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The Future Of Portable EV Chargers.

Word Count – 5054

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Introduction

In the UK, there are currently more than 42,000 charge point connectors spread among more than 15,500 locations. EDF. (n.d). Powell, D. (2021), on the other hand, claims. As of January 2022, there were over 750,000 plug-in hybrids (PHEVs) on the road in the UK, and sales of electric vehicles (EVs) surged by 76.3% in 2021. This demonstrates how desperately the UK needs EV chargers. There aren't enough EV chargers to accommodate the demand for automobiles because electric vehicle use is so prevalent.

Portable electric chargers are rapidly becoming the future of the electric and automotive industries. These chargers are a convenient and efficient way to power electric and hybrid vehicles without needing to plug into a wall outlet or other traditional power source. Portable electric chargers provide the ability to charge vehicles virtually anywhere, offering the consumer freedom and convenience. This new technology is ushering in a new era of electric vehicle design and ownership, with improved performance, a longer range, and greater convenience.

Charging will be consistent with parking practices. "In areas with high residential density, the percentage of automobiles parked overnight on the street rises to 60%. Less than three hours account for 70% of all "non-overnight" parking." Source - Keeping the Nation Moving - Facts on Parking, RAC Foundation. This demonstrates the urgent need for more electric charging stations to prevent shorts in those already present. The demand for charging stations is rising and cannot keep up with the growth in EV sales. According to Zip-MAP (2019). "In the UK, there were 36,752 electric car charging stations spread out over 21,906 charging locations as of the end of November 2022. Since November 2021, there have been 33% more charging devices than this. This does not, however, include the numerous charging stations set up at residences or places of employment.

The report examines the production, design, and significant impact of portable chargers on the development of electric vehicles. This will provide a greater understanding of how the adoption of this technology can alter the future of electric vehicles and make the world more efficient and sustainable. The future value of this concept and how this technology will alter the EV market will also be covered in the research. This technical report will start with a process of divergent thought, employing a user-centred development method throughout the project's first research phase. Additional technical information will be gathered through secondary research to design all of the internals that will be required for the final design.

Additionally, answers to technical design queries on the finished product, such as sustainability, material selections, viability, durability, and manufacturability, as well as concluding remarks regarding their further technical development, must be provided.

How is the EV industry changing?

According to Gibson, T. (2020). "Electric vehicles are getting smarter all the time. Here are five ways in which technology is gathering pace.

- Growing charging network
- Longer ranges
- Innovative technology
- Pleasurable driving experience
- Autonomous driving"

To understand this in detail this will be further explored to showcase how the EV industry is changing for the better. The electric vehicle (EV) industry has experienced significant growth and changes in recent years. One of the major trends in the industry has been the increasing adoption of EVs by consumers and the expansion of EV infrastructure, including charging stations. Governments and businesses around the world are also taking steps to promote the adoption of EVs, such as offering financial incentives and setting targets for the adoption of EVs.

Another trend in the EV industry has been the development of new technologies, such as longer-range batteries and after-charging systems, which are helping to make EVs more practical and convenient for consumers. There has also been a trend towards the development of electric vehicles in a variety of forms, including cars, buses, trucks and two-wheelers, as well as the development of hybrid electric vehicles, which combine traditional internal combustion engines with electric motors.

According to Citroen (n.d.). "Ongoing EV technology has majorly improved electric cars' range. Most Evs have a range of over 200 miles on one charge, with predictions of this to grow to 400 miles by 2028 as the industry develops." This demonstrates that even though electric cars haven't been around for a while, there has been a significant improvement in both the initial range and the current range of EVs on the market. This is crucial information to consider when speculating about the range of EVs in the future because patterns indicate that the range is expected to grow with time.

McKinsey & Company (2021). States that "The European Union presents its "Fit for 55" program, which seeks to align climate, energy, land use, transport, and taxation policies to reduce net greenhouse gas emissions by at least 55% by 2030." As previously stated, numerous governments all over the world are actively encouraging the adoption of EVs through a variety of incentives, including tax credits and rebates as well as setting goals for the percentage of EVs that must be sold in their nations. This promoted the rise of EVs by helping to create a favourable market for them.

This means that the future of the electric vehicle industry will have more support from around the world while making sure that the industry will be moving forward, and the technology used is advancing to make sure the industry evolves for the better. McKinsey also states that "All signs point to continued growth in the EV market, with Europe leading the charge. Reports suggest that EVs will make up 75% of European new car sales by 2030."

According to Seabrook, V. (2022). "Last November's Glasgow climate talks COP26, many analysts predicted the cost of electric vehicles was set to plummet in the new few years. Then in December, the government cut down the grant for buyers of electric vehicles." This means that the cost of EVs is decreasing as the technology improves and production scales up. As the price of EVs becomes more competitive with traditional gasoline-powered vehicles, more people may be willing to consider buying an electric car.

Seabrook, V. (2022). Also states that "The cost of battery electric vehicles (EVs) has already decreased significantly, and it is predicted that between 2025 and 2027, they will be as affordable as gasoline or diesel vehicles. The price decline is partly brought on by improvements in batteries, which are expected to reduce even further, as well as increased production of mass-market vehicles by automakers." Technological advancements such as increased battery life and range, more affordable pricing, improved charging infrastructure, and other features have made electric vehicles much more attractive to consumers. This is one of the main reasons why the overall price of EVs will decrease in the upcoming years, which make EVs a strong competitor within the automotive industry.

As stated, the price of EVs is decreasing as the technology becomes more widespread and efficient. Prices for EV batteries have fallen dramatically in recent years, and it is expected that they will continue to decrease as production scales up and new materials are developed. This has made EVs more affordable for consumers, further driving their adoption. This shows how the future of EVs is changing for the better and that is very positive for the future of EVs.

Overall, the EV industry is growing rapidly and is expected to continue to do so in the coming years, as more and more people turn to electric vehicles as a cleaner and more efficient means of transportation. Compared to conventional gasoline-powered vehicles, EVs have zero tailpipe emissions and much lower air pollution and greenhouse gas emissions. Demand for EVs is projected to rise as awareness of climate change and the need to decrease emissions rises. This enhances the likelihood that consumers will switch to using electric vehicles (EVs) due to other advantages, including government backing and rewards for using EVs. Because EVs are less expensive than combustion engines and are becoming more popular, technological advancements play a major role in user decision-making.

How is EVi going to change the industry?

When portable EV chargers are used, the EV sector will undergo a significant transition. Evi will serve as a stepping-stone concept to synchronise the EV industry's future. Allowing this development to happen implies that consumers will no longer be dependent on home charging or public charging stations because parking anywhere they like will enable them to utilise a portable EV charger for a quick charge. This section will provide additional details which will be split into 5 different sub-sections on how the use of EV chargers will improve and how this will guarantee that the market for electric cars will continue to increase.

When a conventional charging station is not accessible, electric vehicles (EVs) can be charged using portable electric car chargers. This can be especially helpful for those who frequently drive long distances and need to charge their EVs on the go or for those who do not have access to a charging station at home or work. According to Parkers. (n.d.). Portable electric vehicle chargers are essentially power banks on wheels and are aimed at both drivers with range anxiety and the 65% of urban households without approved off-street parking.

There are several distinct positive aspects when it comes to the use of portable electric chargers and how this will affect the future of the electric vehicle industry. To better comprehend portable EV chargers and how this technology will transform the EV infrastructure, they will be discussed in more detail in the next section.

There are several benefits of using a portable electric vehicle charger:

- Portability
- Versatility
- Reliability
- Safety
- Cost saving

Portability

First, Evi enables the user to use the device wherever they go, ensuring that they are not dependent on the range of their selected EV or public charging stations. Due to the design of this product being small and compact it allows the user to take the portable charger along with them as they travel meaning that they do not have to rely on other charging stations or worry about the next charge stop is going to be. This allows the user to save time overall and allows them to charge as they park. Evi allows the consumer to park anywhere they want and get a quick charger allowing a wider spread of charging options.

Versatility

In order to assure that the consumer does not need any additional parts in order to utilise this product, Evi is made to operate with any EV that is currently on the market. As a result, the consumer's overall cost of the product can be reduced, ensuring that they save money while buying an EV. This product can fit in electric cars because of the overall design's suitability and measurement for the majority of EVs now on the market. Evi is made to

ensure that the connectors are appropriate and compatible with other EVs already on the market. The AC adapters and type 2 female adaptors were selected as the connections since they are frequently used by the vast majority of electric vehicles in the market.

Reliability

Evi is designed to provide reliable power, in order to convince the consumer that they do not need to rely on any other charging stations than their own Evi charger. Also, when Evi is in use the product needs to meet its purpose which is making sure that it charges the user's electric car when they need too. Evi is built to last making sure that it has a long battery life and life cycle allowing the user not to worry about any upgrades. This is so that it is designed to make sure that it has a long sustainable life. Due to the power being drawn from the grid, there is no need to worry about not having power. This allows the user to charge anywhere due to its vast connectivity within the grid.

Safety

When it comes to the safety of Evi, its design is crucial. Evi is created with safety elements to ensure that when in use, both the user and the people around them are secure. These safety measures have built-in over-charge protection, which prevents overcharging or consuming more power than is necessary from happening. This is used as a safety buffer in order to make sure the safety of everyone is thought out. In order to protect the product from short circuits and water damage, the product will have a silicon-based seal, which makes sure that there will not be any water damage and ensures that the product is protected in harsh environments.

Cost Saving

Evi can save money in a variety of ways. One way is to make owning and operating a vehicle less expensive overall. Due to their lower maintenance and fuel costs, electric vehicles are often less expensive to run than gasoline-powered vehicles. Additionally, a number of incentives and tax credits may be available for electric vehicles, which could help to offset their greater initial cost.

Utilizing off-peak electricity pricing is another technique to make electric car chargers affordable. For electricity consumed overnight or on the weekends, many utility companies offer discounted rates. You can take advantage of these lower rates and possibly save money on your electricity account by charging your electric car during these times.

What is the future of Portable EV chargers?

How will the infrastructure change in 20-30 years' time?

Tooze, S. (2022). States that in 2022, fuel costs in the UK reached all-time highs, with the average price of gasoline reaching 191.53p per litre and the average price of diesel reaching 199.05p in July. This means that there will be a ripple effect in the system where the rise in fuel prices will make sure the rise in the price of transportation.

This will result in an increase in the cost of items. Customers won't desire this in order to save money and reduce their reliance on fuel. They would want to move to electric vehicles, which would result in a greater number of people converting to renewable energy. In order to meet the need for chargers for electric cars, there would be an increased need for portable and public chargers as a result of the conversion to electric vehicles.

A device like Evi, which would let people own a personal charger and not just rely on public charges, would be excellent given the demand for additional EV chargers. They wouldn't have to rely on home or public chargers thanks to this. There will be a need for some significant systemic changes when the demand for portable EV chargers rises.

Some potential areas of development include:

1. Increased charging speed: Portable EV chargers may be able to charge vehicles more quickly, allowing drivers to spend less time waiting for their vehicles to charge.
2. Improved portability: Portable EV chargers may become more compact and lightweight, making them easier to carry and store.
3. Enhanced durability: Portable EV chargers may be made from more durable materials, such as ruggedized plastic or metal, to withstand rough handling and extreme weather conditions.
4. Greater compatibility: Portable EV chargers may be designed to work with a wider range of EVs, including those with different charging standards or connectors.
5. Advanced features: Portable EV chargers may offer additional features, such as the ability to track charging progress or to communicate with the vehicle to optimize charging.

The use of portable EV chargers will increase as these developments advance, this would mean that there would be drastic changes within the infrastructure in order to make sure that this product can be used anywhere. This is so that the use of portable EV chargers will mean that the roads and pavement will need to be changed in order to make sure that the 2-part system for the Evi will work. According to Emily (2022). Manufacturers are currently working on a portable EV charger that can charge your EV while you're on the move. The need for portable EV chargers is increasing as consumers discover that they are more practical, efficient, and simple to use. This shows that there is a great push towards the portable EV charger initiative, this would mean that there will be a major push towards the development of portable chargers. Due to the rising interest and the impact, portable electric car chargers would have on the community.

How will people's lifestyle change due to the use of portable EV chargers?

As more people adopt electric vehicles (EVs) and use portable EV chargers, it is likely that their lifestyles will change in a number of ways. These changes are to make sure that people adapt in order to make the most of portable chargers while making sure that they don't have to worry about range anxiety. Some of the potential changes when it comes to the use of portable EV chargers are listed below:

1. **Increased convenience:** With a portable EV charger, people will have the ability to charge their vehicle wherever they go, whether it's at home, at work, or on the go. This can make it easier to own and operate an EV, as they will no longer have to plan their trips around the availability of charging stations.
2. **Greater flexibility:** Portable EV chargers allow people to charge their EVs in a variety of locations, which can give them more flexibility in terms of where they park and where they go. For example, if someone has a portable charger, they may feel more comfortable driving their EV to a remote location or taking it on a road trip.
3. **Improved sustainability:** By using a portable EV charger, people can reduce their reliance on fossil fuels and contribute to a more sustainable transportation system. This can help to reduce carbon emissions and improve air quality, which can have a positive impact on the environment.
4. **Cost savings:** In some cases, using a portable EV charger may also help people to save money on fuel costs. As the cost of electricity is generally lower than the cost of gasoline, people may be able to save money by charging their EVs at home or at work rather than filling up at a gas station.

What environment would portable EV chargers be used in?

Typically, portable chargers will be used in places where traditional EV charging stations are not available in. That is the key to portable EV chargers, it is flexible to use, where you can park anywhere and have a quick charge.

1. **At home:** If they don't have access to an EV charging station or outlet, many individuals charge their electric cars at home using portable EV chargers.
2. **On the go:** You may take portable EV chargers with you when you go in your electric vehicle and charge it while you are driving. This is especially helpful if you have a long vacation planned or will be staying somewhere without access to a conventional EV charging station.
3. **While at work:** Some individuals utilise portable EV chargers to recharge their electric automobiles. This can be a practical approach to guarantee that your car is fully charged when you're prepared to head out for the day.

4. At events: Portable EV chargers can be deployed at events like festivals or sporting competitions to give electric vehicle owners a simple method to charge their cars while they are there.

These changes would make sure that the user does not have to have to rely on public chargers as well as home chargers and worry about what range is left in their vehicle. Portable chargers erase that factor and allow you to park anywhere you want to stop and get a quick recharge.

How will portable EV chargers be integrated in the future?

The future of portable EV chargers is bright, the demand for them is increasing as the sales of EV are increasing each quarter. As stated before there is a real push towards portable EV chargers due to the many benefits this product has and how it can change the idea of charging as you go, it is easier to charge your EV when having a portable charger because you do not have to rely on a home charger as well as a traditional public charger, where people would have to worry about the range they have left within their EVs. These portable chargers can be transported in the trunk of an electric vehicle or in a different vehicle, enabling owners to charge their EVs wherever they go. Portable EV chargers could be incorporated in the future in a number of ways:

Rising EV adoption: There will probably be a similar rise in demand for portable EV chargers as EV usage rises. World Economic Forum. (n.d.). states that in the first half of 2022, there were almost 4.3 million new battery-powered EVs and plug-in hybrid EVs sold worldwide. Both EV and PHEV sales increased year over year by a combined 75%. Additionally, 2022 is forecast to continue to climb, with sales expected to increase by 57% year over year to 10.6 million. This means that there would be great demand for extra chargers for the EV community in order to keep up with the sales of EVs. Due to the high demand portable EV chargers would be the ideal product to have within you if you are an EV user, this might result in the creation of portable charging devices that are more sophisticated and effective as well as a rise in their accessibility and availability.

Integration with other technologies: To enable remote monitoring and control of charging, portable EV chargers could be integrated with other technologies like smart home systems or smart grids. Users might be able to schedule charging times and plan their energy usage in this way. There are currently home chargers that are already in the market which have already started to apply smart home integration within home charging stations. According to ChargePoint. (n.d.). they have started to adapt to the smart features that people want with Amazon Alexa voice control, starting, stopping, or monitoring your home charging has never been simpler if you have ChargePoint® Home.

Development of new charging technologies: New technologies that would make portable EV chargers even more practical and effective may emerge as a result of continuous research and development in the field of EV charging. The requirement for physical connections between the charger and the EV, for instance, might be eliminated by wireless charging systems. The UK has already started to trial this new technology for taxi's and buses and it is advancing and becoming more popular as the years go by. According to Lykiardopoulou, I. (2021). "WiCET (Wireless Charging of Electric Taxis) is a demonstration project funded by the UK Office for Zero Emission Vehicles (OZEV), as one of Innovate UK's portfolio of on-street wireless charging (OSWC) projects." This project was the first wireless charging that was introduced in Nottingham in 2021. The success of wireless charging is increasing, and other cities have started to implement this technology all around the UK.

Overall, it is likely that portable EV chargers will play an increasingly important role in the EV charging landscape as the adoption of electric vehicles continues to grow. This shows that

there is a great interest in developing and manufacturing portable chargers and the use of portable EV chargers will increase in use.

Vandalism

According to Blink Mobility. (2022). The adoption of electric vehicles has grown rapidly in recent years, and this change in transportation has presented difficulties for companies that provide EV charging stations. The need for expanding the nation's charging infrastructure is the key area of concern. Vandalism is becoming a great concern for EV users, and the rate of damage on public EV chargers is increasing. The main problem is that EV chargers are easy to access for not only EV users but for the general public. Futurism. (n.d). states that "Vandals are stuffing meant into EV charging stations as officials say it's a part of a trend of charging station vandalism." These are one of the ways that EV chargers around the world are getting destroyed. In order to prevent vandalism on EV chargers further research must be carried out in order to find a solution on preventing vandalism on EV chargers. So how would you stop vandalism on portable EV chargers:

1. Installing surveillance cameras can both dissuade vandals from destroying the chargers and aid in capturing the offenders if vandalism occurs. Currently, 360 cameras are used which will have a full view of the surrounding of the incident. This will give an ideal view of who would be tampering with the product and give a live feed to the user which they can easily report.
2. Utilize durable materials: Choose chargers and other associated equipment made of strong, damage-resistant materials. Make sure you used stronger materials that will last longer and require less upkeep because they are more resistant to wear and tear. Long-term savings are possible because you won't need to continually repair damaged or broken components.
3. Lock the chargers: To prevent illegal access to the chargers, use locks or other physical barriers. Locks can assist in preventing illegal access to the EV charger, hence reducing the risk of theft or charger damage. Locks can assist cut down on the amount of time that the charger needs to be maintained or repaired by preventing tampering and illegal use. In the long term, this can save you money because you won't have to keep replacing or repairing broken parts.
4. Indicate incidents: Report vandalism to the police or the business that runs the chargers if you see it or experience it. This may aid in catching the offenders and assist in preventing further incidents. By making sure the incidents being reported will show the people tampering with the EV chargers what the consequences are and how they will be prosecuted for criminal damage.
5. Make sure the neighbourhood is informed about the value of EV chargers and the negative effects of vandalism. You can advertise this via flyers, social media, or public announcements. By raising awareness and pointing out the consequence of tampering and damaging EV chargers will potentially lower the rate of vandalism on EV chargers.



Figure 1.



Figure 2

Conclusion

Portable EV chargers appear to have a promising future. The demand for convenient and portable charging solutions will increase as electric vehicles gain popularity. In the upcoming years, a few major themes are likely to influence how portable EV chargers are developed.

The growing emphasis on sustainability is one trend. Renewable energy sources, including solar panels, will probably be used more frequently in portable EV chargers. Without using the grid, these chargers can be used to charge EVs while the vehicle is in motion. In addition to lowering carbon emissions, this also makes it simpler for EV owners to charge their cars in isolated or rural locations with limited grid connections.

The rising need for quick charging is another trend. People will want to charge their cars as rapidly as possible as EVs become more commonplace. This will probably spur the creation of portable EV chargers with fast charging rates. Some businesses are already developing portable chargers that can fully charge an electric vehicle while it is parked at work or a shopping centre and can charge an EV in only a few hours.

Another development that will probably have an effect on the market for portable EV chargers is the expansion of the sharing economy. There will be a demand for portable chargers that can be transported easily between vehicles as more people choose to use ride-sharing services or rent EVs. This will necessitate the creation of portable, lightweight chargers that are small enough to be put up anywhere.

Finally, the development of new battery technologies is likely to have a significant impact on the future of portable EV chargers. As battery technology improves, it will become possible to store more energy in a smaller package. This will allow for the development of portable chargers that are even more compact and lightweight, making it easier for people to carry them around with them.

Overall, portable EV chargers have a promising future. The need for practical and eco-friendly charging options will increase as EVs gain in popularity. It is expected that portable EV chargers will become a more frequent sight on the highways as new technologies emerge, such as renewable energy sources and quick charging. Therefore, portable EV chargers will be extremely important for the development of EVs.

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Figure 1:

<https://www.google.com/url?sa=i&url=https%3A%2F%2Ffuturism.com%2Fthe-byte%2Fvandals-are-stuffing-meat-into-electric-vehicle-charging-stations&psig=AOvVaw3QIFxIRhkSQvveW4svKeQx&ust=1672591550002000&source=images&cd=vfe&ved=OCBAQjhxqFwoTCICs3ZunpPwCFQAAAAAdAAAAABAE>

Figure 2:

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