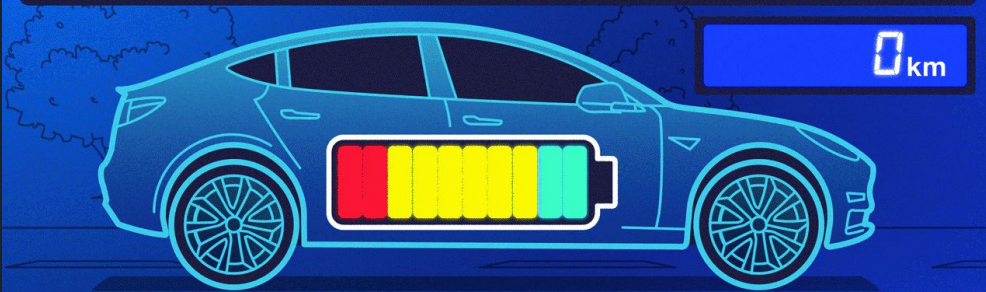


Battery capacity explained:

Total amount of electricity that is generated due to electrochemical reactions in the battery.

POWER FOR A LIFETIME

Like the battery in a phone, EV batteries degrade over time. But according to auto manufacturers, they're designed to last for a vehicle's lifetime.



NUMBER OF YEARS

For most drivers, it's estimated the battery will last from 8 to 12 years. When capacity hits about 80%, drivers will notice a reduction in range.

THE CIRCLE OF (EV) LIFE

Though a battery may not be suitable for driving, it can still hold a charge. Batteries have found second lives powering street lamps, data centres, and even charging stations.



If a second life isn't an option, the materials can be recycled and used to build new batteries.

Level 1, 2 and 3 charging:

- Level 1 charging
 - Regular home outlet
 - 120V
 - Charges at a rate of 4 miles of range/hr
 - Worst case scenario
- Level 2 charging
 - 240V
 - Can be found in residential/commercial locations
 - 12-30 mi/hr
- Level 3 charging
 - 480V
 - Also called DC Fast Charging (DCFC)
 - Much faster
 - Almost always exclusively commercial application
 - Install is expensive



Why wouldn't other ideas work?

Charging an electric car takes time — while the fastest chargers can charge an EV battery by 80 percent in 20 to 30 minutes, **most chargers are slower, taking somewhere between two and 22 hours to get to a full charge.**

The researchers found many reasons a station could be non-functional. Nearly 5 percent of the chargers' cords were too short to reach the car. Other causes included **broken connectors, network failures, payment system failures and unresponsive screens.**

Charging the batteries and the range anxiety are the top concerns when buying an EV in India and worldwide. Car makers are trying to increase the range (mileage) by reducing weight and optimizing energy-draining onboard technology.

Furthermore, the cost of level 3 charging stations is very high. Equipment is \$25-50k and electrical upgrades are another \$50k-100k. This means just building more stations might not be so practical.

Cost of EV Batteries

-In general, it will cost between \$10 and \$30 to charge your EV while on the road, depending on what level of charger you are using.

-Commercial charger rates are often double or triple those of residential rates. Even commercial charger rates can vary more than 50% within the same network. In comparison, gas prices vary by about 10% or less.

-Using a Tesla Supercharger station will cost you **\$0.24/kWh between 9pm and 11am** and **\$0.48/kWh between 9pm and 11am**. Using Tesla's standard chargers will cost you nothing!

-In a year, it would averagely cost you between \$300 to \$400 to charge an electric vehicle, depending on your charging location. On the other hand, a car that runs on gasoline could cost you between \$1000 to \$2000 on fuel alone.